

2019 Butterfly Surveys on Seaford Head

Preface

This is the third annual report on the current series of Seaford Head butterfly surveys which began in 2017. The focus of the reporting has changed as the project has developed.

- The first report (Dec. 2017) provided a detailed discussion of how the survey was designed to cover the different types of habitat on the Head described in Graeme Lyons' 2012 NVC mapping, it also presented the results from 2017.
- The second report (Nov. 2018) presented the substantial changes that were made to both routes for 2018 following analysis of the 2017 data and discussions with the Graeme Lyons and Sarah Quantrill from the Sussex Wildlife Trust (SWT). The 2018 results were used to test whether the changes had the intended effects.
- This report (Jan 2019) is less concerned with basic design issues. It presents the results from the 2019 survey, but also discusses the types of between-years comparisons that could help identify any changes in the butterfly population of the Head. However, we only have comparable data from 2 years so much of this discussion (in Section 4) can be no more than exploratory and is mostly of methodological interest. Readers who decide to skip this section will find a summary in Section 6.

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1. Introduction and transect routes

Weekly butterfly surveys have been carried out along two routes (transects) on Seaford Head since 2017. The eastern route is based in the rides and grassland between South Barn and Hope Gap; the western covers the grassy slopes and rides between Chyngton Road and the thirteenth fairway of the golf course.

Both routes were redesigned for 2018 after discussions with Sussex Wildlife Trust (SWT) and an analysis of the 2017 results. The aim was to register these revised routes with the United Kingdom Butterfly Monitoring Service (UKBMS) and, as far as possible, keep them unchanged for at least five years in order to collect comparable annual data. They have now been registered and the 2018 and 2019 results have been uploaded to the UKBMS database.

Figure 1 Eastern Transect

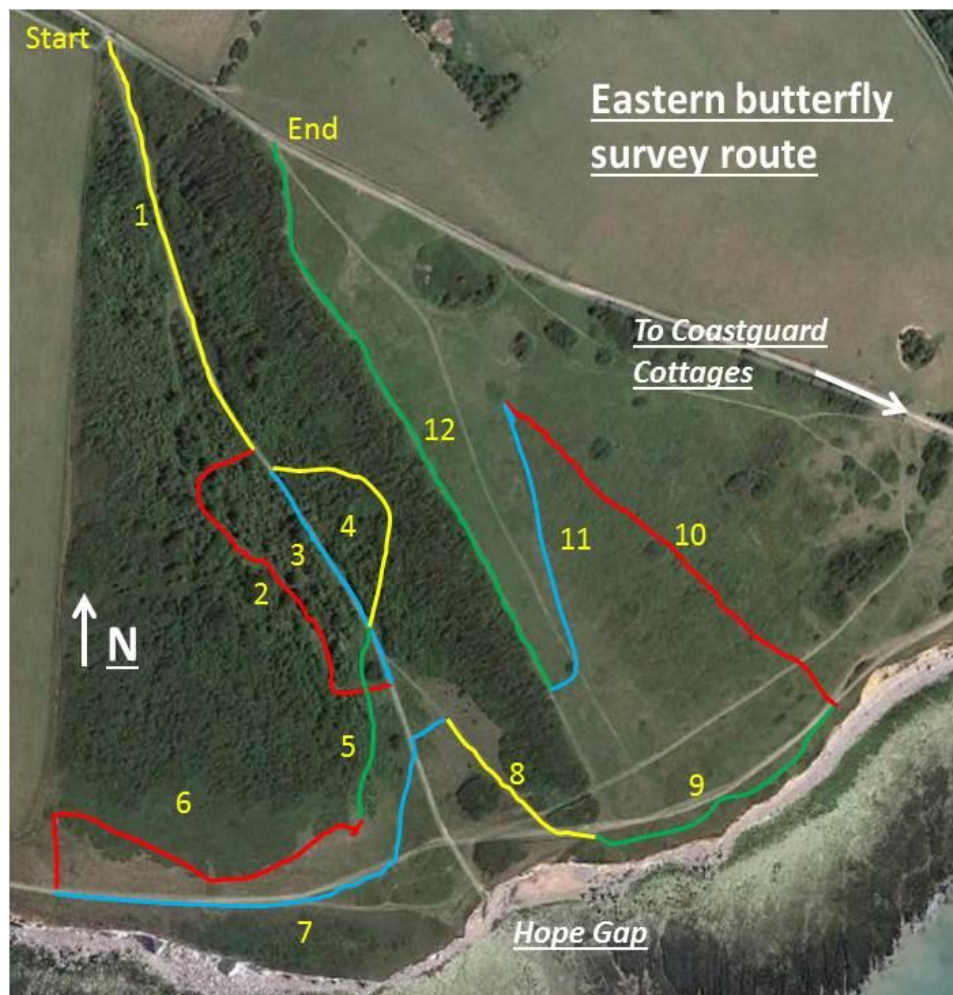
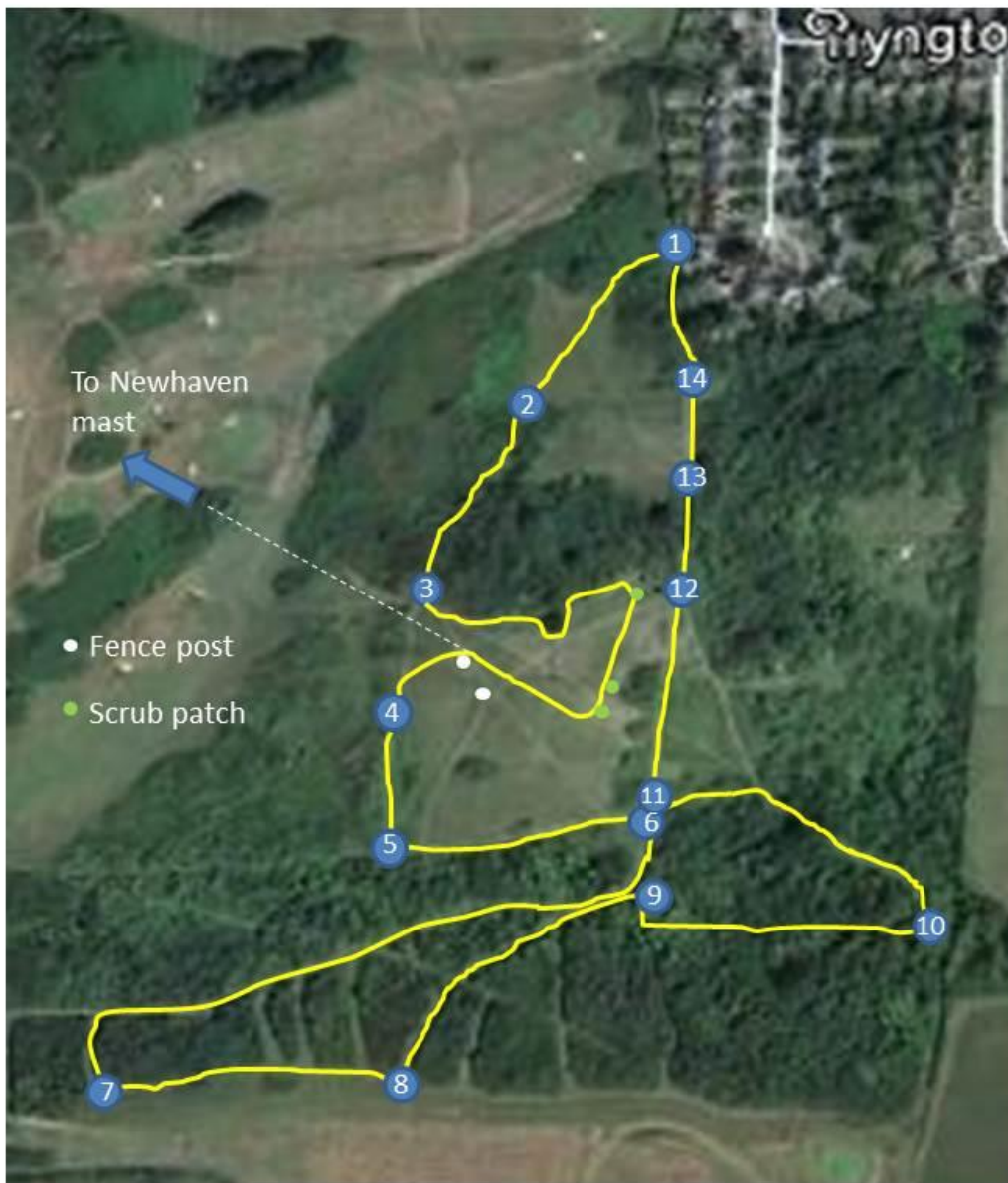


Figure 2 Western Transect



The eastern route is 2835 metres long and, following UKBMS protocols, is divided into 12 sections each representing a distinct habitat. The western route is 2100 metres long, with 14 sections. The routes are shown in Figures 1 and 2. They are the same as those used in 2018 except for western section 3. In 2018 this was a westwards loop between points 3 and 4, but Sarah Quantrill (the SWT ranger) has subsequently advised us that this area could be inaccessible because it would be used to acclimatise sheep that were being brought onto the Head for grazing. As a result, for 2019 Section 3 was changed into the eastwards loop shown in Figure 2. We regard it as fully comparable with the

2018 section because it has the same start and end points, is the same length, and covers very similar habitats

2. Survey methods and overall numbers of sightings

Because of our interest in lodging the survey results with UKBMS, we have followed their guidelines for a Pollard Walk survey (ref). These recommend standards for, amongst others, the lengths of transects, how they should be divided into sections, and when, and how, the surveys should be done. For example, in order for records to be included in UKBMS analyses, surveys have to be carried out under specified weather conditions. Surveyors are also instructed to only record butterflies that are within a certain distance of the transect - 2.5metres in the case of the Seaford surveys. If an unusual sighting is made outside these boundaries it will be recorded separately.

Consistent with UKBMS guidelines, 2019 surveying started in early April and ended at the end of September- though there was one additional eastern transect survey in October. Fifty four surveys were completed (27 in each transect), three less than in 2018. The total number of sightings was 4540 in 2019, 27% lower than the 6271 in 2018 (see Table 1).

Table 1 Total monthly sightings and number of surveys per month (2018-9)

	April	May	June	July	August	Sept	Oct	All months
Total sightings								
2018 E+W	61	322	776	2089	2009	896	118	6271
<i>n surveys</i>	8	9	9	8	10	9	4	57
2019 E+W	118	350	507	1696	1377	489	3	4540
<i>n surveys</i>	8	9	9	9	9	9	1	54

Figure 3 plots the average number of sightings per survey for each month in 2018 and 2019.

