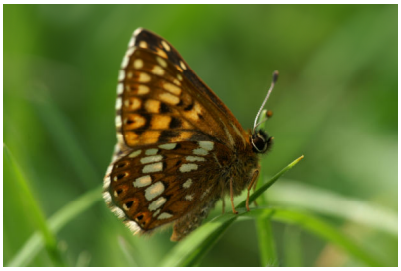
Ravensgate Hill

Results of Butterfly Monitoring

2011



Butterfly Conservation
Saving butterflies, moths and our environment

Gloucestershire Branch

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Results of 2011 butterfly monitoring on Ravensgate Hill

2011 was a disappointing year for the butterflies on Ravensgate Hill with total butterflies recorded on the transect falling by 40%. It was the lowest annual count since the transect began in 2005. However, there was a big reduction on many other sites in the county especially grassland sites. The main cause for this poor butterfly season is the poor summer weather.

In addition to recording on the transect, frequent visits were made to the rest of the hill to obtain casual records. This is useful to get a feel on how the butterflies are faring on all the hill although we cannot compare numbers year on year from these records.

In 2011 the total number of butterflies recorded on the transect decreased from 1424 last year to 862 this year. The number of species also decreased from 28 to 24. If we include off-transect records, the number of species is 27, a slight drop from the record high of 30 in the previous year.

Results

The results are presented as tables and figures as follows:-

The results of this year's survey are given in Tables 1 - 6 and Figures 1 - 3. A walk was carried out in every week. All walks were carried out in acceptable weather conditions in that the conditions met the criteria (temperature greater than 17C or greater than 13C and sunshine greater than 60%). However, for some of the walks, the weather was overcast and even if the temperature was 19 or 20C, the number of butterflies flying was greatly reduced and certainly much lower than on a warm sunny day. Table 1 gives weather conditions for each walk. The weather conditions in the days before a walk are not noted but do seem to also affect the number of butterflies flying.

Main features of 2011

- Spring-flying butterflies increased because of the good weather in April and May. These species included Brimstone, Green Hairstreak and Small Heath.

- Summer-flying butterflies decreased sharply in number because of cool, cloudy conditions in July and August. eg Common Blue by 78%, Small White by 77%, Large White by 72%, Gatekeeper by 54%, Meadow Brown by 50%, Ringlet by 45%. Another reason could have been the dry spring which may have resulted in fewer larvae successfully pupating.

- Speckled Wood increased by 17%. These butterflies fly in both spring and summer. They didn't suffer too much in the summer as they can fly in duller, cooler conditions, their main habitat being openings in woodland.

- Duke of Burgundy did well, although are seen mainly off-transect (see section below)

- Ringlet remained the most numerous butterfly on the hill despite a sharp decrease this year. The second most numerous was Marbled White which actually did not suffer a decrease.

Duke of Burgundy

The main high priority species present on the hill is the Duke of Burgundy. These butterflies are mainly recorded near the foot of the hill (Sections C, J and K on the map), although a few were recorded near the hollow way at the east end of the site . As most of these areas are not on the transect, we have to make use of records from casual visits to get an idea of how they are faring.

The good weather in March and April 2011 meant the the Dukes flew early and the peak count in the casual records was 20 on 5th May. This is slightly down on the previous year's peak count of 26 which occurred three weeks later on 26th May. In fact the first sighting in 2011 was on 26th April in contrast to 19th May in 2011.

There were no sightings of these butterflies in adjacent areas, so it seems as present that they are confined to Ravensgate. This means that we have the responsibility of maintaining their habitat so that we don't lose them as they would not be able to recolonise from surrounding areas. In fact, it is hoped that these butterflies will spread out to other areas from Ravensgate. Lineover Wood is very close by and has suitable habitat, so it is hoped that one day they will move into this wood. This butterfly used to live in woods, but with lack of management of woodland in previous decades, the woods became too shaded and they were forced out. They now seem to live happily in pockets of sheltered scrubby downland, but it is not an easy thing to maintain the right habitat for them.

This butterfly has quite specific requirements. As well as sheltered, sunny spots for the adult butterflies to feed and mate, it requires Cowslips for the larvae to feed on. In addition, these Cowslips need to stay lush and green throughout the larval feeding stage (June – early August) and not become dry and wilted in the summer sun. This is achieved by providing shade from scrubby bushes and long grass. However, the grass needs to be short enough early on in the season for the Cowslips to be able to grow. As Cowslips are short lived, some bare ground or short, sparse grass is desirable to allow some seed to germinate. It is considered that light cattle grazing only within the period August until the end of March, along with some scrub control provides the best management regime.

Weather

The summer of 2011 was quite notable. It was the warmest April since records began, the coolest summer for many years and a very warm autumn. Overall the year was also very dry. As the weather has a profound effect on butterfly activity, it is not surprising to see the strong effect of weather on the transect results.

Figure 1 shows the transect counts for each week. Up until week 14, the beginning of July, the transect counts were about average or above average. The peak weeks usually occur in July and early August (weeks 14 to 19), but in 2011 the counts were well below average, sometimes less than half. This has a huge effect on the total number of butterflies recorded. Of course it is the species that are flying at this time which are most affected eg Ringlet, Meadow Brown, Gatekeeper, Small White, Large White, Green-veined White etc and it is these species that are the most numerous.

It may not have just been the cool, cloudy weather in July that caused such low counts. For example, for week 16, the walk was carried out in reasonable weather (18C, 78%sun). Most butterflies should have been very active in those conditions, but only about 10% of the usual number of butterflies were recorded. It is likely that there were just not as many butterflies around. One explanation for this could be that in the dry warm spring, the grass was not as lush

as usual and the butterfly larvae did not feed up adequately and did not pupate successfully. The summer-flying butterflies would have been larvae in the dry spring.

Comparison with other sites

Official results from butterfly transects in 2011 are not yet available, but unofficial reports from other Gloucestershire sites suggest that many species have performed similarly to those at Ravensgate. In particular, there were few butterflies around in July and August. The total for Ravensgate fell by 40%. The total recorded on The Masts transect on Prestbury Hill also fell by 40%. These are mainly grassland sites so have greater numbers of summer grassland species such as Ringlet and Meadow Brown.

The increase in numbers of spring-flying butterflies such as Brimstone and Green Hairstreak was also reflected at other sites.

