

# Butterfly Surveys, Knepp Castle Estate, 2018

## Headlines

The Purple Emperor had another exceptionally good (and very early) season on the Southern Block, confirming that Knepp's population is now easily the largest in the UK. Counts of 300 or more individuals were made on four days, including a new British record of 388 on 2<sup>nd</sup> July. The Wildland population continues to grow at a rapid pace.

The first Wildland records of Green Hairstreak and Dingy Skipper brought the total of species seen since 2005 (when structured surveying commenced) to 36. These were the first 'new' species to be recorded during the spring survey of the Southern Block.

Butterflies had another excellent year on the estate, with species including the Purple Emperor, Purple Hairstreak, Large White, Small White, Green-veined White, Small Heath, Speckled Wood and Common Blue all faring particularly well.

However, a few species had notably poor years, including Peacock and Red Admiral, which may have suffered from droughting of their foodplants (nettle); this reflects the situation seen nationally. The Small and Essex Skippers also performed badly, with no records of the latter from the Southern Block this year.

The spring survey of the Southern Block produced the highest number of species (14) recorded since this survey began in 2012, and the highest count (107) of individual butterflies.

The July survey of the Southern Block produced the equal highest number of species (24) recorded since this survey began in 2012, matching the 2017 figure.

The high summer (2<sup>nd</sup> and 3<sup>rd</sup> August) survey of the Northern and Middle Blocks produced the second highest number of species (23) recorded since this survey began in 2005, when only 13 were recorded. The count of 1344 individual butterflies has only been bettered by the 2014 and 2017 totals, and is significantly higher than the 2005-2018 average.

An additional winter survey of Brown Hairstreak eggs was conducted using stepladders, to test the theory, proposed by some, that this species lays an atypically high proportion of its eggs above 'head height' in the hedgerows of the Wildland. This theory was disproved, with the proportion of eggs being laid at or above 2.1 metres being entirely consistent with data collected elsewhere in Sussex.



Male Purple Emperors are now visiting the ride surfaces in increasing numbers



Green Hairstreak and Dingy Skipper; two 'new' species for the Wildland, sighted in the Southern Block on 1<sup>st</sup> June