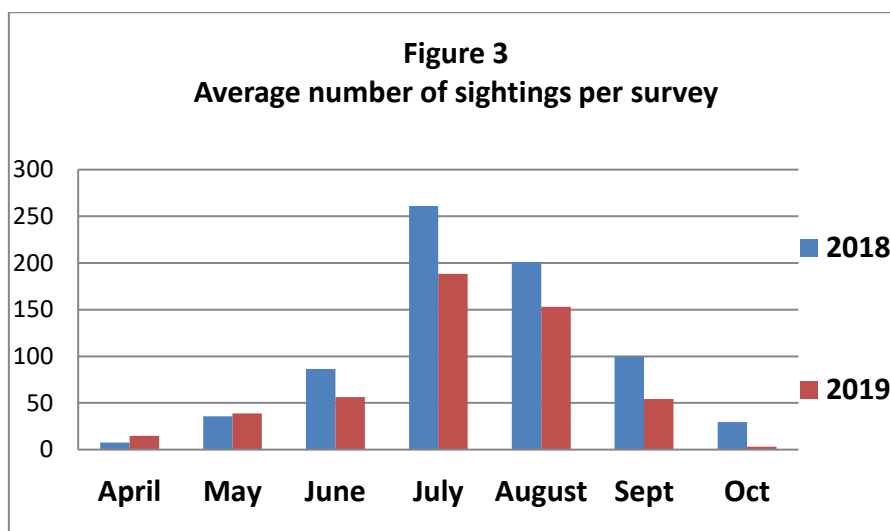


Figure 3 and the numbers in Table 1 show that from June onwards the average number of sightings per survey was always less in 2019 than 2018. We will need several more years of survey results to decide whether this reduction is within the normal variation for this site. Meanwhile (in Section 5 and Annex 2 of this report) we speculatively explore possible reasons for this drop in numbers.

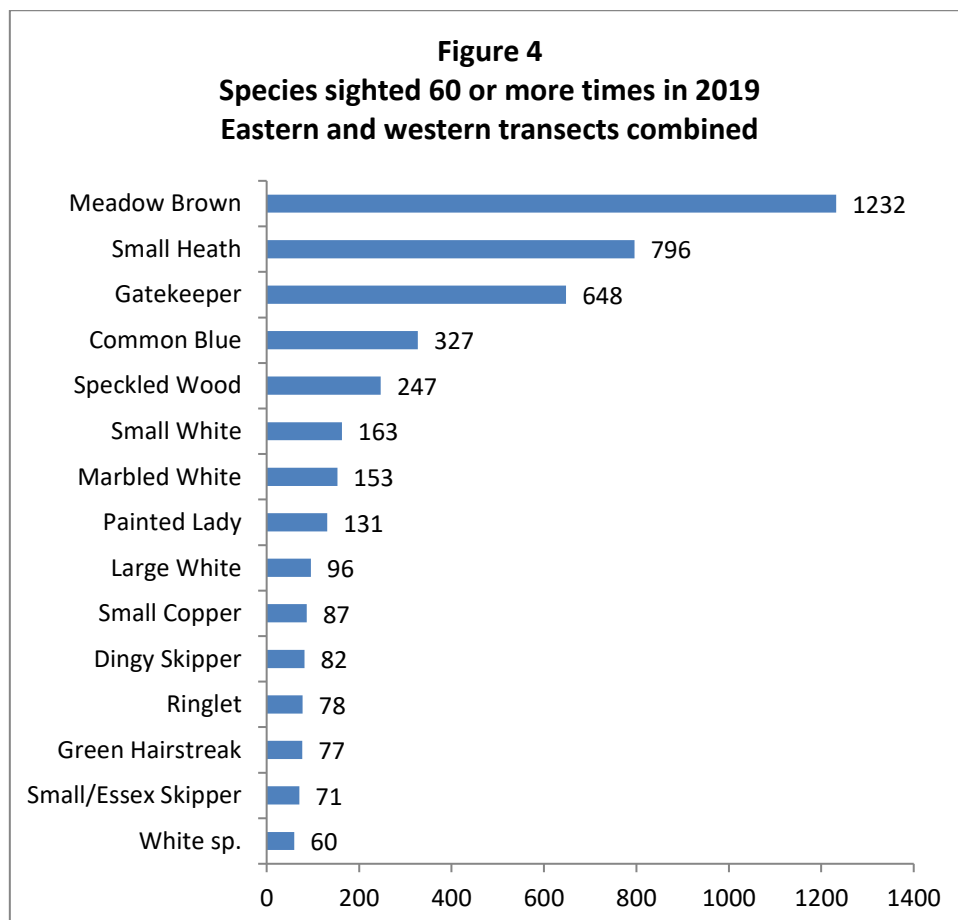
3. Species sighted

3.1 Numbers of each butterfly species

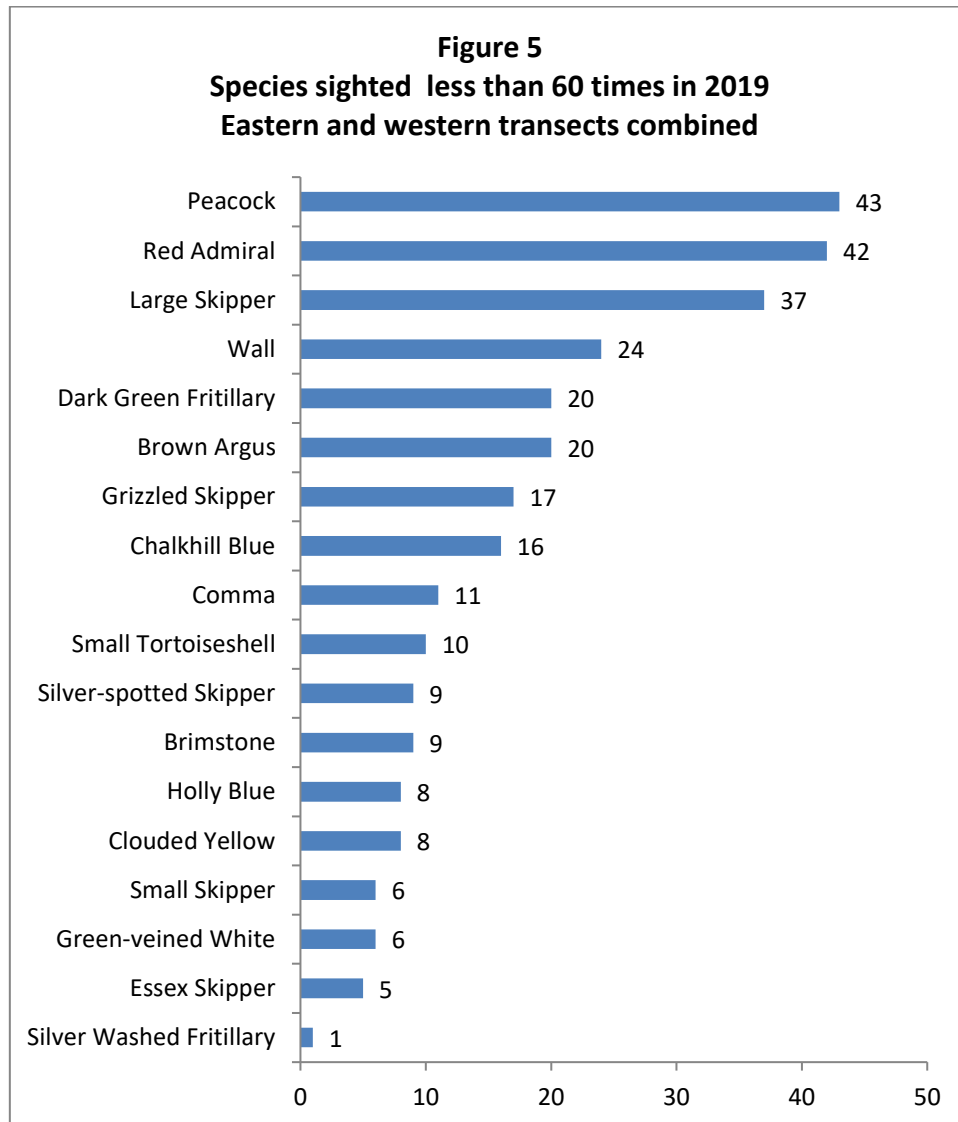
Before presenting the results, it is worth noting that that this type of survey is not hunting for rare or unusual species, but is concerned with collecting standardised data to map any changes over years in the general butterfly population of Seaford Head.

Thirty one species were sighted in 2019, compared to 32 in 2018. The numbers of sightings are shown in Figures 4 and 5. The numbers for both 2018 and 2019 and the percentage changes for each species are reported in Tables 10 and A.1 (Annex A).

Two species were recorded in 2018, but not in 2019: Adonis Blue and Pale Clouded Yellow. The lack of Adonis Blues is surprising given their numbers on Friston Gallops this year. Their absence from the Head may be due to some deterioration of the most suitable habitat: the rabbit grazed turf in eastern sections 6 and 7. The Pale Clouded Yellow sighted in 2018 is a rare migrant.



A single Silver washed Fritillary was the only species seen in 2019 and not 2018. These are probably present in small numbers in the west of the Head, but are not easy to identify in flight over the dense scrubby habitat. The Fritillary seen more often on the Head is the Dark Green which is easily found in several sections of the eastern transect. There were 20 sightings during the 2019 surveys.

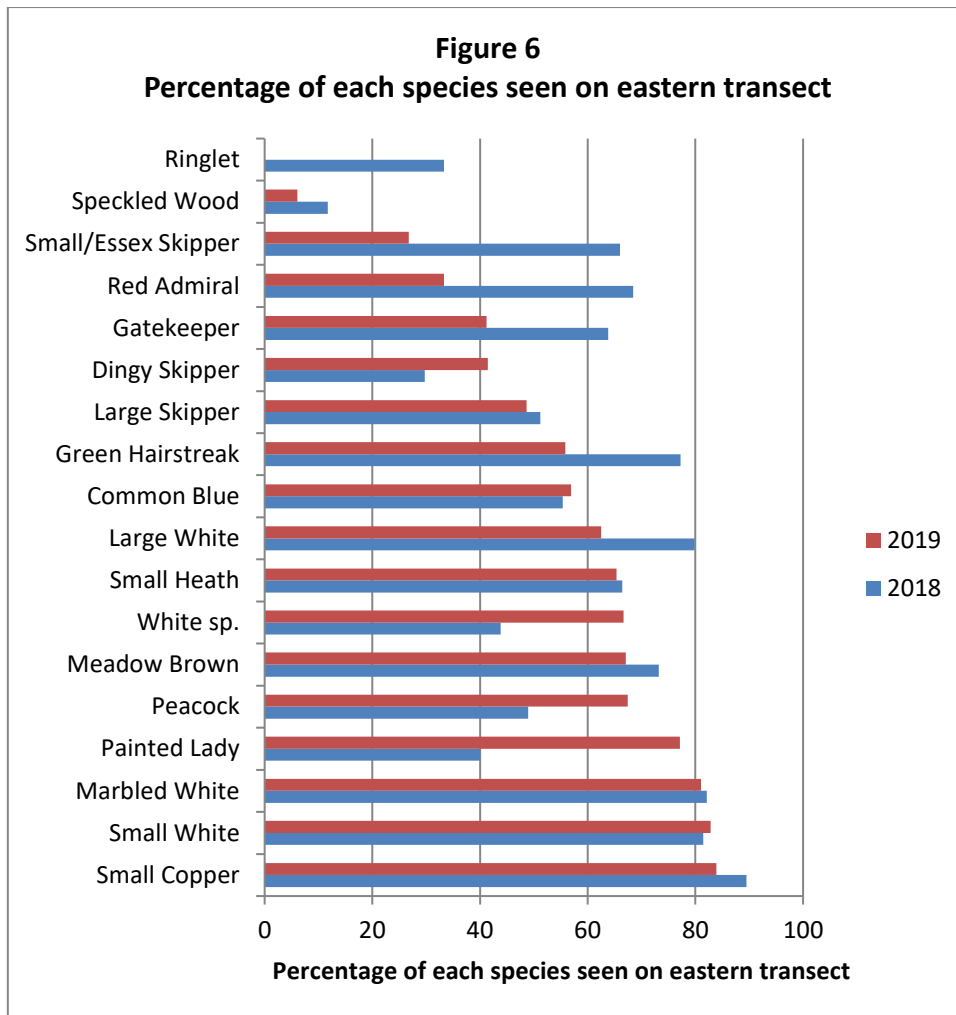


3.2 Distribution of species across the two transects

Table 2 and Figure 6 report the percentage of each species sightings that were on the eastern transect during 2018 and 2019. Both cover only those species with a combined total of 60 or more sightings for the two years. Many species are not evenly distributed between the two transects. At one extreme more than 80% of the 2019 sightings of Small Coppers, Small Whites and Marbled Whites are in the east. At the other, 94% of the 2019 Speckled Wood sightings and all the Ringlets were in the west. The shaded rows in the table represent species that were more often seen in the west than the east.

