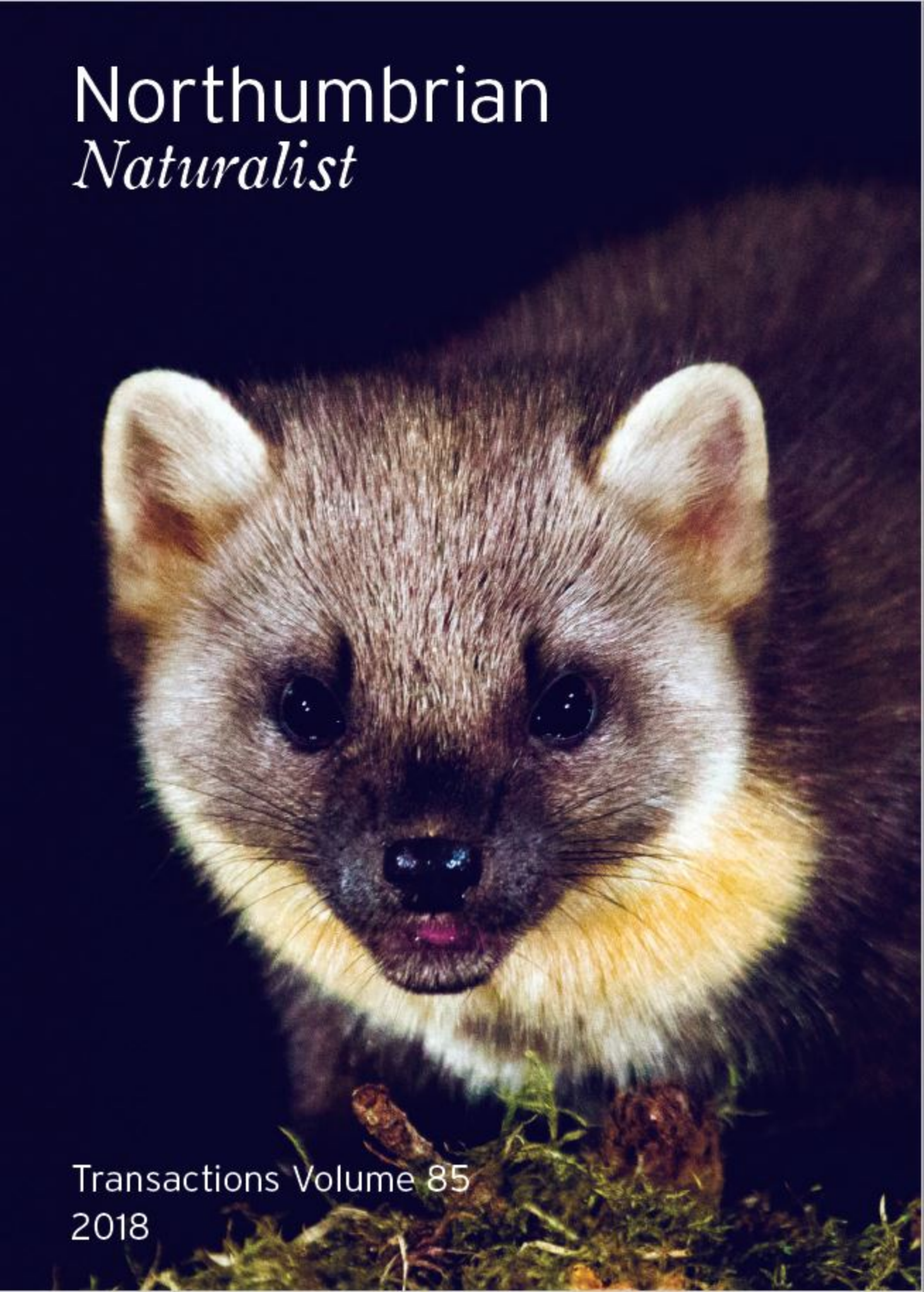
Northumbrian *Naturalist*



Transactions Volume 85
2018

Northumbrian *Naturalist*

Volume 85

The Natural History Society of Northumbria
Great North Museum: Hancock
Newcastle upon Tyne NE2 4PT
www.nhsn.ncl.ac.uk

Front cover:
Pine Marten by Cain Scrimgeour ©
www.wildintrigue.co.uk

ISSN 2050-4128

Published by the Natural History Society of Northumbria, as volume 85 of its *Transactions*.

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Produced by bpd: www.bpduk.biz
Printed by Aztec Colour Print, Washington, Tyne and Wear NE37 2SG

CONTENTS

Natural History Society of Northumbria

CHANGES IN THE MOTH FAUNA OF RIDING MILL OVER THE LAST 50 YEARS

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SUMMARY

A comparison is made between the macro moths recorded in a garden at Riding Mill, Northumberland over the last 10 or so years with those recorded in the same village 50 years earlier. The changes described strongly reflect local, county and national trends.

INTRODUCTION

In 1962 F W Gardner published an article in the *Entomologist's Gazette* describing the macro *Lepidoptera* he had recorded in Northumberland (Gardner 1962). This article consolidated information he had published in the 'Records' section of *The Vasculum* (Gardner 1945-1966). The majority of his records relate to species he encountered in Riding Mill, where he resided between 1937 and the mid-1960s. All these, and his subsequent records from *The Vasculum,* were included in '*The Moths and Butterflies of Northumberland and Durham*' (Dunn and Parrack 1986) and incorporated in the database of information held on the '*Northumberland Moths*' website maintained by the County Recorder Tom Tams (Tams 2017). The authors of the current article were initially unaware of this information when they started recording moths in their own garden in Riding Mill in 2004 but subsequently were able to use Gardner's information to make a comparison with their own records and therefore assess changes to the macro moth fauna of Riding Mill over the last 50 or so years.

METHODS

Field work

In July 2004 the authors started trapping moths in their garden at 5 Oaklands in Riding Mill (NZ018612; latitude 54.945455°, longitude -1.973431°). Initially, a Skinner trap with a 15W Actinic tube was used, but replaced with a Robinson trap (125W) from 2006 onwards. For the first four years, trapping was sporadic and predominantly in the summer months but from August 2008 recording was usually on a weekly basis. Species of macro moth were identified using '*Field guide to the moths of Great Britain and Ireland*' (Waring and Townshend 2003) and when necessary confirmed by the County Recorder Tom Tams. Prior to March 2009, only moth species caught were recorded, but subsequently the number of individuals of each species were also recorded.

Oaklands and the Gardner site are both rural gardens adjacent to mature woodland, situated approximately half a kilometre apart in the village of Riding Mill and,

superficially at least, very similar in character. To address concerns that a direct comparison of data from Oaklands with Gardner's site might not be valid, Robinson traps were operated simultaneously at the two sites for a number of nights between April and October 2015. All records were submitted to local and national recording schemes via the County Recorder.

Historical records

Gardner's records (Gardner 1962) contained little detail and only notes on abundance. They included some species encountered away from Riding Mill and the nomenclature followed Heslop's Checklist of 1945. The authors updated the names he used to the current British checklist (Bradley 2000) and sifted out those species clearly not present in Riding Mill on the basis of the distribution shown by Dunn and Parrack (1986) and the *Northumberland Moths* website (Tams 2017). In addition, the original records published in *The Vasculum* were thoroughly scrutinised. Records that referred to habitats not found in Riding Mill (for example heathland or coastland) or 'near Riding Mill' and therefore by implication not in Riding Mill were excluded. At the end of this process, the authors were able to make a direct comparison of their own records with those collected by Gardner in Riding Mill some 50 years earlier.

County and national comparisons

For each species on the *Northumberland Moths* website (Tams 2017), information on the number of records, number of individuals and number of sites recorded is given together with a map showing the pre-2000 and post-2000 distribution at a 2x2 km (tetrad) scale. These records are updated by the County Recorder as more information is collected and therefore change over time. To avoid partly updated information in the analysis, the authors noted information for each species they and Gardner had recorded by extracting it from the *Northumberland Moths* website at one point in time (4 March 2017).

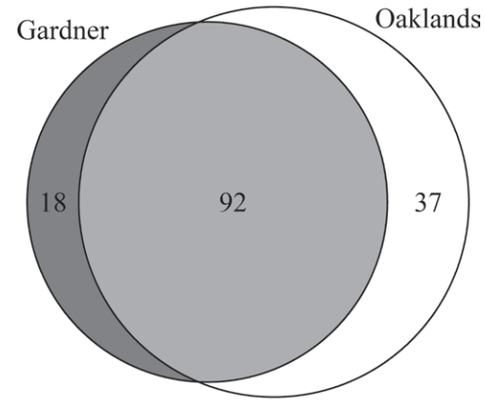
Riding Mill is situated in the 2x2 km square at the bottom SW corner of the 10 km square NY06, and is, therefore, almost at the centre of the four 10 km squares NZ95, NZ96, NY05 and NY06. The authors used the number of pre-2000 and post-2000 tetrad records for all four (NZ95, NY96, NY05 and NY06) to reflect current and historical distribution in the local area, but were not able to assess historical abundance. For the three possible comparisons between the categories of moths recorded ('Gardner only', 'Charman only' and 'Both') the Mann-Whitney U test was used to test the probability of the null hypothesis that each of these 'County' and 'local' parameters were not different in each case.

For comparisons between local and national data, t-tests were used to compare indices of abundance and distribution from the Oaklands site and Gardner's data with indices of annual national change in abundance for a range of macro moth species from the Rothamstead Insect Survey (Conrad et al 2006) and the National Moth Scheme data base (Fox et al 2014). Aggregate species were excluded from these analyses.

RESULTS & DISCUSSION

Direct comparisons between sites

Figure 1. Venn diagram to show a comparison of the number of macro moth species recorded at the Gardner site and Oaklands during the 2015 season.

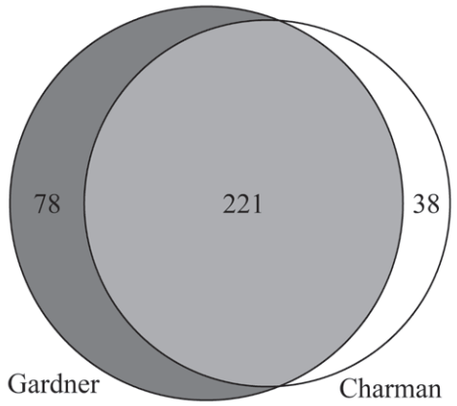


Between April and October 2015, the authors trapped moths overnight on 19 occasions at both sites (Appendix 1). Of these they ran traps at Gardner's site and Oaklands simultaneously 15 times and twice on consecutive nights. They recorded 110 macro moth species at Gardner's site (Appendix 2 and Figure 1) during these sessions. They had recorded all but one of these species at Oaklands previously and the new species (also recorded by Gardner) was subsequently trapped at Oaklands later that season. The authors caught 129 macro moth species at Oaklands during these sessions, including four new species, two of which had been recorded by Gardner (Figure 1 and Appendix 2).

The fact that all the species recorded at Gardner's site that season had previously been recorded by the authors at Oaklands, and that within these trapping sessions 62.2% of the species recorded were common to both sites, would suggest that the two sites were broadly similar with respect to macro-moth fauna. Only 12.8% of the species were recorded at Gardner's site but not at Oaklands during these sessions, but 25.0% of the species trapped occurred at Oaklands but not Gardner's site. This, together with more than twice as many individual moths being caught at Oaklands than at Gardner's site (1508 compared to 641), might indicate that currently Oaklands is a richer site (but this might not have been so in the past) or that the location of the trap there was more effective and efficient at attracting local moths. There would, therefore, appear to be no strong reason to reject comparisons of species occurrence from Gardner's records with the authors' data.

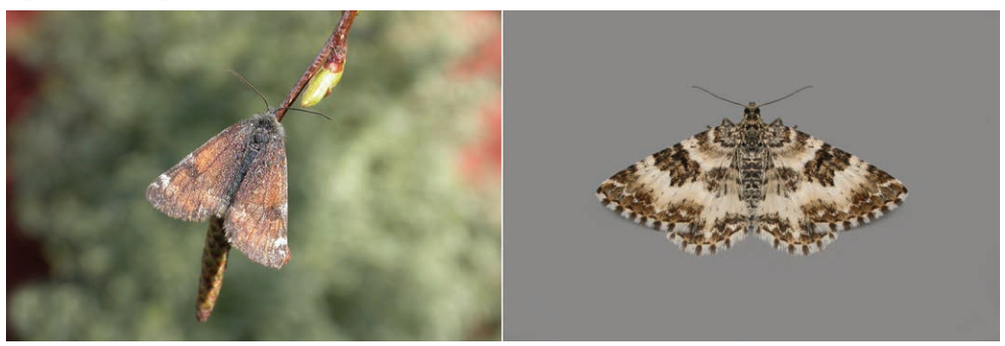
Comparison of Oaklands data with Gardner's historical records

Figure 2. Venn diagram to compare the number of macro moth species recorded by Gardner (1945-66) with those recorded in this study (2004-2017).



At the end of 2017 the authors collated all the information they had collected on the occurrence of macro moth species over the fourteen years between 2004 and 2017 and compared them with Gardner's records (Figure 2). Over this period, the authors had recorded 259 species at Oaklands, 221 of which were also recorded by Gardner (records referred to as 'Both'). Gardner had recorded 78 species that the authors had not ('Gardner only') and they had recorded 38 that did not appear on Gardner's list ('Charman only'). Figures 3 and 4 show two examples of moths from each of these categories. The full lists are shown in Appendix 2. Whilst the authors had expected to have recorded fewer species than Gardner, they were surprised at the size of the difference and at the number of species that they had recorded but Gardner had not, many of which would now be regard as quite common, widespread and abundant species in Northumberland.

Figure 3: Two of the moth species recorded by Gardner but not by the authors: a, Orange Underwing *Archiearis parthenias* ; b, Small Argent & Sable *Epirrhoe tristata*. Photographs reproduced by permission of Tom Tams.



a **b**

Figure 4: Two of the species recorded by the authors but not by Gardner and which are now fairly common in Northumberland: a, Buff Arches *Habrosyne pyritoides*; b, Common Footman *Eilema lurideola*. Photographs reproduced by permission of Tom Tams.

a **b**

Local, county and national level characteristics of the changed macro moth fauna

In order to examine the changes to the macro moth fauna since Gardner's time and to explore the characteristics of the species in the different groups more fully, the authors initially turned to the county records for Northumberland (Tams 2017). The total number of records, individuals and sites for each species in Northumberland were used to reflect the county wide distribution and abundance for each of the species at Oaklands or recorded by Gardner.

Two major statistical analyses of macro moth data have examined national changes in abundance and distribution, and provide estimates of rates of change for individual species. Conrad et al (2006) used quantitative data from the Rothamstead Insect Survey to derive indices of annual national change in abundance for a range of macro moth species for which there were adequate data. Fox et al (2014) used the National Moth Scheme database to derive indices of changes in frequency of occurrence for individual moth species that reflect changes in distribution. The authors used both these factors to examine how the different species recorded by Gardner or at Oaklands relate to national trends in abundance and distribution.

For the three possible pairwise comparisons between the categories of moths recorded ('Gardner only', 'Charman only' and 'Both') for each of the county and local parameters (rows in Table 1), statistical tests were used to assess the chance of getting the observed differences between categories if the null hypotheses of no differences were true. The results are summarised in Table 1; P values in all cases were < 0.05, therefore the null hypotheses should be rejected. If, for each parameter, a Bonferroni correction for multiple testing is applied (P for significance $< 0.05/3$), only in one case (Table 1b: County sites, Charman only versus Gardner only) was this exceeded. Aggregate species have been excluded from these analyses.

Table 1. (a) The mean value for local, county and national parameters of distribution and abundance for each of the three categories of macro moth recorded ('Gardner only', 'Both' [Gardner and Charman] and 'Charman only') together with **(b)** a statistical comparison (Mann-Whitney U test) of the local and county parameters for each of the three categories of macro moth recorded; and **(c)** a statistical comparison (t-test) of the national indices of changes in abundance and distribution for each of the three categories of macro moth.

(a)

Parameter	'Gardner only'	'Both'	'Charman only'
Local four squares pre-2000	3	4	1
Local four squares post-2000	2	8	6
County records	211	1504	544
County individuals	510	5685	1356
County sites	56	156	70
Annual change rate[1]	-0.025	-0.010	0.011
Frequency of occurrence/yr[2]	-0.0045	-0.0001	0.0056

(b)

Parameter	'Gardner only' v. 'Both'		'Charman only' v. 'Both'		'Gardner only' v. 'Charman only'	
	U value	P	U value	P	U value	P
Local four squares pre-2000	6333.5	0.0116	1086.5	<0.00001	495.5	<0.00001
Local four squares post-2000	1091.5	<0.00001	2364.5	0.00008	397.5	<0.00001
County records	1948.5	<0.00001	2075	<0.00001	856.5	0.00044
County individuals	2636	<0.00001	2292	<0.00001	909	0.00142
County sites	2272	<0.00001	1542.5	<0.00001	1064	0.0232

(c)

Parameter	'Gardner only' v. 'Both'		'Charman only' v. 'Both'		'Gardner only' v. 'Charman only'	
	t value	P	t value	P	t value	P
Annual change rate[1]	2.59567	0.01011	-3.38788	0.00085	-2.8533	0.0063
Frequency of occurrence/yr[2]	4.85427	<0.00001	-4.22689	0.00003	-7.55254	<0.00001

1 Index from Conrad et al (2006)
2 Index from Fox et al (2014)

At a local scale, the 'Gardner only' species have significantly fewer post-2000 records than species in the other two categories ('Both' and 'Charman only') but intermediate for pre-2000 records (Table 1b), compared to the county data. In terms of post 2000 records, 'Charman only' species were intermediate between the other two categories but significantly different from both, and the lowest in terms of pre 2000 records. The indications are that the species recorded by Gardner which the authors have not recorded tend to be the rarer, probably less abundant species and that those species not previously recorded by Gardner are recent arrivals in the local area.

In the analysis of county-level information on records, individuals and sites, 'Gardner only' species in each case are the lowest and 'Charman only' are intermediate, but all are significantly different from each other. Again, the indications are that the species not recorded since Gardner's day are those which are rarer, less numerous and with a more limited distribution within the county as a whole.

'Gardner only' species show a significantly-higher rate of decline in abundance than that of species recorded by 'Both' in terms of Conrad *et al*'s (2006) 'Index of Annual Change', and 'Charman only' species show a positive index indicating increasing populations. A similar pattern is shown in terms of changes in distribution when Fox *et al's* (2014) 'Frequency of Occurrence Index is analysed', 'Gardner only' showing the highest level and 'Charman only' a positive figure indicating expansion. 'Gardner only' species are declining nationally more rapidly in terms of both distribution and abundance than species recorded as 'Both', and 'Charman only' species are increasing nationally in terms of both distribution and abundance (Table 1c).

CONCLUSIONS

Gardner's records of macro moths from Riding Mill and Northumberland published in the *Entomologists Gazette* and *The Vasculum* together with the authors' records from the same village some 50 years later, provides a significant opportunity to examine changes in the macro moth fauna at a local level. Whilst there are many similarities between the lists of species recorded, there are also significant differences.

