Diptera recording in Lancashire and Cheshire: past, present and future

A discussion paper by Phil Brighton

Introduction

This paper takes stock of my own recent findings and makes suggestions on how existing data and future recording can best be used in the next few years both to assist and encourage others and to contribute to the wider aims of nature conservation. While intended primarily as a personal stock-taking exercise, it is hoped that it will elicit comments, suggestions and further sources of information from others, both from other dipterists and from the wider local entomological and nature conservation community. I am circulating it to selected individuals.

The insects dominate the biodiversity of the fauna both of Britain and of the world. Within this class which has over 25,000 named species in the UK, the diptera forms the largest single order with over 7000 British species. Moreover flies have a wide range of lifestyles and involvement in ecological processes, as pollinators, predators, parasites and the recycling of nutrients, as well as being prey for many air-borne vertebrates. While the gathering of specimens and records in the field is a fascinating and endless study for the individual, the collation and analysis of diptera data over time and space can contribute in many ways to understanding and managing the many influences at work in our natural environment.

Lancashire and Cheshire is taken to mean the areas covered by the Cheshire, Merseyside, Greater Manchester and Lancashire local biodiversity records centres (LRCs). These cover the Watsonian vice-counties (VC) 58, 59 and 60 with addition of parts of VC64 in the Bowland area, formerly part of the administrative county of Yorkshire. It should be noted that the historic county of Lancashire also included the Furness area of south Cumbria, which is covered by VC69.

The past (to 1970)

In 1959, Leonard Kidd and Alan Brindle published "The Diptera of Lancashire and Cheshire, Part I" (Ref 1). This provided not only a list of species recorded in the "faunal area" (comprising VCs 58, 59 and 60 and that part of VC69 in historic Lancashire), but also summarised data on flight periods and distributions, with ecological notes in many cases. It covered the full range of families (as then defined) in the lower diptera (Nematocera), the lower Brachycera and the lower Cyclorrhapha or Aschiza. 1,018 Nematocera species were listed, amounting to 36% of the current British total of 2844. The number of species in the remaining groups was 562, equating to 35% of the current British total of 1595.

Two supplements to Ref 1 appeared, in 1964[2] and 1971[3], giving records of species new to one or more of the three vice-counties. These have added 32 Nematocera and 25 Brachycera to the species lists, bringing them to 37% of the British total in both cases. Kidd[3] hoped that it would be possible to publish further parts progressively covering the other families. This would cover the Acalypterates and the Calypterates, which are grouped as the Schizophora: the British list contains 2586 British species so a publication somewhat slimmer than the 136 pages of Ref 1 would have sufficed. However this aspiration seems never to have been realised, even partially.

The introduction to Ref 1 identifies a number of sources of data. These included widely scattered papers and monographs in the literature, of which a full bibliography is given, going back as far as an 1880 list published by B. Cooke in *The Naturalist*. However the single most important source of data was a series of record cards prepared by Harry Britten (1870-1954) and deposited in the Manchester Museum, where they are still available for study[4]. A large proportion of these data stemmed from Britten's own collecting in the period 1920-1950, which "transformed what was previously a relatively poorly investigated faunal area into one of the best worked in the country."

I have recently completed transcription of the Britten record cards for the craneflies, plus the associated families of winter gnats, window gnats and the Ptychopteridae. Each card covers a single species, but more than one card may be needed for each. It has proved possible to transcribe all this data into a modern record format, albeit dates are given to the year only for earlier records. All locations have been located and assigned 4-figure grid references, though there may be an uncertainty of a few kilometres for urban locations such as "Oldham". This exercise has yielded 2280 distinct records covering approximately 225 species. Thus the full set of data from the cards is likely to exceed 10,000 records.

This detailed look at the data has indeed illustrated Britten's dominant contribution in the period 1920-1950. During the 1950s and 1960s, substantial contributions were also made by Alan Brindle (1915-2001)[4], Leonard Kidd (1920-2013)[5] and Peter Skidmore (1936-2009)[6].

The past (1970-2012)

In the apparent absence of any published reviews of diptera, the largest single source of data for the post-1970 period is the dataset accumulated by the Cheshire LRC (rECOrd). A count in late 2013 found that this comprised about 59,000 records[7]. These records are regarded as requiring verification before they can be submitted for inclusion in the NBN Gateway database. At that time this would have been addition of 9% to the total of non-Syrphid records on the NBN Gateway, far in excess of Cheshire's area as a proportion of the country. That ratio has now dropped to about 6% using the NBN count on 9th Jan 2016, but this still remains a significant potential contribution to the national picture. For some families the ratio is still as high as 28% (Cecidomyiidae) or 29% (Agromyzidae) even with the latest NBN figures.