Table 2 Percentage of each species sighted in eastern transect				
	Percent in east		Total number	
	2018	2019	2018	2019
Small Copper	89.47	83.91	171	87
Small White	81.45	82.82	124	163
Marbled White	82.14	81.05	112	153
Painted Lady	40	77.1	5	131
Peacock	48.94	67.44	47	43
Meadow Brown	73.22	67.05	1561	1232
White sp.	43.86	66.67	57	60
Small Heath	66.4	65.33	1598	796
Large White	79.86	62.5	144	96
Common Blue	55.39	56.88	1159	327
Green Hairstreak	77.27	55.84	22	77
Large Skipper	51.22	48.65	41	37
Dingy Skipper	29.73	41.46	37	82
Gatekeeper	63.8	41.2	605	648
Red Admiral	68.42	33.33	19	42
Small/Essex Skipper	66	26.76	50	71
Speckled Wood	11.74	6.07	230	247
Ringlet	33.33	0	33	78

Figure 6 shows the differences in location of the sightings across the two years. Ignoring Ringlets, that were not seen in the east in 2019, five species were much more often reported in the east in 2018 than 2019 (Small/Essex Skippers, Red Admirals, Gatekeepers, Green Hairstreaks and Large Whites. Conversely, those with a substantially higher proportion of easterly sightings in 2019 were Dinghy Skipper, White Sp. , Peacock and Painted Lady.



3.3. Brood patterns and flight periods

Table 4 (pages 10-12) reports the weekly numbers of each species seen during the 2018 and 2019 surveys. The cells are tinted in order to highlight the different brood patterns - with darker shades representing higher numbers. For example, the Gatekeeper is a single brood species that we see from the start of July until early September - with peak numbers at the end of July. Table 4 shows that this pattern was observed in both 2018 and 2019. It was also noted in 2017.

The main trends from Table 4 (pages 10-12) are summarised below in Table 3.

Table 3. Summary of flight periods (2017, 2018, 2019) and brood patterns for most numerous species in 2018 and 2019

Common Blue	Displayed typical 2 broods (as in 2017 and 2018) though numbers much lower than both these years.
Small Heath	Typical 2 broods. First brood numbers similar to 2018 - but only 250 seen from 2019 second brood - compares with >1000 in 2018.
Small Copper	Typical 3 brood pattern - same as 2017 and 2018. But much fewer seen from third brood in September 2019.
Large Skipper	Single brood - similar to 2017 and 2018
Small White	First brood seen April-May, as in 2018. Typical 2nd brood July-Sept (seen 2017, 2018 and 2019). The peak at end of September that was seen in 2018, but not 2019, might be sign of an unusual 3rd brood, or possibly continental immigrants.
Gatekeeper	Typical single brood - similar to 2017 and 2018
Speckled Wood	Observed in all but first 2 weeks of the 2018 surveys and in all weeks (but one in July in 2019). Possible evidence of all "three overlapping broods" (Lewington). Both 2018 and 2019 reported more continuous sightings than 2017, but same basic pattern.
Red Admirals	Small numbers seen throughout year - could include some overwintering individuals. General pattern similar to 2018. Numbers in 2019 higher than 2018, but not to level of 2017.
Meadow Brown	Same pattern as 2017 and 2018. Single brood May-Sept.
Large White	First brood (May) seen in 2018 and 2019. High numbers in second brood (starting late June/early July were sustained for 2-3 weeks longer in 2019 (to end August)).
Marbled White	Same typical single brood pattern June/July in all three years.
Ringlet	Typical single brood emerging late June/early July. In all three years sightings stopped rather earlier than expected - none in August in 2017-8 and only 7 in second week of August in 2019.
Painted Lady	Small numbers seen in mid June in 2018. Two flight periods observed in 2019: June/early July and all August /early September.
Dinghy Skipper	May/June emergence observed in both 2018 and 2019
Green Hairstreak	Single brood pattern emerging in late April May in both 2018 and 2019
Peacock	Overwintering hibernators. Most were seen in mid April in both 2018 and 2019. Very few sightings thereafter in both years.

Table 4		April				May				June				July				August				September					October			Total					
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28		29	30			
Adonis Blue	2018																					1		1										2	
Adonis Blue	2019																																		
Brimstone	2018		1			2																												3	
Brimstone	2019		1	4	1	1										1						1												9	
Brown Argus	2018																	3	2															5	
Brown Argus	2019							2		2						5	1				3		1	5	1								20		
Chalkhill Blue	2018													1		4		1																6	
Chalkhill Blue	2019															5		5	4	2														16	
Clouded Yellow	2018																				1					6	4	3	9	9				32	
Clouded Yellow	2019																						1	2	4		1							8	
Clouded Yellow (pale)	2018																							2										2	
Comma	2018		1	6	3	6		1					2	13	8		3					1	1	1										46	
Comma	2019		4										3		1		1		1					1										11	
Common Blue	2018							38	95	37	51	22	8	1	23	44	141	331	178	63	48	18	6	7	21	12	9	4	1	1			1159		
Common Blue	2019					3	11	12	11	12	3	7	8			6	22	41	45	36	27	24	23	14	19	3								327	
Dark Green Fritillary	2018											1	6																						10
Dark Green Fritillary	2019													6	9	4		1																	20
Dingy Skipper	2018					1	5	21	6	1	2	1																							37
Dingy Skipper	2019			1	1	7	24	40	3	4	2																								82
Essex Skipper	2018														6	1		1																	8
Essex Skipper	2019														1		2	2																	5
Gatekeeper	2018														27	105	126	273	60	8	3			1										605	
Gatekeeper	2019														2	38	222	176	88	76	34	8	2	2										648	
Green Hairstreak	2018					1	7	11	1	2																									22

Table 4		April				May					June				July				August						September					October			Total			
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30					
Green Hairstreak	2019			1	4	4	23	27	9	5	4																									77
Green-veined White	2018						9	2				1		1							1			1											15	
Green-veined White	2019					3																				3									6	
Grizzled Skipper	2018						6	3	5	2	1	1																							18	
Grizzled Skipper	2019					1	3	4	3	3	1					2																			17	
Holly Blue	2018					1		4																											5	
Holly Blue	2019					2		4			1			1																					8	
Large Skipper	2018											6	7	5	14	9																			41	
Large Skipper	2019										1	2	5	11	13	3	1				1														37	
Large White	2018					1	2	5	15					20	24	13	13	1	8	4	5	5	5	5	19	2			2					144		
Large White	2019			1	4	2	1	5							11	14	14	2	6		3	5	6	1	14	7								96		
Marbled White	2018											1	29	37	25	15	5																		112	
Marbled White	2019										1	11	56	45	34	3	3																		153	
Meadow Brown	2018										2	48	76	134	104	177	370	262	157	81	48	39	36	22	2	2	1							1561		
Meadow Brown	2019										1	28	38	133	113	84	101	160	159	106	118	117	45	13	14	1	1							1232		
Painted Lady	2018										3	2																							5	
Painted Lady	2019												9	5	3		1	13	17	49	27	4	3											131		
Peacock	2018	1	17	13	2	4	2	2	1					1	1						2										1			47		
Peacock	2019		13	16	7	1		2									2					1									1			43		
Red Admiral	2018											2	3	1			2	1	1									7			2			19		
Red Admiral	2019		3	2				2	1	1		1	4	1		1	3	2	1	1	3	2	4	5	3	1	1							42		
Ringlet	2018											1	3	10	18		1																	33		
Ringlet	2019												2	14	14	41				7														78		
Silver Washed Fritillary	2018																																			
Silver Washed Fritillary	2019												1																						1	

Table 4		April				May					June				July				August					September					October			Total			
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30				
Silver-spotted Skipper	2018																	6	3			2													11
Silver-spotted Skipper	2019																		5	3	1														9
Small Blue	2018									1																									1
Small Copper	2018						17	12	5	4		2		1	1	4		5	10	2			2		33	20	21	14	9	7	2			171	
Small Copper	2019			3	4	11	5	11	8	2			3	1	5		1		4	1	1	11	1	4	9	1	1							87	
Small Heath	2018						7	15	15	24	74	110	82	89	18	9	28	53	49	47	202	180	152	213	161	44	20	3	3				1598		
Small Heath	2019			2	1	6	8	10	14	24	75	85	101	128	42	27	5	10	8	4	38	90	62	31	22	3							796		
Small Skipper	2018						1						3	8	14	20		5																51	
Small Skipper	2019															6																			6
Small Tortoiseshell	2018	1	8	2	1								3		3																			20	
Small Tortoiseshell	2019		1	2				2				1							2	1			1											10	
Small White	2018			1		4	1	20		1			1	3	6	8	3	21	9	2	5	4	1	2	1	2	29							124	
Small White	2019			8	1	4	1								16	1	4	1	8	3	11	10	6	37	30	19	3							163	
Small/Essex Skipper	2018														29	10	5	4			2													50	
Small/Essex Skipper	2019												6	14	12	12	19	5	3																71
Speckled Wood	2018			1	3	6	8	5	4	4	1	14	11	9	3	13	11	6	14	13	5	15	20	14	24	12	4	3	1	4	2		230		
Speckled Wood	2019		3	11	18	11	10	11	6	8	13	5	7	3		2	6	11	13	17	5	9	18	19	18	10	10	3						247	
Wall	2018									1	2				2			1	3	5	2						1	3	1	1				22	
Wall	2019					1	4	3	2	2					1			2	1	3		1			1		3							24	
White sp.	2018						2	7		1	1	6			9	3	6			8	2			1		2		7		1	1		57		
White sp.	2019			1	1	8	2								1		4	5			11	16			2	9								60	
KEY																																			
Sightings per week	2018	1 to 10			11 to 50			51 to 101			101 and over																								
Sightings per week	2019	1 to 10			11 to 50			51 to 101			101 and over																								

3.4 Sightings of moths

At Graeme Lyon's request, two sections of the eastern transect were modified before the 2018 surveys to increase the chances of seeing two diurnal moths: The Forester and the Scarce Purple and Gold. Both were added to the recording sheet for 2018 and retained for 2019.

- **The Forester** For the 2018 and subsequent surveys, the transect section from Hope Gap towards the Coastguard Cottages was moved seawards from the coastal path onto rough grassland in order to be closer to scrub where The Forester might be present. In 2018, none were seen during the surveys, but there were several sightings in early July around the scrub on both sides of this path. On 17th July 2019 one Forester was recorded in section 9E during the survey.
- **The Scarce Purple and Gold** This micro-moth is present around the Privet scrub on the seaward side of the coast path west of Hope Gap and in the valley floor by the Gap. There were 15 sightings here on surveys between 14th and 28th August in 2018 (all in section E7). There were three sightings in 2019: all in section E6 on May 2nd.