Overall, the results from the comparison of this study with that of Gardner indicate a measurable decline in the macro moth fauna at Riding Mill over the last 50 or so years and that the species currently unrecorded are those with a more limited distribution and abundance at a local, county and national scale. Some new species of macro moth are now recorded in Riding Mill which Gardner did not record and these appear to reflect broader local, county and national trends. It is interesting to speculate on the underlying causes of these changes. Do the declines reflect changes in the quality and abundance of habitat, with rarer, perhaps more specialist species suffering more rapidly? Has climate change had a significant impact on this decline and has it been responsible through increases in range of some species for the new records at Riding Mill? Whilst the authors do not have answers to these questions they continue to trap moths at Riding

Mill and contribute to county and national records which are addressing these issues at a higher scale. They also intend undertaking further analysis of their results in an attempt to increase understanding of the reasons behind the changes in the macro moth fauna of Riding Mill.

ACKNOWLEDGEMENTS

The authors are very grateful to Revd and Mrs G Proud, who where at the time the owners of the house where Gardner lived, for allowing us to trap moths in their garden. They were very tolerant, encouraging and interested in the authors' activities and results. The authors also thank Tom Tams, County Moth Recorder for his early support in identifying moths and his subsequent encouragement to continue recording. Both the authors' families have been supportive and patient during this study of the moths of Riding Mill.

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APPENDICES

Appendix 1. The dates of simultaneous and consecutive trapping at 'Gardner's site' and 'Oaklands' during 2015 together with the number of macro moth species and number of individual moths trapped.

	'Gardner's site			'Oaklands'		
Observation	Date	No.Species	No. individuals	Date	No. Species	No. individuals
1	05-Apr-15	6	41	05-Apr-15	6	63
2	15-Apr-15	4	5	15-Apr-15	9	46
3	24-Apr-15	9	12	24-Apr-15	8	52
4	03-May-15	5	6	03-May-15	2	3
5	10-May-15	5	22	10-May-15	13	32
6*	16-Jun-15	25	39	15-Jun-15	17	25
7*	30-Jun-15	31	59	29-Jun-15	23	48
8	10-Jul-15	31	53	10-Jul-15	42	157
9	20-Jul-15	24	51	20-Jul-15	36	150
10	02-Aug-15	21	43	02-Aug-15	37	170
11	10-Aug-15	22	81	10-Aug-15	33	222
12	25-Aug-15	26	125	25-Aug-15	23	285
13	04-Sep-15	19	64	04-Sep-15	22	128
14	25-Sep-15	5	10	25-Sep-15	9	16
15	04-Oct-15	4	5	04-Oct-15	3	7
16	19-Oct-15	5	16	19-Oct-15	10	42
17	26-Oct-15	5	9	26-Oct-15	14	62
		Total 110	Total 641		Total 129	Total 1508

* consecutive days between 'Gardner's site'and 'Oaklands'

Appendix 2. The full list of macro moth species recorded at Riding Mill by (a) 'Gardner only' (1945-1966), (b)'Both' Gardner(1945-66) and this study (2004-2017), (c)'Charman only' (2004-2017), (d)'Gardner's site only' (2015), (e) 'Both sites'- Gardner's and Oaklands (2015), and (f) 'Oaklands only' (2015).

Taxon	Vernacular	a	b	c	d	e	f
Hepialus humuli	Ghost Moth		1			1	
Hepialus sylvina	Orange Swift		1				
Hepialus hecta	Gold Swift	1					
Hepialus lupulinus	Common Swift		1		1		
Hepialus fusconebulosa	Map-winged Swift		1		1		
Zygaena filipendulae	Six-spot Burnet			1			
Poecilocampa populi	December Moth		1				1
Saturnia pavonia	Emperor Moth		1				
Drepana falcataria	Pebble Hook-tip		1		1		
Cilix glaucata	Chinese Character	1					
Thyatira batis	Peach Blossom		1			1	
Habrosyne pyritoides	Buff Arches			1		1	
Tethea ocularis	Figure of Eighty			1			
Ochropacha duplaris	Common Lutestring			1		1	
Achlya flavicornis	Yellow Horned		1				
Archiearis parthenias	Orange Underwing	1					
Alsophila aescularia	March Moth		1				
Pseudoterpna pruinata	Grass Emerald		1				
Geometra papilionaria	Large Emerald		1				
Cyclophora linearia	Clay Triple-lines			1			
Scopula floslactata	Cream Wave	1					
Idaea biselata	Small Fan-footed Wave		1			1	
Idaea seriata	Small Dusty Wave		1				1
Idaea dimidiata	Single-dotted Wave		1			1	
Idaea aversata	Riband Wave		1			1	
Idaea straminata	Plain Wave	1					
Orthonama obstipata	Gem	1					
Xanthorhoe designata	Flame Carpet		1			1	
Xanthorhoe decoloraria	Red Carpet		1		1		
Xanthorhoe montanata	Silver-ground Carpet		1			1	
Xanthorhoe fluctuata	Garden Carpet		1				
Scotopteryx chenopodiata	Shaded Broad-bar		1				
Scotopteryx mucronata	Lead Belle	1					
Scotopteryx luridata	July Belle	1					
Epirrhoe tristata	Small Argent & Sable	1					
Epirrhoe alternata	Common Carpet		1			1	
Epirrhoe rivata	Wood Carpet	1					
Camptogramma bilineata	Yellow Shell		1				
Entephria caesiata	Grey Mountain Carpet	1					

Taxon	Vernacular	a	b	c	d	e	f
Larentia clavaria	Mallow	1					
Anticlea badiata	Shoulder Stripe		1				1
Anticlea derivata	Streamer		1				1
Mesoleuca albicillata	Beautiful Carpet	1					
Pelurga comitata	Dark Spinach	1					
Lampropteryx suffumata	Water Carpet		1				
Cosmorhoe ocellata	Purple Bar		1				
Nebula salicata	Striped Twin-spot Carpet	1					
Eulithis prunata	Phoenix		1			1	
Eulithis testata	Chevron		1			1	
Eulithis populata	Northern Spinach		1				
Eulithis mellinata	Spinach	1					
Eulithis pyraliata	Barred Straw		1				1
Ecliptopera silaceata	Small Phoenix		1			1	
Chloroclysta siterata	Red-green Carpet		1			1	
Chloroclysta miata	Autumn Green Carpet		1				
Chloroclysta citrata	Dark Marbled Carpet		1			1	
Chloroclysta truncata	Common Marbled Carpet		1			1	
Cidaria fulvata	Barred Yellow		1				
Plemyria rubiginata	Blue-bordered Carpet		1			1	
Thera firmata	Pine Carpet		1				
Thera obeliscata	Grey Pine Carpet		1				
Thera britannica	Spruce Carpet			1		1	
Electrophaes corylata	Broken-barred Carpet		1				
Colostygia olivata	Beech-green Carpet	1					
Colostygia multistrigaria	Mottled Grey		1				
Colostygia pectinataria	Green Carpet		1			1	
Hydriomena furcata	July Highflyer		1			1	
Hydriomena impluviata	May Highflyer		1				
Rheumaptera cervinalis	Scarce Tissue	1					
Epirrita dilutata agg.	November Moth agg.		1			1	
Epirrita filigrammaria	Small Autumnal Moth		1				
Operophtera brumata	Winter Moth		1				
Operophtera fagata	Northern Winter Moth	1					
Perizoma affinitata	Rivulet		1		1		
Perizoma alchemillata	Small Rivulet		1			1	
Perizoma bifaciata	Barred Rivulet	1					
Perizoma albulata	Grass Rivulet	1					
Perizoma flavofasciata	Sandy Carpet		1				
Perizoma didymata	Twin-spot Carpet		1				1
Eupithecia tenuiata	Slender Pug		1				
Eupithecia linariata	Toadflax Pug		1				
Eupithecia pulchellata	Foxglove Pug		1			1	
Eupithecia exiguata	Mottled Pug		1				

Taxon	Vernacular	a	b	c	d	e	f
Eupithecia valerianata	Valerian Pug	1					
Eupithecia venosata	Netted Pug	1					
Eupithecia centaureata	Lime-speck Pug	1					
Eupithecia absinthiata	Wormwood Pug	1					
Eupithecia assimilata	Currant Pug		1		1		
Eupithecia vulgata	Common Pug		1		1		
Eupithecia tripunctaria	White-spotted Pug	1					
Eupithecia subfuscata	Grey Pug		1				
Eupithecia icterata	Tawny Speckled Pug		1				
Eupithecia succenturiata	Bordered Pug	1					
Eupithecia nanata	Narrow-winged Pug	1					
Eupithecia innotata	AshPug	1					
Eupithecia abbreviata	Brindled Pug		1			1	
Eupithecia dodoneata	Oak-tree Pug			1			
Eupithecia pusillata	Juniper Pug		1				
Eupithecia tantillaria	Dwarf Pug		1				
Pasiphila rectangulata	Green Pug		1			1	
Gymnoscelis rufifasciata	Double-striped Pug			1			1
Chesias legatella	Streak		1				
Aplocera plagiata	Treble-bar	1					
Odezia atrata	Chimney Sweeper	1					
Venusia cambrica	Welsh Wave	1					
Euchoeca nebulata	Dingy Shell		1		1		
Asthena albulata	Small White Wave		1				
Hydrelia flammeolaria	Small Yellow Wave		1			1	
Trichopteryx carpinata	Early Tooth-striped		1				
Abraxas grossulariata	Magpie Moth			1			
Abraxas sylvata	Clouded Magpie		1				
Lomaspilis marginata	Clouded Border		1			1	
Macaria liturata	Tawny-barred Angle		1				
Chiasmia clathrata	Latticed Heath	1					
Macaria wauaria	V-Moth	1					
Petrophora chlorosata	Brown Silver-line		1		1		
Plagodis dolabraria	Scorched Wing			1		1	
Opisthograptis luteolata	Brimstone Moth		1			1	
Epione repandaria	Bordered Beauty	1					
Apeira syringaria	Lilac Beauty		1				
Ennomos alniaria	Canary-shouldered Thorn		1			1	
Selenia dentaria	Early Thorn		1				1
Selenia lunularia	Lunar Thorn		1				
Selenia tetralunaria	Purple Thorn			1	1		
Odontopera bidentata	Scalloped Hazel		1			1	
Crocallis elinguaria	Scalloped Oak		1				
Ourapteryx sambucaria	Swallow-tailed Moth		1			1	

Taxon	Vernacular	a	b	c	d	e	f
Colotois pennaria	Feathered Thorn		1				1
Apocheima hispidaria	Small Brindled Beauty	1					
Phigalia pilosaria	Pale Brindled Beauty		1				
Biston strataria	Oak Beauty		1				
Biston betularia	Peppered Moth		1			1	
Agriopis leucophaearia	Spring Usher		1				
Agriopis aurantiaria	Scarce Umber		1				
Agriopis marginaria	Dotted Border		1				
Erannis defoliaria	Mottled Umber		1				
Peribatodes rhomboidaria	Willow Beauty		1				
Deileptenia ribeata	Satin Beauty	1					
Alcis repandata	Mottled Beauty		1			1	
Ectropis bistortata	Engrailed		1			1	
Aethalura punctulata	Grey Birch			1			
Ematurga atomaria	Common Heath	1					
Bupalus piniaria	Bordered White		1				1
Cabera pusaria	Common White Wave		1			1	
Cabera exanthemata	Common Wave		1				1
Lomographa bimaculata	White-pinion Spotted			1			
Lomographa temerata	Clouded Silver			1		1	
Theria primaria	Early Moth		1				
Campaea margaritata	Light Emerald		1			1	
Hylaea fasciaria	Barred Red		1			1	
Charissa obscurata	Annulet	1					
Dyscia fagaria	Grey Scalloped Bar		1				
Smerinthus ocellata	Eyed Hawk-moth	1					
Laothoe populi	Poplar Hawk-moth		1			1	
Macroglossum stellatarum	Humming-bird Hawk-moth		1				
Deilephila elpenor	Elephant Hawk-moth		1				1
Deilephila porcellus	Small Elephant Hawk-moth			1			
Phalera bucephala	Buff-tip		1			1	
Cerura vinula	Puss Moth	1					
Furcula furcula	Sallow Kitten		1				
Furcula bifida	Poplar Kitten		1				
Notodonta dromedarius	Iron Prominent		1				1
Notodonta ziczac	Pebble Prominent		1				1
Pheosia gnoma	Lesser Swallow Prominent		1			1	
Pheosia tremula	Swallow Prominent		1				
Ptilodon capucina	Coxcomb Prominent		1			1	
Odontosia carmelita	Scarce Prominent		1			1	
Pterostoma palpina	Pale Prominent			1			
Drymonia ruficornis	Lunar Marbled Brown			1		1	
Orgyia antiqua	Vapourer	1					
Calliteara pudibunda	Pale Tussock			1			1

Taxon	Vernacular	a	b	c	d	e	f
Leucoma salicis	White Satin	1					
Nudaria mundana	Muslin Footman	1					
Cybosia mesomella	Four-dotted Footman	1					
Eilema depressa	Buff Footman			1		1	
Eilema lurideola	Common Footman			1		1	
Arctia caja	Garden Tiger		1				
Spilosoma lubricipeda	White Ermine		1		1		
Spilosoma luteum	Buff Ermine		1			1	
Diaphora mendica	Muslin Moth	1					
Phragmatobia fulginosa	Ruby Tiger	1					
Nola cucullatella	Short-cloaked Moth			1			
Nola confusalis	Least Black Arches		1			1	
Euxoa tritici	White-line Dart	1					
Euxoa nigricans	Garden Dart		1				1
Agrotis segetum	Turnip Moth		1				
Agrotis exclamationis	Heart and Dart		1			1	
Agrotis ipsilon	Dark Sword-grass		1				1
Agrotis puta	Shuttle-shaped Dart			1			1
Ochropleura plecta	Flame Shoulder		1			1	
Rhyacia simulans	Dotted Rustic			1			
Noctua pronuba	Large Yellow Underwing		1			1	
Noctua comes	Lesser Yellow Underwing		1			1	
Noctua fimbriata	Broad-bordered Yellow Underwing		1				1
Noctua janthe	Lesser Broad-bordered Yellow Underwing		1			1	
Noctua interjecta	Least Yellow Underwing			1			
Graphiphora augur	Double Dart		1				
Eugnorisma glareosa	Autumnal Rustic		1				
Lycophotia porphyrea	True Lover's Knot		1				
Peridroma saucia	Pearly Underwing	1					
Diarsia mendica	Ingrailed Clay		1				
Diarsia dahlii	Barred Chestnut		1			1	
Diarsia brunnea	Purple Clay		1			1	
Diarsia rubi	Small Square-spot		1				
Xestia c-nigrum	Setaceous Hebrew Character		1				
Xestia triangulum	Double Square-spot		1			1	
Xestia baja	Dotted Clay		1			1	
Xestia castanea	Neglected Rustic	1					
Xestia sexstrigata	Six-striped Rustic		1				1
Xestia xanthographa	Square-spot Rustic		1				
Xestia agathina	Heath Rustic	1					
Naenia typica	Gothic			1	1		

Taxon	Vernacular	a	b	c	d	e	f
Eurois occulta	Great Brocade	1					
Anaplectoides prasina	Green Arches		1			1	
Cerastis rubricosa	Red Chestnut		1				
Hada plebeja	Shears	1					
Polia nebulosa	Grey Arches	1					
Mamestra brassicae	Cabbage Moth		1				
Melanchra persicariae	Dot Moth	1					
Lacanobia thalassina	Pale-shouldered Brocade		1			1	
Lacanobia oleracea	Bright-line Brown-eye		1				1
Papestra biren	Glaucous Shears	1					
Melanchra pisi	Broom Moth	1					
Hadena rivularis	Campion	1					
Hadena perplexa	Tawny Shears	1					
Hadena confusa	Marbled Coronet	1					
Hadena bicruris	Lychnis		1				1
Cerapteryx graminis	Antler Moth		1				
Tholera cespitis	Hedge Rustic	1					
Tholera decimalis	Feathered Gothic		1				
Panolis flammea	Pine Beauty		1		1		
Orthosia cruda	Small Quaker		1			1	
Orthosia opima	Northern Drab	1					
Orthosia gracilis	Powdered Quaker		1				
Orthosia cerasi	Common Quaker		1			1	
Orthosia incerta	Clouded Drab		1			1	
Orthosia munda	Twin-spotted Quaker		1			1	
Orthosia gothica	Hebrew Character		1			1	
Mythimna ferrago	Clay		1				1
Mythimna impura	Smoky Wainscot		1			1	
Mythimna pallens	Common Wainscot		1				
Mythimna comma	Shoulder-striped Wainscot	1					
Cucullia umbratica	Shark	1					
Brachylomia viminalis	Minor Shoulder-knot		1				
Asteroscopus sphinx	Sprawler		1			1	
Aporophyla lutulenta	Deep-brown Dart	1					
Aporophyla nigra	Black Rustic		1				
Lithophane hepatica	Pale Pinion		1				1
Lithophane leautieri	Blair's Shoulder-knot			1			1
Xylena vetusta	Red Sword-grass		1				1
Xylocampa areola	Early Grey			1		1	
Allophyes oxyacanthae	Green-brindled Crescent		1			1	
Dichonia aprilina	Merveille du Jour		1				1
Dryobotodes eremita	Brindled Green			1			1
Blepharita adusta	Dark Brocade	1					
Antitype chi	Grey Chi		1				

Taxon	Vernacular	a	b	c	d	e	f
Eupsilia transversa	Satellite		1				1
Conistra vaccinii	Chestnut		1			1	
Conistra ligula	Dark Chestnut		1				
Agrochola circellaris	Brick		1				1
Agrochola lota	Red-line Quaker		1			1	
Agrochola macilenta	Yellow-line Quaker		1			1	
Agrochola helvola	Flounced Chestnut	1					
Agrochola litura	Brown-spot Pinion		1			1	
Agrochola lychnidis	Beaded Chestnut		1				
Parastichtis suspecta	Suspected		1				
Atethmia centrago	Centre-barred Sallow		1			1	
Omphaloscelis lunosa	Lunar Underwing		1				
Xanthia citrago	Orange Sallow		1				
Xanthia togata	Pink-barred Sallow		1				
Xanthia icteritia	Sallow		1				1
Acronicta megacephala	Poplar Grey		1				
Acronicta leporina	Miller		1				
Acronicta alni	Alder Moth			1			
Acronicta tridens/psi	Dark / Grey Dagger		1				1
Acronicta rumicis	Knot Grass		1				
Craniophora ligustri	Coronet			1			1
Cryphia domestica	Marbled Beauty		1				
Amphipyra pyramidea agg.	Copper Underwing agg.			1		1	
Amphipyra tragopoginis	Mouse Moth		1			1	
Mormo maura	Old Lady	1					
Rusina ferruginea	Brown Rustic		1			1	
Euplexia lucipara	Small Angle Shades		1			1	
Phlogophora meticulosa	Angle Shades		1				1
Ipimorpha subtusa	Olive	1					
Parastichtis ypsillon	Dingy Shears		1				
Cosmia trapezina	Dun-bar		1			1	
Apamea monoglypha	Dark Arches		1			1	
Apamea lithoxylaea	Light Arches	1					
Apamea crenata	Clouded-bordered Brindle			1		1	
Apamea epomidion	Clouded Brindle		1				
Apamea remissa	Dusky Brocade		1				
Apamea unanimis	Small Clouded Brindle		1				
Apamea sordens	Rustic Shoulder-knot		1				
Apamea scolopacina	Slender Brindle			1			
Apamea ophiogramma	Double Lobed		1				
Oligia strigilis agg.	Marbled Minor agg.		1			1	
Oligia fasciuncula	Middle-barred Minor		1		1		
Mesapamea secalis agg.	Common Rustic agg.		1			1	
Photedes minima	Small dotted buff		1				