## **Transect Survey, Northern & Middle Blocks (with reference to surveys July/August 2005 – 2017)**

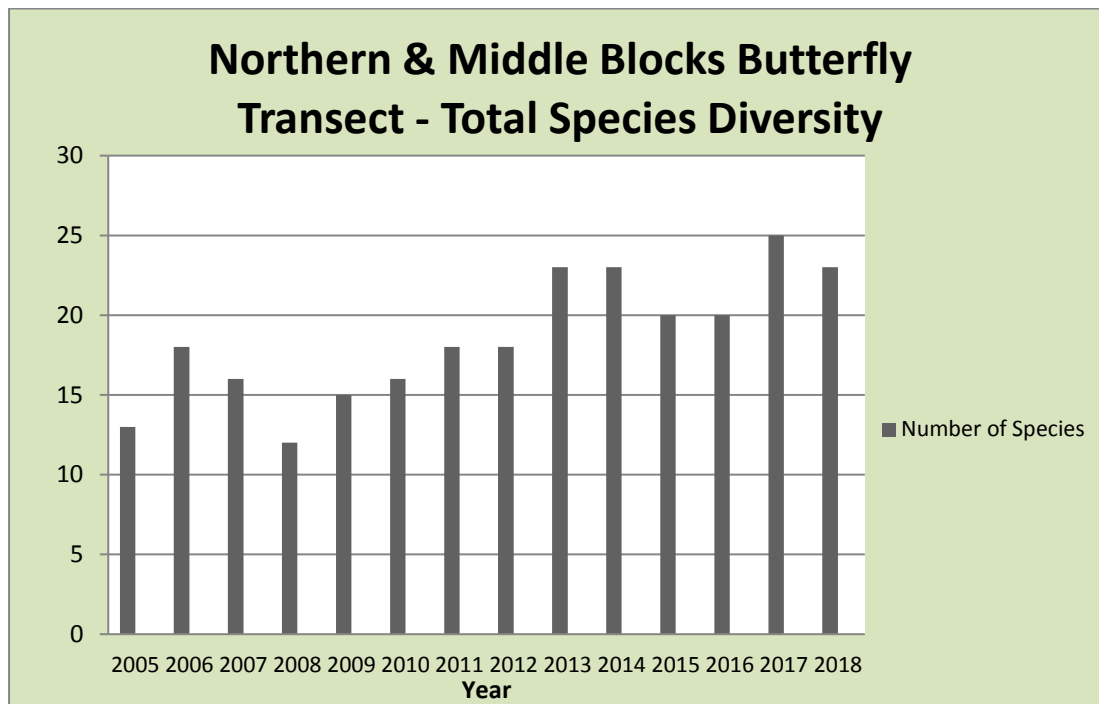
### **Introduction**

Butterflies have been the subject of annual surveys, usually in July, for a total of fourteen years (2005 – 2018 inclusive), as part of the overall monitoring programme to assess the effects of the naturalistic grazing regime first implemented in 2001 and since expanded over much of the Knepp Castle Estate. These surveys of the Northern and Middle Blocks were initially conducted by Rich Howorth of the Sussex Wildlife Trust, but in 2012 the task of monitoring butterflies over the wider Wildland project area was taken on by Neil Hulme, Conservation Adviser for the Sussex Branch of Butterfly Conservation.

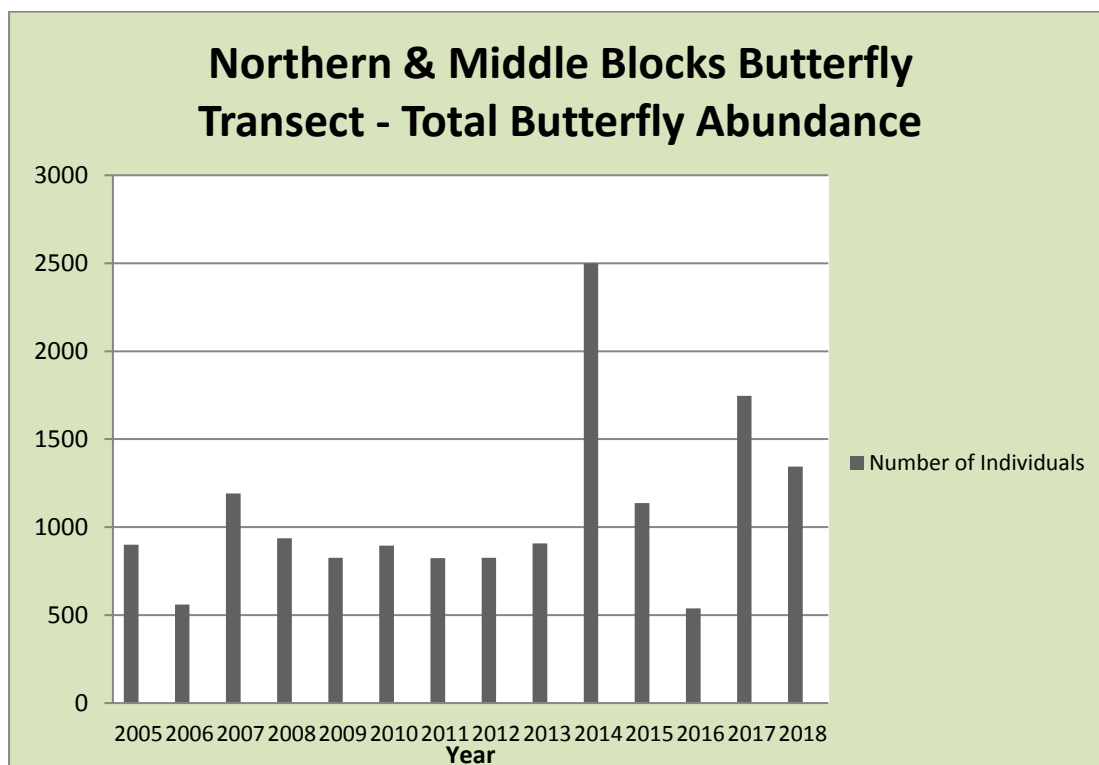
The methodology previously employed by Howorth has been maintained for the Northern and Middle Blocks; namely the standard UKBMS Transect technique, the details of which have been described in earlier reports. The key feature to note is the subdivision of the Transect route into 26 recording parcels.