Several other moths were recorded during the 2019 survey

Burnet Companion	17/6/19	One in W6 and one in W7
Burnet Companion	15/7/19	One in W6 and one in W7
Speckled Yellow	2/5/19	One in E6
Hummingbird Hawkmoth	28/7/19	One in E5

4. Annual variations in the sightings

This section discusses the types of between-years comparisons that could help identify any changes in the butterfly population of the Head. It concludes with a summary table of variations that might be monitored annually. Since there are only two years of comparable data, the specimen comparisons in this section cannot support any firm conclusions on the reasons for the differences between 2018 and 2019, or whether they within or outside expected ranges. Hence the discussion is exploratory and mainly of methodological interest.

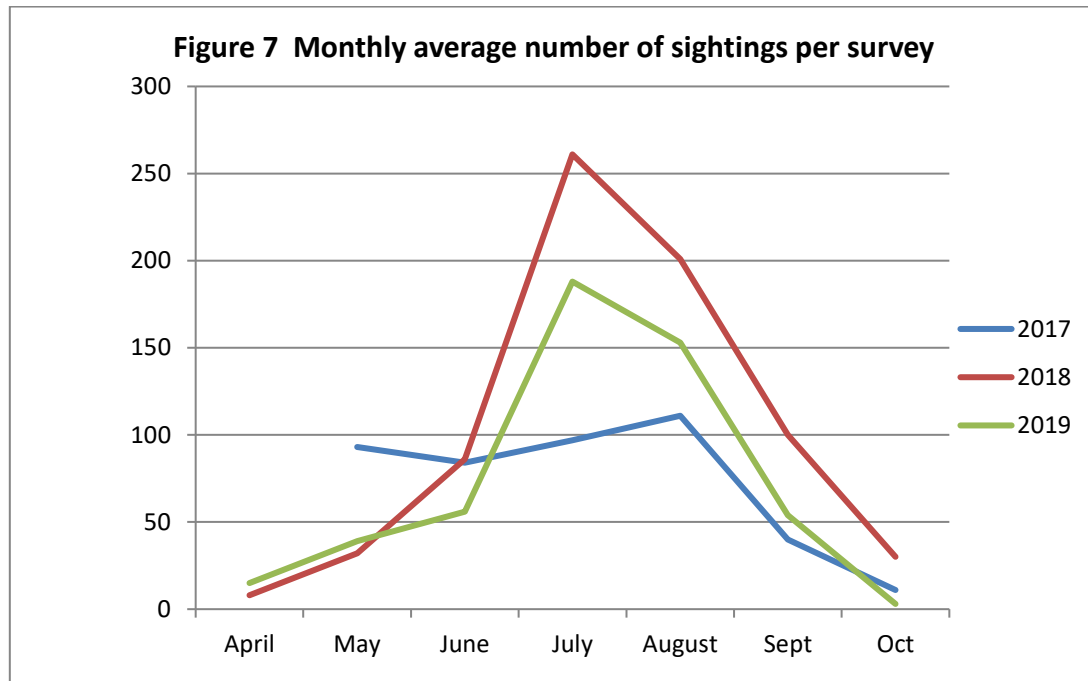
A few of the charts and tables include data from the pilot year 2017. These need to be treated with even more caution as the 2017 results are not strictly comparable with those for 2018 and 2019, given the different routes and later starts in the pilot year.

Summaries of the annual variations of the numbers of sightings of each species can be found in Table 10 in section 4.4. and Table A.1 in Annex 1.

4.1 Overall variations between years

Between 2018 and 2019 total sightings dropped from 6271 to 4250 (-27%). The three extra surveys in 2018 barely contributed to this difference as they were all at the end of the season and had combined sightings of only 65.

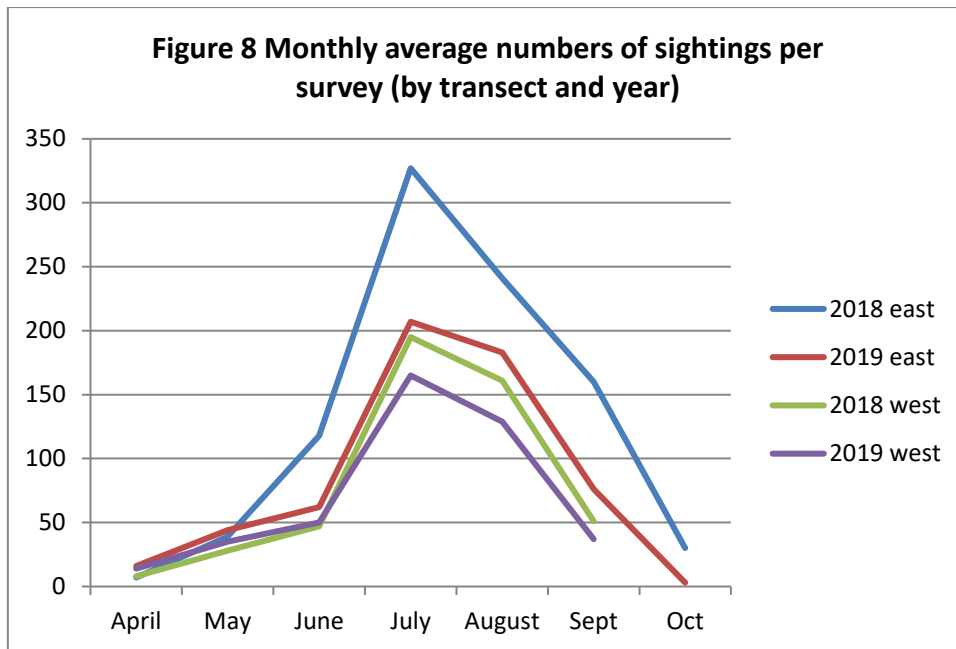
Figure 7 plots the average number of sightings per survey for each month in all three years. The most striking feature is the similar shape of the 2018 and 2019 plots - with the 2019 figures being consistently higher (by approx 50 or more) from June onwards. This shape may recur in future years if the species distribution and weather conditions are similar.



The 2017 May average is higher than that for the other two years because it is only based on the eastern transect, which has more sightings than the west. After the western transect surveys started in July, the 2017 averages drop below those for 2018 and 2019. This is a reminder that we should be monitoring variations between the two transects, which have rather different habitats attracting different combinations of species at different times.

4.2 Differences between transects in 2018 and 2019

Between 2018 and 2019 the number of sightings dropped by 35% in the east (from 4043 to 2620); and by 14% in the west (from 2230 to 1920). The monthly averages per survey for each transect are plotted in Figure 8, which clearly shows the high level of eastern sightings in 2018. Table 9 presents the data underlying Figure 8 and shows that from June to September the numbers of sightings on the eastern transect in 2019 were between 24% and 53% lower than in 2018 (June -47%, July -37%, Aug -24%, Sept -53%). There was less of a reduction in the west where the equivalent monthly figures are: +6%, -15%, -20 and -27. The greater reduction in the east is not unexpected as the three species with the biggest drop in numbers were more often seen on the eastern transect in 2018: Common Blue (55% of all CB sightings were in east), Small Heath (66% in east), Meadow Brown (73% in east).



Section 5 considers whether the 2018 results were exceptional or at the top of the expected range.

Table 6 Monthly average numbers of sightings per survey in each transect

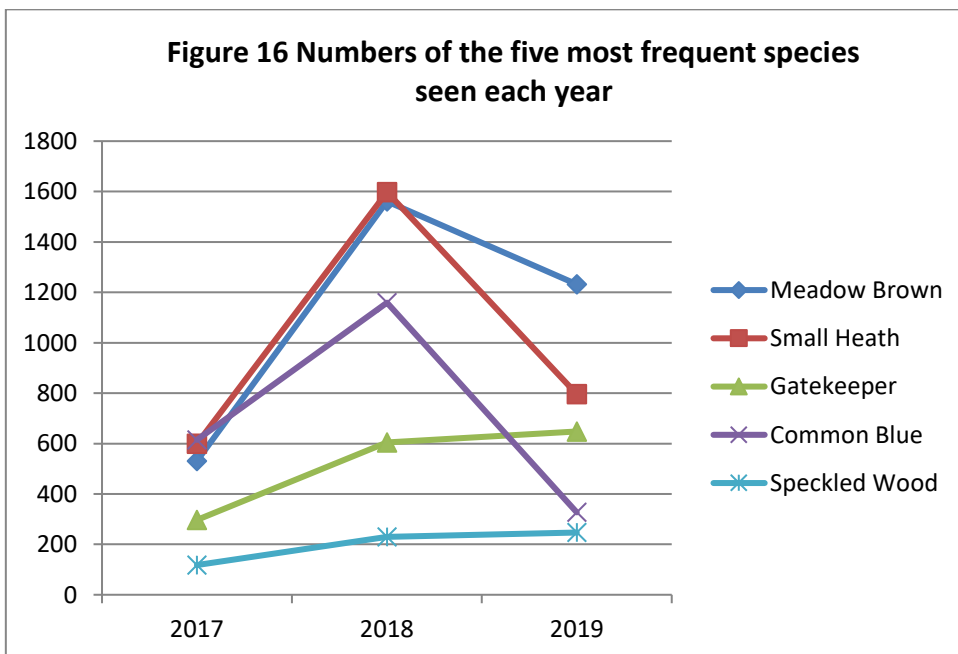
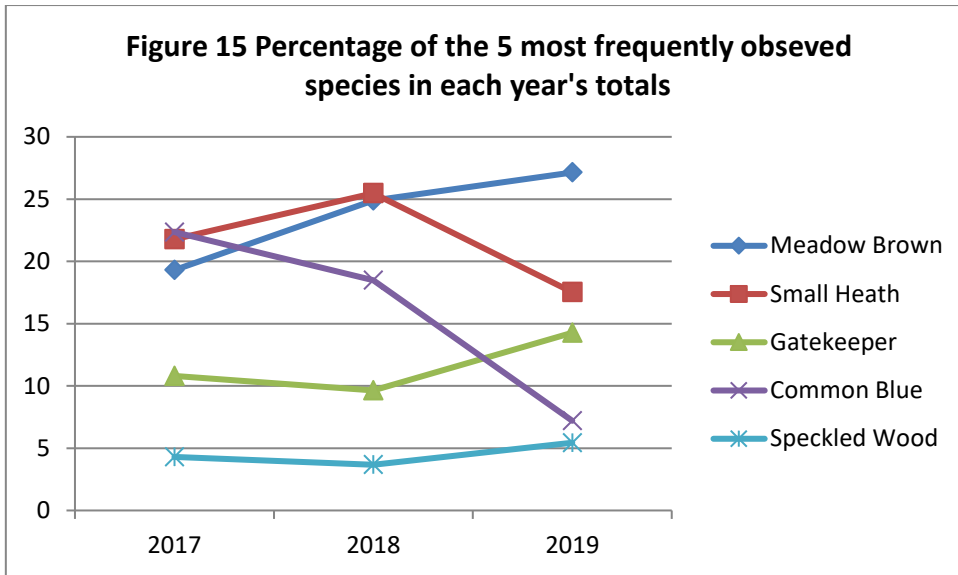
Average sightings per survey	April	May	June	July	August	Sept	Oct
2018 East	7	39	118	327	241	160	30
2019 East	16	44	62	207	183	76	3
% diff	129	13	-47	-37	-24	-53	-90
2018 West	8	28	47	195	161	51	
2019 West	14	35	50	165	129	37	
% diff	75	25	6	-15	-20	-27	

4.3 Variations in the numbers of sightings of each species and the distributions of species

Any large drop in overall numbers, such as occurred between 2018 and 2019 is likely to be linked to changes in the sightings of one or all of the five species that have represented 70-85% of the total in all of the three years surveyed. These are: Meadow Brown, Small Heath, Gatekeeper, Common Blue and Speckled Wood. These five have the most sightings in each year but, as Table 8 shows, they are not always in the same order. For example, Meadow Browns had the highest number in 2019 but were second to Small Heaths in 2018 and third to Small Heaths and Common Blues in 2017.