Taxon	Vernacular	a	b	c	d	e	f
Chortodes pygmina	Small Wainscot		1				
Luperina testacea	Flounced Rustic		1				1
Amphipoea oculea agg.	Ear Moth agg.		1				
Hydraecia micacea	Rosy Rustic		1		1		
Hydraecia petasitis	Butterbur	1					
Gortyna flavago	Frosted Orange		1				
Nonagria typhae	Bulrush Wainscot		1				
Rhizedra lutosa	Large Wainscot		1				
Hoplodrina alsines	Uncertain			1		1	
Hoplodrina blanda	Rustic		1				
Caradrina morpheus	Mottled Rustic		1				
Paradrina clavipalpis	Pale Mottled Willow		1				
Pyrrhia umbra	Bordered Sallow	1					
Heliothis peltigera	Bordered Straw	1					
Pseudoips prasinana	Green Silver-lines		1				
Nycteola revayana	Oak Nycteoline		1				
Diachrysia chrysitis	Burnished Brass		1			1	
Polychrysia moneta	Golden Plusia	1					
Plusia festucae	Gold Spot		1				1
Plusia putnami	Lempke's Gold Spot			1			
Autographa gamma	Silver Y		1			1	
Autographa pulchrina	Beautiful Golden Y		1			1	
Autographa jota	Plain Golden Y		1		1		
Autographa bractea	Gold Spangle		1				
Syngrapha interrogationis	Scarce Silver Y	1					
Abrostola triplasia	Dark Spectacle		1		1		
Abrostola tripartita	Spectacle		1			1	
Catocala nupta	Red Underwing			1	1		
Callistege mi	Mother Shipton	1					
Ectypa glyphica	Burnet Companion	1					
Scoliopteryx libatrix	Herald		1				
Phytometra viridaria	Small purple-barred	1					
Rivula sericealis	Straw Dot			1		1	
Hypena proboscidalis	Snout		1			1	
Schrankia costaestrigalis	Pinion-streaked Snout			1			1
Zanclognatha tarsipennalis	Fan-foot		1			1	
Herminia grisealis	Small Fan-foot		1			1	

A COMMENTARY ON THE CURRENT STATUS OF THE PINE MARTEN *MARTES MARTES* IN NORTHERN ENGLAND

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SUMMARY

The Pine Marten was once widespread across Britain and Ireland but is now very rare in England and Wales. However, there are signs that the Pine Marten population in Scotland has recovered and expanded its range; Pine Martens have started to re-colonise parts of northern England (Northumberland and Cumbria) with suitable habitat for the first time in over a hundred years. The Vincent Wildlife Trust (VWT) is leading on a project to pave the way for the recovery of the Pine Marten in northern England. Targeted areas are surveyed and monitored, with help from a network of volunteers, and trail cameras and hair traps are deployed as part of a raft of measures to give an indication of the status of the species in the region and promote good conservation and management practices. Martens have now been recorded in several locations across the region since the project began in the summer of 2017, and early indications show several routes into the region from recovering populations north of the border in Scotland.

INTRODUCTION

The Pine Marten was once a common and widespread species across Britain and Ireland but, like many predators, declined during the 18th and 19th centuries. It was regarded as the second commonest carnivore in Britain by Maroo and Yalden (2000), but it is now very rare in England and Wales. The Vincent Wildlife Trust (VWT) has spent over 30 years carrying out Pine Marten research and recently carried out a translocation of Pine Martens from Scotland to Wales where the Pine Marten was all but extinct. VWT is now leading on a project, as part of the 'Back from the Brink' portfolio of species conservation projects, to pave the way for the recovery of the Pine Marten in northern England. This project started in the summer of 2017, building on previous work carried out by the Vincent Wildlife Trust and the author whilst working for Northumberland Wildlife Trust, where we had several projects looking to locate Pine Marten presence in northern England throughout the 2000's.

We were tantalisingly close to our initial goal in 2010 when scats were discovered by the author in Kidland forest, Northumberland, which were identified from DNA analysis as originating from Pine Marten. However, the first authenticated image of a Pine Marten in northern England has eluded everyone until the present.

Building on work by Croose *et al.* (2014), which identified expanding Pine Marten presence in the immediate Scottish border districts, previous records and evidence collated by the author from the region, targeted areas are being systematically searched and monitored for Pine Martens with the help of a network of volunteers across the

border region; further records have been collected from north of the border (Stephanie Johnstone, Saving Scotland's Red Squirrels, personal communication). Trail cameras and hair traps have also been deployed to pick up evidence of Pine Marten presence across the northern forest districts.

After a slow start and a rethink on camera locations and other methods of detection, a slow but steady trickle of authenticated records have started to present a picture of improving Pine Marten presence and recovery south of the border in northern England. As Pine Martens appear to be re-establishing themselves in northern England, it is a good time to summarise the history of the Pine Marten in this region and reassess its current recovery path from local extinction, virtual national extinction to almost mythical status, and now to its current resurgent status. For the author, it has been a long and sometimes tortuous journey with many ups and downs and false dawns but now he can most definitely bask with the knowledge there is real evidence of re-establishment in the region for the first time in a hundred years.

THE VINCENT WILDLIFE TRUST AND 'BACK FROM THE BRINK'

The VWT was founded in 1975 by Vincent Weir; it is a national charity engaged in innovative mammal research and conservation but specialises in focused, long-term solutions for the conservation of rare or 'difficult to track' mammals. It has a long history of core work managing bat roosts & conserving rarer bats such as horseshoe species. It has an equally long history of national distribution surveys and monitoring for such species as the Otter *Lutra lutra*, Water Vole *Arvicola amphibious*, Polecat *Mustela putorius* and the Pine Marten. Today, the priority species are the Pine Marten, Polecat and the horseshoe bat species; the VWT now has staff in England, Wales & Ireland working on the conservation of these species.

'Back from the Brink' is a collective project, one of the most ambitious conservation projects ever undertaken in the UK. Nineteen projects delivered across England, support 20 threatened UK species. With the support of a £4.6 million grant from the National Lottery, 'Back from the Brink' is the first nationwide coordinated effort to bring a wide range of leading charities and conservation bodies together to save threatened species. Natural England, the government's wildlife advisory body, is working in partnership with the VWT, Forestry Commission, Amphibian and Reptile Trust, Bat Conservation Trust, Buglife, Bumblebee Conservation Trust, Butterfly Conservation and Plantlife to deliver these projects, and the Pine Marten is the focus of this regional project delivered by VWT.

THE HISTORY OF THE PINE MARTEN IN NORTHERN ENGLAND

In recent years, the Pine Marten has become somewhat of an enigma, a creature of myth that we believed may well be here but never really quite gave us the proof. A fleeting glimpse, a blurred image, a footprint, even a genuine scat, were building up a tantalising portfolio in the north. There are now several populations nationwide that have 'miraculously' appeared, in Shropshire and Yorkshire for instance. Then there is the authentic VWT Welsh Pine Marten translocation project; but it is in the northern border counties of Northumberland and Cumbria that eyes have been fixed waiting for the Pine Marten's natural return to England from its strongholds north of the border in Scotland.

The Pine Marten arrived in the UK post-glaciation some 6,500 years ago, when the UK had virtually continuous woodland cover, it was then the second-most common carnivore in Britain with estimates in excess of 147,000 Pine Martens (Maroo and Yalden 2000). Pine Martens were once well recorded in parish bounty records and Victorian naturalist diaries. It declined particularly during the 18th and 19th centuries as a result of persecution and loss of habitat. As humans started woodland clearance, so the decline of many mammals followed. Woodland cover was down to 5.4% by 1895 and was highly fragmented with small and isolated patches. Persecution increased through game preservation, inducing a severe decline whereby the species was rare in England, Wales & southern/central Scotland. By 1915, it was confined to small pockets in NW Scotland, possibly northern England and Wales (Figure 1) and for a very long time it has been regarded as the second rarest carnivore in the UK (Langley and Yalden 1977)

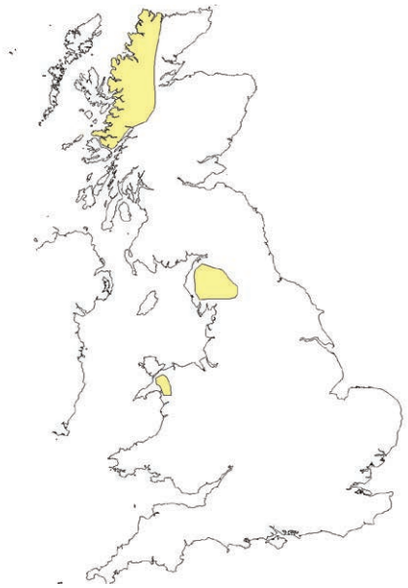

Figure 1. Possible Pine Marten distribution *c.* 1915

In northern England, records stretch back quite a long time but it was certainly regarded as being scarce when Mennell and Perkins (1863-64) wrote that: “although the animal was not common it was still widely distributed over the two counties”. They were still common enough for them to further remark that “the late humane and lamented Edward Charleton, Esq. of Reedsmouth had a young one taken in that neighbourhood, which, by kind treatment, grew as tame and as familiar as his other house animals and continued with him two years, brisk and lively”.

Records of Pine Martens have continued to appear sporadically across the north ever since. There have even been records from a number of sources, including some specimens allegedly from the region, which have been evidenced with DNA analysis. This showed some very interesting origins of particular specimens. Of seven specimens, three showed a DNA match with *Mustela americana*, the north American marten, throwing speculation into the possible hybridisation of the species with the native *M. martes* (Davison *et al,* 2001). However, all the specimens came from the same source and there has always been a degree of scepticism as to the actual authenticity of their origin.

Despite the above, and other often-collaborated reports of Pine Martens in England and Wales, it is only through advances in DNA analysis that concrete proof of their existence has been confirmed in more recent times in both Wales and northern England. Most records for the northeast have been collated via the author and through VWT over the years. It was within this partnership that the first DNA-authenticated records for an English Pine Marten was recorded in 2010 from Kidland forest in the Cheviots. Scat collected by the author from an artificial Pine Marten nest box was shown to be from a female Pine Marten most closely associated with the Scottish haplotype; further scats were then subsequently discovered in Cumbria by VWT staff in 2011 (VWT personal communication).

However, in 2009 evidence came to light that the Scottish Society for the Prevention of Cruelty to Animals had released four captive-reared orphaned Pine Martens into the wild in an apparent bid to boost the population of the species in southern Scotland without any direction from Scottish Natural Heritage. They were released near Peebles less than 50 miles from Kidland forest along with further subsequent releases alleged according to BBC news in August 2009 (BBC News 2009). The current distribution of Pine Marten populations in Britain is summarised in Figure 2.

Figure 2. Most recent Pine Marten distribution map showing the close proximity of confirmed Pine Marten populations in Scotland, the newly established Welsh populations and the number of ‘speculative’ Pine Marten populations.

THE ESTABLISHMENT OF PINE MARTEN IN NORTHERN ENGLAND AND CURRENT CONSERVATION EFFORT

There is now clearly a new source of animals in the borders other than those in the south west of Scotland but there is still confusion about where all these records originate from; are they remnant Pine Marten populations, or travellers from Dumfries and Galloway or the new population around Peebles, the closest known populations, or even hitch hikers? To add further confusion, there is another grouping around Newcastleton collected from squirrel survey data, that is thought may originate from long forgotten and perceived ‘failed’ releases in the early 1980’s (Scottish Forestry Commission, unpublished data).

We do know that Pine Martens, like most mustelids, are inquisitive and also great travellers. In very recent years we have had a road casualty in southern Northumberland in April 2017, and Pine Martens were caught on film in north Yorkshire late 2017; even more recently were the bizarre images of a Pine Marten in the city centre of Sunderland, June 2018, caught on security cameras, and I also recently picked up a road casualty from the A38 in Derbyshire.

So where did these animals come from? We can only speculate, but there are people who wish to stimulate recovery with adhoc releases and there are also those who call for widescale releases, without regulation or careful assessment of risk, of species such as lynx, wolves and even bear. Well-documented populations of beaver have sprung up from unlicensed releases (Mammal Society 2015), and further sporadic and illegal

marten releases may happen again. Such illegal activities hinder legitimate conservation projects by fuelling antagonism in the countryside where we seek to engage and work with landowners, managers and other stakeholders. To some people, however, this is not enough and they seek to pre-empt mainstream conservation work. However, we are confident that the Pine Martens picked up on cameras and squirrel feeders, together with the evidence of hair samples and scats from the region, are natural colonists from over the border where populations have been expanding from southwest Scotland and Dumfriesshire, perhaps quicker than we realised or expected, into the rest of the border regions eastward.

The VWT's 'Back from the Brink' project uses a collaborative approach to engage with every audience we can, including gamekeepers and farm managers and the organisations that represent them. Organisations such as the British Association for Shooting and Conservation (BASC) have been very helpful in promoting the species and its management needs and we have keepers and stalkers amongst other volunteers giving their time to monitor camera traps and report sightings. Encouragingly, the continuing evidence of the negative impact of Pine Martens on Grey Squirrels *Sciurus carolinensis* to the benefit of the native Red Squirrel *Sciurus vulgaris* (Sheehy *et al*. 2018) generates considerable interest and support for Pine Martens from a range of organisations and the wider public. However, it is the role of advising land managers/ owners *etc*. on best practice, raising the profile of the species and easing some of the fears that surrounds Pine Martens that has been one of the most beneficial aspects of the project. This can only be done effectively with the knowledge that we already have Pine Martens in the region and their origins.

Therefore, we are always interested in collecting further records to confirm natural recolonization in northern England. Using volunteers, the project organizes volunteer scat surveys, where anyone can enjoy a walk in the woods collecting scat samples. We are also interested in establishing further camera-trap sites with bait stations and hair traps, and in collating records across the region to establish a recording base where records can be stored and passed on to the relevant record center. An additional component of the project is to erect Pine Marten den boxes and to move existing boxes to new sites. Analysis of some existing boxes has revealed Pine Marten hair samples, a very positive sign as these boxes are often used for breeding.

Having put all this in place throughout 2017 and the winter of 2018, we realised that we were looking for the proverbial needle in a haystack as we searched through the vastness of the northern forests. Chance conversations with a stalking friend and researchers in Scotland, and using squirrel monitoring north of the border as a guide, gave us a clearer methodology to use to try and pin down marten presence. Early attempts brought more Foxes *Vulpes vulpes* than anything else to the camera traps; my stalking friend then suggested the method of catching martens for fur in north America where they say, 'if you don't have squirrels then you won't have martens either'. With this in mind we concentrated efforts in smaller localities where we had some evidence of possible

Pine Marten presence. The winter of 2017/18 had good snow falls, and marten tracks were usually near food, either natural or from feeders, and in areas where squirrels were present (Figure 3).

We augmented these feeders in selected tetrads within larger forest blocks with the co-operation and involvement of Forestry Commission and their rangers, our volunteers manage camera traps (Figure 3) and feeders at about 6-8 feeders per tetrad over 3 to 4 week intervals. The feeders have sticky patches attached that pick up hairs from the feeder users. Feeders are baited with a mix of peanuts, mashed sardines, raisons, dates, peanut butter and chicken bits laced with fish oil scents as an extra attractant.

Cameras are spread across both private and public forestry and we have 24 cameras in the field at present from Kershope to Kidland including Kielder, Harbottle, West Wood, Clennell, the OTA and NT Rothbury Cragside and we now have 18 nest boxes installed in the region with more planned.

Figure 3. Images of the 2017/18 winter survey season top left and right shows marten and squirrel tracks in the snow and a scat from Kielder forest, respectively.

PRESENT STATUS AND DISTRIBUTION

The results of the project so far have been better than we expected, and data have come from a wide range of sources; we have received records from squirrel groups both north and south of the border, and we are co-operating with others to try and avoid duplication of effort and establish a reporting system. We have had private records from individuals who have seen martens and we have taken hair samples collected from various locations. Saving Scotland's Red Squirrels have provided us with their insight into marten activity and distribution north of the border (Figure 4); this has given us an additional impetus to increase our own knowledge base south of the border in norther England.

Figure 4. Pine Marten records 2016/17 from Saving Scotland's Red Squirrels surveys; this gives us an important view of Pine Marten distribution.

In the winter 2017/18, we were sent a video of two martens in the borders just over from Carter Barr and have received unconfirmed reports of Pine Marten in Redesdale, and tantalising observations of footprints in Kielder, scats from Otterburn camp, blurred footage from a mountain biker in Kershope and thermal imagery from a deer stalker near Belford. The cameras have also returned great footage of Badger *Meles meles*, Stoats *Mustela ermine*, Foxes, Ravens *Corvus corax* eating the bait and even a pair of Otters on their wanderings through the wintery forest landscape (but no martens!).

Figure 5. A snapshot of the first ever video recorded Pine Marten in Northumberland

Northumberland's first recorded images of a Pine Marten took me by surprise by arriving on my phone on a wintery Sunday evening in the pub, with the message "check your emails"! The images (Figure 5) showed an animal walking slowly out of the shadows in unblemished snow in a forest of northern England in early March 2018. Drawn to the smell of essence of sardine, marmite and halibut, this short footage showed clearly a large male Pine Marten in Northumberland, the first authenticated record since 2010 and in reality, the best evidence of Pine Marten in the county for nearly 100 years. Several more videos were obtained over a short period of time, probably of the same animal. Since then we have made further advances, the project, volunteers and the Pine Martens are going from strength to strength with further records across to Cumbria and throughout the border region. I think even at this early stage we can say martens are making a welcome comeback. The current records of Pine Marten distribution in northern England are summarised in Figure 6.

