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TRANSACTIONS OF THE NORFOLK & NORWICH NATURALISTS' SOCIETY

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Map of plots surveyed in the arable plant study described in the Presidential Address p.1.

Presidential Address delivered to the Society on 12 January 2016

Muckweed, Sandweed and Buddle: a survey of arable plants in Norfolk carried out between 2007 and 2012

Bob Ellis

Introduction

Arable plants are known to be some of the most threatened in the country. Thirty three of the 435 flowering plant species designated as Critically Endangered, Endangered or Vulnerable on the Great Britain Red List (Cheffings & Farrell 2005) show a preference for the Arable and Horticultural Broad Habitat (Hill *et al.* 2004).

In July 2007, the Norfolk Flora Group trialled a very simple methodology for recording the plants along the margins of arable fields. In part this was prompted by a worry that the widespread implementation of grass margin options in agri-environment schemes could be to the detriment of arable plants, because the grass margins would occupy the field edges; typically the part of the field which receives least input of fertiliser and herbicide and therefore likely to be the main refuge for arable plants.

The names Muckweed, Sandweed and Buddle are taken from Geoffrey Grigson's delightful *An Englishman's Flora* (1996) and are all local Norfolk names. 'Buddle' is still used colloquially; see photograph on front cover

Methods

Arable field margins across Norfolk were sampled over six seasons between July 2007 and October 2012. No surveys were carried in the months December-April with a few in early November.

For each sample arable field, a simple list of plants was made along a transect, ideally between 100 m and 200 m in length, and running along a field margin, recording from the edge of the cultivated area to approximately 1 m into the crop. All flowering plant species (other than the crop) were recorded to the best ability of the recorders on a presence/absence basis; no attempt was made to record abundance. The end points of the sample transect were localised using hand-held GPS and 10 m resolution Ordnance Survey grid references were noted. A note was made of the crop (including stubbles and un-cropped cultivated strips); the presence of any adjacent grass margin and its width (irrespective of agri-environment options); the presence of any disturbed area and an assessment of soil type.

1,147 samples were recorded across Norfolk by some 40 participants. See the map on the inside front cover for the locations of the field margins surveyed.

Access to field margins was often from public footpaths, roadsides or permissive access provided under agri-environment schemes, but in many cases permission to survey otherwise inaccessible fields was granted by the landowners and we are very grateful for this permission.

Data was entered into a database and in 2010 interim data was passed to Norfolk Biological Information Services, and was used in the report on Important Arable Plant Areas in Norfolk (Walker *et al.* 2012).

Analysis

Definition of arable plants

The simple methodology deliberately took no steps to mitigate for 'edge effects' largely because with modern farming methods,

away from the edge of the field there are usually very few flowering plant species present other than the crop itself. As a consequence of this, a wide and sometimes surprising variety of species were recorded in small numbers including **Gooseberry** seedling *Ribes uva-crispa*; **Bluebell** *Hyacinthoides non-scripta*; **Purple Toadflax**, *Linaria purpurea*; **Hoary Cress** *Lepidium draba*; **Moth Mullein** *Verbascum blattaria*; **Snapdragon** *Antirrhinum majus*; **Celery-leaved Buttercup** *Ranunculus sceleratus* and **Watercress** *Nasturtium officinale*. The latter two were found in sample transects close to ditches, where presumably dredgings had been ploughed into the field. In total 370 species were recorded during the survey.

Oak seedlings were recorded in 170 samples (nearly 15%); often well away from established woodland, which demonstrates how effective corvids and other wildlife are at spreading trees.

So what is an 'arable plant' and should other species be excluded from the analysis?

One of the objectives of this analysis was to see if anything can be learnt about species that specialise in regularly cultivated habitats. Common and widespread species that colonise arable margins from adjacent habitats include tree seedlings and grassland species, for example **Cock's-foot** *Dactylis glomerata* was recorded in 32% of samples. Some widespread species with mobile seeds arrive on the wind each year, and so **Groundsel** *Senecio vulgaris* was recorded in 69% of samples and **Dandelion** *Taraxacum* in 35%. Persistent perennials probably survive year on year despite the plough rather than because of it and **Broadleaved Dock** *Rumex obtusifolius* was recorded in 69% of samples and **Mugwort** *Artemisia vulgaris* in 34%. In order to focus on arable specialists all these groups of species were excluded from this analysis.

Most species that specialise in arable habitats have the following attributes: they are annuals, they have relatively large, immobile seeds and they form a persistent seed bank. They also germinate 'in synch' with the crop, but this was not assessed. A subset of 97 'arable' species was identified. The ecological attributes considered to make this selection were:

- Life form: annual land plants only (therophytes), Hill *et al.* 2004;
- Soil seed bank: seed persistent in soil (levels 3 & 4), Grime *et al.* 2007;
- Known association with arable habitat: abundance in primary habitat (3-5), Grime *et al.* 2007 and broad habitat association (for habitat 4: arable and horticultural), Hill *et al.* 2004

If there was no entry in Grime *et al.* 2007, then an annual plant having preference for habitat 4 was accepted for inclusion. Details of these attributes for the 97 arable species are shown in Table 1 which shows known attributes and conservation indicators for the list of arable species recorded and the number of samples they occurred in.

Summary statistics

No of samples: 1147

Mean no. of species per sample: 28.28

Mean no. of arable species per sample: 15.59

Consideration of factors influencing species distribution and diversity

Sample selection

Selection of sample sites was left entirely up to the volunteer surveyors although the distribution of sites to date was reported each year at the annual meeting of the Flora Group to encourage as broad coverage of the county as possible. Inevitably, however, this approach led to a somewhat patchy distribution of samples (see map on inside front cover). There is certainly recorder bias in terms of overall species richness as it was understandably difficult for surveyors to resist selecting floriferous margins.

Table 1 Ecological attributes and conservation indicators for 97 arable plant species

Species	English name	Broad habitat[1]	Abundance in arable habitat[2]	Seed bank	% samples	Plantlife score[3]	GB Red List
Aethusa cynapium	Fool's Parsley	4+	5	3	22.9		
Alopecurus myosuroides	Black-grass	4	5	3	17.6	2	
Amaranthus sp.	Amaranth	4+			3.3		
Amsinckia micrantha	Common Fiddleneck	4	5	3	6.2		
Anagallis arvensis	Scarlet Pimpernel	4	5	4	52.5		
Anchusa arvensis	Bugloss	4	5	3	27.5	1	
Anisantha diandra	Great Brome	4+			12.6		
Anthemis arvensis	Corn Chamomile	4+	5	3	0.4	8	EN
Anthemis cotula	Stinking Chamomile	4	5	3	3.2	7	VU
Anthriscus caucalis	Bur Chervil	4+	4	3	0.5	3	
Apera interrupta	Dense Silky-bent	4+	3	3	0.1	4	
Apera spica-venti	Loose Silky-bent	4+			0.3	6	NT
Aphanes arvensis agg.	Parsley-piert		5	3	7.4		
Aphanes australis	Slender Parsley-piert		3	3	0.4	1	
Atriplex patula	Common Orache	4+	5	4	34.0		
Avena fatua	Wild-oat	4+	5	3	43.2		
Brassica nigra	Black Mustard	4+			0.4	2	
Bromus secalinus	Rye Brome	4			2.9	7	VU
Capsella bursa-pastoris	Shepherd's-purse		5	4	47.3		
Cerastium glomeratum	Sticky Mouse-ear		4	3	1.8		
Chenopodium album	Fat-hen	4	5	4	70.6		
Chenopodium ficifolium	Fig-leaved Goosefoot	4			3.6	2	
Chenopodium hybridum	Maple-leaved Goosefoot	4			0.2	3	
Chenopodium polyspermum	Many-seeded Goosefoot	4	5	3	3.2	2	
Chenopodium rubrum	Red Goosefoot		5	4	4.6		
Claytonia perfoliata	Springbeauty		5	3	0.1		
Descurainia sophia	Flixweed	4			10.0	3	
Diplotaxis muralis	Annual Wall-rocket	4+	4	3	0.7		
Erodium cicutarium	Common Stork's-bill		3	3	4.5	1	
Erysimum cheiranthoides	Treacle-mustard	4+	5	3	3.6	2	
Euphorbia exigua	Dwarf Spurge	4	5	3	8.4	6	NT
Euphorbia helioscopia	Sun Spurge		5	3	32.2		
Euphorbia peplus	Petty Spurge		5	3	5.8		
Fallopia convolvulus	Black-bindweed	4+	5	4	71.0		
Fumaria densiflora	Dense-flowered Fumitory	4			0.1	3	
Fumaria muralis	Common Ramping-fumitory	4	5	3	0.2		

Species	English name	Broad habitat[1]	Abundance in arable habitat[2]	Seed bank	% samples	Plantlife score[3]	GB Red List
Fumaria officinalis	Common Fumitory	4+	5	3	14.7		
Fumaria parviflora	Fine-leaved Fumitory	4			0.2	7	VU
Galeopsis tetrahit agg.	Common Hemp-nettle		5	3	1.6		
Galinsoga parviflora	Gallant Soldier		5	3	0.2		
Galinsoga quadriradiata	Shaggy Soldier	4+	5	3	0.4		
Geranium dissectum	Cut-leaved Crane's-bill	4+	3	3	30.9		
Geranium molle	Dove's-foot Crane's-bill	4+	4	3	11.5		
Geranium pusillum	Small-flowered Crane's-bill		3	3	31.1	2	
Glebionis segetum	Corn Marigold	4	5	3	1.6	7	VU
Gnaphalium uliginosum	Marsh Cudweed		4	3	9.4		
Juncus bufonius	Toad Rush		3	3	9.3		
Kickxia elatine	Sharp-leaved Fluellen	4			15.8	2	
Kickxia spuria	Round-leaved Fluellen	4			2.6	3	
Lamium amplexicaule	Henbit Dead-nettle	4+	5	3	3.6	1	
Lamium hybridum	Cut-leaved Dead-nettle	4	5	3	27.2		
Lamium purpureum	Red Dead-nettle	4+	5	4	31.6		
Lapsana communis	Nipplewort		5	3	23.9		
Legousia hybrida	Venus's-looking-glass	4			3.1	3	
Lepidium coronopus	Swine-cress	4+	4	4	23.7		
Lepidium didymum	Lesser Swine-cress		5	3	10.4		
Matricaria discoidea	Pineappleweed	4+	5	3	36.9		
Matricaria recutita	Scented Mayweed	4+	5	3	13.0		
Medicago lupulina	Black Medick		4	4	4.0		
Mercurialis annua	Annual Mercury	4+	5	3	3.2	2	
Misopates orontium	Weasel's-snout	4			1.0	7	VU
Myosotis arvensis	Field Forget-me-not	4+	5	3	18.5		
Odontites vernus	Red Bartsia		4	3	1.0		
Papaver argemone	Prickly Poppy	4	5	3	1.0	7	VU
Papaver dubium	Long-headed Poppy	4+	3	3	0.4		
Papaver hybridum	Rough Poppy	4			1.0	3	
Papaver rhoeas	Common Poppy	4+	5	4	49.9		
Persicaria lapathifolia	Pale Persicaria		5	3	12.1		
Persicaria maculosa	Redshank	4+	5	4	40.9		
Poa annua	Annual Meadow-grass	4+	5	3	62.9		
Polygonum aviculare agg.	Knotgrass	4+	5	4	65.5		
Polygonum rurivagum	Cornfield Knotgrass	4			1.5	3	
Raphanus raphanistrum	Radish		5	3	36.4	1	

Species	English name	Broad habitat[1]	Abundance in arable habitat[2]	Seed bank	% samples	Plantlife score[3]	GB Red List
Scandix pecten-veneris	Shepherd's-needle	4			0.5	9	CR
Setaria viridis	Green Bristle-grass	4+			0.2		
Sherardia arvensis	Field Madder		4	3	8.9	1	
Silene gallica	Small-flowered Catchfly	4+			0.2	8	EN
Silene noctiflora	Night-flowering Catchfly	4	5	3	8.7	7	VU
Sinapis arvensis	Charlock	4+	5	4	21.2		
Sisymbrium officinale	Hedge Mustard	4+	4	3	51.2		
Solanum nigrum	Black Nightshade	4	5	3	31.6		
Spergula arvensis	Corn Spurrey	4	5	4	10.2	7	VU
Stachys arvensis	Field Woundwort	4+	5	4	2.5	6	NT
Stellaria media	Common Chickweed	4+	5	4	29.3		
Thlaspi arvense	Field Penny-cress	4+	5	4	9.7		
Trifolium dubium	Lesser Trefoil		4	3	2.3		
Triplenrospermum inodorum	Scentless Mayweed	4	5	3	75.2		
Urtica urens	Small Nettle		5	4	20.7		
Valerianella dentata	Narrow-fruited Cornsalad	4			0.7	8	EN
Veronica agrestis	Green Field-speedwell	4+	5	3	0.7	1	
Veronica arvensis	Wall Speedwell	4+	5	3	29.9		
Veronica hederifolia	Ivy-leaved Speedwell	4+	5	3	1.8		
Veronica persica	Common Field-speedwell	4+	5	3	77.4		
Veronica polita	Grey Field-speedwell		5	3	5.3	2	
Vicia sativa ssp. *segetalis*	Common Vetch		3	3	3.8		
Viola arvensis	Field Pansy	4	5	3	66.9		
Viola tricolor ssp. tricolor	Wild Pansy		5	3	0.1	6	NT

Notes

1. + indicates other Broad Habitats are listed as well as 4
2. full range is 0-5
3. see Byfield & Wilson 2005

Sample length

Although the methodology suggested a sample length of 100-200 m this was loosely interpreted by surveyors, and actual lengths recorded ranged from 10 m to 570 m. Fig. 1 is a scattergram of the number of species recorded against the length of margin sampled, and although there is a relation between the two, the broad range of species diversity suggests it is not the most important factor. The data suggests that in most surveys, a large number of the arable species present will be found within the first 50-100 m of a transect. The majority of transect lengths were between 100 and 300 m.

Grass margins

During a survey, if there was a grass margin adjacent to the field this was noted together with the width. Where survey data does not include this information it was assumed that either nothing was noted or the margin was less than 2 m wide. The mean number

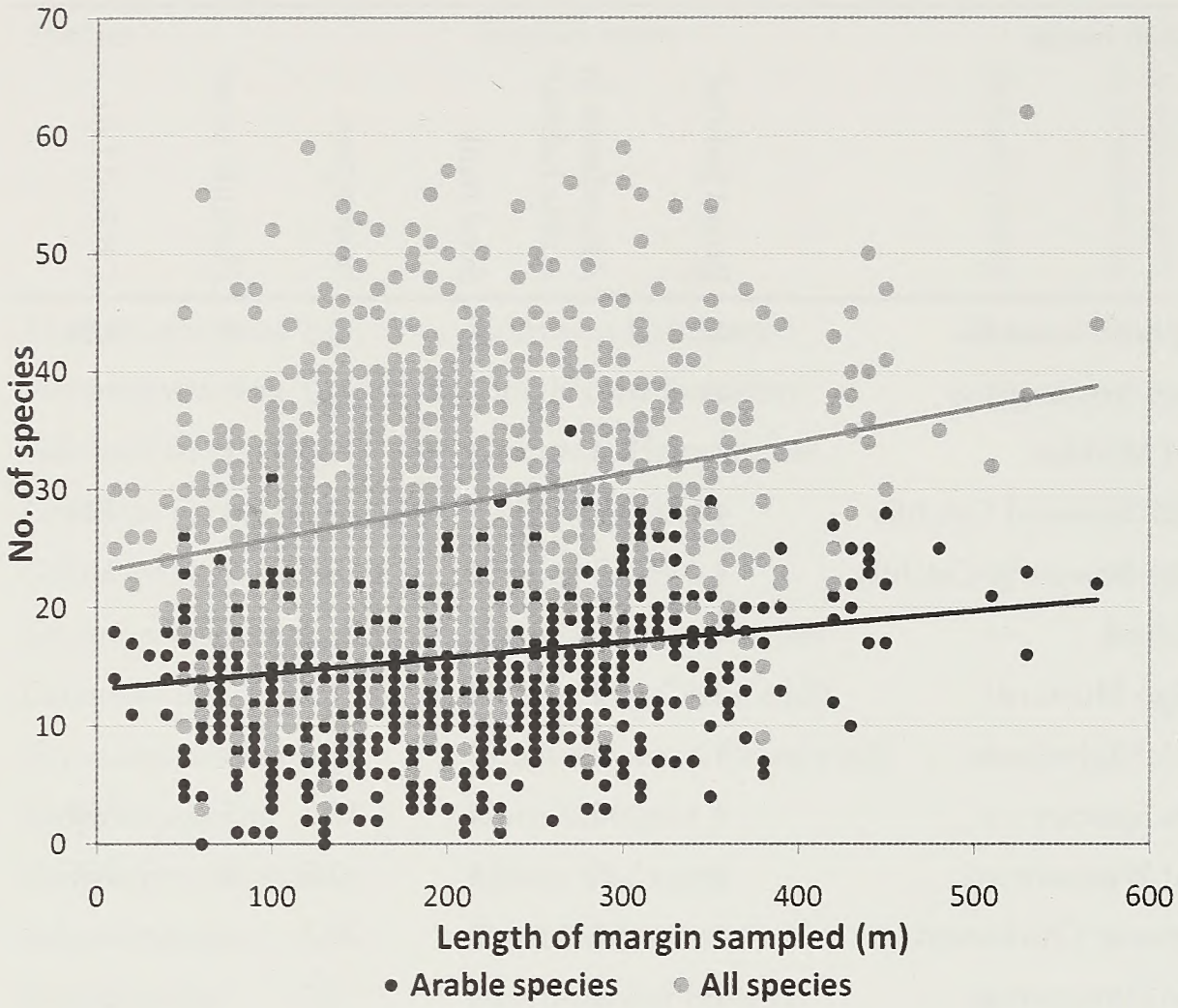

Figure 1. Scattergram of the number of species recorded against the length of margin sampled.

or arable species recorded for samples with a grass margin of 2 m or more (n=238) was compared with that for samples where no grass margin was present (n=653). The mean for samples with a grass margin was 14.87 whereas without it was 15.82. This difference is small but significant ($p < 0.05$*).

Disturbed areas

This was a loose definition covering field corners, tractor-turning points, un-cropped strips at the edge of the cultivated area etc. Anyone who has walked along the edge of an arable field will be aware that these are often good places to look for arable plants, but do they actually make a difference to the species diversity of the field margin? Disturbed areas were noted as present in 585 samples and as absent in 547 (for the remainder of samples, no note was made). The mean number of species in samples with a disturbed area was 16.82 whereas without one it was 14.25. Using a student t-test, two-tailed gives a significant difference ($p < 0.001$) so the answer, unsurprisingly, is yes!

Species diversity and distribution by crop and soil type

For the purpose of this analysis, the samples were grouped into broad categories of crop (Table 2). Note that this variable is not

Table 2. Arable species richness by crop group.

Crop group	Margins sampled	Mean no. arable species	Compared to mean for all samples (15.59)	
Cereal	490	13.44	-2.15	Includes stubbles
Beet	400	18.01	+2.42	
Conservation	63	17.84	+2.25	Includes wildlife & game cover mixes, cultivated un-cropped margins and set-aside/fallow
Rape	40	15.70	+0.11	
Potatoes	39	17.36	+1.77	
Maize	37	14.54	-1.05	Excludes game-cover mixes
Fodder Beans	29	15.17	-0.42	
Other	46	15.63	+0.04	Includes carrots, parsnips, turnips, peas, soft fruit, millet, linseed, French beans, asparagus, brassicas, chamomile & gladioli
Unspecified	3			

independent from soil type as the choice of crop grown frequently depends on soils.

Similarly, for the purpose of this analysis, the samples were grouped into broad soil categories (Table 3).

Table 3. Arable species richness by broad categories of soil type.

Broad soil type	Margins sampled	Mean no. arable species	Compared to mean for all samples (15.59)
Heavy	146	14.14	-1.45
Medium	393	14.77	-0.82
Light	519	16.29	+0.70
Light chalky	72	18.22	+2.63
Unspecified	17		

The results were examined for trends in distribution of the three species which this paper focusses on: **Muckweed** (Fat Hen *Chenopodium album*), **Sandweed** (Corn Spurrey *Spergula arvensis*) and **Buddle** (Corn Marigold *Glebionis segetum*). The species were arranged in a 'hit parade' for each crop group and each soil group i.e. their relative position in the order of frequency within that category.

Muckweed performed well in all crops but did best in beet and game & conservation crops; it was top of the 'hit parade' in both. The other two species are much scarcer but Sandweed did fairly well in game & conservation crops but was not recorded in either rape or fodder beans. Buddle is the scarcest of the three species but, rather surprisingly, seems to have done better in cereals than in all other crop groups with the exception of beet.

Muckweed did well again on all soils but was best on light chalky soils and was top of the hit parade there. Sandweed also did reasonably well on light soils but seems to have been less frequent on the chalky ones. Buddle was at its best on light soils. A couple of other species illustrate a strong soil type preference: **Round-leaved Fluellen** *Kickxia spuria* was best on heavy soils and rare on light chalky ones whereas **Night-flowering Catchfly** *Silene noctiflora* showed the opposite trend.

Conclusions

The simple methodology proved suitable for use by a number of volunteers and

Table 4. 'Performance' of three species by crop group.

* indicates a single instance

	Percentage of samples where present (position in 'hit parade')		
	Muckweed	Sandweed	Buddle
Cereals	53.6 (7)	7.7 (41)	1.2 (72)
Beet	**90.5 (1)**	12.2 (49)	1.5 (70)
Conservation	**85.7 (1)**	**17.5 (39)**	*
Rape	45.0 (14)	0	0
Potatoes	74.4 (14)	14.0 (56)	0
Maize	73.0 (13)	13.5 (55)	*
Fodder Beans	44.8 (11)	0	0

Table 5 Performance of three species by soil type.

	Percent of samples where present (position in 'hit parade'				
Soil group	Muckweed	Sandweed	Buddle	Round-leaved Fluellen	Night-flowering Catch-fly
Heavy	41.8 (14)	2.1 (57)	0	**12.3 (37)**	0
Medium	65.6 (5)	5.6 (46)	3.1 (60)	2.8 (58)	3.6 (53)
Light	**80.7 (2)**	**16.8 (30)**	**5.6 (58)**	0	11.4 (40)
Light chalky	**87.5 (1)**	5.6 (58)	0	1.5 (78)	**34.7 (19)**

resulted in a large number of samples being recorded. Recorder bias and uneven, non-random survey coverage (see map inside front cover) limit what can be concluded statistically from the survey data: in particular, it should not be used to extrapolate the 'state of nature' of arable species; nevertheless some patterns emerge. Many of these preliminary conclusions above are what might be expected but the survey adds to a growing body of evidence which suggests:

- grass margins are somewhat detrimental to the diversity of arable plants
- disturbed areas near the margin lead to an increase in the diversity of arable plants present
- the greatest diversity of arable species occurs in beet and conservation-related crops, whereas the least occurs in cereals and maize
- the greatest diversity of arable species occurs on light soils, especially chalky ones whereas the least occurs on heavy ones
- individual species show different preferences within this pattern

The large sample size means further analysis of the data is possible and desirable.

Other benefits

This large base line survey trial could be repeated in part, and the resultant data used to help assess changes over time and, for example explore the effect of different crops on the same section of arable margin or the effect of addition/removal of grass margins. The database has also made a significant contribution to the data on species distribution including a contribution to the current BSBI Atlas 2020 project. Last but by no means least; it was an enjoyable experience (I hope) for the participants.

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The Coleoptera of Holkham National Nature Reserve, Norfolk: an update

Bryan Sage

Introduction

The beetle fauna of this National Nature Reserve has been the subject of three previous papers (Sage 1996, 2001 and 2003). In 2003 the total number of species recorded stood at 703 in 53 families. Since that time there has been a considerable number of taxonomic changes, further fieldwork has yielded additional species and some additional pre-1996 records have come to hand. By December 2005 the total had reached 817 species in 55 families (Appendix 1). Nomenclature follows Duff (2012).

Some of the earlier records received from Cliff Barham (CB) gave just Wells as the locality. These have been accepted as being within the Holkham NNR boundary since it is known that he habitually collected in the pinewoods and adjacent areas to the west of the Wells channel.

Additional records from 1996 and earlier

There are 35 records in this group of species new to the site list. Records with no initials shown are those of the author. Some of these records are also referred to in the section on Corrections below.

Carabidae

Bembidion properans – Holkham, on damp pasture, 1 July 1993.

Bembidion tetracolum – Holkham Bay, 26 July 1952 (JWT).

Calathus ambiguus – Burnham Overy, 14 April 1994 (MT).

Elaphrus cupreus – Burnham Overy, 12 May 1993 (MT).

Harpalus rufipalpis – Wells-next-the-Sea, 22 July 1952 (HH, JWT).

Olisthopus rotundatus – Holkham, 4 August 1961 (CB).

Ophonus schaubergerianus – Holkham, 17 August 1960 (CB).

Pogonus luridipennis – Holkham Meals, 26 March 1993 (DM).

Cerambycidae

Arhopalus ferus – Holkham, 3 August 1956 (JWT). This is a naturalised introduction, very local in coniferous woods from South Yorkshire to the Isles of Scilly. Holkham is the only known county site.

Chrysomelidae

Psylliodes affinis – Holkham, 17 August 1963 (CB).

Psylliodes dulcamarae – Holkham, 17 August 1963 (CB).

Coccinellidae

Adalia decempunctata – Holkham, 26 July 1992 (MT).

Coccinella hieroglyphica – Holkham Bay, 23 August 1952 (HH).

Cryptophagidae

Micrambe ulicis – Burnham Overy, 10 May 1994.

Curculionidae

Dorytomus longimanus – Warham saltmarsh, 12 September 1987 (RK).

Hypera zoilus – Holkham Bay, 23 August 1952 (HH).

Parethelcus pollinarius – Holkham, 1 May 1969 (MM).

Dasytidae

Dolichosoma lineare – Holkham, 14 August 1977 (TD).

Histeridae

Margarinotus marginatus – Burnham Overy, by a rabbit burrow in the dunes, 17 September 1995.

Hydrophilidae

Cercyon depressus – Wells-next-the-Sea, 25 July 1958 (CB).

Latridiidae

Melanopthalma transversalis – Holkham, August 1982 (JO), no further details.

Nanophyidae

Nanophyes marmoratus – Holkham, on Purple Loosestrife *Lythrum salicaria* by a dyke on the pastures, 19 August 1992

Ptinidae

Ernobius mollis – Holkham, 17 August 1963 (CB).

Scarabaeidae

Hoplia philanthus – Burnham Overy, 17 July 1993 (TD).

Silphidae

Silpha atrata – Holkham, 12 September 1987 (KA).

Staphylinidae

Carpelimus halophilus – Wells-next-the-Sea, 3 June 1977 (RC).

Datomicra celata – Holkham, 9 April 1989 (DL).

Heterothrops praevius – Warham saltmarsh, 10 August 1996 (TJ).

Scaphisoma boleti – Wells-next-the-Sea, 16 August 1962 (CB).

Sepedophilus bipunctatus – Wells-next-the-Sea, 25 May 1969 (AG).

Sepedophilus pedicularius – Holkham, 17 August 1963 (CB).

Sepedophilus testaceus – Holkham, 17 August 1963 (CB).

Stenus providus – Warham saltmarsh, 1 May 1986.

Tasgius globulifer – Holkham, 12 September 1987 (RK).

Tetratomidae

Hallomenus binotatus – Wells-next-the-Sea, 16 August 1962 (CB).

Corrections

In Sage (1996) the staphylinid *Staphylinus nero* (=*Ocypus nitens*) was listed. This should be deleted since the specimen cannot be found and the habitat would be abnormal for this species. In Sage (2001) various species were listed as additions to the site list, but were subsequently found to have been recorded earlier. These were *Psylliodes affinis* and *P. dulcamarae* (Chrysomelidae), both recorded from the pines on the dunes at Wells-next-the Sea on the 4 June 2000. Both species, however, were recorded 37 years earlier at Holkham, 17 August 1963 (CSB). The carabid *Calathus ambiguus*, taken in the dunes at Holkham on 3 or 4 June 2000, had in fact been found at Burnham Overy on 14 April 1994 (MGT). Similarly, *Melanopthalma transversalis* (Latridiidae), taken on the Burnham Overy sea wall on 3 June 2000, had been found at Holkham in August 1982 (JAO). In Sage (2002) *Hallomenus binotatus* (Tetratomidae) was listed from Holkham on 7 July 2002, but had previously been found there on 17 August 1963 (CSB).

Additional records received since 2003

The following 104 species have been added to the site list since the publication of Sage (2003). The records are the author's unless shown otherwise. Where the recorder has given the habitat the relevant details are shown.

Anthicidae

Omonadus floralis – Holkham, 8 October 2013 (PH).

Apionidae

Apion (Perapion) marchicum – Burnham Overy dunes, 31 July 2010 (RB).

Apion rubiginosum – Burnham Overy dunes, 31 July 2010 (RB).

Apion (Ischnopterapion) virens – Holkham, 8 Octoober 2013 (PH).

Cantharidae

Cantharis decipiens – Holkham, 23 May 2004 (CW).

Carabidae

Acupalpus dubius – Burnham Overy, 3 September 2013 (SL).

Agonum fuliginosum – In pitfall trap in damp pasture at Holkham on 8 & 21 April 2015.

Anisodactylus binotatus – Burnham Overy, 24 April 2004 (MT).
Bembidion dentellum – Holkham, on damp mud in former arable field reverting to grassland, 3 September 2004.
Bembidion fumigatum – One at the edge of the saltmarsh at Burnham Norton on 3 October 2006.
Calathus cinctus – Burnham Overy dunes, 7 July 2003.
Chlaenius nigricornis – In pitfall trap in damp pasture at Holkham on 6 May 2014.
Demetrias imperialis – Holkham, 23 May 2004 (CW).
Notiophilus germinyi – Gun Hill, Burnham Overy on 28 November (MC).
Poecilus cupreus – Burnham Overy on 24 April 2004 (MT).
Pterostichus diligens – In pitfall trap in damp pasture at Holkham on 14 May 2015.
Pterostichus madidus – In pitfall trap in damp pasture at Holkham on 22 April 2014.
Pterostichus melanarius – In pitfall trap in pasture at Holkham on 21 September 2014.
Pterostichus minor – In pitfall trap in damp pasture at Holkham on 16 April 2015.
Pterostichus rhaeticus – In pitfall trap in damp pasture at Holkham on 16 April 2015.
Pterostichus vernalis – In pitfall trap in damp pasture at Holkham on 22 April 2014.
Synuchus nivalis – In pitfall trap in damp pasture at Holkham on 22 April 2014.
Trechus rivularis – On sand dunes in Holkham Bay on 1 October 2015 (TJ). This is a species of lowland fens, upland mires and bogs, and was presumably carried here by the wind.

Cerambycidae

Clytus arietis – Holkham Gap, 5 July 2001 (MR).

Chrysomelidae

Altica longicollisi – Wells-next-the-Sea, 4 June 2000 (MC Det. M.L.Cox).
Altica palustris – In pitfall trap in damp pasture at Holkham on 27 May 2015.
Aphthona nonstriatus – Holkham, swept on damp pastures, 6 May 2005.
Cassida vibex – Holkham, 3 September 2013 (SL).
Phyllotreta cruciferae – Burnham Overy, 31 July 2010 (RB).
Phyllotreta nigripes – Burnham Overy, 31 July 2010 (RB).
Phyllotreta ochripes – Holkham, 23 May 2004 (CW).
Plateumaris sericea – Holkham damp pastures, on vegetation by dyke, 6 May 2005.
Psylliodes napi – Holkham, 23 May 2004 (CW).

Cleridae

Necrobia violacea – Burnham Overy, 8 July 2011 (RB).

Coccinellidae

Exochomus quadripustulatus – Holkham on pines, 12 November 2011 (TD).
Harmonia axyridis – Holkham Meals, 29 July 2006 (TH).
Hippodamia variegata – East Hills, Wells-next-the-Sea, 24 September 2011.

Cryptophagidae

Atomaria punctithorax – Gun Hill, Burnham Overy, on 28 November 2014 (MC, SL).
Atomaria pusilla – Holkham Meals, in moss, 1 October 2015.
Atomaria scutellaris – Gun Hill, Burnham Overy on 28 November 2014 (MC, SL).
Cryptophagus punctipennis – Gun Hill, Burnham Overy, on 28 November 2014 (SL).

Curculionidae

Barynotus obscurus – In pitfall trap in damp pasture at Holkham on 8 April 2015.
Ceutorhynchus constrictus – Holkham, 23 May 2004 (CW).
Euophryum confine – Under bark of pine tree on the East Hills, Wellsa-next-the-Sea on 1 September 2005.
Limnobaris dolorosa - In pitfall trap in damp pasture at Holkham on 27 May 2015.

This weevil is associated with species of *Carex* sedges.

Mecinus pascuorum – Holkham, in pitfall trap on damp pasture on 16 April 2015.

Orthochaetes setiger – Holkham, 18 September 2005 (MS).

Phyllobius glaucus – Holkham, 6 May 2005.

Polydrusus tereticollis – Holkham, 6 May 2005.

Dryopidae

Dryops luridus – Holkham, in pitfall trap in damp pasture on 27 May 2015.

Elateridae

Ampedus quercicola – Beaten from Hawthorn *Crataegus monogyna* in Bone's Drove, Holkham, on 27 May 2015.

Athous vittatus – Burnham Overy, 30 May 2004 (EBB).

Erirhinidae

Notaris acridulus – In pitfall trap in damp pasture at Holkham on 8 April 2015. This weevil is found in a variety of damp and wet habitats.

Helophoridae

Helophorus obscurus – Gun Hill, Burnham Overy , 28th November 2014 (SL).

Histeridae

Carcinops pumilio – Burnham Overy, 8 July 2011 (RB).

Margarinotus purpurascens – Burnham Overy, 24 April 2004 (MT).

Kateretidae

Kateretes rufilabris – Holkham, swept on damp pastures, 19 July 2002.

Leoididae

Catops fuscus – Gun Hill, Burnham Overy, 28 November 2014 (MC).

Nargus anisotomoides – Gun Hill, Burnham Overy, 28 November 2014 (MC).

Nitidulidae

Meligethes rotundicollis – Burnham Norton, swept from Hedge Parsley *Sisymbrium officinale*, 1 July 2005.

Pocadius ferrugineus – East Hills, Wells-next-the-Sea, 14 June 2003.

Phalacridae

Phalacrus fimetarius – Burnham Overy, 3 September 2013 (SL).

Aphodius paykulli – Gun Hill, Burnham Overy, 15 April 2002 (DM). This is the first modern Norfolk record.

Aphodius sphacelatus – Holkham Meals, 15 April 2002 (DJM).

Onthophagus similis – In pitfall trap in damp pasture at Holkham on 22 April 2014.

Phyllopertha horticola – Holkham, 3 July 2005 (PB).

Scraptiiidae

Anaspis lurida – Holkham, 6 May 2005.

Silphidae

Nicrophorus investigator – In pitfall trap in damp pasture at Holkham on 6 May 2014.

Silpha laevigata – Holkham Meals, 28 May 2013 (MC).

Silpha tristis – In pitfall trap in damp pasture at Holkham on 22 April 2014.

Staphylinidae

Aleochara bilineata – Holkham, 19 October 2012 (AD).

Aleochara binotata – Burnham Overy dunes, 3 August 2010 (Booth, MC)..

Aleochara cuniculorum – Burnham Overy dunes, 3 August 2010 (Booth, MC).

Aleochara intricata – Holkham, 19 October 2012 (AD).

Aleochara verna – Burnham Overy, 8 July 2011 (RB).

Amischa analis – Holkham, 8 October 2013 (PH).

Anthobium unicolor – Gun Hill, Burnham Overy, 28 November 2014 (SL).

Atheta crassicornis – Holkham, 12 November 2011 (TD).

Atheta divisa – Holkham, 19 October 2012 (AD).

Chaetida longicornis – Burnham Overy, 3 August 2010 (RB).

Datomicra nigra – Burnham Overy, 8 July 2011 (RB).

Gabrius osseticus - East Hills, Wells-next-the-Sea, 11 June 2013.

Eusphalerum torquatum – Holkham, 6 May 2005.

Gnypeta rubrior – Holkham, on damp mud in former arable field reverting to grassland, 3 September 2004 (Det.CW).
Hygronoma dimidiata – Burnham Overy, July 2000 (JD).
Ischnosoma splendidum – Gun Hill, Burnham Overy, 28 November 2014 (MC)
Megrarthrus prosseni – Gun Hill, Burnham Overy, 28 November 2014 (SL).
Omalium caesum – Gun Hill, Burnham Overy, 28 November 2014 (SL).
Ouisipalia caesula – Burnham Overy, 3 August 2010 (RB).
Oxypoda haemorrhoa – Holkham, 8 October 2013 (PH).
Philonthus addendus – Holkham, 19 October 2012 (AD).
Philonthus carbonarius – In pitfall trap in damp pasture at Holkham on 6 May 2014.
Philonthus succicola – Holkham, 19 October 2012 (AD).
Quedius cruentus – Gun Hill, Burnham Overy, 28 November 2014 (SL).
Quedius fulgidus – Gun Hill, Burnham Overy, 28 November 2014 (SL).
Quedius nigriceps – Holkham, 19 October 2012 (AD).
Quedius persimilis – Burnham Overy, 3 August 2010 (RB).
Stenus fulvicornis – Burnham Overy, 3 September 2013 (SL).
Sunius propinquus – Holkham, 8 October 2013 (PH).
Tachyporus pallidus – In pitfall trap in damp pasture at Holkham on 27 May 2015.
Thinoma atra – Gun Hill, Burnham Overy, 28 November 2014 (SL).
Xantholinus gallicus – In pine woods at Holkham Gap on 1 October 2015 (TJ).

Tenebrionidae

Opatrum sabulosum – East Hills, Wells-next-the-Sea, 1 September 2005.
Xanthomus pallidus – Holkham, 8 October 2013 (PH).

Discussion

Taking into account the additions listed above, the total number of species recorded on the reserve up to the end of December 2015 is 817 as shown in Appendix 1. The high species total for Holkham reflects the considerable diversity of habitats found on the reserve as described by Sage (1996). This fact makes it difficult to compare Holkham with other sites on or near the coast in this area. However, it may be noted that Dersingham Bog and Fen has 346 species, and Scolt Head 378 species.

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Postcript

Since the above paper was written a further 15 species have been noted at Holkham by Martin Collier, Steve Lane and the author, bringing the site list total

to 832 species. The following were first recorded at Burnham Norton on 19 June 2016 – *Anisosticta 19*-punctata, *Bruchus loti, Cantharis pallida, Donacia bicolora* (pRDB2), *Donacia marginata, Donacia vulgaris,* and *Silis ruficollis*. A further eight species were found on 24 June – *Apion (Oxystomia) pomonae, Atomaria fuscata, Cordylepherus viridis, Isochnus sequensi, Phalaacrus championi, Stilbus oblongus,Telmatophilus brevicollis,* and *Telmatophilus caricis*. The most interesting of these additions is *Donacia bicolora* which is the first modern record for Norfolk and the only known county site with a living population. It was found in just one dyke together with the other two species of *Donacia* listed above, and also *Donacia simplex*. All four species are associated with Branched Bur-reed *Sparganium erectum*. With just one known site on the whole reserve the species is potentially vulnerable.

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APPENDIX 1: Checklist of the Coleoptera of Holkham National Nature Reserve, Norfolk, December 2015

Anthicidae

Anthicus antherinus (L.)
Anthiicus bimaculatus (Illiger)
Anthicus constrictus Curtis
Anthicus formicarius (Goeze)
Cordicollis instabilis (Schmiodt)
Notoxus monoceros Geoffroy
Omonadus floralis (L.)

Apionidae

Apion aeneum (Fabricius)
Apion apricans (Herbst)
Apion assimile (Kirby)
Apion carduorum Kirby
Apion curtirostre (Germar)
Apion ervi Kirby
Apion frumentarium (.L.)
Apion fulvipes (Geoffroy)
Apion gibbirostre (Gyllenhal)
Apion haematodes Kirby
Apion hydrolapathi (Marsham)
Apion limoni (Kirby)
Apion loti Kirby
Apion malvae (Fabricius)
Apion marchicum (Herbst)
Apion nigritarse (Kirby)
Apion onopordi (Kirby)
Apion pubescens (Kirby)
Apion radiolus (Kirby)
Apion rubens Stephens
Apion rubiginosum Grill
Apion rufirostre (Fabricius)
Apion ulicis (Forster)
Apion violaceum (Kirby)
Apion virens (Herbst)
Apion vorax (Herbst)

Byrrhidae

Simplocaria semistriata (Fabricius

Byturidae

Byturus ochraceus (Scriba)
Byturus tomentosus (DeGeer)

Cantharidae

Cantharis cryptica Ashe

Cantharis decipiens Baudi
Cantharis figurata Mannerheim
Cantharis lateralis L.
Cantharis nigra (Degeer)
Cantharis nigricans (Muller)
Cantharis rufa (L.)
Cantharis rustica Fallen
Malthinus seriepunctatus Kiesenwetter
Malthodes mininus (L.)
Malthodes marginatus (Latreille)
Rhagonycha fulva (Scopoli)
Rhagonycha lignosa (Muller)
Rhagonycha limbata Thomson

Carabidae

Acupalpus dubius Schilsky
Agonum dorsale (Pontoppidan)
Agonum fuliginosum (Panzer)
Agonum marginatum (L.)
Agonum muelleri (Herbst)
Amara aenea (Degeer)
Amara apricaria (Paykull)
Amara bifrons (Gyllenhal)
Amara convexiuscula (Marsham)
Amara familiaris (Duftschmidt)
Amara lucida (Duftschmidt)
Amara ovata (Fabricius)
Amara plebeja (Gyllenhal)
Amara similataa (Gyllenhal)
Amara tibialis (Paykull)
Anisodactylus binotatis (Fab.)
Asaphidion stierlini Heyden
Badister bullatus (Schrank)
Bembidion aeneum Germa
Bembidion articulatum (Panzer)
Bembidion assimile Gyllenhal
Bembidion bruxellense Wesmael
Bembidion dentellum (Thunberg)
Bembidion epphipium (Marsham)
Bembidion femoratum Sturm.
Bembidion fumigatum (Duftschmid)
Bembidion genei Kuster
Bembidion guttula (Fab.)
Bembidion iricolor Bedel
Bembidion lampros (Herbst)
Bembidion lunulatum (Fourcroy)
Bembidion minimum (Fab.)
Bembidion normannum Dejean
Bembidion obtusum Serville
Bembidion pallidipenne (Illiger)
Bembidion properans (Stephens)
Bembidion quadrimaculatum (L.)
Bembidion saxatile Gyllenhal
Bembidion varium (Olivier)
Bradycellus harpalinus (Audinet-Servile)
Broscus cephalotes (L.)
Calathus ambiguus (Paykull)
Calathus cinctus Motschulsky
Calathus erratus (Sahlberg)
Calathus fuscipes (Goeze)
Calathus melanocephalus (L.)
Calathus mollis (Marsham)
Calathus piceus (Marsham)
Calodromius spilotus (Illiger)
Chlaenius nigricornis (Fab.)
Cicindela maritima Latreille & Dejean
Cillenus lateralis Samouelle
Demetrias atricapillus (L.)
Demetrias imperialis (Germar)
Demetrias monostigma Samouelle
Dicheirotrichus gustavi Crotch
Dicheirotrichus obsoletus (Dejean)
Dromius angustus Brulle
Dromius linearis (Olivier)
Dromius melanocephalus Dejean
Dyschirius aeneus (Dejean)
Dyschirius globosus (Herbst)
Dyschirius impunctipennis Dawson
Dyschirius luedersi Wagner
Dyschirius politus (Dejean)
Dyschirius salinus Schaum
Dyschirius thoracicus (Rossi)
Elaphrus cupreus Duftschmid
Elaphrus riparius (L.)
Harpalus affinis (Schrank)
Harpalus anxius (Duftschmid)
Harpalus attenuatus Stephens
Harpalus rubripes (Duftschmid)
Harpalus rufipes (Degeer)
Harpalus servus Duftschmid)
Harpalus tardus (Panzer)
Harpalus vernalis (Duftschmid)
Leistus ferrugineus (L.)
Leistus rufomarginatus (Duftschmid)
Leistus spinibarbis (Fab.)
Loricera pilicornis (Fab.)
Masoreus wetterhali (Gyllenhal)
Nebria brevicollis (Fab.)
Nebria salina Fairmaire
Notiophilus aquaticus (L.)
Notiophilus biguttatus (Fab.)
Notiophilus germinyi Fauvel
Notiophilus palustris (Duftschmid)
Notiophilus rufipes Curtis
Olisthopus rotundatus (Paykull)
Ophonus schaubergerianus (Puel)
Panagaeus bipustulatus (Fab.)
Poecilus cupreus (L.)
Poecilus versicolor (Sturm)
Pogonus chalceus (Marsham)
Pogonus littoralis (Duftschmid)
Pogonus luridipennis (Germar)
Pterostichus diligens (Sturm)
Pterostichus madidus (Fab.)
Pterostichus melanarius (Illiger)
Pterostichus minor (Gyllenhal)
Pterostichus niger (Schaller)
Pterostichus nigrita (Paykull)
Pterostichus rhaeticus Heer
Pterostichus strenuus (Panzer)
Pterostichus vernalis (Panzeer)
Stenolophus mixtus (Herbst)
Synuchus vivalis (Illiger)
Syntomus foveatus (Geoffroy)
Syntomus truncatellus (L.)
Tachy scutellaris Stephens
Trechus fulvus Dejean
Trechus obtusus Ierichson
Trechus quadristriatus (Schrank)
Trechus rivularis (Gyllenhal)

Cerambycidae

Agapanthia villosoviridescens (Degeer)
Arhopalus ferus (Mulsant
Arhopalus rusticus (L)
Clytus arietis (L.)
Grammoptera ruficornis (Fab.)
Leptura rubra L.
Pseudovadonia livida (Fab.)
Saperda carcharias (L.)

Cerylonidae

Cerylon ferrugineum Stephens

Chrysomelidae

Altica longicollis (Allard)
Altica lythri Aube
Altica palustris Weise
Aphthona euphorbiae (Schrank)
Aphthona nonstriata (Goeze)
Apteropeda orbiculata (Marsham)
Bruchidius villosus (Fab.)
Bruchidius rufimanus Boheman
Cassida rubiginosa Muller
Cassida vibex (L.)
Cassida vittata de Villiers
Chaetocnema concinna (Marsham)
Chaetocnema hortensis (Fourcroy)
Chalcoides aurata (Marsham)
Chalcoides aurea (Fourcroy)
Chalcoides fulvicornis (Fab.)
Chrysolina staphylea (L.)
Crioceris asparagi (L.)
Cryptocephalus fulvus Goeze
Cryptocephalus pusillus Fab.
Donacia simplex Fab.
Galeruca tanaceti (L.)
Galerucella lineola (Fab.)
Galerucella pusilla (Duftschmid)
Galerucella sagittariae (Gyllenhal)
Gastrophysa polygoni (L.)
Hippuriphila modeeri (L.)
Lema cyanella (L.)
Lochmaea crataegi (Forster)
Longitarsus dorsalis (Fab.)
Longitarsus ganglbaueri Heikertinger
Longitarsus jacobaeae (Waterhouse)

Longitarsus parvulus (Paykull)
Longitarsus plantagonaritimus Dollman
Longitarsus suturellus (Duftschmid)
Luperus longicornis (Fab.)
Neocrepidodera ferruginea (Scopoli)
Ouleua melanopus (L.)
Phaedon armoraciaew (L.)
Phaedon cochleariae (FAB.)
Phaedon concinnus (Stephens)
Phaedon tumidulus (Germar)
Phratora laticollis Suffrian
Phyllotreta atra (Fab.)
Phyllotreta cruciferae (Goeze)
Phyllotreta nemorum (L.)
Phyllotreta nigripes (Fab.)
Phyllotreta ochripes (Curtis)
Phyllotreta undulata Kutschera
Plateumaris sericea (L.)
Podagrica fuscicornis (L.)
Prasocuris junci (Brahm)
Psylliodes affinis (Paykull)
Psylliodes chrysocephala (L.)
Psylliodes dulcamarae (Koch)
Psylliodes marcida (Iliger)
Psylliodes napi (Fab.)
Seriaylassa haleusis (L.)
Sphaeroderma rubidum (Graells)

Cleridae

Necrobia rufipes (Degeer)
Necrobia violacea (L.)
Thanasimus formicarius (L.)

Coccinellidae

Adalia bipunctata (L.)
Adalia decempunctata (L.)
Anatis ocellata (L.)
Calvia 14-guttata (L.)
Coccidula rufa (Herbst)
Coccinella 7-punctata L.
Coccinella11-punctata (L.)
Exochomus quadripustulatus (L.)
Harmonia axyridis (Pallas)
Harmonia quadripunctata (Pont.)
Hippodamia variegata (Goeze)
Myrrha 18-guttata (L.)
Propylea 14-punctata (L.)
Psyllobora 22-punctata (L.)
Rhyzobius litura (Fab.)
Scymnus frontalis (Fab.)
Stethorus punctillum (Weise)
Subcocciuella 24-punctata (L.)
Tytthaspis 16-punctata (L.)