Figures 15 and 16 show the changes in numbers of sightings of these species and the corresponding changes in their proportions of the total. They demonstrate that it is worth tracking both the numbers and rankings. For example, although the sightings of Meadow Browns decreased by more than 300 from 2018 to 2019, they accounted for a greater proportion of the total in the later year.

	2017		2018		2019	
	Rank	N	Rank	N	Rank	N
Meadow Brown	3	531	2	1561	1	1232
Small Heath	2	599	1	1598	2	796
Gatekeeper	4	297	4	605	3	648
Common Blue	1	615	3	1159	4	327
Speckled Wood	5	118	5	203	5	247



As an aid to understanding why these changes occurred, it is worth checking if the differences are maintained across all the months surveyed and, if not, how they related to the flight periods of each species. Monthly figures for the 3 species showing the greatest reductions are shown in Table 9. The months with the largest drops in numbers are highlighted. There is no common pattern. For

Meadow Browns (a single brood species) sightings were similar in August 2018 and 2019, but much lower in the June and July in 2019. Both Small Heaths and Common Blues are typically two brood species, but while Common Blue sightings were much lower in both flight periods, the numbers of Small Heaths were only lower for the second brood. In fact, the first brood, flying in June and July produced more sightings in 2019 than 2018.

Table 9 Months and species showing greatest drop in sightings from 2018 to 2019								
	April	May	June	July	August	Sept.	Oct.	Total
Common Blue (2017)*		99	39	199	235	40	3	615
Common Blue (2018)	0	65	186	209	638	47	14	1159
Common Blue (2019)	0	28	39	43	158	59	0	327
Meadow Brown (2017)*		0	36	205	263	27	0	531
Meadow Brown (2018)	0	0	126	785	587	62	1	1561
Meadow Brown (2019)	0	0	67	502	589	73	1	1232
Small Heath (2017)*		29	195	71	225	79	0	599
Small Heath (2018)	0	30	297	144	531	570	26	1598
Small Heath (2019)	2	32	292	206	146	118	0	796
No. Surveys (2017)*		2	4	9	9	7	7	38
No. Surveys (2018)	8	9	9	8	10	9	4	57
No. Surveys (2019)	8	9	9	9	9	9	1	54
* Figures for 2017 are not strictly comparable given the later start dates and the different transects used in that pilot year.								

The complexity of the variations at species level is demonstrated by the numbers in Table 10. The second and third columns of this table show the numbers of sightings of each species for 2018 and 2019. Column 4 has the percentage changes from 2018. Species where the numbers of sightings decreased from 2018 to 2019 are shown in blue; those that increased are in yellow.

The remainder of the table (columns 5-11) shows the monthly percentage changes in the numbers of sightings (averaged over the numbers of surveys per month). Increases are in shades of brown and decreases in blue. Darker shades represent larger changes.

Cells are left blank when there were no sightings in that month in both years and are shaded green when the percentages change could not be computed because there were sightings in 2019 but none in 2018.

TABLE 10	No. in	No. in	% difference	April	May	June	July	August	Sept	Oct
	2018	2019	2018 to 2019							
Adonis Blue	2	0	-100.00					-100.0	-100.0	
Brimstone	3	9	200.00	500.0	-50.0					
Brown Argus	5	20	300.00					-33.3		
Chalkhill Blue	6	16	166.67				-11.1	1122.2		
Clouded Yellow	32	8	-75.00					-100.0	16.7	-84.0
Comma	46	11	-76.09	-60.0	-100.0	50.0	-92.6	-44.4	0.0	
Common Blue	1159	327	-71.79		-56.9	-79.0	-81.7	-72.5	25.5	-100.0
Dark Green Fritillary	10	20	100.00			-100.0		-100.0		
Dingy Skipper	37	82	121.62		126.5	0.0				
Essex Skipper	8	5	-37.50				-44.4			
Gatekeeper	605	648	7.11				-19.6	159.8	100.0	-100.0
Green Hairstreak	22	77	250.00		186.4					
Green-veined White	15	6	-60.00		-72.7	-100.0	-100.0	-100.0	200.0	
Grizzled Skipper	18	17	-5.56		-13.3	-33.3				
Holly Blue	5	8	60.00		20.0					
Large Skipper	41	37	-9.76			5.6	-34.3			
Large White	144	96	-33.33		-65.2	-100.0	-26.8	-21.8	-4.3	
Marbled White	112	153	36.61			-60.0	52.8			
Meadow Brown	1561	1232	-21.08			-46.8	-43.2	11.5	17.7	300.0
Painted Lady	5	131	2520.00			80.0				
Peacock	47	43	-8.51	9.1	-66.7		-11.1	-44.4	0.0	
Red Admiral	19	42	121.05			0.0	77.8	344.4	100.0	-100.0
Ringlet	33	78	136.36			-50.0	111.5			
Silver Washed Fritillary	0	1								
Silver-spotted Skipper	11	9	-18.18					-9.1		
Small Copper	171	87	-49.12		0.0	-16.7	-37.8	34.9	-80.5	-86.2
Small Heath	1598	796	-50.19		6.7	-1.7	27.2	-69.4	-79.3	-100.0
Small Skipper	51	6	-88.24		-100.0	-100.0	-86.3			
Small Tortoiseshell	20	10	-50.00	-75.0		-66.7	-100.0	122.2		
Small White	124	163	31.45	800.0	-80.8	-100.0	-29.8	58.7	161.8	
Small/Essex Skipper	50	71	42.00				11.1	177.8		
Speckled Wood	230	247	7.39	700.0	70.4	-20.0	-48.8	2.8	7.1	-100.0
Wall	22	24	9.09		1100.0	-100.0	-11.1	-44.4	0.0	-100.0
White sp.	57	60	5.26		11.1	-100.0	-50.6	200.0	266.7	-100.0

Several points emerge from Table 10.

- Although there was a substantial drop in the overall number of sightings, numbers increased for 18 species, and decreased for 16.
- There was an encouraging start to 2019. Seven species were seen in April 2019 that had not been seen in the same month in the previous year. Of the 5 species that had been seen in this month in both years, sightings were higher for 3 in 2019 and lower for only 2.
- Sightings in June and July 2019 were substantially lower than in 2018. In June numbers decreased for 15 species. Of the five increases, two were less than 0.1%. In July numbers fell for 17 species and increased for only five.
- The number of species showing reduced sightings were slightly less in August, but there were big drops in two of the most common species: Common Blue sightings fell from 638 to 158 and Small Heaths from 531 to 146,
- Based on the numbers of species showing gains and losses, there was something of a revival in September: with 12 showing increases and 3 reductions. However this was also the month where Small Heath sightings declined from 570 to 118.
- Many of the increases are relatively small and are probably within what is normal annual variation. Several species saw increases of more than 100%: Brimstone (3 to 9), Brown Argus (5 to 20), Chalkhill Blue (6 to 16), Dark Green Fritillary (10 to 20), Dinghy Skipper (37 to 82), Green Hairstreak (22 to 77), Painted Lady (5 to 131), Red Admiral (19 to 42) and Ringlet (33 to 78). It would be interesting to further investigate the considerable increases in the numbers of Dinghy Skippers and Green Hairstreaks as both species are very dependent on good habitat management. The largest increase, in the Painted Lady sightings, is not unusual as their numbers are very variable and dependent on conditions both in their overwintering areas in North Africa and southern Europe and during their subsequent northwards migration.

4.4 Differences between transect sections.

The final set of comparisons explore variations in the numbers of sightings in each of the 26 transect sections.

In 2018 the total number of butterflies seen on individual sections of the eastern transect ranged from 109 in section E8 to 1068 (in E12). In the west they went from 31 in W14 to 378 (in W3). In 2019 the same two sections had the most sightings in each transect: E12 with 636 sightings and W3, with 296, but those with the lowest were different from 2018: E8 (with 28) and W13 (39). The figures for all the sections in both years are plotted in Figures 11 and 12. They are shown as the average number of sightings per survey: for example in 2019 the figure plotted for E12 is $636/27=23.6$. Rank orders based on these numbers can be found in Tables A.3-4.

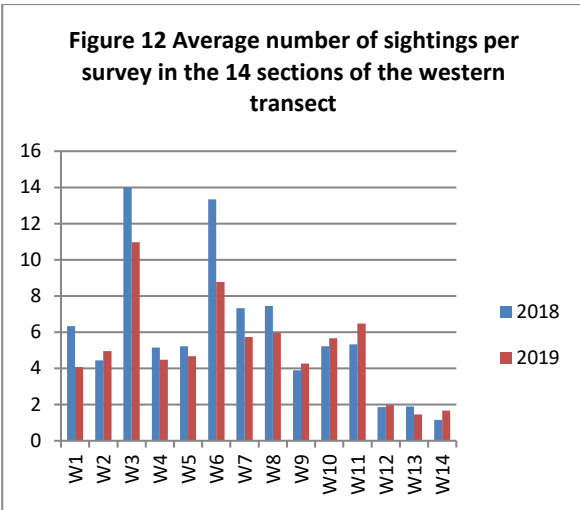
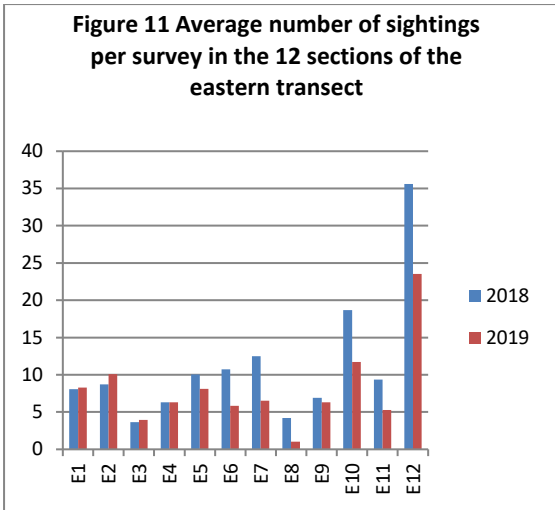