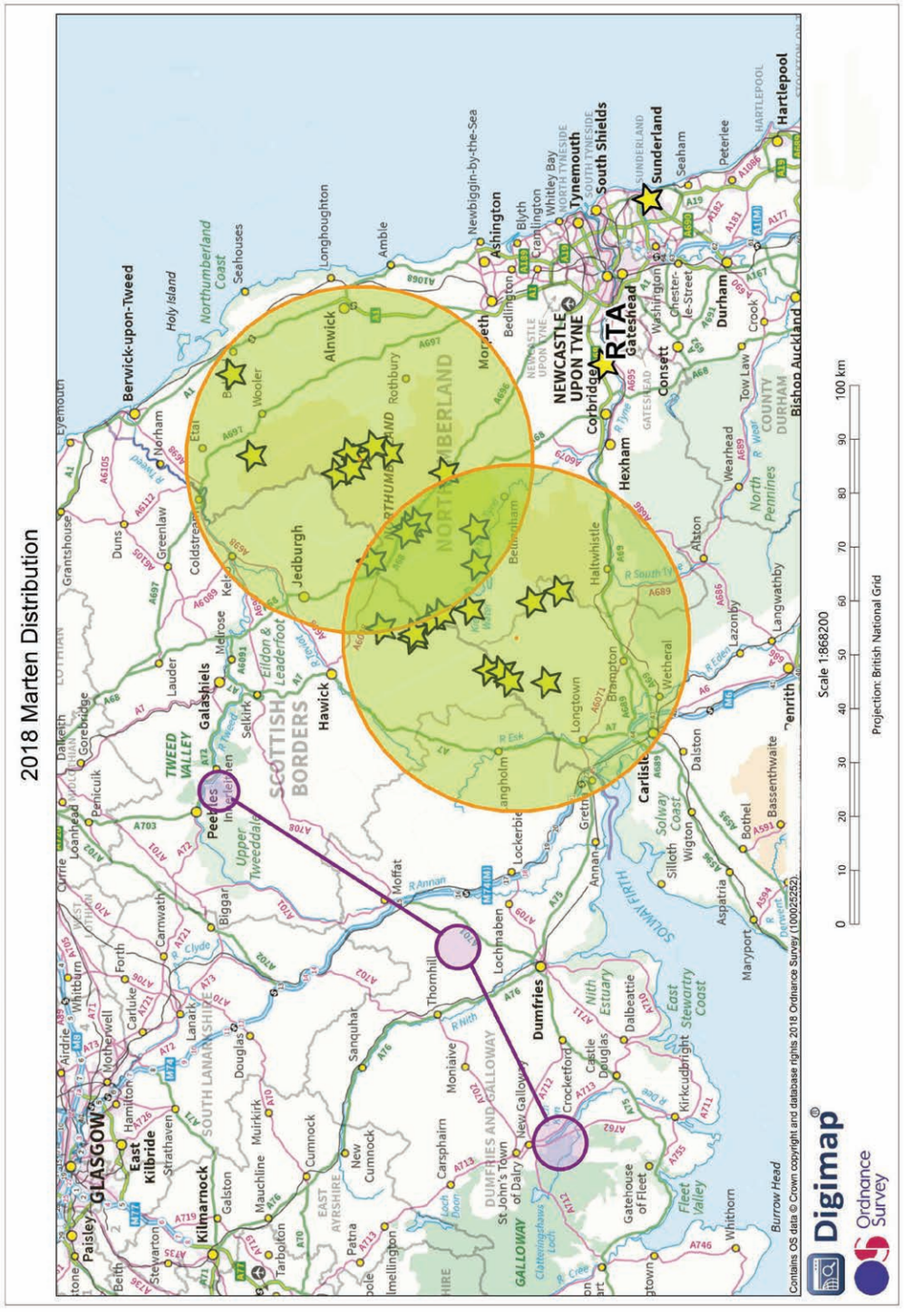

Figure 6. A projection of Pine Marten distribution including possible source origins and a 20-mile dispersal radius based on the centre of current distribution patches.

THE FUTURE

According to Mathews *et al*. (2018) one in five British mammals face extinction; conversely, however, four out of five are not and the Pine Marten is proving this point. With improved understanding and changing attitudes towards predators there is perhaps a greater range of predatory birds and mammals across the UK countryside than there has been for over 200 years. That the Pine Marten is now showing very positive signs of recovery, along with the Otter, Badger and Polecat, gives us indication that conditions are better than they have been for many years.

The most recent records pinpoint Pine Marten presence in Redesdale, below the Kielder water dam, Kershope and Spadeadam forests, with additional records from north of the County near Kyloe. VWT and the 'Back from the Brink' project aims to facilitate and monitor the natural recovery of the Pine Marten across northern England. By the end of the project, we will have monitored the spread of the Pine Marten, and have a clearer idea of its status and distribution in the region. As part of the overall recovery of the species in this country we want to provide further advice to land owners and land managers to accommodate this natural addition to our fauna. The production of a strategy will help decide the priorities in species conservation and management but, most of all, it will help to advocate and educate about the species with an action plan for future species management across the regions. It will be interesting to see how the expansion of Pine Marten range affects Grey Squirrel populations, and the project will continue to work with partners to monitor progress.

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CHECK-LIST OF THE CADDIS (TRICHOPTERA) OF NORTHUMBERLAND AND DURHAM

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SUMMARY

Analysis of data in the UK Caddis Recording Scheme shows that 136 species of caddis, which is 68% of the UK list, have been recorded from Northumbria, 117 from Durham and 132 from Northumberland. The history of caddis recording in the region is discussed. Habitat requirements are summarised. The distribution of some rare species is described.

INTRODUCTION

Purpose of the check-list

Caddisflies are a small order of insects that are allied to the Lepidoptera, which they quite closely resemble at the adult stage. Their larvae are conspicuous and well-known freshwater insects. The check-list presented here summarises the knowledge of the distribution of the caddis of Northumbria at 1 September 2018. It is hoped it will help recorders put their observations into context.

The contribution of George Norman Philipson

Norman Philipson (1916-1991) has been responsible directly or indirectly for most of the caddis recording in Northumbria (obituary: Clark and Wallace 1993). He contributed by his own recording, but especially by leading the freshwater group at Newcastle University where a succession of doctoral students studied caddis biology and wrote identification keys on which caddis larva recording in this country relies (Figure 1). Norman's studies began in 1937 on the River Blyth at Plessey (Philipson 1955) and he wrote a check-list for Northumberland (Philipson 1957) and added a further four species in Philipson (1962). Papers and theses from his students are a good source of records (Edington, 1964; Bray, 1964; Gray, 1968; Moorhouse, 1972; Hiley, 1973; Boon, 1976; Wallace, 1976; Gislason, 1992). Bray was the only one to write a distribution paper (Bray, 1966).

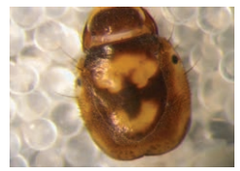

Figure 1. The head of *Hydropsyche siltalai;* Norman Philipson did pioneer ecological work with this species.

Later recording
A significant batch of records came from M I Crichton, who with his assistant Dorothea Fisher, identified caddis from the Rothamsted light traps, with Kielder and Chester-le-Street being in Northumbria; a summary of the findings is in Crichton (1971) and Crichton and Fisher (1981).

There have been few caddis records published in the past few decades but that does not reflect absence of recording. The local biological records centre ERIC (Environmental Records Information Centre - North East) actively encourages recording, accumulates data from many sources and has gathered funds to commission surveys. ERIC puts a summary of its data on the National Biodiversity Network and they are happy to provide more detail on request. Over three thousand of their records have been passed to the caddis recording scheme. In addition, 6,000 post-2000 species records have been given to the recording scheme from routine monitoring by the Environment Agency (EA) and associated bodies; prior to that date, identification by the EA and predecessors was mainly at the family level. By contrast, the Wallace family has only produced 1,400 records for the area since 1972.

Northumberland, mainly VC 67, has the largest number of records and there is no previous check-list for Durham. However, the earliest, and only 19th century records, are from Castle Eden Dene and nearby Hartlepool made by J C Dale and J E Robson. Philipson (1957, 1962) recorded 73 species for Northumberland and the list for that county now stands at 132 (136 for Northumbria).

Distribution maps
A caddis data set is submitted to the National Biodiversity Network (NBN) every few years and the data are made available by the NBN to enquirers at full resolution for non-commercial use. The data contribute to the distribution maps on the NBN Atlas web-site. Distribution is not generally described in this paper as it can be deduced from those maps.

METHODS

Data capture
The author has run the UK Caddis Recording Scheme for over 30 years and on 1 September 2018 it had 426,000 entries; the scheme takes data from all sources and that produces some duplication so the term ‘entry’ is more appropriate than ‘record’ for some species. A vice county approach is also adopted so that a species recorded at a site where a river forms the vice county boundary is counted for both. There are 4,784 entries for Durham (VC 66), 8,211 for South Northumberland (VC 67) and 3,230 for North Northumberland (VC 68); the total for Northumberland and Durham is 14,984. The data have been abstracted by the author from the literature, museum collections and

the National Biodiversity Network website. Data have been given by the Environment Agency, the local biological records centre (ERIC), and other organisations and people interested in the group. The author and his family have ties to the north-east and continue to record caddis there.

Analysis
The number of entries per vice county for each species was tabulated. That enabled the check-list to be prepared but also the comparative abundance of species to be noted to a general extent. However, the numbers have not been added to the list in this publication as they require considerable interpretation to tease out actual differences in distribution as opposed to frequency of recording. As an example, larvae of *Rhyacophila dorsalis* (Curtis 1834) are likely to be taken in most riverine surveys, so there are 1,107 entries in the database. *Limnephilus auricula* Curtis, 1834 is likely to be a common caddis at any light trap run over a season, but there are only 163 entries, reflecting the smaller number of light trap lists of caddis as opposed to riverine samples, rather than the relative abundance of the two species (Figure 2).

Figure 2. a, *Rhyacophila dorsalis*; b, *Limnephilus auricula,* (North Wales, April 2012). Images ©Janet Graham.

THE CHECK-LIST

The order of species follows the check-list in Barnard and Ross (2012), the standard guide for identifying UK caddis adults.

	List for Durham and Northumberland	VC 66	VC 67	VC 68	Northumberland	larval habitat
	Green denotes 200 or more entries in the database					
	Yellow denotes 10 or fewer entries in the database					
	Uncoloured denotes between 11 and 199 entries in the database					
	NS - Nationally Scarce *NR - Nationally Rare*					
	Suborder Spicipalpia (primitive groups)					
	Rhyacophilidae					
1	*Rhyacophila dorsalis (Curtis, 1834)*	+	+	+	+	rivers and streams
2	*Rhyacophila fasciata Hagen, 1859*	+	+	+	+	rivers and streams
3	*Rhyacophila munda McLachlan, 1862*	+	+	+	+	rivers and streams
4	*Rhyacophila obliterata McLachlan, 1863*	+	+	+	+	rivers and streams
	Glossosomatidae					
5	*Agapetus delicatulus McLachlan, 1884*	+	+	+	+	rivers and streams
6	*Agapetus fuscipes Curtis, 1834*	+	+	+	+	streams and rivers
7	*Agapetus ochripes Curtis, 1834*	+	+	+	+	rivers
8	*Glossosoma boltoni Curtis, 1834*	+	+	+	+	rivers and streams
9	*Glossosoma conformis Neboiss, 1963*	+	+	+	+	rivers and streams
	Hydroptilidae					
10	*Agraylea multipunctata Curtis, 1834*	+	+	+	+	still waters
11	*Agraylea sexmaculata Curtis, 1834*	+	+		+	still waters
12	*Allotrichia pallicornis (Eaton, 1873) NS*	+	+	+	+	rivers
13	*Hydroptila angulata Mosely, 1922 NS*		+	+	+	rivers
14	*Hydroptila forcipata (Eaton, 1873)*		+	+	+	rivers and streams
15	*Hydroptila sparsa Curtis, 1834*		+		+	rivers and streams
16	*Hydroptila tineoides Dalman, 1819*	+				still and flowing
17	*Hydroptila vectis Curtis, 1834*	+	+	+	+	streams
18	*Ithytrichia lamellaris Eaton, 1873*	+	+	+	+	rivers
19	*Oxyethira falcata Morton, 1893*	+				streams
20	*Oxyethira flavicornis (Pictet, 1834)*		+		+	lakes
21	*Oxyethira simplex Ris, 1897 NS*	+				various

	List for Durham and Northumberland	VC 66	VC 67	VC 68	Northumberland	larval habitat
	Suborder Annulipalpia (retreat-making or "Caseless" caddis)					
	Hydroptilidae					
22	*Chimarra marginata (Linnaeus, 1761) NS*		+		+	rivers
23	*Philopotamus montanus (Donovan, 1813)*	+	+	+	+	streams
24	*Wormaldia mediana McLachlan, 1878 NR*		+	+	+	rivers and streams
25	*Wormaldia occipitalis (Pictet, 1834)*	+	+	+	+	streams
26	*Wormaldia subnigra McLachlan, 1865 NS*		+	+	+	rivers and streams
	Polycentropodidae					
27	*Cyrnus flavidus McLachlan, 1864*	+	+	+	+	lakes
28	*Cyrnus trimaculatus (Curtis, 1834)*	+	+	+	+	lakes and rivers
29	*Holocentropus dubius (Rambur, 1842)*	+	+	+	+	ponds
30	*Holocentropus picicornis (Stephens, 1836)*	+	+	+	+	ponds and lakes
31	*Holocentropus stagnalis (Albarda, 1874) NS*	+	+		+	ponds
32	*Neureclipsis bimaculata (Linnaeus, 1758)*		+	+	+	rivers
33	*Plectrocnemia brevis McLachlan, 1871 NS*	+	+		+	tiny streams
34	*Plectrocnemia conspersa (Curtis, 1834)*	+	+	+	+	streams
35	*Plectrocnemia geniculata McLachlan, 1871*	+	+	+	+	streams
36	*Polycentropus flavomaculatus (Pictet, 1834)*	+	+	+	+	rivers streams lakes
37	*Polycentropus irroratus (Curtis, 1835)*	+	+	+	+	rivers streams lakes
38	*Polycentropus kingi McLachlan, 1881*	+	+	+	+	rivers and streams
	Psychomyiidae					
39	*Lype phaeopa (Stephens, 1836)*	+	+	+	+	rivers and streams
40	*Lype reducta (Hagen, 1868)*	+	+	+	+	streams
41	*Psychomyia pusilla (Fabricius, 1781)*	+	+	+	+	rivers
442	*Tinodes assimilis McLachlan, 1865 NS*			+	+	tiny streams
443	*Tinodes maclachlani Kimmins, 1966*	+	+	+	+	streams
44	*Tinodes unicolor (Pictet, 1834)*	+	+	+	+	streams
45	*Tinodes waeneri (Linnaeus, 1758)*	+	+	+	+	lakes rivers streams

	List for Durham and Northumberland	VC 66	VC 67	VC 68	Northumberland	larval habitat
	Hydropsychidae					
46	*Cheumatopsyche lepida (Pictet, 1834)*	+	+	+	+	rivers
47	*Diplectrona felix McLachlan, 1878*	+	+	+	+	streams
48	*Hydropsyche angustipennis (Curtis, 1834)*	+	+	+	+	rivers and streams
49	*Hydropsyche contubernalis McLachlan, 1865*	+	+	+	+	rivers
50	*Hydropsyche fulvipes (Curtis, 1834)*		+		+	streams
51	*Hydropsyche instabilis (Curtis, 1834)*	+	+	+	+	rivers and streams
52	*Hydropsyche pellucidula (Curtis, 1834)*	+	+	+	+	rivers and streams
53	*Hydropsyche saxonica McLachlan, 1884 NS*		+		+	rivers and streams
54	*Hydropsyche siltalai Döhler, 1963*	+	+	+	+	rivers and streams
	Suborder Integripalpia ("Cased" caddis) **Phryganeidae**					
55	*Agrypnia obsoleta (Hagen, 1864)*	+	+	+	+	upland lakes
56	*Agrypnia pagetana Curtis, 1835*		+		+	lakes
57	*Agrypnia varia (Fabricius, 1793)*	+	+	+	+	still waters
58	*Oligotricha striata (Linnaeus, 1758) NS*	+	+	+	+	bogs
59	*Phryganea bipunctata Retzius, 1783*	+	+	+	+	still water
60	*Phryganea grandis Linnaeus, 1758*	+	+		+	still water
61	*Trichostegia minor (Curtis, 1834) NS*	+	+		+	leaf-filled pools
	Brachycentridae					
62	*Brachycentrus subnubilus Curtis, 1834*	+	+	+	+	rivers
	Goeridae					
63	*Goera pilosa (Fabricius, 1775)*	+	+	+	+	rivers and streams
64	*Silo nigricornis (Pictet, 1834)*	+	+	+	+	rivers and streams
65	*Silo pallipes (Fabricius, 1781)*	+	+	+	+	rivers and streams
	Lepidostomatidae					
66	*Crunoecia irrorata (Curtis, 1834)*	+	+	+	+	trickles
67	*Lepidostoma basale (Kolenati, 1848)*	+	+		+	rivers and streams
68	*Lepidostoma hirtum (Fabricius, 1775)*	+	+	+	+	rivers and streams
	Apataniidae					
69	*Apatania muliebris McLachlan, 1866*	+	+		+	spring streams
	Limnephilidae					
70	*Drusus annulatus (Stephens, 1837*	+	+	+	+	rivers and streams
71	*Ecclisopteryx dalecarlica Kolenati, 1848*	+	+	+	+	rivers and streams

	List for Durham and Northumberland	VC 66	VC 67	VC 68	Northumberland	larval habitat
72	*Chaetopteryx villosa (Fabricius. 1798)*	+	+	+	+	rivers and streams
73	*Anabolia brevipennis (Curtis, 1834) NR*	+				wooded fens
74	*Anabolia nervosa (Curtis, 1834)*	+	+	+	+	rivers lakes
75	*Glyphotaelius pellucidus (Retzius, 1783)*	+	+	+	+	ponds and streams
76	*Grammotaulius nigropunctatus (Retzius, 1783)*	+	+	+	+	ponds and marshes
77	*Grammotaulius nitidus (Müller, 1764) NR*	+				fens
78	*Limnephilus affinis Curtis, 1834*	+	+	+	+	ponds and marshes
79	*Limnephilus auricula Curtis, 1834*	+	+	+	+	ponds and marshes
80	*Limnephilus binotatus Curtis, 1834 NS*	+	+	+	+	ponds and marshes
81	*Limnephilus bipunctatus Curtis, 1834 NS*	+	+		+	marshes streams
82	*Limnephilus centralis Curtis, 1834*	+	+	+	+	marshes streams
83	*Limnephilus coenosus Curtis, 1834*	+	+	+	+	moorland pools
84	*Limnephilus elegans Curtis, 1834 NS*	+	+		+	bogs
85	*Limnephilus extricatus McLachlan, 1865*	+	+	+	+	Streams
86	*Limnephilus flavicornis (Fabricius, 1787)*	+	+	+	+	still water
87	*Limnephilus fuscicornis (Rambur, 1842) NS*	+	+	+	+	rivers
88	*Limnephilus griseus (Linnaeus, 1758) NS*	+	+	+	+	acid marshes
89	*Limnephilus hirsutus (Pictet, 1834) NS*	+	+		+	alkaline trickles
90	*Limnephilus ignavus McLachlan, 1865 NS*	+	+		+	marshes
91	*Limnephilus incisus Curtis, 1834*	+	+	+	+	marshes
92	*Limnephilus lunatus Curtis, 1834*	+	+	+	+	all waters
93	*Limnephilus luridus Curtis, 1834*	+	+	+	+	acid marshes
94	*Limnephilus marmoratus Curtis, 1834*	+	+	+	+	still waters
95	*Limnephilus nigriceps (Zetterstedt, 1840) NS*		+		+	upland lakes
96	*Limnephilus politus McLachlan, 1865 NS*	+	+		+	lakes
97	*Limnephilus rhombicus (Linnaeus, 1758)*	+	+	+	+	still and flowing
98	*Limnephilus sparsus Curtis, 1834*	+	+	+	+	marshes