Colydiidae

Orthocerus clavicornis (L.)

Corylophidae

Corylophus cassidoides (Marsham)
Corylophus sublaevippensis Jacquelin du Val

Cryptophagidae

Antherophagus pallens (L.)
Antherophagus silaceus (Herbst)
Atomaria atricapilla Stephens
Atomaria lewisi Reitter
Atomaria linearis Stephens
Atomaria mesomela (Herbst)
Atomaria nigirostris Stephens
Atomaria nitidula (Marsham)
Atomaria punctithorax Reitter
Atomaria pusilla (Paykull)
Atomaria rubella Heer
Atomaria scutellaris Motschulsk
Atomaria testacea Stephens
Cryptophagus punctipennis Brisout de Barneville
Cryptophagus scanicus (L.)
Episthemus globulus (Paykull)
Micraube ulicis (Stephens)

Curculionidae

Anthonomus pedicularis (L.)
Anthonomus rubi (Herbst)
Barynotus obscurus (Fab.)
Barypeithes pellucidus (Boheman)
Ceutorhynchus chalybaeus Germar
Ceutorhynchus constrictus (Marsham)
Ceutorhynchus contractus (Marsham)
Ceutorhynchus erysimi (Fab)
Ceutorhynchus obstrictus (Marsham)
Ceutorhynchus pallidactylus (Marsham)
Ceutorhynchus picitaris Gyllenhal
Ceutorhynchus pyrrhorhynchus (Marsham)
Ceutorhynchus sulcicollis (Paykull)
Ceutorhynchus turbatus Schultze
Ceutorhynchus typhae (Herbst)
Cleonis pigra (Scopoli)
Coeliodenus rubicundus (Herbst)
Coeliodes transversealbofasciatus (Goeze)
Curcullio pyrrhoceras Marsham
Curculio salicivorus Paykull
Datonychus melanostictus (Marsham)
Dorytomus filirostris Gyllenhal
Dorytomus longimanus (Forster)
Dorytomus rufatus (Bedel)
Dorytomus taeniatus (Fab.)
Euophryum confine (Broun)
Gronops lunatus (Fab.)
Hylastes ater (Paykull)
Hylobius arietis (L.)
Hypera arator (L.)
Hypera dauci (Olivier)
Limnobaris dolorosa (Goeze)
Magdalis armigera (Fourcroy)
Mecinus collaris Germar
Mecinus pascuorum (Gylllenhal)
Mecinus pyraster (Herbst)
Microplontus rugulosus (Herbst)
Mogulones asperifoliarum (Gyllenhal)
Nedyus quadrimaculatus (L.)
Neliocarus faber (Herbst)
Orchestes rusci (Herbst)
Orthochaetes setiger (Beck)
Otiorhynchus atroapterus (DeGeer)
Otiorhynchus clavipes (Bonsdorff)
Otiorhynchus desertus Rosenhauer
Otiorhynchus ovatus I(L.)
Otiorhynchus raucus (Fab.)
Otiorhynchus rugifrons (Gyllenhal)
Otiorhynchus rugostriatus (Goeze)
Otiorhynchus singularis (L.)
Otiorhynchus sulcatus (Fab.)
Parethelcus pollinarius (Forster)
Philopedon plagiatum (Schaller)
Phyllobius glaucus (Scopoli)
Phyllobius pyri (L.)
Phyllobius roboretanus Gredler
Phyllobius vespertinus (Fab.)
Phyllobius viridiaeris (Laicharting)
Phytobius leucogaster (Marsham)
Pissodes castaneus (DeGeer)
Pissodes piui (L.)
Pityophthorus pubescens (Marsham)
Polydrusus cervinus (L.)
Polydrusus confluens Stephens
Polydrusus pulchellus Stephens
Polydrusus tereticollis (DeGeer)
Pselactus spadix (Herbst)
Rhinoucus castor (Fab.)
Rhinoncus pericarpius (L.)
Rhinusa antirrhini (Paykull)
Romualdeus angustisetulus (Hansen)
Scolytus rugulosus (Muller)
Sitona ambiguus Gyllenhal
Sitona cyliudricollis (Fahraeus)
Sitona hispidulus (Fab.)
Sitona humeralis Stephens
Sitona lepidus Gyllenhal
Sitona lineatus (L.)
Tanymecus palliatus (Fab.)
Tricosirocalus troglodytes (Fab.)
Tychius picirostris (Fab.)

Dasytidae

Dasytes aeratus Stephens
Dolichosoma lineare (Rossi)
Psilothrix viridicoeruleus (Fourcroy)

Dermestidae

Dermestes murinus L.

Derodontidae

Laricobius erichsonii Rosenhauer

Dryopidae
Dryops luridus (Erichson)

Dytiscidae
Agabus bipustulatus (L.)
Agabus conspersus (Marsham)
Agabus nebulosus (Forster)
Agabus sturmi (Gyllenhal)
Coelambus impressopunctatus (Schaller)
Coelambus parallelogrammus (Ahrens)
Colymbetes fuscus (L.)
Copelatus haemorrhoidalis (Fab.)
Dytiscus circumcinctus Ahrens
Dytiscus marginalis L.
Graptodytes pictus (Fb.)
Hydroporus memnonius Nicolai
Hydroporus palustris (L.)
Hydroporus planus (Fab)
Hydroporus striola (Gyllenhal)
Hydroporus tesselatus Drapiez
Hydroporus tristis (Paykull)
Hygrotus inaequalis (Fab.)
Hygrotus versicolor (Schaller)
Hyphydrus ovatus (L.)
Ilybius ater (Degeer)
Ilybius fenestratus (Fab.)
Ilybius fuliginosus (Fab.)
Ilybius quadriguttatus (Laccordare & Boisduval)
Llaccophilus hyalinus (Degeer)
Laccophilus minutus (L.)
Nebrioporus elegans (Panzer)
Rhantus frontalis (Marsham)
Stictotarsus duodecimpustulatus (Fab.)
Suphrodytes dorsal

is (Fab.)

Elateridae
Agriotes lineatus (L..)
Agriotes obscurus (L.)
Agriotes pallidulus (Illiger)
Agriotes sputator (L.)
Agrypnus murinus (L.)
Ampedus quercicola (du Buysson)
Athous haemorrhoidalis (Fab.)
Athous vittatus (Fab.)
Cidnopus aeruginosus (Olivier)
Dalopius marginatus (L.)
Kibunea minuta (L.)
Melanotus villosus (Fourcroy)
Prosternon tessellatum (L.)

Elmidae
Elmis aenea (Muller)

Errhinidae
Notaris acridulus (L.)

Geotrupidae
Geotrupes spiniger (Marsham)

Gyrinidae
Gyrinus caspius Menetries
Gyrinus marinus GyllenhaL
Gyrinus substriaatus Stephens

Haliplidae
Haliplus apicalis Thomson
Haliplus confinis Stephens
Haliplus flavicollis Sturm
Haliplus immaculaatus Gerhardt
Haliplus lineatocollis (Marsham)
Haliplus lineolatus Mannerheim
Haliplus ruficollis Degeer
Haliplus weluckei Gerhardt

Helophoridae
Helophorus aequalis Thomson
Helophorus brevipalpis Bedel
Helophorus fulgidicollis Motsch
Helophorus grandis Illiger
Helophorus griseus Herbst
Helophorus minutus Fab.
Helophorus nanus Sturm
Helophorus obscurus Mulsant
Helophorus strigifrons Thomson

Heteroceridae
Heterocerus fenestratus (Thunberg)
Heterocerus flexuosus Stephens
Heterocerus fossor Kiesenwetter
Heterocerus marritimus Guerin-Meneville
Heterocerus obsoletus Curtis

Histeridae
Abraeus perpusillus (Marsham)
Baeckmanniolus dimidiatus (Illiger)
Carcinops pumilio (Erichson)
Hister striola Sahlberg
Hister unicolor L.
Hypocaccus metallicus (Herbst)
Kissister minimus (Aube)
Margarinotus brunneus (Fab.)
Margarinotus marginatus (Erichson)
Margarinotus purpurascens (Herbst)
Margarinotus ventralis (Marseul)
Onthophilus striatus (Forster)
Paromalus flavicornis (Herbst)
Saprinus aeneus (Fab.)
Saprinus cuspidatus Ihssen
Saprinus semistriatus (Scriba)

Hydraenidae
Limnebius truncatellus Thunberg)
Ochthebius auriculatus Rey
Ochthebius dilatatus Stephens
Ochthebius marinus (Paykull)
Ochthebius minimus Fab.)
Ochthebius nanus Stephens

Hydrophilidae
Anacaena bipustulata (Marsham)
Anacaena globulus (Paykull)
Anacaena limbata (Fab.)
Anacaena lutescens (Stephens)
Cercyon analis (Paykull)
Cercyon atomarius (Fab.)
Cercyon depressus Stephens
Cercyon haemorrhoidalis (Fab.)
Cercyon lateralis (Marsham)
Cercyon littoralis (Gyllenhal)
Cercyon marinus Thomson
Cercyon melanocephalus (L.)
Cercyon quisquilius (L.)
Cercyon terminatus (Marsham)
Chaetarthria seminulum (Herbst)
Coelostoma orbiculare (Fab.)
Cryptopleurum minutum (Fab.)
Cymbiota marginella (Fab.)
Enochrus bicolor (Fab.)
Enochrus halophilus (Bedel)
Enochrus melanocephalus (Olivier)
Enochrus ohropterus (Marsham)
Enochrus quadripunctatus (Herbst)
Enochrus testaceus (Fab.)
Hydrobius fuscipes (L.)
Laccobius biguttatus Gerhardt
Laccobius bipunctatus (Fab.)
Laccobius minutus (L.)
Laccobius striatulus (Fab.)
Sphaeridium lunatum Fab.
Sphaeridium scarabaeoides (L.)

Hygrobiidae
Hygrobia hermanni (Fab.)

Kateretidae
Brachypterus glaber (Newman)
Brachypterus urticae (Fab.)
Kateretes rufilabris (Latreille)

Latridiidae
Aridius bifasciata (Reitter)
Aridius nodifer(Westwood)
Corticaria crenulata (Gyllenhal
Corticaria impressa (Olivier)
Corticaria punctulata (Marsham)
Corticarina minuta (Fab.)
Cortinicara gibbosa (Herbst)
Enicmus histrio Joy & Tomlin
Enicmus transversus (Olivier)
Melanopthalma transversalis (Gyllenhal)
Stephostethus lardarius (Degeer)

Leiodidae
Anisotoma humeralis (Fab.)
Catops chrysomeloides (Panzer)
Catops fuliginosus Erichson
Catops fuscus (Panzer)
Catops grandicollis Erichson
Catops morio (Fab.)
Hydnobius punctatus (Sturm)
Leiodes dubia (Kugelann)
Leiodes obesa (Schmidt, W.L.E.)

Nargus anisotomoides (Spence)
Potamaphagus subvillosus (Goeze)
Sogda suturalis (Zetterstedt)

Malachidae

Anthocomus rufus (Herbst)
Clanoptilus barnevillei (Puton)
Malachius bipustulatus (L.)

Mordellidae

Mordellistena pumilia (Gyllenhal)

Nanophyidae

Nanophyes marmoratus (Goeze)

Nitidulidae

Carpophilus marginellus Motschulsky
Cychramus luteus (Fab.)
Epuraea aestiva (L.)
Glischrochilus hortensis (Fourcroy)
Meligethes aeneus (Fab.)
Meligethes carinulatus Forster
Meligethes flavimanus Stephens
Meligethes fulvipes Brisout
Meligethes nigrescens Stephens
Meligethes obscurus Erichson
Meligethes planiusculus (Heer)
Meligethes rotundicollis Brisout de Barneville
Meligethes viridescens (Fab.)
Omosita colon (L.)
Pocadius ferrugineus Fab.)
Pria dulcamarae (Scopoli)

Noteridae

Noterus clavicornis (Degeer)

Oedemeridae

Nacerdes melanura (L.)
Oedemera femoralis (Olivier)
Oedemera lurida (Marsham)
Oedemera nobilis (Scopoli)

Phalacridae

Olibrus aeneus (Fab.)
Olibrus affinis (Sturm)
Olibrus corticalis (Panzer)
Olibrus liquidus Erichson
Phalacrus fimetarius (Fab.)
Stilbus testaceus (Panzer)

Ptilidae

Acrotrichis fascicularis (Herbst)
Acrotrichis sitkaensis (Motschulsky)
Ptenidium fuscicorne Erichson
Ptenidium punctatum (Gyllenhal)

Ptinidae

Anobium fulvicorne (Sturm)
Anobium punctatum (Degeer)
Ernobius mollis (L.)
Stegobium paniceum (L.)

Pyrochriodae

Pyrochroa serraticornis (Scopoli)

Rhizophagidae

Rhizophagus dispar (Paykull)

Rhynchitidae

Deporaus betulae (L.)
Neoceonorrhinus germanicus (Herbst)
Neoceonorrhinus minutus (Herbst)
Tatianaerhynchites aequatus (L.)

Salpingidae

Salpingus reyi (Abeille)

Scarabaeidae

Aegialia arenaria (Fab.)
Amphimallon solstitalis (L.)
Anomala dubia (Scopoli)
Aphodius ater (Degeer)
Aphodius contaminatus (Herbst)
Aphodius distinctus (Muller)
Aphodius erraticus (L.)
Aphodius fimetarius (L.)
Aphodius foetens (Fab.)
Aphodius foetidus Herbst.
Aphodius fossor (L.)
Aphodius granarius (L.)
Aphodius ictericus (Laicharting)
Aphodius merdarius (Fab.)
Aphodius paykulli Bedel
Aphodius prodromus (Brahm)
Aphodius rufipes (L.)
Aphodius rufus (Moll)
Aphodius sphacelatus (Panzer)
Hoplia philanthus (Fuewssly)
Onthophagus similis (Scriba)
Phyllopertha horticola (L.)

Scirtidae

Cyphon coarctatus Paykull
Cyphon hilaris Nyholm
Cyphon laevipennis Tournier
Cyphon padi (L.)
Cyphon palustris Thomson
Scirtes hemisphaericus (L.)

Scraptiidae

Anaspis lurida Stephens
Anaspis maculata Fourcroy
Anaspis pulicaria Costa, A.
Anaspis regimbarti Schilsky

Silphidae

Necrodes littoralis (L.)
Nicrophorus humator (Gleditisch)
Nicrophorus investigator Zetterstedt
Nicrophorus vespillo (L.)
Nicrophorus vespilloides Herbs
Oiceoptoma thoracicum (L.)
Silpha atrata L:
Silpha laevigata Fab.
Silpha tristis Illiger
Thanatophilus rugosus (L.)
Thanatophilus sinuatus (Fab.)

Staphylinidae

Acrotona parvula (Mann.)
Aleochara bilineata Gyllenhal
Aleochara binotata Kraatz
Aleochara bipustulata (L.)
Aleochara cuniculorum Kraatz
Aleochara curtula (Goeze)
Aleochara grisea Kraatz
Aleochara intricata Mann.
Aleochara lanuginosa Gravenhorst
Aleochara obscurella Grav enhorst
Aleochara punctatella Motschulsky
Aleochara verna Say
Aloconota gregaria (Erichson)
Amischa analis (Gravenhorst)
Amischa decipiens (Sharp)
Amischa forcipata Mulsant & Rey
Anotylus complanatus (Erichson)
Anotylus inustus (Gravenhorst)
Anotylus maritimus Thomson
Anotylus rugosus (Fab.)
Anotylus sculpturatus (Gravenhorst)
Anotylus tetracarinatus (Block)
Anthobium unicolor (Marsham)
Atheta aterrima (Gravenhorst)
Atheta atramentaria (Gyllenhal)
Atheta crassicornis (Fab.)
Atheta divisa (Markel)
Atheta fungi (Gravenhorst)
Atheta graminicola (Gravenhorst)
Atheta malleus Joy
Atheta orbata (Erichson)
Atheta triangulum (Kraatz)
Atheta vollans (Scriba)
Atheta xanthopus (Thomson)
Atrecus affinis (Paykull)
Autalia longicornis Scheerpeltz
Bisnius fimetarius (Gravenhorst)
Bledius atricapillus (Germar)
Bledius bicornis (Germar)
Bledius diota Schiodte
Bledius fergussoni Joy
Bledius furcatus (Olivier)
Bledius fuscipes Rye
Bledius germanicus Wagner
Bledius spectabilis Kraatz
Bledius subniger Schneider
Bledius subterraneus Erichson
Bledius tricornis (Herbst)
Bledius unicornis (Germar)
Bolitobius castaneus (Stephens)
Brachygluta helferi (Schmidt-Goebl)
Brachygluta waterhousei (Rye)
Cafius xantholoma (Gravenhorst)
Callicerus obscurus Gravenhorst
Carpelimus corticinus (Gravenhorst)
Carpelimus halophilus (Keisenwetter)
Chaetida longicornis (Gravenhorst)

Chiloporata longitarsis (Erichson)
Corophilus striatulus (Fab.)
Creophilus maxillosus (L.)
Cypha longicornis (Paykull)
Cypha pulicaria (Erichson)
Datomicra celata (Erichson)
Datomicra nigra (Kraatz)
Diglotta mersa (Halliday)
Diglotta submarina (Fairmaire & Laboulbene)
Dimetrota marcida (Erichson)
Dinaraea angustula (Gyllenhal)
Dinothenarus pubescens (Degeer)
Eusphalerum minutum (Fab.)
Eusthalerum torquatum (Marsham)
Gabrius osseticus (Kolenati)
Gyupeta rubrior Tottenham
Gyrohypnus angustatus Stephens
Gyrohypnus fracticornis (Muller)
Gyrohypnus punctulatus (Paykull)
Halobrecta algae (Hardy)
Halobrecta flavipes Thomson
Heterothrops binotatus (Gravenhorst)
Heterothrops praevius Erichson
Hygronoma dimidiata (Gravenhorst)
Ischnosoma splendidum (Gravenhorst)
Lathrobium fulvipenne (Gravenhorst)
Lesteva heeri Fauvel
Liogluta longiuscula (Gravenhorst)
Lordithon trinotatus (Erichson)
Megarthrus prosseri Schatzmayr
Metopsia retusa (Stephens)
Mocyta amplicollis (Mulsant & Rey)
Mycetoporus lepidus (Gravenhorst)
Mycetoporus longulus Mannerheim
Mycetoporus nigricollis Stephens
Myllaena infuscata Kraatz
Nehemitropia lividipennis (Mannerheim)
Ocypus aeneocephalus (Degeer)
Ocypus brunnipes (Fab.)
Ocypus olens (Muller)
Ocypus opthalmicus (Scopoli)
Oligota pumilio Keisenwetter
Omalium caesum Gravenhorst
Omalium laeviusculum Gyllenhal
Omalium riparium Thomson
Oualium rivulare (Paykull)
Ontholestes murinus (L.)
Othius laeviusculus Stephens
Othius subuliformis Stephens
Ousipalia caesula (Erichson)
Oxypoda elongatula Aube
Oxypoda haemorrhoa (Mannerheim)
Oxypoda opaca (Gravenhorst)
Oxypoda umbrata (Gyllenhal)
Oxytelus laqueatus (Marsham)
Philhygra palustris (Keisenwetter)
Philonthus addendus Sharp
Philonthus carbonarius (Gravenhorst)
Philonthus cognatus Stephens
Philonthus concinnus (Gravenhorst)
Philonthus cruentatus (Gmelin)
Philonthus laminatus (Creutzer)
Philonthus marginatus (Strom)
Philonthus politus (L.)
Philonthus quisquillarius (Gyllenhal)
Philonthus rectangulus Sharp
Philonthus sanguinolentus (Gravenhorst)
Philonthus splendens (Fab.)
Philonthus succicola Thomson
Philonthus tenuicornis Mulsant & Rey
Philonthus varians (Paykull)
Philonthus ventralis (Gravenhorst)
Phloeostiba plana (Paykull)
Phytosus balticus Kraatz
Phytosus spinifer Curtis
Platydracus stercorarius (Olivier)
Platystethus cornutus (Gravenhorst)
Platystethus nitens (Sahlberg)
Proteinus brachypterus (Fab.)
Quedius boops (Gravenhorst)
Quedius cinctus (Paykull)
Quedius cruentus (Olivier)
Quedius curtipennis Bernhauer
Quedius fulgidus (Fab.)
Quedius fuliginosus (Gravenhorst)
Quedius lateralis (Gravenhorst)
Quedius levicollis (Brulle)
Quedius mesomelinus (Marsham)
Quedius nigriceps Kraatz
Quedius persimillis Mulsant & Rey
Quedius picipes (Mannerheim)
Quedius semiaeneus (Stephens)
Quedius semiobscurus (Marsham)
Quedius simplicifrons Fairmaire
Rugilus erichsoni (Fauvel)
Rugilus orbiculatus (Paykull)
Rugilus rufipes Germar
Scaphisoma boleti (Panzer)
Sepedophilus bipunctatus (Gravenhorst)
Sepedophilus lusitanicus Hammond
Sepedophilus marshami (Stephens)
Sepedophilus nigripennis (Stephens)
Sepedophilus pedicularis (Gravenhorst)
Sepedophilus testaceus (Fab.)
Staphylinus erythropterus L.
Stenichnus scutellaris (Muller
Stenus aceris Istepheus
Stenus ater Mannerheim
Stenus binotatus Ljungh
Stenus brunnipes Stephens
Stenus canaliculatus Gyllenhal
Stenus clavicornis (Scopoli)
Stenus formicetorum Mannerheim
Stenus fulvicornis Stephens
Stenus impressus Germar
Stenus juno (Paykull)
Stenus providus Erichson
Stenus pusillus Stephens
Stenus solutus Erichson
Stenus tarsalis Ljungh
Sunius propinquus (Brisout de Barneville)
Tachinus signatus Gravenhorst
Tachyporus chrysomelinus (L.)
Tachyporus dispar (Paykull)
Tachyporus hypnorum (Fab.)
Tachyporus obtusus (L.)
Tachyporus pallidus Sharp
Tachyporus pusillus Gravenhorst
Tachyporus solutus Erichson
Tasgius ater (Gravenhorst)
Tasgius globulifer (Geoffroy)
Tasgius melanarius (Heer)
Tasgius morsitans (Rossi)
Thinobaena vestita (Gravenhorst)
Thinonoma atra (Gravenhorst)
Tinotus morion (Gravenhorst)
Tychus niger (Paykull)
Xantholinus elegans (Olivier)
Xantholinus gallicus Coiffait
Xantholinus glabratus (Gravenhorst)
Xantholinus linearis (Olivier)
Xantholinus longiventris Heer

Tenebrionidae

Crypticus quisquillius (L.)
Ctenopius sulphureus (L.)
Isomira murina (L.)
Lagria hirta (L.)
Melanimon tibialis (Fab.)
Opatrum sabulosum (L.)
Phaleria cadaverina (Fab.)
Phylan gibbus (Fab.)
Xanthomus pallidus (Curtiis)

Tetratomidae

Hallomenus binotatus (Quensel)

Total 817

The Bryophytes of Ingoldisthorpe Common, a relict mire in West Norfolk

Robin Stevenson

Summary: Apparent changes in the bryoflora of the damp areas of Ingoldisthorpe Common, west Norfolk were investigated, but could not be attributed with certainty to any specific factors. The mire-related nature of the vegetation may indicate that mires on the east coast of the Wash, such as that seen at Dersingham Bog NNR, may formerly have been more extensive.

The setting

Ingoldisthorpe Common falls largely in the Ordnance Survey monad TF6831. The underlying geology consists of Head, i.e. material which has moved down slope in post-glacial times, under the influence of gravity. It is derived from the outcrop of lower Cretaceous sands lying to the east (Gallois 1994). To the west the terrain consists of flat reclaimed marshland. The Common sits on the marsh edge with dry woodland to the east, and wet woodland, fed by water seeping out at the base of the slope, to the west. The site is hemmed in on the western side by the A149 Dersingham Bypass and on the east by housing, and the B1440. It is further dissected by an old railway line and, running parallel to this, a major dyke (Fig. 1).

The adjacent Life Wood is, at present very dry, although a narrow fringe of *Molinia*-dominated vegetation lies immediately to the east of the old railway track; this, and the presence of a series of major drains crossing the site, suggests the whole area may have been much wetter in the past.

East of the former railway line the ground rises very gradually towards the B1440. At present there is a mosaic of vegetation types present. The vegetation is dominated by dry birch dominated woodland. At present only fragments of *Calluna*-dominated heath survive, along with a few small patches of *Sphagnum* spp. (*S. fimbriatum* and *S. subnitens*) in a series of irregular shallow depressions at the northern end of the site but it can be surmised that formerly heath - and probably wet heath - occupied much of the site.

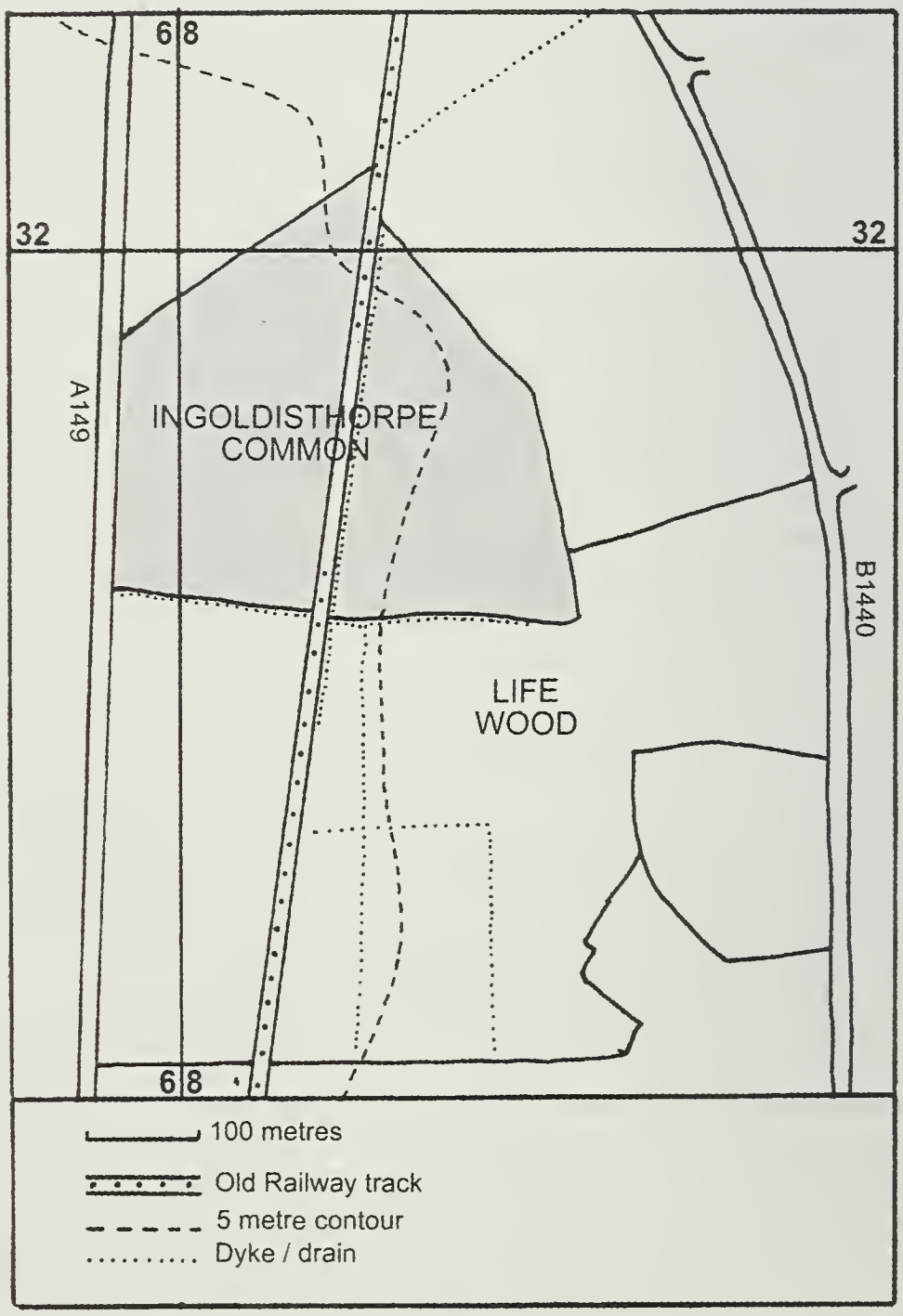

Figure 1. Map showing the position of Ingoldisthorpe Common.

The vegetation

To the west of the old railway line (now a footpath) the dominant vegetation type is, following the National Vegetation Classification (NVC) criteria (Rodwell 1991a), a W4 *Betula pubescens-Molinia caerulea* woodland, belonging to the *Sphagnum* spp. sub-community (Fig.3; p.68).

W4 woodland is very closely related to the M25 *Molinia caerulea - Potentilla erecta* mire community (Rodwell 1991b). W4 woodland is, more-or-less, simply M25 mire, with trees, and M25 mire is W4 woodland, without trees. Rodwell (1991a) in fact points out that (in some instances) the vegetation in this sub-community "preserves elements of the wet heath or mire from which the woodland has developed".

Purple Moorgrass *Molinia caerulea* is a defining plant in both the W4 and M25 communities. With its tendency to produce ankle-wrenching tussocks it ranks amongst the less attractive British grasses, however, *Molinia* is a common plant, particularly in western Britain; in eastern Britain *Molinia*-dominated communities are rarer, and therefore more noteworthy. *Molinia* has an interesting ecology, details of which can be found in Grime *et al.* 2007, and Rodwell 1991a & b).

In the early 1980s areas of damp woodland also existed to the east of the railway line but the deepening of the N - S dyke has dried out those areas to the east of the line almost completely - to the point when species, such as *Sphagnum* spp. have almost disappeared.

Even in the remaining area of 'good' M4 the *Sphagnum* spp. appear to be less abundant than in the 1980s, whilst the range of other bryophytes encountered during a recent survey (Table 1) seemed much greater than normally associated with W4 woodlands.

Analysis of change

Over the last 30 years or so many environmental changes have occurred, some of which will have impacted on the site. Acid deposition has declined; nitrogen deposition has increased; a major road (the A149 Dersingham Bypass) has been constructed nearby; dyke deepening may have affected the hydrology of the site, and

Table 1. Bryophyte species present within the *Betula-Molinia* woodland west of the old rail track, Ingoldisthorpe Common. Nomenclature follows Hill *et al.*, 2008. Emboldened species are not listed in the floristic tables presented by Rodwell (1991); species followed by an* are epiphytic species whose presence is independent of the woodland classification. Species abundance has been assessed using the DAFOR scale: **D**ominant; **A**bundant; **F**requent; **O**ccasional; **R**are.

Species	Ecological notes	Abundance
Aulacomnium androgynum	On rotting tree stumps	O
Aulacomnium palustre	In Molinia rich areas though patchy in occurrence.	O
Brachythecium rutabulum	Tree bases and trunks	O
Calypogeia fissa	Only a few strands were found, in deep dark runnels between Molinia tussocks.	R
Campylopus flexuosus	On tree roots and stumps.	O
Campylopus introflexus	Tree bases and roots	F
Cephalozia bicuspidata	On damp humus rich paths subject to trampling	O
Dicranoweissia cirrata*	Epiphytic on birch and oak.	F
Dicranum scoparium	Seen fruiting in several places, which is rare for Norfolk.	F

Species	Ecological notes	Abundance
Dicranum majus	A single fairly small colony found.	R
Dicranum polysetum	A single fairly small colony found.	R
*Dicranum tauricum**	Epiphytic on a single oak and adjacent birch. This is a species which appeared to be spreading when acid rain was prevalent; now, it may be shrinking in range.	R
Eurhynchium striatum	This woodland taxon was rather unexpected	O
*Frullania dilatata**	Epiphytic on oak.	
Gymnocolea inflata	A small patch, growing on a relatively little used path. This is a plant of acid mires.	R
Hylocomium splendens	A couple of small colonies.	R
Hypnum cupressiforme	Mainly associated with tree roots, but also on the soil in drier areas.	F
Hypnum jutlandicum	A major contributor to bryophyte dominated areas within the Molinia mire.	F
Isothecium myosuroides	A single small colony on a tree stump	R
Kindbergia praelonga	A major contributor to bryophyte dominated areas within the Molinia mire.	A
Leucobryum glaucum	A small colony in the area of dry woodland	R
Lophocolea bidentata	Present in small quantities in a variety of habitats, ranging from tree roots to amongst grassland species.	O
Lophocolea heterophylla	Present on tree bases and roots.	
Lophocolea semiteres	This alien liverwort was growing on a damp, trampled, path.	R
Orthodontium lineare	On tree bases and stumps.	O
*Orthotrichum affine**	Epiphytic on young oak trees.	
Plagiothecium curvifolium	Occurring on tree roots and bases.	O
Plagiothecium undulatum	In places this plant was quite prominent, spreading over other species.	O
Pleurozium schreberi	The dominant species in some areas, but absent elsewhere.	F
Pohlia nutans	Only a few strands seen.	R
Polytrichum formosum	Only in a few places.	R
Pseudoscleropodium purum	Probably the single commonest species growing up amongst the Molinia tussocks.	A
Rhytidiadelphus loreus	This plant appears to be spreading in the county; several separate colonies of this species were found on this site alone.	R
Rhytidiadelphus squarrosus	This species, common in grasslands and lawns is less frequent than some of the other robust pleurocarpous species such as Hypnum jutlandicum and Pseudoscleropodium purum	O
Rhytidiadelphus triquetrus	A single colony of this found. This is normally a plant of fairly dry habitats so to find it in such a damp situation was unusual.	R
Sphagnum fimbriatum	Only one relatively small patch found.	R
Sphagnum palustre	Several patches found; formerly - if memory serves - it was much more frequent.	R
Sphagnum subnitens	Some small patches in irregular pits.	R
Thuidium tamariscinum	Only one, relatively big, colony found.	R
*Ulota bruchii**	The commonest epiphyte on oaks.	F

Table 2. Species present and their Ellenberg values (Hill et al 2007).

L = Light [1-9]; F = Moisture [1-12]; R = Reaction(pH) [1-9]; N = Nitrogen [1-7]; S = Salt tolerance [1-5]; HM = Heavy-metal tolerance [1-5]. Figures in brackets indicate the total range of the scale used. Species in bold do not occur in the floristic tables defining the W4 community (Rodwell 1991a).

Species	L	F	R	N	S	HM
Aulacomnium androgynum	5	6	3	4	0	0
Aulacomnium palustre	7	8	3	2	0	1
Brachythecium rutabulum	6	6	6	6	0	0
Calypogeia fissa	3	7	3	3	0	0
Campylopus flexuosus	6	6	2	1	0	2
Campylopus introflexus	7	5	2	2	0	2
Cephalozia bicuspidata	4	7	2	2	0	1
Dicranum scoparium	6	5	3	2	0	2
Dicranum majus	4	6	3	2	0	0
Dicranum polysetum	5	5	3	2	0	0
Eurhynchium striatum	4	6	6	5	0	0
Gymnocolea inflata	7	7	1	1	0	3
Herzogiella seligeri	4	6	3	3	0	0
Hylocomium splendens	6	5	4	2	0	2
Hypnum cupressiforme	6	4	4	4	0	1
Hypnum jutlandicum	6	5	2	2	0	1
Isothecium myosuroides	4	6	4	3	0	0
Kindbergia praelonga	5	6	5	5	1	1
Lophocolea bidentata	5	6	4	3	0	1
Lophocolea heterophylla	4	5	4	5	0	0
Lophocolea semiteres	5	5	4	2	0	0
Mnium hornum	4	5	4	4	0	1
Orthodontium lineare	4	5	3	4	0	0
Plagiothecium curvifolium	3	5	3	5	0	0
Plagiothecium undulatum	4	6	2	2	0	0
Pleurozium schreberi	6	5	2	2	0	1
Pohlia nutans	5	5	2	2	0	3
Polytrichum formosum	4	6	3	3	0	1
Pseudoscleropodium purum	7	5	6	3	0	2
Rhytidiadelphus loreus	5	6	2	2	0	0
Rhytidiadelphus squarrosus	7	5	5	4	0	2
Rhytidiadelphus triquetrus	6	6	6	3	0	1
Sphagnum fimbriatum	6	8	3	3	0	2
Sphagnum palustre	7	8	3	2	0	0
Thuidium tamariscinum	5	6	5	4	0	1
Epiphytes: not included in the ensuing analysis						
Dicranoweissia cirrata	5	4	4	4	0	3
Dicranum tauricum	4	4	3	3	0	0
Frullania dilatata	6	4	6	4	1	0
Orthotrichum affine	6	4	6	5	0	0
Ulota bruchii	5	5	5	4	0	0

seral changes to vegetation may also have occurred.

Although it is clear that the essential character of the woodland (i.e. W4) has remained unchanged, vascular plants are not as sensitive to minor environmental changes as are many bryophytes. It was therefore decided to compare the bryoflora present today with those species listed in the floristic tables accompanying the original definitions of the W4 woodland type (Rodwell 1991a).

The ecological requirements of all the species present, as represented by their Ellenberg Values, have been tabulated (Table 2), and the results then separated and compared (Table 3). (Heinz Ellenberg was a German botanist and ecologist who developed scales for rating plant preferences for various environmental conditions, such as light (L), soil moisture (F), pH (R), nutrients (N), and salinity (S). These were partly based on actual measurements, but also included assessments based on expert ecological opinions).

The 'original' species present are 20 in number whilst there are 15 'additions'.

Results and discussion

The 'additions' can be regarded either as a) species which have colonised the community as a result of post-1991 environmental changes, or b) examples of species which were present pre-1991, but which did not occur sufficiently frequently as to figure in the floristic tables defining the community. If, for the sake of argument, assumption a) is followed then the data in Table 3 might be expected

Table 3. A comparison of the percentage of particular Ellenberg Values represented by the species used to define the NVC W4 community, and the percentage values of the additional species recorded during this survey. NB. The fact that a plant may be capable of withstanding certain conditions does not mean that they actually occur. Cells highlighted are the highest percentage in each category.

	Percentage of Ellenberg Values								
	0	1	2	3	4	5	6	7	8
L NVC				5	20	20	35	20	
'New' species				7	40	26	14	13	
F NVC					5	45	30	5	15
'New' species						33	53	14	
R NVC			20	35	20	15	10		
'New' species		7	26	33	20		14		
N NVC		5	30	25	25	10	5		
'New' species		7	52	20	7	14			
S NVC	95	5							
'New' species	100								
HM NVC	25	45	15	5					
'New' species	67	13	13	7					

to show major differences at some point(s). However, the distribution of Ellenberg values indicate that there has been little overall change in the acidity of the site.

L. The wide range of values for light are what one might expect for an area of light woodland. There does seem as if there has been a shift towards less light demanding species amongst the newcomers - perhaps an indication of an increasing tree density (seral change) over time?

F. Those species new to the community seem to indicate a slight preference for rather damper conditions. This is not consistent with the original impression that there was less *Sphagnum* than formerly, and the observation that the dyke parallel to the footpath had been deepened.

R. The range of values for R, which is an expression of acidity (as measured by pH)) is quite considerable. The bulk of the values are low, as one might expect, but there are a scattering of higher values, as expressed by species such as *Brachythecium rutabulum, Pseudoscleropodium purum, Eurhynchium striatum* and *Rhytidiadelphus triquetrus*.

N. Again there is a considerable range of values exhibited. The bulk of the species present are consistent with low nutrient levels. However, as time passes, and at present rates of nitrogen deposition, it is to be expected that the relative proportions of nitrogen-intolerant: tolerant species will change, with nitrogen-tolerant species becoming more abundant.

S. Despite the relative proximity of the sea none of the plants present give any indication of salt tolerance.

HM. Again, only a few of the species present are capable of dealing with anything other than moderate levels of heavy metals. Their presence does not, of course, indicate that there are any heavy metals present, indeed the increasing percentage of intolerant species amongst the additions confirms this.

Conclusions

Although the results presented above do suggest that changes might be occurring, there is not enough data for any meaningful statistical analysis. And, of course, results from a single small site may be totally aberrant.

Under the circumstances it is probably safest to assume either that the 'new' species seen do occur in W4 woodlands, but at very low frequency levels, or that their presence has been caused by changes in the environment which are too subtle to register on the Ellenberg scales. (The scale gaps used on the Ellenberg scales may be insufficiently narrow to reflect what are possibly very small, but nonetheless environmentally significant changes; additionally the analysis presented above has not taken any account of the relative abundance of the species present).

However, given that most of the data on which the NVC characterisation of plant communities are based is now well over twenty years old, a much larger scale study might be able to accumulate enough data to yield meaningful indications of change - if it is, indeed, happening.

Lophocolea semiteres and *Campylopus introflexus* are both invasive aliens, whilst *Herzogiella seligeri* and *Dicranum polysetum* may also be expanding their range. *Rhytidiadelphus loreus* is a species which, nationally, seems to be regaining ground lost during the years of SO_2 pollution (Blockeel et al 2014).

Implications for management

Despite the equivocal status of its bryoflora it seems worth drawing attention at this stage to the importance of Ingoldisthorpe Common as a possible relic of a former fringe of mire habitats between the higher ground of west Norfolk and its marshland fringe. Other such sites exist, including Dersingham Fen SSSI, parts of Ling Common, North Wootton, and parts of White Hills Woods, Castle Rising bordering the Babingley valley. The last two sites have been affected, to some degree or another, by coniferisation, however Ling Common has the best preserved remnants of other mire types, including fragments close to M16 Erica tetralix - Sphagnum compactum mire.

Rankin, in one of the earliest summaries of British ecology (Tansley 1911) discussed what we would now term mire communities, making a distinction between estuarine and lacustrine 'moors'. These relict mires, bordering the Wash would qualify as 'estuarine', though this is a distinction which has been long discarded. However, the notion that a group of related plant communities once formed part of a ribbon fringing the edge of the higher ground in West Norfolk, feeds into the concept of a 'Living Landscape'.

All these sites would benefit - were this possible - from management designed to restore and enhance their status as mires or mire fragments and allow them to re-establish an identity as a 'Living Landscape' (Anon, 2010). Dersingham Bog NNR, however, remains the most complete example of this 'estuarine' type of mire in southern Britain. However, it too would probably have been drained and reclaimed had the construction of the railway not taken place.

Acknowledgements

Julia Masson first drew my attention of the 'Living Landscape' concept, one which was further explored by discussion in the field with Ash Murray, who also pointed out features suggesting that communities may have been even more extensive in the past. Keith Redhead provided assistance in the field. Bob Ellis and Dr. Mark Hill commented on earlier drafts, comments which - if I have interpreted them correctly - have greatly improved this note, as have several editorial suggestions.

Ingoldisthorpe Common is owned by the Parish Council but at present appears to be completely unmanaged. Such open heath as survives is associated with clearance along a power line, and the main use of the site seems to be recreational.

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An early record of Grape Vine (*Vitis vinifera*) as a food refuse casual in King's Lynn, West Norfolk

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In reading a recent translation of John Ray's work on plant classification *Methodus plantarum nova* (Nimis *et al*. 2014), my attention was caught by a passage in which Ray discusses the longevity of seeds. This includes an interesting record of the Grape Vine in Norfolk. Ray's original passage (1682, p. 4) reads:

> *Ostendit mihi olim* D. Toll *curiosus florum cultor* Lennæ Norfolcæ *fimetum, in quod ante aliquot annos projectæ fuissent uvæ passæ corruptæ, ut ibidem computrescerent; ex earum autem vinaceis quotannis, stercore moto, vites aliquam multæ enascebantur, & novæ post 4. minimùm annos.*

The following translation differs in several ways from that offered by Nimis *et al*.:

> *Master Toll* of *Lynn, Norfolk*, a diligent cultivator of flowers, once showed me a dunghill on which spoiled raisins had been thrown several years before, so that they might rot there; but every year, after the dung had been moved, a considerable number of grape vines arose from their grape stones, & new vines arose after at least 4 years.

The vines described by Toll to Ray are clearly 'food refuse casuals' in the classification of Clement & Foster (1994); they note that in the British Isles *Vitis vitifera* occurs as "a food refuse casual on tips".

Who was Master Toll? Ray refers to him as *D. Toll, D.* standing for *Dominus*, the honorific then given to those possessing the Master of Arts (M.A.) degree. This is translated here as Master, although it is of course no longer customary to give M.A.s this title. There is only one possible candidate for Ray's informant in the on-line database of University of Cambridge alumni (ACAD), and none in the University of Oxford equivalent. Nicholas Toll (c. 1601–1657) was the son of William Toll, rector of Wells, Norfolk; he went to school at Norwich and then to Cambridge, where he was initially admitted as a sizar to Magdalene College (1619) and then as a scholar to Caius College (1621), when he was 20 years old. After his Cambridge years he spent ten years as rector of St. Julian, St. Edward and St. Clement, Norwich (1624–34) before becoming curate of St. Nicholas Chapel, King's Lynn, Norfolk (1633–51) and then rector there until his death in December 1657 (Venn 1897; Venn & Venn 1927). He was buried in St. Nicholas Chapel and the inscription on his tomb (which he shared with his wife, who died in November 1657) is set out by Mackerell (1738, p. 132).

John Ray became interested in botany in 1650 or 1651, so he presumably visited King's Lynn between then and Toll's death in 1657. We know from the localities in Ray's first book, *Catalogus plantarum circa Cantabrigiam nascentium* (1660), that he visited Wisbech in the 1650s. He may have combined a visit to Wisbech with one to King's Lynn, a possibility perhaps suggested by the record of *Bolboschoenus maritimus* (as *Gramen cyperoides palustre paniculâ sparsâ*) in Ray's later English Catalogue, "In the Fen-ditches about Wisbich and Marshland in Norfolk, abundantly" (Ray 1670, p. 147). Ray (1670, p. 296) also recorded *Lepidium ruderale* "Near the Sea in many places, v.g. Maldon in Essex, Lynne in Norfolk, Truro in Cornwal, &c." The record of *Vitis vitifera* was not included in Ray's national floras, almost certainly because he did not consider that such casuals merited inclusion (see

Oswald & Preston 2011, p. 473), nor is it given in his very detailed treatment of *Vitis* in *Historia Plantarum* (1688, pp. 1613–1618). It is not surprising that Toll's observation, written in Latin and published only in a general work on plant taxonomy, has been overlooked by Ray's biographers, and by the compilers of county floras.

It is in the *Methodus* that Ray set out for the first time a considered taxonomic arrangement of plants. Here, famously, he first employed his celebrated division of plants into monocotyledons and dicotyledons, and the discussions of seeds in the introductory material can be seen against this background. Ray's treatment of seeds in the *Methodus* is discussed by Michael Black (2014) in an introductory chapter to the new translation, although this valuable contribution does not bring out the long-standing nature of Ray's interest in plant seeds. The Cambridge *Catalogus* (1660) includes numerous observations on seeds, most of which are drawn from earlier authors including the notes on the germination of cereals published by the Norfolk physician Thomas Browne (see Oswald & Preston 2011, p. 309). However, Ray also includes some observations of his own on the kernel of the Date in the *Catalogus* (Oswald & Preston 2011, p. 198). By 1674 Ray had made enough original observations on seeds to summarise them in one of two papers he sent to the Royal Society that year, *A discourse on the seeds of plants*. These papers were submitted by Ray in response to a request from the Council of the Royal Society that members should send an annual "discourse grounded on experiment &c" to make the Society's "meetings more considerable and inviting". Ray sent his papers with his usual protestations of inadequacy, describing that on seeds as "inchoate and imperfect ... but ... I have nothing better to send" (Gunther 1928, p. 68). The discourse on seeds, and another pioneering work, *A discourse on the specific differences of plants*, were read at a meeting of the Society but were not published until long after Ray's death (Birch 1757, pp. 162–173; Gunther 1928, pp. 70–83). Neither the Cambridge *Catalogus* nor the 1674 paper include the anecdote about Master Toll's dunghill, which was apparently published in 1682 for the first time.

Acknowledgements

I thank Philip Oswald for correcting my translation of Ray's Latin text, and Robin Stevenson for the suggestion that I send this note to the Transactions.

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Lacewings and allied insects of Norfolk (Mecoptera, Megaloptera, Neuroptera and Raphidioptera)

Paul Cobb

Dedication

This paper is dedicated to the memory of the late Ken Durrant (K.C. Durrant, J.P., F.R.E.S.) from whom I learned my entomology in my teenage years.

Introduction

The groups covered here are the snakeflies (Raphidioptera), alderflies (Megaloptera), scorpionflies and the snow flea (Mecoptera), and the true lacewings (Neuroptera) which includes waxflies, spongeflies and antlions. I take Norfolk to be the whole of modern Norfolk, and I pay no regard to the old Watsonian vice-county system.