Management of the hill

The hill is now being actively managed for wildlife, in particular for the butterflies. It is a wonderful site in that the topography naturally provides a variety of habitats. It is ideally suited to the Duke of Burgundy, which likes a north-facing slope with some scrub and long grass as this provides shelter from the wind and some shade for it's food plant, the Cowslip. All butterflies require a different habitat, so a mosaic of different habitats, with different turf heights throughout the site would be ideal. This mosaic effect is usually achieved by grazing. Removing coarse grasses and dead vegetation improves the flora which in turn helps the butterflies by providing a valuable nectar source. Certain butterflies also require specific flowering plants on which their larvae feed e.g. the Common Blue requires Bird's foot Trefoil. Hence improving the conditions for these specific plants is also beneficial for the butterflies.
The slope needs to be carefully managed to conserve the Duke of Burgundy which has specific habitat requirements i.e. the grass not too short and areas of scrub. It is important that this part of the site is not overgrazed.

In early spring 2011 contractors were paid for two days work clearing part of the Gorse and scrub on the slope. We are also grateful to the Cotswold Wardens for clearing scrub at the foot of the eastern side of the slope.

In the late Autumn 2011, one third of the slope was fenced off and cattle put on for nearly two weeks. The cattle did a wonderful job and really reduced the sward. There was a little poaching but not too much. Some poaching is beneficial as it provides bare ground for the seeds of flowering plants to germinate. This is particularly good for Cowslips, the foodplant of the Duke of Burgundy.

Five cattle were put on the hill in Februrary 2012 and it is hoped that this will help to maintain the condition of the grassland. However, they should really be taken off at the beginning of April before the flowering plants grow, although light summer grazing may be acceptable in some cases. The level area on the top of the slope was cut in August 2011. This has produced a shorter sward in this area.

Some scrub management should be carried out particularly at the western edge of the foot of the slope. Duke of Burgundy do require some scrub but it should be managed well to prevent it taking over the grassland areas. On Butterfly Conservation's Bill Smyllie reserve on Cleeve Hill, the scrub is being managed by cutting bays into it. This provides sheltered areas of grassland which seem to suit the Duke of Burgundy butterflies.

It is of concern that there are many Ash seedlings on the slope which are getting established. If something is not done about this soon, they could become a problem and be much more difficult to remove.

The disappointing numbers of butterflies recorded in 2011 is thought to be caused by the poor weather in the summer and not by the management regime. We may have to wait until 2012 and beyond to see the effects of management.

2012

The butterfly monitoring will continue in 2012 both on and off the transects. It is hoped that we get better weather in July and August so that our summer grassland butterflies can recover from the effect of a run of about five poor summers.

(Butterfly photos in text and on cover by Tricia Atkinson and Andrew Daw, Glos Branch of Butterfly Conservation)

The views expressed are those of the author and not necessarily of Butterfly Conservation.

Butterfly Conservation main website: www.butterfly-conservation.org

Gloucestershire Branch website: www.gloucestershire-butterflies.org.uk

Week	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	**Total**	**Index**
Mean Temp	*17*	*19*	*17*	*20*	*17*	*18*	*14*	*17*	*18*	*22*	*21*	*20*	*24*	*18*	*21*	*18*	*21*	*24*	*20*	*19*	*21*	*17*	*21*	*21*	*18*	23		
Mean Sun	*92.5*	*100*	*100*	*100*	*100*	*92.5*	*72.5*	*47.5*	*80*	*100*	*82.5*	*25*	*100*	*37.5*	*50*	*80*	*97.5*	*77.5*	*100*	*10*	*100*	*100*	*100*	*52.5*	*10*	100		
Small Skipper													4	4			8	9	12	1	2						**40**	**40**
Essex Skipper																											**0**	**0**
Small/Essex Skipper																											**0**	**0**
Large Skipper											8	2	40	14	12	1	2		1								**80**	**80**
Dingy Skipper									1																		**1**	**1**
Grizzled Skipper																											**0**	**0**
Clouded Yellow																											**0**	**0**
Brimstone			3	3	5	2				3								1	1		1					1	**20**	**20**
Large White			1		1	1			1						6	1	4	2		1	1						**19**	**19**
Small White			1														1	2	3								**7**	**7**
Green-veined White				1	4	3	2	1		7				4	4		4	4	6			2					**42**	**42**
Orange-tip				3	2	3																					**8**	**8**
Green Hairstreak				5	4																						**9**	**9**
Purple Hairstreak																											**0**	**0**
Small Copper							1																				**1**	**1**
Small Blue																											**0**	**0**
Brown Argus																											**0**	**0**
Common Blue						2		1	2	3										3	3						**14**	**14**
Chalkhill Blue																											**0**	**0**
Holly Blue			1		1																						**2**	**2**
Duke of Burgundy						2																					**2**	**2**
White Admiral																											**0**	**0**
Red Admiral															2	2	1									1	**6**	**6**
Painted Lady																											**0**	**0**
Small Tortoiseshell		2	1							1	1				1		1										**7**	**7**
Peacock	2	5	2	1	2		1										3	5	2	1			1				**25**	**25**
Comma															1												**1**	**1**
Dark Green Fritillary																											**0**	**0**
Silver-washed Fritillary																											**0**	**0**
Marsh Fritillary																											**0**	**0**
Speckled Wood			2	3	2	3	1		3	2	2		1	1			1	2	8	5	7	3	5	7	3	1	**62**	**62**
Wall																				1							**1**	**1**
Marbled White													13	17	39	8	21	12	11								**121**	**121**
Grayling																											**0**	**0**
Gatekeeper																1	1	11	4	3	5						**25**	**25**
Meadow Brown													5	9	17	3	16	10	8	5	1	3	2	1			**80**	**80**
Small Heath						2	1	3	2	2	1	1	8	4					2	1		1	1				**29**	**29**
Ringlet												13	66	91	75	8	6	1									**260**	**260**
Total	**2**	**7**	**11**	**16**	**21**	**18**	**6**	**5**	**9**	**18**	**12**	**16**	**137**	**144**	**157**	**24**	**69**	**59**	**58**	**21**	**20**	**9**	**9**	**8**	**3**	**3**	**862**	**862**