This year the Transect was again walked over two days, as it has proven increasingly difficult to complete the route within a single day, during the hours when butterflies are likely to be on the wing, due largely to significant increases in abundance and diversity. This year the Transect was walked on 2<sup>nd</sup> and 3<sup>rd</sup> August.

## Results



This bar chart shows the total number of species seen (species diversity) along the Transect route across the Northern and Middle Blocks between 2005 and 2018.



This bar chart shows the total number of butterflies counted along the Transect route across the Northern and Middle Blocks between 2005 and 2018.

**NORTHERN & MIDDLE BLOCKS BUTTERFLY TRANSECT – RECORDED SPECIES: TOTAL ABUNDANCE**

<b>Species</b>	2005 Abun	2006 Abun	2007 Abun	2008 Abun	2009 Abun	2010 Abun	2011 Abun	2012 Abun	2013 Abun	2014 Abun	2015 Abun	2016 Abun	2017 Abun	2018 Abun
Small Skipper	35	23	1	38	9	8	21	15	62	790	52	18	64	19
Essex Skipper	3	0	33	0	0	11	9	41	15	159	65	3	7	3
Large Skipper	2	1	1	2	2	1	6	0	5	14	4	0	11	8
Clouded Yellow	0	1	0	0	0	0	0	0	1	0	0	0	1	0
Brimstone	2	1	0	0	0	0	0	6	2	1	0	1	1	2
Large White	9	62	27	45	24	18	20	3	55	15	28	9	11	23
Small White	15	16	19	42	36	20	70	0	7	6	8	9	2	3
Green-veined White	0	4	4	2	3	6	5	43	124	123	57	91	56	45
Purple Hairstreak	0	2	1	0	0	0	0	1	1	13	3	6	43	47
Small Copper	0	0	0	0	1	5	3	1	2	1	2	1	1	1
Small Blue	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Brown Argus	0	0	1	0	0	0	2	0	0	0	0	3	0	0
Common Blue	0	21	0	0	1	43	1	1	2	1	27	3	44	35
Holly Blue	0	0	0	0	0	0	0	1	0	0	1	1	0	0
White Admiral	0	0	1	0	0	0	0	1	0	3	0	0	2	2
Purple Emperor	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Red Admiral	0	3	0	0	0	2	7	0	1	4	0	10	13	1
Painted Lady	0	7	2	0	313	0	0	0	2	3	3	6	4	1
Small Tortoiseshell	0	0	0	0	0	0	0	1	1	8	0	0	5	1
Peacock	1	0	4	17	19	1	2	2	19	37	5	8	16	3
Comma	2	2	0	4	8	1	2	2	6	11	7	3	5	4
Silver-washed Fritillary	13	16	26	19	34	59	38	20	60	70	64	14	40	29
Speckled Wood	5	6	5	10	9	9	17	6	6	2	8	6	6	10
Marbled White	0	0	0	1	0	2	1	1	4	33	7	0	2	1
Gatekeeper	198	179	92	138	131	332	187	154	164	251	338	82	505	358
Meadow Brown	611	214	974	619	233	377	431	527	364	946	448	262	897	741
Ringlet	5	1	1	0	2	0	2	0	3	4	8	0	2	2
White-letter Hairstreak	0	0	0	0	0	0	0	0	0	4	0	2	0	0
Dark Green Fritillary	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Brown Hairstreak	0	0	0	0	0	0	0	0	0	0	0	0	7	0
Small Heath	0	0	0	0	0	0	0	0	0	0	0	0	1	5

**TOTAL SPECIES = 31**

This table shows the total number of butterflies of each species counted along the Transect route across the Northern and Middle Blocks between 2005 and 2018.