This small group of diverse species inhabits a wide range of habitats and ecological niches, and while it is true that most are arboreal, some of them can be found almost anywhere. The collecting methods needed to find them are equally diverse; beating, sweep-netting and light-trapping will find most, but water traps, pitfall traps and malaise traps are most effective for some of the others. The more familiar lacewings are well known, in both adult and larval stages, for feeding on aphids (Hemiptera: Aphidoidea), as do many of the less familiar, often confining their attentions to the aphids of particular host plants. Other members of these orders are predators on other invertebrates, and a few specialise, in for example ants (Hymenoptera: Formicidae) or freshwater sponges (Porifera: Spongilidae), but there is much that is still unknown.

They are a particularly under-recorded group, yet in my data-gathering, which I anticipated to be mere rounding up of a few stragglers, I found an unexpected number of recent or previously un-reported records. The majority of recording has taken place in recent decades, and for most species there are very few old records.

Lacewings can be a frustrating group to specialise in. Many of them are elusive, some extremely so. Some are specialist canopy insects, rarely descending close enough to the ground to be encountered by the terrrestrial entomologist. Some are found only on conifers, which in plantations rarely have low branches with accessible foliage. Others hide in dense undergrowth or grass tussocks. Consequently many of them are under-recorded, and some always will be.

The older literature is plagued with errors and false assumptions, often distinguishing species by characters that are variable and unreliable, leading to inevitable misidentifications, to such an extent that all old records need to be viewed with a degree of suspicion, no matter how eminent the recorder. For some species certain identification requires examining the genitalia, a discipline that has not always been practiced in the past, even though it normally only involves looking at the shape of the rear end.

The only British work that should be used for identification is the AIDGAP key (Plant 1997), and even that has been overtaken by events. Hopefully, by the time this paper is published, updates to the key will be available in *Neuro News*, accessible at the website http://lacewings.myspecies.info/newsletter. It is not normally possible to name lacewings from illustrations in general books or photographs on the internet.

Little has been published previously on Norfolk lacewings. The main work is that

of K.C. Durrant who gave an account of the Neuroptera (Durrant 1985), E.A. Ellis summarised Broadland species (Ellis 1965) and his work at Wheatfen is collated by Baker (1996), J. Edwards contributed a list of species to Victoria County History (Edwards 1901), and E.A. Atmore recorded in the King's Lynn area and published mainly on *Chrysopa dorsalis* (Atmore 1907a, 1911). (Anyone referring to Durrant's paper needs to be aware that it contains some errors, due to the shortcomings of the literature of the time, and in particular his Coniopterygidae and female *Wesmaelius nervosus* and *W. subnebulosus* were not cleared as is now considered essential).

Validation of data

This has been a problem. While recent records are generally straightforward and often need no validation, the same is not true of older records. Our predecessors were not good at recording precise details, often leading to uncertainty as to exactly where a record really was. Records published or republished by others at a later date can become attributed to the author and date of publication, instead of to the actual date and recorder, or the recorder's name may be given as the locality, and the correct details can become lost.

Checking old records by reference to surviving museum specimens is not straightforward either. Lacewings and their allies generally make poor specimens when kept dry and pinned. They shrivel, discolour, and lose their markings, and it can be difficult to confirm their identity with certainty.

Further problems arise in the computer age. Multiple copies of the same record can enter the system from different sources, disguised by different versions of the details, such as incorrect dates and recorder names, or different permutations of the place name. Worse, parts of the data can become transposed with those of other records, or lost completely, and even recently submitted records can quickly become garbled. False records can thus be created that give the impression of being additional and distinct from the real ones, and I have found some attributed to myself 12 years before I was born.

One particular such problem needs to be reported here, concerning a batch of records from the National Museums of Scotland 1983 to 1985 malaise-trapping study near Santon Downham, confusingly given as in Suffolk when in fact it was on the Norfolk side of the boundary. There were many discrepancies between these records in the dataset and the published account of the study (Whittington 1999), and after consulting with Whittington, who had personally re-examined and identified the material, it was clear these discrepancies could only be explained by transposition of data with other records from Chippenham Fen in Cambridgeshire and the Rothamstead Insect Survey trap at Santon Downham in Suffolk. For example, they include *Sisyra fuscata* and *Sympherobius elegans*, which were recorded by the Museums at Chippenham Fen, but not at Santon Downham. I have therefore discarded these records and used only the ones from Whittington's paper.

Another issue is grid references. There is a distressing tendency for fictitious 6-figure grid references to be invented for imprecise old records, which without local knowledge can, and sometimes does, result in records being placed as much as two miles away in the wrong 10 kilometre square. Some seem to be the grid reference of where the place name is printed on the map, or of the nearest town or village, rather than the site itself. Sometimes all records for a large site carry the same 6-figure reference, regardless of which part of the site they were from, apparently caused by the computer programme changing things to match what it expects to find for the site name (I have found examples of my own records with their correct grid references changed to

incorrect ones). Unpicking and correcting these errors has been unnecessarily time-consuming.

The Provisional Atlas (Plant 1994a) and the National Biodiversity Network Gateway maps (http://data.nbn.org.uk) are not immune to these problems, and contain a number of mis-spotted records and computer-generated false records. I hope that my local knowledge has enabled me to spot most of them but some false records may still remain undetected, and because of a reluctance to throw the baby out with the bathwater there may still be a few errors among those old records that cannot be verified.

The Norfolk species

Of the 81 species on the British list, 51 have been reliably recorded for Norfolk, 34 of them in the present century. Seven are known from pre-1980 records only. The six best recorded 10 kilometre squares in the county have from 22 to 25 species each (Figure 1), potentially more if some imprecise old records could be pinned down, and I have had 16 species in my garden in Heacham. Similar numbers should be present almost anywhere in the county, it's just a matter of finding the little blighters.

E.A. Atmore gave all his records, and labelled all his specimens, simply as King's Lynn, regardless of where they were actually from. They are given for grid square TF61 in the national dataset, but we know from the rare occasions (in other insect groups) when he did in fact give an exact locality that he recorded widely in the King's Lynn area. I therefore 'place' his records as being somewhere near King's Lynn in either TF61 or TF62, although it is possible that some of them could be from further afield. His notebooks, that might have shed light on his localities, do not seem to have survived, but if anyone knows their whereabouts, would they please get in touch.

The national dataset has all the old Norwich

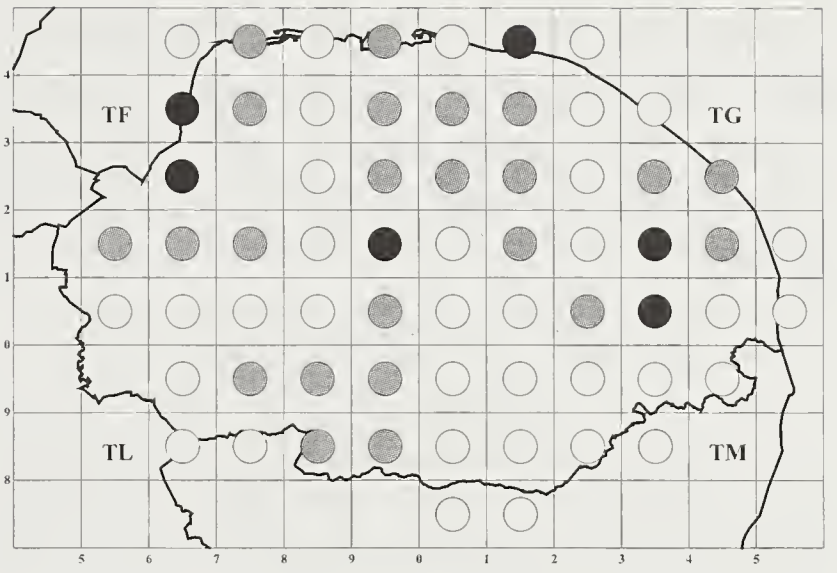


Figure 1. Species recorded per 10 kilometre square. ○ 1-9 species ● 10-19 species ● 20 or more species

records as being in TG20, when they are just as likely to have been in TG21, and were not necessarily in the city itself at all, but since we don't know exactly where they really were I have had little choice but to follow this convention, and similar problems affect some records from other places that straddle a square boundary. A batch of records from Stanford Training Area (STANTA) in 1976 have the grid reference TL98, but this is surely an error for TL89, so I have placed them in TL89. Unlocalised old literature records of common species and old records of Coniopterygidae are generally excluded.

The full data for all the records are held by myself, the national Lacewing Recording Scheme, and Norfolk Biodiversity Information Service, and they will find their way to the National Biodiversity Network in due course.

Order RAPHIDIOPTERA, snakeflies

Snakeflies are specialist canopy insects, only found at ground level immediately after emergence from the pupa, or when blown down by strong winds, and therefore they are rarely recorded. It is not impossible that most of them could actually be common. The larvae are apparently easier to find, living under loose bark of fallen logs, but have to be reared through to the adult stage before they can be identified.

Atlantoraphidia maculicollis (Stephens)

The only record comes from Victoria County History (Edwards 1901) where it is simply listed with no details. It is found on conifers.

Phaeostigma notata (Fabricius)

Found on oaks *Quercus* spp. There is no woodland at Kirby's locality, and one of Evans' records is from a hedgerow, so this species can occur on isolated trees as well as in woodland.

TG00, Welborne, twice in 1973, R.E. Evans (ex card index at Norwich Castle Museum).

TG01, no site name but grid reference is Lyng or North Tuddenham, 1981, P. Kirby.

TG13, Moorgate Farm, Blickling, 2011, S. Warrington.

TG30, Wheatfen, 1969, E.A. Ellis (Baker 1996).

TL98, West Harling Common, 1984, P. Withers.

TM28, Gawdy Hall Wood, 1985, M. Collier, det. P.R. Cobb.

Subilla confinis (Stephens)

The records form a tight cluster in central Norfolk. Its tree associations are not known.

TF91, Bushy Common, Gressenhall, 1963, K.C. Durrant.

TF91, near East Dereham, 1968, K.C. Durrant.

TF91, Scarning Fen, 1968, K.C. Durrant.

TF92, Horningtoft, 1954, K.C. Durrant.

TG02, Foxley Wood, 1886, H.J. Thouless (McLachlan 1900).

Xanthostigma xanthostigma (Schummel)

There are sufficient records of this species to regard it as probably common. Its tree associations are not fully known, but appear to be deciduous.

TF93, Walsingham, 1927, H.W. Daltry.

TG01, no site name but grid reference is North Tuddenham or Elsing, 1981, P. Kirby.

TG12, Blickling Park, 2011, S. Warrington.

TG13, Mannington Hall, 2006, C. Jones.

TG14, Felbrigg Great Wood, 1988, K. Alexander. (TG13 Felbrigg records are erroneous duplicates of this record.)

TG14, Sheringham, 1927 H.W. Daltry and 1992 K.C. Durrant.

"Norfolk Fens, Norwich", 1873, C.G. Barrett.

TG30, Wheatfen, 1938, E.A. Ellis *et al.*

TG31, Hoveton Great Broad Trail (Bure Marshes NNR), 1972, J. Buckley, found on several dates, including larvae in a dead Alder *Alnus glutinosa* branch. (It may be easier to find in alder carr, where the trees are short and the canopy close to the ground.)

TL89, 1976, at "no site name available" by "unknown" (this seems likely to be Stanford Training Area by G.J. Moller).

TL99, Wayland Wood, 1982, P. Withers.

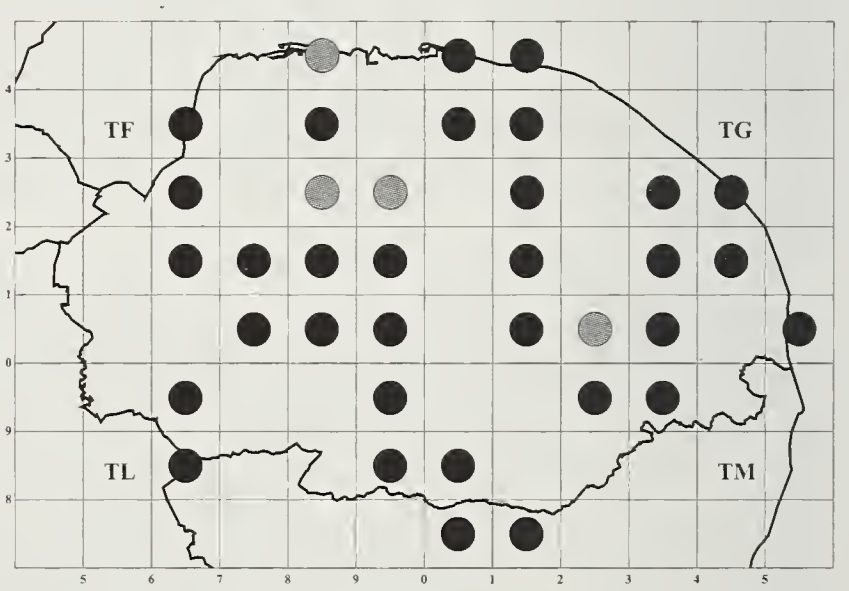
It is also listed without details by J. Edwards (1901) in Victoria County History.

Order MEGALOPTERA, alderflies

Identification by genitalia is necessary for the adults; wing venation characters used in the past are too variable to be reliable. The larvae are aquatic.

Sialis lutaria (Linnaeus) [Map 1]

Common and often abundant almost wherever there is a body of water, still or flowing, that is larger than a garden pond or a field ditch. Many of the records are of larvae from the frequent aquatic surveys of recent times.



Map 1. *Sialis lutaria*

10 km squares ● Post-1979 records ● Pre-1980 records

[*Sialis fuliginosa* Pictet]

This species requires fast flowing water in the larval stage, and although it has been reported from Norfolk on a few occasions, it has never been confirmed, and the only report accompanied by a specimen is *S. lutaria*. It is not impossible though that it

might turn up in the faster flowing upper reaches of our rivers.

There is a female specimen labelled *S. fuliginosa* in Durrant's collection at Norwich Castle Museum, from Mannington Hall (TG13) in 1988, with the tip of the abdomen removed and placed in a small tube attached to the pin. It has suffered from the fluid evaporating through the cork, and although superficially it resembles *S. fuliginosa*, critical examination by Tony Irwin shows it is in fact *S. lutaria*.

It was reported from the Catfield Hall Estate (TG32) in 2005-2007 by Baker (2008), who tells me identification was by Durrant. However there are no Catfield specimens of any *Sialis* species in Durrant's collection, and if he thought he really had found *S. fuliginosa* there, we can assume he would have kept a specimen, given the special treatment accorded to his Mannington specimen.

Baker (*op. cit.*) also cites it as being recorded at Catfield by Claude Morley in 1936 (presumably the same as a 1937 record by 'anon.' from Broads Authority data), but this record is not in the national Lacewing Recording Scheme dataset. There are no Catfield specimens of any *Sialis* species in Morley's collection at Ipswich Museum (M. Carter pers. comm.). Ellis (1965) states that only *S. lutaria* had been recorded in the Broads, and he would surely have been aware if Morley had really found *S. fuliginosa*.

I suspect that what has happened at Catfield is that it was always *S. lutaria* that was recorded, but someone in the past used the wrong name, which continued to be applied. There are 2004 and 2013 records of *S. lutaria* from the site.

Another report, from Strumpshaw Fen (TG30) in 1979, sometimes appears in species lists and inventories, citing as the source Willis (1980), an unpublished University of East Anglia student paper variously described as a third year dissertation or an undergraduate project. I have not been able to trace a copy of this paper; it is not held by the university library (Z. Cross pers. comm.) or by the RSPB at Strumpshaw Fen (B. Lewis pers. comm.), and I suspect no copies now exist.

In the absence of any verification, and slow Broadland waters being unsuitable for the species, these Broadland records of *S. fuliginosa* cannot be accepted.

[***Sialis nigripes*** Pictet]

There is a Pond Conservation record of this species for TL98, from Hornwood Pond near Larling in 1990, but with no recorder name given. Since *S. nigripes* requires large rivers and lakes, and is highly unlikely to turn up at a small pond, I reject the record, and it was also excluded from the Provisional Atlas (Plant 1994a). It is not inconceivable though that it might occur in the Broads.

Order NEUROPTERA: Family CHRYSOPIDAE, green lacewings

Chrysopa abbreviata Curtis

This is a rare species of sand dunes, and given the extent of sand dunes in Norfolk it ought to have been found here more frequently. It is associated with Marram Grass *Ammophila arenaria*, but in France (P. Lerault in Plant 1994b) it is frequently found on Sea Buckthorn *Hippophae rhamnoides* by mountain streams.

> TG42, Winterton Dunes, June 1951, S. Wakely & Canon Edwards (Wakely 1952).
>
> TG51, The Marrams near Yarmouth, 1834 or earlier, in June, C.J. Paget (Curtis 1823-1840).

The Yarmouth record is usually erroneously cited as being for 1937, and at Great Yarmouth in TG50, but this is based on misunderstanding of its repetition by Killington (1936, 1937). It is cited by Curtis in his original description of the species in 1834, and it is clear from Paget & Paget (1834) that The Marrams was north of North Denes which places it firmly in TG51.

Chrysopa commata Kis & Ujhelyi [Map 2] and *Chrysopa phyllochroma* Wesmael

These two species are considered together as they were formerly regarded as a single species under the name *C. phyllochroma*. Old records cannot therefore be used unless they are accompanied by a surviving specimen.

The true *C. phyllochroma* is a rare species about which little is known, and I believe that at the time of writing the East Wretham record remains the most recent British record.

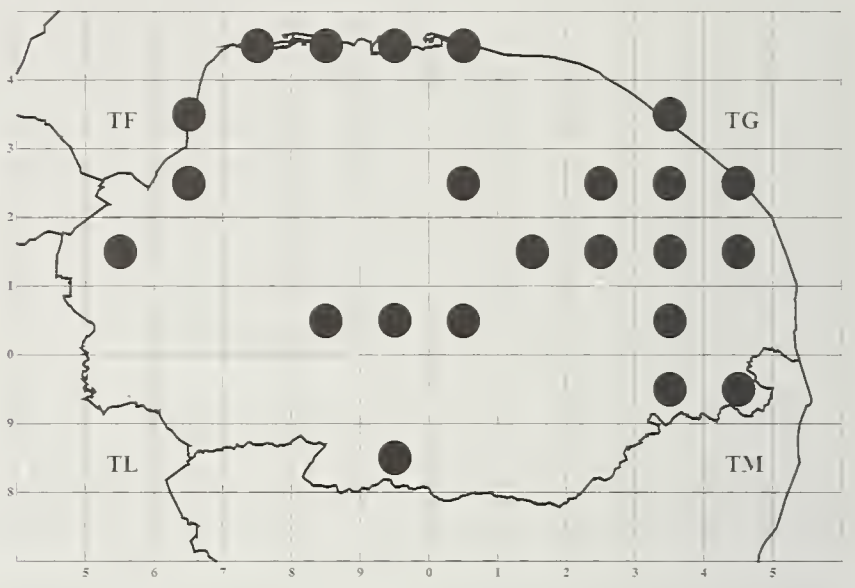
TL89, Stanford Training Area (STANTA), 1976, G.J. Moller.

TL9088, East Wretham Heath, 30 July 1994, P.R. Cobb, conf. C.W. Plant, female at moth trap.

There have to be reservations about Moller's record, as we cannot be certain he would have been aware of the then recent species split, but it is reassuringly close to the other record. A Wheatfen record from 1936 under the name *C. phyllochroma* is not supported by a specimen, so must be excluded.

There is another record of *C. phyllochroma* in the dataset, from the King's Lynn area by E.A. Atmore for 24 June 1906 (actually giving the locality as Atmore, and the recorder name unknown), but there is also an identical record for *C. commata*, which suggests that a single record of one of the species pair may have been entered for both species. The sole corresponding specimen from Atmore's collection at Norwich Castle Museum, dated 1906 and labelled as *C. phyllochroma*, is badly faded and discoloured, but still recognisable as being *C. commata*.

The "new" species *C. commata* is common in a wide range of habitats: deciduous and coniferous woodland, parkland, scrub, gardens, fens, heathland, commons, sand dunes, and arable and urban areas. It seems to have increased considerably in the last 25 years, though it is impossible to be certain in the absence of reliable old records, the only one we have being the above Atmore specimen (not mapped as it is too imprecise). Certainly Durrant did not find it until 1994, and he had been recording lacewings since the 1950s.



Map 2. *Chrysopa commata*

10 km squares ● Post-1979 records ● Pre-1980 records

Chrysopa dorsalis Burmeister

This is a rare species associated with pine *Pinus* spp. E.A. Atmore recorded it in 1904, annually from 1906 to 1910, and in 1917, somewhere near King's Lynn (Atmore 1907a, 1911, Lucas 1919), but he does not reveal the locality. He only tells us "a very restricted area near this town", which implies it must be in either TF61 or TF62. He was clearly finding it regularly, easily, and in quantity, always from Scots Pine *P. sylvestris*, and he believed he had seen it repeatedly during the previous 20 years or more. He also found it in 1906 at a second site, "some six or seven miles distant", and we don't know where that was either. Other records all seem to derive from later writers mentioning Atmore's work in their own. Otherwise, there is just a single record by K.C. Durrant from Holkham Park (TF84) on 23 August 1968.

Chrysopa pallens (Rambur)

It has something of a preference for gardens, which implies it should be more frequent than the few records would suggest. Perhaps it is just elusive.

TF63, Heacham, 1968, P.R. Cobb, garden.

TF71, West Acre, 2015, A. Murray, det. P.R. Cobb.

TG20 (or TG21), Norwich, 1938, E.A. Ellis.

TG31, Hoveton Great Broad Trail (Bure Marshes NNR), 1972, J. Buckley, alder carr.

TG31, near Salhouse Broad, 2014, P. Heath.

TG32, Honing, 2001, P. Heath, garden.

TG42, Winterton Dunes, 1993, Mrs. M.J. Morgan, sand dunes.

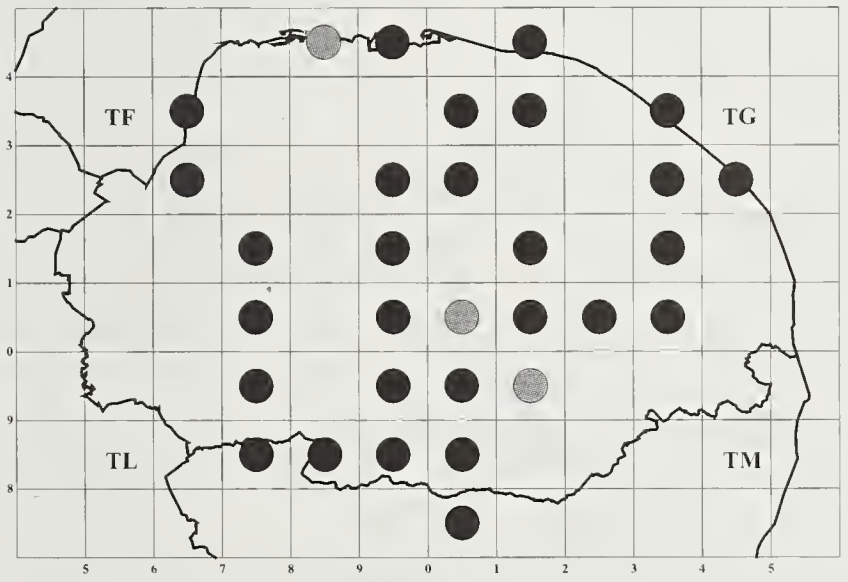
TL89, Stanford Training Area (STANTA), 1976, G.J. Moller.

TM09, Old Buckenham, 1950, S.A. Manning.

TM17, Scole, 2001, M. Hall, garden.

Chrysopa perla (Linnaeus) [Map 3]

This common species is usually considered to inhabit scrubby grassland and woodland edges, but in Norfolk it is mainly a wetland species. Of the sites for which the habitat is known, around 60% are fens and other damp habitats such as wet woodland and commons, meadows and disused pits. The remainder are dry woodland, forest rides, heaths, dry commons and grassland, and rarely gardens and coastal shingle. Perhaps tall herbage with some scrub may be the common factor. Two old records are too imprecise to be mapped, from the Yarmouth area by Paget & Paget, and the King's Lynn area by Atmore.



Map 3. *Chrysopa perla*

10 km squares ● Post-1979 records ● Pre-1980 records

Chrysoperla carnea species group

Once upon a time this was an easy matter. *Chrysoperla carnea* was the abundant and ubiquitous species that everyone gets on their windows and hibernating in their houses and sheds. Then it gradually became apparent that more than one species was involved, and there followed a period of confusion as to how many species there were and how best to distinguish them. It is now established that there are three British species (Henry et al. 1996, 2002), very similar morphologically, but confirmed by their distinct courtship songs (yes some lacewings 'sing', by drumming their abdomen against the substrate). *C. carnea* (Stephens) *sensu stricto* is indeed the abundant and ubiquitous one, *C. lucasina* (Lacroix) is also common and widespread, and *C. pallida* Henry, Brooks, Duelli & Johnson is scarce and has not been recorded from Norfolk.

It is not realistic to attempt to assign all the old records and specimens to species, not least because of the way the abdomens of dry pinned specimens shrivel and distort. It is really a case of starting again. The aggregate is recorded from 57 of the 10 kilometre squares that are wholly or partially in Norfolk, but as yet certain records of the segregates are few.

C. carnea is recorded from TF60, TF61, TF62, TF63 and TG02.

C. lucasina is recorded from TF60, TF61, TF62, TF63, TF64, TF71, TF73, TF74, TG02, TG10, TG11, TG31 and TM29.

The higher number of *C. lucasina* records is because it is the easiest of the three to recognise.

Chrysopidia ciliata (Wesmael) [Map 4]

A common species of deciduous woodland, less often in scrub, and only rarely in

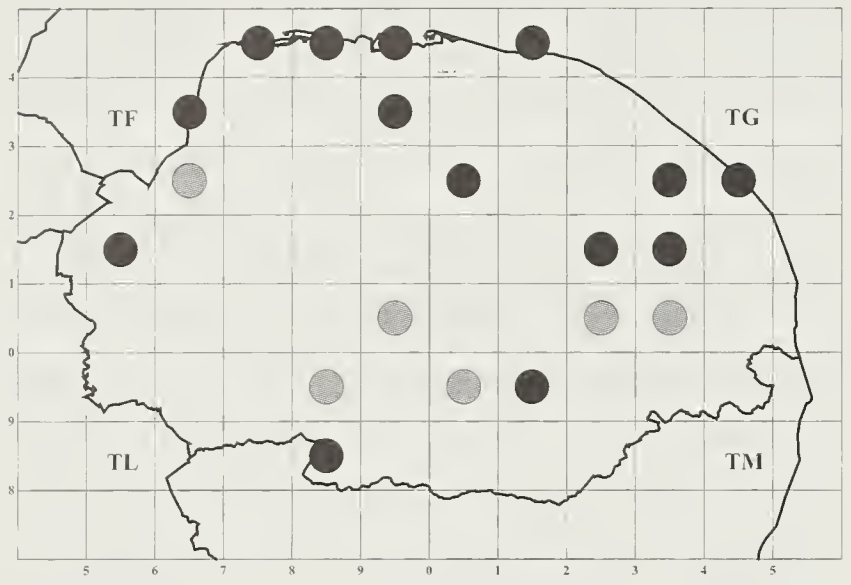
Map 4. ***Chrysopidia ciliata***

10 km squares ● Post-1979 records ● Pre-1980 records

gardens. Of the few records where a tree association was noted most are from Oak *Quercus robur* and Hazel *Corylus avellana*. A 1978 record for Watton in TF90 is an error for Wayland Wood in TL99.

Cunctochrysa albolineata (Killington) [Map 5]

A common species of deciduous woodland and scrub, including gardens and urban areas.



Map 5. ***Cunctochrysa albolineata***

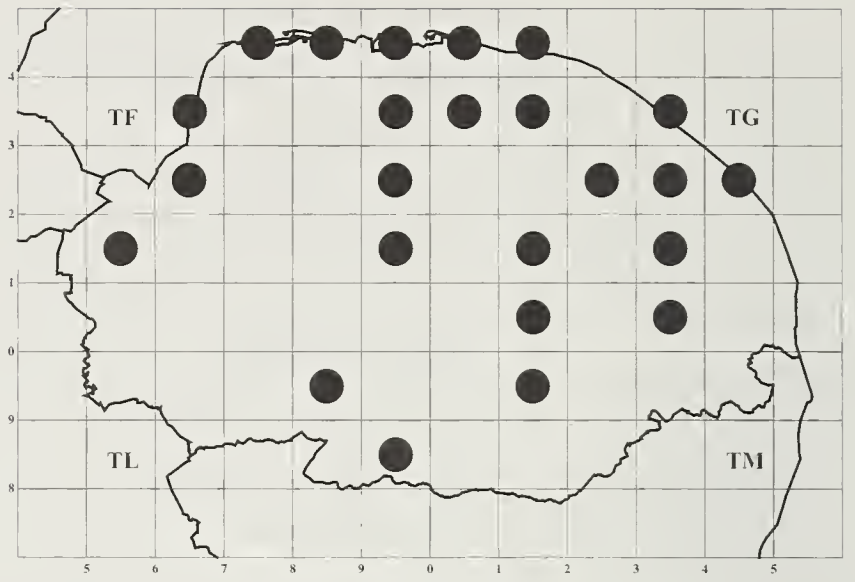
10 km squares ● Post-1979 records ● Pre-1980 records

Dichochrysa flavifrons (Brauer) [Map 6]

Until fairly recently this was a rather local species associated with pine, and only rarely recorded in gardens (Plant 1994a), and in Norfolk there were just three records before 1984. Then in the early 1990s it suddenly seemed to be everywhere, and had rapidly become common, certainly no longer confined to pines, and very common in my own garden, and this increase was repeated elsewhere in the country (Plant 1993, 1997). It is now common in deciduous woodland and scrub (both dry and wet), gardens, heaths, fens and sand dunes, but only rarely in coniferous woodland. One old record is too imprecise to be mapped, from the King's Lynn area by Atmore.

Dichochrysa prasina (Burmeister) [Map 7] and *Dichochrysa ventralis* (Curtis) [Map 8]

These two species are treated together as in the past they have often been regarded



Map 6. ***Dichochrysa flavifrons***

10 km squares ● Post-1979 records ● Pre-1980 records

Map 7. ***Dichochrysa prasina***

10 km squares ● Post-1979 records ● Pre-1980 records

Map 8. ***Dichochrysa ventralis***

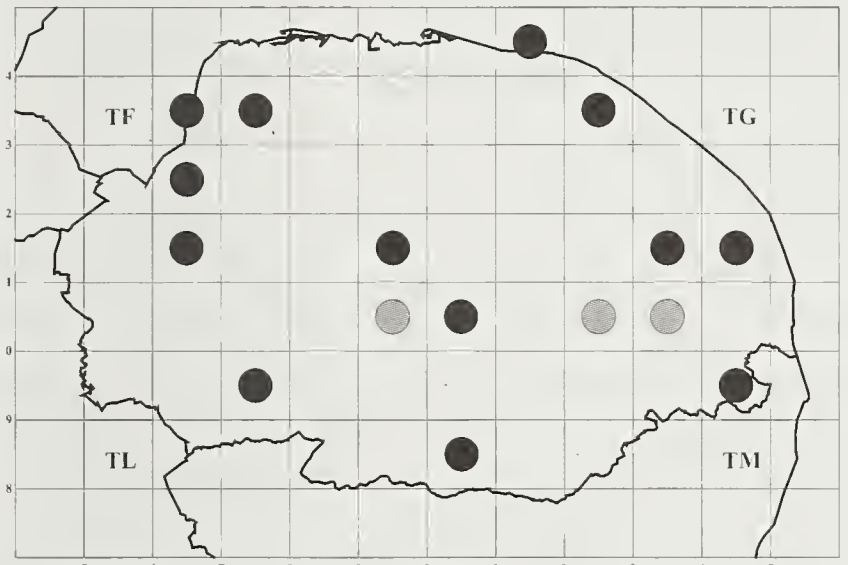
10 km squares ● Post-1979 records ● Pre-1980 records

as one, with *D. prasina* only a variety of *D. ventralis*, so old records can only be used when it is clear which one is being referred to. Both species are common in open bushy habitats including fens, heaths, commons and grassland. *D. prasina* uses

deciduous woodland less frequently, and ventures into more open habitats including gardens and sand dunes, and occasionally saltmarsh and arable farmland. *D. ventralis* extends further into more closed woodland habitats, including coniferous plantation.

Nineta flava (Scopoli) [Map 9]

This large species is common in deciduous woodland, and also occurs in scrub and gardens. It seems to have a slight preference for drier woods. I have excluded a 1987 Felbrigg record for TG23, because it appears to be a combination of a 1997 Felbrigg Great Wood TG14 record with the date of a 1987 Felbrigg Great Wood *N. vittata*.



Map 9. *Nineta flava*

10 km squares ● Post-1979 records ● Pre-1980 records

Nineta vittata (Wesmael) [Map 10]

Like *N. flava*, this large species is common in deciduous woodland, and also occurs in scrub, but only rarely in gardens, with one unexpected record from sand dunes. It seems to have a slight preference for wetter woods.

Nothochrysa capitata (Fabricius)

This large (and brown) member of the green lacewing family is mainly a canopy species, so records are few, and many of them are old ones, but two of them being within the city of Norwich suggests it may be frequent. The older literature regarded it as being confined to conifers, and the older records support this view, yet the few recent records are from deciduous situations.

Map 10. *Nineta vittata*

10 km squares ● Post-1979 records ● Pre-1980 records

"West Norfolk" (presumably near King's Lynn), 1904 and 1906, E.A. Atmore, from Scots Pine *Pinus sylvestris* and spruce *Picea* sp. (Atmore 1907b).

TF61 or TF62, King's Lynn area, 1917, E.A. Atmore (Lucas 1919). A 1916 record with the locality "Atmore, Kings Lyn" (*sic*) by "unknown" is likely to be the same.

TF61, Bawsey Heath, 1887, C.G. Barrett, from "fir" trees (McLachlan 1888).

TF91, Lolly Moor, 1996, E. Boosey, det. P.R. Cobb, deciduous fen woodland.

TG03, Holt Hall, 1968, K.C. Durrant.

TG20, Norwich, 1997, S. Paston, det. A.G. Irwin.

TG20, Earlham Cemetery, Norwich, 2005, S. Paston, on Whitebeam *Sorbus aria*.

TG22, Stratton Strawless, 1897, J. Edwards.

TG24, Cromer, 1808, by an unknown recorder.

Nothochrysa fulviceps (Stephens)

A female of this rare species of oak *Quercus* spp. woodland unexpectedly turned up on the outside of a moth trap on the morning of 22 July 2015 at Titchwell RSPB reserve, TF751438, an area with very few oak trees (P.R. Cobb, conf. C.W. Plant). At around the same time four others were found at three sites in England and Wales (Plant 2015), increasing the number of British records by about a third in the course of a single month. Migration is the obvious, and most likely, explanation. It is possible that another was present at nearby Holme Bird Observatory six days earlier, as a large green lacewing with a black stripe was seen briefly before escaping (S. Barker pers. comm.).

Order NEUROPTERA: Family CONIOPTERYGIDAE, waxflies

These lacewings are tiny, superficially resembling whitefly (Hemiptera: Aleyrodidae), and are easily overlooked. Certain identification can only be made by microscopic examination of the male genitalia, after clearing in potassium hydroxide, and not surprisingly few people take this trouble with such tiny insects. They will always be under-recorded.

Entomologists of the past were not always in the habit of checking the genitalia, leading to errors and misconceptions. For example, *Coniopteryx borealis* was once believed to be a great rarity confined to the Scottish highlands, but it is now known to be common, and I have found it in my garden. This, combined with the recognition of several species additional to the British list in recent decades, means that all old records have to be rejected unless supported by a cleared male specimen.

Coniopteryx borealis Tjeder

Probably common.

TF63, Heacham, 1995, P.R. Cobb, det. C.W. Plant, male at house lights.

TF71, Narborough Railway Embankment, 1994, P.R. Cobb, det. C.W. Plant, male beaten from Privet *Ligustrum vulgare* in scrub woodland.

[*Coniopteryx pygmaea* Enderlein]

Durrant recorded this species from Sheringham (TG14) in 1987 and 1995, but one of the specimens, in Norwich Castle Museum, is an unidentifiable female, the other is missing its abdomen and bears a label "abdomen lost after clearing". There is also a record from Sandringham (TF62) in 1931 (Brown 1932), but that is too old to be reliable. There is therefore no confirmed Norfolk record for this species.

Coniopteryx tineiformis Curtis

May prove to be common, even though there is currently only a single certain record.

TG02, Foxley Wood, 2014, P. Heath, det. P.R. Cobb, male netted by day.

All of Durrant's *Coniopteryx* specimens, at Norwich Castle Museum, have proved to be females, and therefore unidentifiable.

Conwentzia pineticola Enderlein

Associated with pine, and may prove to be common.

TF73, Courtyard Farm, Ringstead, 1995, P.R. Cobb, det. C.W. Plant, three males beaten from Scots Pine *P. sylvestris*.

TF73, Ringstead Downs, 1995, P.R. Cobb, det. C.W. Plant, male beaten from Elder Sambucus nigra (but a few pines present nearby).

If the belief that female *Conwentzia* can be separated by the number of antennal segments is proved to be reliable then I have a further record, from Bawsey Country Park (TF61) in 1995, beaten from Scots Pine.

Conwentzia psociformis (Curtis)

This species is certainly common, in woodland, gardens and hedges, on many deciduous trees and shrubs, and evergreens such as Ivy *Hedera helix* and cultivated *Euonymus fortunei*. There are post-1979 records from TF62, TF63, TF73, TF93, TF94, TG04, TG14, TG30 and TL98, and a pre-1980 record for TF91. If the belief that female *Conwentzia* can be separated by the number of antennal segments is proved to be reliable then I have a further record from TL99.

Semidalis aleyrodiformis (Stephens)

Likely to be common, given the very ordinary nature of the localities.

TF63, Heacham, 1997, P.R. Cobb, male flying by day about Oak Quercus robur sapling in roadside hedge.

TF63, Snettisham Common, 1998, P.R. Cobb, males disturbed from scrub Oak on two dates.

TG30, Lingwood, 1945, no recorder name.

Order NEUROPTERA: Family HEMEROBIIDAE, brown lacewings

[*Drepanepteryx phalaenoides* Linnaeus]

There is a reported sighting from Brundall (TG30) in 2013, which escaped by falling into long grass, so it remains an unconfirmed mystery.

Hemerobius atrifrons McLachlan

This species is associated with Larch Larix decidua, and its apparent rarity may have more to do with the rarity of Larch trees with foliage accessible from the ground.

TF61 or TF62, King's Lynn area, July 1906, E.A. Atmore, det. K.J. Morton (specimen at Norwich Castle Museum).

TL99, Merton, 7 May 1900, by an unknown recorder.

Hemerobius humulinus Linnaeus [Map 11]

Common in deciduous woodland and scrub, including in wet habitats, and in gardens.

Map 11. ***Hemerobius humulinus***
10 km squares ● Post-1979 records ● Pre-1980 records

Hemerobius lutescens Fabricius [Map 12]

Common in deciduous woodland and scrub, gardens, heaths, commons, grassland and roadside verges. A 1938 record for Keswick in TG33 must be an error for the other Keswick in TG20.

Hemerobius marginatus Stephens

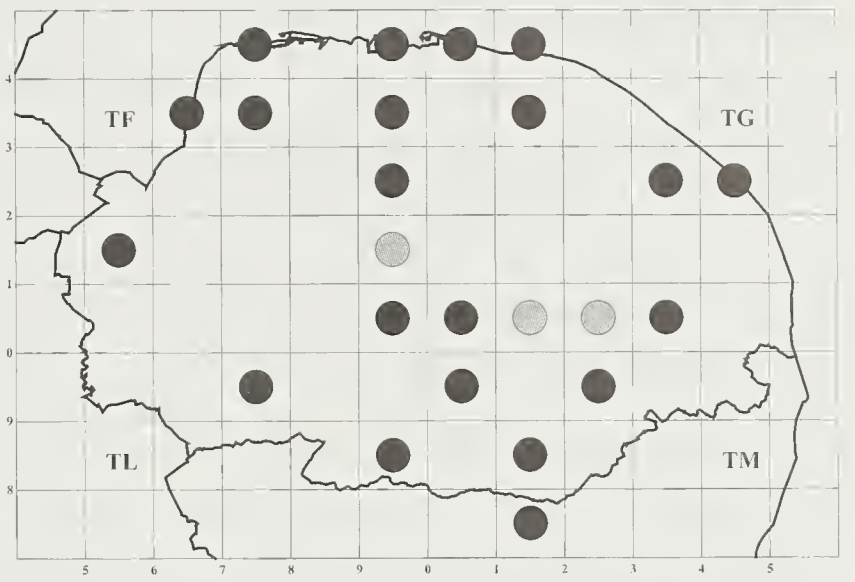
Seemingly less frequent in Norfolk than other parts of the country.

TF63, Ken Hill Woods, Snettisham, 2008, P.R. Cobb, on lime Tilia sp.

TG14, Felbrigg (presumably Great Wood), 1993, Mrs. M.J. Morgan.

TG31, Hoveton Great Broad Trail (Bure Marshes NNR), 1969, P.R. Cobb, in alder carr.

TG31, Woodbastwick Fen (Bure Marshes NNR), 1993, Mrs. M.J. Morgan.



Map 12. ***Hemerobius lutescens***
10 km squares ● Post-1979 records ● Pre-1980 records

It is also listed without details by J. Edwards (1901) in Victoria County History.

Hemerobius micans Olivier

Common in deciduous woodland. Of the few records where the tree species is noted, three are from Oak *Quercus robur*, three from Beech *Fagus sylvatica*, and one each from Wych Elm *Ulmus glabra*, Ash *Fraxinus excelsior* and Hazel *Corylus avellana*. There are post-1979 records from TF62, TF63, TF73, TF74, TG01, TG14, TG31, TL79 and TM29, and pre-1980 records from TF91 and TL78.

Hemerobius nitidulus Fabricius

Confined to pines, perhaps not as scarce as the few records imply.

TF61 or TF62, King's Lynn area, 1917, E.A. Atmore (Lucas 1919).

TF62, Dersingham Bog NNR, 1966, K.C. Durrant.

TL79, Cranwich Heath, 1988, C.W. Plant.

TL88, near Santon Downham, 1983-1985, National Museums of Scotland (Whittington 1999).

TL89, Stanford Training Area (STANTA), 1976, G.J. Moller.

Hemerobius pini Stephens

Found on pines. For a species which is nationally widespread and quite frequent it is surprising that there is only a single very old Norfolk record. It was found at (or more likely near) Norwich in 1888 by J. Edwards.

Hemerobius stigma Stephens

Common on pines and by far the commonest of the pine species. There are post-1979 records from TF61, TF62, TF74, TG12, TG23, TL79, TL88 and TL89, and pre-1980 records from TF91, TG11, TG14, TG30 and TL98.

Micromus angulatus (Stephens)

Recorded by the National Museums of Scotland malaise trapping study near Santon Downham (TL88) in 1983-1985 (Whittington 1999). It is a scarce species that seems to require grassland or low vegetation.

Micromus paganus (Linnaeus)

This species ought to be more frequent than these few records. It has been found in deciduous woodland and scrub, fens and gardens, most records coming from house lights and moth traps.

TF61, Bluebell Wood, Leziate, 2001, P.R. Cobb.

TF62, Dersingham Bog NNR, 2006, A. Murray.

TF63, Heacham, 1995 and 1997, P.R. Cobb.

TF71, Narborough Railway Embankment, 1994, P.R. Cobb.

TF91, Podmore, Scarning, 1962, K.C. Durrant.

TG23, Trimingham, 1978, K.C. Durrant.

TG30, Wheatfen, 1939, E.A. Ellis.

TG31, The Doles, Upton Fen, 1993, C.M. Drake.

In addition, Ellis (1965) states "found regularly" in the Broads.

Micromus variegatus (Fabricius) [Map 13]

Common in woodland edge, gardens, fens, heaths, commons and grasslands. Low herbage may be the common factor. A TG04 record for Langham is really Langford in TL89.

Psectra diptera (Burmeister)

This lacewing is hard to find, even by lacewing standards. It inhabits dense grass tussocks, seemingly regardless of the habitat that harbours the tussocks, and is not normally found by netting or light trapping. It was unknown in Norfolk before 1988, but the advent of intensive

Map 13. ***Micromus variegatus***

10 km squares ● Post-1979 records ● Pre-1980 records

invertebrate recording using techniques such as water traps and pitfall traps has revealed it to be frequent, particularly in the Broads. It is so far recorded from TG02, TG14, TG30, TG31, TG32 and TG42, and may prove to be widespread.

Sympherobius fuscescens (Wallengren)

A scarce species found on Scots Pine

TF61 or TF62, King's Lynn area, 1917, E.A. Atmore, as Hemerobius inconspicuus (Lucas 1919).

TF62, Dersingham Bog NNR, 11 June 1994, P.R. Cobb.

TL88, Croxton, 1879, C.W. Dale (Killington 1932).

TL88, near Santon Downham, 1983-1985, National Museums of Scotland (Whittington 1999).

Sympherobius pygmaeus (Rambur)

Like all *Sympherobius*, this species is rarely recorded, but it is not necessarily rare since the Heacham record is from my garden.

TF62, Wolferton, 21 August 1994, K.C. Durrant.

TF63, Heacham, 25 August 1991, P.R. Cobb, at house lights.

Wesmaelius concinnus (Stephens)

Confined to pines and perhaps not as scarce as the few records imply.

TF61 or TF62, King's Lynn area, 1901 & 1906, E.A. Atmore, det. A.G. Irwin (four badly faded specimens at Norwich Castle Museum determined on genitalia).

TF62, Dersingham Bog NNR, 1994, P.R. Cobb.

TG11, Horsford, 1938, E.T. Daniels.

TL88, near Santon Downham, 1983-1985, National Museums of Scotland (Whittington 1999).

TL99, Merton, 1902, recorder unknown.

It is also listed without details by J. Edwards (1901) in Victoria County History.

I have excluded a 1972 record from TL88 because of the locality "Thetford Chase (site for unlocalised records)".

Wesmaelius nervosus (Fabricius)

The country cousin of *W. subnebulosus*, with records from deciduous woodland, scrub and heath, also suburban and arable areas. It may be more frequent than these few records suggest. Some of the female specimens have been previously published as *W. subnebulosus* in Durrant (1985).

TF51, Terrington St. Clement, 1988, Rothamstead Insect Survey, det. C.W. Plant.

TF71, Narborough Railway Embankment, 1994, P.R. Cobb, conf. C.W. Plant.

TF91, Bittering, 1963, K.C. Durrant, det. A.G. Irwin.

TF91, Toftwood, 1994, E. Boosey, det. P.R. Cobb.

TG01, East Tuddenham, 1963, K.C. Durrant, conf. A.G. Irwin.

TG14, Sheringham Park, 1997, K.C. Durrant.

TG22, Stratton Strawless, 1883, J. Edwards, det. A.G. Irwin.

TG24, Cromer, 1963, K.C. Durrant.

TL88, near Santon Downham, 1983-1985, National Museums of Scotland (Whittington 1999).

TL98, East Wretham Heath, 1994, P.R. Cobb.

[*Wesmaelius quadrifasciatus* (Reuter)]

There is a record of this species, which is confined to Larch *Larix decidua*, for the King's Lynn area by E.A. Atmore in June 1906, actually given as at the locality "Atmore, Kings Lyn" (sic) by "unknown". Unfortunately there is also an identical record for the closely similar *W. concinnus*, suggesting that a single record of one of the species pair may have been entered for both species. I saw at Norwich Castle Museum a very badly faded and discoloured 1906 Atmore specimen labelled as *W. quadrifasciatus*, which I did not then have time to examine thoroughly, but on a subsequent visit I was unable to find it again. An equally faded June 1906 specimen, without a species name, has proved on genitalia examination to be *W. concinnus*.

Wesmaelius subnebulosus (Stephens) [Map 14]

Common, particularly in gardens and urban areas, also in deciduous woodland, fens, heaths and arable areas. It is the Hemerobiid that most often comes to lighted windows and enters buildings. Females can only be separated from W. nervosus after clearing in potassium hydroxide, the wing characters used in the past being unreliable, so older records of either species with the sex not specified and not supported by a specimen have to be suspect. Durrant's female specimens of the species pair have been cleared and re-named by Tony Irwin.

Map 14. *Wesmaelius subnebulosus*

10 km squares ● Post-1979 records ● Pre-1980 records

Order NEUROPTERA: Family MYRMELEONTIDAE, antlions

Euroleon nostras (Fourcroy)

The well known antlion colony in the pine woods of Holkham NNR is fully documented in these Transactions by Bloomfield (2014). First discovered at Wells Dunes in TF94 in 2005, they extended into Holkham Dunes in TF84 in 2008, and into the open sand dunes in 2015. Hundreds of larval pits are present annually, peaking at close to two thousand in 2011.

Elsewhere there are records of single adults from Gorleston in 1931 (the first

British record, mis-identified at the time as *Myrmeleon formicarius* L.) and Great Yarmouth in 2010, both in TG50, and at Burnham Deepdale in TF84 in 2012.

It is disappointing that the county recorder's first knowledge of modern Norfolk records came from stories in local newspapers, so I take this opportunity to remind everyone that antlions are lacewings!