Table 1. Ravensgate - 2011. Total butterflies recorded each week

Table 2. Ravensgate - 2011. Total butterflies recorded in each section

Section	A	B	C	D	Total
Small Skipper	31	5	4		40
Essex Skipper					0
Small/Essex Skipper					0
Large Skipper	37	16	25	2	80
Dingy Skipper		1			1
Grizzled Skipper					0
Clouded Yellow					0
Brimstone	3	9	8		20
Large White	6	2	10	1	19
Small White	3		4		7
Green-veined White	11	15	16		42
Orange-tip		3	4	1	8
Green Hairstreak			9		9
Purple Hairstreak					0
Small Copper	1				1
Small Blue					0
Brown Argus					0
Common Blue	10	2	2		14
Chalkhill Blue					0
Holly Blue	1		1		2
Duke of Burgundy			2		2
White Admiral					0
Red Admiral	1	4		1	6
Painted Lady					0
Small Tortoiseshell	4	1	2		7
Peacock	7	5	11	2	25
Comma			1		1
Dark Green Fritillary					0
Silver-washed Fritillary					0
Marsh Fritillary					0
Speckled Wood	7	6	42	7	62
Wall	1				1
Marbled White	97	21	2	1	121
Grayling					0
Gatekeeper	10	5	10		25
Meadow Brown	44	16	13	7	80
Small Heath	26	3			29
Ringlet	93	104	52	11	260
Total	**393**	**218**	**218**	**33**	**862**

Table 3. Ravensgate - Total butterfly species count for each year

	2005	2006	2007	2008	2009	2010	2011	*Avg (05-10)*
Number of species	24	29	22	20	23	28	**24**	*24*
Small Skipper	114	77	25	52	63	48	**40**	*63*
Essex Skipper	8	1	0	1	0	2	**0**	*2*
Small/Essex Skipper	0	8	4	0	0	0	**0**	*2*
Large Skipper	32	53	44	49	81	138	**80**	*66*
Dingy Skipper	0	0	0	0	0	6	**1**	*1*
Grizzled Skipper	0	0	0	0	0	0	**0**	*0*
Clouded Yellow	0	1	0	0	0	0	**0**	*0*
Brimstone	17	16	16	20	10	9	**20**	*15*
Large White	22	22	10	16	85	69	**19**	*37*
Small White	22	17	9	20	50	30	**7**	*25*
Green-veined White	12	37	18	12	64	53	**42**	*33*
Orange-tip	3	1	0	3	2	2	**8**	*2*
Green Hairstreak	4	3	2	0	7	5	**9**	*4*
Purple Hairstreak	1	0	0	0	0	0	**0**	*0*
Small Copper	0	1	0	0	0	2	**1**	*1*
Small Blue	2	3	0	0	0	0	**0**	*1*
Brown Argus	2	0	0	0	0	2	**0**	*1*
Common Blue	13	32	2	1	9	63	**14**	*20*
Chalkhill Blue	0	0	0	0	0	0	**0**	*0*
Holly Blue	3	5	1	8	0	1	**2**	*3*
Duke of Burgundy	0	2	0	0	3	8	**2**	*2*
White Admiral	0	0	0	0	0	0	**0**	*0*
Red Admiral	13	23	5	8	10	3	**6**	*10*
Painted Lady	0	5	0	0	61	2	**0**	*11*
Small Tortoiseshell	14	2	0	1	14	12	**7**	*7*
Peacock	42	127	48	44	78	60	**25**	*67*
Comma	19	31	6	10	16	16	**1**	*16*
Dark Green Fritillary	0	0	2	0	1	3	**0**	*1*
Silver-washed Fritillary	0	2	1	0	0	2	**0**	*1*
Marsh Fritillary	0	3	1	0	0	0	**0**	*1*
Speckled Wood	49	58	39	51	54	53	**62**	*51*
Wall	0	1	0	0	1	0	**1**	*0*
Marbled White	266	401	351	280	269	119	**121**	*281*
Grayling	0	0	0	0	0	0	**0**	*0*
Gatekeeper	174	191	141	179	103	54	**25**	*140*
Meadow Brown	385	420	184	252	214	159	**80**	*269*
Small Heath	27	50	14	14	27	23	**29**	*26*
Ringlet	195	295	251	576	677	472	**260**	*411*
Totals	**1439**	**1888**	**1174**	**1597**	**1899**	**1424**	**862**	*1570*

Table 4. Ravensgate - Presence of butterfly species on whole site (both on and off transect)

	2005	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	***Priority***
Number of species	21	26	28	23	26	30	**27**	***status***
Small Skipper	Y	Y	Y	Y	Y	Y	**Y**	
Essex Skipper	Y	Y	Y	Y	?	Y(T)	**?**	
Large Skipper	Y	Y	Y	Y	Y	Y	**Y**	
Dingy Skipper	?	?	Y	Y	Y	Y	**Y**	*High*
Grizzled Skipper								
Clouded Yellow		Y(T)						
Brimstone	Y	Y	Y	Y	Y	Y	**Y**	
Large White	Y	Y	Y	Y	Y	Y	**Y**	
Small White	Y	Y	Y	Y	Y	Y	**Y**	
Green-veined White	Y	Y	Y	Y	Y	Y	**Y**	
Orange-tip	Y	Y	Y	Y	Y	Y(T)	**Y**	
Green Hairstreak	Y	Y	Y	Y	Y(T)	Y	**Y**	*Medium*
Purple Hairstreak								
White-letter Hairstreak								
Small Copper		Y(T)				Y	**Y**	
Small Blue	?	?	Y	?	Ova	Y		*High*
Brown Argus	Y(T)					Y	**Y**	
Common Blue	Y	Y	Y	Y	Y	Y	**Y**	
Holly Blue	?	?	Y	Y		Y(T)	**Y(T)**	
Duke of Burgundy	?	Y	Y	Y	Y	Y	**Y**	*High*
White Admiral								
Red Admiral	Y	Y	Y	Y	Y	Y	**Y**	
Painted Lady	?	Y	Y		Y	Y(T)	**Y**	
Small Tortoiseshell	Y	?	Y	Y(T)	Y	Y	**Y**	
Peacock	Y	Y	Y	Y	Y	Y	**Y**	
Comma	Y	Y	Y	Y	Y	Y	**Y**	
Dark Green Fritillary			Y		Y (T)	Y	**Y**	*Medium*
Silver-washed Fritillary		Y(T)	Y(T)			Y(T)		
Marsh Fritillary	?	Y	Y		Y			*High*
Speckled Wood	Y	Y	Y	Y	Y	Y	**Y**	
Wall		Y			Y(T)	Y	**Y**	*High*
Marbled White	Y	Y	Y	Y	Y	Y	**Y**	
Grayling								
Gatekeeper	Y	Y	Y	Y	Y	Y	**Y**	
Meadow Brown	Y	Y	Y	Y	Y	Y	**Y**	
Small Heath	Y	Y	Y	Y	Y	Y	**Y**	*High*
Ringlet	Y	Y	Y	Y	Y	Y	**Y**	