	List for Durham and Northumberland	VC 66	VC 67	VC 68	Northumberland	larval habitat
99	*Limnephilus stigma Curtis, 1834*	+	+	+	+	marshes
100	*Limnephilus vittatus (Fabricius, 1798)*	+	+	+	+	ponds and lakes
101	*Rhadicoleptus alpestris (Kolenati, 1848)* NS		+		+	upland bogs
102	*Allogamus auricollis (Pictet, 1834)*	+	+	+	+	rivers and streams
103	*Halesus digitatus (Schrank, 1781)*	+	+	+	+	rivers and streams
104	*Halesus radiatus (Curtis, 1834*	+	+	+	+	rivers and streams
105	*Hydatophylax infumatus (McLachlan, 1865)* NS	+	+	+	+	rivers and streams
106	*Melampophylax mucoreus (Hagen, 1861)*	+	+	+	+	rivers and streams
107	*Micropterna lateralis (Stephens, 1837)*	+	+	+	+	streams
108	*Micropterna sequax McLachlan, 1875*	+	+	+	+	streams
109	*Potamophylax cingulatus (Stephens, 1837)*	+	+	+	+	rivers and streams
110	*Potamophylax latipennis (Curtis, 1834)*	+	+	+	+	rivers and streams
111	*Potamophylax rotundipennis (Brauer, 1857)* NS	+	+	+	+	rivers and streams
112	*Stenophylax permistus McLachlan, 1895*	+	+	+	+	streams marshes
113	*Stenophylax vibex (Curtis, 1834)* NS	+	+	+	+	streams
	Sericostomatidae					
114	*Sericostoma personatum (Spence, 1826)*	+	+	+	+	rivers streams lakes
	Beraeidae					
115	*Beraea maurus (Curtis, 1834)*	+	+	+	+	trickles
116	*Beraea pullata (Curtis, 1834)*	+	+		+	trickles
117	*Beraeodes minutus (Linnaeus, 1761)*		+	+	+	rivers and streams
	Odontoceridae					
118	*Odontocerum albicorne (Scopoli, 1763)*	+	+	+	+	rivers and streams
	Molannidae					
119	*Molanna angustata Curtis, 1834*	+	+	+	+	lakes
	Leptoceridae					
120	*Adicella reducta (McLachlan, 1865)*	+	+	+	+	rivers and streams
121	*Athripsodes albifrons (Linnaeus, 1758)*	+	+	+	+	rivers
122	*Athripsodes aterrimus (Stephens, 1836)*	+	+	+	+	still water
123	*Athripsodes bilineatus (Linnaeus, 1758)*	+	+	+	+	streams and rivers
124	*Athripsodes cinereus (Curtis, 1834)*	+	+	+	+	rivers streams lakes

	List for Durham and Northumberland	VC 66	VC 67	VC 68	Northumberland	larval habitat
125	*Athripsodes commutatus (Rostock, 1874)* NS		+		+	rivers
126	*Ceraclea albimacula (Rambur, 1842)* NS		+	+	+	rivers and streams
127	*Ceraclea annulicornis (Stephens, 1836)*	+	+	+	+	rivers and streams
128	*Ceraclea dissimilis (Stephens, 1836)*	+	+	+	+	rivers and streams
129	*Ceraclea fulva (Rambur, 1842)*		+	+	+	lakes
130	*Ceraclea nigronervosa (Retzius, 1783)*	+	+		+	rivers streams lakes
131	*Mystacides azurea (Linnaeus, 1761)*	+	+	+	+	rivers streams lakes
132	*Mystacides longicornis (Linnaeus, 1758)*	+	+	+	+	ponds and lakes
133	*Mystacides nigra (Linnaeus, 1758)*	+	+	+	+	rivers streams lakes
134	*Oecetis lacustris (Pictet, 1834)*		+	+	+	ponds and lakes
135	*Oecetis ochracea (Curtis, 1825*	+	+	+	+	ponds and lakes
136	*Triaenodes bicolor (Curtis, 1834)*		+		+	ponds and lakes

Some accessible on-line data sets have additional species recorded for Northumbria which, at the present time, are not included in the check-list. They are rejected due to being geographically unlikely, or from a very unusual habitat for the species or probable mis-identifications, due often to inadequate keys available to the recorders. The species are:
Glossosoma intermedium (Klapálek, 1892); *Psychomyia fragilis* (Pictet, 1834); *Tinodes dives* (Pictet, 1834); *Limnephilus borealis* (Zetterstedt, 1840); *Mesophylax impunctatus* McLachlan, 1884; *Ernodes articularis* (Pictet, 1834); *Ceraclea senilis* (Burmeister, 1839).

136 of the UK's 200 species (68% of the UK list) have been recorded from Northumberland and Durham.

The UK rarity status in the list is taken from Wallace (2016). Species with no status mentioned can be regarded as nationally common, or local at most. There are 27 species that are regarded as Nationally Scarce and three species that are Nationally Rare. The rare species are also regarded as being of conservation concern. They are *Anabolia brevipennis* Curtis, 1834, *Grammotaulius nitidus* Müller, 1764 and *Wormaldia mediana* McLachlan, 1878.

Notes on certain species

Every species has a story to tell, but a few are particularly interesting:

Anabolia brevipennis was recorded from Cowpen Bewley by J W H Harrison in 1916. It is a national rarity, especially liking carr woodland and it has probably been lost due to the many changes to the site; other records for the north east are probably incorrect. *Grammotaulius nitidus* is another national rarity recorded from Castle Eden Dene in 1837 by J C Dale, and seems to be the first caddis record for the north-east. It is a species of extensive reed-swamps, especially those near the coast but may have come from nearby Hartlepool where J. E Robson recorded it in 1861. The nearest current sites are in East Anglia and it is presumed was long gone from Durham before new habitat became established in the area. Another attractive caddis that seems to have been lost from that area is *Limnephilus elegans* Curtis, 1834 (Figure 3), a nationally scarce species that lives in raised bogs and acid fens and was recorded from Seaton Carew by J W H Harrison in 1936; other records for the north-east are unconfirmed.

Figure 3. *Limnephilus elegans* Image: The Netherlands © Ernest van Asseldonk (https://nl.m.wikipedia.org/wiki/Bestand:Limnephilus_elegans.jpg)

The other National Rarity is *Wormaldia mediana* which lives in small rivers and large streams that are swift and clean and was recorded between 1980 and 1995 from five sites in the Cheviots and the Ham Burn near Whitley Chapel. Locally and nationally, it seems to have declined significantly and there are no recent local records, despite it being sought at some of its old haunts. The related nationally scarce *Wormaldia subnigra* McLachlan, 1865 also seems to have disappeared. For example, the Wallace family found it abundant in the River Rede at Redesmouth in 1996 but no trace of it there in 2015. Both species are very sensitive to siltation which clogs their filter-feeding nets but they may have also succumbed to pollution by Cypermethrin sheep-dip, now banned from use, that was found to be massively more toxic to insect life than had been anticipated and affected many upland sites in the UK with Northumbria being an area mentioned as being particularly badly affected in a Buglife campaign report (Buglife, 2018). *W subnigra* was also recorded from the Blyth at Plessey in the 1930s but has now gone with siltation from disturbance to the water course upstream during open-cast mining possibly being to blame. *Chimarra marginata* (Figure 4) is yet another nationally scarce philopotamid caddis that seems to have disappeared, but for no obvious reason. Adults of this distinctive insect were collected from the River North Tyne at Chollerford in 1934 by S J Bosanquet, but it has not been seen there again.

Figure 4. *Chimarra marginata* (Jimena, Andalucia, Spain). © Janet Graham.

By contrast it is pleasing to report the massive success of another caddis in colonising our area. One of the few caddis with a common name, the Grannom of fly-fishing fame, *Brachycentrus subnubilus* Curtis, 1834, was not recorded in Norman Philipson's time. A general expansion within its UK range led to the first north-east records which were from the Tees in the 1970 and the South Tyne, Coquet and Tweed about 1990; it is now recorded from all of our rivers, except the Aln. Of the largest rivers, the North Tyne and Tees have comparatively recently become regulated by large dams on their upper course. The dams seem to have had a generally beneficial effect on caddis (Armitage, 1978 and Boon, 1978).

Spring streams that deposit calcium carbonate are not necessarily restricted to limestone districts. *Tinodes unicolor* (Pictet, 1834) makes larval galleries (Figure 5) out of the deposit and is found in a few streams such as the Cor Burn, Whittle Burn and the intriguing stream by Starlight Castle at Seaton Sluice. *Plectronemia brevis* McLachlan, 1871 lives in depositing trickles and has been recorded recently from isolated sites near Fontburn, Bedlington, Greenlee Lough and Middleton in Teesdale. Other rare species often associated with these waters have not so far been recorded in the north-east.

Figure 5. A larval gallery of a *Tinodes* larva on a stone.

FUTURE RECORDING

As a group, caddis are no longer seriously under-recorded, but records from anywhere are always of value and these become easier to collect as identification resources improve. Barnard and Ross (2012) whilst comprehensive, is not always easy to use with living adults or photographs of them. An AIDGAP key (**A**id to **I**dentification in **D**ifficult **G**roups of **A**nimals and **P**lants, a series published by the Field Studies Council) is proposed to assist with that and to encourage, in particular, light-trappers to consider trying to identify caddis rather than just discarding them. The standard keys to larvae (Edington and Hildrew 1995 and Wallace *et al.* 2003) were supplemented by Wallace (2006) for field identification but the need to use a microscope to separate many common species groups and the difficulty of photographing specimens in fluid means larval identification is still difficult for the casual recorder. There are many places to send records and increasingly there is good data exchange. iRECORD on-line (www.brc.ac.uk/irecord/) is popular as the data, after being verified, is made available quickly to local and national users. The local record centre, ERIC supports individual recording and also organises recording events; the resultant data reaches national users in due course.

Northumbria has many flowing waters of various sizes and they are also the focus of activity for the Environment Agency. There are many flowing-water caddis, as can be seen from the list. Conversely, there are few natural lakes, ponds and fens, and they have not been as intensively surveyed, both of which result in a lower number of still-water species. As a suggestion, further recording on natural still waters such as the Roman Wall Loughs could add species. Highly alkaline waters, flowing and still, are always worth investigating even if very small, as they often hold rare species.

ACKNOWLEDGEMENTS

I would like to thank the late Norman Philipson for starting my career with caddis. Norman provided the job but my predecessor in caddis taxonomy at Newcastle University, Peter Hiley, was the person who trained me in techniques. It is traditional to thank your partner for their support but doubly justified in this case as my wife Brenda is also a highly skilled co-worker. Finally, this list would not have been possible without the numerous records passed to me by many people interested in caddis.

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BORINGS AND ENCRUSTATIONS ON COBBLES AND PEBBLES, EASINGTON, CO. DURHAM

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SUMMARY

The beach north of Easington, Co. Durham, between Hawthorn Hive and Shippersea Bay, abounds with many hundreds of rock clasts, from pebbles to boulders. Many of these were derived locally from the Permian Magnesian Limestone; others are erratics of diverse lithologies. Borings in the limestones consist of the common trinity of *Caulostrepsis* Clarke (spoor of spionid polychaetes), *Entobia* Bronn (clionaid sponges) and *Gastrochaenolites* Leymerie (boring bivalves). *Caulostrepsis* includes the type species, *Caulostrepsis taeniola* Clarke (in a cobble of Mississippian limestone), and *Caulostrepsis* isp. aff. *C. spiralis* Pickerill *et al*. *Entobia* is generally indeterminate apart from *Entobia* isp. aff. *E. cateniformis* Bromley and d'Alessandro. *Gastrochaenolites clavatus* (Leymerie) is common and was determined by taking latex casts from borings. Encrusting organisms inhabit a wider range of substrates than borings, including limestones, sandstones and coals. Encrusting organisms include the barnacle *Balanus crenatus* Brugière, serpulid worm *Pomatoceros triqueter* (Linnæus), calcareous algae *Lithothamnion* sp. and *Lomentaria*? sp., spirorbid worms, and bryozoans. The suite of borings is similar to that previously recorded from the Easington 60-foot raised beach (Oxygen Isotope Stage 7 = late Middle Pleistocene, *c*. 38,000 years old).

INTRODUCTION

The coastline of the British Isles is replete with outcrops of rocks of diverse lithologies (Steers 1960) that are constantly being eroded, principally by the action of the sea and under the influence of gravity. Once broken away from the coast, rocks are available for further mechanical and chemical fragmentation, being washed into the shallow marine realm where they are transported by longshore drift, tides, waves and storms, an environment where physical abrasion and chemical solution are continuous in their effects. Certain rock types, most particularly limestones and mudrocks, can be further broken down by the action of boring organisms which weaken them, particularly at the

outer rim. This part of a rock clast may be densely infested by borers settling from single spatfalls. In contrast, invertebrates that form gregarious, cemented accumulations on mobile rock substrates may act as an additional layer of armour, retarding the breakdown of the clast.

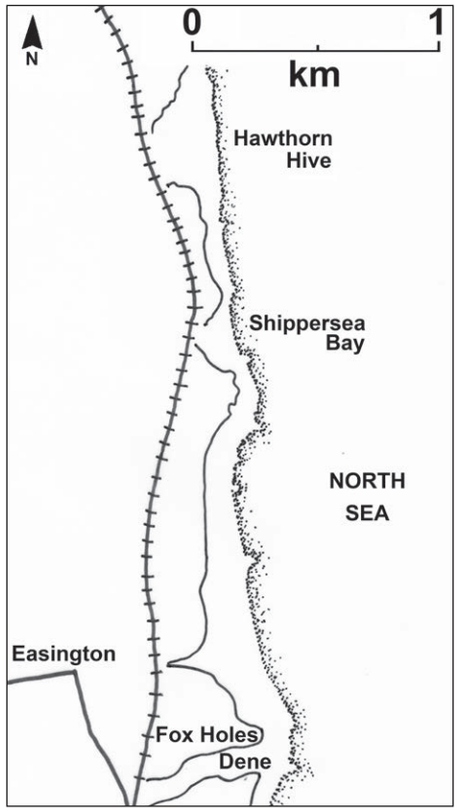

Figure 1. Locality map of the coast north of Easington, Co. Durham. Specimens described herein were collected between Hawthorn Hive and Shippersea Bay. Key: heavy black line = major road; trellised line = railway; light black line = cliffline; stippled line = low water mark.

The beach north of Easington, Co. Durham (Figure 1), retains many hundreds of rock clasts, including boulders, cobbles and pebbles. Most are Permian Magnesian Limestone derived from the cliffs at the back of the beach and offshore, submerged outcrop; other lithologies were most likely derived from a mixture of longshore drift and reworked glacial erratics (Trechmann 1931a). There is ample evidence that the rock clasts have been rolled most energetically in the sea manifest by their common rounded shape; preservation on the beach would have been the work of storms in the North Sea. It is these rock clasts on the beach that are the subject of our investigation, particularly those rich in invertebrate borings, providing data relevant to the continuing studies of S.K.D. (Donovan *et al*. in press).

The specimens described below are a selection from samples seen between Hawthorn Hive south to below the Easington Raised Beach at Shippersea Bay and collected on 31 July 2017. Every attempt was made to sample the full range of boring and encrusting invertebrate taxa, and clast lithologies, seen on the day they were collected. We document the variety of invertebrate encrusters on certain clasts, providing a different pattern to that shown by borings (Bromley and Heinberg 2006). All collected specimens are deposited in the Naturalis Biodiversity Center, Leiden, the Netherlands (prefix RGM). A pebble is 4-64 mm and a cobble is 64-256 mm (Neuendorf *et al*. 2005).

A NOTE ON ICHNOTAXONOMY

Ichnology is the study of trace fossils; neoichnology is the study of modern traces, as considered herein. Traces and trace fossils include burrows, borings, tracks, trails and coprolites, among others. These are not organisms, but they are evidence of organic activity or behaviour. Traces and trace fossils are given names that that are like those of organisms, but they are not truly Linnæan. This is an historical accident dating from the early 19th Century, when some trace fossils were mistaken for fossil plants and named accordingly (Osgood 1975). In consequence, the names applied to trace fossils are Latinized binomens, yet applied to sedimentary structures made by animals and plants. Our use of these names may imply particular trace-making organisms, but, unless the body and trace fossils are preserved in close association, this can never be absolutely certain. Further, an organism may produce more than one form of trace (think of all the different impressions – 'traces' – you might make in wet sand at the seaside) and any given trace morphology may be the spoor of more than one producing taxon.

One further point. When considering species, we use abbreviations of one sp. or several spp. Similarly, we use isp. for a single ichnospecies (= trace fossil species) and ispp. for more than one of them (Bromley 1996, p. 162). Ichnogenus is abbreviated to igen.

BORINGS

***Caulostrepsis* Clarke, 1908 (Figures 2E, 3E, 4A, B)**

Diagnosis. (After Bromley and d'Alessandro 1983, p. 286.) "Single-entrance borings or embedment structures having a pouch shape or ear shape produced by a gallery bent in a U. More complex structures can be produced by development of multiple lobes on the same basic U-plan. The limbs may be clearly visible throughout their length and connected by a vane, or they may be fused to produce an oval or flattened pouch lacking a vane. All intermediate states, involving an axial depression, occur. At the distal end the width is at least double the thickness; the cross-sectional shape here varies from flat-oval, elliptical or constricted to dumbbell-shaped. At the apertural end the width is normally noticeably less than at the distal end, but the shape of the section may be more or less the same, or subcircular. In some cases, symmetrical rows of deep pits may be developed towards the apertural end. The aperture itself may have the same form as the proximal cross section, or it may be modified by the development of superficial branches or apertural grooves, normally 2 to 4 in number, radiating out from it."

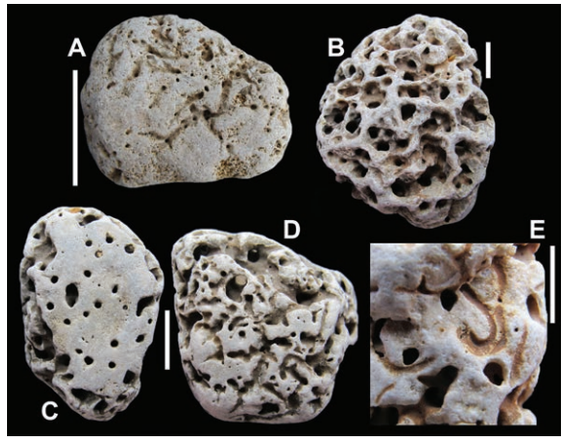

Figure 2. Magnesian Limestone cobbles bored by *Entobia* (A-D) and *Caulostrepsis*. (A) *Entobia* isp. aff. *E. cateniformis* Bromley and d'Alessandro, 1984, RGM 1332260, cobble that has been corraded to expose the internal network of borings, perhaps sub-parallel to the original surface. Scale bar represents 50 mm. (B) RGM 1332261, intensely bored pebble. (C, D) RGM 1332262, two views of a pebble, showing apertures on an external surface (C) and the internal colonial structures (D). (E) RGM 1332264, *Caulostrepsis* isp. aff. *C. spiralis* Pickerill *et al*., 2002. Scale bars represent 10 mm unless stated otherwise.