Order NEUROPTERA: Family OSMYLIDAE, giant lacewings

Osmylus fulvicephalus (Scopoli)

The larva is amphibious, living in wet moss in the splash zone at the edge of woodland streams, a requirement which severely restricts its opportunities in Norfolk. The adults spend the day in the shade, hanging beneath foliage or under bridges. Durrant found it twice in 1963 at East Bilney Ford (TF9519), and otherwise it is listed for Norfolk without details by Killington (1936, 1937). The East Bilney site appears unsuitable now, as when I visited in 2015 I could see no moss at the edge of the stream.

There is also an unconfirmed sighting from Brundall (TG30) in 2013. Broadland seems unsuitable, but it is not inconceivable that a suitable mossy splash zone could be created artificially by the wash of pleasure craft, or the rise and fall of the tide.

Order NEUROPTERA: Family SISYRIDAE, spongeflies

Sisyra fuscata (Fabricius)

The larvae are aquatic, associated with freshwater sponges (Porifera: Spongilidae), so the distribution is restricted, and the adults are largely canopy insects and so relatively under-recorded. Nonetheless, Ellis (1965) was able to say it "abounds" in the Broads. There are post-1979 records from TF51, TG20, TG30, TG31, TG32 and TG41, and pre-1980 records from TG11, TL89 and TL99.

Order MECOPTERA: Family BOREIDAE, snow flea

Boreus hyemalis (Linnaeus)

The snow flea is active in winter when entomologists are dormant, and is in any case easily overlooked as it is small and flightless, so it is inevitably under-recorded. The Costessey record was the first British record, but it was more than 170 years before the next Norfolk record. It lives in short moss, and the habitat does not seem to be important, but the Norfolk records are from heaths and deciduous woodland. As bryologists are the only people who habitually examine moss in the middle of winter, it is no surprise that two of the records are by bryologists. Two of the other records come from pitfall traps.

TF61, Bawsey Country Park, 2013 & 2015, S. Lane.

TF62, Roydon Common, 2014 S. Lane, 2015 R.S.J. Smith.

TG03, Holmes's Wood, Hindolveston, 2014, C.R. Stevenson, on the moss *Orthotrichum affine* growing on a young plantation Oak *Quercus robur*.

TG11, Costessey, sometime before 1826, Dr. W.E. Leach (Curtis 1823-1840).

TG14, Felbrigg Great Wood, 2014, M. Ghullam, on the moss *Orthotrichum affine* growing on Sweet Chestnut *Castanea sativa*.

TL88, Thetford Lodge Warren, 1999, M. Telfer.

There is also an intriguing reference (Ellis 1980) to Dr. E. Duffey finding it "in great abundance on one of the Breckland heaths", but he does not tell us in which county, never mind which heath. Ellis stated that if searched for they might prove by no means uncommon, and that statement remains true today. The more frequent records of the last two years are no doubt down to increasing awareness of its existence rather than any increase in the species itself.

Order MECOPTERA: Family PANORPIDAE, scorpionflies

Certain identification depends on examining the genitalia, which in the case of the males is easy. The problem is catching them in order to do so. They live in dense vegetation, typically nettlebeds, brambles,

and other stiff or spiny vegetation, where a net cannot be used. They are among the most alert and seemingly intelligent of insects, with keen eyesight, swift to spot the approaching entomologist, when they will shuffle to the far side of a stem, or beneath a leaf, or as a last resort simply drop to the ground never to be seen again. Because of the need to check genitalia, and past practices of using characters that are quite unreliable, old records must be treated with caution. In particular, females must have the abdomen cleared with potassium hydroxide before they can be named, and there are many female specimens at the Castle Museum in need of clearing to ascertain their true identity.

Panorpa cognata Rambur

This is the uncommon member of the genus. It is often considered to be a species of calcareous soils, but that is certainly not the case in Norfolk. Our records come from various habitats, but they are all either wet or acid (or both).

TF61, Bawsey Country Park, 2015, P.R. Cobb, scrub woodland on acid sand.

TF61, East Winch Common, 1983, W. Ely, damp heath.

TF62, "site name unavailable" (two Invertebrate Site Register records, grid references fit Dersingham Bog NNR), 1988, Dr. S. Ball & Dr. R. Key, acid soils.

TF90, Caudlesprings, Carbrooke, 1993 & 1998, G. Nobes and others, fen habitats.

TF91, Bushy Common, Gressenhall, 1963, K.C. Durrant.

TF91, East Dereham, 1968, K.C. Durrant.

TF91, Scarning Fen, 1968, K.C. Durrant, fen.

TG01, Hockering Wood, 2015, A. Murray, calcareous flush in deciduous woodland.

TG30, Wheatfen, 1936, E.A. Ellis, fen.

TG31, How Hill, 1968, K.C. Durrant, fen habitats.

TG33, Witton Heath, 2013, P. Heath, scrub and ponds on former heath.

TL99, Hills and Holes, Great Hockham, 2008, G. Nobes, wet woodland.

TM19, "site name unavailable" (grid reference is Flordon Common), 1990, Invertebrate Site Register record with no recorder name, damp common.

It is also listed without details by J. Edwards (1901) in Victoria County History.

A 1962 Wheatfen record attributed to myself (at the age of eleven!) appears to be a computer-generated error for *P. communis*.

Panorpa communis Linnaeus [Map 15]

Common in dense herbage and low scrub in any habitat.

Map 15. ***Panorpa communis***
10 km squares ● Post-1979 records ● Pre-1980 records

Panorpa germanica Linnaeus [Map 16]

Common in dense herbage and low scrub in any habitat.

Map 16. ***Panorpa germanica***
10 km squares ● Post-1979 records ● Pre-1980 records

Acknowledgments

It seemed at first a simple task to collate the records of a small group of poorly recorded species, but it has required the assistance of many people, with research and clarification as well as merely obtaining records. My

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New species of moth for Dersingham

R E Jones

When The moths of the Dersingham area (Jones 2015) was published with a total of 1005 species recorded, I thought that that was probably that. I did not expect to add many species for some time. To my amazement several more have been added to the parish list despite the year being a poor one for moths in general. The genitalia were checked for all the micros. In addition several species were omitted from the original list in error. They are set out below with the same layout as before.

The knot-horn *Delplanqueia inscriptella/dilutella* has not been identified to species as mentioned in the original paper and should be recorded as an aggregate species

Acknowledgments

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JONES, R. E., The moths of the Dersingham area. Trans. Norfolk Norwich Nat. Soc. 2015 48(1):2-27

37.102 563	Yarrow Case-bearer *Coleophora argentula*	Common
37.019 502	Scarce Thorn Case-bearer *Coleophora trigeminella*	Nationally Scarce A
37.030 512	Grey Alder Case-bearer *Coleophora binderella*	Local
37.081 561	Black-bindweed Case-bearer *Coleophora therinella*	Nationally Scarce B
37.082 562	Sea-aster Case-bearer *Coleophora asteris*	Nationally Scarce A
37.091 574	Grey Blite Case-bearer *Coleophora deviella*	pRDB3 JH.
38.030 601	White-headed Dwarf *Elachista albifrontella*	Common JH.
45.021 1507	Dowdy Plume *Stenoptilia zophodactylus*	Local JH.
45.028 1494	Wood Sage Plume *Capperia britanniodactylus*	Nationally Scarce B
49.005 1006	Brown-barred Tortrix *Epagoge grotiana*	Common JH.
49.057 1016	Long-winged Shade *Cnephasia longana*	Common JH.
49.164 1067	Thyme Marble *Celypha cespitana*	Local
49.289 1187	Ragwort Bell *Epiblema costipunctana*	Common JH.
49.359 1245	Pale-bordered Piercer *Grapholita janthinana*	Common
62.005 1426	Lesser Wax Moth *Achroia grisella*	Local JH.
63.046 1403a	Dark Marbled Tabby *Duponchelia fovealis*	Migrant/Adventive JH.
63.054 1409a	Box Tree Moth *Cydalima perspectalis*	Adventive
72.061 2484	Pinion-streaked Snout *Schrankia costaestrigalis*	Local JH.
73.010 2436	Dewick's Plusia *Macdunnoughia confusa*	Immigrant JH.
73.082 2292	Tree-lichen Beauty *Cryphia algae*	Immigrant JH.
73.179 2271	Orange Sallow *Tiliacea citrago*	Common JH.
73.200 2235	Tawny Pinion *Lithophane semibrunnea*	Local JH.
73.211 2313	Angle-striped Sallow *Enargia paleacea*	Nationally Scarce B

A history of the exploitation of the Broadland floodplains: peat extraction in the Broadland Fens

Jo Parmenter

Introduction

Since the seminal work undertaken by Lambert et al (1960), which focussed on the creation of the large bodies of water known as the Norfolk Broads, a number of researchers, notably Ken Giller in the 1980s (Giller & Wheeler 1986) and myself in the early 1990s (Parmenter 2000), have undertaken in-depth investigation into the peat resource of the fens and its relationship with the overlying vegetation.

I am interested in the ways in which both current and past landuse influence wetland vegetation; and have a particular interest in the relationship between peat cutting and the various uses historically made of fen vegetation, and began to research this area for my DPhil thesis in the late 1990s. This paper extends some of the subjects I explored then with more recent work carried out by myself, particularly at Catfield Fen, taking account of some of the more recent research by the archaeological and paleo-environmental community.

Landuse in Broadland

The extraction of peat for fuel, or 'turbary' was one part of a traditional system of exploitation of the resources of the Broadland valleys which survived in places well into the twentieth century. Some areas were used mainly for livestock grazing but the wetter parts of the floodplain, and particularly the peat fenland, were principally cut for peat (turf) but also for sedge, reed and marsh hay, with some limited areas of carr and scrub being maintained as coppice, cut for firewood. Drier areas would have been grazed by livestock.

Common reed *Phragmites australis* was cut for thatch and fen sedge Cladium mariscus was cut for ridging. Rush dominated marshes would have been exploited for marsh hay or litter (bedding for animals and also used as a domestic floor-covering), or the rush would have been cut to supply the wicks for rush lights. Reedmace *Typha* spp. and bulrush *Schoenoplectus* spp. were cut and woven to create baskets, mats and horse collars. Materials taken from the fens had financial value, so that in Ranworth, in 1237, peat turves and marsh hay replaced the more usual tithes of money, hens, pigs or eggs.

> "... the assignment of this vicarage consisting of ... small tithes of hay and turf ..." (Blomefield 1806; Vol. XI).

Properly managed, and intensively exploited, peat fen represented a resource of considerable value, and while the price per acre would not approach that of good arable land, well managed reed beds, for example, might well have been regarded as of at least equal value to, if not greater value than poor agricultural land. Land which could be mown for marsh hay likewise seems to have been of greater value than rough grazing marsh, although good grazing land would be likely to command a higher price.

In all probability, the freshwater or slightly brackish fens which existed prior to the commencement of the Romano-British marine transgression, approximately 2000 years B.P. (Wells & Wheeler 1999) were exploited by the indigenous population at the time. The brushwood peat which can be found beneath the deposited clay includes fragments of plant species which can be found in the present day vegetation; *Cladium mariscus*, *Phragmites australis*, various species of bryophyte and the woody

remains of *Myrica gale, Salix* spp., *Alnus glutinosa* and *Betula* spp., which give this type of peat its name. It seems likely that the wetland vegetation would have been exploited by the pre-Roman population in similar ways to the more recent usage and it is quite possible that various products of the Broadland fens have been exploited for at least the past two or three millennia.

During the Saxon and Medieval periods, there seems to have been increasing exploitation of the various resources provided by the floodplain fens. Documentary evidence for the exploitation of wetland resources other than peat over this period is rather sketchy. However the existing material is supported by archaeological finds, including the discovery in various parts of the county, and most notably during the Castle Mall investigations in Norwich, of the charred remains of wetland plants including *Phragmites*, various species of *Carex*, *Eleocharis* etc (Peter Murphy pers. comm.). The precise source of these residues has not yet been established, but in order to be recognisable after partial burning, it is probable that this material was brought onto the site as litter or hay.

There seems to be a general consensus about the types of activities which took place on fen and marshland in Broadland in the 18th and 19th centuries, and numerous authors make reference to these activities. It is usually rather difficult, however to separate those which derive from genuine knowledge from those which merely reproduce the statements of others. It is also often difficult to date a particular type of activity, and, as noted above, it can only be assumed that peat digging, grazing, fishing and the management of fen for reed and sedge have taken place to greater or lesser extent, but at least sporadically, for well over two millennia.

Documentary sources

Marshall (1787) describes the natural products of the Broadland fens as follows, and moreover, was writing at a time when these products were still being actively exploited.

> "Under this head [fens] I class the swampy margins of the rivers and lakes which abound in the southern part of this District ... Their natural produce is reed, gladdon, sedge, rushes and other aquatic and palustrean plants; their upper sides being frequently out of the waters way, affording a proportion of grazable land: hence, probably, they are provincially termed 'marshes'. This, however, is not only contrary to the common acceptation of the term; but the produce and principal use of a fen are totally different from those of a grazing marsh ... The profits of a fen arise, in general, from Reed and gladdon, cut for thatch, for buildings; Sedge and rushes, for litter; and thatch, for hay and corn ricks, and sometimes for buildings; Coarse grass, for fodder and sometimes for pasturage; and Peat for fuel. The last, if made the most of, is a very valuable article ..."

Cooper (1993) wrote in his autobiography about the land use of the middle Yare valley in the first few decades of the twentieth century.

> "... Reed cutting seems to have stopped around here now but when I first worked on the river there were quite a lot of men cutting."

> "The marsh farmers of those days were an entirely different type of person to the arable farmer of the uplands. Their world was mainly cattle, often having many hundreds to look after during the summer, which were turned out to fatten on the lush grass ... This and harvesting the marsh hay for winter use, cutting the rough marshes for litter, keeping the dykes clear and keeping the water in the drainage dykes to a safe level, netting eels when running, duck shooting in the winter both for family good and market ... many of them did a bit of reed cutting also till the young colts came through."

Many writers have commented upon the adversities of fenland life, and the general consensus seems to have been that survival in this landscape required strength of character as well as physical

capability. Descriptions of those who worked as marshmen, either tending cattle and maintaining windpumps on the marshland, or cutting reed and sedge on the fenland paint a picture of individuals who were impervious to the vagaries of the climate, immune from disease and usually lived to a ripe old age on a diet of tobacco, alcohol and eels. Mosby, writing in the late 1930s (Mosby 1938,) noted of the Broads marshmen:

> "The marshmen are a hardy and independent folk, but there are only about 20 left in the Broadland marshes. Almost every marshman inherits his job, and certain areas have been in the hands of one family for many generations ... The marshman lives near his work, by the side of the draining pump ... he looks after the mill and operates it when necessary."

Jennings (1952) although writing at a time when most 'traditional' management practices had ceased, is almost certainly a reliable source of information on past management practices. He describes past landuse along the Ant and Bure valleys as follows.

> "The spoil banks of dredgings, piled discontinuously along these rivers, do not protect the fenland behind from the vagaries of the river level and in the past the bulk of this undrained fenland was used as 'mowing marsh' cut for reeds, sedge, and grass which were used in a variety of ways, though little of this industry survives today. A further complication arises from the former extensive cutting of peat in the undrained fens; indeed it is more difficult to find areas which have not been used in this way than areas which have ..."

One of the most useful sources of information is offered by various original documents, although these often present problems in terms of both translation of text and translation of meaning and intent. For example, Kett petitioned in 1549 that

> "redegrounde and meadowe-grounde may be at such price as they were in the first yere of Kyng Henry the VII" (Dutt 1903).

This suggests firstly that reed and litter cutting was then important in the local economy, and also that the availability of fodder and the rights to cut reed and other materials on the marshes were of considerable value to small landowners and the 'peasantry'. What is not clear, however, is the type of ownership which this land might have been under, or whether Kett is requesting a reduction in land value, or of land rentals.

An 18th century translation of an Inspeximus of Chancery Petition, dating from 1682 (Norfolk Records Office MC 36/123 480), provides ample evidence of fen and marshland management and usage in the parishes of Neatishead and Irstead.

> " ... the several Owners of the several Messuages mentioned and inquired of ... and their several Farmers and Tenants of the said Messuages have for the space of sixty years last past had enjoyed and taken Common of Pasture in and upon the several Commons and Waste Grounds particularly mentioned ... for all their Commonable Cattle Levant and Couchant in and upon their respective Messuages every year at all times in the year at their Wills and Pleasures ... And also had enjoyed and taken in and upon the said Commons and Waste Grounds Fodder Rushes Reed and Sedge growing upon the said Commons and Waste Grounds from Time to Time yearly at their Wills and Pleasures for the Feding [sic] and Foddering their said Commonable Cattle And for the repairing of their said respective Messuages And also had and tooke upon the said Commons and Waste Grounds Common of Turbary and Common of Estovers Namely Alders Flaggs and other Combustible Matter there found (other than Alders in Irstead Hall Fen) for their necessary Fervel to be burnt and spent in their said respective Messuages And also had enjoyed and taken Liberty of Fishing in the Water called Alder Fenn ..."

Some of the most valuable sources of landuse information are the documents associated with Parliamentary Enclosures, which in east Norfolk took place mainly in the early decades of the 19th century (Kain et. al. 2004)

and the Tithe Apportionments of the 1840s. These documents are generally lacking in specific details of land use, and also lack the descriptive detail and indeed the 'colour' of some of the other contemporary texts, but have the advantages of having very often been written to a prescribed formula, which makes possible the unbiased comparison of one parish with another.

Different parishes have different ways of representing land use on the Tithe Apportionments, although a set series of land classifications was usually adopted, namely 'arable', 'pasture', 'wood' and 'water'. This system was somewhat inflexible, for example, Table 1 is an excerpt from the Martham Tithe Apportionment (Norfolk Records Office DN/TA/750 Tithe Award for Martham (1843)).

Table 1 Martham Tithe Apportionment

Parcel no.	Parcel name	Land use
713	Reed Rand	Pasture
714	Starch Grass	Pasture
716	Starch Grass	Pasture

The term 'rand' or 'rond' refers to the strip of marsh or fen between the river and the flood embankment. In the lower floodplains, this strip was often grazed, although more recently, reed cultivation has also become important. In the middle floodplain, for example, along the Thurne at Heigham Sound and Martham, the rond, as the name suggests, was more usually dominated by reed, and would not have been used for grazing, however neither would it have come under the headings of arable, wood or water. 'Pasture' is possibly a more appropriate description than any of the other three classes, however. The land use classification used by the Tithe Apportionments is not really meant to represent true land use at all, but is used simply to assign a value to the land, so that land which could be cut for reed had the same tithable value as land which could be grazed. Some care is therefore necessary when interpreting these documents.

In Broadland, the terms 'marshland' and, very occasionally 'fen', were also used in the Tithe Apportionments. This seems to have mainly been the case where a particular vegetation type or highly specialised land use is very important within a parish, either because it yields a very valuable 'product', for example, a turf cutting or gravel working, or because it covers a large area, for example an area of sand dune or beach. For example, Hemsby Tithe Apportionment listed 'marram land' in the summary. In general, where there were large quantities of a distinct habitat, for example, marrams, or plantation woodland, an effort seems to have been made to incorporate this into the classification.

The parcel names given by the Tithe Apportionment also provide an important guide to land use at the time of the production of the Apportionment document. In some cases, parcel names preserve a former land use, for example, there are a number of lower valley floodplain sites which had no peat cutting at the time of the Tithe Apportionment, but which did have a number of grazing parcels named for former peat workings, for example 'turf marsh', which was used for grazing. Hardley tithe map shows several such areas, particularly along the edge of the floodplain, where the estuarine clay layer would have been thinnest and the peat resource most easily exploitable.

Another good source of information about land use is provided by the Charities Returns. In 1835, the incumbents of each parish were asked to account for the parish charities, including the poor allotments. This process produced a series of accounts relating to charities in Broadland, many of which gave some indication of the use made of, and the value attached to, the poors allotments.

A use seems to have been found for most

natural products of both the floodplain and adjoining higher ground and during the 17th, 18th and 19th centuries strict bylaws were used to govern the management and use made of these natural resources. Nothing was wasted: as well as fodder, fuel and thatching materials, a wealth of resources were provided by the commons, and later by the poor allotments, for the cottage economy.

Some of the most valuable early evidence of the types and methods of management being carried out on the fenland and wet marshland of the region comes from lists of regulations governing land use of common fen and from accounts of legal disputes concerning misuse.

A large proportion of the peat fen in Broadland was suitable for grazing, at least on a sporadic seasonal basis. It was also suitable for peat extraction, for reed, sedge and marsh hay cutting and for the exploitation of various other natural resources. Even agricultural writers such as Marshall, uncertain as to whether the best use of some of this wetland would be attained through agricultural improvement for grazing, or whether the natural products of the marshes should be managed in order to increase the quantities of materials they could supply.

> "I am of opinion that there is scarcely an acre of land in the county which is not worth more under the Norfolk system of aration than it would be in any other state; except the meadows, the marshes and the fens; which I am equally clear in opinion ought to be improved as grassland, or as sources of turf, reed, oziers, sedge, or other aquatic and palustrean productions ..." (Marshall 1787; Vol. I).

Given the wide range of profitable uses to which fen and marshland might potentially be put, it is likely that the owners of fen and marshland had some difficulty in deciding the best way in which to manage their land, and that the conflicts affecting common land were still greater. Because of the potential for conflicting landuse on many of the common grounds of Broadland, most of the commons had strict regulations which governed their use, both in terms of the types of activities which might be undertaken and the people who were permitted to exercise those activities. By the 17th century, a series of often complex rules and regulations governing the use of common land were already in place.

There are few written records of the timings and duration of various management activities which went on in the Broadland fens. In the case of common land, lists of regulations have occasionally survived. These include the Regulations for the Commons of Ludham, Catfield and Potter Heigham which may be found in the Ludham Manor Court Regulations from 1677, and various documents associated with the management and landuse of Beccles Common (Beccles Borough Records).

The Manor Court Regulations outline the timings of cutting and quantities of various types of marsh and heathland crops which could be taken by the holders of common rights (Ludham Court papers 1677).

- That no reed be cut upon any of the said commons before the day after St. Andrew under penalty of 6*s*. 8*d*. for every fathom so cut.
- That no bushes, hedge, gladden or fodder be cut upon any of the said commons till the day after Midsummer under penalty of 20*s*. for every load so cut.
- That ... flags not flags upon the lords ground but only lings, whinflags, be cut upon any of the said commons nor they will be first day of May under penalty of 5*s*. for each hundred so cut.
- That no brakes or whins be cut upon any of the said commons before the 14th day of September under penalty of 20*s*. for every days offence.
- That no more than one person out of or for a house shall receive benefit from any

of the said commons and that none but ancient tenants shall presume to reap any profit from them under penalty of 10*s*. for every day for every person.

- That no person do cut anything of or from the said commons but only between sunrising and sunsetting under penalty of 10*s*. for every offence.
- That no flags be sold out of the three towns under penalty of 20*s*. for every hundred sold.
- That no bridge be made over any running stream from one common to another for private use under penalty of 40*s*.

The various documents which make up Beccles Borough records include papers concerning offences against the constitutions (Beccles Borough Records, Box 3, Shelf 1 (9)).

A true breviat of offences done and committed by certain persons contrary to the ordinances made concerning Beccles Fen [5th May 1612]. The offences comprised:

1. Colouring the cattle
2. Cattle put into the fen before warning given
3. Cattle put into the fen before May Day not wintered in town
4. Diseased horses
5. Abusing the Portreeve
6. Swine 'unringled'
7. Not scoring ditches
8. Carrying away timber and clay without leave
9. Being drunk in court
10. For leaving beasts four hours after the drift and after the bell man had called it

Beccles Common is a floodplain site, in an area underlain by estuarine clay. Marshland of this type was better suited for grazing than peat fen. Consequently, most of the Beccles records seem to be connected or associated with grazing or the management of land for grazing, although some fen vegetation was evidently present. The leases of the town lands include a 16th century document describing the lease, for a period of 21 years, of 2 acres of reedbeds or marshes, which were "parcel of Beccles Fen" (Beccles Borough Records, Box 5, Shelf 2 (20)). The above list of offences indicates that many of the common regulations were also concerned with grazing, and with the protection of that resource, although other resources, including the estuarine clay itself, were evidently exploited when opportunity arose.

Peat cutting and fuel

The date at which peat cutting began in Broadland is not known. Smith, writing in Lambert *et al*. 1960 noted that while the earliest records date from the first part of the 12th century, 'the silence of Domesday cannot be taken as evidence that turf cutting did not exist' at this time. It is likely that peat has been cut for fuel in Broadland for perhaps well over 1000 years, and there are indications that it may have been cut for very much longer, although the period in which this activity began is not precisely known. An increasing population and a growing shortage of wood for fuel in the late Saxon period is thought to be the main reason behind the increased use of peat as a fuel source, for domestic purposes, and thus the creation of the extensive turbaries in East Norfolk which became the waterbodies now known as 'broads' (Williamson 1993).

In addition to domestic usage, a number of industries in the medieval and pre-medieval period also used peat as a fuel. There is plentiful evidence in the medieval period of salterns fuelled by peat (Tom Lane pers. comm.), for example in Lincolnshire, there are numerous references to peat being used to fire salterns in the medieval period. These come from documentary sources, with grants of salterns usually being accompanied by grants of peat in the fen to use in firing the saltern. Tom considers that, without question, peat was commonly

used in Lincolnshire in the medieval period, simply because of the ready availability of this fuel. Prehistoric and Roman salterns are numerous in Lincolnshire and almost certainly peat-fired, again peat being the chief or only fuel resource. The saltmaking industry used peat as a fuel for the process known as 'sleeching'; where the salt-encrusted surface of saltmarsh was scraped off, the salt content leached out, and the resulting brine boiled in a 'saltcote', using peat or wood as a fuel. It is probable that in Broadland, peat was used in a similar way, and over a similar period.

Other evidence for the usage of peat as an industrial fuel source in East Norfolk includes finds of red-brown deposits, thought to be of peat ash, close to the medieval ironworks on the north bank of the Wensum on Oak Street, in Norwich (Shepherd (ed.) 1999). Iron smelting took place here in the 12th and 13th centuries. The location of the site is unusual, as medieval ironworks were usually situated close to a fuel source (Jane Cowgill pers. comm.), and there is no evidence for extensive woodland in the area, which would have provided the obvious source of fuel. Smelting hearths usually used wood charcoal, which provides a better source of heat than wood, but it is also possible to produce a form of charcoal from brushwood peat, or indeed, from the massive trunks of 'bog oak' which were being recovered from the brushwood peat deposits during this period (Lambert *et al.* 1960). The massive dumps of peat ash found alongside the river with the ironworking waste indicate peat was an important source of fuel, and possibly the primary fuel, and that the ironworks may have actually been situated alongside the river in the vicinity of the ironpan in order to facilitate the procurement of peat. If correct, this would suggest that large quantities of peat were being dug from the Broadland fens and regularly transported, presumably by boat, into the centre of Norwich as early as the 12th century.

Peat cutting developed into a commercially important and widespread industry in Broadland in the early medieval period. While cutting probably took place on any suitable privately owned land and also on the extensive common and waste land, it was on the ecclesiastical estates that most large scale peat cutting in the medieval period occurred, and under ecclesiastical control that it developed into an organised industry. St. Benets Abbey, a Benedictine monastic community, had the right to cut peat in turbaries at Ludham, Hickling, Waxham, Beeston St. Lawrence, Horning, Carleton, Thurne, Potter Heigham, Hoveton, Barton Turf, Panxworth and Rackheath. The Augustinian communities based at Hickling Priory and Acle may have exercised similar rights.

Both the deep medieval peat cuttings, or broads, and later shallower cuttings (the turf ponds), correspond in shape and form to present and past property boundaries. Where parish boundaries cross a broad, a ridge of peat, or baulk, which followed the line of the boundary, was often left uncut. For example, the boundary between the parishes of Sutton and Stalham is marked by a baulk in the overgrown basin of Sutton Broad (Lambert *et al.* 1960). A large number of turf ponds are rectilinear in shape, and correspond to post-enclosure property boundaries (see ownership map for part of Catfield Fen, Figure 1).

The Broadland peat cutting industry peaked in the 13th century, when the basins of the broads were excavated. During the 14th century, these deep workings (typically between 2 and 3 metres below O.D.), became flooded through sea level rise, which is thought to have increased at a mean rate of about 1.6 mm per year in this area over the past seven centuries (Valentin 1953). The resultant water bodies are termed 'broads', although not all of the broads of Norfolk and north Suffolk were produced by peat extraction. In contrast to the other water bodies of Broadland, the majority

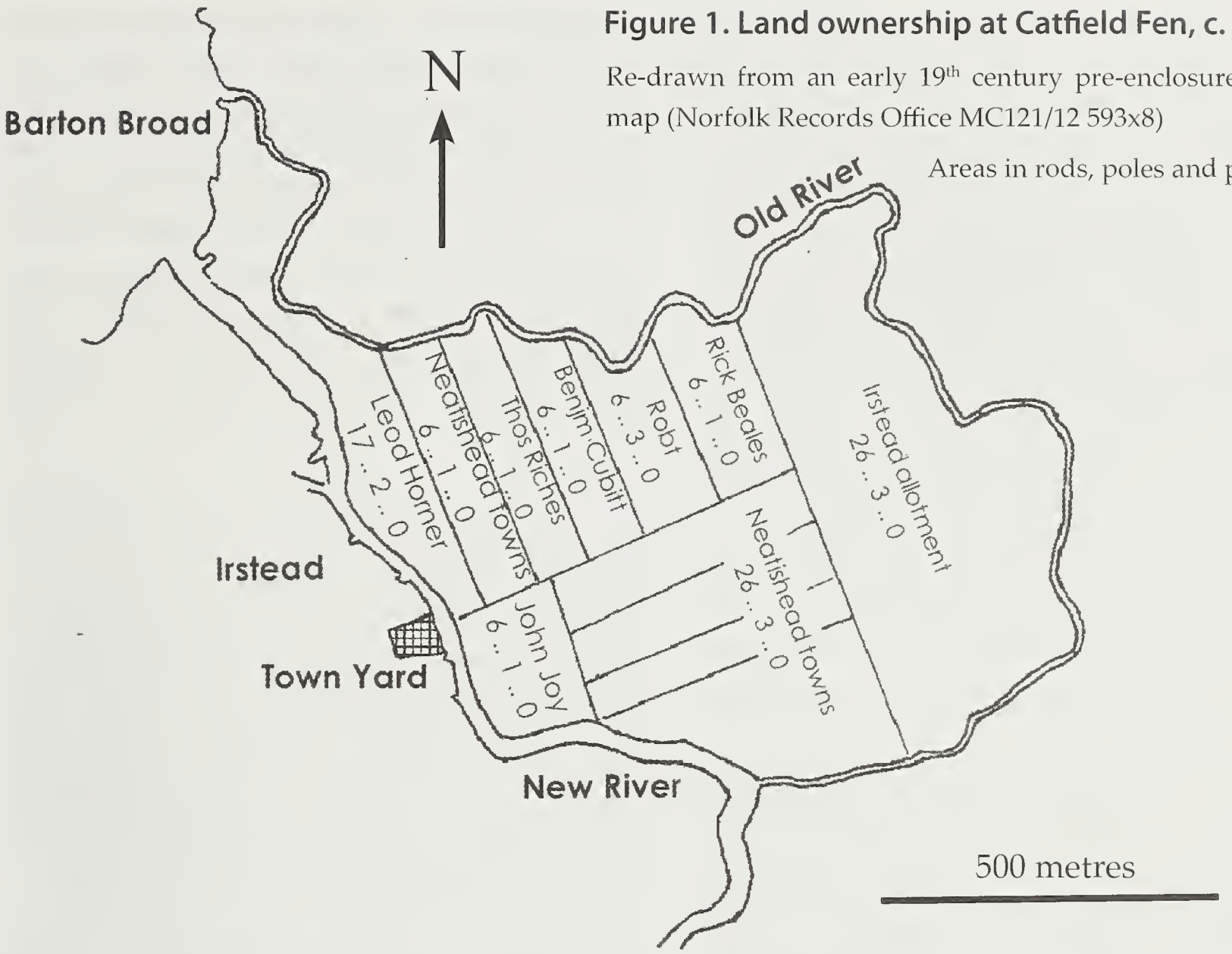

Figure 1. Land ownership at Catfield Fen, c. 1815

Re-drawn from an early 19th century pre-enclosure sketch map (Norfolk Records Office MC121/12 593x8)

Areas in rods, poles and perches.

of the open water area of Heigham Sound derived from the exploitation of the local clay resource for the medieval pottery industry based at Potter Heigham or for brick-making.

Following the 1281 floods, flood events became more commonplace, and water levels were generally higher, consequently, peat extraction became more difficult and costly. Towards the end of the 14th century, the relative sea level had risen to the extent that the peat workings were flooded on a regular basis. It is likely that, once flooded, the deep peat cuttings could not be adequately drained with the technology then available, and it was probably nearly impossible to continue to extract peat from the flooded workings using the traditional method of cutting turves with a specially adapted spade. Smith (1966) suggests that new techniques for peat extraction may have been devised and used to cope with the partial or occasional flooding which had probably occurred by the early 14th century. These included dredging soft, wet peat from the sides and floor of the flooded workings using a long handled scoop or by a hooped net fixed onto a pole, both forms of tool known locally as a 'dydle', or by using a long handled angled spade.

The wet peat would have been transported to dry land, where it could be shaped into blocks and dried. Smith, writing in Lambert *et al.* (1960) elucidated from account rolls that from the early 14th century onwards there were two separate operations connected with peat extraction, rather than the simple operation of cutting from a working peat face as had occurred formerly. The first operation was the ferrying of 'fen' or 'mora', which was costed at 4*s.* per 'lest' and the second was the making or 'scouring' of turves from the 'fen'. One 'lest' or 'last' of turves comprised 10 000 blocks of peat.

This two phase operation suggests that once the turbaries had become partially flooded, cutting peat from a working face and

barrowing it off site would no longer have been possible. Upon flooding, however, the peat on the bottom and sides of the cutting would have become waterlogged, expanded and loosened somewhat, thereby making it easier to dredge, or cut from the sides of the turf pits over the side of a boat and ferry to dry land. The wet peat would then have been shaped into blocks and dried for sale. Despite the obviously arduous work that this method of extraction would have entailed, the deep brushwood peat which could have been exploited by these methods was rather denser and was probably a superior fuel to that excavated from the surface layers of peat and would therefore have repaid the greater investment entailed in its extraction.

Peat dredging was certainly carried out in the Audomarois of north-eastern France in the early 20th century (pers. obs), and Smith (1966) describes similar operations in the Netherlands. The extraction of peat even under dry conditions and with stable footing is an onerous task, however, and the removal of anything other than very soft peat from a small, and possibly not terribly stable boat would have been extremely difficult. It is perhaps the case, therefore, that peat dredging was only effective in removing very soft, or loose peat from the existing cuttings, and would not have resulted in any significant deepening of the turf pits. It should also be remembered that the peat resource of Broadland was by no means close to exhaustion at this time; large tracts of uncut peat fen still existed in many of the river valleys. If Smith is correct, and peat dredging was widespread, at least for a time, then it might be inferred that there was some reason or reasons why the remaining surface resources could not have been exploited. The most likely explanations are either that this land was unavailable because it lay in private ownership, or that there was some other significant and conflicting economic use of the land, for example grazing or management for marsh products, which would have precluded peat cutting at that time. Although turbaries can and do grow commercially viable crops of reed and sedge, this process tends to take place over a long timespan (>100 years) and so whilst turbary would provide significant short term income, this would need to be weighed against long-term and regular income from a managed reedbed or litter marsh.

What is certain, however, is that despite alternative methods of extracting peat from deep workings, for example, by dredging wet peat and then drying it, dredging would have been far more labour intensive than simply digging the peat and, as water levels in the region continued to rise, the creation of deep pits for peat extraction was gradually abandoned in favour of the shallow workings known as turf ponds.

Towards the end of the 14th century, the decline in the peat industry caused by natural phenomena was exacerbated by changing economic and social circumstances. The sporadic outbreaks of plague in this period would have caused labour shortages and made it increasingly difficult to ensure adequate drainage at the beginning of the short peat cutting season, which, according to Bird (1909), ran from May to July. At the beginning of the season it would presumably have been necessary to bale out the water which had collected in the peat pits over the winter months. The cost of producing turf rose during the first half of the 14th century and the profit margin fell correspondingly. The price for turves is known to have increased over this period (Lambert *et al.* 1960) and this may have stimulated a partial reversion to wood for fuel, which was made possible by a falling demand for fuel as a result of the reduced population size in the wake of the Black Death.

By the mid 15th century, it seems likely that almost all of the deep pits which were still

being worked would have been inundated to a depth which would have made even peat dredging exploitation unprofitable. Lamb (1981) has identified several years in which tidal forces would have caused massive flooding, including 1433 AD.

Throughout much of Broadland, medieval peat cuttings became relatively less important to the local economy after about 1400, and after about 1415, references to turbary in the accounts are not common. Martham Broad appears unique in Broadland in this respect, because commercial cutting not only seems to have begun relatively late, but also remained possible much later than in some of the other river valleys. The Norwich Cathedral Priory account rolls indicate that the turf cuttings at Martham extended over some 42 ha. (Lambert *et al.* 1960). The earliest account rolls for Martham date from 1261 to 1274 and contain no mention of peat cutting, but from 1294-95, immediately after a detailed rental and survey of Martham had been compiled, peat cutting appears to have become an important local industry. Up until the early 15th century, turf accounts were being made more or less systematically, although there was an overall decline in the quantities produced. This suggests that while flooding may have been problematic, it did not entirely prohibit commercial peat extraction. This may have been because of the relative position of Martham Broad high up in the river system, and it may also be possible to speculate from this that there were already effective water control structures on the seaward end of the Hundred Stream channel, so that salt water flooding from this direction was only a very rare occurrence.

There is a widely held, although erroneous view which suggests that there were two distinct phases of peat cutting. The first phase in the early medieval period produced the broads and the second, in the late 18th and 19th centuries, produced the shallow workings known locally as turf ponds. It is more likely that, on a local basis, the demand for peat as a fuel never entirely disappeared. The two-phase theory may have derived from the research by Lambert and Jennings (Lambert *et al.* 1960), following which there was a general acceptance of the existence of medieval peat cutting. Most people are also aware of the evidence for 19th century cutting, which has its basis in examination of the Tithe Apportionments and accompanying maps, and also in the early Ordnance Survey maps.

We already have evidence of the importance of turf cutting to the local economy from the early 19th century Enclosure Acts, and it requires only a very small leap of faith to suppose that peat cutting throughout the 15th, 16th, 17th and 18th centuries. Any organised activity on a very large scale would have ceased with, or prior to the dissolution of the monasteries in the 1530s. However, cutting for domestic purposes almost certainly involved considerable quantities of peat, and a degree of social organisation. It is very likely that during this time, the rate of peat extraction fluctuated according to climatic factors such as cold winters or local variations in water levels, or according to varying economic and social conditions, but it is inconceivable that it would have stopped altogether.

In the late 18th century, massively increased rural populations and high rural poverty would have occasioned an increased demand for fuel which could not be met by an increased usage of either coal or wood, even supposing that sufficient supplies of these were available or even affordable. The resulting increased rate of peat cutting was recorded in a series of maps produced in accordance with the requirements of the processes of Parliamentary Enclosure and later Tithe Apportionment. After enclosure, the increased control by individuals over what had formerly been land held in common, and used for a variety of often mutually exclusive purposes, such as peat cutting, litter cutting and grazing, may also

have led to an increased area of fenland being cut for peat.

There has been little or no research into peat cutting between the medieval and post enclosure phases, and, were detailed research undertaken, evidence of peat exploitation would undoubtedly be found. For example, the regulations governing use of common land at Ludham (Ludham Court Papers 1677), refer twice to the cutting of flags of turf. As discussed below, the cutting of flags is slightly different to the cutting of peat turves, but nevertheless the regulations indicate that the use of fen substrate as a fuel was commonplace. Other evidence for pre-19th century peat cutting includes a 1809 pre-enclosure map of Barton Turf, which shows a considerable area of turf diggings in Catfield Marsh Allotments, close to the broad.

The 18th century translation of the 1682 Inspeximus of Chancery Petition which describes land use on Irstead Common (Norfolk Records Office MC 36/123 480, pgs. 51, 125, 142) also makes several references to peat cutting with the suggestion that this was a greatly valued resource.

> "... the several owners of the several messuages mentioned and inquired of ... had enjoyed and taken in and upon the said Commons and Wast Grounds and every of them other than and except in and upon part of Bisley fenn as are called Severals Common of Turbary and Common of Estovers That is to say such Combustible stuff as they could there find for their necessary fuel to be burnt and spent in the said respective messuages ..."

The post-medieval turf ponds were cut to a lesser depth than the medieval broads; usually to a maximum of 1.5 metres below the surface of the fen (circa 1.5 metres below O.D.), although some of the older workings at Catfield Fen, on the River Ant, were about 0.5 metres deeper than this, enabling exploitation of the brushwood peat (Wheeler & Giller, 1982). Conversely, some of the most recent peat cuttings appear to be very shallow indeed, for example late 19th century cuttings at Catfield Fen are less than a metre deep.

The majority of the post-medieval cuttings would have been dug in relatively dry conditions; water being kept out of the workings by the retention of a system of baulks of solid peat, which would have prevented widespread inundation in times of flood; a method originally used in the creation of the medieval cuttings. These baulks are still visible, both as promontories which extend into the waters of the broads, for example at Barton Broad and Decoy Broad, and as raised banks which are still visible on the ground, supporting a different flora to that of the terrestrialised former turf ponds. Peat baulks are generally linear and approximately straight, although there are exceptions. In addition to this simple practice, it is possible that in the areas of greatest peat cutting activity, for example in the extensive 19th century peat workings at Catfield Fen, Ranworth Marshes and Horning Hall Marshes, temporary wind-powered trestle pumps, or simple 'ladle and gantry' devices may have been installed to keep the cuttings free of water. It is known that permanent brick structures were used to keep agricultural land dry during this period and, on occasion in the fens themselves to reduce waterlogging in embanked areas to a sufficiently low level to allow cattle grazing, as in the internal fen system at Catfield. It is possible that this technology would have been adopted where necessary in the peat workings.

It is now apparent that some of the turf pits were cut more than once for peat, presumably with an interval of several hundred years between cuts to enable a sufficient accumulation of organic material. This practice of multiple cutting is likely to have been particularly prevalent where peat was being cut out of domestic necessity, rather than as any kind of commercial enterprise. The recently formed secondary peat taken on the second extraction would have been of inferior quality to dense

Table 2. Results of peat stratigraphy survey (peat baulk)

Depth (cm)	Details	Interpretation
0-10	Dense rootmat.	
10-20	Dark brown humified peat with roots.	Secondary peat
20-25	Lighter brown-orange fibrous peat, with numerous partially decomposed plant fragments. Strong Hydrogen sulphide odour.	Secondary peat
25-80	Orange-brown fibrous peat, with reed rhizomes.	Secondary peat
80-150	Darker brown fibrous peat, with abundant plant remains.	Secondary peat
150-160	Dark, amorphous, solid peat, without plant fibres.	Primary (solid) peat
160-200+	Blue-grey clay, with plant roots.	Upper clay

Table 3. Results of peat stratigraphy survey (adjacent fen)

Depth (cm)	Details	Interpretation
0-5	Dense rootmat	
5-20	Very wet, sloppy peat, comprised mainly of partially decomposed plant fibres, with living roots.	Tertiary peat
20-70	Water with plant fibres and some semi-decomposed material	Tertiary peat
70-120	Very wet, sloppy light brown peat, with some plant fibres.	Tertiary peat
120-140	Very wet, light brown peat, comprised mainly of partially decomposed plant fibres.	Tertiary peat
140+	Blue-grey clay.	Upper clay

NB The relative height of the baulk above the surrounding vegetation was approximately 20 cm.

primary brushwood peat or sedge peat, and would not have had the same capacity for heat production. However, there is strong evidence to suggest that this type of extraction took place.

The main field evidence for multiple peat cutting lies in peat borings at Reedham Marshes in the Ant valley. Reedham Marshes forms part of the extensive fuel allotments belonging to the parishes of Catfield, Irstead and Neatishead, although other sites have been noted in the Bure valley. The borings at Reedham Marshes indicated that many of the peat baulks, previously assumed to be solid peat, are themselves the remnants of terrestrialised former peat cuttings (pers. obs.). The removal of secondary peat might conceivably have been undertaken to improve reed quality, however the depth of cutting makes this explanation unlikely and this would not explain why the peat baulks were themselves cut. If the site were being annually visited for reed cutting, then it would make no sense to remove the peat baulks, which would have provided easy access to the site and dry ground on which to stack reed, and keep supplies. In addition, the fen in this area is dominated by saw sedge *Cladium mariscus* rather than reed, and appears to have been cropped for this product for many years.

If the baulks of solid peat were simply removed for fuel at a later date, then there would be no present day baulk-and-pit topography. Unfortunately, it would not be possible to determine whether the peat baulks left by the second cut ran parallel, or at right-angles, to the original solid baulks without extensive boring. Tables 2 & 3 give the stratigraphic data for bores made into a baulk of secondary peat and into the adjacent fen, which is comprised of 'tertiary' peat, or peat formed in the turbary after secondary peat has been cut and removed. While the bore made into the fen indicates recent cutting, the nature of the peat which comprises the baulk is also consistent with the consolidated secondary peat which might be formed in a terrestrialised cutting rather than with solid peat. The 'tertiary' peat is to all intents and purposes indistinguishable from secondary peat except where the two types are juxtaposed to enable a comparison to be made. Both secondary and tertiary peat are unconsolidated, usually fairly recent deposits, but the tertiary peat will be less consolidated and have a higher water content, and is more likely to support early successional swamp communities than the secondary peat. Figure 2 depicts the cuttings after peat had been extracted for a second time. These peat cuttings have now partially terrestrialised.

In some parts of Broadland in the 19th and early 20th centuries, and possibly earlier, the surface peat of terrestrialised cuttings was being removed, not necessarily for fuel, although it may well have been burnt as a by-product, but to improve reed, and particularly sedge growth once fuel-quality peat had been extracted. This practice was known as 'turfing out' and typically resulted in very much shallower cuttings than those which were dug for peat, usually in the region of <40 cm. George (1992) records that the late Herbert Grapes, a former marshman on the Ranworth Estate, stated that the process of turfing out involved cutting away the top 18 inches of peat (c.45 cm) in strips of about 10 foot (3m) in width. The cut peat was then stacked on the baulks which were left between the new pits and dried for use as fuel.

Giller & Wheeler (1986) suggested that several of the shallow workings at Catfield might have been cut into secondary peat for this reason. The shallow cuttings at Catfield are in the region of 80 cm in depth, however, which suggests that, even if improvements to the reed harvest were the primary objective for cutting, the value of the cut peat for fuel encouraged removal to a much greater depth than would have been necessary for reed culture alone. In fact, excavation to a depth greater than 50cm could easily have meant an interval of at least ten years before reed grew in sufficient quantities to merit harvesting.

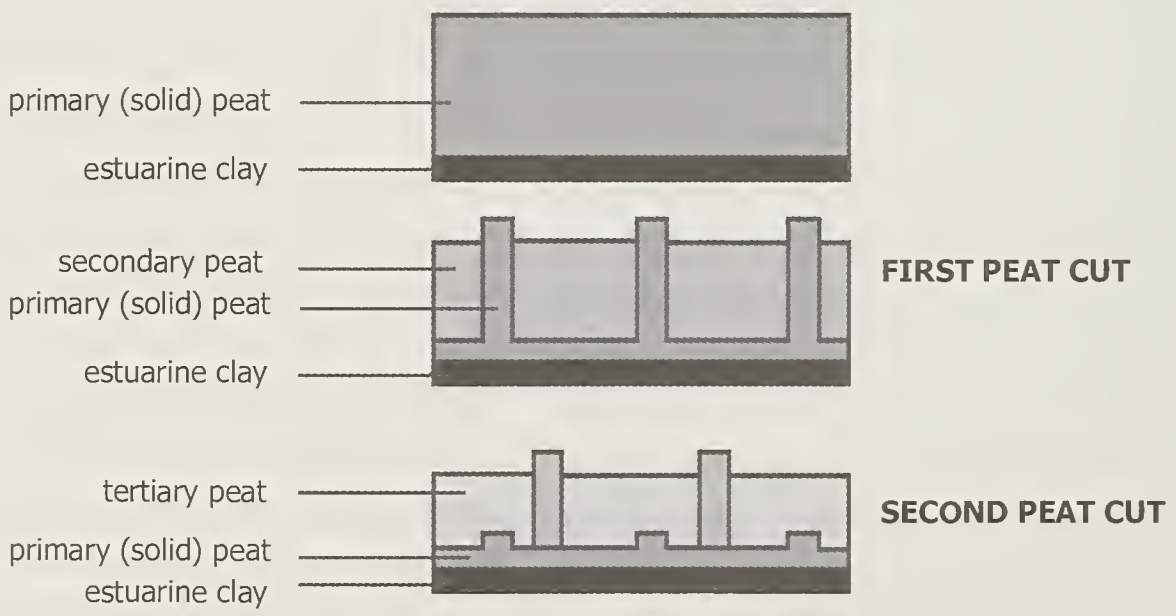

Figure 2. Diagrammatic representation of multiple phases of peat cutting (Parmenter 2000)

Turf ponds which were dug to a depth of 50 cm at Redgrave and Lopham Fen on the Norfolk-Suffolk border, had not developed even a sparse reed cover after four years (Parmenter 1999), although another pond which varied in depth between 20 and 40 cm supported some reed growth, and one of the shallowest turf ponds (c25 cm in depth) supported quite dense growth. In effect, the cuttings at Catfield would have resulted in the loss of an area of commercial reedbed for a period in excess of twenty years, whereas a shallow cut of 25 cm would have resulted in the same regeneration of reed, but with a shorter time interval before the reedbed could once again have been harvested. In addition, deeper cuttings, even when they supported commercial quality reed, would have produced unsafe and probably unpleasant working conditions for the reedcutter, assuming the reed was growing as hover. In summary, cutting to depths of over 50 cm to improve reed growth would not have been a financially viable operation unless there was a secondary benefit; *viz.* the material which was being removed had a significant commercial value, and this is unlikely to have been true of the poorly consolidated secondary peat.