Y(T): Species recorded only on transect walks

Ova: no butterfly recorded, but eggs found on food plant

Table 5. Ravensgate Casual records 2011. Butterflies recorded at each visit

Day	**6**	**19**	**26**	**1**	**2**	**5**	**5**	**9**	**11**	**16**	**22**	**1**	**3**	**10**	**2**	**3**	**5**	**19**	**2**	**Total**
Month	**4**	**4**	**4**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**6**	**6**	**6**	**7**	**7**	**8**	**8**	**9**	
Length of visit (min)	**20**	*45*	*30*	*30*	*15*	*30*	*60*	*15*	*30*	*10*	*60*	*10*	*60*	*6*	*60*	*50*	*45*	*10*	*60*	
Recorder	**JC**	*TA*	*JC*	*JH*	*JC*	*JH*	*JC*	*JC*	*JC*	*JC*	*JC*	*JC*	*JH*	*PA*	*JH*	*TA*	*JH*	*JC*	*JH*	
Small Skipper															2		8			**10**
Essex Skipper																				**0**
Small/Essex Skipper																				**0**
Large Skipper															2	20	1			**23**
Dingy Skipper					2		2	1	2	1				2						**10**
Grizzled Skipper																				**0**
Clouded Yellow																				**0**
Brimstone	2	4		2		5	7						2				1			**23**
Large White																				**0**
Small White																	5		1	**6**
Green-veined White		3		6		7				1					2	5	6		1	**31**
Orange-tip		1				4	3													**8**
Green Hairstreak		1					1				2									**4**
Purple Hairstreak																				**0**
Small Copper											1									**1**
Small Blue																				**0**
Brown Argus																			3	**3**
Common Blue							4		2	2	4		7				5			**24**
Chalkhill Blue																				**0**
Holly Blue																				**0**
Duke of Burgundy			2	6	4	9	20	8	6	10	12	1	1							**79**
White Admiral																				**0**
Red Admiral								1												**1**
Painted Lady											1									**1**
Small Tortoiseshell	1	1					1								2	3				**8**
Peacock	5	6															2		1	**14**
Comma	2																			**2**
Dark Green Fritillary																1				**1**
Silver-washed Fritillary																				**0**
Marsh Fritillary																				**0**
Speckled Wood	1	2											5		1					**9**
Wall																		1		**1**
Marbled White															37	53	9			**99**
Grayling																				**0**
Gatekeeper																2	14			**16**
Meadow Brown															15	28	24		2	**69**
Small Heath							1	1		1	3		7	6	11	3	5		8	**46**
Ringlet															82	153				**235**
Total	**11**	**18**	**2**	**14**	**6**	**25**	**39**	**11**	**10**	**15**	**23**	**1**	**22**	**8**	**154**	**268**	**80**	**1**	**16**	**724**

Note these are recordings on separate visits so that individual butterflies could be recorded on more than one visit.

Table 6. Ravensgate Casual records 2011. Butterflies recorded in each 'section'

Section	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Total
Small Skipper					3	5					1		1		**10**
Essex Skipper															**0**
Small/Essex Skipper															**0**
Large Skipper	10				4	5	1				1			2	**23**
Dingy Skipper						2			5	3					**10**
Grizzled Skipper															**0**
Clouded Yellow															**0**
Brimstone		2	3		1			1	6	10					**23**
Large White															**0**
Small White						1	2			2	1				**6**
Green-veined White	1		1		2		7		3	14			2	1	**31**
Orange-tip			2			1	1		2	2					**8**
Green Hairstreak			2						1	1					**4**
Purple Hairstreak															**0**
Small Copper	1														**1**
Small Blue															**0**
Brown Argus						3									**3**
Common Blue			4			11			3	6					**24**
Chalkhill Blue															**0**
Holly Blue															**0**
Duke of Burgundy		1				1	1		20	56					**79**
White Admiral															**0**
Red Admiral										1					**1**
Painted Lady	1														**1**
Small Tortoiseshell					2	1	1	1					2	1	**8**
Peacock		3	1		4		1	2	1	2					**14**
Comma								1		1					**2**
Dark Green Fritillary	1														**1**
Silver-washed Fritillary															**0**
Marsh Fritillary															**0**
Speckled Wood						1	1		1	5	1				**9**
Wall	1														**1**
Marbled White	16				18	7	4				13	13	13	15	**99**
Grayling															**0**
Gatekeeper							4			4	2	2	2	2	**16**
Meadow Brown	8				11	3	11			5	13	2	6	10	**69**
Small Heath	10	4	1	1	9	9	1			1	0	3	5	2	**46**
Ringlet	76				32	23	8		9	2	27	21	16	21	**235**
Total	**125**	**10**	**14**	**1**	**86**	**73**	**43**	**5**	**51**	**115**	**59**	**41**	**47**	**54**	**724**

N.B. These are number of observations of butterflies.
An individual butterfly may be recorded on more than one occasion.