Table 7a No. of sections with these total numbers of sightings

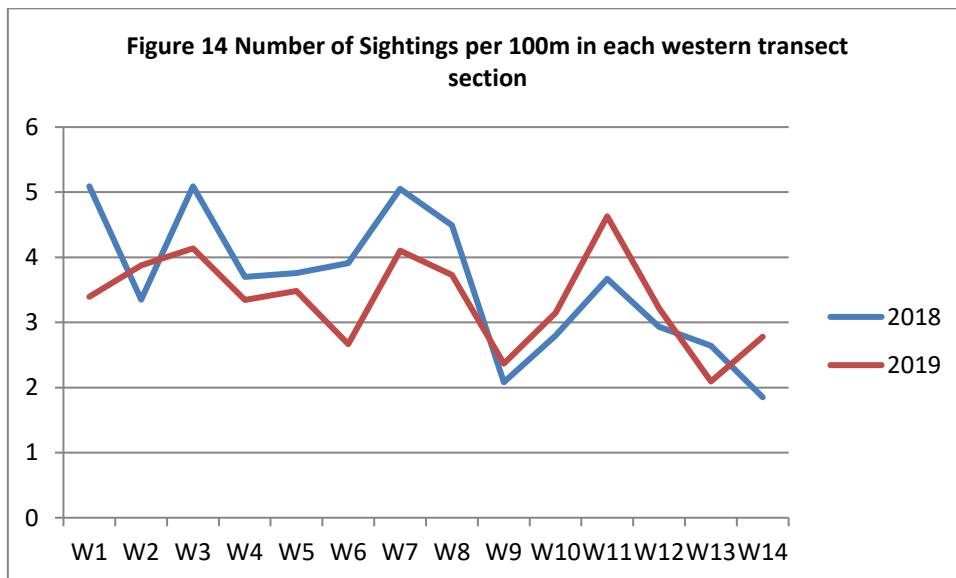
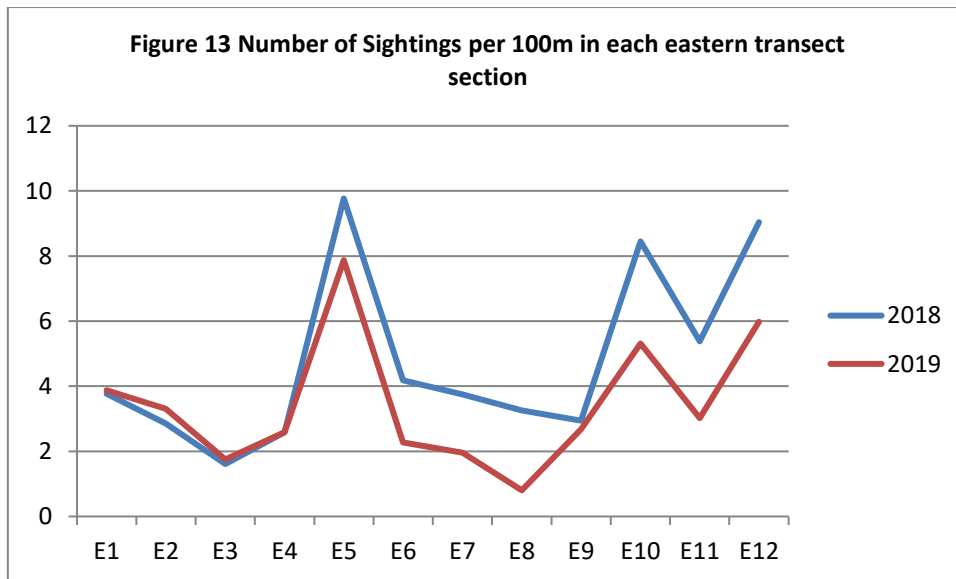
	2018		2019	
	East	West	East	West
Under 50	0	1	1	2
50-99	0	2	0	1
100-199	3	8	6	9
200-399	7	3	4	2
400 and over	2	0	1	0

Sightings per section are of interest because they are the most specific indicator of the effects of habitat management - or its lack. Although there is a risk of the numbers being too small for robust comparisons, in 2019 only 4 sections recorded less than 100 sightings and only 3 had less than this in the previous year. (See Table 7).

Section level presentations can be misleading unless the lengths of the sections are taken into account. Figures corrected in this way can reflect the experience of conducting the surveys, showing how often butterflies are seen in each section of the transects.

Figures 13 and 14 are plots of the total sightings/100m/survey along the sections of the eastern and western transects. The 2018 and 19 eastern plots have similar shapes with the 2018 figures being higher from E5 onwards. There is more fluctuation around a common pattern in the western figures, albeit on a smaller scale. Reassuringly, the substitution of a new section 3, which might have been slightly richer floristically than the one it replaced, did not produce a peak in the 2019 sightings.

It will be worth checking that these pattern recur in subsequent years. They are, in effect, the sightings profiles of the transects.



The above comparisons are based on sightings of all species in each section. The method could be extended to compare numbers for individual species, but the numbers, even for the most abundant species, such as Common Blue, will often be too small for robust comparisons. For example, Table 8 shows that in 2019 there were less than 10 Common Blue sightings in 13 of the 26 transect sections.

	2018		2019	
	East	West	East	West
Under 50	7	11	12*	14**
50-99	3	2	0	0
100-199	2	1	0	0
*5 of these were <10				
**8 of these were <10				

4.5 Possible variations to be monitored annually

Based on the examples shown in sections 4.1 to 4.5 annual differences in the following may be worth monitoring ; though not necessarily worth reporting.

Numbers	Broken down by	And by	Examples
Total numbers (all species combined)	Month		Fig. 7
	Transect		In text
	Transect	Month	Fig. 8 Tab.6
	Transect	Transect length	Figs. 13 & 14
	Transect	Section	Figs. 11 & 12
Numbers for each species	Raw numbers and percentage of total sightings		Table 10 & Table A.1
	Transect		Tab.2, Fig.6
The 5 or 10 species seen most often	Rank order of raw numbers and percentage of total sightings		Tabs.8 Figs. 15
	Raw numbers by Month		Tab.9 Fig. 16
Sightings of the more abundant species	Transect section		Tab.8

5. Trying to explain the variations

5.1 General issues

From the complexity of the variations shown in Table 10 it is obvious that it will not be easy to account for changes in the numbers of sightings, especially without sufficient years of records to judge what are normal and exceptional variations, or long-term trends.

There is the further complication that the numbers of sightings can only be a biased estimate of the numbers actually present. Not least because the transects are not fully representative of the distribution of habitats on the Head, especially of scrub and other inaccessible areas.

Factors associated with the conduct and conditions of the survey other than transect design may also bias results. These include : attention to identifying/distinguishing particular species, under representing species that are difficult to see, consistently unusual weather on survey days and habitat management on and close to the transects.

There is the additional question of what can be inferred from changes in the overall numbers when the patterns of sightings are very different for the component species (see Tables 9 and 10). A full understanding of the reasons for annual changes might require monthly data on the state of the larval food plants and nectar sources for individual species. This is obviously impractical, though it might be considered for a couple of the more common species.

On a more positive note, there is readily available data on some of the factors that can influence the numbers of sightings.

- During the surveys we are required to record the weather conditions We may also make notes on aspects of habitat management that we observe, such a mowing scrub clearance and grazing. All of these may have a short-term impact on numbers.
- There is also information in the public domain on factors that may result in longer term changes, such as historic meteorological data; and public discussions and summaries of suspected changes in butterfly populations.

The key question is whether any of these can shed light on the decline in numbers from 23018 to 2019.

5.2 Speculations on reasons for the 2018 to 2019 changes

We have some data that allows us to check whether any extreme happened within the process of surveying or the immediate habitat during 2019 corresponded to a decline. The two most obvious candidates are:

- did the surveys take place on days when the weather was likely to reduce the numbers seen?
- And did the mid August mowing on the eastern route reduce sightings in seductions E10,E11 and E12?

Both these possibilities are explored in Annex 2 where there are charts showing the weather conditions on the survey dates and plots of the numbers of sightings on sections E10-12 around the date when these areas were mowed.

In relation to the mowing, numbers in Section E10 show something of a dip during the subsequent week, but there are signs of recovery and the average number of sightings across these three sections in weeks 21-23 are not dissimilar from those in 2018 when no mowing took place (See Figure B.6).

Weather conditions during surveys can have a major impact on the number of sightings, but because we try to adhere to UKBMS criteria, there is far less variation in survey day weather than weather more generally. The charts in Annex B show there were some minor variations in survey day temperature and sun cover between 2018 and 2019. Wind speed was the only factor where surveys in 2019 were frequently done under less favourable conditions than 2018 (Figure B.3). Conversely, there were two occasions where the 2018 monthly average levels of sunshine on survey days were substantially less than in 2019: for the eastern transect in July and the western transect in June (see Figure B.1). As both months were sunnier in 2018 than 2019, these are counterintuitive examples of the survey day weather being worse than more general conditions

There are characteristics of the surveys that may influence results but are hard to assess without controlled experiment. One of these is whether we deliberately or inadvertently encourage temporary biases in the recording by placing emphasis on particular species or aspects of identification - and whether individual recorders respond differently to these? For example did the increase in the number of Ringlets sightings in 2019 result from putting more effort into

distinguishing them from Speckled Woods? And have discussions around the difficulties of distinguishing Small from Essex Skippers led to more use of the combined category - and is there a similar issue with the use of "White Sp."?

We do not have sufficient long-term data to draw reliable conclusion on the reasons for the decline in overall sightings between 2018 and 2019 and will be looking at records from other sites to see whether the changes in our pattern of sightings were mirrored elsewhere. Our provisional conclusion is that high levels of sun in June, July, August and October 2018 (see Figure B.5) were responsible for unusually high numbers of several of the most abundant butterflies on the Head in that year, especially Common Blues and Small Heaths. Natural history and press reports mention the abundance of Common Blues in 2018. UKBMS Country Trends also report a 110% increase in Common Blue sightings from 2017 to 2018; and a 48% increase for Small Heaths - despite this species being in general decline. As the reductions in Common Blue and Small Heath sightings from 2018 to 2019 (802+832) represent 94% of the total drop of 1733, the exceptional weather in 2018 may be the main cause of the differences between the two years.

That said, the variations in sightings of around 30 species are bound to be complex and difficult to interpret fully. At the very least, we need several more years of data to tell if results for any of 2017, 8 and 9 were unusual, i.e. outside the normal variability for Seaford Head. And we should put more effort into looking for any comparable sites in the UKBMS database to see if their results display similar patterns.

6. Summary and conclusions

The current set of surveys started in 2017. in accordance with UKBMS guidelines they are conducted weekly from April to September (27 weeks in all). They take place along two transects that were finalised in 2018. The eastern route is based in the rides and grassland between South Barn and Hope Gap. It is 2835m long and divided into 12 sections. The western route covers the grassy slopes and rides between Chyngton Road and the thirteenth fairway of the golf course. It is 2100m, divided into 14 sections. There was a small diversion on the western route in 2019, to avoid an area that we were advised would be used to acclimatise sheep. The diversion was the same length and had the same distribution of habitats as the section it replaced. Both routes are registered with UKBMS and our results for 2018 and 2019 have been loaded onto their national database.

Fifty four surveys were conducted in 2019, three less than in 2018. Total sightings were 6271 in 2018 and 4540 in 2019 - a drop of 27%. Thirty one species were seen in 2019, one less than 2018. Two species were recorded in 2018, but not in 2019: Adonis Blue and Pale Clouded Yellow. The lack of Adonis Blues in 2019 is surprising given their numbers on Friston Gallops this year. A single Silver washed Fritillary was the only species seen in 2019 and not 2018.

The same five species dominated the sightings in both years: Meadow Brown, Small Heath, Gatekeeper Common Blue and Speckled Wood. They accounted for 82% of sightings in 2018 and 72% in 2019. Their numbers dropped from 5126 in 2018 to 3250 in 2019. In particular, Common Blue sightings fell from 1159 to 327 and Small Heaths from 1598 to 796. The reductions in sightings of these two open grassland species together (802+832) represent 94% of the total drop of 1733 from 2018 to 2019. Interestingly, the drop in sightings of these two species did not occur simultaneously, (see Table 9). In June and July Common Blue sightings dropped while Small Heath numbers held up.