The value of post-medieval turbary

The value of the peat cutting industry between c1850 and c1900 to the local economy should not be under-estimated. Marshall (1787) described the economics of the peat cutting industry in the late 18th century as follows (Vol. II).

> "The following is an accurate account of the peat-grounds of the fens.
>
> | | |
> |---|---|
> | The 'turf-man' pays for rent | £.0 4 0 |
> | For cutting from 1*s*. 6*d*. to 2*s*. | 0 1 9 |
> | For 'chimneying' (that is, piling them lattice-wise to dry) | 0 0 6 |
> | For boating to the staithe 6*d*. to 1*s*. | 0 0 9 |
> | | £0 7 0 |
> | Profit and hazard (great quantities are sometimes swept away by the floods) | £0 1 6 |
> | The selling price per thousand | £0 8 6 |
>
> The peats, when cut, are about four inches square (but dry to about three inches and a quarter); and from two or three feet long, or of a length equal to the depth of the moor; - every foot of which, therefore, affords nine peats: each yard 81: each rod 2,450¼: and each acre 392,040: which, at 4*s*. per thousand amounts to the sum of £ 78 8*s*. 2*d* an acre: besides the additional advantage of having uncovered a stratum of earth, which, in many parts, produces reed, spontaneously; and on which, it is highly probable, that valuable aquatic might on every part be propagated."

A large proportion of land in the middle and lower Ant valley was allotted to the poor of the parishes of Barton Turf, Catfield, Neatishead and Ludham for the express purpose of peat cutting. Much of the land at Reedham Marshes was labelled 'Poor's Firing' on the Enclosure map; another area was called Turf Fen. Again, even though this land was 'waste' and may have had little other commercial value, to the poor of the parish, it nevertheless represented a significant resource. Irstead Enclosure Act describes the usage of the allotment at Irstead Holmes, totalling 40 acres in area, and at Reedham, almost all of which land was eventually cut for peat.

> "...and we the said commissioners do hereby assign set out and allot unto the Lords of the Several Manors of Neatishead with Irstead ... the Rector ... and the churchwardens and overseers of the poor ...one piece of land ... bounded by the Old Hundred Stream ... and we do hereby direct that the said trustees ... shall forever hereafter keep in good repair ... the said ditch. And we do hereby declare that the land comprised in the said allotment ... is ... equal in value to one twentieth part of the average value of the said commons ffens [sic] and waste grounds ..." (Norfolk Records Office C/Sca2/177).

A large proportion of the marsh at Irstead seems to have been doled, again suggesting that turf cutting was the principal form of management.

Carrodus (1949) indicates that, where peat cutting was taking place, it remained one of the main fenland industries from the

time of enclosure until the end of the 19th century:

> "By the Poor's Allotment Award at the time of the Enclosure Horning people were allowed to cut 3,000 turves a year for each cottage. For countless generations this was the chief industry of Horning in the spring of each year, and boys of the tender age of seven or eight turned out to help their fathers in that work on the marshes ... The turf was mainly cut from the water-logged banks of the river, and in its place the graceful reed beds which now fringe the waterside sprang into existence ... there was for many years quite a considerable trade done in it (turf). In fact so stabilised was its value that it was used as a basis of exchange in other commodities. The turf ... went to all parts of Norfolk, Suffolk and East Anglia ... This type of harvesting brought into use a special kind of implement which produces turves uniformly measuring $3^{1/2}$ inches, both in thickness and width, and running to a length of from two to three feet. That was different from the turves cut on the Lincolnshire Fens, which were square. In this part of Norfolk the cutting of a thousand turves was considered a good day's work."

> "The turf staithe was on the river bank, opposite what was then known as Gryme's Farm. It was approached by a good broad fairway from the road. There the turves were bought and sold ... At the staithe the turves tilted at an angle, were first left to drain the water off them and then they were stacked five or six feet high to complete the drying process ... The turf cutters were paid 10s a thousand."

Carrodus estimated that the cost to keep a cottage going for a year was somewhere in the region of 20-25s. Turf was sold on at a shilling a hundred. The track leading to the turf staithe had apparently disappeared at the time of writing.

At both Hickling and Horning, the Enclosure award allowed each qualifying parishioner to cut 3000 turves a year from the allotment, while the common-rights holders at east Ruston were allowed to take 5000 turves each year (Bird 1909). The Enclosure Award usually forbade the sale of turf cut by individuals from Poor's Land, although this practice probably did take place.

Fen which could yield peat was therefore of great value; although peat was a non-renewable resource, at least within the lifetime of the landowner, the land could later be used for reed or sedge cultivation, both of which were highly profitable, and moreover represented a renewable resource.

Peat blocks seems to have varied in size and shape in different parts of the country, much as reed was sold in bundles of different sizes (see below). In 1924, Gurney made notes on the peat cutting industry then operating at Wicken Fen, in Cambridgeshire:

> 3 peats = one hand
> 5 hands = 1 quarter
> 'one hundred' = 60 peats
> 'one thousand' = 600 peats (which could be sold for 10 shillings) (Gurney, 1924)

One peat should be cut 15" by 5 1/2" by 3", but very often the peat cutter would

> "... swindle over it and cut them narrower so getting five when four only should be cut".

At Chippenham Fen, peats were cut and sold by the full hundred, whereas at Wicken Fen they cut the peats larger and sold fewer to the hundred.

The decline of turbary

Despite the continued exploitation of peat, and the existence of alternative fuel sources such as wood and coal, there seems to have been a general shortage of fuel, at least in the late 18th and early 19th centuries. While many Broadland parishes had quite large areas of woodland, and several, for example Catfield, had extensive tracts (Armstrong 1781), much of this woodland was in private ownership and was thus not available for exploitation by the populace.

> "In this parish is a wood, the most extensive of any in Norfolk, comprehending one hundred and fifty acres ..." (Armstrong 1781).

Whatever the reason, where the two resources were to be found abundantly and in close proximity, large tracts of fen were nevertheless being exploited for peat throughout the 18th and 19th centuries. Transportation of coal from the north of England was commonplace by the 19th century. However, initially this would have been a fuel which was only available to an affluent minority, although coal later gradually replaced the widespread use of peat as a fuel.

Catfield Fen was probably more intensively exploited for peat, at least during the 18th and 19th centuries, than almost any other site in Broadland (see Figure 3; p. 65), which suggests a scarcity of alternative fuel.

In a number of Broadland parishes, the Enclosure Acts suggest that the peat resource was already exhausted, or at least had been exhausted on the land which was allotted to the poor. Hemsby Enclosure Act described 'a piece of allotted land formerly part of the common or waste' which was situated close to the broad and states that

> "... the said trustees ... are hereby empowered ... to lease and demise such Allotment or Allotments ... for any term of years not exceeding 21 years ... the rents and profits ... shall from time to time be laid out in purchasing fuel and such fuel shall be distributed among the poor ..." (Norfolk Records Office C/Sca2/148).

Of course an alternative explanation would be that the Trustees had determined that rental of the land for some other purpose would be more beneficial to the poor than allowing peat cutting, but Hemsby had little land on the floodplain, and that which was present had largely been exploited in the medieval period to produce Ormesby Broad.

Several other documents refer to the exhaustion of the peat resource on a local scale, for example the Returns to the Commissioners for inquiry into charities in England and Wales, most of the relevant Broadland examples of which date from c1830, note that at Stalham

> "Poor persons being resident and settled in the Parish are appointed by the Trustees to have the privilege of cutting turves three thousand being allowed to each person last year but the turf is now nearly cut up (exhausted). 60 persons were appointed last year ..." (Norfolk Records Office P/CH1/10).

Stalham did not at the time have peat grounds in Sutton Broad, but parishioners possibly cut turf further up the channel nearer to Stalham or at Chapelfield, although the last appears unlikely from the vegetation.

Norfolk Records Office P/CH1/29 (1832), from the same series of documents describes a similar situation at Sutton, which seems to have a much greater peat resource. "80 acres land and water" were allotted to the poor of Sutton in about 1806. By 1832, the quantity of turf cut annually was a little over 10 thousand turves.

> "... turf and rushes have been cut upon this (allotment) for the poor settled inhabitants but there is now very little remaining to be cut. The produce is now very small about 10 or 12 thousand turves is the utmost quantity now cut and these are distributed amongst poor parishioners ... each person receiving any portion pays 6d. a thousand for the expense of cutting and boating it."

In some parishes, the trustees responsible for the management and usage of the poor allotments tried to conserve the dwindling reserve of fuel by imposing limits upon the annual cutting. Bird (1909) notes that at East Ruston Common, the regulations originally allowed each qualifying resident to cut 5000 turves of peat annually; presumably from the low lying areas of valley fen on the margins of the heath. In 1845, the regulations were revised, so that it was no longer permissible to sell peat cut from the allotment except to 'poor inhabitants'. In 1853, the annual allowance of peat turves was reduced from 5000 per annum to 3500 per annum, again indicating a depletion

of the resource. The original allowance of 5000 turves was reinstated in 1867, possibly because fears that the peat might be exhausted were found to be groundless, although it is more likely that coal was increasingly used as fuel, and the demand for peat consequently reduced.

The extraction of peat from shallow pits, of 50-100 cm in depth, seems to have increased in intensity during the 18th and 19th centuries, and the practice continued well into the 20th century. Shallow cuttings are known from throughout Broadland, although the earlier pits are often rather difficult to detect except by exhaustive stratigraphical survey. Such cuttings rapidly fill with water and these shallow 'turf ponds' are unstable features in the landscape, prone to rapid terrestrialisation. The shallowest cuttings probably represent the cutting of 'flag' for fuel rather than strictly peat, although there are problems in defining what is meant by the term 'flag' as opposed to peat. According to Kent, 'flag' appears to have comprised the root-mat zone and associated soil.

> " ... within the parish of Grimshoe: what peat is dug, is merely for domestic use; the general fuel of the country is flag, or surface turf, pared off the fen: its component parts are the roots of herbage, common earth ... and some peat" (Kent 1796, Pg. 213).

The difficulty in determining the exact nature of the material which was described as 'flag' is compounded by a certain degree of confusion as to its usage. Flags of peat or turf could, and did, provide a useful fuel, and, indeed, Young (1804) notes that the poor of Carleton Colville had "40 acres allotted for fuel; not turf but flag", but turf was also used for roofing. Bird (1909) records the various uses made of flag, and also noted restrictions upon the locations from which it might be cut; presumably this was in order to protect those areas of the allotment which might be grazed or put to some other usage.

> "As to the cutting of Turves or upground flags (then used for roofing, laying down lawns, inoculating pastures or banking, although some were burnt), these were to be cut form amongst the Furze bushes only." (Bird, 1909).

To complicate matters further, 'flag' is used in some districts when referring to *Iris pseudacorus*. Whatever the eventual usage, 'flag' was a material in great demand and the apparent inadvertent cutting of flags without permission seems to have caused some controversy.

> July 19th 1752. Memorandum " ... wheras diverse Flaggs were cut for my use by William Clark upon the Several of Anthony Norris Esq., about 50 yards on the south side of the Comon [sic] Lane in Barton and so on to the southward I doe [sic] thereby acknowledge to take the same as the Gift of the said Anthony Norris by his leave only which I have this day asked and obtained ..." marked Samual Furness (Norfolk Records Office Sco. 29/25/2 111x5).
>
> July 20th 1752 Memorandum " ... whereas we John Snelling, John Osborne and William Clark have by mistake and without any ill design cut diverse Flaggs upon the Several of Anthony Norris Esq., in Barton about 50 yards on the south side of the Comon [sic] Lane in Barton aforesaid and so on to the southwards of the same Lane and between the Broad Water and the Green Way we doe [sic] hereby acknowledge each for our selves severally and respectively to have asked and obtained leave of the said Anthony Norris to take the said Flaggs away as in his Right and as his gift ... " marked John Osborne, John Snelling, William Clark (Norfolk Records Office Sco. 29/25/2 111x5).

It is quite certain that small scale peat excavation by the poorer sectors of society for domestic use continued into the 19th and, in some instances the 20th centuries where resources were available. However the use of 'flag' as an alternative source of fuel suggests some degree of desperation, and possibly the exhaustion of readily available peat, at least on a local scale.

Eventually, most of the poor allotments formerly used as turbaries were rented out

as grazing land, or used instead for reed and sedge cutting, and the profits, if any, distributed among the poor of the parish as coals. It remains uncertain whether this change to an alternative fuel source was driven by the exhaustion of peat on the fuel allotments, or whether the dwindling peat resources, were eventually viewed as a 'primitive' and thus undesirable source of fuel and replaced by the rather more energy-efficient coal for that reason alone.

Discussion

There is still a great deal we do not know about peat cutting in Broadland: precisely when did it begin? I believe that it was rather earlier than is commonly thought, and possibly as early as the Roman period when it is postulated that peat cutting may have been used to fuel the Roman-period salterns. Was the process near-continuous or were there large gaps; for example during the Early Middle Ages c.5th–10th century, and between the 'commercial' large scale medieval turbary operations which created the basins of the broads and the 18th and 19th century domestic cutting?

What is becoming increasingly apparent is that turbary is much more extensive in Broadland than was previously thought. Recent in-depth analysis of aerial photographic imagery by staff at the Norfolk Historic Environment Service, at Gressenhall as part of the National Mapping Programme (Albone & Massey 2007) has identified a number of potential additional areas of peat extraction in parts of Broadland which were previously assumed to be solid peat. I spent some time in 2013 investigating one of these areas, at Catfield Hall Fen (The Landscape Partnership 2013), and although at first glance the area in question appeared to be solid peat, a detailed inspection along a transect demonstrated that there were, in fact, minor differences in peat composition which might be interpreted as a very well-consolidated turbary, and that the change between 'solid' peat and postulated turbary more or less equates to the location indicated by the analysis of aerial imagery. I have since identified other 'lost' turbaries at Brundall Marina and at Wroxham Broad, in areas where I had not previously thought that peat cutting had taken place.

I am now of the opinion that rather less than 10% of the solid peat resource in Broadland remains, and that the true figure may well be around 5%. Solid peat is an important heritage asset, and is an invaluable palaeoenvironmental resource (Murphy 2014). Given the importance of the uncut peat resource, more research is certainly required into this subject, and I consider that this should include an update of the mapping of the known turbaries.

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Much of the work upon which this paper is based was undertaken as part of my historical research for the Broads Fen Resource Survey (Parmenter 1995), a project jointly funded by the Broads Authority, English Nature (now Natural England) and the Environment Agency. A large proportion of the subsequent research was carried out as part of my study for my DPhil thesis (Parmenter 2000) and I thank Professor Tom Williamson, who inspired a change in the direction of my research into this area.

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Figure 3. The extent of turbary at Catfield Fen

Redrawn from Giller & Wheeler 1986 with additions based on recent research

The plants of Blakeney Point: update 2014 -2016

Richard Porter

Prior to this update, a total of 294 flowering plant and fern species or aggregates has been recorded on Blakeney Point since records have been kept, of which c. 200 can be described as comprising the main flora (Porter &Tegala 2015). Twenty species are of particular conservation importance because of their Red List status, national scarcity or Great Britain having more than 25% of the world population (Porter 2013a).

Furthermore, one of the Point's main plant communities, that of coastal vegetated shingle, is one of the rarest and most threatened habitats in Britain with just 5,000 ha in England (Maddock 2006). The shingle ridge of Blakeney Point has >1%, making it of national importance.

This paper updates the plant accounts in Porter (2013a) (hereafter referred to as the Atlas) and Porter & Tegala (2015) in respect of those species which have shown the most noticeable change in distribution and abundance in the three years following the Atlas and the tidal surge of December 2013 (Porter 2013b) with particular emphasis on those of conservation concern.

Where relevant to understand changes in plant distribution, reference is made to Figure 1, which shows the recording squares used in the Atlas.

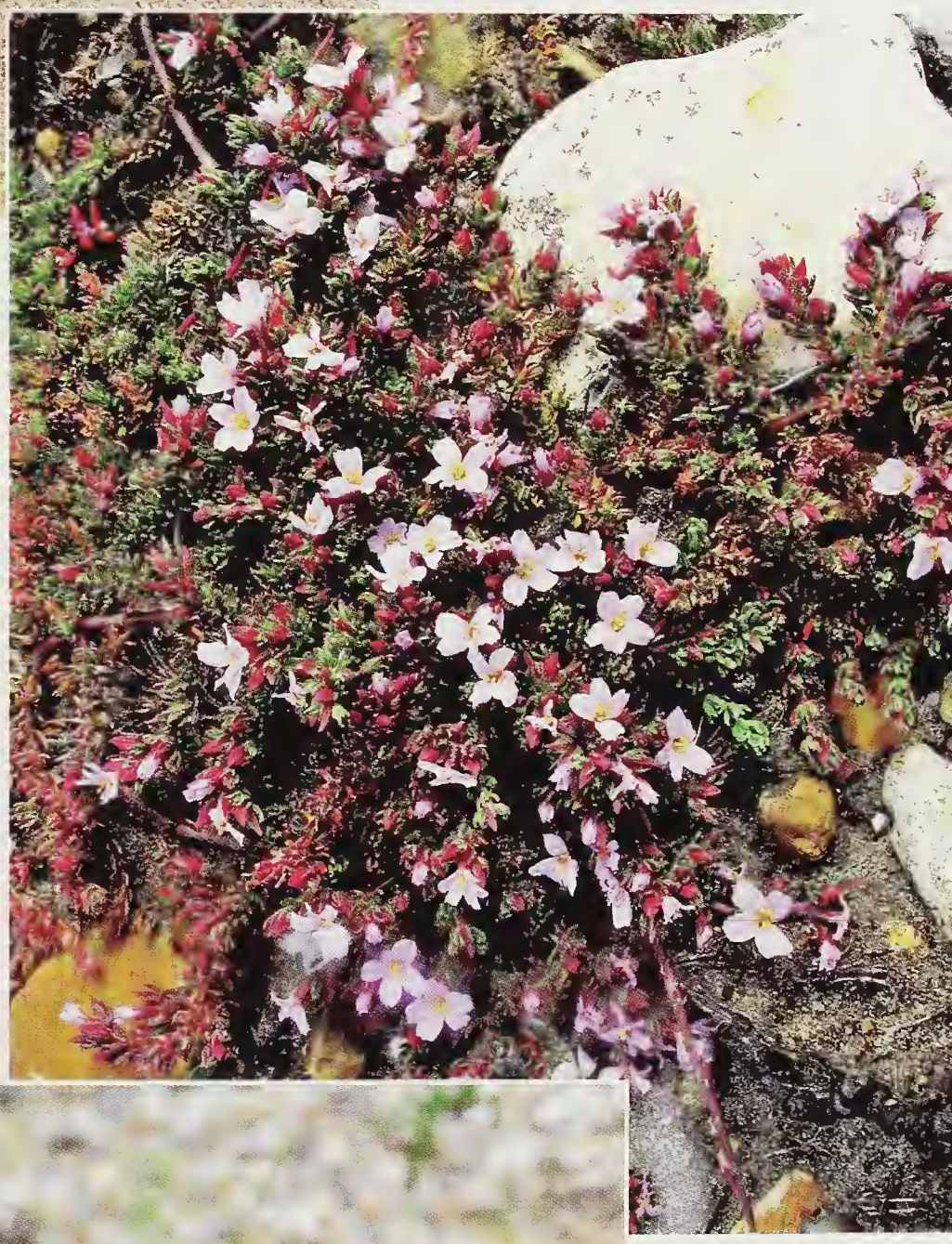
New species

Five new species were recorded bringing the Blakeney Point 'list' to 299. Single plants of Creeping Buttercup *Ranunculus repens* (recording square Q3), Hairy Buttercup *R. sardous* (Q3), Wild Clary *Sylvia verbenaca* (I3) and Purple Toadflax *Linaria purpurea* (I3) were all found in 2016, whilst a 'colony' of over 90 plants of Wild Pansy *Viola tricolor* suddenly appeared in the Lifeboat House Garden (I2) in 2015 and were still flourishing the following year.

Changes in abundance and distribution

Plant surveys in the two years post-surge (2014 & 2015), although not fully comprehensive, showed that the abundance and/or distribution of 40 species (i.e. 20% of the species that comprise the Point's main flora) had changed adversely since the Atlas (Porter & Tegala 2015). However, by 2016 the status of most of these had returned to that pre-surge. Thus, some of the most affected species of the vegetated shingle were back to 'normal,' notably Sea

Figure 1. Map of Blakeney Point showing recording squares.



Plants of Blakeney Point

1. *Above:* **Prickly Saltwort** *Salsola kali.*

2. *Right:* **Sea-heath** *Frankenia laevis.*

3. *Below:* **Sea Spurge** *Euphorbia paralias.*

Photos: *Richard Porter.*

Plants of Blakeney Point

1. *Right:* **Sheep's-bit** *Jasione montana.*

2. *Below:* **Sea Pea** *Lathyrus japonicus* emerging through **Sea Sandwort** *Honkenya peploides.*

Photos: *Richard Porter.*

Ingoldisthorpe Common

3. *Right:* W4 *Betula pubescens-Molinia caerulea* woodland community at Ingoldisthorpe Common.

Photo: *Robin Stevenson.*

See p. 20

Beet *Beta vulgaris* ssp. *maritima*, Shrubby Sea-blite *Suaeda vera*, Sea Campion *Silene uniflora*, Curled Dock *Rumex crispus* ssp. *littoreus*, Thrift *Armeria maritima*, Biting Stonecrop *Sedum acre* and Common Bird's-foot Trefoil *Lotus corniculatus*.

How is the long-term survival of the flora of the vegetated shingle affected by events such as tidal surges? This is difficult to answer without a detailed study which would not be easy as dramatic surges, such as those of 1953 and 2013, are rare. However, I offer a few observations. The shingle ridge is regularly overtopped (say twice a decade), usually when there is a combination of high tides and strong, northerly winds. This can result shingle from the beach being pushed over the ridge and smothering the vegetation. As a consequence plants can be buried to a depth of up to 1.5 metres (pers. obs.). On the crest of the ridge, however, plants are rarely covered more than 30 cm (pers. obs.). Stabilising species, notably Sea Sandwort *Honkenya peploides* and Sea Campion will quickly grow back through the shingle and flower in the following summer; the same is true of Curled Dock. Pioneer colonisers, notably Yellow-horned Poppy *Glaucium flavum*, will have a poor year following a shingle overtopping, but the resulting seed dispersal leads to a proliferation of plants in the following few years.

On the dunes and sandy areas the clovers, *Trifolium* spp., and the Red Listed Near threatened Hound's-tongue *Cynoglossum officinale* were returning to that typical of their pre-surge status, and there was an indication that the latter species was spreading. However the Vulnerable Smooth Cat's-ear *Hypochaeris glabra* was no longer a relatively common plant of the dunes. It is also worthy of note that many of the small trees and saplings of White Poplar *Populus alba*, that comprise much of the woody cover in the Plantation and had been spreading onto the nearby dunes, died during 2016, perhaps the result of salt water inundation during the tidal surge of December 2013.

Several species have made noteworthy increases in their abundance and distribution since Porter (2014). The most significant are listed with their status change:

Prickly Saltwort *Salsola kali* (Red Listed as Vulnerable) has spread and increased in abundance notably in its core area of the sandy edges of Far and Middle Point. Furthermore its distribution has extended east, patchily, with some plants reaching near to Cley Beach Car Park (R4). This 'conservation success' was probably due to the greater extent of sandy areas and the easterly movement of seeds as a result of the tidal surge, supported by the proliferation also noted on RSPB East Anglia coastal reserves (James Cadbury *in litt.*).

Rock Sea-lavender *Limonium binervosum* had spread and increased noticeably in abundance on the shingle ridge. This is a species for which Great Britain holds over 25% of the world population.

Sea Heath *Frankenia laevis* had spread noticeably in its core areas of compacted sandy shingle, possibly as a result of the inundations of the tidal surge (James Cadbury *in litt.*). The species is Red Listed as Near Threatened and is nationally scarce.

Sea Rocket *Cakile maritima* was largely confined to the western end of Blakeney Point during the Atlas, but has since spread eastwards though not to the extent shown by Prickly Saltwort.

Common Vetch *Vicia sativa*. From one plant in the dunes in 2013, it has become much commoner and more widespread in I2 & J2.

Sea Pea *Lathyrus japonicus* has spread significantly since the Atlas in its core area at the easternmost section of the shingle ridge (R3 & R4), possibly as a result of the deposition of sand and dispersal of seeds by

the tidal surge. In 2015 the patches occupied an area of c.470 m^2 and, remarkably, a year later in 2016 this had increased to over 1200 m^2. Sea Pea is Nationally Scarce.

Gorse *Ulex europaeus*. From a single bush in the dunes in 2006 (J2) there is now a flourishing community with over 30 small satellite bushes.

Sea Spurge *Euphorbia paralias* was first recorded on Blakeney Point in 1959 (Pearson *et al.* 2007). Over 300 plants were counted in 2008 in the core habitat of the dunes (Porter 2014). Since then it has continued to spread and increase in abundance and in 2013 over 3,000 plants were counted. Surveys in 2016 also showed that the plant was spreading eastwards along the shingle ridge and was recorded in all squares to R4.

Sheep's-bit *Jasione montana* was a rare plant in the dunes prior to 2009, but was becoming more frequent by 2013 and by 2016 it was widespread over many of the western parts of the main dunes in J2, K1 & K2.

Fox-and-cubs *Pilosella aurantiaca*, an introduced, invasive species, was only recorded during the period of the Atlas as a single plant in 2012. However in 2014 a total of 94 plants were discovered on the edge of a dune hollow in J2. They were not seen the following year.

Common Cudweed *Filago vulgaris*, a Red Listed NearThreatened species, was found growing in two patches on the shingle ridge where it had previously not been recorded (both in square P3). This eastwards extension of its range may be the result of sand deposition by the tidal surge.

Southern Marsh-orchid *Dactylorhiza prae-termissa*. From the first occurrence in the dunes in 2009, when two plants were found in I2, numbers have increased to ten in 2016 with a further single plant a little distance away. This is one of only three orchid species that are regularly found in the dunes on the Point.

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The Wasp Spider, *Argiope bruennichi* in Norfolk with an account of its occurrence at Salthouse

Pip Collyer & John Furse

Distribution *(Pip Collyer)*

The adult female wasp spider is between 11 and 15 mm in size and has an unmistakable appearance, the abdomen having horizontal stripes of yellow, black and white (Fig. 1). The male is much smaller at about half the size of the female and is not so strikingly marked. The spider spins a large orb web which is characterized by the presence of a stabilimentum, a zig-zag band of silk, the function of which is the subject of debate. The web is constructed low down in the vegetation and the spider favours coastal chalk grassland, open rough grassland and wasteland.

Figure 1. Wasp Spider *Argiope bruennichi*, Thornham. Photo: *Andy Bloomfield.*

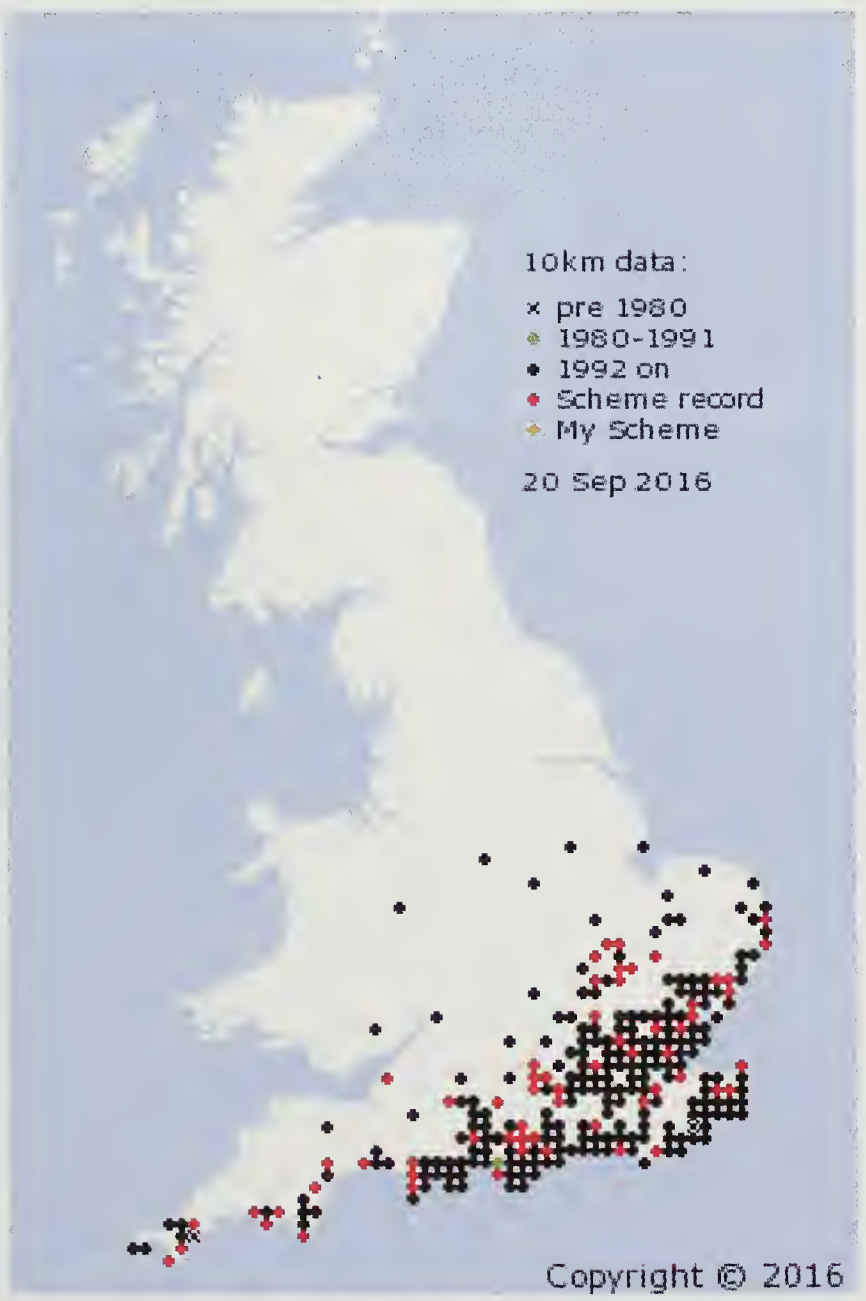

Fig. 2 Distribution of *Argiope bruennichi* September 2016. Reproduced by permission of the Spider and Harvestman Recording Scheme)

The first County record for *Argiope bruennichi* was at Saxlingham in North Norfolk in August 2006. Since then it has been recorded most years, many of the sightings being within a few miles of the coast. In the last two years in particular there have been regular reports of the spider and at some sites, where the habitat is suitable, there would appear to be established communities. At Bradwell Recreation Park near Great Yarmouth and Gramborough Hill near Salthouse, the spider was recorded in both 2015 and 2016. At both sites it was found in long grass.

The spider was first recorded in Britain near Rye, East Sussex in 1922 (Locket &

See p. 74

Above: Male **Purse Web Spider** *Atypus affinis*, Dersingham Bog NNR.

Photo: *Jules Painter.*

Left: **Yellow-striped Bear Spider** *Arctosa fulvolineata* known from three areas of saltmarsh in North Norfolk.

Photo: *Andy Bloomfield* .

Below: The distinctive purse web of *Atypus affinis* with silk tube above the surface covered with particles of soil and vegetation.

Photo: *Andy Bloomfield.*

Millidge 1951) and for the next 50 years or so was reported to be locally frequent in a few areas close to the south coast in the counties of Kent, Sussex, Hampshire and Dorset. However, in the 1970s it began to extend its range further inland and northwards up the eastern half of the country. The first record from Essex was in 1997 and the spider is now well established there and also in Suffolk, mainly in suitable areas close to the coast.

The main prey item is grasshoppers. The spiders reach maturity in the late summer and whilst the females probably live on until around October; the males die much earlier. The female constructs an urn-shaped egg cocoon which overwinters, with the spiderlings hatching out the following spring. As they favour long grass or tallish vegetation, any regular cutting will destroy the webs and any overwintering egg cocoons. This is perhaps why most records are from unmanaged grassland or waste areas.

There are now two records of the spider from Lincolnshire, the most recent being from Gibraltar Point NNR in 2015 (Fig. 2; p.71). As many spiders disperse by 'ballooning' it is interesting to speculate whether it originated from the Norfolk population directly across the Wash.

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Wasp Spider at Salthouse *(John Furse)*

On 24 July 2016, I birded my regular 'patch', Gramborough Hill near Salthouse. Entering a gap in the main brambles (where I've previously found Blyth's Reed Warbler, Great Spotted Cuckoo, Woodchat Shrike - amongst others), I spotted out of the corner of my eye something that immediately 'said' Wasp Spider *Argiope bruennichi*. A few seconds later, with ultra-cautious repositioning, I confirmed my find (with no little incredulity), as a female ensconced proudly in her web. After a short while, I observed two much smaller and younger females and a male. He disappeared a few days before the large female. I last saw her on 10 August: she'd been present for only 2½ weeks. During her residence she moved her web twice - about 0.5 metres each time. Last year (2015) one was seen at the top of the Hill, but not subsequently after a torrential downpour.

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Two rare Norfolk spiders

Andrew Bloomfield

Introduction

The following short article describes two very different species of spider that were found in Norfolk during 2015. One had been recorded in the county on a single previous occasion while the other is exceptionally rare in the UK but has ancient links with the county and has recently been found at additional Norfolk localities. Both species are not only distinctive in appearance but have also evolved with unique ecological traits. It is hoped that describing them here will serve as a means of inspiring more naturalists to look at spiders in Norfolk, a branch of wildlife in the county that is quite neglected.

Purse Web Spider *Atypus affinis*

Sometimes referred to as the Purse Web Spider, *Atypus affinis* is unique in the UK due to its ecology and its looks. It possesses a huge pair of horizontal chelicerae (used for gripping prey) from which its fangs extend downwards. In most other spiders the chelicerae are vertical with the fangs pointing inwards. A mature female might measure only 18 mm of which 8 mm is the extension of its chelicerae, giving the spider a very front-heavy appearance. This feature, combined with two of its eight eyes being central and larger than the other six, could also perhaps be described as making it look rather 'comical'.

Purse Web Spiders belong to the same sub-order as the infamous trap door, funnel web and tarantula spiders of more tropical climes; the Mygalomorphae or primitive spiders (Roberts 1995). Purse Web Spiders are found mainly across southern England although they have been reported as far north as south west Scotland with their preferred habitat being unimproved grassland, chalk downs and heathland. They have also been seen on slumped cliffs near rocky outcrops along the coast.

Loose soil or sand is integral to the spider's lifestyle for it is here the female makes a burrow in which she will live most of her life, which can be as long as eight years. From here the spider constructs a silken web tube (its 'purse') that could be described as looking like a small dirty sock (photo p. 72) that extends above the surface and lies draped over the ground (to about six inches). This forms not only a home for the spider but also as a means of finding its prey. Vibrations from a victim wandering over the web sends the female spider up from its burrow and tube web to tear through the silk on the surface and into its prey. Subsequent repairs are then made to its web. All manner of insects are taken as prey. Males live a more solitary wandering and mostly nocturnal existence but converge on colonies during the autumn in search of a mate. Most daytime sightings undoubtedly relate to males on their autumnal treks.

In East Anglia, the Purse Web Spider has a very patchy distribution with only a few localities in Suffolk, Cambridgeshire and Bedfordshire. In Norfolk there had only been a previous single record, from Winterton Dunes on 8 September 1988. With that in mind it came as a great surprise when a non-naturalist friend (Miss Jules Painter) sent me a picture of a male taken on an iPhone at Dersingham Bog NNR in November 2015 (see p. 72). The spider wandered across the main path in front of her during the daytime and such was its distinctive look she wondered what it was. A subsequent search on 14 April 2016 by Norfolk Spider Recorder Pip Collyer and

the author soon revealed a small colony. Up to eight of its distinctive silken web tubes were found in a small area alongside the main footpath. Whilst no live spiders were found, the shed skin of one was further confirmation of its recent presence. The area had been cut into shape a few years previously by Natural England in the aim of attracting solitary bees and in doing so had seemingly created the ideal habitat for Purse Web Spiders.

Sandy soil means good burrowing opportunities whilst an abundance of overhanging heather creates a haven for plenty of insect prey. The fact that a colony had been discovered also meant that subsequent management work could take in the spider's needs and ultimately their protection and survival in their precarious Norfolk existence. Who knows, there could well be more of these charismatic spiders at large in the county. Places such as Kelling Heath, Roydon Common and parts of Breckland must surely harbour colonies too?

Yellow-striped Bear Spider *Arctosa fulvolineata*

Unlike the last species, *Arctosa fulvolineata* is a definite UK rarity. It inhabits the saltmarshes around the eastern and southern coasts of England but seems to be in a state of decline having been recorded in only eleven 10 km squares since 1992, making it a UK Biodiversity Action Plan Priority Species (Spider and Harvestman Recording Scheme Website). In Norfolk it was known only from Scolt Head Island, where it was first recorded in 1800 then again in 1959 before a cluster of modern records on 12 June 2007 when nine males and two females were seen.

This species belongs to the family of spiders known as Lycosidae or 'wolf spiders'. It is a large family, characterised by their habit of actively hunting rather than relying on webs. On warm days many varied habitats in the UK host plentiful numbers of several species rushing about in the open in search of prey. They are also recognizable as eggs are carried by the female at the rear of the abdomen in a 'sac' attached to its 'spinners'. Upon hatching the youngsters then cling to their mother's abdomen. *Arctosa fulvolineata* is a relatively large species, the female measuring up to 12 mm and with its golden-yellow stripe in the centre of its head and carapace that extends down its abdomen it is readily identifiable in the field and has been christened with an English name, the Yellow-striped Bear Spider (photo p. 72).

Unlike many of its near relatives, the Yellow-striped Bear Spider lives in a very harsh and changeable habitat. Even within the vast swathes of coastal saltmarshes it seems to have found its own micro habitat, preferring the upper reaches where saltpans form. These often dry out over neap tides to produce a cracked mosaic of mud and the ideal hideout for spiders. Stones and tightly matted tidal debris also make perfect hiding places for the spider. The area is frequently covered with sea water and during spring tides for a considerably longer period of time. An experiment carried out in France (Pétillon *et al.* 2009) found that the species has a unique adaptation that sets it apart from its close relatives and indeed enables it to survive in tidal marshes. It was found that when it was kept under water it could survive up to 40 hours by slipping into suspended animation, a temporary coma, switching its metabolism from aerobic to anaerobic. Whilst 40 hours was exceptional, 16 hours seemed a more standard time for survival and one that would take it through even a drawn out spring tide.

My quest for *Arctosa fulvolineata* began in 2015. Having been recorded at Scolt Head, my thought was that it must surely be elsewhere along the north Norfolk coast, home to one of the UK's finest stretches of saltmarsh. Working at Holkham as warden, I felt it had to be present on the NNR's salt marshes, particularly as the western section

of the reserve joins onto Scolt Head's marshes. I searched in vain at Burnham Norton and Overy and soon came to the conclusion I might really be looking for the proverbial needle in the haystack. Perhaps it really was very rare and very restricted. A visit to Wells and Warham saltmarshes on 29 June however brought some good fortune; when following a high 'marsh tide' a male wandered across a footpath in front of me. It was a new site and being part of Holkham NNR one that remains totally protected apart from the risk of tidal surges such as that in 2013. It was very close to a series of saltpans, the preferred habitat. Further searching produced no more encounters despite searching a sizeable area of saltpans. I judged my find to be one of great luck! In 2016 I again searched similar habitat elsewhere and almost instantly stumbled on a seemingly good population at Burnham Overy saltmarshes. I managed to find a total of six individuals over 28-29 May; four females and two males. All were underneath stones adjacent to saltpans, with the exception of one female which was under a stone in the detritus beneath a line of *Suaeda* bushes at the foot of the sea wall. Three females had egg sacs, yet unlike many of their relatives, they seemed to prefer to remain hidden in a hole in the mud rather than rush about out in the open with them. This could be why the species remains poorly recorded. Alternatively, it could be that the lack of active naturalists searching for spiders makes them appear rarer than they really are, or it could be that the species is indeed genuinely rare and only present in very small numbers. Whatever the scenario, there are questions to be answered. The species is now known from three distinct parts of the north Norfolk coast, all protected by the highest conservation designations. All sites have been around or close to saltpans, a relatively scarce feature of the coast's salt marshes, yet plentiful enough to suggest there are more populations awaiting discovery.

Acknowledgements

Thanks to Pip Collyer for much help and encouragement.

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The status of the saproxylic beetles (Coleoptera) of Swanton Novers Wood NNR, Norfolk, with some comments on woodland management.

Bryan Sage

Changes in status

The concept of the Saproxylic Quality Index (SQI) and the method by which the indices are calculated are explained in detail in Sage (2006). The published list of SQI species has not changed since 1999 (see Fowles, Alexander & Key 1999) and the present paper is based on this list. However, some changes have been suggested but have not yet been implemented. Two of the suggested changes are relevant here: *Ernoporicus caucasicus* from RDB1 to Nationally Scarce A (Alexander 2002), and *Diaperis boleti* from RDB2 to Nationally Scarce (Alexander 2014).

The status of this group of beetles at this site was updated by Sage (2011), but it should be noted that the staphylinid *Pseudomedon obscurella* which was mentioned on page 10 is not in fact a saproxylic species. Also, *Oedemera virescens* which was listed in Appendix 3 of Sage (2010) with a high score of 24, is no longer accepted as a saproxylic species. Since the publication of Sage (2011) a further 10 species have been added to the list and are listed below in alphabetical order with details of their ecology as given by Alexander (2002). The ecology of 93 species is given in Appendix 3 in Sage (2010), and for a further five species in Sage (2011).

Agrilus angustulus Larvae feed under the bark of younger stems and branches of oak, hazel and other broadleaved trees and shrubs. Mainly in coppice woodlands.

Epuraea rufomarginata Amongst borings of the beetle *Trypodendron domesticum* in a cut bough; also under dead spruce bark and in oak faggots; and in *Daldinia* fungus on ash.

Nudobius lentus Develops under bark of coniferous logs and occasionally in nearby deadwood of broadleaves. Originally characteristic of the Scottish pine forest it has spread to southern England where it is associated with hardwoods as well as soft.

Phloeonomus punctipennis A fungal feeder. Adults and larvae under bark of various broadleaved trees.

Pogonocherus hispidus Develops in thin dead branches of a variety of broadleaved trees.

Pyrochroa serraticornis Larvae develop under bark on various dead broadleaved trees.

Rhizophagus ferrugineus Under bark on deadwood and in heart-rot.

Sepedophilus testaceus Largely rotten and fungoid hardwood. Associated primarily with ancient broadleaved woodland.

Silvanus unidentatus Under sappy bark of deadwood of oak and beech, but also a wide range of other broadleaved trees.

Thanasimus formicarius Larvae and adults feed on bark beetles, and also other beetles, in hard dead timber; especially Ash and elm, but also pine and oak.

These additions bring the total number of species recorded to 106 with an SQI of 396.2 and these are listed in Appendix 1, which also shows the SQI score for each species and the year in which it was last recorded. Of these 106 species, 69 (65%) have not been recorded since 2008, despite regular monitoring.

Reference to Appendix 1 shows that only two species have a high score of 24, namely *Diaperis boleti* and *Rhizophagus fenestralis.* There are just three species with a score of 16 – *Cryptophagus micaceus, Ernoporicus caucasicus* and *Poecilum alni.* These five species are discussed in more detail below. It is clear that the majority of the saproxylic beetles found at Swanton Novers Woods are low-scoring species which has the effect of reducing the SQI. The Index of Ecological Continuity (IEC) and the Revised Index of Ecological Continuity (RIEC) discussed in Sage (2010) remain unchanged by any amendments made in the present paper.

There is now a European Red List of saproxylic beetles (Alexander 2011) and 18 of the species recorded at Swanton Novers are on this list, indicated by an asterisk in Appendix 1. They fall into three different categories on the European List: 15 are classified as LC (Least Concern); two species (*Dacne rufifrons* and *Pediacus dermestoides*) are DD (Data Deficient) and *Ampedus elongantulus* is classified as NT (Near Threatened). There is only one record for this species at Swanton Novers and that is one beaten from an old oak tree in ride 68 (see Figure 1 in Sage 2006 for compartment and ride numbers) on 15 June 2008. This was the first record for Norfolk (Sage 2008a) and remains the only record at the time of writing.

There is subfossil evidence of assemblages of saproxylic beetles dating back to the Bronze Age (3000-4000 years BP). This indicates that a significant number of species have either become extinct or undergone major declines in Britain. For example, Girling (1982) lists 20 species of saproxylic beetles represented in these subfossil assemblages which are now extinct in Britain. Osborne (1964), Hammond (1984) and Speight (1989) summarise the decline in the British saproxylic beetle fauna. Out of a total of 45 species of saproxylic beetles found in Bronze Age peat deposits 12 no longer occur in Britain, and most of the remainder are now extremely rare (Buckland 1979). It seems therefore, that the major declines of saproxylic invertebrates occurred during the early woodland clearances. As mentioned in Sage (2010) the present-day fauna includes relic elements of a fauna that was associated with the unmanaged forest cover in the first half of the Holocene (11500-8900 years ago). As long ago as 1988 the Council of Europe Committee of Ministers were so concerned by the continuing loss of habitat for saproxylic invertebrates that they drew up a ten-point plan for habitat conservation.

Discussion of changes

As mentioned above, the removal of *Oedemera virescens* from the list leaves just two species which also have a score of 24, both of which are Red Data Book species. These are *Rhizophagus fenestralis* (formerly *R. parvulus*) an RDB3 species, and *Diaperis boleti* an RDB2 species. The former occurs under the bark of dead broadleaved trees, whilst the latter develops inside large brackets of the fungus *Piptoporus betulinus* on birch. The only record of *R.fenestralis* is of one found in a banana-baited trap on an oak tree in compartment 4 on 10 May 2006. Similarly, the only record of *D.boleti* is of two found in a bracket fungus on 12 October 2004 in compartment 7. This leaves three species each of which has a score of 16; *Poecilium alni* Notable B, *Cryptophagus micaceus* pRDBK and *Ernoporicus caucasicus* RDB1 and a Biodiversity Action Plan (BAP) species. Natural England have a particular statutory responsibility to maintain a healthy population of this species in the wood for the long term. There are only single records for the first two species; *P.alni*, one seen in ride 57 by Robert Baker on 20 May 2005, and *C.micaceus* beaten from oak in Great Wood on 14 August 2002 (determined by Dr.Colin Johnson). The longhorn beetle *P.alni* occurs in recently dead or decaying twigs and slender branches of various broadleaved trees. *C.micaceus* is found in tree nests of the Hornet and social wasps, also rotting

timber, fungi, sap and nest debris. This leaves *E. caucasicus* which is dealt with in detail below.

One of the low-scoring species is *Eledona agricola* the larvae of which have only ever been found in the brackets of the heartwood-decay fungus Chicken-of-the-Woods or Sulphur Polypore *Laetiporus sulphureus*. Whilst the larvae appear to be very host-specific, the adult beetles may on occasion visit other fungi. Trees bearing this bracket fungus are generally old for the species as the tree needs to have developed a substantial girth before it can be colonised by the fungus (Alexander 2012). Although not warranting special species conservation status, *Eledona agricola* is a significant species ecologically and tends to be associated with the richer sites for saproxylic inveretebrates generally. It remains a useful indicator species, especially as part of an assemblage of such species (Alexander 2004). There are four records of this species, the earliest being in May 1981, and the most recent two in July 2005.

The large black longhorn beetle *Prionus coriarius*, a Notable A species with an SQI score of 16, appears to be extending its range in Norfolk. The larvae feed at the roots of dead or moribund mainly broadleaved trees for 3-4 years. In July 2010 three pheromone traps, kindly provided by Dr Martin Rezjek, were deployed by large old oak trees in rides 44, 58 and 60. Unfortunately no trace of the presence of this species was forthcoming.