These are casual recordings, rather than systematic recordings as on a transect.
Numbers of butterflies recorded in each section depend heavily on recorder activity
ie. how often the sections are monitored

Figure 1. Ravensgate - Number of butterflies recorded each week in 2010 and 2011 and average for 2005 - 2009

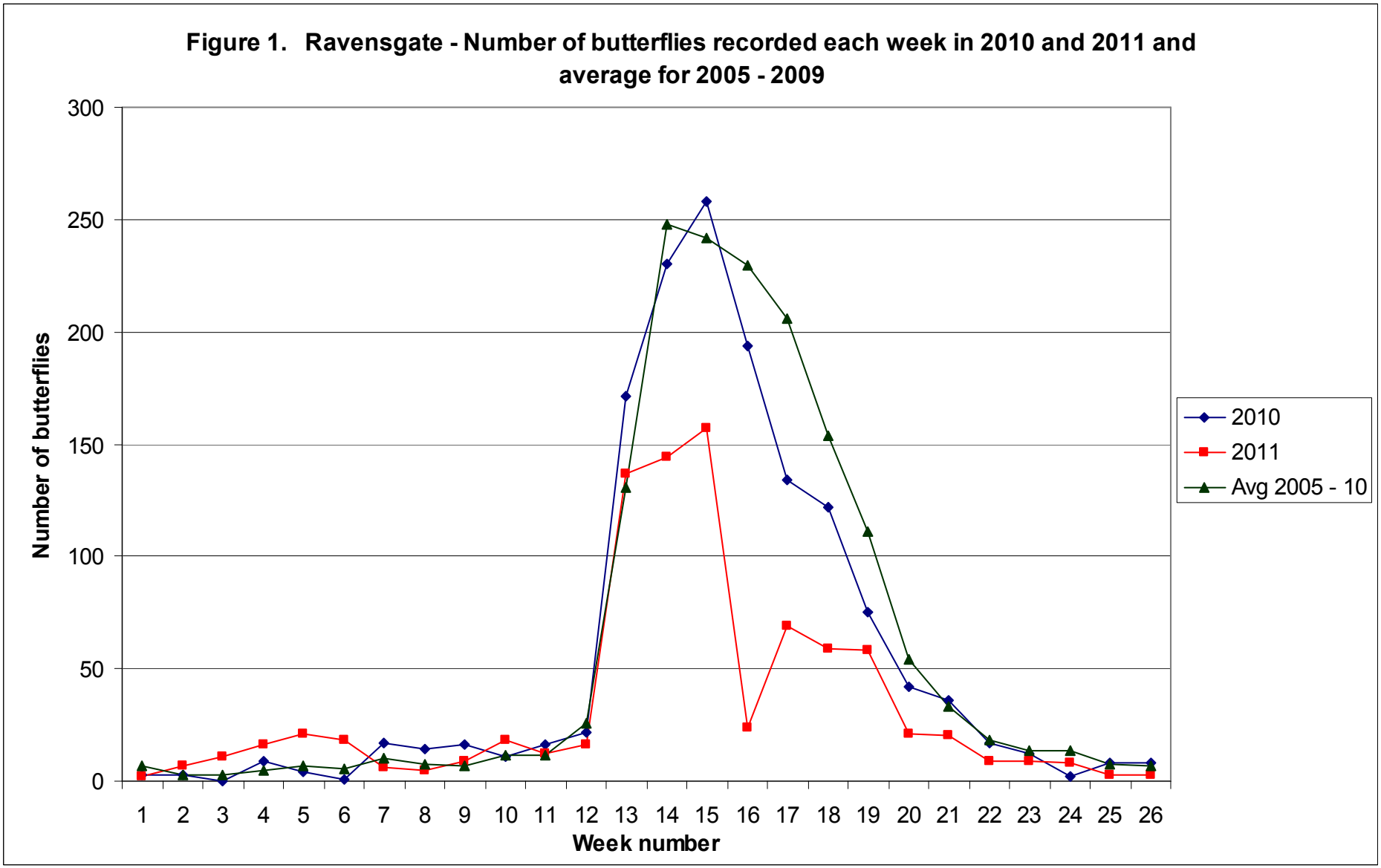
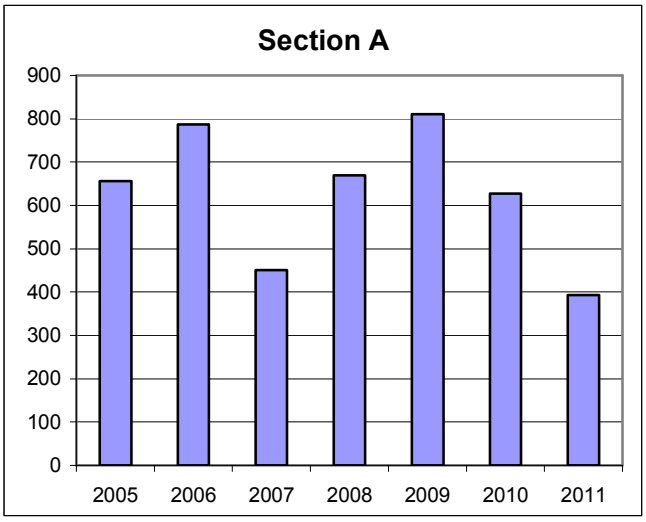
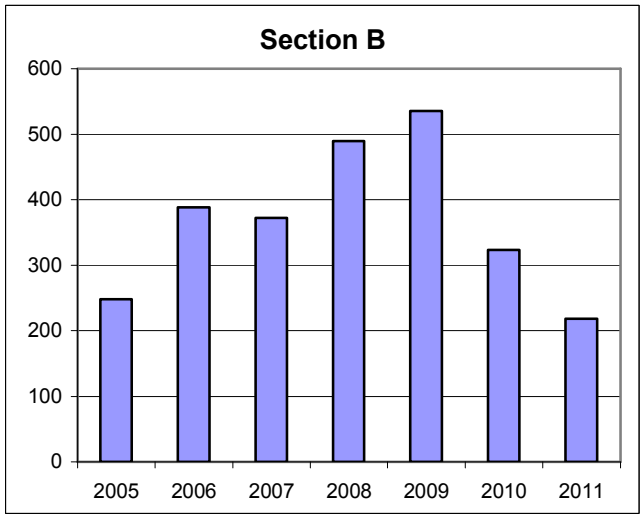
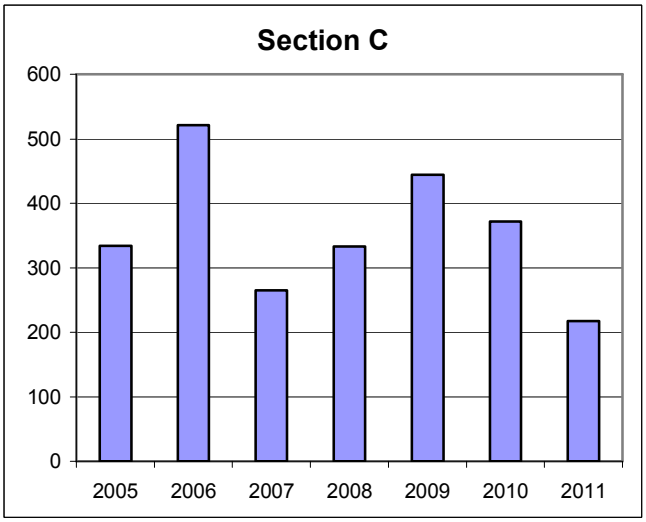
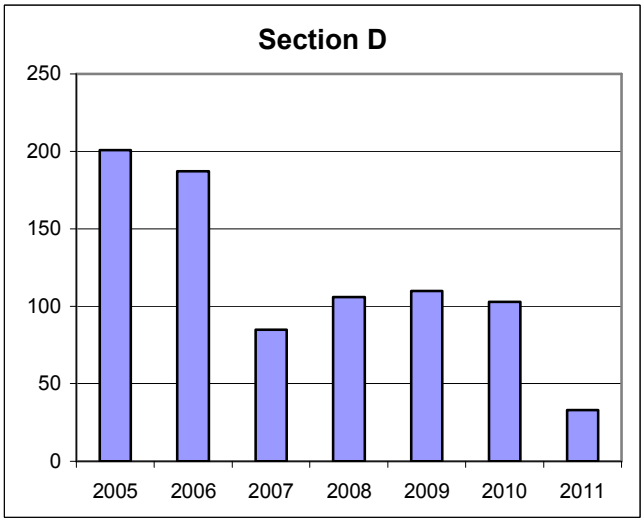