This dataset was initially compiled during the early years of rECOrd by the founding manager Steve McWilliam. No overall count of species in this dataset by species is currently available. (The rECOrd website does provide a "species search" facility whereby the public can find the number of records with the locations and years for a specific species.) However, reviews of the data for three groups of diptera (craneflies in the wide sense, soldierflies and allies[8,9], and Sepsidae[10]) show some common features in the distribution of recording effort.

These reviews have shown that a significant part of the dataset extends back into the "historic" period before 1970, and the name of Harry Britten is prominent. This is explained by the derivation of the data from records at World Museum Liverpool, whose collection was replenished from Manchester after destruction during World War II. In the modern period, a dominant contribution was made by Bill Hardwick, often in collaboration with Steve McWilliam. This leads to a large surge in the number of records from the mid-1980s onwards, with a geographical concentration around the corridor of the River Weaver from Runcorn to Winsford. It is likely that this pattern will be repeated for the other fly families.

North of the Mersey, the main recent diptera recorders known to me have been Tom Mawdesley and Richard Underwood, based at the World Museum, Liverpool. For VC60 and Cumbria, a large dataset, covering 4994 records and 1081 species, was compiled by the Dipterists Forum summer field meeting in 1999. The 2013 DF summer meeting was based in Lancaster and should also result in a significant contribution.

I have also used the "site search" facility on the NBN Gateway to derive total record and species numbers for the three vice-counties. The numbers of records may to some extent duplicate data sources already mentioned above. They may also be incomplete because, for most of the national diptera recording schemes, no data or only older data has yet been passed to NBN[11]. Nevertheless these figures are useful for putting current efforts into perspective. Table 2 shows the overall figures from which it is seen that VC58 has the most records but the fewest species. However the former may reflect the greater area of Cheshire, as is seen from the number of records per hectad. It also shows the dominant contributions from the hoverfly recording scheme, ranging from 40 to 60%

of the records. Other contributing datasets may also contain significant numbers of Syrphidae, particularly those from the LRCs, though it seems unlikely that these would add additional species.

Interestingly, the numbers of hoverfly species in each vice-county exceed the 169 listed by Kidd and Brindle[1] for the combined faunal area. The cranefly recording scheme numbers are slightly less – there does not seem to be any simple way of determining the number across all three VCs from the NBN Gateway. For all diptera, if the 37% incidence rate noted above applied to all fly families on the British list, the number of species should be about 2,600, so the figures in Table 2 suggest there could of the order of 1000 species present but not yet recorded. Of course many, if not most of these, would probably come from the more intractable families.

The NBN site search facility can also be used to list species and datasets contributing records for individual 10km squares (hectads). Figure 3 shows the set of hectads covering the three vice-counties, while Figures 4 and 5 shows the distribution of the numbers of species in each. This shows the unevenness of coverage, ranging from records of over 800 species in SD 47 containing the Arnside and Silverdale area to as few as 19 for SD40, a mainly agricultural area in South Lancashire including the towns of Ormskirk and Skelmersdale. The hoverfly species richness distribution is naturally much more even given the much greater ratio of records to species, and the aforesaid hotspots are less prominent. Nevertheless SD94, mainly occupied by south-west Yorkshire (VC63) scores 0. Subtracting the HRS totals from the diptera totals gives the figures plotted in Table 6, showing the extreme variation in the recorded numbers of non-syrphid species.

The present

None of the above history was apparent when I started serious diptera recording in 2012. Indeed I was partly influenced to take it up by involvement in the early days of Cheshire Active Naturalists and the Bioblitz held in 2011. This showed an apparent lack of active dipterists in the area, and thus an opportunity to fill a gap. My qualifications to do so are based on attendance at a number of training courses and events run by the Dipterists Forum (DF) and Field Studies Council (FSC) as follows:

- Aug 2011: FSC Hoverfly ID - Stuart Ball & Roger Morris
- Mar 2012: FSC Diptera families - Alan Stubbs and Roger Morris
- May 2013: FSC Biodiversity Fellows programme, Coarse Woody Debris - Pete Boardman & Nigel Jones
- July 2013: Dipterists Forum Field Meeting, Lancaster
- Aug 2013: FSC Biodiversity Fellows programme, Tephritidae - Nigel Jones
- Aug 2013: FSC Biodiversity Fellows programme, Craneflies introduction - Pete Boardman
- Sep 2013: FSC Biodiversity Fellows programme, Craneflies - John Kramer
- Oct 2013: FSC Biodiversity Fellows programme, Scathophagidae - Stuart Ball & Roger Morris
- Jan 2015: DF Tachinid Workshop – Matt Smith & Chris Raper
- Feb 2016: DF Workshop – Calliphoridae, Sarcophagidae & Rhinophoridae

With these courses and acquisition of books and keys for other groups, I have gradually increased the scope of my systematic diptera recording to cover the range of families shown in Table 1, which include a total of 2531 British species. A number of other species and groups have been recorded on an ad-hoc basis where suitable identification resources can be found. I have also made use of the DF on-line identification forum and the diptera collection at World Museum Liverpool for checking identifications, as well as consulting individual recording scheme organisers.