## Summary

- 1) The July survey of the Northern and Middle Blocks produced the equal second highest number of species (23, as also seen in 2013 and 2014) recorded since this survey began in 2005, when only 13 were recorded. This species total has only been beaten by the 2017 figure of 25.
- 2) The count of 1344 individual butterflies has only been bettered by the 2014 total of 2499 and the 2017 total of 1746; it is significantly higher than the 2005-2018 average.
- 3) The diversity and abundance figures for 2018 may have been influenced by the timing of the survey, which was performed later (2<sup>nd</sup> and 3<sup>rd</sup> August) than in most years, particularly as the very warm and sunny weather meant that many species experienced early and quite short flight seasons.
- 4) Some species (e.g. Peacock and Red Admiral) suffered a poor season, probably due to droughting of their foodplants (nettle). The Essex and Small Skippers also performed badly here in 2018.
- 5) The Purple Hairstreak did particularly well (total 47 counts), following a strong flight season in 2017.

## Timed Count Survey, Southern Block, June 2018

### Introduction

In 2012 the decision was taken to increase the number and spread of butterfly surveys across the Wildland project area. Two of these additional, annual surveys focus on a fixed route, planned to cover a variety of habitats over part of the Southern Block.

One of the aims of this spring survey (this year conducted on 1<sup>st</sup> and 3<sup>rd</sup> June) is to record species which potentially occur on the estate, but which fly earlier in the year, thus avoiding 'capture' by the original recording regime.

The methodology employed for these two surveys is significantly different to the standard UKBMS Transect technique employed for the Northern and Middle Blocks. The Transect technique does have limitations when only performed on one or two days each year, rather than the recommended 26 weekly repetitions.

These Southern Block surveys are conducted as Timed Counts, with a standardised period of recording being spent (flexibly) within each of the named survey sections (e.g. 'Sallow Fields') along the route. A more generous survey corridor is allowed (20 m width, rather than 5 m) and there is no ceiling to the recording cube, allowing for the easier 'capture' of arboreal species. There is no requirement to walk at a steady, rapid pace, so that more interesting habitat patches can be examined more thoroughly, potentially allowing for the sighting of less common butterflies; indeed some species are notoriously adept at avoiding inclusion within Transect counts. Wind speed, cloud cover and temperature are recorded. Precise details of this Southern Block route, including the time limits for each survey section, are appended to this year's report (see Timed Count survey route map).

## Results

SOUTHERN BLOCK BUTTERFLY SURVEY (TIMED COUNT) – JUNE 2018											
Species	Survey Section										Total Species Counts
	Green Lane Approach	Green Lane	Pen Bridge North	Pen Bridge West	The Strip	Brookhouse Farm	Sallow Fields	Grasslands	Woodland Block	Emperor Walk	
Large White		1									1
Green-veined White	1		1			1					3
Painted Lady									1		1
Small Heath			6	9	5	5		12			37
Holly Blue						1					1
Speckled Wood	2	3		2	1	2	2		4	1	17
Common Blue			1	2	3	2	2	2		2	14
Large Skipper				3	1	2				3	9
Red Admiral	1	1									2
Meadow Brown				4		5	3			4	16
Small Copper							1	1			2
Orange-tip	1										1
Dingy Skipper				1	1						2
Green Hairstreak					1						1
TOTAL SECTION COUNTS	5	5	8	21	12	18	8	15	5	10	107
TOTAL SECTION SPECIES	4	3	3	6	6	7	4	3	2	4	

### TOTAL SPECIES = 14

This table shows the number of butterflies of each species counted in each named survey section (e.g. 'Sallow Fields') along the Timed Count survey route across the Southern Block in June 2018.