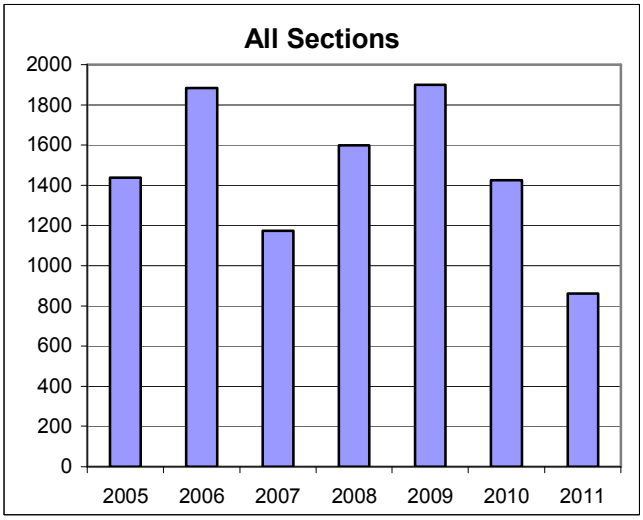
Figure 2. Number of buterflies in each section 2005 - 2011

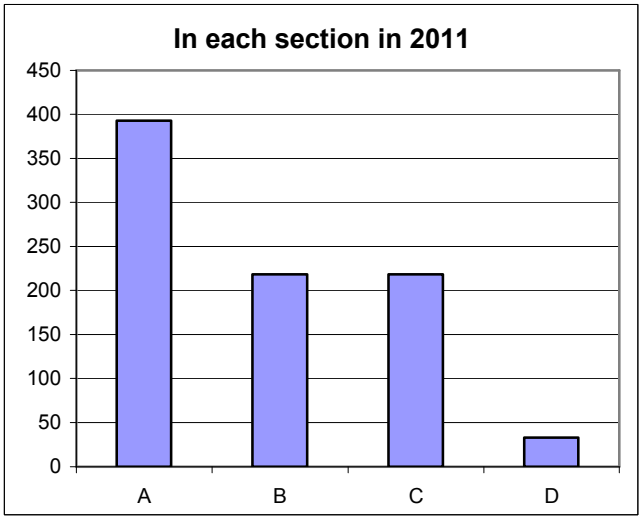






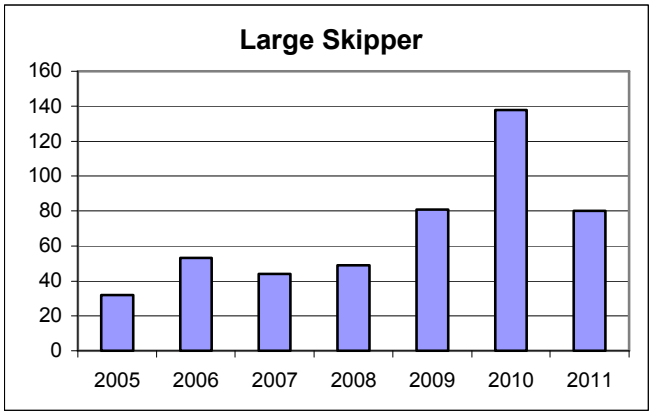


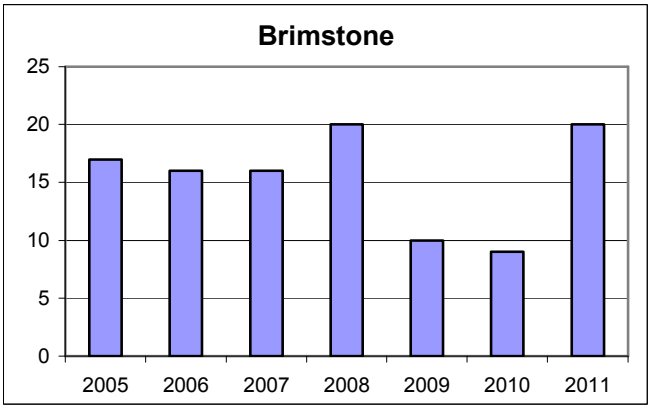


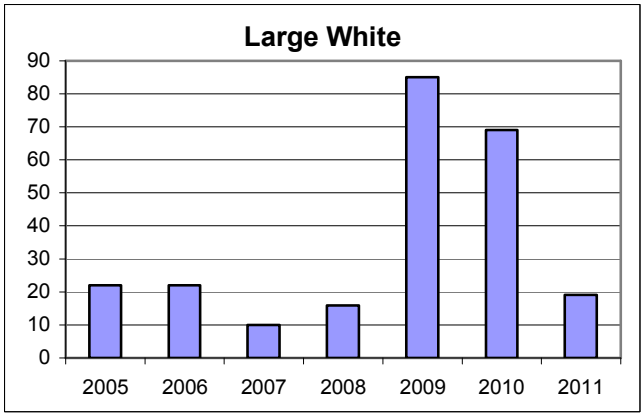


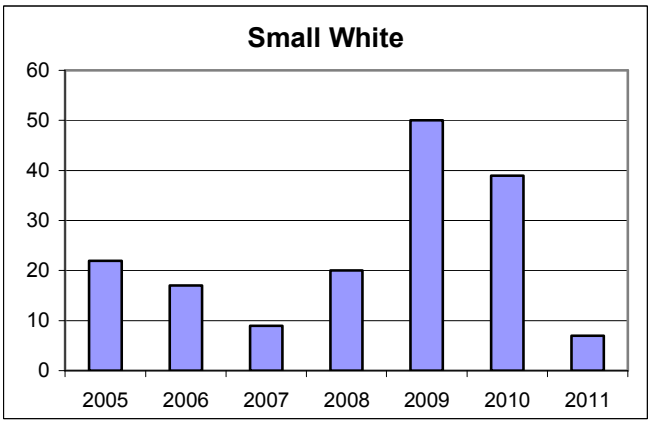
Note that scales for each chart are different.