In 2013, I gathered a total of 1151 records covering 271 species from the above list of families[12]. By the end of 2014, I was able to report cumulative totals from 2011-14 of 3537 records for 444 species

from the 18 most-visited sites[13]. In 2015, I have managed 2547 records for 487 species from the Table 1 families. These last figures are probably indicative of the level of recording that can be sustained in future years. Cumulative totals from 2012 onwards including all the ad-hoc additions to the list now amount to 6890 records covering 754 species.

For comparison with the survey of individual hectads, I have now recorded 523 diptera species from 3797 records in my home square SJ69. This compares with the NBN total of 90, of which only 21 are non-syrphids. While this area does contain some special habitats such as the mosslands, there are relatively few associated specialist species, and rich habitats such as ancient woodland are lacking, so similar numbers could probably be achieved in any hectad. Thus while the apparent hotspots in Tables 4 and 5 do generally coincide with areas of recognised nature conservation and entomological interest, the figures clearly do overstate the relative degree of diversity in the diptera fauna.

In addition, recording of heteroptera has been carried out as part of these surveys, producing 630 records for 90 species in 2015. The vast majority of the records for both flies and bugs were obtained by simple sweep-netting and pooting, with occasional use of beating particularly from thorny shrubs and trees. In Refs 14 and 15, comparisons are made with species lists from previous professional surveys to assess the effectiveness of the sampling carried out on individual sites. While the overall numbers of species recorded from my own recording remains significantly less than from the benchmark surveys, a surprisingly large proportion had not been found in those surveys – including some with national designations of rarity or scarcity.

The future

The gathering of biodiversity records and their collation onto the national NBN database where they are publically available has gained increasing recognition as an important part of natural history activity. However, given the size of the diptera fauna and the great range of habitats flies can be found in, even the most intensive practicable recording effort can reveal only a miniscule proportion of the total distribution and abundance of species across the area. So it is worth thinking about how to get the greatest value from the amount of sampling that can be carried out.

The traditional approach has been the mapping of data at the vice-county or hectad level showing the distribution of species over scales of 10-100 km. Such data can demonstrate overall correlations with habitats and climate, providing there has been enough recording effort throughout the country to make the probability of a species being undetected where it is present sufficiently low. There is also great interest in whether such distributions are changing over time as the results of changes in land use, climatic changes or other factors such as the dynamics of predator and prey relationships or a genetic tendency towards dispersal or migration. Insects are also subject to short-term fluctuations as a result of weather or habitat management actions. Tables 4 and 5 suggest that such national distributions must remain very incomplete for the majority of diptera species.

On a smaller geographical scale, individual site surveys can be made to produce lists of species, which can be assessed according to national frequency and habitat specificity[16]. On the smallest scale, say within a 100m square, regular surveying of a transect can reveal detailed data on the influence of weather, vegetation changes, and other local factors which can add to the understanding of the ecology individual species and species assemblages. Such studies can in turn feed back into understanding the variations and changes on the national scale.

From the above review of past recording, it is clear that only for hoverflies does the nation or county-wide data approach the comprehensive coverage needed for interpretation of local studies. But it is also clear that relatively modest individual efforts can make a significant difference to the existing data holdings. If I am able to continue my present recording effort for the next years, I should be able to accumulate over 30,000 records, amounting to over half the number currently logged on the NBN – though this comparison may be somewhat misleading as the ease and precision of current recording tools means that we now tend to collect far more records of the commoner

species than was customary 50 years and more ago (see Refs 10 and 17 for evidence of this). As seen above, there is great scope for adding significantly to existing data in all areas, apart from perhaps the Sefton Coast and the Silverdale area. Conversely, if there is a good base of past data at a site already, further recording can reveal ongoing changes from environmental factors, deliberate habitat management or the incidental effects of development and changes in land use.