Saproxylic beetles have been at the forefront of invertebrate conservation in Britain for some years now, with 'deadwood' being widely recognised as a key conservation issue. This group of beetles are good indicators of the quality of a woodland, the status of a site being assessed by the use of the three indices mentioned earlier, all being derived from the individual species scores. The way in which a woodland site is managed has a direct bearing on the status of saproxylic and other insects. Seven scores are used for calculating the SQI: 1, 2, 4, 8, 16, 24 and 32 (see Fowles *et al.* 1999) - the higher the score the rarer the species. An analysis of the data in Appendix 1 shows quite clearly that 83 (78%) of the species recorded fall within the three lowest scoring groups From this it is reasonable to conclude that, as a habitat for saproxylic beetles, Swanton Novers Great Wood is of rather poor quality and is not attractive to the rarer species. One possible explanation is that the problem is at least partly due to inappropriate management (for saproxylics), particularly of compartments 14, 15, 17, 19 and 20 in the south of the wood where the coppice is primarily Small-leaved Lime *Tilia cordata* and Hazel *Corylus avellana*. Another relevant factor is the shortage of very large and old trees in the wood. The largest and oldest trees are invariably those that support the most diverse fauna of saproxylic species, particularly of the more specialised, usually rare, species (Warren & Kirby 1991). The oldest standard oak tree aged by John White in the Great Wood in 2007 was 216 years of age (Sage 2008b). On the southern boundary there are two old oak pollards dating from about 1595 and 1674 respectively. Top-heavy old pollards which may not have been cut for 100 years or more can be given a new lease of life by re-pollarding, but veteran trees may be killed outright by this treatment (Kirby & Drake 1993). According to Tyler (2008) natural pollarding by the oak takes place at about 400 years of age with gradual replacement of the more heavy branches with shorter branches in accordance with ageing needs. Another factor which may be having an effect is climate change

The Great Wood is an ancient woodland site which needs to be managed in a sensitive manner, and various options are available. One could be to try and create a habitat as near as possible to that of a true ancient woodland (the 'wildwood'), a difficult and long-term objective, but

possibly achievable. A few far-sighted and imaginative woodland managers have risen to the challenge and one example is Lady Park Wood in the Wye Valley. This is one of our oldest and wildest woodland nature reserves which has been allowed to grow without management for well over half a century. Parts have developed the large trees, accumulations of deadwood and patchy structure that we assume are characteristics of natural woodland (Peterken & Mountford 1995). Some 39 years ago Flower (1977) pointed out that some coppices had been neglected since the 16th century and, especially in parts of the New Forest, had developed into areas of fine, uneven-aged high forest. In reality there is nobody who knows exactly what the original wildwood was like. However, pollen studies have shown the wildwood to have been a dense, complicated mosaic of forest trees dominated by Small-leaved Lime, Pedunculate Oak *Quercus robur* and Hazel, with Wych Elm *Ulmus glabra* on base-rich soils and Alder *Alnus glutinosa* in permanently wet places. There were many other, perhaps fifty or more, species of less common trees and shrubs. The age structure of the trees in the primeval forest was far more dominated by old and very old trees than in forests now managed by people. Clearly the wildwood had characteristics that would be almost unrecognisable in today's managed woodlands. It should be noted that much of the northern part of the Great Wood (for example compartments 6,7,11,12 and 13) are shown in the Management Plan as 'minimum intervention' areas, to be left to develop as high forest. These compartments, however, are quite different in character to those in the southern section (see Sage 2006). As pointed out by Sage (2010) the change from low-key to a more intrusive management regime commenced during the winter of 2008/2009.

Management: coppice with standards

Natural England have opted to continue with what is usually called the 'traditional' method of managing the southern end of the wood. This approach has involved frequent intervention, considerable use of heavy machinery, and 'blanket' coppicing and re-pollarding.

It is instructive to look at the origins of coppicing and pollarding, the history of which, since the 12th century, has been well recorded. Evidence of coppicing can be found throughout the Bronze Age, Roman and Saxon periods, and by 1250 was almost universal (Evans 1992). The point is that neither coppicing or pollarding originally had anything whatsoever to do with nature conservation; their purpose was to exploit the resources of the forest. It is of interest to note that in the tithe files (surveys of parish agriculture and land use drawn up in the late 1830s) the coppice from Swanton Novers is described as "inferior" or "very inferior" (Barnes & Williamson 2015). In Hambler (1990) it was pointed out that the simple traditional practices of Europeans abused habitats for millennia and were certainly not designed to protect biodiversity. Coppicing is not analogous with natural woodland cycles because the cycles are short (7-30 years instead of 300-1000). It is, however, an easy and safe method of management, but it is also a destructive method and can hardly be deemed 'natural' (Goldsmith 1992). The appeal of coppicing is very largely aesthetic; it enhances the attractiveness of the spring flora, albeit for only the first two or three years. These massed displays of common woodland wildflowers are a fine sight and is one of the main reasons why this method of management is so common in nature reserves open to the public, as for example Foxley Wood which attracts hundreds of visitors each year. Swanton Novers, however, is a private woodland with restricted access by permit only. These floristic displays are not indicators of either species or habitat diversity. Many common species of plants and insects invade coppice

plots but do not in themselves give grounds for undertaking this type of management since they are common elsewhere (Waring & Haggett 1991).

The situation regarding woodland management was aptly summed up by Warren & Key (1991): "It is necessary to divert the planning of conservation management more towards these vulnerable invertebrates and away from well-intentioned, but potentially damaging, management operations in woodland."

In this context it should be noted that the Management Plan specifies that in the coppiced compartments the optimum density for standard trees should be 20-25 per hectare. This is a completely artificial criterion which is related more to commercial forestry and has little advantage from a nature conservation point of view. In pursuance of this arbitrary objective a good many healthy maiden oaks have been felled, including the largest in compartment 19 during the winter of 2008/2009. In the winter of 2011/2012, seven large standard oaks were felled in compartment 17 and left lying. One of these trees was approximately 200 years old. It is regrettable that this should happen in a wood where large old oaks are at a premium. Whilst there is a lot that we do not know about the original wildwood, there is one thing of which we can be certain; the standard trees did not grow evenly spaced apart at densities predetermined by humans. Insofar as density is concerned, it is of interest to note that Beevor (1924) quotes examples varying from 5-40 trees per acre in Norfolk woodlands. A wood at Barningham had 40 trees per acre (i.e. 92 per hectare), a figure said to resemble closely the common average for Norfolk oakwoods before the 1914-1918 war.

As regards the felling of standard oak trees, the situation would be less damaging if the results of recent research in deciduous forests in southern France had been taken into account (Bouget, Nusillard , Pineau & Ricou 2011). This research looked at the conservation value of leaving high stumps (snags and monoliths) in woodlands. Several key points emerged, including that snags produced more individuals than lying logs, snags produced more species than logs and snags had more rare beetle species than lying logs (50% more rare species cumulatively). Large snags scored the highest in abundance and richness of rare species. The authors concluded that snags are crucial to maintaining saproxylic beetle assemblages.

Another aspect of the coppicing in the Great Wood is that non-coppice species, such as birch and Rowan *Sorbus aucuparia*, are also frequently removed, as pointed out by Sage (2010). The scale of birch removal is considerable, which is unfortunate since birch is a species much favoured by a wide range of invertebrates. Mature birch, for example, was found to support twice as many leaf miners (24 species) as young birch (Godfray 1985). Also, over 40 species of beetle are known to be associated with birch including *Diaperis boleti*, discussed earlier. There is also a problem with the management of Aspen *Populus tremula* which began in 2007 (see Sage 2008). Most of the Aspen in this part of the wood occurs in or near compartment 17, but little is allowed to reach maturity. Again, this is regrettable since it is now known that this species is almost as good as oak and birch in terms of attracting invertebrates. These include over a dozen species of beetle, and moths such as the Light-orange Underwing Moth *Archiaeris notha* whose larvae feed initially on the catkins (Waring 1989). This species has not been found at Swanton Novers. Aspen is host to many specialist species of plants and invertebrates, despite the fact that the tree itself is no longer very common and does not occur in extensive stands. The dependency of numerous specialist species on Aspen indicates a very long ecological association, and the species seems to be

strongly linked to ancient woodland sites in both Scotland and England, where it is usually seen as a rather rare component of ancient woodlands (Rackham 1986, 1990). Peter Quelch of the Forestry Commission suggested that Aspen is actually an ancient woodland indicator species (Quelch, in Cosgrove & Amphlett 2002).

The undesirability of removing non-coppice species from coppiced plots was recognised by Warren & Haggett (1991) who state "When felling trees, the natural species composition should be maintained, retaining such species as ash, lime, aspen and others as well as oak."

Some negative aspects of coppicing

The subject of coppicing, its advantages and disadvantages, are discussed at length by Peterken (1996). In the right circumstances there are various beneficial aspects to coppicing, see for example Fuller & Warren (1990). The desirability of coppicing in woodlands has often been questioned. For example, Rose (1976) pointed out that it involves a rotation which is often too rapid and drastic for woodland species, including many shade- or moisture-loving organisms such as lichens, bryophytes or ferns. A number of ecologists have pointed out that, generally, neglected coppice is improving gradually as a habitat, and many coppices neglected for decades are very rich in wildlife and rarities (Duffey 1973, Harding & Rose 1986, Sterling & Hambler, 1988, Sterling 1988). Insofar as Hazel-dependent species are concerned, Welch (1969) pointed out that some would not be catered for in a 10 year coppice cycle and that mature Hazel of perhaps 30-40 years would need to be present to maintain populations of such beetles as *Synchita humeralis*, *Hypulus quercinus* and *Lissodema quadripustulatum*, none of which have ever been found at Swanton Novers. Coppicing effectively turns woodland into glorified scrub, and is often thought to increase diversity since rotational cutting of patches of the coppice woodland gives an impression of variety. To saproxylic organisms, species requiring large or complex structures, or abundant foliage, coppicing does not increase diversity (Hambler & Speight 1995). Coppicing has been found to be damaging to woodland spiders and moths (Sterling & Hambler 1988, Waring 1988). Another disadvantage of coppicing is that it results in a highly artificial structure. In Sage (2010) attention was drawn to the decline in the returns from pitfall trapping for beetles in recent lime coppiced areas.

A case history: *Ernoporicus caucasicus*

The national authority on the specialised ernoporine beetles is Dr A.B. Drane whose detailed research has shown that this species requires ongoing supplies of moribund timber, either in the canopy of mature trees or moribund coppice poles that are producing die-back. The micro-habitat requirements are quite precise for this species and the closely related *Ernoporus tiliae*. They require timber 1 cm to approximately 10 cm in diameter, which is showing signs of moribund decline. The beetles never bore into healthy timber. As they live in the lenticular bast/cambium rather than in the wood, they can only utilise thin bark with a layer of cambium beneath. Thinner branches do not have sufficient development of cambium; thicker branches and boles are too hard. A further requirement is that the timber should not be completely desiccated. These requirements mean that usable habitat is finished in one to four years. Woodland which contains poles of a range of ages, where dead and dying poles are not cleared away and where brashings are left on site, will provide an ideal habitat for the maintenance of a population of both species (Drane 2001-2). Another point of interest is that in some cases populations have been found to be restricted to just one or two trees where the species occurs. These two bark beetles are associated with limes and both species may occur at the same site. In Britain *E. tiliae* seems to

be confined to Small-leaved Lime, whereas *E. caucasicus* can be found not only on this species but also on Large-leaved Lime *Tilia platyphyllos* and hybrid lime *Tilia x vulgaris*. Furthermore, *E. caucasicus* appears to be more shade tolerant whilst *E. tiliae* is more thermophilic. Both species are rare in Norfolk with *E. tiliae* being known only from Hockering Wood (TG0714), whilst *E. caucasicus* has been found in Hockering Wood and also in Swanton Novers Great Wood. It is entirely possible that the former species is not present at Swanton Novers, but on the other hand it could be present but has yet to be found.

We can now look at the history of *E. caucasicus* at Swanton Novers. On 4 May 1997 Dr Drane visited the Great Wood, with the writer and Martin Collier, and found the species in the twigs of a standard lime tree close to the NW corner of compartment 17. On 2 May 2009 the writer found it in dying twigs on a pollarded Small-leaved Lime in ride 71. On 20 May 2009 Dr Drane and the writer located it on other lime pollards in rides 70 and 71, and also on moribund small branches that had fallen from the canopy of some tall lime trees in ride 43. On 1 September 2010 and again on 7 May 2011 the writer found it on moribund twigs of lime coppice in compartment 17 close to the NW corner where it was first found in 1997. Searches in 2012 and 2015 failed to locate the species, but it can be a difficult beetle to find.

The effects of management

In the light of the detailed information given above we can now look at the impact of recent management practices on *E. caucasicus*, but first it is instructive to look at the comments made by visiting experts. Following his visit in May 2009 Dr Drane said in his report: "There are superb examples of limes associated with bank and ditch and as such should be preserved, pollarding (or re-pollarding) should be a last resort for those showing decline" (Sage 2010). The southern boundary had earlier been surveyed by a professional forester who found no lime trees in danger of falling over or showing signs of cracking at the bolling. Dr Oliver Rackham visited the wood in November 2009 and subsequently wrote that all the trees along the southern boundary should be treated as veteran trees, and no further felling should take place (Sage 2010). Nevertheless, during the winters of 2008/2009 and 2009/2010 a total of 25 Small-leaved Limes were re-pollarded, and 10 standard trees were pollarded for the first time (Sage 2010 and photograph); in all cases the resultant brash was burnt on site. The trees that were cut down included those where *E. caucasicus* had been found in May 2009. It is, of course, impossible to say how many 'colonies' of this beetle were eliminated as a result of these operations. The important fact is that all these pollards developed uniformly young growth which the ernoporine beetles are unable to colonise. This situation could have been avoided if a long-term re-pollarding cycle of 20-25 years had been instituted, cutting say four trees each time with about 4-5 years between each cut. This would have produced the diversity of growth that is required by these beetles to whom continuity of habitat is crucial.

Having discussed some of the negative aspects of coppicing, the physical procedures must now be examined. The most recent compartment to be coppiced is 17 so this can be taken as an example. Prior to coppicing most of the marginal scrub was removed (see Sage 2011), thus opening up the area. From a nature conservation point of view nothing was gained by removing this scrub. In the process of coppicing every single stool was cut including those where *E. caucasicus* was found in 2010 and 2011, and all the brash burnt. Concurrently a number of non-coppice tree species were removed and seven large standard oaks felled, as mentioned above. Similar procedures had been followed in previous winters when other compartments were coppiced. Part

of the problem is that these compartments have been coppiced in successive winters over a quite short time span, so that all have young or relatively young growth which offers no opportunity for colonisation by ernoporine beetles. This situation could have been avoided if sections of coppice in each compartment had been left uncut so that over mature is mixed amongst new coppice and mature trees.

The Small-leaved Lime

Swanton Novers Great Wood is highly rated for its lime trees even though Hockering Wood is much larger. However, what is lacking are large free-standing lime trees that have not been pollarded. There are a number of very tall trees along ride 43 in the high forest area, but these are quite close together and the canopy is high above the ground (see Sage 2008). There are also a few standard trees scattered along the southern boundary. Unfortunately, as mentioned earlier, a total of ten standard trees were cut in the course of the re-pollarding operations in the winters of 2008/2009 and 2009/2010. What is needed are standard trees scattered through the coppiced areas, this could easily be done by singling selected coppice stools or by planting young trees. Small-leaved Lime was a dominant species in the primeval woodlands of the English lowlands for over 2000 years (Birks 1989).

Summary

A total of 106 species of saproxylic beetles have been recorded at Swanton Novers of which 83 (78%) fall within the three lowest-scoring groups used for calculating the Saproxylic Quality Index (SQI). Sixty nine species (65%) have not been recorded since 2008 or earlier. This is a high proportion and suggests that the attractiveness of the habitat to saproxylic species has declined. The ecology of some species is discussed with particular reference to *Ernoporicus caucasicus* which is a Red Data Book (RDB1) and a Biodiversity Action Plan (BAP) species for which Natural England have a statutory responsibility. Eighteen of the species recorded at Swanton Novers are on the European Red List of saproxylic beetles. The status of the saproxylic beetles is discussed in relation to the current management regime, particularly the policy of blanket re-pollarding and coppicing. It is concluded that this regime is not saproxylic friendly, has had a particularly adverse impact on *E. caucasicus*, and that both habitat and species diversity have declined. The amount of habitat suitable for *E. caucasicus* has decreased markedly which makes its dispersal difficult. The current management regime has not created conditions that would encourage colonisation by more saproxylic species. Some suggestions to improve the situation are put forward. Attention is drawn to the fact that there is a lack of large standard Small-leaved Lime trees in the coppiced compartments. In addition to management, the lack of large old standard trees is an adverse factor, and climate change may also be having an effect.

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APPENDIX 1: Checklist of Saproxylic Beetles Swanton Novers Woods, Norfolk (as of December 2015).

Species	SQI score	Last record
ANOBIIDAE		
Grynobius planus (Fab.)	2	2000
Ptilinus pectinicornis (L.)	1	1998
BUPESTRIDAE		
Agrilus angustulus (Ill.)	8	2012
Agrilus laticornis (Ill.)	8	2001
Agrilus pannonicus (Pill. & Mitter.)	8	2004
CANTHARIDAE		
Malthinus flaveolus (Herbst)	1	1988
Malthodes marginatus (Latreille)	!	2008
Malthodes minimus (L.)	1	2008
CERAMBYCIDAE		
Alosterna tabacicolor (DeGeer)	2	2015
Clytus arietis (L.)*	1	2010
Grammoptera ruficornis (Fab.)	1	2011
Leiopus nebulosus (L.)	2	2010
Stenurella melanura (L.)	2	2007
Phymatodes testaceus (L.)*	4	2004
Poecilium alni (L.)*	16	2005
Pogonocherus hispidus (L.)	2	2010
Pogonocherus hispidulus (Pill. & Mitt.)	2	2010
Rhagium bifasciatum Fab.	1	2010
Rhagium mordax (DeGeer)	1	2010
Rutpela maculata (Poda)	1	2011
Stenocorus meridianus (L.)	2	2006
Tetrops praeusta (L.)	2	2005
CERYLONIDAE		
Cerylon ferrugineum Stephens	2	2004
Cerylon histeroides (Fab.)	4	2005
CIIDAE		
Cis boleti (Scopoli)	1	2011
Cis pygmaeus (Marsham)	2	2008
Ennearthron cornutum (Gyll.)	2	2008
CLERIDAE		
Thanasimus formicarius (L.)	4	2011
Tilus elongatus (Oliv.)	8	2010
COLYDIIDAE		
Bitoma crenata (Fab.)	4	2011
CRYPTOPHAGIDAE		
Cryptophagus unicaceus Rey	16	2002
Henoticus serratus (Gyll.)	2	1999
CUCUJIDAE		
Pediacus dermestoides (Fab.)*	4	2011
CURCULIONIDAE		
Ernoporicus caucasicus (Lindemann)	16	2011
Hylesinus crenatus (Fab.)	2	2003
Hylesinus varius (Fab.)	1	1997
Magdalis carbonaria (L.)	4	1998
Magdalis cerasi (L.)	4	2007
Scolytus intricatus (Ratzeburg)	2	2010
DASYTIDAE		
Dasytes aeratus Stephens	2	2010

Species	SQI score	Last record
ELATERIDAE		
Ampedus elongantulus (Fab.)*	8	2008
Ampedus quercicola (du Bysson)*	8	2004
Denticollis linearis (L.)*	1	2010
Melanotus villosus (Geoff.)*	1	2011
Stenagostus rhombeus (Oliv.)*	4	2005
ENDOMYCHIDAE		
Endomychus coccineus (L.)	2	2008
EROTYLIDAE		
Dacne bipustulata (Thunberg)*	2	2011
Dacne rufifrons (Fab.)*	2	2006
Triplax russica (L.)*	4	1993
EUCNEMIDAE		
Melasis bupestroides (L.)*	4	1998
LATRIDIIDAE		
Enicmus rugosus (Herbst)	8	2005
LEIODIIDAE		
Agathidium nigrinum Sturm	2	2006
Anistoma humeralis (Fab.)	2	1988
LUCANIDAE		
Dorcus parallelipipedus (L.)*	2	1995
Sinodendron cylindricum (L.)*	2	2004
LYCIDAE		
Platycis minuta (Fab.)	8	2001
MELANDRYIDAE		
Conopalpus testaceus (Oliv.)	8	1997
Melandrya caraboides (L.)	4	2000
Orchesia undulata Kroatz	4	2009
MELYRIDAE		
Malachius bipustulatus (L.)	1	2010
MONOTOMIDAE		
Rhizophagus bipustulatus (Fab.)	1	2011
Rhizophagus dispar (Payk.)	1	2011
Rhizophagus fenestralis (L.)	24	2006
Rhizophagus ferrugineus (Payk.)	2	2011
Rhizophagus nitidulus (Fab.)	4	2007
MORDELLIDAE		
Mordellochroa abdominalis (Fab.)	4	2010
MYCETOPHAGIDAE		
Mycetophagus multipunctatus Fab.*	2	2005
Mycetophagus piceus (Fab.)*	4	2005
Mycetophagus quadripustulatus (L.)*	2	2007
NITIDULIDAE		
Cryptarcha strigata (Fab.)	8	2006
Epuraea biguttata (Thunberg)	2	2010
Epuraea distincta (Grimmer)	8	2006
Epuraea marsueli Reitter	1	2006
Epuraea rufomarginata (Steph.)	2	2011
Epuraea silacea (Herbst)	1	2010
Soronia punctatissima (Illiger)	2	1995
OEDEMERIDAE		
Ischnomera cyanea (Fab.)	4	2010
PHOLIOPHILIDAE		
Philiophilus edwardsi Stephens	8	2006
PYROCHROIDAE		
Pyrochroa coccinea (L.)	4	2009
Pyrochroa serraticornis (Scopoli))	1	2011
SALPINGIDAE		
Rhinosimus planirostris (Fab.)	1	2008
SCRAPTIIDAE		
Anaspis fasciata (Forst.)	2	2000
Anaspis frontalis (L.)	1	2008
Anaspis lurida Stephens	2	1995
Anaspis pulicaria Costa, A	1	1998
Anaspis rufilabris (L.)	1	2008
SILVANIDAE		
Silvanus unidentatus (Oliv.)	4	2011
SPHINDIDAE		
Aspidiphorus orbiculatus (Gyll.)	2	2000
STAPHYLINIDAE		
Atrecus affinis (Payk.)	1	2010
Coryphium angusticolle Stephens	2	1995
Gabrius splendidulus (Grav.)	1	2009
Gryophaena lucidula Erichson	8	2001
Hapalarea pygmaea (Payk.)	2	1988
Nudobius lentus (Grav.)	2	2011
Phloeonomus punctipennis Thomson	2	2010
Phloeostiba plana (Payk.)	2	2008
Quedius maurus (Sahlberg)	4	1997
Quedius scitus (Grav.)	8	1999
Scaphidium quadrinaculatum Oliv.	2	2010
Scaphisoma boleti (Panzer)	8	2006
Sepedophilus testaceus (Fab.)	8	2011
Thamiaraea cinnamomea (Grav.)	2	2006
TENEBRIONIDAE		
Diaperis boleti (L.)	24	2004
Eledona agricola (Herbst)	4	2005
Prionychus ater (Fab.)	8	2002
TETRATOMIDAE		
Hallomenus binotatus (Quenssel)	8	2005

Excludes *Arhopalus rusticus, Hylastes ater, Hylobius abietis, Phloeonomus pusillus* and *Tomicus piniperda* which are associated with conifers.

* Indicates species on the European Red List of saproxylic beetles.

Weather Report 2015

Norman Brooks

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

January 2015 An unremarkable winter month with the mean temperature close to normal hiding the fact that the mean maximum was one degree above average, and the mean minimum one above.

Exceptional warmth briefly bathed our area on the 9th when the maximum of 15.1 °C was the highest January temperature in the Norwich area since at least the middle of the 19th century.

Slight snow or sleet fell on five days but only provided a transient cover on the 30th. Rainfall was close to normal with the county average being 51.1mm.

Jan. wind	N	NE	E	SE	S	SW	W	NW	Calm
Days	1	1	0	1	2	9	10	2	5

February 2015 Another rather featureless month with both temperature and rainfall very close to average. The whole month was dominated by an almost continuous, usually strong, jet stream that exerted an Atlantic influence over the British Isles (and much of Western Europe).

Unsurprisingly, there was little smowfall. with a thin snow cover only on the 3rd. There was a small excess of sunshine and the county average rainfall was 44.3 mm.

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

March 2015 An uneventful month but enlivened in the final week by a thunderstorm on the 29th and a gale on the 31st.

Table 1. Monthly summaries for 2015.

Month	Total rainfall (mm)	Percentage of mean rainfall	Days air frost	Days ground frost	Monthly mean temperature (°C)	Deviation from mean (°C)	Mean soil temp. 10cm depth
January	49.7	86	13	17	4.2	+ 0.2	3.3
February	45.3	105	10	19	4.4	+ 0.6	3.1
March	33.8	73	7	17	7.0	+ 1.1	5.1
April	23.2	47	2	14	9.4	+ 1.8	8.4
May	55.5	122	2	3	11.8	+ 0.5	1.2
June	36.4	68	0	0	14.5	+ 0.2	13.6
July	91.6	162	0	0	17.4	+ 0.9	16.9
August	80.3	157	0	0	17.4	+ 1.0	15.9
September	48.0	88	0	0	13.1	- 1.2	12.0
October	49.5	85	0	4	10.7	- 0.3	9.7
November	81.8	115	2	6	9.5	+ 2.7	8.9
December	50.2	111	0	4	9.9	+ 5.0	8.4
ANNUAL	645.3	99	36	84	10.8	+ 1.1	9.7

The main feature of the month was its dryness. From 1st to 24th inclusive only 3.9 mm of rain was measured and only the 15.5 mm that fell during the thunderstorm on the 29th saved the month from being one of the driest Marches on record.

Views of the eclipse on the 20th were nearly thwarted by cloud; a drop in 0.6 °C was noted.

Seventeen ground frosts inhibited spring growth. The county average rainfall total was 28.3 mm.

Mar. wind	N	NE	E	SE	S	SW	W	NW	Calm
Days	2	3	4	3	0	7	3	9	0

April 2015 Although daytime maxima were frequently well above average, nights were often cold with frequent frosts. A comparison of the incidence of frost for the period 1 January - 2 May reveals that this year more ground and air frosts have been logged than for the whole of 2014. The parched countryside bore witness to the dry nature of the month, with the lack of rain exacerbated by the frequent drying winds and excessive sunshine. The county average rainfall total of 19.2 mm was barely 50% of normal.

Apr. wind	N	NE	E	SE	S	SW	W	NW	Calm
Days	5	6	0	4	2	6	3	4	0

May 2015 With rain recorded on 18 days, the rainfall total of 55.5 mm was, unsurprisingly, above average.

There was a marked lack of warm days with only two achieving a maximum of over 21 °C. Early on the 22nd, tremors emanating from a minor earthquake off the Kent coast were felt widely across Norfolk.

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

June 2015 Predominantly cool until the final week, with a maximum of 27.1 °C on the 30th. With a temperature of only 14 °C on the 9th, no fewer than eight days in December were warmer! It was a decidedly dry month with a rainfall total of 36.4 mm to the west of Norwich and 28.4 mm to the east.

Jun. wind	N	NE	E	SE	S	SW	W	NW	Calm
Days	1	3	0	1	4	9	5	5	2

July 2015 Fairly warm but cooler at the end of the month, The maximum of 32.1 °C on the 1st was the highest since 18 August 2012 and was followed by an exceptionally warm night with the temperature failing to fall below 18.5 °C.

With a county average of 110.2 mm it was the wettest July in Norfolk since 1988. Much of this excess was caused by torrential rain on the 24th.

Jul. wind	N	NE	E	SE	S	SW	W	NW	Calm
Days	0	0	1	5	4	13	4	3	1

August 2015 An unsettled and wet month with our favoured location in the east of England enjoying slightly warmer than average temperatures. The period 4th - 16th produced only 4.8 mm of rain but thereafter it became wet, with the county average of 81.2 mm showing an excess of about 50%.

Aug. wind	N	NE	E	SE	S	SW	W	NW	Calm
Days	2	3	1	2	5	15	0	1	2

September 2015 Unusually cool and autumnal with few indications of lingering summer warmth. Only on a single day was a maximum in excess of 21 °C achieved. Rain, measured on 15 days, allowed the county average monthly total of 54.9 mm to be very close to normal. The total lunar eclipse during the early hours of the 28th caused the moon's disc to assume a drab dirty copper hue.

Sep. wind	N	NE	E	SE	S	SW	W	NW	Calm
Days	2	1	5	3	1	8	1	7	3

October 2015 Most unusually for October, winds blew from an easterly quadrant on 15 days, with only the final week reverting to the normal westerly regime. Very few localities recorde an air frost and the county average rainfall of 50.6 mm was slightly below normal.

Oct. wind	N	NE	E	SE	S	SW	W	NW	Calm
Days	2	8	5	2	2	7	2	0	3

November 2015 Exceptionally mild (but not as warm as November 1994). With rain measured on 24 days and leaden skies predominating, it was a dismal month. A very brief incursion of arctic air on the 20th brought about snow on the 21st and the 22nd with the first air frost of autumn - about a month later than usual. The county average rainfall total of 80.3 mm was about 120% of normal.

Nov. wind	N	NE	E	SE	S	SW	W	NW	Calm
Days	1	0	0	2	3	9	8	2	5

December 2015 An extraordinary month with no warmer December having been recorded in central England since 1659. The maximum of 25 °C on the 26th was identical to that on 22 June!

The month shared the distinction with December 1934 of not having a single air frost. The mean soil temperature of 8.4 °C (identical to that of April) allowed grass growth to continue throughout the month. The rainfall total of 50.2 mm was close to normal.

Dec. wind	N	NE	E	SE	S	SW	W	NW	Calm
Days	0	0	1	2	5	14	6	0	3

Annual summary 2015

Total rainfall	645.3 mm 99% of average
Days with rain recorded	195
Days with sleet or snow	12
Days with snow lying	3
Highest maximum temperature	32.1 °C 1 Jul
Lowest maximum temperature	2.0 °C 19 Jan
Highest minimum temperature	18.5 °C 2 Jul
Lowest minimum temperature	-5.4 °C 23 Jan
Lowest grass min. temperature	-7.6 °C 20, 23 Jan
Air frosts	36
Ground frosts	84
Days with gales	2
Days with hail	6
Days with thunder	11
Days with fog	11
Longest period with no measurable rain	11 days (13 -23 April inclusive)
Mean cloud cover at 09.00 hrs	67%
Wind direction at 09.00 hrs (days):	
North	18
North-east	30
East	20
South-east	26
South	30
South-west	111
West	59
North-west	41
Calm	430
Annual mean maximum temp.	15.0 °C
Annual mean minimum temp.	6.5 °C
Annual mean temperature	10.8 °C

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Wildlife Report 2015

Dragonflies

Pam Taylor

Norfolk seems to have had a reasonably good dragonfly season in 2015, with a fair scattering of migrants thrown in to liven things up. Spring started well with several reports of **Large Red Damselfly** *Pyrrhosoma nymphula* during the second half of April. These were soon joined by all the regular spring species and then the first **Norfolk Hawker** *Aeshna isosceles* on 23 May.

Scarce Emerald Damselfly *Lestes dryas* put in a surprise appearance at Upton Fen on 18 July when I caught a single female while leading a dragonfly walk. On the same day seventeen other species were also recorded on the reserve.

Southern Emerald Damselfly *Lestes barbarus* was reported only once this year, as a single female from Winterton Dunes on 1 August. It was described by Phil Heath as being immature, but not a teneral. We still seek proof that Winterton Dunes holds a breeding colony of this species.

Willow Emerald Damselfly *Chalcolestes viridis* is now quite widespread in Norfolk and 2015 saw another successful season for it with breeding behaviour reported from several localities including Alderfen, Mallingford Mill, Sutton Fen and Thorpe Marshes. Reports of the species began on 4 August and continued into mid-October.

Small Red Damselfly *Ceriagrion tenellum* was seen in low numbers at Scarning Fen from early July onwards. This weak flyer has only one known breeding colony in Norfolk, so the report and photograph of a male seen at Roydon Common on 10 July by Stu Rowland came as a great surprise. Intensive searches of the area both on that day and subsequently failed to secure any further sightings.

Scarce Blue-tailed Damselfly *Ischnura pumilio* continues to maintain a small colony on pools near the east coast of Norfolk at Hempstead Marshes. This is a private site where eight individuals were seen on 3 July and six on 24 July. The former sighting included an immature female of the form *aurantiaca* and an ovipositing pair.

Norfolk Hawker *Aeshna isosceles* was seen in good numbers at all its usual broadland haunts. Additionally single wanderers turned up at both Sprowston in Norwich on 2 July and at Pensthorpe in west Norfolk on four occasions between 15 and 31 July.

Lesser Emperor *Anax parthenope* was the first migrant to appear with one being seen at Felbrigg lake on 29 June. A few days later at least three were seen at Filby Broad, including a pair ovipositing in almost exactly the same spot as the previous year. The same or other Lesser Emperors were then seen at the nearby Ormesby Broad until at least 11 July. It would appear that a small colony is now established in the area.

Keeled Skimmer *Orthetrum coerulescens* was reported in low numbers from its colonies at Beeston Regis Common, Sheringham Common and Buxton Heath. Better numbers were seen by Julie Hogg at Holt Lowes where almost forty were counted on 6 July. The colony at Roydon Common and Grimston Warren continues to gather strength with breeding behaviour also observed on 9 July. Wandering individuals were seen at Bawsey Ruins and Upton Fen on 18 July and at Winterton Dunes on 22 July. The Upton individual turned up on the same day as the single Scarce Emerald Damselfly so was probably brought in by the same weather conditions.

Red-veined Darter *Sympetrum fonscolombii* appeared during July with over thirty seen by Simon Chidwick at Felbrigg lake on 27 June, including at least ten ovipositing pairs. Similar numbers were also reported from there on 2 July when at least five pairs were present and ovipositing. It is assumed the emerging darters seen in September came from these breeding attempts. A single male was reported from Winterton Dunes on both 2 August and 4 August.

Yellow-winged Darter *Sympetrum flaveolum* was seen on three occasions and involved at least two individuals. On 1 August a male was observed at Winterton Dunes by Phil Heath. He then saw a female at the same site on 7 August. A further sighting was reported on Rare Bird Alert on 3 August.

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Hoverflies

Stuart Paston

A total of 125 species featured in hoverfly records received by the author for 2015, with one addition to the county list. Coverage was weighted towards the north of the county and areas south of Norwich.

It was a year that saw North Norfolk host the Dipterists Forum spring field meeting between 15-17 May, based in Cromer, which gave local dipterists the opportunity to join national experts in visiting a variety of sites and habitats. The weather stayed dry throughout the meeting, albeit with a chilly north wind making coastal sites rather unproductive, and there were some significant hoverfly finds which included *Cheilosia antiqua* at Holt Lowes and *Meligramma trianguliferum* at Kelling Heath. Among other species recorded during the meeting were *Brachypalpoides lentus, Cheilosia fraterna, Cheilosia lasiopa, Criorhina floccosa, Orthonevra nobilis* and *Portevinia maculata*. Details are provided below in the species accounts that highlight some of the more significant records of the year.

Species new to Norfolk

Rhingia rostrata

The discovery of a female of this species at Swanton Novers Great Wood TG014307 on 13 May produced the second county addition of the year. The recorder Nick Owens was drawn to a bright individual distinct from the many *Rhingia campestris* that were visiting flowers of Ground Ivy *Glechoma hederacea* and Yellow Archangel *Lamiastrum galeobdolon* in the area. It was found on a leaf of blossoming Bird Cherry *Prunus padus* and confirmation of his determination was made by Roger Morris, co-organiser of the Hoverfly Recording Scheme from a submitted photograph. Later in the year, on 4 October, Nick discovered a gravid female at the same locality TG017307.

Formerly a rare species in the UK, this hoverfly has spread across southern Britain since the turn of the century and the discovery of new populations in the east Midlands makes its arrival in East Anglia not unexpected. The larva develops in dung of badger and deer and expanding numbers of both are alikely factor in the advance of *rostrata* into new areas. There is clearly potential for it to become well-established in the county, especially in the heavily wooded part of north Norfolk. As indicated by the records above this species has two flight periods and is much more numerous in the autumn (Ball *et al*. 2011).

Nationally Scarce species

Anasimyia interpuncta

In the national context, the Norfolk Broads are significant in supporting a strong population of this species which is mainly confined to the south-east of the UK. The only record received for 2015 was of a female at buttercup *Ranunculus* sp. at Wheatfen TG326057 on 27 May (Nick Elsey).

Cheilosia velutina

Two records were received. Dave Brice found a male and three females on 9 August during a survey of diptera on a mixed flower crop in an arable field at Muckleton TF829393 and Nick Owens found a female on Hogweed *Heracleum sphondylium* on 12 September at STANTA harrier strip TL835970.

Platycheirus discimanus

A female of this species was swept from Blackthorn *Prunus spinosa* at South Creake TF875372 on 18 April by Dave Brice. Previous records are known from

Breckland but this is the first report of this species that the author has received. This early spring hoverfly is best searched for by using a long-handled net (as in this instance) to sweep blossom of Blackthorn *Prunus spinosa* and sallow *Salix* spp. as it invariably occurs out of reach of equipment more regularly employed by entomologists. Bearing this in mind, there is scope for finding the species more widely in Norfolk. This is a woodland species occurring in both deciduous and coniferous woods. The capture site comprises bushes beside a lane opposite a pine plantation with arable land nearby and broad-leaved woodland of mainly Beech *Fagus sylvatica* and Ash *Fraxinus excelsior* around half a mile away. The larva is predaceous on aphids with continental records from Larch *Larix decidua* which may therefore be significant in UK conifer plantations (Ball & Morris 2014).

Xylota abiens

Tony Irwin swept a male of this species from lime *Tilia* sp. foliage at Shotesham Park TM219984 on 22 May. The capture site was beside a meadow within a sheltered, largely wooded, river valley.

Other noteworthy records

Brachyopa scutellaris

Having received no data for this species (or any other *Brachyopa*) since taking over as Hoverfly Recorder in 2012, the author decided to make a concerted effort to obtain records in 2015 and succeeded in finding it at three Norwich area sites by searching in likely situations within woodland. On 4 May he found a male on elm *Ulmus* sp. foliage under a mature Yew *Taxus baccata* beside a woodland path in Catton Park TG227119 and, three days later, whilst searching Sycamore Crescent Wood, he discovered a male on foliage at the base of Common Lime *Tilia* x *europaea* beside a well-used pathway at TG208095.

The last record was on 13 May when, after a considerable period of time spent looking in suitable areas, the author found a male on foliage at the base of a Sycamore *Acer pseudoplatanus* beside the main path through woodland at Earlham Park TG188076. Larvae develop in sap runs but none were located in the vicinity of any of the capture sites. Two further potential sites, Trowse Wood and Woodlands Park, Norwich were checked during this period without success.The only other 2015 record came from Roger Morris who found two males on 16 May in woodland at Glandford TG046406 during the DF field meeting. This is undoubtedly a widespread hoverfly in suitable woodland in Norfolk but among obstacles to its discovery is a similarity to Anthomyiid flies of the genus *Pegomya* that are usually numerous in areas frequented by *B. scutellaris* as was the case at all the Norwich sites. It can also have a somewhat limited flight period.

Cheilosia antiqua

Nick Owens discovered this species at two north Norfolk sites; the first county records since Ken Durrant found it at Beeston Common in 1987. A female was found on Dandelion *Taraxacum officinale* at Swanton Novers Great Wood TG014307 on 13 May and another female on Marsh Marigold *Caltha palustris* at Holt Lowes TG092379 on 16 May. This mainly spring species has a wide UK distribution but records are somewhat sparse and the vast majority in eastern England are pre-2000. (Ball *et al.* 2011).

Cheilosia caerulescens

The discovery by Andy Musgrove of a male at The Nunnery, Thetford TL8782 on 21 April was a first record for VC28. It is the first report received by the author of this species, known as Houseleek Cheilosia or Sempervivum Leaf Miner, since its arrival in Norfolk in 2013.

Cheilosia fraterna

Two records were received, the DF field meeting yielding a female taken by Nick Owens on Marsh Marigold *Caltha palustris*

at Holt Lowes TG092379 on 16 May whilst both sexes were found at Sculthorpe Moor in wet meadow TF903303 on 2 August by Dave Brice.

Cheilosia lasiopa

Four records were received of this local species: 3 May, Edgefield TG087350, male at Ramsons *Allium ursinum* (Dave Brice); 8 May, Roadhills, North Creake TF8538, male at Cow Parsley *Anthriscus sylvestris* (Dave Brice); 16 May, Kelling Heath TG1042, both sexes (Roger Morris); 17 May, Felbrigg Great Wood TG192399, male (Roger Morris).

Cheilosia scutellata

Records of females were received from Wheatfen TG325056 on 11 August (Nick Elsey) and Swanton Novers Great Wood TG017307/TG019312 on 4 October (Nick Owens).

Cheilosia soror

This species which is increasing nationally (Ball & Morris 2014) was recorded at four sites. The earliest record was of a female found on 21 May by the author on low foliage of Sycamore *Acer pseudoplatanus* beside a path in Trowse Wood TG252065. There are chalk pits in the vicinity. Both sexes were found by Dave Brice on 6 August at Roadhills, North Creake TF859380 and a visit by Andy Gardiner to Redgrave and Lopham Fen TM0580 on 6 September produced a small female that was confirmed by the author following determination by Tracy Money. The last record came from Hethersett TG143058, a female found by Tracy Money in grassland beside a track to a lake.

Cheilosia urbana

Most Norfolk records of this spring species come from the west of the county, its habitats including grassland and heathland where there is some scrub or woodland. Two records were received. On 24 April a female was swept from Yellow Archangel *Lamiastrum galeobdolon* inside mixed woodland at Roadhills, North Creake TF859380 by Dave Brice. On 28 April two females were taken in yellow pan traps at Stoke Ferry TL695989 by Nick Owens. The traps were set on short grass on the bank of the cut-off channel which is comprised of sandy calcareous material dug from beneath the peat. Sallow (*Salix* spp.) was plentiful in the area.

Criorhina berberina

The following records were received: 10 May, Wheatfen TG326057 (Nick Elsey), a new site record; 13 May, Swanton Novers Great Wood TG014307, about flowers of Holly *Ilex aquifolium* along with *C. floccosa.* (Nick Owens); 16 May, Bayfield TG046406, on Ramsons *Allium ursinum* (Nick Owens); 20 May, Ashwellthorpe Wood TG138978, male at Ramsons *Allium ursinum* (Andy Gardiner); 20 May, Beeston Common TG165423 (Francis Farrow).

Criorhina floccosa

This species was found at four sites in North Norfolk: 13 May, Swanton Novers Great Wood TG014307, male about flowers of Holly *Ilex aquifolium* (Nick Owens); 16 May, Glandford TG046406, a male (Roger Morris); 16 May, Kelling Heath TG1042, adult at Rowan *Sorbus aucuparia* (Roger Morris); 17 May, Felbrigg Great Wood TG192399, both sexes (Roger Morris).

Dasysyrphus pinastri

A male of this species was found on Ramsons *Allium ursinum* on 29 April at Whitwell Common TG0820 by Dave Brice. This is the first Norfolk record since 1989 when it was found at Beeston Common. It has not been possible to confirm recorder details for the 1989 record. Nationally many of the strong concentrations of records coincide with comparatively highly coniferised areas (Ball *et al.* 2011) although the larva feeds on aphids on both broad-leaved and coniferous trees.

Didea fasciata

The author recorded this species in Catton Park, Norwich with females found at Ivy

Hedera helix at two widely spaced locations: TG228118 on 10 September and TG230116 on 30 September. No further records were received of a hoverfly that appears to be very local in the county.

Eristalinus aeneus

This essentially coastal species was reported from Walsey Hills TG061440 where many males were observed basking on 18 April (Nick Owens). A further record was received of a male visiting Sea Aster *Aster pannonicum* at Burnham Deepdale Marsh TF803444 on 17 September (Dave Brice).

Melangynalasi ophthalma

The following four records were received of this early spring species which indicate it is widespread in the county: 20 March, The Nunnery, Thetford TL8782, on sallow *Salix* sp. (Andy Musgrove); 22 March, Silfield TG125006, female on Gorse *Ulex europaeus* (Ian Smith, confirmed by the author from a photograph); 1 April, Sheringham Park TG1341 male on sallow *Salix* sp. (AM); 2 April, Stoke Holy Cross TG237015, adult in garden (Nick Elsey).

Meligramma trianguliferum

One of the hoverfly highlights of the DF meeting in North Norfolk was the capture on 16 May of a female of this species at Kelling Heath TG1042 by Roger Morris. This is a first record for VC27, all previous records having come from Breckland. This species can be found in a variety of habitats including rides in deciduous woodland, along hedgerows and about scrub, often on heathland. It tends to be elusive but can be found at flowers although is more often found sunning itself on foliage.

Orthonevra brevicornis

Two records were received for this scarce species. Roger Morris found a female at Glandford TG046406 on 16 May and Andy Musgrove recorded an adult on buttercup *Ranunculus* sp. growing beside a ford at Hollow Lane, Shotesham TM242994 on 31 May.

Ortonevra geniculata

East Anglian fens support significant populations of this scarce species which was recorded at Sculthorpe Moor TF901301 by Dave Brice on 6 and 7 April. Both sexes were present on sallow *Salix* sp. on the latter date.

Orthonevra nobilis

Adults of this species are known to occur well away from wetland breeding areas and records were received from Felbrigg Great Wood TG192399, a female on 17 May (Roger Morris), and a North Creake garden TF854382, both sexes, on 14 June (Dave Brice).

Pipiza luteitarsis

A male was swept near woodland at Roadhills North Creake TF859380 on 28 April by Dave Brice.

Pipiza notata

A male of this species was taken in a yellow pan trap at Stoke Ferry TL695989 on 28 April by Nick Owens. Habitat details as for *Cheilosia urbana* record.

Portevinia maculata

Six records were received as follows, those in bold are new sites. Those for Bayfield/ Glandford represent an additional 10 km square record. 13 May, Swanton Novers Great Wood TG014307 (Nick Owens). **16 May, Glandford TG046406 (Roger Morris).** 16 May, Sheringwood, Beeston Regis TG1641 (Mark Clements). 20 May, Ashwellthorpe Wood TG138978 (Andy Gardiner). **21 May, Wymondham College TM075985 (Andy Gardiner). 30 May, Grays Plantation, Cromer TG2041 (Francis Farrow).** The Wymondham College record (confirmed from photographs) is unusual in that both sexes were photographed at a site where the foodplant, Ramsons *Allium ursinum*, has yet to be found.

Scaeva selenitica

An adult of this widespread but infrequently recorded species was reported

from Beeston Common TG1642 on 19 May by Mark Clements.

Sericomyia superbiens

A male of this striking species was photographed on 27 September at Booton Common TG111228 by Ian Smith.

Sphaerophoria rueppellii

Reports were received of this species from Sculthorpe Moor TF903303 on 2 August (Dave Brice) and Morston TG004441 on 5 September (Nick Owens). It occurs in a range of open habitats but is most frequent in coastal areas.

Sphaerophoria taeniata

A male of this scarce species was recorded from a typical wet meadow habitat at Sculthorpe Moor TF8930 on 25 May (Dave Brice). A male was also found on 24 May at Hethersett in grassland beside a track to a lake TG144055 (Andy Gardiner, det. Tracy Money)

Volucella inflata

This species continues to expand its range in Norfolk with records of a male photographed on 7 June at Taverham Mill TG158133 (Ian Smith) and a male photographed on buddleia on 23 July in Earlham Cemetery, Norwich TG211087 (James Emerson). Two records were also received from Holt Country Park where it seems to be well established, John Furse finding it on 15 June at TG081377 and James Emerson on 27 July at TG083373.

Xylota florum

A male of this species was recorded at Bramble *Rubus fruticosus* at Sculthorpe Moor TF9030 on 18 June by Dave Brice. This hoverfly of damp woodland, usually close to streams or ditches, is infrequently reported in Norfolk with a thin scattering of records across the county.