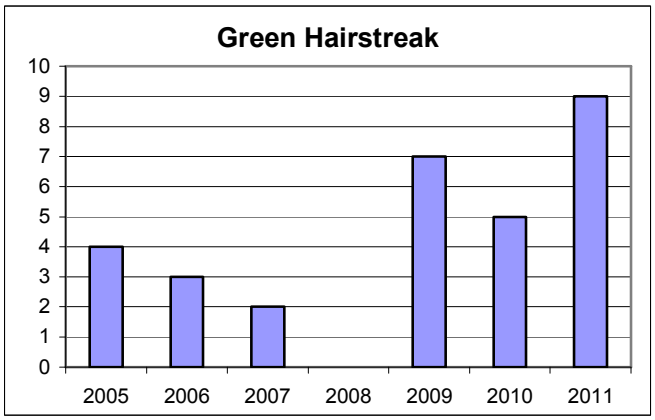
Figure 3. Trends for several species

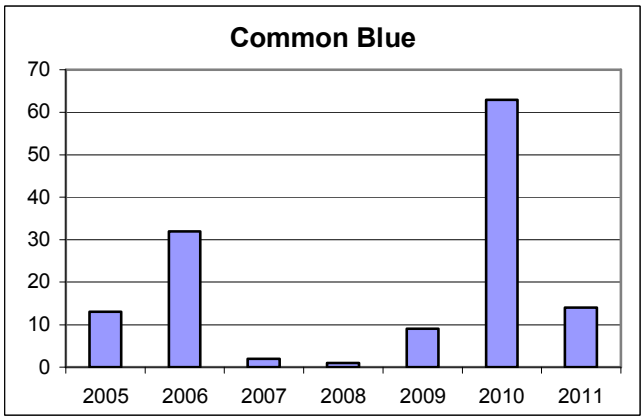


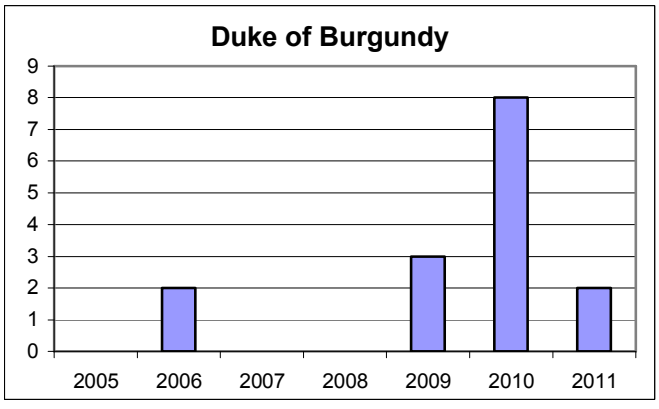


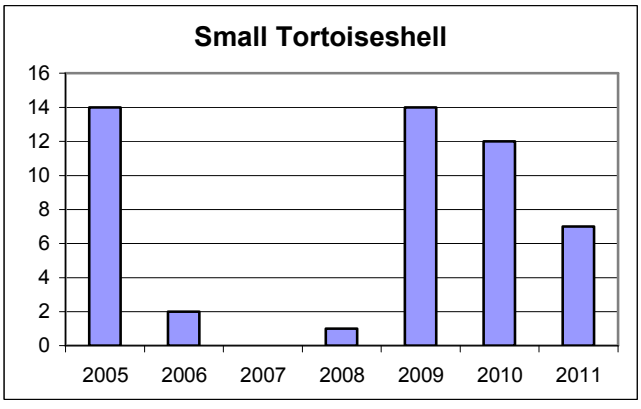






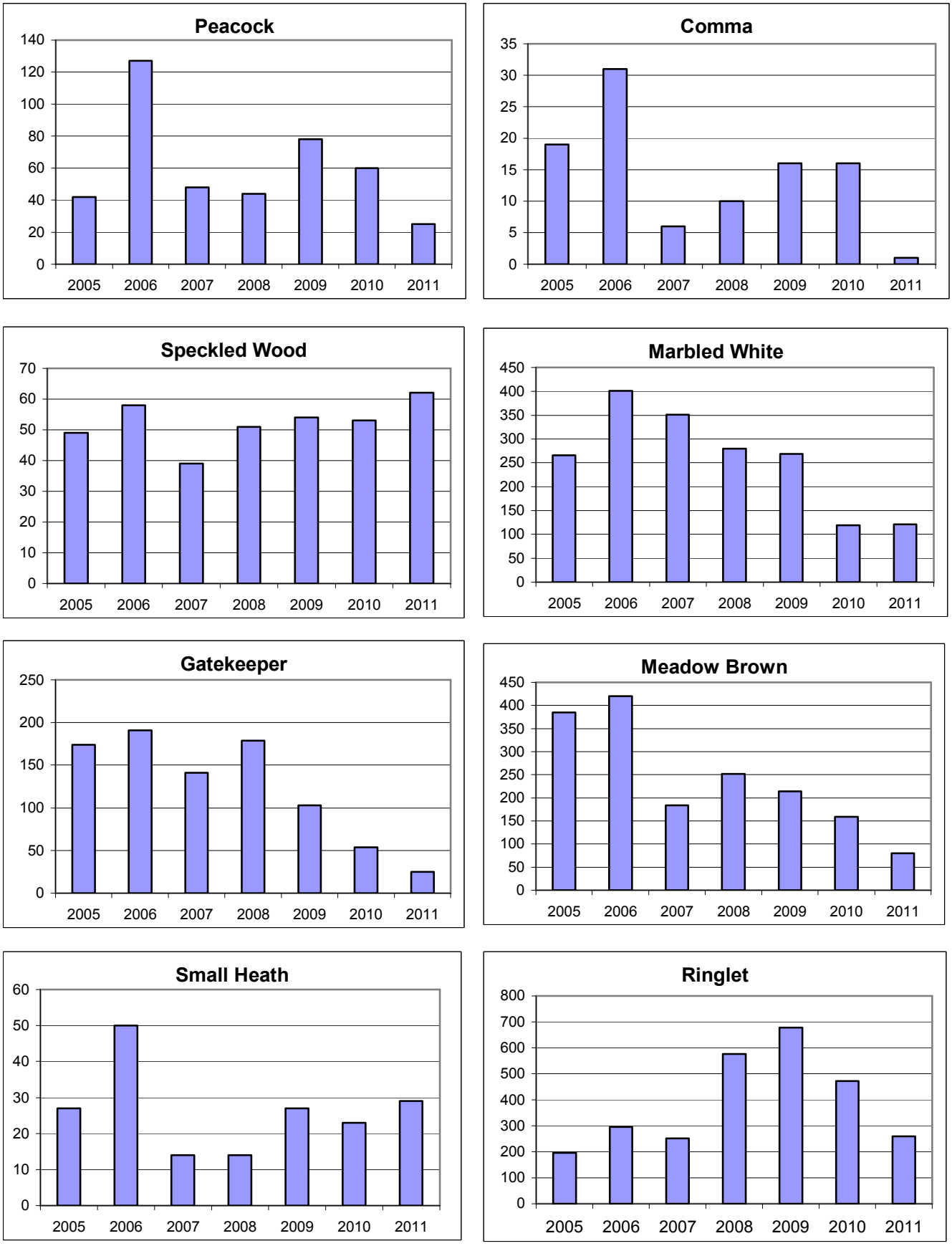






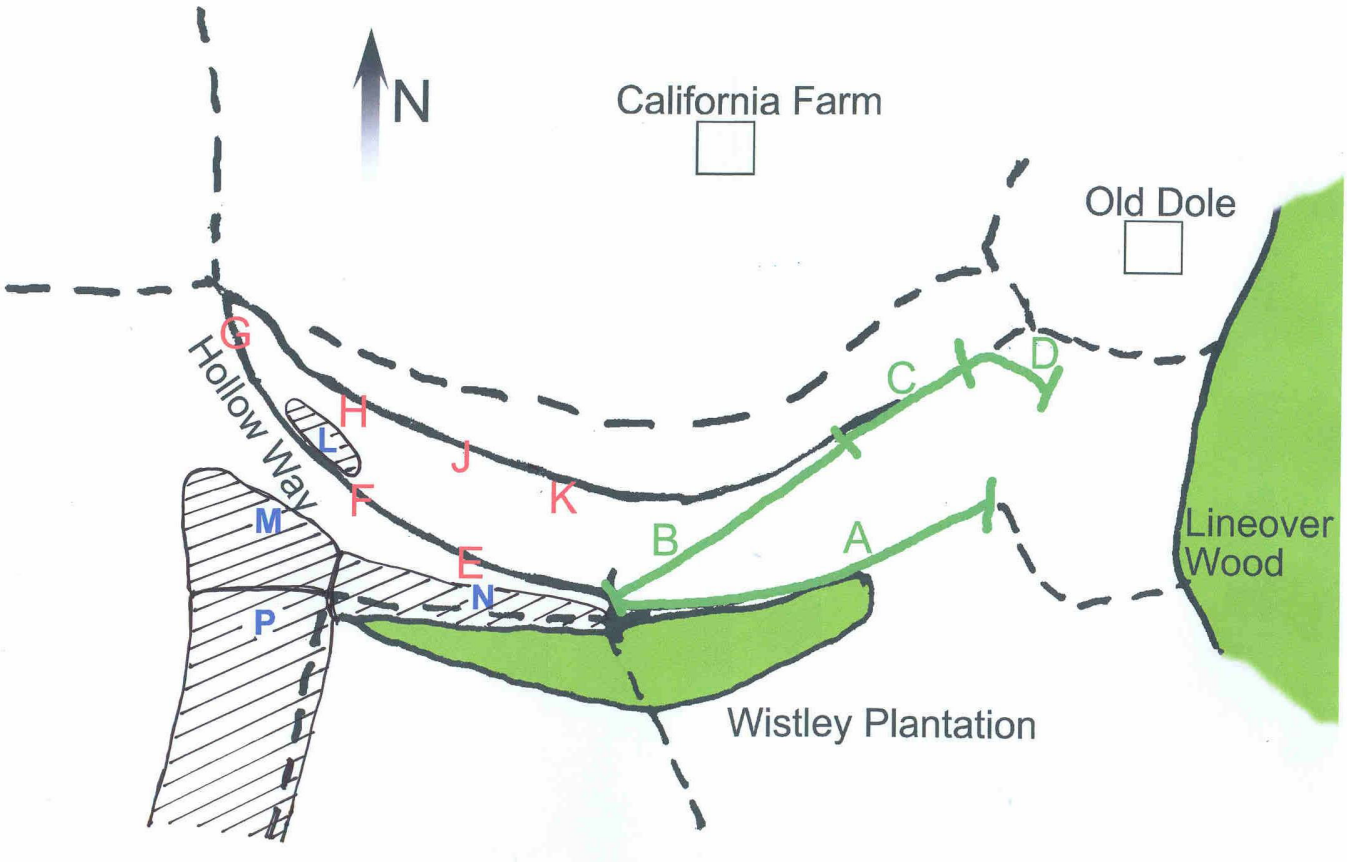
NB. The scales for each chart are not the same!

Figure 3. (Continued) Trends for several species



NB. Scales for each chart are not the same

Figure 4. Map of transect and sections off-transect



Note

Transect route and sections A, B, C, D (in green)

Off-transect 'sections' E, F, G, H, J, K (in red)

Other areas of hill surveyed L, M, N, P (in blue on shaded areas)

Figure 5. Weather records from 2000 to 2011
(Average of observations from Ross-on-Wye and Oxford)