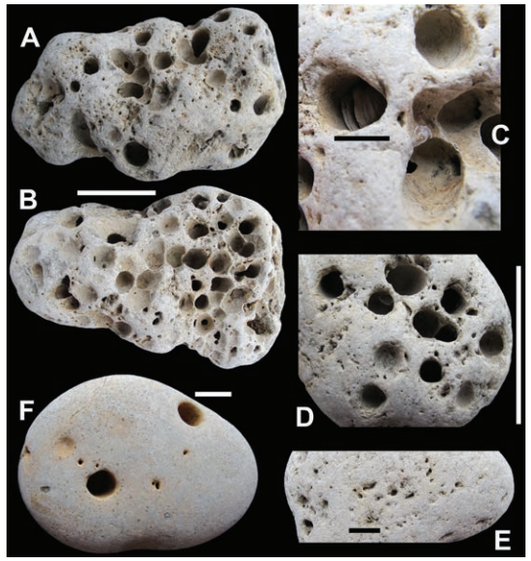

Figure 3. Magnesian Limestone cobbles bored by (mainly) *Gastrochaenolites clavatus* (Leymerie, 1842) (A-D, F) and *Caulostrepsis* isp. (E). (A-C) RGM 1332259. (A, B) Two sides of a cobble, showing incomplete borings of similar depth on both sides (*contra* specimen in Figure 5), suggesting that this was a mobile clast bored equally on both sides and then similarly eroded correspondingly on both sides. Some borings have a calcite lining. Scale bar represents 50 mm. (C) Detail of boring, just above scale bar, with bivalve (borer? or nestler?) preserved within. It could not be removed without breaking and was therefore left *in situ*. (D, E) RGM 1332266. (D)

Deep borings, *G. clavatus*, on one side of a cobble. Scale bar represents 50 mm. (E) Another side of the specimen showing slot-shaped borings (*Caulostrepsis* isp.). (F) RGM 1332263, unusually smooth limestone clast. The *G. clavatus* in the lower left is deep; that in the upper right is a hole through the clast and was bored from the reverse side. Scale bars represent 10 mm unless stated otherwise.

Remarks. *Caulostrepsis* Clarke are "U-shaped borings that have a vane connecting the limbs of the U-boring" (Bromley 2004, p. 460) and are the spoor of polychaete worms, in the North Sea most commonly generated by the spionids that belong to the genus *Polydora*. They are typically shallow borings and are soon lost by surface corrasion (*sensu* Brett and Baird 1986; that is, corrosion + abrasion) of a mobile substrate. Where preserved, they are apparent in cross-section as slot or figure-of-eight shaped holes, *Caulostrepsis* isp. (Cadée 2018; Figure 3E herein), but are more apparent in longitudinal section. Straight specimens with a central vane, preserved in a cobble of Mississippian(?) limestone, are assigned herein to the type ichnospecies, *Caulostrepsis taeniola* Clarke (Figure 4A, B). More teasing is a curved specimen, RGM 1332264, with an incomplete central vane and limbs that diverge more proximally (Figure 2E). The curvature is reminiscent of *Caulostrepsis sprialis* Pickerill *et al*., 2002, previously only recorded from the Middle Miocene of Carriacou, Lesser Antilles, but that ichnospecies lacks a central vane. We provisionally refer RGM 1332264 to *Caulostrepsis* isp. aff. *C. spiralis* until further specimens become available.

***Entobia* Bronn, 1838 (Figure 2A-D)**

Diagnosis. (After Bromley and d'Alessandro 1984, p. 238.) "Boring in carbonate substrates comprising a single chamber or networks or boxworks of galleries connected to the surface by several or numerous apertures. Morphology changes markedly with ontogeny. The galleries show progressive increase in diameter during growth; in some forms, inflation at more or less regular distances produces a system of closely interconnected chambers; in other forms, chamber development is restricted to only a brief ontogenetic stage; in still other forms, no cameration is developed. The surface of the boring bears a cuspate microsculpture that may be lost in gerontic specimens. Fine apophyses arise from all or most surfaces of the system."

Remarks. Sponge borings such as *Entobia* are "… generally an anastomosing network of canals that in most cases swell to form rounded chambers. Commonly the chambers dominate the boring and obscure the design of the network" (Bromley 2004, p. 459). The interplay of ontogeny and taphonomy commonly makes identification of *Entobia* to ichnospecies problematic except where specimens are particularly well preserved. Herein, we assign all specimens to *Entobia* isp. for simplicity (Figure 2A-D). The complexities involved are demonstrated by RGM 1332262 which exposes both the internal (Figure 2D) and external morphology (Figure 2C), with apertures, of what is presumed to be a single network. RGM 1332260 is at least superficially close to *Entobia cateniformis* Bromley and d'Alessandro, 1984 (compare Figure 3 therein with Figure 2A).

***Gastrochaenolites* Leymerie, 1842 (Figures 3A-D, F, 5, 6)**

Diagnosis. (After Donovan and Ewin 2018, p. 106, modified after Kelly and Bromley 1984, p. 797.) "Clavate borings, with or without a calcareous lining. The aperture region of the boring is narrower than the main chamber, and may be circular, oval or dumbbell shaped. The aperture may be separated from the main chamber by a neck region which in some cases may be widely flared. The main chamber may vary from sub-spherical to elongate, having a parabolic to rounded truncated base and a circular to oval cross section, modified in some forms by a longitudinal ridge or grooves to produce an almond or heart-shaped section. Typical substrates are rock (commonly mudrock or limestone), shell or, less commonly, wood."

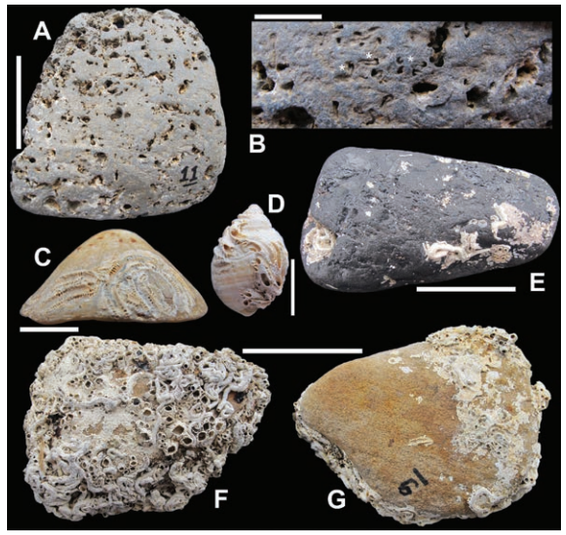

Figure 4. (A, B) RGM 1332269, cobble of Mississippian(?) limestone. (A) Densely-bored surface of cobble. Scale bar represents 50 mm. (B) Detail of surface. Three good examples of *Caulostrepsis taeniola* Clarke, 1908, marked (*). (C) RGM 1332270, limpet *Patella* sp. encrusted by basal attachments of serpulid *Pomatoceros triqueter* (Linnaeus). The limpet is only encrusted in the area shown and not on the inner surface, which may suggest that it was alive when infested. (D) RGM 1332271, gastropod *Nucella lapillus* (Linnaeus) encrusted by serpulid *Pomatoceros triqueter* (Linnaeus) on the external surface only. (E) RGM 1332268, coal cobble encrusted by serpulid *Pomatoceros triqueter* (Linnaeus), balanid *Balanus crenatus* Bruguière, calcareous algae *Lithothamnion* sp., spirorbids and bryozoans. The incomplete preservation of many encrusting organisms and the 'naked' areas of the clast indicates subsequent corrasion. Scale bar represents 50 mm. (F, G) RGM 1332267, sandstone cobble densely (F) to more sparsely infested (corraded) (G) by serpulid *Pomatoceros triqueter* (Linnaeus), balanid *Balanus crenatus* Bruguière, calcareous algae *Lithothamnion* sp. and *Lomentaria*? sp., and bryozoans. Scale bar represents 50 mm. Scale bars represent 10 mm unless stated otherwise.

Remarks. *Gastrochaenolites* includes clavate (club-shaped) borings in lithic substrates, including robust shells (such as Pickerill and Donovan 1997), and wood (formerly included in *Teredolites* Leymerie, 1842, but now synonymised with *Gastrochaenolites*; Donovan and Ewin 2018). These are the most prominent borings in rocks on the beach at Easington, partly because they are the largest borings in this assemblage, but also due to their high preservation potential. By boring vertical to sub-vertical to the surface of a clast, considerable corrasion is required to completely remove them (see, for example, Figure 5), making *Gastrochaenolites* particularly persistent.

The easiest way to determine the ichnospecific identity of modern *Gastrochaenolites* borings is to take casts of the borehole using some suitable medium, in this case liquid latex (compare with Donovan 2013, 2017). All of the casts taken from RGM 1332259, 1332263 and 1332266 were similar (Figure 6), although none was complete. Comparison with Kelly and Bromley (1984, text-Figure 3) shows that they are closest to *Gastrochaenolites turbinatus* Kelly and Bromley, 1984, a junior synonym of *Gastrochaenolites clavatus* (Leymerie, 1842) (Donovan and Ewin, 2018).

Other borings

Apart from those infested by *Entobia* isp., the bored limestone clasts illustrated herein (Figures 3, 4A, B, 5) include indeterminate small, round or rounded holes that appear to be more or less deeply perforate in the substrate. Without seeing the three-dimensional form of these borings, it is impossible to determine to which ichnotaxon (more probably ichnotaxa) they should be assigned. Such an investigation would be destructive, involving splitting clasts, but may form the focus of a later study on recollected material.

Balanid barnacles (Figure 4E, F)
Gregarious accumulations of balanid barnacles, most likely *Balanus crenatus* Bruguière, occur on substrates of coal (Figure 4E) and sandstone (Figure 4F). On both specimens the balanids are partially overgrown by serpulid worms, implying a succession. In turn, gregarious accumulations of small, presumed juvenile *B. crenatus* are found on some serpulids. On RGM 1332267 (Figure 4F) the balanids and *Lithothamnion* show little evidence of interaction and may have been coeval.

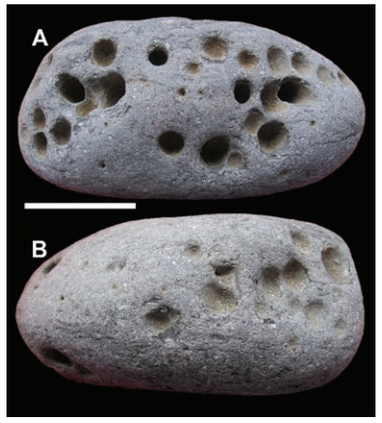

Figure 5. Two views of a limestone cobble that has been intensely bored by *Gastrochaenolites clavatus* (Leymerie, 1842) (specimen not collected). All of these borings would have been flask-shaped originally, so although side (A) appears to be more densely infested than (B), borings on the latter are shallower. One possible scenario would have been that side (B) was bored first, then partially corraded (*sensu* Brett & Baird, 1986). Side (A) was then infested and corrasion continued equally on both sides, leaving those in (A) more complete. Scale bar represents 50 mm.

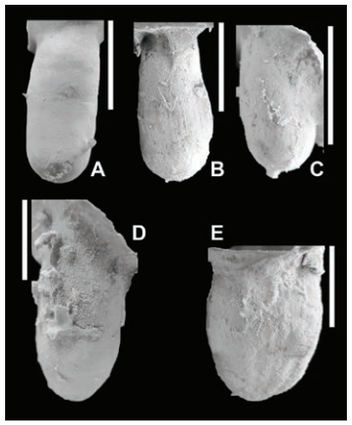

Figure 6. Latex casts of *Gastrochaenolites clavatus* (Leymerie, 1842). (A) RGM 1332263. (B, C) RGM 1332266, two specimens. (D, E) RGM 1332259, two specimens. All scale bars represent 10 mm. Specimens whitened with ammonium chloride.

Serpulid worms (Figures 4C-G, 7)
Serpulids are provisionally referred to *Pomatoceros triqueter* (Linnaeus) (Barrett and Yonge 1958, p. 77; Campbell 1982, pp. 134-135). They infest a range of substrates, sometimes densely, including gastropods, limestones (particularly within holes, such as vacant borings, particularly *Gastrochaenolites*), coal and sandstones, and have grown over *Lithothamnion* and *Balanus*, which in turn have encrusted *Pomatoceros*.

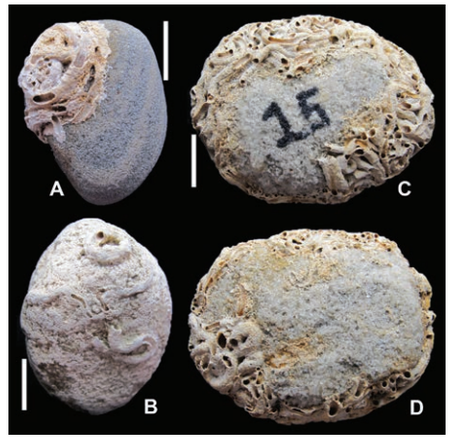

Figure 7. Encrusting organisms on sandstone pebbles. (A) RGM 1332272, pebble of fine-grained, bedded sandstone encrusted by serpulid *Pomatoceros triqueter* (Linnaeus) which, in turn, preserves traces of the calcareous alga *Lithothamnion* sp. This specimen is surely an erosional remnant of a clast that was formerly more densely covered by encrusters. (B) RGM 1332274, rounded pebble of coarse-grained sandstone, encrusted by serpulid worm tubes and subsequently overgrown by calcareous algae, *Lithothamnion* sp. (C, D) RGM 1332273, pebble of coarse-grained sandstone, densely encrusted in part by the serpulid *Pomatoceros triqueter* (Linnaeus). The distribution of serpulids suggests that any tubes on the two flattened faces have been scraped clean during transport. All scale bars represent 10 mm.

Calcareous algae (Figures 4E, F, 7B)
More than one specimen is encrusted by the white, chalky, warty calcareous alga referred to *Lithothamnion* sp. herein (Barrett and Yonge 1958, p. 250; Campbell 1982, pp. 50-51). It is possible that similar algae are more common at Easington, but not apparent because of their similarity to the many pale limestone clasts that dominate the beach. RGM 1332267 preserves both encrusting *Lithothamnion* sp. and upright *Lomentaria*? sp. (Figure 4F).

RGM 1332274 is particularly interesting on its own. The sandstone pebble is well rounded, indicating considerable transport, and dense *Lithothamnion* sp. gives it the appearance of a limestone. It was encrusted by serpulid worms and their tubes were subsequently overgrown by *Lithothamnion*. Some of the serpulid tubes have broken through, giving a false impression of sinuous borings (Figure 7B, just above centre). Some algae have also been lost by corrasion.

Other encrusting organisms
Rare coiled spirorbid worm tubes and incomplete (corraded) encrusting bryozoan colonies were noted on, for example, RGM 1332268.

DISCUSSION

We first need to emphasize the collecting bias exhibited by the authors. Beach clasts are heavy and rapidly a collection might be amassed that could not easily be transported in a single haversack. The specimens described herein are thus a selection taken from many hundreds of possible samples seen between Hawthorn Hive south to below the Easington Raised Beach at Shippersea Bay. Every attempt was made to sample the full range of boring and encrusting invertebrate taxa, and clast lithologies, seen on the day they were collected (31 July 2017). That other varieties of rocks and invertebrates will be found in the future is undoubted; this report concerns one collection made on one day, but nonetheless provides a good sample of the organic diversity. Results are summarized in Table 1.

Table 1. Summary of substrate preferences of trace fossils penetrating and invertebrates inhabiting pebbles and cobbles on the beach at Easington, based on a collection of 22 specimens (RGM 1332259 to 1332280; 22 specimens, not all are illustrated). Key: X = present; ? = identification provisional.

	Mississippian limestone	Magnesian Limestone	coal	sandstone	gastropods	siltstone
Borings						
Caulostrepsis	X	X				
Entobia		X				
Gastrochaenolites	X	X				
Encrusters						
Balanus			X			
Pomatoceros			X	X		X
calcareous algae	X	X	X	X	X	
spirorbids			X	X		
bryozoans			X			X

The association of the boring 'trinity' of ichnogenera, *Caulostrepsis*, *Entobia* and *Gastrochaenolites*, is common on the coasts of the southern and western North Sea today (Donovan *et al*., in press), and elsewhere in the fossil record (such as Santos *et al*. 2010, 2011). These three ichnogenera can be easily separated by the novice ichnologist. The bored clasts are mobile and have been washed onshore, probably mainly during major storms, from the shallow shelf environment; they are all dwelling traces (= domichnia).

Boring organisms only infest limestone substrates; encrusters are recorded from various types of rock and shells, but not common on limestones. Further fieldwork is necessary to determine if this is a true pattern of substrate preference or merely one generated by the collecting pattern of the authors.

It is instructive to compare the modern borings described herein with trace fossils from the Easington 60-foot raised beach (Oxygen Isotope Stage 7 = late Middle Pleistocene, *c*. 38,000 years ago; Bridgland and Austin 1999, p. 55; Ogg *et al*. 2008, Figure 15.6; Davies *et al*. 2009). Bridgland and Austin (1999, p. 53) included *Cliona* sp. and *Polydora* sp. in a faunal list, and noted that "Pebbles bored by marine molluscs and annelid worms are also common (Woolacott, 1920, 1922; Trechmann, 1931b)." *Cliona* sp. is unlikely, but this probably refers to clionaid sponge borings, *Entobia* isp. Similarly, the polychaete *Polydora* sp. would be a most unlikely fossil, but its borings, *Caulostrepsis* isp., are likely, particularly in *Ostrea* sp. which makes the same faunal list. Whether these are also the borings of "… marine … annelid worms" is possible. The marine molluscs boring pebbles were most likely boring bivalves producing *Gastrochaenolites* isp. Woolacott (1920, pp. 308-310; 1922, p. 66) and Trechmann (1931b, p. 295) noted rolled clasts of Magnesian Limestone with boreholes inhabited by *Saxicava* Fleuriau de Bellevue, a junior synonym of *Hiatella* Bosc (www.marinespecies.org/aphia.php?p=taxdetails&id=152307), a nestling and boring bivalve (Beedham 1972, p. 188; Tebble 1976, p. 173). That we were unable to confirm any of these determinations was due to the overgrown nature of the paths to the Easington shell bed exposure on our joint visit in July 2017, making ingress treacherous. However, available evidence suggests that the ichnofossils of Easington have changed little since the Middle Pleistocene.

ACKNOWLEDGEMENTS

S. K. Donovan acknowledges the support of the Naturalis Biodiversity Center, Leiden. Harper acknowledges support from the Leverhulme Trust.

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GEORGE WAILES, ENTOMOLOGIST AND HORTICULTURALIST

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SUMMARY

George Wailes is one of the lesser-known members of the cohort of Naturalists active in the Newcastle area in the mid-1800s.This article brings together information from a number of sources, including newspapers as well as manuscripts and academic journals, to present a summary account of his life and activities.