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Wildlife Report 2013-2016

Vascular Plants

Richard Carter & Bob Ellis

West Norfolk (Watsonian vice-county 28)

Among plants growing on old walls, West Norfolk remains a national stronghold for two uncommon and non-showy species that are easily overlooked: Wall Bedstraw *Galium parisiense* and Fine-leaved Sandwort *Minuartia hybrida*. The bedstraw looks like a bit like a small version of Hedge Bedstraw *Galium album* and besides being recorded by Norfolk Flora Group at well-known sites in Binham and Weeting in recent years, it has also turned up this year as a surprise on the mid-Norfolk Railway. The sandwort is a small slender plant looking intermediate between the even smaller Annual Pearlwort *Sagina apetala* and the larger Thyme-leaved Sandwort *Arenaria serpyllifolia*, both of which are common on old walls. Awareness and careful searching have yielded a steady string of Norfolk Flora Group records over the last few years. It has turned up on old walls in Beachamwell, Castle Acre and Croxton, and seems to have a concentration of sites in the villages between Kings Lynn and Hunstanton where it has been recorded from walls in Snettisham, Ingoldisthorpe and Dersingham. In contrast with these inconspicuous native species, a spectacular alien regularly to be seen on an old wall in West Rudham is Fern-leaved Corydalis *Corydalis cheilanthifolia*. It carries a blaze of yellow flowers a bit like those of Yellow Corydalis *Pseudofumaria lutea* in late spring, but at other times of year it could as its name suggests be easily mistaken for a small fern.

The Stanford Training Area (Stanta) is well known for its grassland plants and for a range of established aliens, but it also has a significant assemblage of wetland plants. When BSBI obtained permission to visit in 2015, a very significant rediscovery of an old record in the draw-down zone of a fluctuating water body was Shoreweed *Litorella uniflora*. And this year (2016) Peter Lambley and Richard Carter added three new uncommon native species to the Stanta list: Fibrous Tussock-sedge *Carex appropinquata*, Slender Sedge *Carex lasiocarpa* and Greater Bladderwort *Utricularia vulgaris*. Though these species were not in pingos on Stanta, they are well known from the West Norfolk pingo sites including Thompson Common just to the east. If you want to see these plants please seek them out there and not on Stanta; it is very dangerous indeed to visit Stanta without proper authorisation (and also illegal), and only organised groups are ever likely to get permission.

Over the past few years the fenlands have been the focus of intensive recording effort for the upcoming Flora of the Fenlands. The work has been organised by Jonathan Graham and Owen Mountford, but Norfolk Flora Group have been making at least three day-outings a year. Encouraging finds include water plants such as Long-stalked Pondweed *Potamogeton praelongus* and Fan-leaved Water-crowfoot *Ranunculus circinatus* in greater frequency than might have been imagined, given the dire state of so many ditches in the intensively farmed landscape. Another slightly unexpected outcome has been the frequency of plants of dry sandy soils on river banks near the Breckland edge of the fens, where species such as Smooth Cat's-ear *Hypochaeris glabra* and Bur Medick *Medicago minima* have been recorded several times. Some ruderals have emerged as rather characteristic of the area including Indehiscent Amaranth

Amaranthus bouchonii and Maple-leaved Goosefoot *Chenopodium hybridum.*

Remaining with the fens, the find of Marsh Sow-thistle *Sonchus palustris*, new to West Norfolk, by Tim Inskipp at Nordelph in 2012 has already been reported. It was always slightly surprising that this species was not known from the west of the county given its local abundance in the east, but perhaps even more surprising among wetland plant gaps in the West Norfolk flora was Hemlock Water-dropwort *Oenanthe crocata*. This was found on a river bank by Arthur Copping and Richard Carter during a Norfolk Flora Group visit to the Denver Sluice area in 2013, and has since been recorded elsewhere in the vice-county by Jon Graham and others. There is a report, unconfirmed but apparently reliable, of Lizard Orchid *Himantoglossum hircinum* on private land in one fenland site. We only have a 10 km square record. Occasionally even very well-botanised areas of the fenlands have turned up exciting finds. Following the Kings Lynn Flora by Robin Stevenson and Francis Schumann, Norfolk Flora Group have not expected to find much new there, but a 'Flora of the Fenland' day-trip to the industrial outskirts of Kings Lynn turned up the very rare inter-generic grass hybrid Perennial Beard-grass *Agropogon lutosus* growing with both its parents, Creeping Bent *Agrostis stolonifera* and Annual Beard-grass *Polypogon monspeliensis*, as well as the small fern Rustyback *Asplenium ceterach* on some old engineering brickwork.

East Norfolk (Watsonian vice-county 27)

Locally rare & scarce species

In East Norfolk there are still quite a number of scarcer species that have not been recorded in the tetrads (2 x 2 km grid squares) for which they were reported in the most recent Flora (Beckett *et al.* 1999). Some of these were probably just casual appearances, some will be genuine losses but several will still be there waiting to be found. It is always pleasing when one of these turns up; such as when in 2013, Fred Rumsey and others found Few-flowered Spike-rush *Eleocharis quinqueflora* at Catfield Great Fen. Another such occurrence was when, in the same year, Alec Bull found Stiff Saltmarsh-grass *Puccinellia rupestris* at Cley, though not in the same spot where it was recorded in 1988. There are more localities for this species in the Great Yarmouth area and the list there was added to when Mary Ghullam and Mike Crewe found it on Haddiscoe Island in 2016.

Toothed Medick *Medicago polymorpha* seems to be slowly expanding its range in the county. It was 're-found' in three tetrads in 2013, at Wiveton (RWE) & Blakeney (RWE & MPG) and also in Norwich by Bob Leaney in grass on a recently built road verge, suggesting that it might spread as a contaminant of grass seed and perhaps by mowing. It was found in additional tetrads at Roughton (NFG) & Kelling Heath (RWE) in 2014 Another species of this genus, Sickle Medick *Medicago sativa* ssp. *falcata*, was once more frequent in East Norfolk than it is now, particularly on the light soils to the north and west of Norwich. It was recorded from five tetrads in that area between 1987 and 1998 but in only one since, until several patches were seen in 2014 on the banks of a lane in Taverham (RWE & MPG).

Several small clovers seem to be spreading, perhaps in the same way as Toothed Medick. Of these, the most infrequent and elusive is Suffocated Clover *Trifolium suffocatum.* In 2013 Mary Ghullam found it in Cromer, the first record on the North Norfolk coast. In 2014 it was found in the grounds of the sugar processing factory at Cantley (NFG) and in Hemsby by Bob Leaney on a grassed traffic 'island' off the Yarmouth road. It was recorded in just three tetrads between 1987 and 1998. It has now been re-found in two of those and found in five additional tetrads.

The discovery of Rock Samphire *Crithmum maritimum* in 2008 at Scratby was reported

in Transactions (Ellis 2009). In 2014 it was interesting to see that it had not only survived the tidal surge of December 2013 but that a second plant was present. In 2015 a single plant was found at the top of the shingle at the base of the cliffs at Sidestrand by members of the Flora Group. This is in a position that is probably somewhat more precarious than that at Scratby.

Flattened Meadow-grass *Poa compressa* has been known on the walls in the vicinity of Norwich Cathedral Close for many years. In his 1866 Flora, Kirby Trimmer described it as being 'on old walls about Norwich'; it was noted as being specifically in Cathedral Close and attributed to Arthur Copping in Petch & Swann's 1968 Flora and there is a dot in the appropriate square in the 1999 Flora. In 2014 Bob Leaney reported about 200 plants on top of a high wall near Pull's Ferry. In the 19th century it was known to both Sir James Paget and Kirby Trimmer in Great Yarmouth but there is no record for the town in Petch & Swann and no dot in those squares in the 1999 Flora, so it was a particular pleasure to happen across it in some quantity there on a remaining part of the town wall in 2016.

Intermediate Bladderwort *Utricularia intermedia sens. lat.* was found at Catfield Great Fen in 2002, the first record for the county since 1979. This taxon is now considered to be a complex of three similar species also including Nordic Bladderwort *U. stygia* and Pale Bladderwort *U. ochroleuca.* In 2015 Fred Rumsey visited the small colony at Catfield and determined that it was *U. intermedia sensu stricto,* possibly the rarest species in the complex.

Another important find in the Broads was Long-stalked Pondweed *Potamogeton praelongus,* which has not been reported in the area since 1976 though apparently it was once frequent here (Beckett *et al.* 1999). It was found at Wroxham by Sally McColl during the course of a plant survey for the Broads Authority in 2015. As mentioned above, there have also been a few recent sightings in the Fenland drains of west Norfolk, the most recent being in Wretton in 2014 (NFG).

2015 was the year of the Lizard Orchid *Himantoglossum hircinum;* a fine specimen was discovered in Drayton and admired by many. The first known record from Norfolk was made in 1923 and it was seen occasionally thereafter until 1956 (Petch & Swann). This was the first confirmed sighting since then.

Alien species

In 2013 Red Duckweed *Lemna turionifera* was recorded for the first time in Norfolk when it was found by the Norfolk Flora Group at Upton Fen and confirmed by Richard Lansdown. It has since been reported at five further East Norfolk Broadland locations since. First found in Great Britain in 2007 (Lansdown 2008), it has been reported widely in England and Wales since then, so this find was not unexpected.

It is unusual for us to include garden plants in this report (as there are so many recorded these days as escapes and throw-outs) but perhaps Tasteless Stonecrop *Sedum sexangulare* deserves a mention. It was reported outside of gardens in Norfolk for the first time in 2014 when it was recorded in a pavement crack in Trunch by Mary Ghullam and members of the Flora Group. It was then recorded three times in 2015; near Costessey, in Cawston and in Diss. In 2016 it was seen in Taverham growing abundantly in grass between the road edge and the footway outside the nursery. Undoubtedly this is one to look out for.

Another discovery that caused a bit of a stir in the year of the Lizard Orchid was that of Purple Toothwort *Lathraea clandestina* in Bowthorpe. No earlier East Norfolk records are known, though the 1999 Flora mentions that it was well established on the roots of willows in an estate at Fincham in West Norfolk. It turns out that the colony at Bowthorpe is a deliberate introduction.

Also discovered in 2015 and somewhat less dramatic than the toothwort but perhaps more intriguing, were several large patches of the diminutive antipodean Annual Buttonweed *Cotula australis* at Kelling Heath Holiday Park (NFG). Both Stace (2010) and Sell & Murrell (2005) describe it as a rather frequent wool-alien but it's hard to imagine that shoddy was the source in this instance.

There is a record of Four-leaved Allseed *Polycarpon tetraphyllum* on the BSBI database from Watton in 1922, which is treated as a casual occurrence, although no mention is made of it in either of the two more recent Norfolk Floras. There is now a record from Gillingham where it was spotted growing in a gravel forecourt by Mary Ghullam in 2016; a first for East Norfolk at least. It is generally considered to be native in the Channel Islands and the southwest of England but casual elsewhere (Stace 2010) but apparently this species has recently been spreading rapidly in south-east England, often in urban areas.

Species of national conservation concern in both vice-counties

A Vascular Plant Red List for England (Stroh et al.) was published in 2014. Like the Vascular Plant Red Data List for Great Britain (Cheffings & Farrell 2005), the list for England is based on IUCN (International Union for Conservation of Nature) standard criteria, thresholds and categories to assess the risk of extinction in the area under consideration.

This report is welcome, partly because it gives some scientific credence to our suspicions that several species have been declining here that have had no national conservation status until now because they are not under significant threat in Scotland or Wales. For example, Norfolk species that are classified as least concern (LC) in the Red Data List for Great Britain but are classified as vulnerable (VU) in Red List for England include: Lesser Marshwort *Apium inundatum*, Sea Bindweed *Calystegia soldanella*, Slender Sedge *Carex lasiocarpa*, Bladder-sedge *Carex vesicaria*, Oblong-leaved Sundew *Drosera intermedia*, Common Cotton-grass *Eriophorum angustifolium*, Water-violet *Hottonia palustris*, Sheep's-bit *Jasione montana*, Grass-of-Parnassus *Parnassia palustris*, Marsh Lousewort *Pedicularis palustris*, Lousewort *Pedicularis sylvatica*, Common Butterwort *Pinguicula vulgaris*, Red Pondweed *Potamogeton alpinus*, Lesser Spearwort *Ranunculus flammula*, Knotted Pearlwort *Sagina nodosa*, Least Bur-reed *Sparganium natans*, Strawberry Clover *Trifolium fragiferum* and Lesser Bladderwort *Utricularia minor*.

Table 1 lists recent records that are new to a tetrad for species in the 'threatened' IUCN categories from both Red Lists (a species may not be considered threatened in England but it may still be of conservation concern for Great Britain as a whole). Where there are more than five non-adjacent tetrad records from the period 2013-2016 these are shown as maps in Figure 1, partly in order to make the size of the table a bit more manageable, but also to better illustrate any trends that might be apparent.

Sainfoin *Onobrychis viciifolia*: has been excluded from Table 1 because, although this species is treated as vulnerable in the England Red List, only native occurrences of a smaller ecotype found in calcareous grassland are relevant. There has been a resurgence in the use of Sainfoin in agriculture, now as a component of pollen and nectar mixes under agri-environment schemes rather than as a fodder crop, and most of the recent records on road verges and so on in Norfolk are from this source and are not thought to be native.

With three exceptions, the species in Fig. 1 fall into two main groups. Lesser Water-plantain, Water-violet, Frogbit, and Whorled Water-milfoil are perennial aquatic plants, mainly of ponds and ditches. All are adapted to survive adverse conditions (e.g.

Table 1. 2013-2016 records within tetrads (2 x 2 km squares) of species with the IUCN categories CR (critically endangered), EN (endangered) and VU (vulnerable), where they were not recorded in *A Flora of Norfolk* (Beckett *et al.*1999) or between 1999 and 2012. An * indicates that the species was probably introduced at that location. See p. 107 for abbreviations for recorders

Species	English Name	GB	Eng	Year	Tetrad	Locality	Rcrdr
Anthemis arvensis	Corn Chamomile	EN	EN	2014	TF82I	West Rudham Common	NFG
Apium inundatum	Lesser Marshwort	LC	VU	2013	TM09K	Old Buckenham Fen	NFG
Astragalus danicus	Purple Milk-vetch	EN	EN	2013	TL78Z	Weeting	NFG
					TL79K	Weeting Heath	NSBG
Calystegia soldanella	Sea Bindweed	LC	VU	2013	TF84X	Holkham	RNC et al.
					TF94H	Wells & Warham	NFG
				2014	TG42V	Winterton Dunes	NNNS
					TG50H	Yarmouth South Denes	NFG
Carex diandra	Lesser Tussock-sedge	NT	VU	2015	TG32L	Barton Turf	NFG
Carex lasiocarpa	Slender Sedge	LC	VU	2015	TM07P	South Lopham Fen	NFG
					TG32L	Barton Turf	NFG
					TF79P	Foulden Common	NFG
Catabrosa aquatica	Whorl-grass	LC	VU	2013	TM19R	Forncett St Peter	NFG
					TG22G, K, L, Q	Buxton, Coltishall & Horstead	RWE
				2016	TG01I, N	Swanton Morley	NFG
Clinopodium acinos	Basil Thyme	VU	VU	2013	TL99F	Hockham	RNC
				2015	TL78I	Hockwold-cum-Wilton	NFG
Cuscuta epithymum	Dodder	LC	VU	2013	TG04V	Kelling Heath	NNNS
					TG14B	Kelling Heath	NNNS
Daphne mezereum	Mezereon	LC	VU	2014	TF83V	Sculthorpe Moor	MPG
Dryopteris cristata	Crested Buckler-fern	CR	EN	2013	TG32L	Barton Broad, The Heater	NFG
Dryopteris uliginosa	Crested Buckler-fern ◎Narrow Buckler Fern	VU	-	2013	TG31M	Horning	FJR et al.
					TG31N	Horning	NFG
					TG32K	Barton Turf	NFG
					TG42A	Hickling Broad	FJR et al.
Eriophorum angustifolium	Common Cottongrass	LC	VU	2013	TM09K	Old Buckenham Fen	
				2014	TG31X	Upton Marshes	JMH
				2015	TG30W	Limpenhoe	NFG
					TG42G	Hickling Broad	NFG
Fumaria parviflora	Fine-leaved Fumitory	VU	NT	2013	TL79V	Weeting	SH
				2014	TF63V	Dersingham	RNC
Galium parisiense	Wall Bedstraw	VU	VU	2016	TF92W	North Elmham	NFG
Hyoscyamus niger	Henbane	VU	VU	2013	TG13H	Plumstead	NFG
				2015	TF63U	Heacham	NFG
Jasione montana	Sheep's-bit	LC	VU	2014	TG50H, I	Great Yarmouth	NFG

Species	English Name	GB	Eng	Year	Tetrad	Locality	Rcrdr
					TG51D	Winterton Dunes	NFG
Medicago minima	Bur Medick	VU	VU	2013	TL98R	Middle Harling Heath	JS
				2014	TL69Z	Stoke Ferry	NFG
					TL88J	Lynford	NFG
					TL88R	Croxton	RNC
Minuartia hybrida	Fine-leaved Sandwort	EN	EN	2014	TL88T	Croxton	RNC
				2015	TF70M	Beachamwell	NFG
				2016	TL98W	Middle Harling Heath	NNNS
Misopates orontium	Weasel's-snout	VU	VU	2016	TG20L	Upper Stoke *	RWE
					TG21F	Norwich	NFG
Oenanthe fistulosa	Tubular Water-dropwort	VU	VU	2013	TM09K	Old Buckenham Fen	NFG
				2014	TF93S	Little Snoring	NFG
				2016	TG40L	Haddiscoe Island & Wickhampton Marshes	NFG
					TG41P	Heigham Holmes	NFG
Pedicularis palustris	Marsh Lousewort	LC	VU	2013	TF62V	Roydon	RNC
				2014	TG30S	Hassingham Marshes	NFG
				2015	TG30W	Limpenhoe	NFG
Pedicularis sylvatica	Lousewort	LC	VU	2016	TG32P	East Ruston	PH
Persicaria minor	Small Water-pepper	VU	LC	2014	TG20E	Sweetbriar Marshes	SH
				2016	TG31I	Woodbastwick	NFG
Potamogeton alpinus	Red Pondweed	LC	VU	2013	TG22K	Coltishall	
Potamogeton friesii	Flat-stalked Pondweed	NT	VU	2013	TF50K	Nordelph	JG & MH
				2014	TG32M	Dilham	NFG
				2016	TG41T	Rollesby	NFG
Potamogeton praelongus	Long-stalked Pondweed	NT	EN	2014	TL69Z	Wretton	NFG
				2015	TG21Z	Wroxham	SM
Sagina nodosa	Knotted Pearlwort	LC	VU	2015	TL69U	Wretton	NSBG
					TL78I	Hockwold-cum-Wilton	NFG
					TF70F	Oxburgh	NFG
Scandix pecten-veneris	Shepherd's-needle	CR	EN	2016	TM18Z	Moulton St Mary & Wacton	RWE
Scleranthus annuus	Annual Knawel	EN	EN	2014	TL69Z	Stoke Ferry	NFG
					TG01T	Lyng	RWE & PWL
					TG23G	Roughton	NFG
				2015	TL88J	Lynford	BSBI
Silene gallica	Small-flowered Catchfly	EN	EN	2014	TG03Q	Briston	ES
					TG51D	Hemsby	NFG
				2016	TG23Q	North Walsham	CH
Sium latifolium	Greater Water-parsnip	EN	EN	2013	TG14A	Weybourne *	SH
Sparganium natans	Least Bur-reed	LC	VU	2014	TG40E	Halvergate, Damgate Marshes	NFG
Stellaria palustris	Marsh Stitchwort	VU	VU	2013	TM09L	Old Buckenham	NFG

Species	English Name	GB	Eng	Year	Tetrad	Locality	Rcrdr
Thyselium (Peucedanum) palustre	Milk-parsley	VU	VU	2013	TG32S	Stalham	RWE & MPG
Trifolium fragiferum	Strawberry Clover	LC	VU	2013	TF41H	West Walton	NFG
					TM09G, H	Attleborough *	NFG
				2016	TM39T	Hales Green	NFG
					TG42K	Heigham Holmes	NFG
Trifolium ochroleucon	Sulphur Clover	NT	VU	2013	TM38E	Earsham	RWE
				2014	TM28A, B, C, F	Needham & Pulham St Mary	NFG
				2015	TG02R	Themelthorpe	RWE & MPG
					TM18T	Tivetshall St Margaret	RWE
Utricularia minor	Lesser Bladderwort	LC	VU	2014	TG32R	Sutton Fen	NFG
Valerianella dentata	Narrow-fruited Cornsalad	EN	EN	2013	TG04L	Cley next the Sea	RWE & MPG
Viola canina	Heath Dog-violet	NT	VU	2013	TM08A	Garboldisham, Broomscot Common	RWE
				2016	TG01Y, Z	Great Witchingham	NFG

drought, dredging, shading and increasing competition) so may disappear from a location for some time only to reappear when conditions become favourable, possibly in a different ditch or pond. Surveys are therefore something of a lottery and the species are easy to under-record. This is particularly true when these locations are isolated and widely scattered. For example, a few ponds in a tetrad are much less likely yield a record on a single survey than an extensive system of drainage ditches. These species are also occasionally either deliberately or unwittingly introduced, particularly to newly created ponds. This is certainly true in the case of Whorled Water-milfoil in tetrad TG14A (a pond at Kelling Heath Holiday Park) and very likely to be true in the case of the recent tetrads in TG10 for Frogbit.

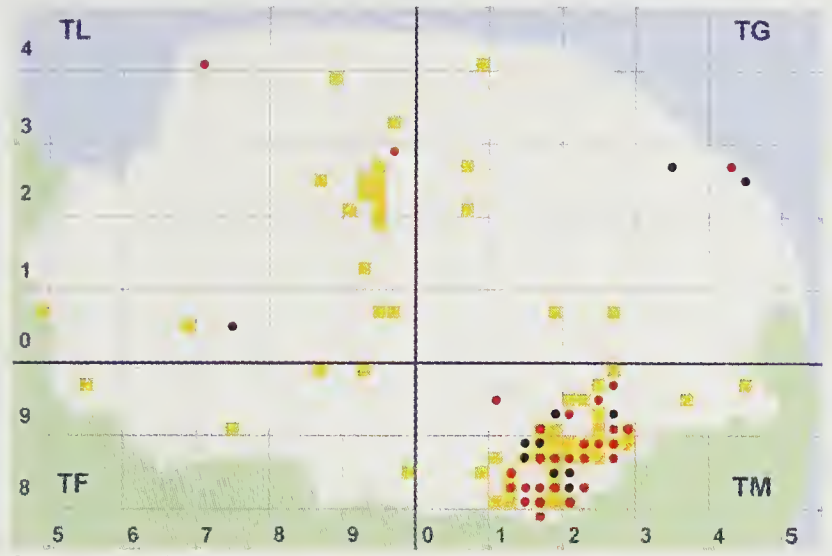
Stinking Chamomile, Rye Brome, Dwarf Spurge, Prickly-poppy, Night-flowering Catchfly and Corn Spurrey are all annual species specialising in disturbed ground, primarily arable fields. They are adapted to survive for long periods underground by means of a persistent seed bank and their presence above ground in any particular year depends on farming practice. Corn Marigold is also subject to deliberate introduction as a component of 'wild' flower seed mixes and this is true for the two recent records in TG40.

In Norfolk, Smooth Cat's-ear is a plant of intermittently disturbed grassland on light, often somewhat acid soils. Not only does it come and go depending on frequency and degree of disturbance (often involving rabbits), it is quite difficult to spot and to identify.

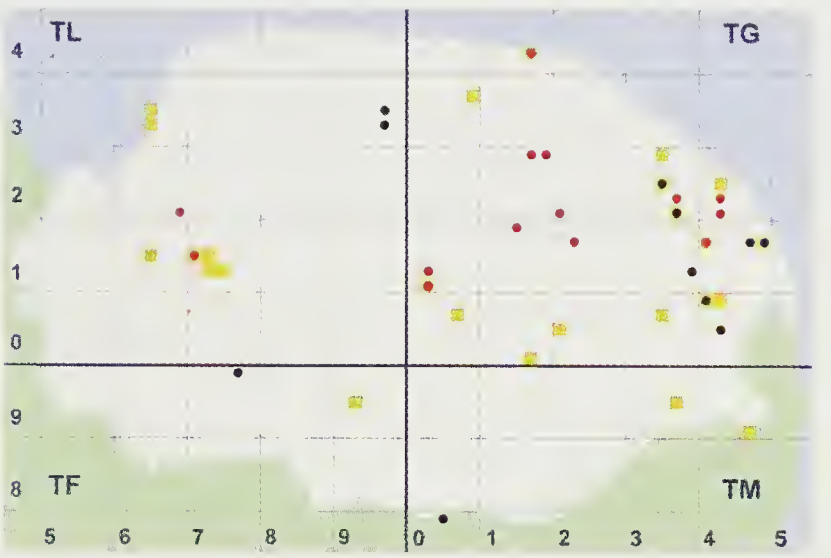
Prickly Saltwort is a strand-line species. In such a dynamic coastal habitat it is not surprising that the distribution varies from year to year.

There is a common theme of a unpredictable detectability although it is difficult to explain why this should apply to Lesser Spearwort. Perhaps it a matter of how easy it is to gain access to the places where it grows and how widely scattered they are.

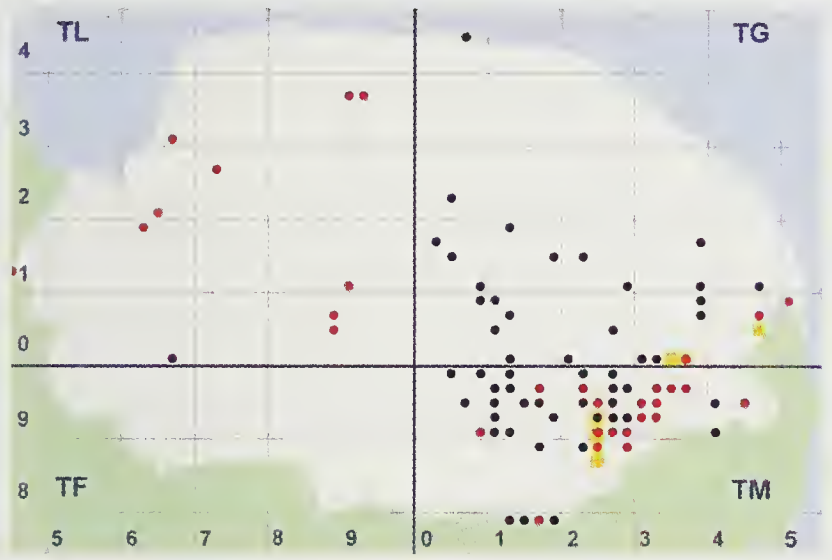
All this makes it difficult to draw conclusions from these maps, especially at this stage of re-surveying the tetrads in the



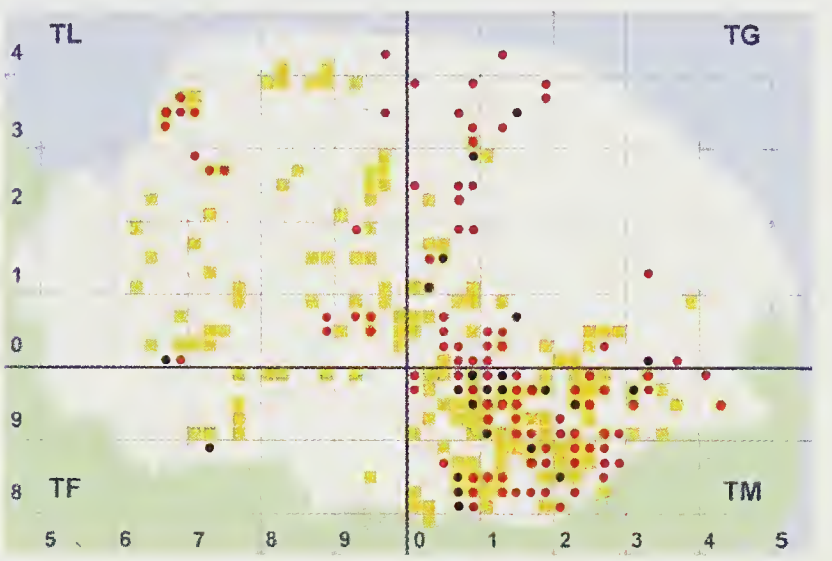
Stinking Chamomile *Anthemis cotula*



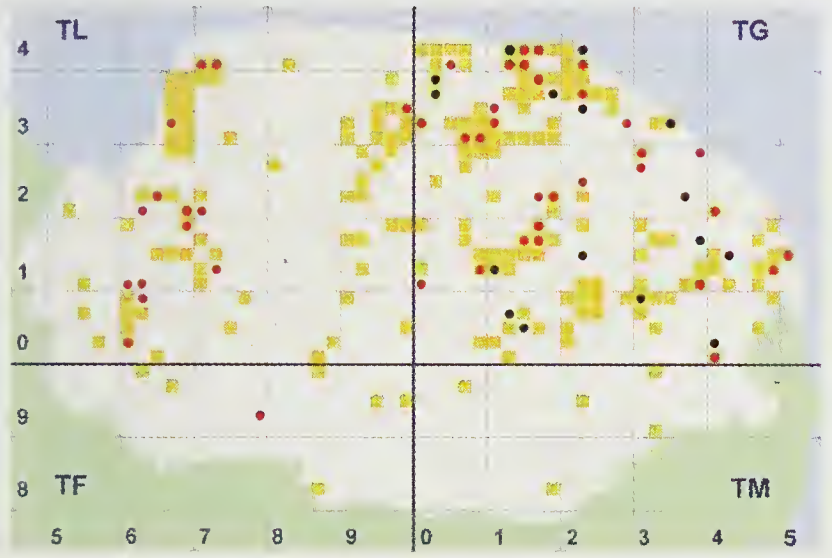
Lesser Water-plantain *Baldellia ranunculoides*



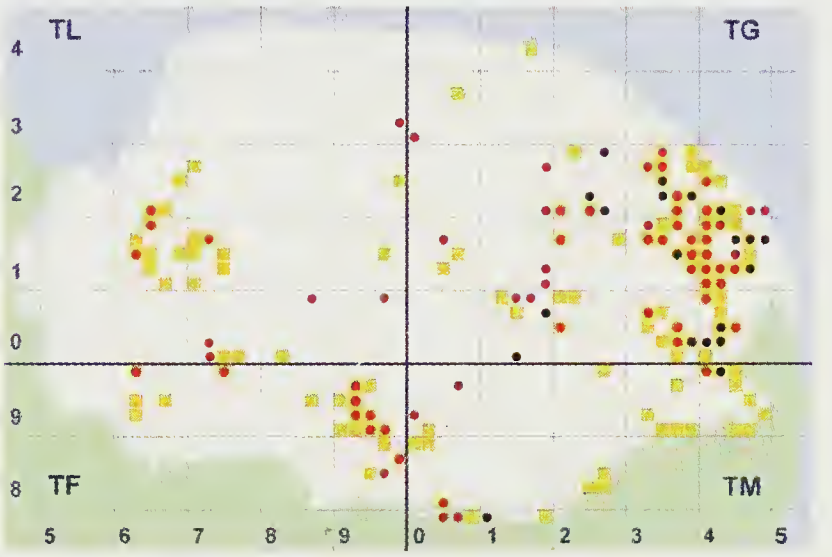
Rye Brome *Bromus secalinus*



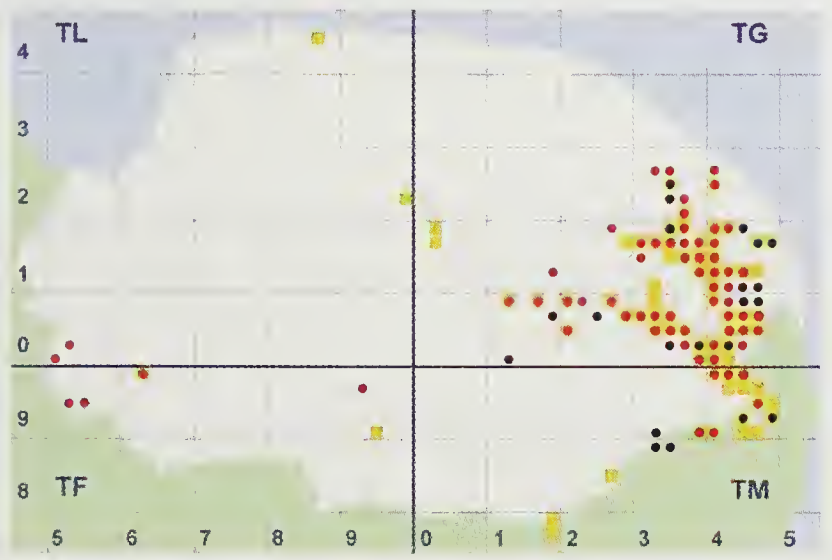
Dwarf Spurge *Euphorbia exigua*



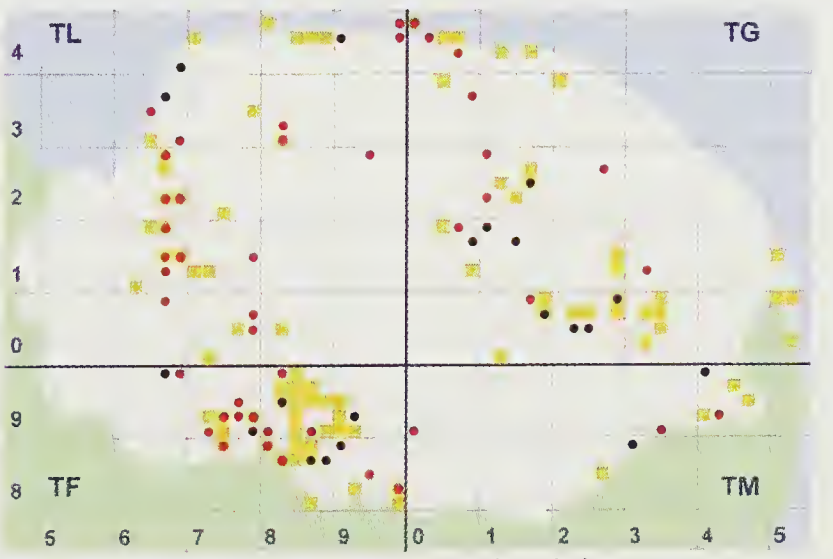
Corn Marigold *Glebionis segetum*



Water-violet *Hottonia palustris*

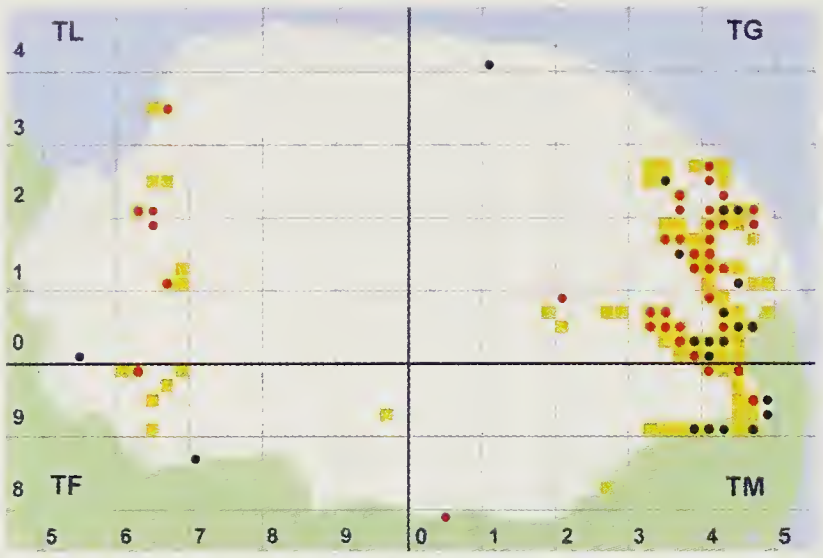


Frogbit *Hydrocharis morsus-ranae*

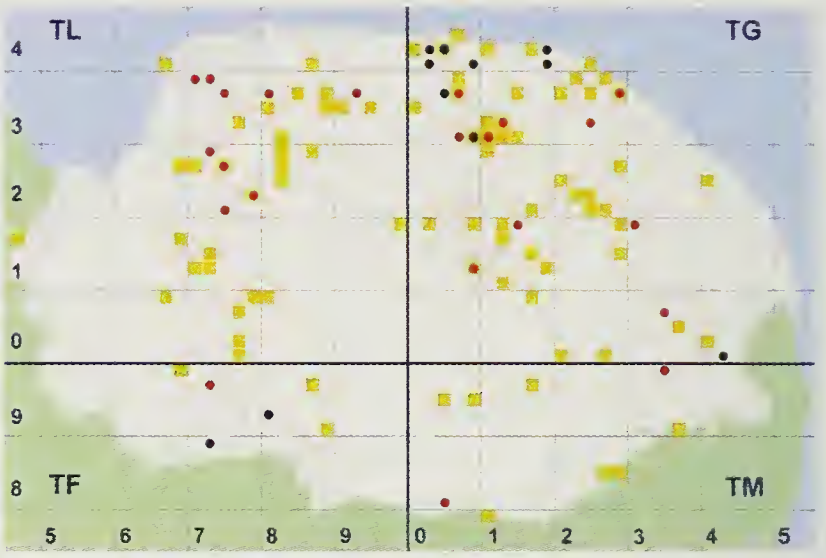


Smooth Cat's-ear *Hypochaeris glabra*

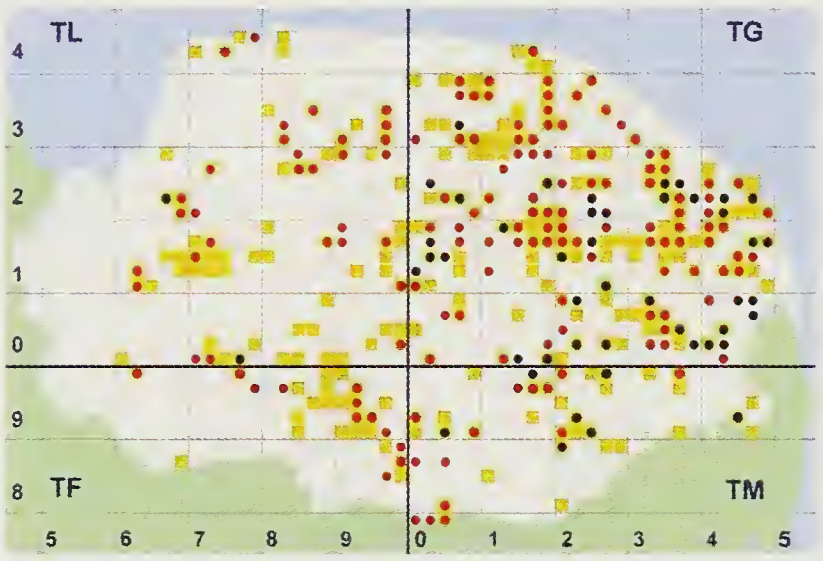
Figure 1. Maps of species excluded from Table 1. Yellow squares are based on records from 1987 to 1999, red dots from 2000 to 2012 and black dots from 2013 to 2016 (if not already recorded since 2000).



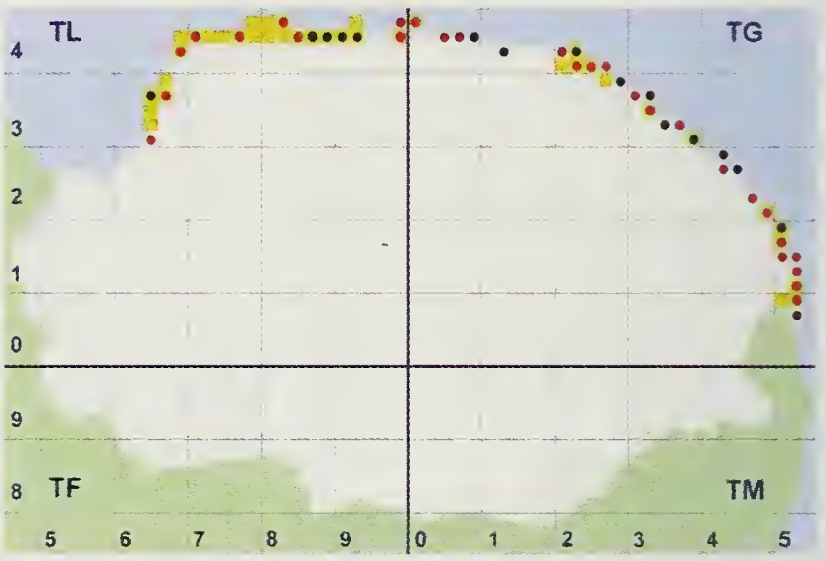
Whorled Water-milfoil *Myriophyllum verticillatum*



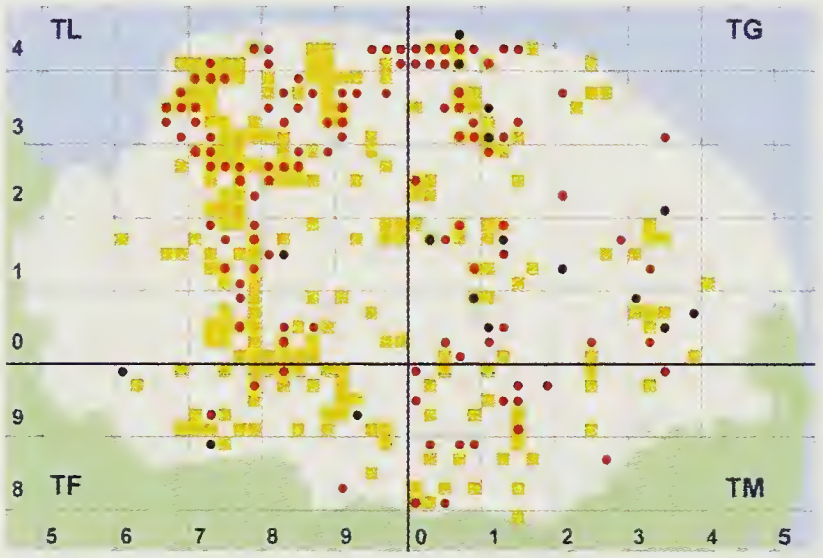
Prickly-poppy *Papaver argemone*



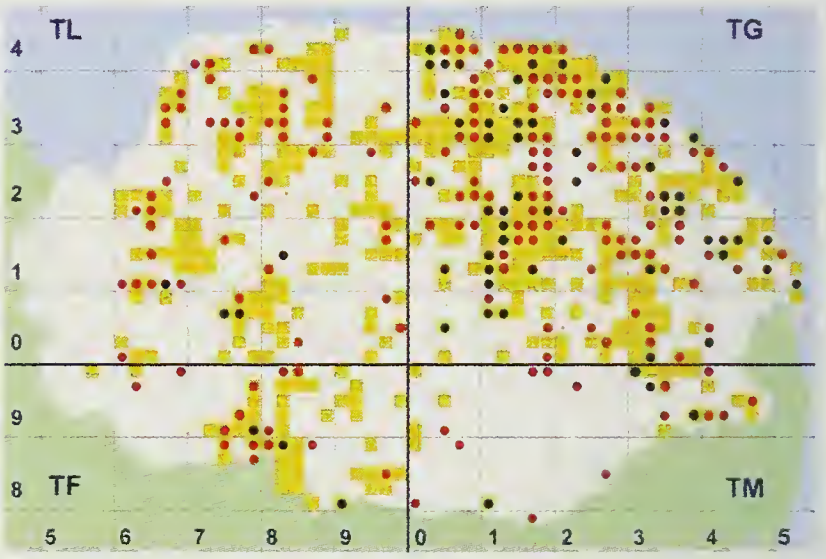
Lesser Spearwort *Ranunculus flammula*



Prickly Saltwort *Salsola kali* ssp. *kali*



Night-flowering Catchfly *Silene noctiflora*



Corn Spurrey *Spergula arvensis*

Figure 1 cont. Maps of species excluded from Table 1. Yellow squares are based on records from 1987 to 1999, red dots from 2000 to 2012 and black dots from 2013 to 2016 (if not already recorded since 2000).

county. It does seem, however, that one or two trends may be apparent. Rye Brome is clearly increasing and spreading quite rapidly. Lesser Water-plantain is more widespread than was apparent in Beckett, Bull & Stevenson but the high proportion of 'new' tetrads and 'losses' compared to 're-finds' suggest it is particularly difficult to detect in a county-wide survey. In several cases many of the 'new' tetrads show a consolidation of the range shown in the 1999 Flora: see Stinking Chamomile, Dwarf Spurge, Water-violet, Frogbit and Whorled Water-milfoil, although in the case of Dwarf Spurge, there is a tantalising suggestion of a northward spread in parts of East Norfolk.

Aknowledgements

The County Plant Recorders thank all who have submitted records. The following abbreviations are used in Table 1:

BSBI	Botanical Society of Britain & Ireland
CH	Cornel Howells
ES	Emily Swan
FJR	Fred Rumsey
JG	Jonathan Graham
JMH	Jeremy Halls
JS	Jonathan Shanklin
MH	Martin Hammond
MPG	Mary Ghullam
NFG	Norfolk Flora Group
NNNS	Norfolk & Norwich Naturalists' Society
NSBG	Norfolk & Suffolk Bryology Group
PH	Phil Heath
PWL	Peter Lambley
RNC	Richard Carter
RWE	Bob Ellis
SH	Simon Harrap
SM	Sally McColl

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Fungi

Tony Leech

Fresh eyes – new species

Finding new fungi for the Norfolk list, now over 3250 species, is largely a matter of the right person being in the right place at the right time. Fresh eyes often notice species which although not nationally rare have escaped local attention. Yvonne Mynett, recently arrived from Lancashire, has drawn our attention to ***Flammulaster carpophila***, a small brown mushroom sprouting from beech fruits in leaf litter, finding it at Emily's Wood (TL7989) near Brandon. Later in the year it was also found at Brett's Wood, Thursford (TF9632). Yvonne enjoys the challenge of tiny agarics in leaf litter and has added ***Mycena polyadelpha***, on a dead oak leaf at Winterton (TG4920) and ***Hemimycena mauretanica*** on a cone scale at Sandringham (TF6929). A rather more showy find of Yvonne's was the delicate orange waxcap ***Hygrocybe coccineocrenata*** which she found, with Stephen Pinnington, at Catfield Fen (TG3721). Her final contribution was ***Lasiobelonium variegatum***, a small but very attractive fringed cup fungus on dead wood at Damgate Wood, Acle (TG4010).

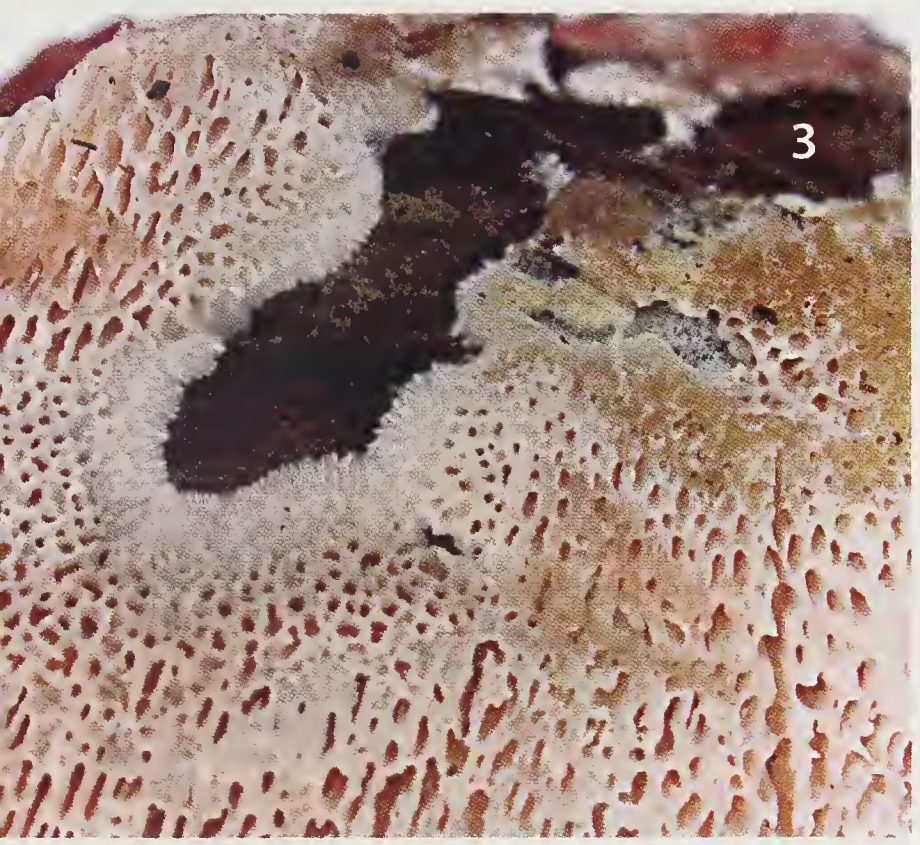
Neil Mahler, Suffolk County Fungus Recorder, is a frequent attender at Norfolk Fungus Study Group forays and has introduced us to ***Camarops polysperma***, known 'officially' as Thick Tarcrust but often referred to as the slug fungus from its long black appearance on the trunks of dead Alder trees. His first Norfolk recordfor this species was also at Catfield Fen (TG3721). This fungus, long considered rare, is now being recorded quite frequently in Britain. His second contribution to new Norfolk fungi in 2015 was the small bracket-like fungus ***Plicatura crispa*** at Mousehold Heath (TG2410) on a public foray and later at Winterton (TG4920). Finally, on a very productive December foray at Sandringham (TF6929), he found ***Postia placenta***, a soft pink encrusting bracket, on the cut end of a conifer log. In case you were wondering, 'placenta' is Latin for cake.