### Summary

1) The 1<sup>st</sup>/3<sup>rd</sup> June survey of the Southern Block produced the highest number of species (14) recorded since this survey began in 2012, beating the previous best of 12 achieved in 2017. This included the first Wildland records of Green Hairstreak and Dingy Skipper, bringing the total of all butterfly species seen at Knepp (since 2005) to 36.

These 'new' species probably dispersed northwards across the Weald from the Downs at Washington or Storrington, covering a distance of between 8.5km and 9.25km. 2018 was notable for the wide dispersal of many species across the landscape, with such adventurous behaviour probably being influenced by factors including population strength and anticyclonic weather conditions.

2) The count of 107 individual butterflies exceeded the previous best total of 69, recorded in both 2012 and 2017. The Small Heath fared particularly well (37 counts), as it did in 2017.

# Timed Count Survey, Southern Block, July 2018

## Introduction

In 2012 the decision was taken to increase the number and spread of butterfly surveys across the Wildland project area. Two of these additional, annual surveys focus on a fixed route, planned to cover a variety of habitats over part of the Southern Block. This particular survey, conducted on 21<sup>st</sup> July, was designed to 'capture' high summer species over a previously (pre-2012) unsampled area of the estate.

The methodology employed for these two surveys is significantly different to the standard UKBMS Transect technique employed for the Northern and Middle Blocks. The Transect technique does have limitations when only performed on one or two days each year, rather than the recommended 26 weekly repetitions.

These Southern Block surveys are conducted as Timed Counts, with a standardised period of recording being spent (flexibly) within each of the named survey sections (e.g. 'Sallow Fields') along the route. A more generous survey corridor is allowed (20 m width, rather than 5 m) and there is no ceiling to the recording cube, allowing for the easier 'capture' of arboreal species. There is no requirement to walk at a steady, rapid pace, so that more interesting habitat patches can be examined more thoroughly, potentially allowing for the sighting of less common butterflies; indeed some species are notoriously adept at avoiding inclusion within Transect counts. Wind speed, cloud cover and temperature are recorded. Precise details of this Southern Block route, including the time limits for each survey section, are appended to this year's report (see Timed Count survey route map).

## Results

SOUTHERN BLOCK BUTTERFLY SURVEY (TIMED COUNT) – JULY 2018											
Survey Section											
Species	Green Lane Approach	Green Lane	Pen Bridge North	Pen Bridge West	The Strip	Brookhouse Farm	Sallow Fields	Grasslands	Woodland Block	Emperor Walk	Total Species Counts
Small Skipper		1	9	1	7	9		4			31
Large Skipper					1						1
Large White	9	8		1	4	4	1	2		1	30
Small White	1	1	1	5	3	7	1	1			20
Green-veined White	8	14	4	4	6	8	4	2		1	51
Purple Hairstreak	1	6	1	4	7	5	1	1		5	31
Purple Emperor		4				1	2				7
Red Admiral	1										1
Peacock					1					1	2
Painted Lady			2	2		1					5
Comma		2			3		1				6
Marbled White		1	4	6	1	2		3		1	18
Gatekeeper	12	41	29	46	24	50	16	29	5	15	267
Meadow Brown	13	27	47	36	30	79	23	44	6	29	334