INTRODUCTION

George Wailes (1803-1882) was one of the most active naturalists in the Newcastle area in the 1800s, but he is not well known today; if he is remembered locally it is because of his work on *Lepidoptera*, and because his brother William was a famed manufacturer of stained glass.

Indeed, the few obituaries for George Wailes suggest that memories of him were already fading by the time he died. A brief notice in the *Newcastle Courant*, 17 November 1882, recorded his death and mentioned his role in various societies. The following May, in his presidential address to the Tyneside Naturalists' Field Club, Canon Wheeler (1883) noted that George Wailes had been a founder member of the club and was its president in 1860, adding that he "possessed a good library of works on his favourite topics" and that he had for a long time been unable to follow his studies.

An anonymous short note in the *Gardener's Chronicle* in 1882 (**18**: 727) added little to what is otherwise known except to say "at one time he was a frequent correspondent of this journal, and to the last took great pride in his garden. Alpine plants and Orchids were his pet subjects".

The obituary by Henry Stainton (1883) in the *Entomologist's Monthly Magazine* focussed on his entomological work but included some personal details. "He certainly excelled as a letter writer, his neat handwriting, and the amount of geniality he threw upon the subject, rendered the arrival of a letter from him an unfailing source of pleasure". He added that deafness began to affect George Wailes 20 years before his death.

Five years after George Wailes's death a single paragraph in the *Natural History Transactions of Northumberland, Durham and Newcastle-on-Tyne* (Anonymous 1887) stood as a tribute from a society that he had helped to found almost six decades earlier. It commented on the legal work he did for the society free of charge, on his entomological work and on his interest in growing orchids. Finally, it noted, as Wheeler had, that he had been an invalid "for many long years", unable to follow his interests.

This paper brings information together from several sources to build a more complete picture of George Wailes and his activities in the field of natural history.

Figure 1. Portrait of George Wailes with a dog. By a member of the Burnup family of Newcastle. Undated, possibly 1830s (Private collection).

Background

George Wailes (Figure 1) came from a solid professional family from Bearl in Northumberland that was prominent enough to have a genealogy printed in the *Victoria County History* (Hodgson 1902). The genealogy records that he was born 21 March 1803 and was the eldest of 11 brothers and sisters. His father, Thomas Wailes, was a Receiver of the Estates of Greenwich Hospital, a position paying £1,500 each year,[1] and owned property in Newcastle's Westgate.[2] One of his brothers, William, was a renowned producer of stained glass and the owner of one of Gateshead's grandest houses, Saltwell Towers (Torbet 2003). George Wailes married twice, but had no children. He was a

1 *Hansard*, reporting on House of Commons sitting 7 June 1815.
2 It was sold in 1834 (*Newcastle Courant* 24 May 1834); Thomas Wailes was living at 8 Carlton Terrace in 1837 (Richardson's *Directory*), and died in 1838.

solicitor, with a practice in Newcastle.[3] In *Parson & White's directory* in 1827 his business was in Mosley Street, but later directories give an address in the Royal Arcade. He lived first in Newcastle, at 2 Ridley Place from at least 1844 until 1860,[4] and later in Gateshead, at Burghfield Grange from at least 1861 until 1877,[5] then at 1 Poplar Crescent Road (Bensham) until 1879 and at 4 Mardale Parade (Bensham) in 1881.[6] The *Entomologist's annual* for 1857 gave his address as Ryton, which is an anomaly.

The first of these addresses, Ridley Place, is an early nineteenth century street of terraced houses, solidly middle class, that still stands at the top end of Northumberland Street. Burghfield Grange was a detached Victorian villa in its own grounds. The last address is again a terrace, much smaller than Burghfield Grange, and suggests a move by an elderly couple who could no longer cope with – or saw no need for – the large house and gardens of Burghfield Grange. Indeed, already by 1868 it was being advertised for sale "with the garden and ornamental grounds attached thereto, containing 2 acres or thereabouts".[7]

Local Societies

George Wailes was an active member of several academic societies as well as the professional Newcastle Law Society. His name is frequently found on the committees of local ones such as the Literary and Philosophical Society in Newcastle, and it seems that the only academic society in the Newcastle area that he did not join was the Society of Antiquaries.

An example of his involvement in the Literary and Philosophical Society can be seen in the 'Fancy Fair', a fundraising exhibition held in 1850 on behalf of the society. The book of committee minutes surviving in the society's archives reveals that George Wailes sat on the House Committee for the fair. One aspect of the Fancy Fair was a special horticultural exhibition staged in a marquee, and on 13 August it was noted that George Wailes required two gross (288) of small flower pots to hold the ferns he was supplying. If he grew them himself, rather than buying them from a nurseryman, it suggests he had an extensive Fern House.

He also superintended the production of the Literary and Philosophical Society's catalogue, published in 1848 (Anonymous 1848).

He was a founder member of the Natural History Society of Northumberland, Durham and Newcastle upon Tyne in 1829, served on its committee from 1829 to 1834 and again1838-1839, and was Secretary of the society 1834-1838. At that time the collections

3 Newcastle and Gateshead Law Society printed proceedings 1826-1834 (Tyne and Wear Archives AS.LS.1/1) record his name as a member as early as 1827. This implies that he might have trained – and always worked – in Newcastle.
4 Nathaniel Winch lived at 2 Ridley Place until his death in 1838 (see entry for Winch in Welford 1895), so the building was home to two naturalists: this might not be pure coincidence.
5 His census addresses were: 1851, 2 Ridley Place, 1861-1871 Bensham Road, 1881 Mardale Place.
6 *Tyneside Naturalists' Field Club* list of members 1846; trade directories to 1881.
7 *Newcastle Courant* 26 June 1868. Burghfield Grange has been demolished, but close inspection of maps and Trade Directories indicates it occupied the plot between Kyle Road, Lobley Hill Road and the railway line. It is now (2017) the site of a car showroom, with the grounds covered with tarmac.

were supervised by Honorary Curators, and he was one of the Honorary Curators for Entomology between 1829 and 1840. His connection with the society then suddenly ceased. Although listed in the society's *Annual Report* for 1840 as an Honorary Curator, that year he sent a letter[8] resigning his membership: he never re-joined although he did take part much later in one of the society's activities: weather recording.

The mid nineteenth century was a period of organised meteorological recording in Newcastle, with large parts of the Natural History Society's *Transactions* being devoted to weather reports. One of the recorders in the network was George Wailes, who took weather readings at Burghfield Grange in 1864-1866 (see for instance Atkinson 1866). These seem to be the only years in which he provided records.

In 1846, six years after leaving the Natural History Society, he was a founder member of the Tyneside Naturalists' Field Club, and was its president in 1860. His work with the Botanical and Horticultural Society will be discussed below.

GEORGE WAILES AS AN ENTOMOLOGIST

If George Wailes has been remembered at all as a naturalist, it has been as the compiler of the first thorough catalogue of the butterflies of Northumberland and Durham. But this was not published until the 1850s, and he was active in entomology three decades earlier. His entomological interests were not purely local, as not only was he a founder member of the Entomological Society of London, subsequently lapsing and then re-joining in 1854[9] (then remaining a member until 1868), but he was also a member of the prestigious entomological societies in France and Prussia, the *Société Entomologique de France* and the *Entomologischer Verein zu Stettin*. His few contributions to the published entomological literature suggest that he had a wide circle of entomological correspondents.

The first indications of George Wailes's interest in entomology are the records he contributed to James Francis Stephens for his *Illustrations of British Entomology*. He supplied hundreds of records, not only of butterflies and moths for the *Haustellata* volumes (1829-34), but also of beetles for the *Mandibulata* volumes (1828-1835). Many of the localities, such as Gibside, Prestwick Carr and Castle Eden, will be familiar to local entomologists, but there are also a lot of records from Meldon Park, which was an estate managed by the Wailes family. He must have continued to amass records, because when Hardy and Bold's catalogue of Coleoptera appeared (1848-1852) there were many localities for beetles additional to those published by Stephens.[10]

8 Natural History Society of Northumbria archive, letter NEWHM 1996.H278.75.

9 The Society's proceedings, reported in *The Zoologist* (**13**: 4567-4568) show that he was elected a member at a meeting on 4 December 1854.

10 There are many references to George Wailes in Bold's entomological journals (two volumes, Natural History Society of Northumbria archives NEWHM 1996.H23 and H24).

His Coleoptera records indicate more than just a passing interest in beetles. The highlights among the rarities he recorded include *Bembidion nigricorne* (Carabidae), which was first found in England by George Wailes,[11] and *Cryptophagus scutellatus* (Cryptophagidae) which was described and named by Edward Newman (1834) from a specimen in George Wailes's collection.

He subscribed to the first 10 volumes of Henry Stainton's *Natural history of the Tineina*, and provided information and records to Stainton on *Microlepidoptera*. For instance, *Coleophora genistae* was first discovered by George Wailes and described by Stainton (Stainton 1857). Stainton even named a species of leaf-mining moth in Wailes's honour: this was *Cemiostoma wailesella*, first named in an article in the *Entomologist's Weekly Intelligencer* in 1858. Unfortunately, the name is no longer in use, being now considered to be a junior synonym of *Leucoptera laburnella*

A total of 77 records were provided to Henry Stainton for the second volume of his *Manual of British butterflies and moths* (Stainton 1859), where they are listed as "Ne." [the abbreviations refer to the home towns of Stainton's correspondents rather than the moth localities]. Since no records were provided for the first volume, and Wailes's records only appear from "the eighth family of the Geometrina" onwards it suggests that he had not been involved in Stainton's project from its outset.

His most high-profile discovery was a butterfly found in Castle Eden Dene and sent in 1831 to Stephens, who named it as *Polyommatus salmacis*. This was the Castle Eden Argus butterfly, now *Aricia artaxerxes salmacis*. There has been much subsequent discussion about whether the butterfly is a separate species, or a subspecies or variety of *Aricia artaxerxes*.[12] Wailes himself (Wailes 1857) devoted 12 pages of his catalogue to the discussion of the butterfly and concluded that all three named forms (*Aricia agestis*, *artaxerxes* and *salmacis*) should be treated under one name. Whatever is the truth of this, very few of the many British lepidopterists could lay claim to have discovered such a distinctive butterfly in Britain as late as the 1830s.

Records were provided for Henry Stainton's periodical the *Entomologist's annual* (1855-1874), including especially the *Tineina* but also extended to other *Lepidoptera*, Coleoptera, Hymenoptera and Odonata.

Several short notes were contributed to Edward Newman and Francis Walker's journal the *Entomological magazine* in the 1830s, and these are listed in the bibliography below. Probably the most interesting for the natural history of the North East is his list (published 1833) of insects found in Castle Eden Dene.

11 *Bembidion nigricorne* was reported as a British species by G R Waterhouse, who exhibited specimens from his collection to the Entomological Society of London; he had forgotten where they came from (see *The Zoologist* **18**: 6396). George Wailes sent a letter in response (Wailes 1862), giving the history of the specimens: he had collected several in 1827, before Gyllenhal's description of the species had been published. He distributed examples to several of his correspondents, including Waterhouse.

12 See for example Selman *et al*. (1973), Aagard *et al*. (2002), Norman *et al*. (2014). Incidentally, there is a typographic error in Robson (1902) suggesting Wailes united the three forms in 1877 rather than 1857.

Despite being a founder and a long-standing member of what is now the Royal Entomological Society of London, he contributed little to their journal: just three short notes between 1858 and 1862. One of these (Wailes 1859) throws an extra light on his horticulture. In discussing the insect pests of rhododendrons, he noted that his rhododendron house, which was devoted to the species from Sikkim and Bhutan, needed only three or four species to include all of those introduced to Britain.

He made one substantial contribution to the literature on Lepidoptera of our region, and that was the catalogue issued as part of an ambitious programme on the part of the Tyneside Naturalists' Field Club to document the fauna and flora of Northumberland and Durham. These catalogues were not only published as part of the club's *Transactions* series but could also be bought as separately published booklets. Perhaps the task of cataloguing all of the moths was too great for one man alone at that time, but George Wailes's *Catalogue* included only the butterflies and the Sesiidae, Zygaenidae and Sphingidae. This might give the impression that he was only interested in the big and conspicuous Lepidoptera, but we have seen that his interests went much deeper.

One aspect worth noting about Wailes's *Catalogue* is that his interests had moved away from entomology a long time previously. In the introduction he noted that his collection was chiefly formed between 1826 and 1834, and he only came back to Lepidoptera in 1854.

The *Catalogue* stood as the only monograph of the region's Lepidoptera for almost half a century until the first part of John E Robson's catalogue was issued (Robson 1902, 1905; Gardner 1912). Although Hardy and Bold had been able to incorporate a lot of Wailes's records of beetles into their catalogue, none of his records of micro-moths was used by Robson. It is inconceivable that he did not keep records of 'micros', but we must presume that by two decades after his death his notebooks or record cards had been lost or discarded.

GEORGE WAILES AS A HORTICULTURALIST

> The first meeting of the season was held in the Music Hall on April 29th ... The scientific secretary George Wailes had also his share of the beauty of the show, but his plants are too rare for north country taste, and so simple that they escape the eyes of the spectators, who look for glaring flowers. Mr Wailes, as an amateur, is one of the best supporters of the society, and, as a proof, it may be mentioned that at every show he produces something singularly rare and beautiful.[13]

Figure 2. The Summer show of the Botanical and Horticultural Society, in the Music Hall (Nelson Street, Newcastle). (*Illustrated London News* 24 June 1843, page 435)

We have seen some allusions to George Wailes's horticultural activities: that alpines and orchids were his pet subjects, and that he had a rhododendron house. In a paper on bees in 1833 he mentioned that he had several *Passiflora caerulea* growing against the south wall of his house (they bore fruit in 1829, an unusually northern occurrence).[14] In this section we will get a greater measure of his floral interests by following the reports

13 *Newcastle Journal* 30 April 1842.
14 This was possibly the family home in Westgate, Newcastle, which was sold in 1834.

of the Durham, Northumberland and Newcastle upon Tyne Botanical and Horticultural Society (B&HS). This society was founded in April 1824 (see Mackenzie 1827 for a description of the society in its earliest years) and was very active throughout the nineteenth century. Although its name implied wide coverage in northeast England the focus of its activities seems to have been the city of Newcastle. The Newcastle newspapers recorded the 'annual meetings' each August at the Queen's Head when prizes were distributed and officers appointed.[15] There was usually also a spring show in June or July and an autumn show in August or September; usually these shows were held in the Music Hall on Nelson Street (see Figure 2**)** or the Corn Market.[16] In some years there was also a summer exhibition. From the late 1840s the society had a permanent showground.

George Wailes was already a member of the B&HS by 1825; he was a committee member as early as 1835, and in 1836 he was elected as one of the Secretaries, a post he held until 1847.[17] A newspaper reporter in 1840 described him as "one of the indefatigable secretaries of the society".[18] His name appeared frequently in the reports of the shows. In the early years this was mainly as a competitor, and later his displays of exotic blooms are frequently singled out for special mention.

His first silver medal was in 1837, for the *Cypripedium insigne* he entered in the "Best Exotic" class.[19] All of his subsequent medals were silver, except on two occasions: he was awarded only bronze medals in 1841 for "Best three gladioli" and for the second best "Exotic Plant in Flower" (a *Catasetum proboscideum*).[20]

Many of his medals were for "Best Exotic", but he also won "Best *Alstroemeria*" class in 1839, 1840 and 1841.[21]

He won "Best Exotic" medals for a *Gongora atropurpurea* (in 1839), an *Oncidium papilio* and a "*Myranthus*"[22] (both 1840) a *Cattleya skinneri* (1842), and an *Oncidium huntianum* (1843). At the Great Summer show in June 1843 his "fine and rare plant the *Calanthe veratrifolia*" was greatly admired and was given a silver medal for "Best single specimen of a new or rare exotic plant" but this was nearly the end of his competing phase: his last medal was awarded the following year for an *Oncidium sanguineum*. [23].

15 Checked online using Gale Newsvault for the period 1820-1864
16 The *Illustrated London News* for June 24th 1843 (issue 60, p. 435) carried an article about the show and an illustrated scene of the display in the Music hall.
17 See a membership list for 1825 in the *Proceedings* of the society; also, Newcastle *Courant*, 29 August 1835, 3 September 1836, 2 April 1847
18 *Newcastle Journal*, 5 June 1841.
19 *Newcastle Journal,* 16 September 1837.
20 *Newcastle Journal,* 9 July 1841, 28 August 1841.
21 *Newcastle Courant,* 12 July 1839; *Newcastle Journal*, 4 July 1840; *Newcastle Journal,* 5 June 1841
22 There is no genus *Myranthus*. If the plant was an orchid then this was possibly a typing error for *Mycaranthes*; there is also a genus of Urticaceae called *Myrianthus*.
23 *Newcastle Courant,* 5 September 1839, 4 September 1840, 1 September 1843, 30 August 1844; *Newcastle Journal,* 24 October 1840, 29 April 1842, 17 June 1843. See also *Illustrated London News* Issue 60 (24 June 1843), p. 435.

Exhibiting blooms

The year 1838 saw a visit to Newcastle by the prestigious British Association for the Advancement of Science. One of the treats for the attendees was a show of fruits and flowers organised by the B&HS, in a "spacious tent on Forth Field". The newspaper reported that among the flowers "we noticed some very curious productions, particularly the *Melocactus* from Pernambuca" and the *Musa paradisaca*.[24] Both were supplied by George Wailes, and are incidentally rare records of him displaying plants other than orchids.

From 1841 and for the next decade we see him mentioned as one of the exhibitors at the B&HS shows, rather than a competitor. His displays of orchids were major attractions year after year, and the newspaper reports frequently praised them and listed the species individually. In 1841 for instance there was "the curious *Cattleya forbesii* and *Calanthe veratrifolia* with its snowy flowers, as well as a long raceme of *Gongora atropurpurea* whose dark flowers looked like a strop of some strange insects, and another of the rare *Catasetum proboscideum*. ... Mr Wailes also exhibited a splendid bloom of the Lady's Slipper, a favourite plant with every botanist who has had the opportunity and gratification of exploring the beauties of Castle Eden Dene",[25]

In September 1844 he showed "the rare *Cycnoches chlorochilon* so seldom seen in flower, and so accurately representing the bird from which its name is derived (the swan) – the beautiful *Miltonia spectabilis* and *Acropera loddigisii* with its helmet-like flowers". And in 1845 "for the first time in this district, several bunches of the flowers of that charming stove climber" *Stephanotis floribunda*. The last extensive list, in 1851, consists of names so mangled as to suggest that the journalist, or the person providing the list, was not familiar with the species. In 1852 his orchids "were not remarkable for a profusion of bloom".[26]

But by then George Wailes's brother William was already exhibiting. He showed a *Lycastes skinneri* and *Adiantum trapeziforme* in April 1852, and by 1855 when a display of orchids is mentioned it is unclear whether the "Mr Wailes" is George or William.[27] The later references to stove- and greenhouse plants in B&HS shows are all to WilliamWailes and his gardener Mr Cant.