I am therefore proposing to continue intensive sampling in three areas of particular conservation interest: the Manchester Mosses (SJ69), the Delamere Forest (SJ57) and Cotterill Clough (SJ88). The first two of these are subject to significant programmes of habitat improvement, so it is hoped by ongoing recording to detect the effects of this in the diptera fauna.

The historic account above has already referred to two ongoing activities to make available existing sources of data for publication on the NBN Gateway. The first is the review of the large rECOrd Cheshire dataset, with the aim of ensuring that it meets the NBN verification requirements. Preliminary reports on the soldierflies and allies and the Sepsidae have already been produced (Refs 8,9 and 10). Glenn Rostron has recently begun review of the Dolichopodid data. The second is the extraction of data from the Harry Britten record cards at Manchester Museum, which has now been achieved for the craneflies. This data will also be used as a reference for the verification of the rECOrd cranefly data.

I further wish to propose the establishment of a project to compile an updated account of the diptera of Lancashire and Cheshire to replace and build on Kidd and Brindle's work. It might be thought that the existence of the NBN Gateway and other online sources of data might make such a publication redundant. Arguably the opposite is the case, in that it increases the need for an overview of the overall dataset and the sources from which they have been derived - the completeness and quality of the data currently on the NBN are issues for dipterists, while it is also clear that there has been considerable duplication of data.

The proposed publication could include:

- a summary of relevant features of local geography and habitats;
- the history of diptera recording in the area;
- details of the sources of the bulk of the data and discussion of verification issues;
- a checklist of species with additional information along the lines of that in Ref 1, eg
    - earliest and latest year of record in each VC
    - number of tetrads with records in each VC
    - specific sites for species recorded at four or fewer tetrads in each VC
    - typical habitat
    - national status
- photos of typical species from local sites, and also local prime habitats;
- maps of species richness and recording, and perhaps for individual species in selected cases;
- bibliography.

The key step towards this would be assembly of a master database of verified records, from which the core checklist could be automatically generated.

Further benefits of such a publication would be to attract potential recorders and to inform the local natural history and nature conservation communities, as well as providing less experienced local recorders with information on the plausibility of their identifications.

Inevitably, this would need to be produced in tranches. Craneflies seem a good place to start, particularly with the imminence of the publication of an updated JNCC status review, Pete Boardman's 2nd edition of the craneflies of Shropshire, and even perhaps Alan Stubbs' long-awaited book.

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Table 1: scope of diptera families covered in my own current diptera recording in VCs 58 and 59.

Recording Scheme	Family	English name (if any)	No. of British species
CRANEFLIES	Tipulidae	Long-palped Craneflies	87
	Cylindotomidae	Long-bodied Craneflies	4
	Pediciidae	Hairy-eyed Craneflies	20
	Limoniidae	Short-palped Craneflies	218
	Trichoceridae	Winter Gnats	10
	Ptychopteridae		7
SOLDIERFLIES AND ALLIES (formerly LARGER BRACHYCERA)	Xylophagidae	Awl-flies	3
	Athericidae	Water-snipeflies	3
	Rhagionidae	Snipeflies	15
	Tabanidae	Horseflies	30
	Xylomyidae	Wood-soldierflies	3
	Stratiomyidae	Soldierflies	48
	Acroceridae	Hunchback-flies	3
	Bombyliidae	Bee-flies	9
	Therevidae	Stiletto-flies	14
	Scenopinidae	Windowflies	2
	Asilidae	Robberflies	29
EMPIDS AND DOLLIES	Atelestidae		2
	Hybotidae		178
	Empididae	Dance-flies	208
	Brachystomatidae		4
	Dolichopodidae	"Dollies"	299
HOVERFLIES	Syrphidae	Hoverflies	281
CONOPIDAE AND OTHERS	Lonchopteridae	Pointed-wing Flies	7
	Conopidae		23
	*Pallopteridae		13
	*Ulidiidae		20
	*Platystomatidae		2
TEPHRITIDAE	*Tephritidae	Gall-flies	77
STILT & STALK FLIES	Pseudopomyzidae		1
	Micropezidae	Stilt-flies	10
	Tanypezidae		1
	Strongylophthalmyiidae		1
	Megamerinidae		1
	Psilidae	Rust Flies	26
SCIOMYZIDAE	Phaeomyiidae	Millipede-killing Flies	2
	Sciomyzidae	Snail-killing Flies	71
SEPSIDAE	Sepsidae		29
SCATHOPHAGIDAE	Scathophagidae	Dungflies	54
TACHINIDAE	Tachinidae	Parasite-flies	265
None	Fannidae	Lesser Houseflies	60
	Muscidae	Houseflies	286
	Calliphoridae	Bluebottles etc.	38
	Rhinophoridae		8
	Sarcophagidae	Fleshflies	60
TOTALS			2531

*Also collectively known as "picture-wing" flies.