Ringlet	2	1									<b>3</b>
Speckled Wood	3	8	1	6	5	1	4	3	4	2	<b>37</b>
Brown Hairstreak			1		2						<b>3</b>
Silver-washed Fritillary		1				1					<b>2</b>
Common Blue					2	6		5		2	<b>15</b>
Brown Argus					2	1		3			<b>6</b>
Holly Blue		1									<b>1</b>
Small Heath				8	6	3		11		3	<b>31</b>
Small Copper				1				2			<b>3</b>
Brimstone		1	1								<b>2</b>
<b>TOTAL SECTION COUNTS</b>	<b>50</b>	<b>117</b>	<b>100</b>	<b>120</b>	<b>104</b>	<b>178</b>	<b>53</b>	<b>110</b>	<b>15</b>	<b>60</b>	<b>907</b>
<b>TOTAL SECTION SPECIES</b>	<b>9</b>	<b>15</b>	<b>11</b>	<b>12</b>	<b>16</b>	<b>15</b>	<b>9</b>	<b>13</b>	<b>3</b>	<b>10</b>	

### **TOTAL SPECIES = 24**

This table shows the number of butterflies of each species counted in each named survey section (e.g. 'Sallow Fields') along the Timed Count survey route across the Southern Block in July 2018.

### **Summary**

- 1) The July survey of the Southern Block produced the equal (with 2017) highest number of species (24) recorded since this survey began in 2012.
- 2) The count of 907 individual butterflies has only been bettered by the totals recorded in 2013 (1137), 2014 (1145) and 2017 (1009).
- 3) Those species which fared particularly well include the Large White (30), Small White (20), Green-veined White (51), Purple Hairstreak (31), Speckled Wood (37), Common Blue (15) and Small Heath (31).
- 4) A few species had notably poor seasons, including the Peacock and Red Admiral, which may have suffered through droughting of their foodplants (nettle). The Essex Skipper was not recorded in the Southern Block this year, mirroring its poor performance elsewhere on the Wildland.



# **Single Species Survey (Purple Emperor), Southern Block, June/July 2018**

## **Introduction**

In 2013 several additional butterfly surveys were added to the already improved and extended programme covering the Wildland project area. In addition to the more formalised UKBMS style Transect (2005 onwards), Timed Counts (2012 onwards) and Brown Hairstreak egg searches (winter 2012/2013 onwards), there are now focused, Single Species surveys for the Purple Emperor.

This species is invariably under-recorded by most standardised survey methods, due to its arboreal lifestyle and highly elusive habits. Numerous casual records of the Purple Emperor are also now collated each season, often arising from field outings run as part of the Knepp Safaris programme.

The methodology employed is very informal, involving a search of the areas considered most likely to reveal the presence of the butterfly, based on detailed knowledge of the species' autecology. As this requires a considerable level of experience, the results are not necessarily repeatable by other observers.

## **Summary**

- 1) The 2018 Purple Emperor season at Knepp commenced on the exceptionally early date of 15<sup>th</sup> June, as it did in 2017, thereby matching the earliest ever date for Sussex.
- 2) The flight season ran from at least 15<sup>th</sup> June to 26<sup>th</sup> July and was of a typical six weeks duration. As always, males made the early running, with females dominating the tail-end of the season, often visiting sap bleeds to collect life-extending nutrients.
- 3) Maximum day counts exceeded 20 on almost every day between 19<sup>th</sup> June and 21<sup>st</sup> July, and exceeded 100 on almost every day between 22<sup>nd</sup> June and 4<sup>th</sup> July. Counts of 300 or more were made on 24<sup>th</sup> June, 27<sup>th</sup> June, 30<sup>th</sup> June and 2<sup>nd</sup> July.
- 4) The highest count of 388 was made on 2<sup>nd</sup> July, easily beating the all-time Knepp/UK record of 148 made in 2017; the Wildland population continues to grow.
- 5) The majority of individuals were again observed within the one kilometre squares at TQ1319, TQ1320, TQ1321, TQ1420 and TQ1421.
- 6) The number of male butterflies visiting ride surfaces continues to increase from year-to-year, although the reasons for this are poorly understood.