With his entomological experience as well as a keen interest in growing plants, we might expect George Wailes to be a 'field' botanist. But there seems to be no evidence that he had an interest in the wild flora of northeast England: he did not contribute records to Nathaniel Winch's *Flora* of 1838 nor to Baker and Tate's *New Flora* of 1868. A list of plant species known to have been grown by George Wailes is available as Supplementary material online. (www.nhsn.ncl.ac.uk/members-area/resources/northumbrian-naturalist-volume-84-2018/).

24 *Newcastle Courant*, 31 August 1838
25 *Newcastle Journal*, 5 June 1841.
26 *Newcastle Journal,* 28 September 1844, 12 July 1845; *Newcastle Courant,* 27 June 1851, 4 September 1852
27 *Newcastle Courant,* 30 April 1852; *Newcastle Guardian and Tyne Mercury,* 8 September 1855.

Honorific names and new introductions

George Wailes exhibited a selection of orchids from his "extraordinary, rare and novel collection" in the B&HS exhibition in July 1846.[28] One plant, "which has blown the first time in this country in Mr Wailes's stove and who possesses the finest specimen yet seen in this kingdom" has a name that immediately jumps out of the list: it is *Catasetum wailesii* (see Figure 3).

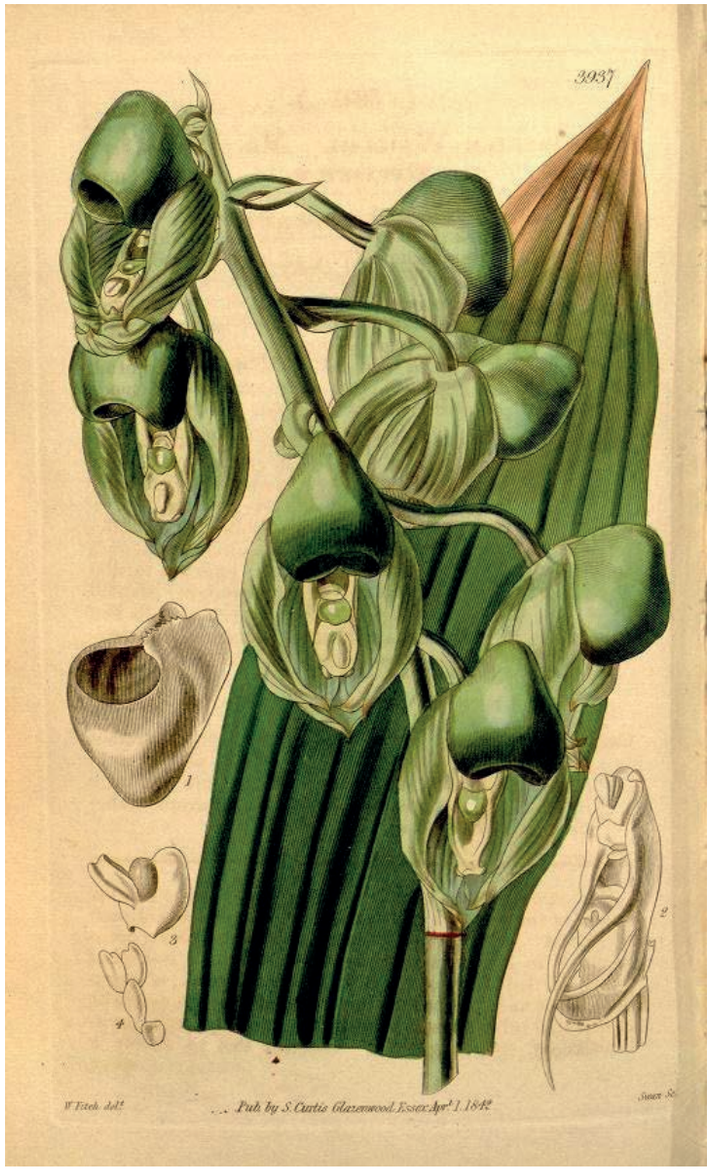

Figure 3. The orchid *Catasetum wailesii* described by Sir William Jackson Hooker in 1842 (*Botanical Magazine* **68** t.3937)

28 *Newcastle Journal,* 18 July 1846.

Catasetum wailesii was described by Sir William Jackson Hooker (1842). Hooker said that "I have dedicated this species to G. Wailes esq. of Newcastle, a most enthusiastic lover and student of natural history, and particularly of Horticulture and Botany. His collection of Orchideous plants is considerable, and the present individual is one of many that he has introduced from Honduras, through the kindness of G.U. Skinner Esq.". The name is no longer in use, the current name for the species being *Catasetum integerrimum*

A BOTANICAL JOKE

A Great Misfortune – In a late Number of the "Botanical Magazine" is a figure of a plant called Mr. Wailes's Catasetum. A young lady, hearing this mentioned, exclaimed "Mr Wailes's cat-has-eat-him! What a sad death to die!"
The Gardeners' Chronicle 1842: 478.

But this was not the only plant to be named in George Wailes's honour. John Lindley in 1849 contributed an article to the *Journal of the Royal Horticultural Society* in which he described *Warrea wailesiana* (this name is still used, but the species is now in the genus *Cochleanthes*) and also named the genus *Wailesia* for the species *Wailesia picta*, saying that "the name which it bears is that of George Wailes ... a gentleman who has for many years occupied himself with the cultivation and scientific study of Orchids, and to whom such a compliment has been long due from botanists". Unfortunately the name is no longer used, *Wailesia* being now considered as a junior synonym of *Dipodium*.

When John Lindley described the species *Catasetum proboscideum* in 1839 in *Edwards's Botanical Register: or, Ornamental Flower-Garden and Shrubbery* (25: 86), his description was based on specimens sent by George Wailes, who had received it from Dr Gardner, who had found it growing on a small species of palm near Sertao.

Another species named by John Lindley using plants sent by George Wailes was *Leochilus herbaceous* (now called *Leochilus scripta*). The description was published in 1845 in *Edwards's Botanical Register* (30: 90). The plant originated in La Guayra (Peru).

Cleisostoma lanatum (now called *Cleisomeria lanatum*) was described in 1849 by John Lindley in a list of plants recently introduced into gardens (*Journal of the Horticultural Society of London* 4*:* 264 – the same list in which he named several species after Wailes). It was introduced by George Wailes, with whom it flowered in 1849. Lindley said "it has no beauty, but is an interesting species to botanists".

Wailes even had the confidence to propose new names. *Gesneria marchi* was described in a note by W J Hooker in 1840, but his information was provided by George Wailes. The specimen was collected on the estate of George March in Brazil and sent to England where Wailes was the first person to grow it.

A Botanical and Zoological Garden

One of the earliest schemes proposed by the B&HS, recorded in their *Proceedings* for 1825, was for a botanical and horticultural garden supported by subscription, but this did not materialise. In 1838 a scheme was again afoot to develop a botanical and zoological garden in Newcastle. A prospectus was issued claiming that such a Garden "has long been desired by naturalists",[29] and the public's attention was drawn by Sir William Hooker during his course of lectures to the Newcastle Literary and Philosophical Society. A site had been chosen on the Elswick estate (owned by Mr Grainger) and £7,000 was needed to set up the garden with a further £3,000 to make it "at least unsurpassed by any in the kingdom". A society – The Botanical and Zoological Society of Newcastle-upon-Tyne – with a subscription rate of £10 would be founded, and the prospectus outlined the rules. George Wailes was one of the secretaries.

Nothing came of the scheme immediately but it is just possible that one eventual outcome was a permanent showground for the B&HS. Situated beside the Great North Road to the north of Barras Bridge, it was first mentioned in reports of the summer show in 1847, and in 1850 there was "an elegant and spacious marquee". The marquee, described as being striped in appearance and laid out on a radiating ground-plan, seems to have been a wonder in its own right, as it was frequently mentioned in the early 1850s.

In 1867 the society issued a *Prospectus* illustrated with a view of the marquee, and also showing a stone-built Library and Committee Room .[30] Possibly these buildings were never erected. Other views of the marquee were published in the *Illustrated London News* (18 July 1846).

George Wailes and collectors

George Wailes was growing orchids at a time when many new introductions were being sent to Britain from abroad. Sir William Jackson Hooker's correspondence in the archives of the Royal Botanic Gardens (Kew) tells us of some of the collectors who provided Wailes with plants: in the early 1840s he received material from George Gardner (in Sri Lanka), George March (Brazil), George Ure Skinner (Guatemala) and Nathaniel Wallich (Indian subcontinent). He also exchanged plants with Hooker at Kew between 1842 and 1849, but in1858 there was an argument because Hooker denied a request to send him some material.

There was also an Australian connection, known through letters to James Mangles (transcripts are in the J S Battye Library in Perth, Australia). Seeds collected in Western Australia by Georgiana Molloy had been sent to Mangles and he had forwarded some to George Wailes to be grown. Not all were successful: Wailes wrote to Mangles in June 1840 that the seeds of *Chrysorhoe*, *Nuytsia* and *Kingia* had not germinated, but on the other hand "it is far otherwise with many of the others – the fine Kennedya – Helichrysum – several Acacias – Patersonia – Salinia – and several are now fine plants with me".

29 *Newcastle Journal,* 10 March 1838
30 Copy housed in Northumberland County Archives, reference SANT/GUI/NCL/6/5/3/3.

His joy at flowering *Caesia hirsuta* (now called *Agrostocrinum hirsutum*) can be read in a letter written to Mangles on 18 June 1842:

> Within these few days past, I have flowered the first novelty to our Gardens which the seeds from "Swan River," you so kindly sent me two years ago have produced with me. I enclose you a sketch of its flower which though very roughly done will give you an idea of the great beauty of it.
>
> I need not tell you that even with the greatest care, it is impossible to do justice to a blue flower and in this case particularly so for it has a transparent appearance like the flowers of the old Agapanthus umbellatus. I had hoped that it was new and intended to ask my friend Sir Wm Hooker to figure it with my name of "Caesia Molloyae" as a fitting memorial of the fair Lady to whose exertions we owe so much and who has been very un-gallantly overlooked by all the describers of her collections, but on examining Lindley's Sketch [*Sketch of the Vegetation of Swan River*] I found it was described as "Caesia hirsuta". It is however the first of the Genus yet bloomed in Britain, and though the flowers are very fugacious, it well deserves cultivation. It does not seem inclined to seed, and I must trust to division for increasing it, which is a slow process, and as it is to your kindness that I owe the plant, I shall be very happy when I have divided it to send you a specimen should you wish it. There are some others of the seeds to flower yet, and after my luck with this I shall give them extra attention.
>
> I hope you have good news of "Mrs Molloy" and when you next write to her pray inform her of the beautiful plant her seeds have produced they were marked "Vasse" Grass like plant – Blue.

CONCLUSIONS AND SOME UNRESOLVED QUESTIONS

This study has produced an outline of the life and natural history interests of George Wailes, and possibly raised him out of the shadow of his already famous brother.

There is no evidence that George Wailes had an interest in theoretical natural science, or about his attitudes to the debates of the day. He is best seen as a practitioner of natural history, acting within the context of the 'structures' (that is the various societies) that he often helped to create and run, and of his friends and correspondents. However, we have to acknowledge that the surviving archives, both locally and nationally, are scant and allow us only a bare outline of his networks and activities.

His known interests in the natural world were not the obvious ones (such as botany, birdwatching and butterflies) but focussed on areas where knowledge of the subject was developing rapidly. The two entomological groups he studied, beetles and micro-moths,

contain many species that were poorly defined in the early nineteenth century: as a consequence, there were opportunities for discovering species new to the British fauna, possibly even new to science, but the difficulties of identifying the insects without adequate literature, collections or readily-available expertise posed big problems.

In orchids, he was focussing on a popular group of plants but again in an area where there are many species, and during a period when many new introductions were coming to British horticulture, and as a consequence the taxonomy was by no means settled. There were difficulties in growing orchids from various parts of the world, which needed to be overcome by skill as well as equipment.

He corresponded with several leading botanists and entomologists but without himself achieving the status of 'national expert' in either field. Locally he achieved much, but as a coleopterist he was overshadowed by Thomas John Bold and James Hardy, and as a lepidopterist by John Robson and others working half a century later. It is more difficult to place him in the horticultural history of northeast England, since there is little information on plant-growers of his period.

There are several unresolved questions about George Wailes:

Stove Houses

A major question is the location of George Wailes's greenhouses. He was a very keen grower of orchids, and for that you need at least one 'stove house', kept at a high temperature and with the humidity controlled, perhaps with staff to look after it. We know that Wailes also grew rhododendrons, cacti, alpines and possibly ferns, each of which requires greenhouses with their own conditions.

Ridley Place is a street of town houses with no possibility of attaching stove houses, and by the time he moved to Burghfield Grange his days of orchid growing seem to have been over. So where were George Wailes's greenhouses? If they were at a convenient distance for daily visits, it suggests they were within about three miles of Ridley Place; because of the risk of vandalism or theft they would be preferably sited in the grounds of a private house, rather than in public gardens or allotment-style plots. A likely location would be Jesmond, possibly in grounds of the largest houses owned by (for instance) Armorer Donkin or John Adamson. An obvious location would be the grounds of William Wailes's house, but his first large property in Gateshead (Salt Dene Towers) was only built in 1856 and Saltwell Towers in 1862.

Books and specimens

We only have a few glimpses of George Wailes's library, but enough to show that he had a collection that was extensive and contained some exceptional items. In 1857 he claimed to possess "an almost complete library" on European entomology, and we can only imagine the extent of his botanical library. He displayed copies of Bateman's *Orchidaceae of Mexico and Guatemala* and of Hooker's *Rhododendrons of the Sikkim Himalaya* at a *Conversazione* meeting of the Tyneside Naturalists' Field Club on 12 December 1849.[31] Both of these books would be worth noting as the highlights of any private botanical library, especially Bateman's *Orchidaceae*, a famously large-sized lavish production of which only 125 copies were published (George Wailes is listed in the book as one of the subscribers).

In 1862 he gave a *Biblia Germanica* published in 1483 – an important Bible in Middle High German with over 100 woodcuts – to the Chapter Library of Durham Cathedral (see online catalogue of Durham University Library).

The fate of the library is not known, but there were plans to dispose of it in 1877: in letters to John Hancock from Anne Wailes in October 1877 about cataloguing his books, she said "There are also a considerable number of valuable books in numbers on Entomology & other subjects, Transactions of different societies & many volumes of the Gardeners' Chronicle & The Garden".[32] She wanted to talk to Hancock about disposing of the library, the insects and cabinets. Nothing more is known of the books.

As for the insect collections, Robson noted in his *Catalogue of Lepidoptera* (see page iv of introduction and page 51) that some insects purporting to be Wailes's collection were sold in London on 14 May 1884, but "they were few in number and not at all representative of the district".[33] Francis (2015) cited a manuscript that suggests the coleoptera collection was acquired by the London natural history dealer Janson, and sold to P B Mason. If this is the case, some specimens might survive.

Manuscripts

George Wailes had a wide range of correspondents, locally and nationally, in entomology and horticulture. He must have had a collection of incoming letters, as well as his natural history notebooks, records of insects, etc. These have disappeared; indeed even Robson in 1902 did not have access to the moth records. With most of his immediate family dead and no children to take his *personalia* it is possible that the papers were all destroyed.

The few archival items in the Natural History Society of Northumbria's collections have already been noted, and there are further items in Newcastle, in the Literary and Philosophical Society. In his obituary notice, Henry Stainton commented on George Wailes's skills as a letter writer, and some of the outgoing letters have survived in several locations. These include: at least 17 letters to James Francis Stephens in the Natural History Museum (see Sherborn 1939); correspondence to Sir William Jackson Hooker in the archives of the Royal Botanic Gardens (Kew); letters in the John Lindley archive in the Royal Horticultural Society.

31 Recorded in the *Transactions of the Tyneside Naturalists' Field Club* **1**: 324.
32 Natural History Society of Northumbria, Hancock letters #1234-1237.
33 A catalogue of the auction survives, and was listed by Chalmers-Hunt (1976).

The Botanical and Horticultural Society

One of the tangential benefits of the work done on this article has been the light thrown on the Botanical and Horticultural Society, which flourished in the mid nineteenth century and vanished seemingly without trace early in the twentieth. There are some printed ephemera of the society dating from the 1820s, but they give no inkling of its importance and it has been only by going through old newspapers and the horticultural journals that we gain a picture of its activities. The society would make a suitable target for an in-depth research project.

ACKNOWLEDGEMENTS

I would like to thank the librarians in Newcastle for providing access to material in their care: at the Literary and Philosophical Society, the Society of Antiquaries, the City Library, and Ian Bower the librarian at the Great North Museum: Hancock. I would also like to thank Dr Jessica White and other several friends who have provided thoughts and suggestions about George Wailes, the history of Gateshead and Newcastle and the cultivation of plants.

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A list of plant species known to have been grown by George Wailes is available as Supplementary material online (www.nhsn.ncl.ac.uk/members-area/resources/northumbrian-naturalist-volume-84-2018/).

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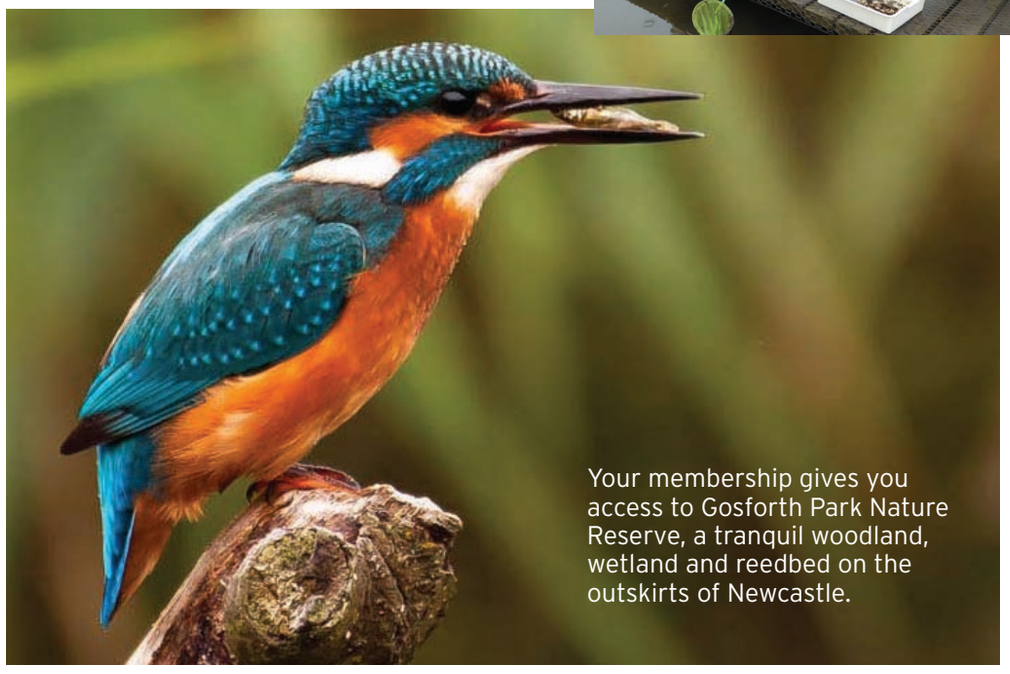

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