The largest new find of 2015 was probably ***Rubinoboletus rubinus***, a sturdy bolete with rose-pink pores and stem, collected by Niall Traynor (NWT) under oak in a remote part of the Hickling Broad reserve (TG4220). Much less impressive (but much rarer with fewer than eight national records) was ***Entoloma phaeocyathus*** found in bare sand (its preferred habitat) on dunes at Titchwell (TF7444) by TL who also recorded ***Inocybe aghardii***, a small brown fibrecap, under willows at Cranwich Pits (TL7795).

Adding new coprophilous fungi to the Norfolk list is made easier by the fact that few Norfolk mycologists have looked at herbivore dung. TL added ***Arnium leporinum*** from deer dung collected at Catfield Fen (TG3721) and ***Ascobolus elegans*** and ***Trichobolus zukalii*** from rabbit dung collected on a National Trust bioblitz at Blakeney (TG0344). Both are tiny cup fungi with the former having been recorded only eight times in Britain.

A star is born

Some of us get excited when a new fungus is added to the Norfolk list, and even more so when it is also new to Britain. But adding a 'new to science' is quite exceptional and although Norfolk can't quite claim that, Jonathan Revett played a significant part in the discovery of a new earthstar. In 2000, he collected what he described as a 'fleshy form of *Geastrum quadrifidum*' at Cockley Cley (TF7804). He sent specimens to the Royal Botanic Gardens Kew and to L. Jalink



Norfolk fungi

1 ***Flamulaster carpophila,*** Emily's Wood.

2. *Geastrum britannicum,* Lyng (col. Peter Lambley).

3. Postia placenta, Sandringham.

4. Crimped Gill *Plicatura crispa*, Winterton.

5. *Baranowskiella ehnstromii* (beetle) on ***Phellinopsis conchata,*** U.E.A. Photo: *Neil Mahler.* Photos**:** *Tony Leech unless otherwise stated.*

at Leiden but was assured that it was a known variant.Trevor Dove had also sent a specimen with similar characteristics,which he had collected at Surlingham (TG3107), to Kew in 2002, and in 2009 Don MacNeil found a similar earthstar at Rushford (TL9281), near Thetford.

In 2014, the Kew Fungarium was asked to submit three specimens of the Rayed Earthstar *G. quadrifidum* for a DNA sequencing study of European earthstars. They sent the three most recently acquired (including the Cockley Cley and Surlingham specimens) but when the results came back these three were identical but did not match any other European specimens of *G. quadrifidum*. This suggested that a new species was involved and careful examination revealed that all three were morphologically distinct from *G. quadrifidum*. Zamora *et al.* (2015) named the new species *Geastrum britannicum* and designated Jonathan Revett's CockleyCley specimen as holotype and Trevor Dove's Surlingham specimen as a paratype. These events and outcomes were described by Henrici (2015).

Geastrum britannicum has smaller spores (4-4.5 µm including ornament), lacks the pale 'saucer' round the peristome and has a spore sac which is typically broader than high. The first British record, recognised retrospectively, was from Abergavenny in 1995. Now that it has been described it is proving to be quite widespread and has been recorded from thirteen counties in England and Wales, with about half of the records coming from churchyards.

Europe's smallest beetle

In this story, the ptiliid beetle *Baranowskiella ehnstromi* is the principal, with the bracket fungus *Phellinopsis conchata* playing a supporting role. Andrew Duff had heard that this smallest beetle ever recorded from Europe had recently been found in France, Belgium, Denmark and Luxembourgand suspected that it might occur in Britain. As it had hitherto been found only in the fungus *Phellinus conchatus* (now known as *Phellinopsis conchata)* he contacted TL to see whether the fungus had been recorded in Norfolk. The bracket occurs mainly on willow but is generally uncommon, with only a handful of records from Norfolk. One of the most recent was from the grounds of the University of East Anglia to which Neil Mahler was able to take Andrew Duff in August 2015. Within minutes, the tiny beetle had been found in the pores of the fungus – for the first time in Britain. A few days later, James Emerson photographed an adult beetle and numerous larvae on a bracket of *P. conchata* taken from a willow at Whitlingham Marsh (TG2808). A full account of the beetle and its discovery has been given by Duff et al. (2015).

References

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Moths

Jim Wheeler

Table 1 gives a selection of notable records for 2015, including 12 species new for Norfolk plus nine new for Vice-county 28 (West Norfolk) and five new for Vice-county 27 (East Norfolk). The table also gives five species recorded in 2015 that were last listed in the county by C.G. Barrettin Victorian documents. Two further species new for Norfolk in 2014, omitted from the previous report, are included.

Details of the new Norfolk records

*Denotes macro-moths

Shining Smoke *Bacotia claustrella* New for Norfolk in 2014/15 when larval cases (originally incorrectly identified as Dahlica lichenella) were found along the Peddars Way in VC28 and bred out, with both male and female specimens emerging. (S. Youngs July 2015). Species also new for VC27 at Shotesham in 2015 (A. Musgrove 22 May 2015).

Sorrel Owlet *Scythris potentillella* New for Norfolk in 2014 when a larva collected at Landmere, East Wretham Heath (S. Beavan 18 May 2014) was confirmed by Professor T. Baran in Poland.

Mugwort Bell *Eucosma metzneriana* A recent colonist to Britain. The first record was from Cambridgeshire in 1977. New for Norfolk in 2015 at Weeting Heath (Ian Barton/Kathleen Rosewarne 25 June 2015).

Scarce Thorn Case-bearer *Coleophora trigeminella* New for Norfolk in 2015 when a male was taken at Dersingham (R. Jones, 28 June 2015; gen. det.).

Dotted-margin Smoke *Diplodoma laichartingella* New for Norfolk in 2015 when found on a wall in the toilets at Natural Surroundings, Bayfield (Ann Duff 30 June 2015). Male gen. det. by J. Clifton.

Orange-headed Tubic *Pseudatemelia josephinae* New for Norfolk 2015 when a male was recorded at Overstrand (G. Bond 30 June 2015). Gen. det. by J. Clifton.

Speckled Footman* *Coscinia cribraria* A rare and local species, confined to the heathland areas of southern Dorset. Occasional migrants of the continental subspecies *arenaria* also turn up in southern England. New for Norfolk in 2015 when a presumed migrant was recorded in east Norfolk at Ridlington VC27 (A. Mansfield, 3 July 2015).

Marbled Grass-veneer *Catoptria verellus* New for Norfolk 2015 when three specimens came to a light trap at Horsey on the same night (T. Hodge 6 July 2015).

Splendid Brocade* *Lacanobia splendens* First recorded as a migrant on mainland Britain in 2003. The species has since been recorded on a number of occasions, usually from southern coastal locations. New for Norfolk 2015 when recorded at Strumpshaw Fen (Ben Lewis, 10 July 2015). Also recorded at Eccles (N. Bowman, 11 &12 July 2015) and new for VC28 at Ickburgh (N. Tuck, 14 July 2015).

Scarce Striped Grass-veneer *Ancylolomia tentaculella* Very rare migrant mostly from the Kent or Essex coast.N ew for Norfolk in 2015 at Horsey (T. Hodge 19 July 2015) Gen. det. J. Clifton. The 5th British record.

Passenger* *Dysgonia algira* Rare migrant occurring in southern Europe and Africa; UK records from southern England, mostly in August - September. A peak

Moths new to Norfolk 2015

1. *Above:* **Speckled Footman** *Coscinia cribraria.*
Photo: *Anne Mansfield.*

2. *Left:* **Ruddy Streak** *Tachystola acroxantha*
Photo: *Rob Lee.*

3. *Right:* **African Sober** *Syncopacma polychromella.*
Photo: *Chris Knott*.

4. *Below:* **Passenger** *Dysgonia algira*.
Photo: *Mike McCarthy.*

Table 1. County and vice-county Norfolk records 2015 (listed by date recorded).

Date	Species	No.	VC	Locality	Recorder	Stage	Comment
12/03/2015	*Ypsolopha mucronella*	1	28	North Elmham	Dave Appleton	Adult	New VC28
12/03/2015	*Mompha miscella*	0	28	Ringstead Downs	Stewart Wright	Mine	Post-Vic Norfolk
16/04/2015	*Phaneta pauperana*	1	27	Cley	S. McElwee	Adult	New VC27
02/05/2015	*Rhopobota stagnana*	1	28	Weeting	Mark Hammond	Adult	Post-Vic Norfolk
11/05/2015	*Scythris potentillella*	4	27	Winterton	Bob Heckford, Stella Beavan	Larval	New VC27
11/05/2015	Golden Twin-spot *Chrysodeixis chalcites*	1	28	Ingoldisthorpe	Richard Bysouth	Adult	New VC28
16/05/2015	*Elachista subnigrella*	1	28	Grimes Graves	Bob Heckford, Stella Beavan (Female gen. det.)	Adult	Post-Vic Norfolk
22/05/2015	*Bacotia claustrella*	1	27	Shotesham	Andy Musgrove (F bred)	Larva	New VC27
27/05/2015	*Epinotia fraternana*	1	27	West Runton	Andrew Lawson	Adult	New VC27
30/05/2015	*Dichrorampha plumbagana*	1	27	Banham Hall	Ken Saul	Adult	New VC27
03/06/2015	*Lampronia morosa*	1	27	Hethersett	Stephen Youngs	Adult	Post -Vic Norfolk
20/06/2015	*Epiblema grandaevana*	1	28	East Wretham	Roger Ward, NMS (det. J Clifton)	Adult	New VC28
20/06/2015	*Coleophora badiipennella*	1	28	Methwold	Graham Geen	Adult	Post -Vic VC28
25/06/2015	*Eucosma metzneriana*	1	28	Weeting Heath	Ian Barton, Kathleen Rosewarne	Adult	New Norfolk
25/06/2015	*Carpatolechia fugitivella*	1	28	North Elmham	Dave Appleton	Adult	Post-Vic Norfolk
28/06/2015	*Coleophora trigeminella*	1	28	Dersingham	Dick Jones	Adult	New Norfolk
30/06/2015	*Diplodoma laichartingella*	1	27	Bayfield	Ann Duff (det. J Clifton)	Adult	New Norfolk
30/06/2015	*Pseudatemelia josephinae*	1	27	Overstrand	Greg Bond (det. J Clifton)	Adult	New Norfolk
03/07/2015	Speckled Footman *Coscinia cribraria*	1	27	Ridlington	Anne Mansfield	Adult	New Norfolk
06/07/2015	*Catoptria verellus*	3	27	Horsey	Tim Hodge	Adult	New Norfolk
10/07/2015	*Epinotia cinereana*	1	28	North Elmham	Dave Appleton	Adult	New VC28

Date	Species	No.	VC	Locality	Recorder	Stage	Comment
10/07/2015	Splendid Brocade *Lacanobia splendens*	1	27	Strumpshaw	Ben Lewis	Adult	New Norfolk
10/07/2015	*Vitula biviella*	1	27	Strumpshaw Fen	Ben Lewis	Adult	New Norfolk
11/07/2015	Splendid Brocade *Lacanobia splendens*	2	27	Eccles	Neil Bowman (2nd following night)	Adult	Norfolk 2nd & 3rd
12/07/2015	*Coleophora therinella*	1	28	Dersingham	Dick Jones	Adult	New VC28
14/07/2015	Splendid Brocade *Lacanobia splendens*	1	28	Ickburgh	Norman, Margery Tuck	Adult	New VC28
19/07/2015	*Ancylolomia tentaculella*	1	27	Horsey	Tim Hodge (det. J. Clifton)	Adult	New Norfolk
08/08/2015	The Passenger *Dysgonia algira*	1	27	Taverham	Mike McCarthy	Adult	New Norfolk
09/08/2015	*Clavigesta sylvestrana*	1	28	Dersingham	Dick Jones	Adult	New VC28
22/08/2015	*Apodia bifractella*	1	28	Dersingham	Dick Jones	Adult	Post-Vic VC28
30/09/2015	*Tachystola acroxantha*	1	27	Norwich	Rob Lee	Adult	New Norfolk
25/10/2015	*Coleophora solitariella*	0	28	Wayland Wood	Stewart Wright	Larval	New VC28
25/10/2015	*Coleophora artemisicolella*	0	28	East Wretham, Merton, Gasthorpe	Stewart Wright	Larval	New VC28 (?)
19/12/2015	*Syncopacma polychromella*	1	28	Great Ellingham	Chris Knott	Adult	New Norfolk

year occurred in 2006 when 12 specimens were recorded. Trapped at Taverham (M. McCarthy, 8 August 2015) The 27th UK record (Atropos).

Ruddy Streak *Tachystola acroxantha* New for Norfolk 2015, found hiding by day in a stack of bricks in central Norwich (R. Lee 30 September 2015). Originally imported with Australian plants to Devon 1908, it has since expanded its range rapidly and is quite common in some areas, especially along the south coast.

African Sober *Syncopacma polychromella* Until recently, only a handful of UK records of this migrant species existed from the south and south-west of Britain, mostly in May and June. 2015 ended with an unusual influx throughout the UK during December, but only the one record from Norfolk (C. Knott, 19 December 2015).

Full details and photos of these and all other records can be found on the Norfolk Moths Website www.norfolkmoths.co.uk, along with various methods to submit your own records if you have not yet done so.

Jim Wheeler Iveygreen, Town Street, Upwell, Wisbech PE14 9AD.

See also:

New species of moth for Dersingham ***R.E.Jones*** p. 45.

Orthoptera

David Richmond

I am grateful to Dr Stuart Newson, Senior Research Ecologist at the British Trust for Ornithology, for sharing his analysis of bush-cricket recordings, incidentally captured by volunteers taking part in the Norfolk Bat Survey during 2013-15.

That project has researched every 10km square in the county, using bat detectors left out over night to record sonograms of bats and a significant by-catch of bush-cricket stridulations.

Dark Bush-cricket *Pholidoptera griseoaptera* and **Speckled Bush-cricket** *Leptophyes punctatissima* were the most frequently recorded orthopterans and their distributions, as reported from the Norfolk Bat Survey data, correlate well with the long-term data reported by orthoptera recorders in the county (Figs. 1 & 2).

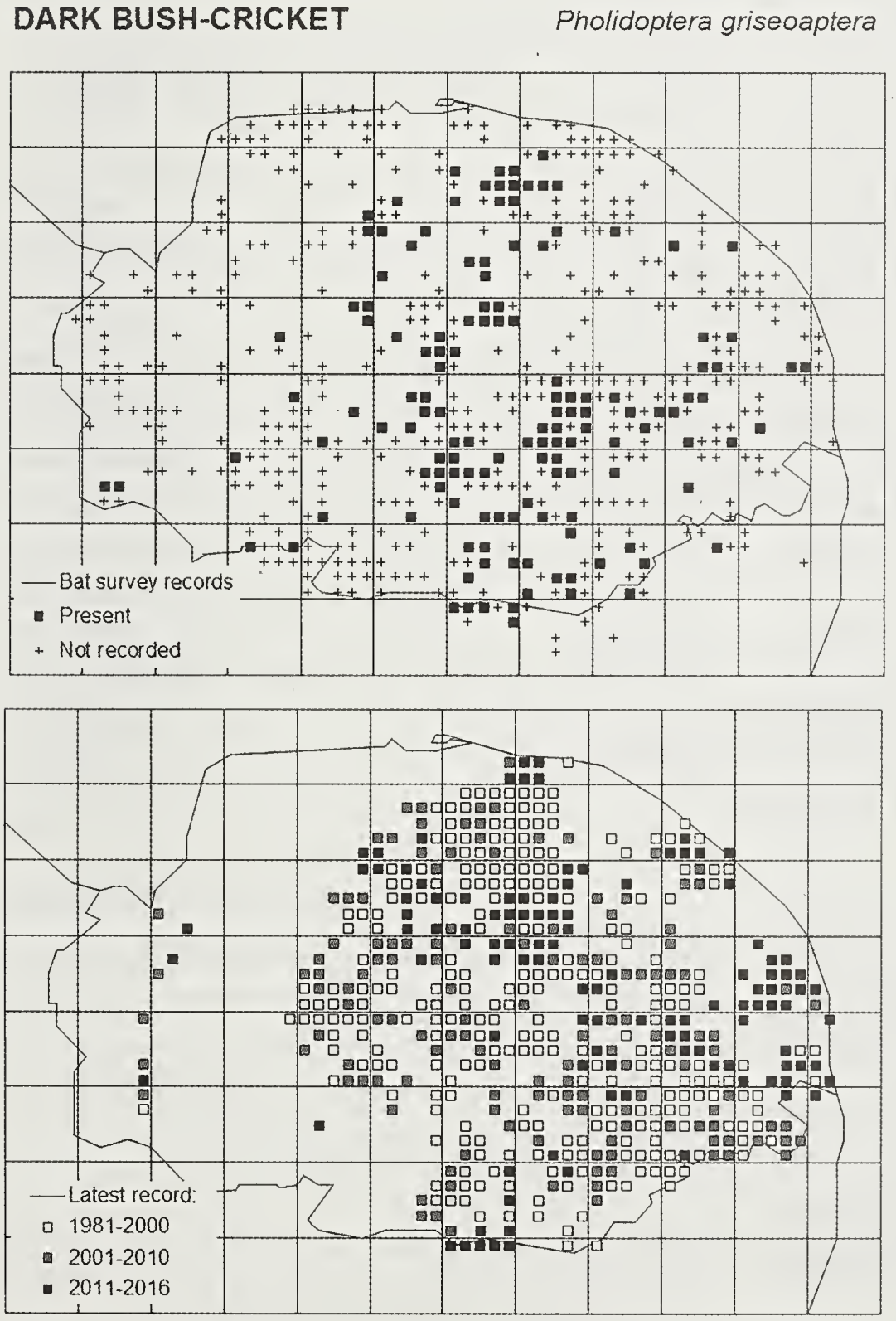
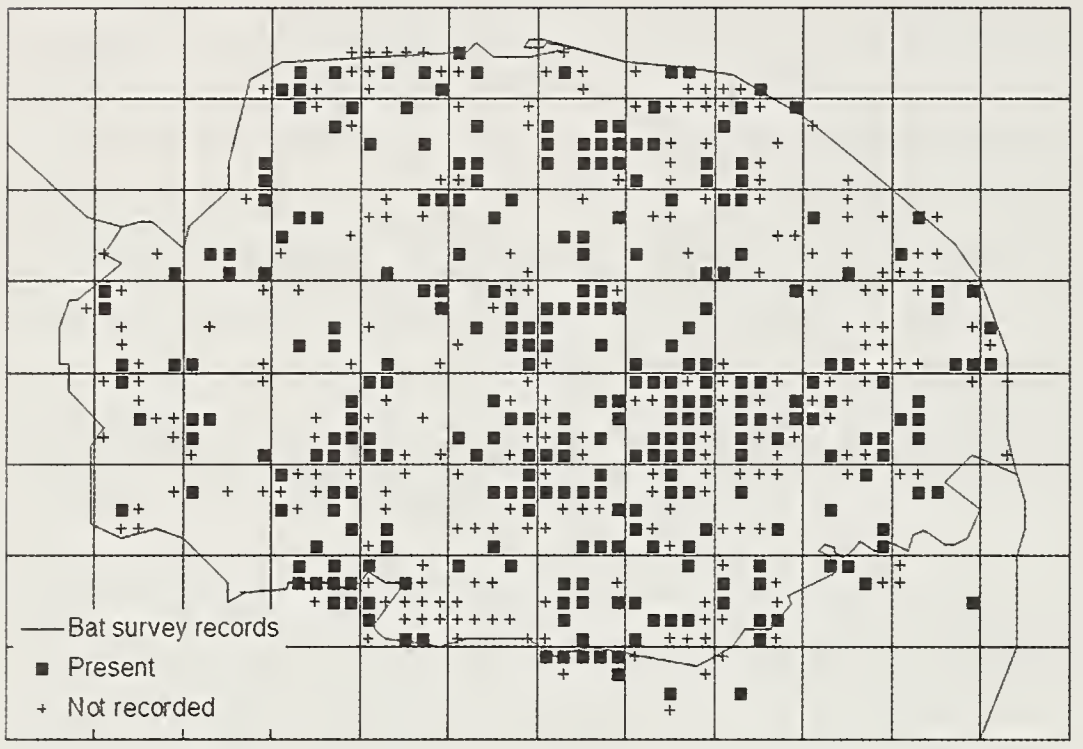


Figure 1. Comparison of incidental records for Dark Bush-cricket from Norfolk Bat Survey *(upper)* with distribution maps from Norfolk orthoptera recording scheme *(lower)*.

In particular, the apparent absence of Dark Bush-cricket from much of the west of the county, as reported by orthopterists, is reflected in the absence of records from this area in the bat survey data. The bat survey did identify new sites for Dark Bush-cricket at Welney, which tie in with the orthopterists' knowledge of sites along the Great Ouse, plus a scattering of new sites along the south-western boundary of the known range.

Significantly, the bat survey analyses did identify the known populations of Speckled Bush-cricket in the west of the county giving us confidence in the methodology.

The bat survey data were also analysed for evidence of **Great Green Bush-cricket** *Tettigonia viridissima*. The recordings successfully logged the known colonies at Reedham, but also identified a possible new site at Mautby (TG4610), where



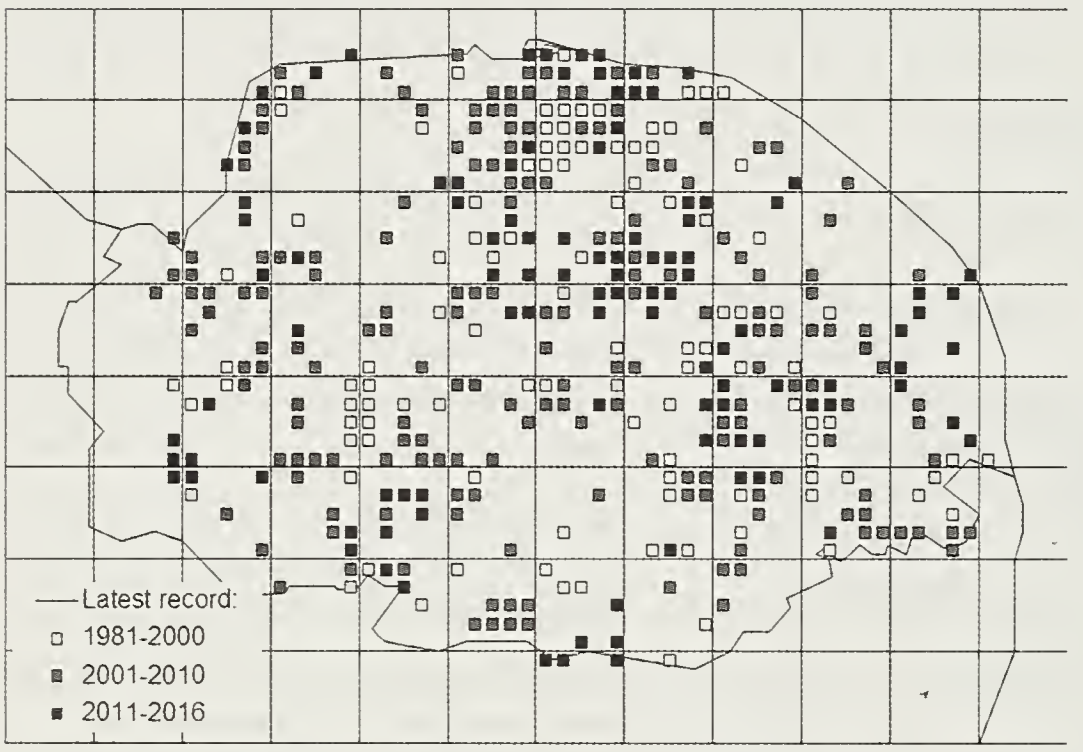


Figure 1. Comparison of incidental records for Speckled Bush-cricket from Norfolk Bat Survey *(upper)* with distribution maps from Norfolk orthoptera recording scheme *(lower)*.

stridulations were recorded at three locations in 2014, but unfortunately these were not picked up in the following year. Further research is needed here.

Late dates

Two species of grasshopper and six species of bush-crickets survived into November 2015.

Field Grasshopper and **Bog Bush-cricket** persisted until at least 5 November at Buxton Heath and **Dark Bush-cricket** to 11 November at Reepham. **Roesel's Bush-cricket** and **Long** and **Short-winged Coneheads** were heard by the author at Titchwell on 12 November, while Andy Bloomfied had a **Mottled Grasshopper** at Holme Dunes on 15 November. The author's last **Speckled Bush-cricket** was heard at Reepham on 20 November before stormy weather with wintery showers and light snow brought the season to a close the following day.

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Wildlife Report 2015

Butterflies

Andy Brazil

Nationally the year was ranked 30th out of the 40 years for which we have comparable records. Flight periods were mostly shorter than usual; species emerged later and finished sooner. However the exceptionally mild weather at the end of the year resulted in the flight periods of autumn species continuing longer, with some exceptionally late records.

We received 17,581 records (16,159) covering 706 tetrads (573) and representing 6,285 site reports (5,512)[1]. As usual I have not included the data from the Big Butterfly Count in this analysis, as it would prevent results being comparable to previous years.

Because some recorders were concentrating on un-surveyed areas, results are not strictly comparable. I have therefore given the number of new tetrads for species, where they had not been recorded previously within the current recording period 2011-2019. In total, 143 tetrads were visited for the first time this year, bringing surveyed tetrads to 1,061 (out of 1,444 total). I have also included some details from the preliminary analysis of the national results.

Resident species

Grizzled Skipper ***Pyrgus malvae*** Although it was recorded from just 6 tetrads (7), no records were received from Leziate/ Bawsey, where access has been difficult. As well as records from Foulden Common and the Cut-Off Channel, there was a single sighting near East Harling, a new site that suggests that there are still undiscovered colonies to be found. Highest count was 13 (29) at the Channel on 17 May, seen between 22 April (14/4) [Many] and 30 May with a single late sighting 10 June [KF] (21/6).

Dingy Skipper ***Erynnis tages*** Recorded from 16 tetrads (15). The one new square represents an existing colony drifting into an adjacent square. Earliest sighting 1 May [SH] (23/4), last 11 June [SP](21/6). Highest count 12 (46). As above no Leziate records, but the Lynford site produced sightings again after its discovery last year. Also seen at Narborough, Cranwich and Grimes Graves. I suspect that rides in Forestry Commission woods west of Bodney and east of Foulden represent the best hope of finding new colonies.

Large Skipper ***Ochlodes sylvanus*** First seen on 4 June [Many] (13/5) until 21 August [PT] (20/8). Recorded from 113 tetrads (131), of which 38 were new. Highest counts were 'C' (40). A poor year for all skippers I think.

Small Skipper ***Thymelicus sylvestris*** Recorded from 134 Tetrads (137), of which 48 were new. First sighting 23 May [NT] was an outlier, next seen 6 June (9/6), last 28 August [Many] (15/8). Highest counts were 'D' (60).

Essex Skipper ***Thymelicus lineola*** Recorded from 60 Tetrads (75), 26 new. First sighting 24 June [JM] (12/6), but then not recorded until 5 July. Then until 22 August [AR] (21/8). Highest count 31(103).

Swallowtail ***Papilio machaon britannicus*** First seen 13 May [Many] (13/5), then regular until 6 July. There were then just five reports between 16 July until

1 In this report, where I give figures the following figure in brackets is the comparable 2014 result, while the initials in braces are the recorder –unless several reports were received on the same day, where I just show [Many]. Refer to the list of recorders for details. Since records have arrived after publication, 2014 figures given may be larger than those given in the 2014 Butterfly Report.

15 August [GH] (9/8). Recorded from 17 tetrads (21), but three new. A poor year for records, and a poor year for the species. Certainly a very poor second brood. Transects recorded a 65% drop from 2014.

Brimstone *Gonepteryx rhamni* First seen 17 February [SP] (16/2), but that was an outlier, main emergence was 1 March. Last an astonishing 17 December [GH] (28/10). Recorded from 219 tetrads (242). Nationally it recorded its best year ever, but this was not true locally I think.

Large White *Pieris brassicae* First seen on 10 March [AH] (7/3), but then not again until 8 April. Last on 1 November [SP] (30/10), recorded from 289 tetrads (301), 100 new. The usual records of summer migration returned this year. From 21/7 until 7/8 there were several reports of movements in off the sea, and counts of 'hundreds' from coastal locations. Inland counts in gardens also spiked during the first week of August, although this might be local emergence. Nationally it showed a 59% increase from 2014, again not mirrored locally.

Small White *Pieris rapae* First seen 24 March [AF] (16/3) until 9 October [BYA] (16/10). Recorded from 251 tetrads (258), 87 new. Highest count 100+ (58) on 23 July might reflect migration.

Green-veined White *Pieris napi* 205 (259) tetrads, 69 new. 9 April [Many] (1/4) till 9 October [PD](30/9). Nationally down 40% on 2014.

Orangetip *Anthocharis cardamines* Emergence began on 21March [FJ] (21/3), Last seen on 30 June [MR] (21/6) Recorded from 212 tetrads (218), 82 new.

Small Copper *Lycaena phlaeas* Recorded 95 tetrads (116), 28 new. First 17 April [AT] (30/3) last a remarkable 26 November [AM] (4/11). That was exceptional; regular sightings ended around the 3 November, with just one other on the 12 November. Highest count 20 (16). Nationally it recorded its worst year ever, down 24% on 2014.

Holly Blue *Celastrina argiolus* Recorded from 166 tetrads (113) of which 64 were new. First 13 March [AH](16/3) was an outlier, not then reported until 10 April. Last seen 6 November [CM] (3/10). Populations continue to recover, with good numbers. One of the few species to do better this year than last.

Common Blue *Polyommatus icarus* First 22 April [SP] (4/5) Last 3 October [Many] (7/10). Recorded from 148 tetrads (156); 51 were new.

Chalkhill Blue *Polyommatus coridon* Recorded from 3 tetrads (4) This represents two sites: Warham, and Ringstead Downs; plus a single sighting from Titchwell that must represent a stray male from Ringstead. We must now assume that a small colony exists at Ringstead, but as yet in fairly low numbers. First seen 15 July [CG](7/7), last 21 August [Many](23/8). The BC annual count at Warham this year was 2,239, slightly lower than last year's 2,765.

Silver-studded Blue *Plebejus argus* First seen 12 June [MPG](6/6), last 9 August [HG](17/8). This was an outlier, other reports ended 21 July. Highest count 303 (324) from Kelling Heath.

Brown Argus *Aricia agestis* First seen 10 May [AM](15/4), then regular to 7 June. Second brood 27 June to 10 September, and then a small third brood seen 8 October to 1 November [AB&MC](4/10). Recorded from 41 tetrads (61), of which 12 were new.

Green Hairstreak *Callophrys rubi* First seen 17 April [Many] (13/4) then almost daily until 15 June. Then seen 25, 30 and last 3 July [KF](18/6). Highest count 10(13). Recorded from 28 tetrads (33) but 6 were new.

Purple Hairstreak *Favonius quercus* Recorded from 30 tetrads (31) of which 14 were new. First 9 July [Many] (20/6), last 3 September [PH] (24/8). This is a species where the flight period is quite variable, but this was a noticeable shift. Highest count was 'C'(6). Still very under-recorded. (The date of first sighting given in the 2014 Report was a data entry error, the actual first sighting was not until 20 June 2014 [MC&AB])

White-letter Hairstreak *Satyrium w-album* Recorded from 20 tetrads (19) of which 15 were new. This has to be the hardest butterfly to see in Norfolk, it seems to just pop up unexpectedly in many places, never to be seen again. Holkham again produced the most sightings, and remains the best location to start if you've never seen it. First seen 3 July [MH] (20/6) last 10 August [Many] (4/8). Again a late start to the season; this and the previous species overwinter as eggs, so they had to do all their growing in a cold spring, while species that overwinter as a larva (and so had done some growth in 2014's warmer autumn) were much closer to 'normal' dates. Nationally down 12% from 2014. This species has declined 97% since 1976.

White Admiral *Limenitis camilla* Recorded from 51 tetrads (47) of which 15 were new. First 26 June [BC](13/6), last 17 August [TD](4/8) Highest count 40(22). No second brood, but another species that did better than last year. New tetrads do seem to represent expansion rather than discovery, as at least some new records were from well surveyed tetrads.

Red Admiral *Vanessa atalanta* This year we received just under 200 records from an online survey run by the NWT. As such, records are not strictly comparable to a normal year. Recorded from 321 tetrads (321) but 99 were new. First seen 9 January [AB&MC](8/1), but that and two others on 18 February and 7 March were anomalies; it wasn't until 23 March that it began to be seen regularly. Again the last sightings on 29 December [Many](26/12) were a reflection of that day's weather. Regular sightings however continued to 20 November and there were six December records. Highest counts at Blakeney Point and Scolt Head on 30 June and 1 July were probably migration (200+), but it was not large and tailed off rapidly; Blakeney Point had under 30 in total by the 2 July for example. Overall a poor year.

Small Tortoiseshell *Aglais urticae* First 9 February [MG](13/1), Last 7 December[MHa](4/11). Sightings peaked early April and early July, but were continuous from 27 February to 11 November. Recorded from 273 tetrads (376) of which 69 were new. Highest count 70 (148) on 9 July from Wells was possibly migration, but no significant influx.

Peacock *Aglais io* First 4 January [AB&MC] (4/1), last 29 December [BCo](23/12). Main emergence from hibernation was 5 April, that brood till 17 June. New brood emerged 5 July and continued till late September, then a late cluster of sightings from 19 October onwards which might be hibernators tempted out or just individuals late to bed. I thought it did poorly this year, and nationally it recorded a 45% fall from 2014. Given the lack of caterpillars seen I wonder if egg parasites are to blame for declines? Recorded from 311 tetrads (564) of which 87 were new. Highest count 80 (109).

Painted Lady *Vanessa cardui* Records include sightings submitted to national BC's migrant watch website. The first sightings, 13April [JB] and 20 April were followed by regular sightings from 8 May (21/5) to 1 November [DPW]. Recorded from 230 tetrads (147). In the end there was no major migration this year, despite the species having a good brood in Africa

at the start of the year. Only one specific report of noticeable migration, on the north coast on 17 June, but there was an increase in sightings over 2014.

Comma *Polygonia c-album* Reported from 211 tetrads (222), of which 61 new. First 4 March [AR]. Charting the reports shows a strange pattern. Based on sightings I would say hibernators mainly over 20 May, first brood 26 June until 29 August, then a second brood 10 September till 14 October with stragglers then seen until last report 16 December [AB&MC](3/12) This would suggest the two broods were three to four weeks later than usual, a phenomenal shift.

Dark Green Fritillary *Argynnis aglaja* Recorded from 12 tetrads (13) but 3 were new and inland. The colonies at Horsey/Winterton and the north coast between Scolt Head and Blakeney Point were joined this year by reports from no fewer than 3 tetrads in the Beachamwell area, and it is clear that we now have an inland colony (or colonies) in the Brecks. Certainly it is unsafe to just assume that any woodland fritillary seen is Silver-washed. First seen 22 June [i](8/6), Last 9 August [AMa](24/8). Highest count of 61(112) on 11 July at Horsey [PT]. Numbers on the north coast remain low.

Silver-washed Fritillary *Argynnis paphia* Recorded from 25 Tetrads (19) of which 16 were new to this period. The species continues to spread, with first records from Reffley wood and Narborough railway line notable, as well as three sightings in Norwich, and a count of 40 from Marsham Heath. First seen 29 June [i] (21/7), Last seen 30th August [ATi] (12/8)

Speckled Wood *Pararge aegeria* Recorded from 226 tetrads (284), 60 new. First sighting 13 March [MC](30/4), Last 26 October [MC] (24/11).

Wall Brown *Lasiommata megera* Recorded from 52 tetrads (79), 18 new. First seen 4 May [LBo](22/4), that brood ended 16 June. Second 31 July to 6 September, [MG] (12/10) Interestingly, no sign of a third brood. Given the theory that declines are caused by an incomplete, failed third brood this might suggest that 2016 will be better for this species. Nationally declined by 44% over 2014, and 87% since 1976. Declines are even worse on the continent and, if the research is correct, this may be the first butterfly to go extinct in England due to climate change.

Grayling *Hipparchia semele* First 1 July [PN](20/7) Last 10 September [Many] (12/9). Recorded from 20 tetrads (25), 3 new, of which 2 in the Brecks. Nationally declined 38% from last year, but the Winterton population here seemed healthy with several recorders reporting 100+. At Blakeney however only four records got into double figures.

Gatekeeper *Pyronia tithonus* First 16 June [Many](8/6), until 16 September [MCl] (5/9). Recorded from 243 tetrads (234), 83 new.

Meadow Brown *Maniola jurtina* First 30 May [IT](20/5), until 4 October [BO](10/9). That was an outlier; the main sequence ended 12 September. Recorded from 289 tetrads (288), 80 new.

Ringlet *Aphantopus hyperantus* First 15 June [JM](7/6) Last 1 September [AH] (18/8) was an outlier, otherwise sightings ended 23 August. Recorded from 229 tetrads (228), 61 new.

Small Heath *Coenonympha pamphilus* First reports 10 May [JGD](5/5) until 8 October [PMG](7/10). Recorded from 55 tetrads (44), 19 new. Strongholds are the coast and Brecks, with only 18 tetrads away from those areas.

Incidentals and migrants

Clouded Yellow *Colias croceus* First report 14 April [ABu] (14/5) and 17 April, then

14 July till 13 September [AC] (6/11). Recorded from 13 tetrads (47). A better year than last, but not outstanding.

Yellow-Legged Tortoiseshell ***Nymphalis xanthomelas*** Two reports of overwintering individuals emerging: Holt Country Park on March 12 [WF] and Holme, March 23 [LB]. No adults were seen in the summer in the UK, and only a few in the Netherlands. It was seen in good numbers in Denmark in the spring, and many larval webs were reported, but strangely very few adults. It does hibernate very soon after emergence however, so newly emerged individuals are hard to spot. We will just have to wait and see if we get a repeat of the 2014 invasion, but it may be some years yet.

Purple Emperor ***Apatura iris*** Two good reports received: Swannington Upgate Common 22 July [SL] and North Lopham, 27 July [LC]. This is a species which seems to be expanding into the eastern counties at present, with a number of new records from Cambridgeshire and Suffolk. Given its strong flight and tendency to wander I would not be surprised at more records in coming years.

Queen Of Spain Fritillary ***Issoria lathonia*** An individual photographed at private land in Fritton Lake Country Park on 18 & 19 July [RF] is the third record this century for the county.

Zebra Longwing ***Heliconius charithonia*** Astonishingly no fewer than four reports of free-flying individuals were received this summer, two in Norfolk and two in Suffolk. Our two were seen in Roughton, near Cromer on the 22 August (TM) and then in Garboldisham on the 23 (TW). This raises the interesting question of whether they were two separate individuals, or the same insect. Since they're known to migrate from Mexico to Texas, popping across Norfolk in a day might be feasible. If we add the two sightings from Suffolk however, it seems more likely that a mass escape from a butterfly house is the source.

Map ***Araschnia levana*** An individual of this species was found by I Rix on 28 September at the entrance to Pentney Park caravan Site. Resourcefully, he spotted a newly-arrived camper van with Dutch plates in the park, and on enquiry was told that: yes, they had found a butterfly in the van that morning which they had let out of the window. So we must presume that our Map had crossed by Eurotunnel, possibly the first butterfly ever to arrive under the channel instead of over it!

Acknowledgements

It just remains for me to thank all the recorders who submitted data this year. Their records will now go forward to the national database, to be used in research, conservation and the production of the next national atlas. Without their time and effort none of this would be possible.

G Albon, C Allen, G Allen, B & Y Anderson [BYA], K Antcliffe, M Arber, A Archer, D Arthur, M Attenborough, D Austin, D Balcombe, G Baldock, L Ballantine, H Bannister, T Barker, S Barnett, J Barrett, D Bearfield, D Beckley, T Bennett, S Berry, K Betts, S Betts, H Birley, A Blackham, J Blofield, J Boulter, L Bovey, J Bows[JB], S Box, B Boyle, L Boys, K Bradbury, J Brandish, A Brazil, H & K Breach, K Brett, A Brewster, B Bridge, A Brown[AB], D Brown, L Brown[LB], P Brown, R Brunton, S Bryan, K Buck, J Bull, Z Burbridge, A Burkin[ABu], C Burt, R Bushell, S Cain, M Callow, M Campbell, A Cannon, B Carman, M Casey [MC], M Christmas, S Clark, A Clarke, J Clarke, K & M Claydon, M Clements[MCl], P Cobb, B Cobbold[BCo], W Cockerell, B Cole[BC], M Colegate, I Colman, P Colston, W Connell, A Cook, L Cook [LC], N Cooke, L Cooper, L Cootes, T Corcoran, P Corley, C Crawford, A Culshaw[AC], J Daltry, M Daniels, A Davis, A Dawson, K Dearing, L Demaine, S Dent, S Dickinson, L Dolan, T

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Records were also received from BADCOG, Birdguides, Bug Alert, Gaywood Valley Conservation Group, NBIS, Norfolk Bryophyte Group, Norfolk Flora Group, Norfolk Wildlife Trust, and Rare Bird Alert, and taken from various internet forums (shown as i in the text above)

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Wildlife Report 2015

Terrestrial Heteroptera

Rob Coleman

Even entomologists call insects 'bugs' so a group as specific as 'terrestrial heteroptera' deserves a short introduction.

The true bugs (hemiptera) are one of the major groups of insects found in the UK and are represented here by nearly 2000 species. Heteroptera is a suborder of hemiptera and includes shieldbugs and squashbugs, ground bugs, stilt bugs, assassin bugs, damsel bugs, lacebugs, plant bugs and all the water bugs. Two further sub-orders of hemiptera occur in Britain; the auchenorrhyncha (leafhoppers, planthoppers, froghoppers, treehoppers & cicadas) and the sternorrhyncha (which includes the psyllids, aphids, whiteflies and scale insects, amongst others). County recorders dealing with hemiptera are:

Heteroptera: Rob Coleman

Auchenorrhyncha: Colin Lucas

Sternorrhyncha: JIT Thacker

All aquatic invertebrates, including hemiptera: Dan Hoare

Terrestrial heteroptera are covered by two national recording schemes: the Shieldbugs and Allies Recording Scheme (63 species); and the Plant Bugs and Allies Recording Scheme (425 species). An up-to-date checklist can be found on the 'British Bugs' website (Bantock 2016).

I took on the role of county recorder for terrestrial heteroptera in 2013, foolishly thinking that a group comprising around 500 species would be a fairly manageable number! Hemiptera in general have been rather poorly recorded (even when compared with less well-studied groups such as flies and beetles). In Norfolk, much of the prior work on this group was by Ken Durrant, who published an illustrated synopsis of the county fauna (Durrant 2002-2005). These accounts contain species descriptions and useful ecological information, although there have been a number of nomenclature changes in recent times.

I have been compiling records to obtain baseline data, but the production of a useful county list is still a little way off. Many species are exhibiting fairly spectacular range expansion, which adds to the interest of the group but also makes the overall picture somewhat fluid.

When I started work in 2013, there were around 2000 records of terrestrial heteroptera on the NBIS database of 265 species. There are currently approaching 6000 Norfolk records of 327 species; partly through efforts in extracting records from national and recently digitised sources and partly from a recent surge in interest, with a number of new and existing recorders making excellent contributions in terms of both quantity and quality of records. My thanks go to all recorders who have sent me records over the past three years, and also to recorders entering bug data on iRecord (over 800 records from this source to date).

Ryan (2014) includes Norfolk in his paper on the county distributions of hempitera-heteroptera. These lists are an up-date of the work of Massee (1955) with additional records sourced from publications in the national entomological literature over the intervening years. More recently, the same author has produced a Norfolk list divided by vice-county incorporating some extra data which are currently unavailable digitally (Ryan, unpublished). This list includes 337 terrestrial species in the county. Omitted are records that could not

be assigned a vice-county location and more locally published records (in particular records published in *Transactions*). A more complete article presenting an updated list divided by vice-county and incorporating the new Norfolk data I have compiled is due for publication in January (Ryan 2016, pers. comm.). Following this publication I intend to summarise the current information in a *Transactions* article which will present a provisional county list, similar to Tim Strudwick's paper which covers Norfolk's bees (Strudwick 2011).

In the meantime, I would encourage any entomologists who have hemiptera records to submit them through the usual channels.

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Lichens

Peter Lambley

It has been a productive two years in the study of lichens in the county with new species being recorded and changes in the distribution of others being noted.

Changes in the types of atmospheric pollution over the last few decades are reflected in the lichen flora of trees. In the 1960s and 70s sulphur dioxide levels were high in East Anglia, largely coming from outside the area. Since then the balance and composition has shifted to high nitrogen levels in the atmosphere in the form of ammonia and nitrogen oxides from sources in agriculture and traffic. Hence the predominance of yellow species, notably *Xanthoria parietina* and those coloured grey, especially *Physcia adscendens* and *P. tenella*, which now clothe garden shrubs and roadside trees, whilst the once common *Lecanora conizaeoides*, which thrived in high SO_2 levels, has become uncommon.

Visits to sites such as Shadwell Park near Thetford in 2016, previously visited in 1972, show the loss of the acid-loving species such as *Cetraria glauca* and *Tuckermanopsis chlorophylla*. However it was interesting that in 2016 *Cetraria glauca* was still to be found in the middle of the Stanford Training Area and also at Ling Heath near King's Lynn, both areas where nitrogen levels appear to be low. Two species which have experienced catastrophic declines in the last few decades, probably as a result of the changing air pollution regime, *Pleurosticta acetabulum* and *Physconia distorta*, were found in 2015 and 2016 respectively at Kimberley Park and in the Stanford Training Area. Other species appear to be expanding their range, for example *Candelaria concolor* now appears in a variety of sites, including those close to pig farms, but also on trees in the canopy, as at Upton Broad.

The Brecklands were formerly important for a group of terrestrial lichens which have likewise declined catastrophically probably as a result of atmospheric deposition of nitrogen compounds which may act in two ways, by either damaging the lichens directly or by encouraging the growth of some bryophytes and vascular plants reducing the amount of bare ground. However *Psora decipiens* and *Toninia sediifolia* still just hang on in a pit at Weeting Heath and were confirmed still present in 2015. In the east, the lichen communities on acid dunes at Winterton do not appear to be affected. An important find there was *Cladonia uncialis* ssp. *uncialis*, a species which looks rather like a hedgehog. It is one of a number of species with a boreal distribution which has been found in recent years, the most notable, of which is *Cladonia rangifera* at Horsey. This is the true reindeer lichen and was found by Neil Sanderson on a visit from Hampshire in 2014.

Churchyards remain a rich hunting ground for lichens in the county; with about 650 medieval churches they continue to spring surprises. Two Fenland churches were visited by myself and fellow lichenologists Mark Powell and Ivan Pedley in the spring of 2015: Walpole St Peter and Walpole St Andrew. Walpole St Peter proved particularly rich with about 90 species recorded including three new to the county: *Verrucaria obfuscens*, *V. ochrostoma* and *Rinodina calcarea*. There was also a second record for *Petractis clausa*, previously known from one pebble on Weeting Heath. This visit was followed up with visits to Upwell and Outwell churches in 2016. At Upwell, *Psorotichia schaereri* was found and subsequently also at Hunstanton Church. Previously it was known only from the

ruins of the old Kimberley Hall. Other lichens of interest include a puzzling species of *Lepraria* which has now been identified as *Lepraria crassissima,* which was covering the face of a sandstone headstone at Deopham Church. The monument at Holkham proved to have an interesting range of lichens on acid stone including *Caloplaca crenularia* which has blood red fruits. A common species on acid rocks in the north and west but it is rare in East Anglia. Other species are recorded for the first time because they have been over looked. *Lecanora horiza* is such an example; previously it was included by recorders under *Lecanora campestris*. Similarly, *Verrucaria calciseda* can now be separated from *V. baldensis*. Almost every churchyard yields at least one puzzling species, so it is almost certain that there are many more discoveries yet to be made.

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The Norfolk & Norwich Naturalists' Society has as a principal aim the investigation and recording of Norfolk's wildlife and to this end it publishes:

- An annual volume of *Transactions*, consisting of papers and notes on wildlife in the county.
- The *Norfolk Bird and Mammal Report* which contains systematic lists of observations on the county's birds and mammals, as well as relevant articles.
- *The Norfolk Natterjack*, a quarterly illustrated newsletter.

All of these publications are free to members, as are *Occasional Publications* on specific topics.

The Society also arranges lectures and field meetings which are planned to appeal to anyone interested in natural history. More specialist groups cover many aspects of the county's flora and fauna.

The subscription rate is £20 per year, which includes all members of a family living at the same address.

Membership enquiries should be made to: Jim Froud, Westward Ho, 4 Kingsley Road, Norwich NR1 3RB. jim @froud.org.uk. All other enquiries should be directed to the Secretary, Nick Owens, 22 Springfield Close, Weybourne, Holt, Norfolk NR25 7TB. Tel: 01263 588410.

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Cover photo: Buddle *Glebionis segetum*. See Presidential Address. *Photo:* Jo Parmenter