Sightings of both species fell August, Small Heath sightings also dropped dramatically in September, by which time the flight period of the Common Blue was ending.

Despite the drop in total numbers, sightings of 16 species and the two combined groups (Essex/Small Skipper and White Sp.) increased. Several species saw increases of more than 100%, albeit from small bases: Brimstone (3 to 9), Brown Argus (5 to 20), Chalkhill Blue (6 to 16), Dark Green Fritillary (10 to 20), Dinghy Skipper (37 to 82), Green Hairstreak (22 to 77), Painted Lady (5 to 131), Red Admiral (19 to 42) and Ringlet (33 to 78). Although Red Admiral sightings rose, they did not reach the levels of 2017. The large fluctuations in Painted Lady numbers are typical of this immigrant species.

The two transects were designed, as far as possible, to include all the main types of habitats on Seaford Head and to focus on areas likely to be actively managed by SWT. This does not mean that they are statistically representative of the distribution of habitats. Results from both 2018 and 2019 suggest that there are different distributions of species on the two transects, consistent with them covering different habitats. Although there is some variation between the years, of the more frequently sighted species, those more likely to be seen in the east rather than the west are: Small Copper, Small White, Marbled White Meadow Brown and, to a lesser extent Small Heaths. Those more often seen in the west are Speckled Woods, Ringlets and Dinghy skippers.

Section 4 of the report has examined ways of presenting and interpreting annual changes and trends in the overall number of sightings and distribution of species. Since there are only two years of comparable data, the specimen comparisons in this section cannot support any firm conclusions on the reasons for the differences between 2018 and 2019, or whether they are within or outside expected ranges. Hence the discussion had to be exploratory and of mainly methodological interest.

That said, the comparisons did show some similarities between the years, albeit ones that need to be confirmed when more results are available.

- The same five species dominated the sightings in both years
- There were similar flight patterns for individual species in both years
- The plot of the total number of observations per month had a similar shape in 2019 to 2018, though the 2018 figures were consistently higher.
- The monthly plots of sightings for the eastern transect had a rather different shape to that for the west - and this difference was maintained in both years. This was true for both the total number of sightings and the sightings adjusted for section length.

We do not have sufficient long-term data to draw a reliable conclusion on the reasons for the decline in overall sightings between 2018 and 2019 and will be looking at records from other sites to see whether the changes in our pattern of sightings were mirrored elsewhere. Our provisional conclusion is that high levels of sun in June, July, August and October 2018 (see Figure B.5) were responsible for unusually high numbers of several of the most abundant butterflies on the Head in that year, especially Common Blues and Small Heaths. Natural history and press reports mention the abundance of Common Blues in 2018. UKBMS Country Trends also report a 110% increase in Common Blue sightings from 2017 to 2018; and a 48% increase for Small Heaths - despite this

species being in general decline. As the reductions in Common Blue and Small Heath sightings from 2018 to 2019 (802+832) represent 94% of the total drop of 1733, the sunny weather in 2018 may be the main cause of the differences between the two years.

Again it should be stressed that there is a complex relation between abundance and numbers of sightings. Many factors are involved, not least that some butterflies are more conspicuous because of size, colour and behaviour; and some make more use of habitats that are not easily surveyed. For example, the tendency of Small Heaths to shelter from the wind in thick grass may have caused them to be overlooked in 2019 when the average wind speed on survey days was higher than that in 2018.

To sum up, in many respects this has been an interim report. Survey design was finalised for 2018, and did not need further discussion. And as we do not have sufficient data to be able to draw firm conclusions on changes and trends, much of the reporting has concentrated on simple comparisons between 2018 and 2019, and speculation on the types of presentation that are most appropriate for mapping changes over time. Nevertheless, the results we have show some reassuring signs that despite the changes in overall numbers of sightings, many of the underlying distributional patterns were similar for the two years for which we have full data.

We are planning to repeat the surveys in 2020. The survey procedures will stay the same, but a few enhancements might be considered. Firstly, to more systematically record changes to habitat on or near the transects. Secondly to try to standardise advice on identification, especially around confusion species and use of the Essex/Small and White Sp. groupings. Thirdly to crudely monitor the state of selected plant species that are critical for the most abundant butterflies. This could involve no more than noting when they emerge, come into flower and whether they are in areas that are undergoing active management. Finally, we should start using the resources of the UKBMS database to look for transects that have similar habitat distributions to those on Seaford Head and check whether their results for the past three years are similar to ours.

Annex A Supplementary tables and figures

Table A.1 Changes in Numbers of sightings between 2018 and 2019	Sightings in 2018	Sightings in 2019	2018 - 2019	Percentage change 2018 to 2019	Sightings in 2018 as % of 2018 totals	Sightings in 2019 as % of 2019 total
Meadow Brown	1561	1232	-329	-21%	24.88	27.14
Small Heath	1598	796	-802	-50%	25.47	17.53
Gatekeeper	605	648	43	7%	9.64	14.27
Common Blue	1159	327	-832	-72%	18.48	7.2
Speckled Wood	230	247	17	7%	3.67	5.44
Small White	124	163	39	32%	1.98	3.59
Marbled White	112	153	41	37%	1.79	3.37
Painted Lady	5	131	126	2520%	0.08	2.89
Large White	144	96	-48	-33%	2.3	2.11
Small Copper	171	87	-84	-49%	2.73	1.92
Dingy Skipper	37	82	45	122%	0.59	1.81
Ringlet	33	78	45	136%	0.53	1.72
Green Hairstreak	22	77	55	250%	0.35	1.7
Small/Essex Skipper	50	71	21	42%	0.8	1.56
White sp.	57	60	3	5%	0.91	1.32
Peacock	47	43	-4	-9%	0.75	0.95
Red Admiral	19	42	23	121%	0.3	0.93
Large Skipper	41	37	-4	-10%	0.65	0.81
Wall	22	24	2	9%	0.35	0.53
Brown Argus	5	20	15	300%	0.08	0.44
Dark Green Fritillary	10	20	10	100%	0.16	0.44
Grizzled Skipper	18	17	-1	-6%	0.29	0.37
Chalkhill Blue	6	16	10	167%	0.1	0.35
Comma	46	11	-35	-76%	0.73	0.24
Small Tortoiseshell	20	10	-10	-50%	0.32	0.22
Brimstone	3	9	6	200%	0.05	0.2
Silver-spotted Skipper	11	9	-2	-18%	0.18	0.2
Clouded Yellow	32	8	-24	-75%	0.51	0.18
Holly Blue	5	8	3	60%	0.08	0.18
Green-veined White	15	6	-9	-60%	0.24	0.13
Small Skipper	51	6	-45	-88%	0.81	0.13
Essex Skipper	8	5	-3	-38%	0.13	0.11
Silver Washed Fritillary	0	1	1		0	0.02
Adonis Blue	2	0	-2	-100%	0.03	0
Clouded Yellow (pale)	2		-2	-100%	0.03	0
Total (all species)	6271	4540	-1733	-28%	100	100

Table A.2 Percentage of total sightings represented by each species - and consequent rankings

	Rank in 2018	Rank in 2019	Sightings in 2018 as % of 2018 totals	Sightings in 2019 as % of 2019 total
Table A.2				
Meadow Brown	2	1	24.88	27.14
Small Heath	1	2	25.47	17.53
Gatekeeper	4	3	9.64	14.27
Common Blue	3	4	18.48	7.2
Speckled Wood	5	5	3.67	5.44
Small White	8	6	1.98	3.59
Marbled White	9	7	1.79	3.37
Painted Lady	29	8	0.08	2.89
Large White	7	9	2.3	2.11
Small Copper	6	10	2.73	1.92

Figure A.1 Numbers of selected species sighted from 2017-2019

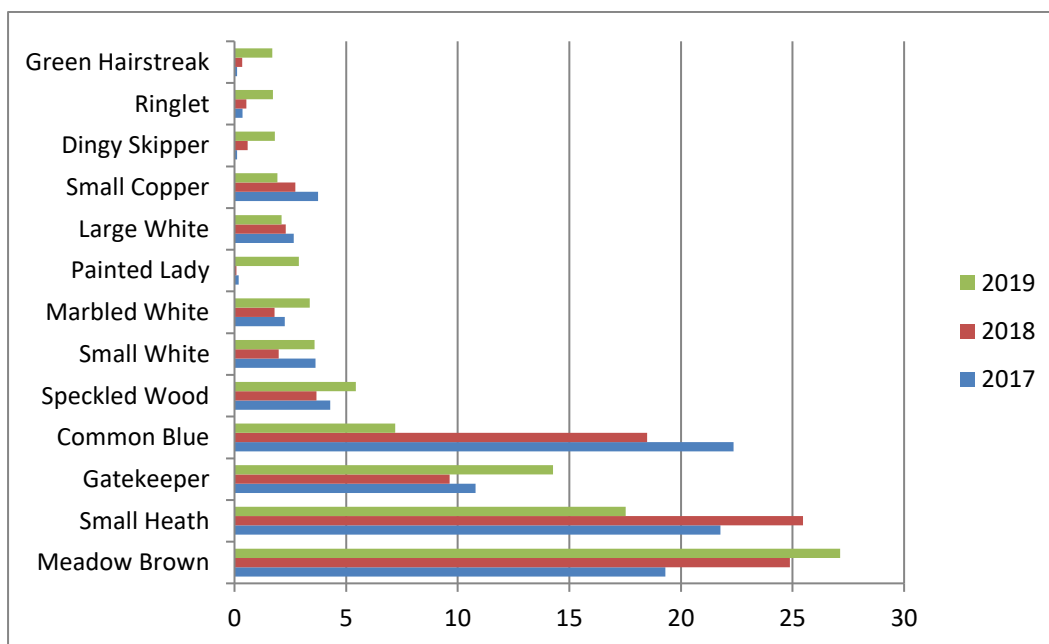


Table A.3 Ranking of eastern transect sections based on average number of sightings per survey (1=highest)

	1	2	3	4	5	6	7	8	9	10	11	12
2018	E12	E10	E7	E6	E5	E11	E2	E1	E9	E4	E8	E3
2019	E12	E10	E2	E1	E5	E7	E9	E4	E6	E11	E3	E8

Table A.4 Ranking of western transect sections based on average number of sightings per survey (1=highest)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
2018	W3	W6	W8	W7	W1	W11	W10	W5	W4	W2	W9	W13	W12	W14
2019	W3	W6	W11	W8	W7	W10	W2	W5	W4	W9	W1	W12	W14	W13

Annex B

Weather conditions and habitat management during the surveys

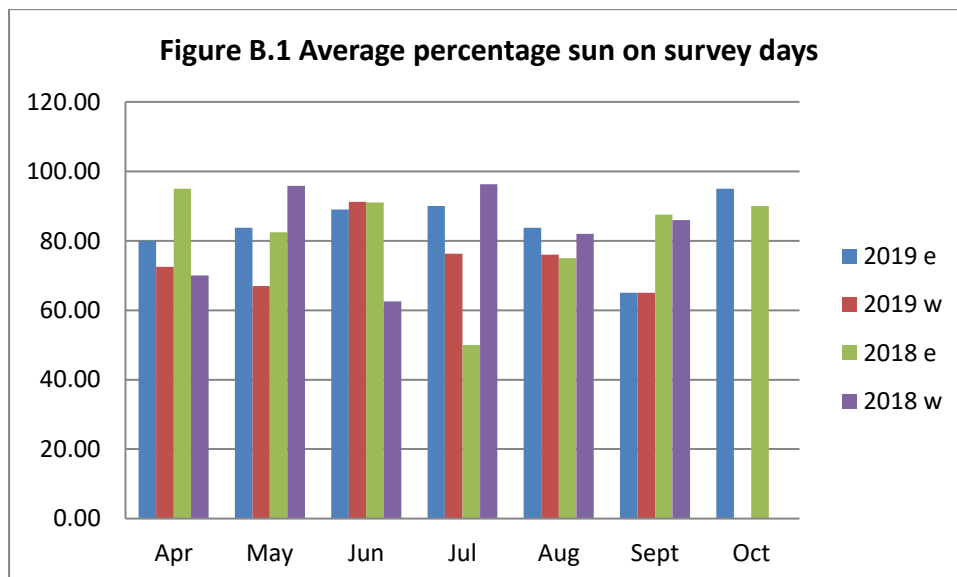
Section B.1 Weather conditions - on survey days and more generally.