Table 2: summary of NBN diptera data holdings for VCs 58, 59 and 60 revealed by a data search on the NBN Gateway in January 2016. HRS refers to the Hoverfly Recording Scheme dataset. CRS refers to the Cranefly recording scheme. LRCs are the local recording centres contributing records, comprising: Cheshire (rECOrd), Merseyside Biobank, and Lancashire (LERN) "in area"; Staffordshire, Sheffield and Cumbria "out of area". The latter contributions appear to arise as a result of the search including squares only partially within the faunal area. No diptera records were found for the Greater Manchester LRC.

Vice-County	VC58 (Cheshire)	VC59 (S. Lancs)	VC60 (N. Lancs)*
Total no of diptera records, including:	20183	16240	9976
HRS	14201	7902	4087
CRS	1861	2315	1368
In-area LRCs	23	4838	1133
Out-of-area LRCs	2081	0	1212
Net records per hectad	500	640	500
Number of species:			
Total diptera	980	1500	1194
HRS	188	179	176
CRS	188	195	183

*VC60 is officially called West Lancs, but it is less confusing to call it North Lancs as it lies north of the Ribble while the current local authority called West Lancashire lies entirely to the south of that river.

Table 3: OS hectads superimposed on a map of vice-counties 58, 59 and 60.

			SD47	SD57	SD67					
			SD46	SD56	SD66					
		SD35	SD45	SD55	SD65					
		SD34	SD44	SD54	SD64	SD74	SD84	SD94		
		SD33	SD43	SD53	SD63	SD73	SD83	SD93		
	SD22	SD32	SD42	SD52	SD62	SD72	SD82	SD92		
	SD21	SD31	SD41	SD51	SD61	SD71	SD81	SD91		
	SD20	SD30	SD40	SD50	SD60	SD70	SD80	SD90	SK00	SK10
	SJ29	SJ39	SJ49	SJ59	SJ69	SJ79	SJ89	SJ99	SK09	
SJ18	SJ28	SJ38	SJ48	SJ58	SJ68	SJ78	SJ88	SJ98	SK08	
	SJ27	SJ37	SJ47	SJ57	SJ67	SJ77	SJ87	SJ97	SK07	
		SJ36	SJ46	SJ56	SJ66	SJ76	SJ86	SJ96	SK06	
		SJ35	SJ45	SJ55	SJ65	SJ75	SJ85			
			SJ44	SJ54	SJ64	SJ74				

Table 4: total number of diptera species recorded on NBN for the OS hectads covering vice-counties 58, 59 and 60.

			854	445	116					
			100	132	41					
		8	44	97	48					
		171	163	192	179	136	133	26		
		100	73	243	135	181	89	148		
		52	32	81	120	46	45	226		
	695	134	101	121	169	162	93	70		
	511	100	19	69	90	152	90	237	83	329
	86	134	177	209	90	89	75	173	67	
151	174	101	219	162	84	244	207	133	96	
	34	71	46	309	164	98	106	115	160	
		71	67	198	164	74	112	120	147	
		381	40	66	102	60	118			
			13	192	49	183				

Table 5: total number of syrphid species recorded in the HRS dataset on NBN for the OS hectads covering vice-counties 58, 59 and 60.

			176	77	6					
			25	33	5					
		8	20	49	17					
		72	49	66	67	38	3	0		
		23	25	101	46	40	26	64		
		7	6	35	63	13	23	59		
	63	24	61	52	73	87	72	49		
	111	46	9	56	34	109	82	101	44	89
	77	57	34	40	69	46	32	89	39	
40	98	64	55	90	45	92	99	66	49	
	21	48	32	122	93	64	73	69	75	
		39	45	95	81	38	47	36	43	
		108	30	37	52	44	54			
			10	40	38	71				

Table 6: balance of diptera species recorded by subtracting Table 5 (HRS) figures from the Table 4 totals on NBN for the OS hectads covering vice-counties 58, 59 and 60.

			678	368	110					
			75	99	36					
		0	24	48	31					
		99	114	126	112	98	130	26		
		77	48	142	89	141	63	84		
		45	26	46	57	33	22	167		
	632	110	40	69	96	75	21	21		
	400	54	10	13	56	43	8	136	39	240
	9	77	143	169	21	43	43	84	28	
111	76	37	164	72	39	152	108	67	47	
	13	23	14	187	71	34	33	46	85	
		32	22	103	83	36	65	84	104	
		273	10	29	50	16	64			
			3	152	11	112				

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