# Brown Hairstreak Egg Survey, All Blocks, Winter 2017/2018

## Introduction

Brown Hairstreak egg surveys are now included as part of the extended Knepp Castle Estate Wildland monitoring programme, initiated during the winter of 2012/2013. This report sets out the findings of searches conducted at five locations within the Southern Block of the project area on 16<sup>th</sup> December 2017, and the results of an additional 'ladder survey' performed on 2<sup>nd</sup> February 2018.

The methodology employed by the first of these surveys is straightforward and easily repeatable, involving a timed count of Brown Hairstreak eggs over areas where suitable blackthorn growth occurs. A measure of their relative density is achieved by calculating the number of eggs discovered per hour of searching. In line with the previous surveys (winter 2012/2013 onwards), the technique involved counting the eggs visible from ground level, to a maximum height of c.2.1 metres.

The veracity of this technique, in providing a relative measure of the Brown Hairstreak population at Knepp, has been questioned by a number of commentators over the last few years, who have suggested that the species has learned to preferentially lay its eggs higher within the hedgerows at Knepp (at a frequency above the maximum 10%-15% previously noted in other Sussex-wide surveys), presumably in response to the generally high (but annually variable) browsing pressure exerted by larger herbivores - the effects of which are herein considered to act as a significant break on local population size, in some years suppressing adult numbers in a similar manner to the mechanical flailing of e.g. roadside hedgerows (see previous reports).

In order to test whether the Brown Hairstreak is egg-laying at atypically high levels within the Wildland hedgerows, a 'ladder survey' was conducted by Knepp Ecologist Penny Green and students Georgina Pashler, Alexandra Harnerou and Chloe Harrison on 2<sup>nd</sup> February 2018. The same lengths (and aspects) of hedgerow surveyed using the usual technique were searched using stepladders, and all eggs located at or above 2.1 metres were recorded. The time allowed for each survey was adjusted by +50%, to take into account the time required for moving and climbing the stepladders. An eggs-per-hour find rate was calculated for comparison with the usual survey, conducted from ground level.

## Results

BROWN HAIRSTREAK EGG SURVEY (TIMED COUNT) ALL BLOCKS – WINTER 2017/2018					
Survey Area	Hampshire Buildings Small & Bull Field	Wild Flower Meadow	Oaklands 5	Fresco West	Fresco West /East
Grid Ref	TQ140212	TQ137207	TQ133205	TQ143204	TQ144204
Eggs Per Hour	34	40	5	26	48

This table shows the relative density of Brown Hairstreak eggs found by searching suitable blackthorn growth in each survey area, from ground level, measured as the number of eggs discovered per hour.

**LADDER SURVEY (TIMED COUNT) OF EGGS LOCATED AT OR ABOVE 2.1 METRES 2.2.18**

<b>Survey Area</b>	Hampshire Buildings Small & Bull Field	Wild Flower Meadow	Oaklands 5	Fresco West	Fresco West /East
<b>Grid Ref</b>	TQ140212	TQ137207	TQ133205	TQ143204	TQ144204
<b>Eggs Per Hour</b>	0	0	0	1.34	9

This table shows the relative density of Brown Hairstreak eggs found by searching the same stretches of hedgerow as in the first survey, but at or above 2.1 metres, measured as the number of eggs discovered per hour.

**Summary**

1) In addition to the winter egg survey conducted at ground level, using the technique adopted since winter 2012/2013, a survey of eggs deposited at or above a height of 2.1 metres, along the same sections of hedgerow, was performed using stepladders. This was to test the theory, proposed by some, that this species lays an atypically high proportion of its eggs above 'head height' on the Wildland (at a frequency above the maximum 10%-15% previously noted in other Sussex-wide surveys).

However, this theory proved to be incorrect, with the proportion of eggs laid at or above 2.1 metres falling within the range 0% - 15.8%. This is entirely consistent with the behaviour of the Brown Hairstreak elsewhere in Sussex. Confidence in the veracity of the survey technique adopted since winter 2012/2013 has therefore been maintained.