Could weather conditions on survey days partly explain drop in total sightings between 2018 and 2019?

"Transect walks should only be carried out in warm and at least bright weather, with no more than moderate winds and not when it is raining. The minimum criteria are either 13-17°C with at least 60% sunshine, or if there is no sunshine the temperature must be 17°C or above. Wind speed (Beaufort scale) should be no more than 5 unless the transect route is sheltered from the wind."
(UKBMS G2: FIELD GUIDANCE NOTES FOR BUTTERFLY TRANSECTS).

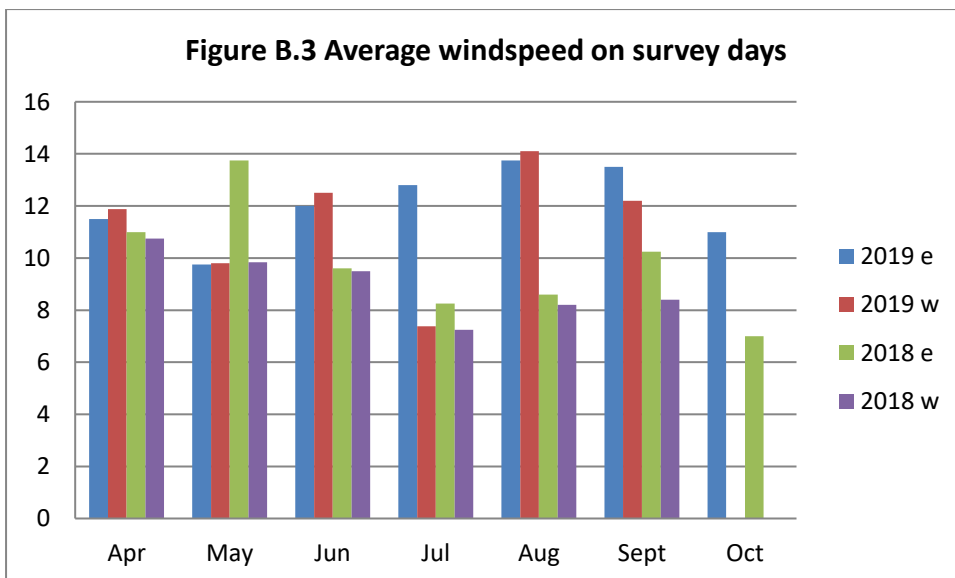
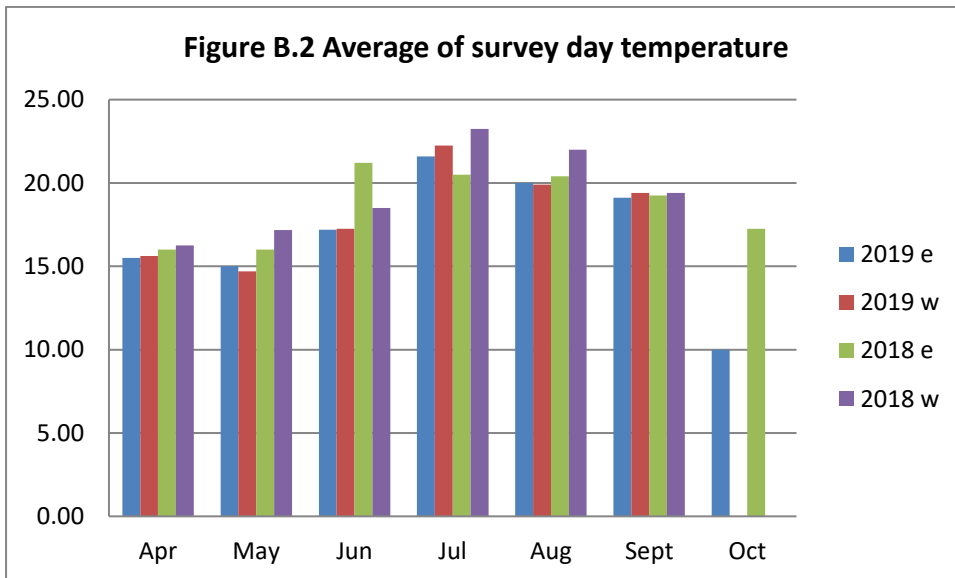
Whenever possible, the surveys were conducted on days when the conditions met the above criteria and it was nearly always possible to find such conditions on at least one day per week between April and September. As a result the survey weather may be less variable than general weather patterns and unrepresentative.

Figures B.1-3 show the monthly averages for the percentage of sunshine, temperature and wind speed on survey days on each transect in 2018 and 2019.

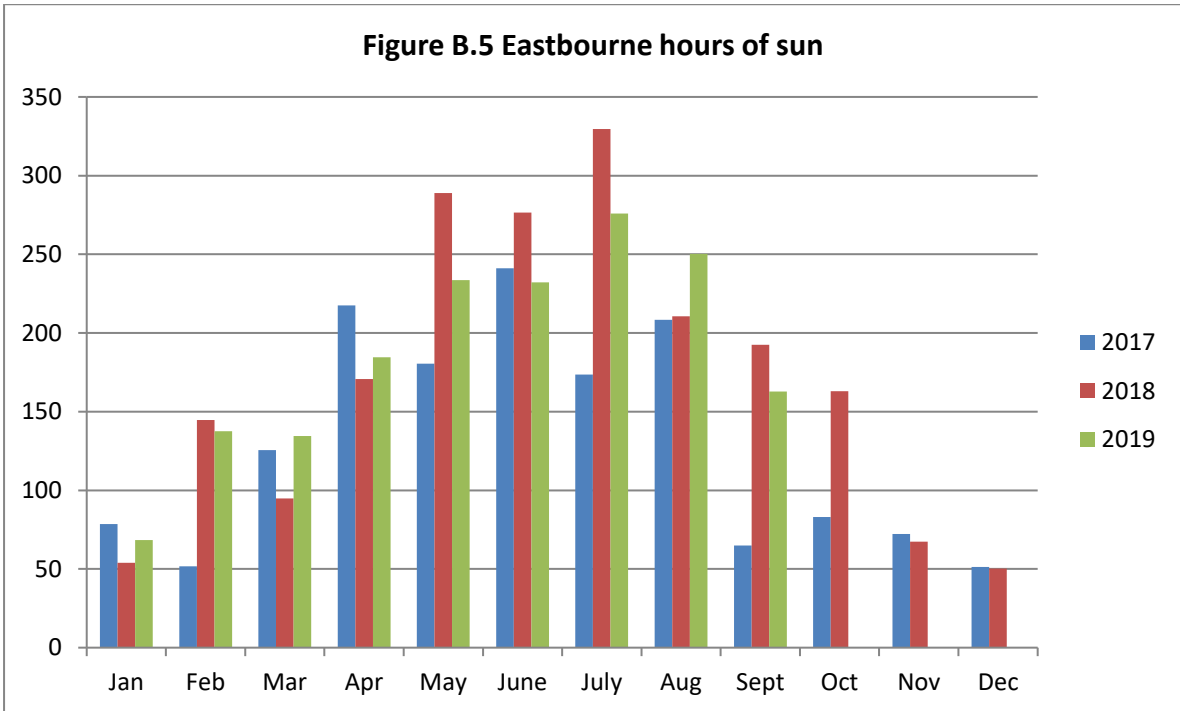
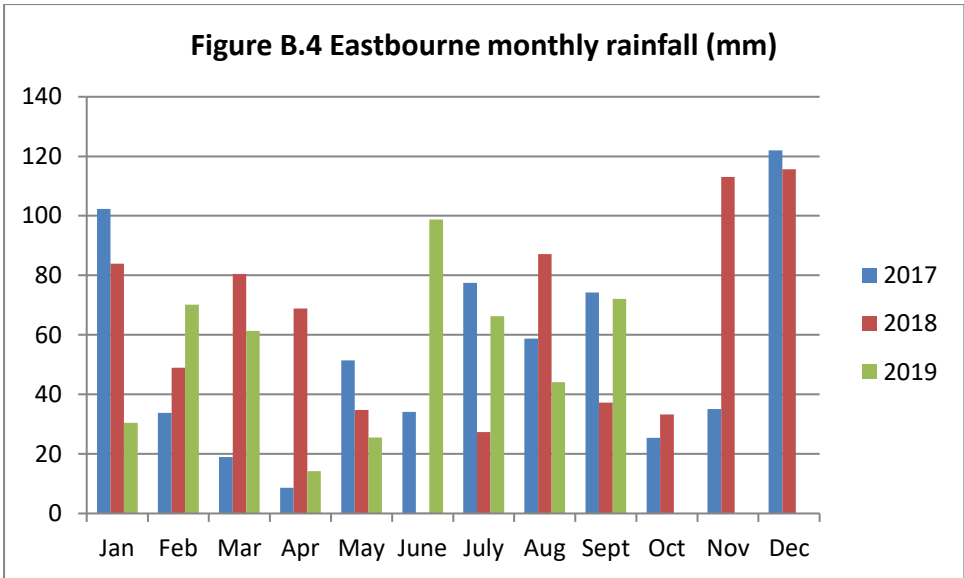


There were some slight differences between the years in survey day sunshine levels. The two months in which there are substantial differences between the two years in the percentages of sun on survey days were the lower sunshine figures for the east in July 2018 and for the west in June 2018. They were much the same in August 2018 and 2019. Only in September were both transects surveyed under less sunny conditions in 2019 than 2018.

There is even less variation in average survey day temperatures between the two years (Figure B.2).



Wind speed was the one factor where surveys in 2019 were frequently done under less favourable conditions than 2018(See Figure B.3) . May is the only month when average speed for surveys on one of the 2018 transects exceeded the speed in 2019. In all other months from April to October the average wind speed for at least one of the 2019 survey transects exceeded that for both transects in 2018. And in four of these months, speeds for both 2019 transects exceeded those for both 2018 transects.



Section B.2 Grass cutting during the surveys.

Mowing on a large area of grazed grassland between Hope Gap and the track to the Coastguard Cottages was the largest piece of habitat management likely to influence the numbers of sightings during the surveys.

This area was crossed by part of section E10 and all of E11, and formed the edge of E12. The grass here was cut and collected during week 20 of the survey. Figure B.6 reports the numbers of sightings for these three sections around the time of the survey. Section 10 shows something of a dip during week 20, but there are signs of recovery and the average number of sightings across these three sections in weeks 21,2 and 3 are not dissimilar from those in 2018.

Figure B.6 Sightings per section (E10,11&12) around time of grass cut in 2019

