13. UFZ - Workshop

„Populationsbiologie von Tagfaltern und Widderchen“

Leipzig, 3. - 5. März 2011

tagfalter-monitoring

Zur Methodik der phänologischen Auswertung von Monitoringdaten

Norbert Hirneisen

Matthias Kühling

Martin Musche

1. Statement: Pflege der Zählermotivation, Qualitätssicherung & Datenauswertung TMD
2. Grundvereinbarungen TMD
3. Aufbereitung eigener Zähldaten / Jahr-zu-Jahr-Vergleich MK
4. Standortvergleiche NH & MK
5. Passfähigkeit der Darstellungen MM & MK
6. Ausblick NH, MM & MK

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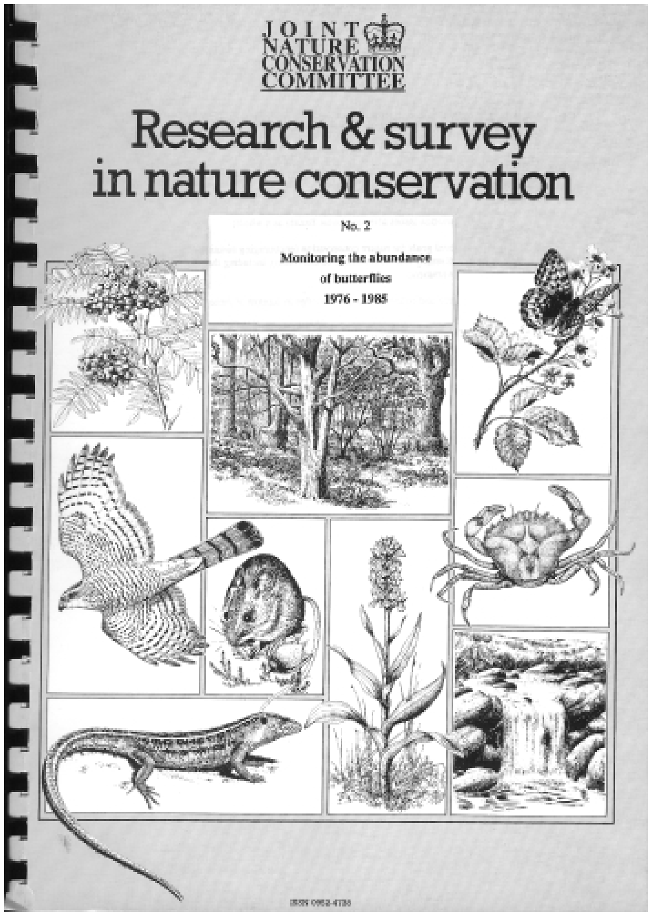
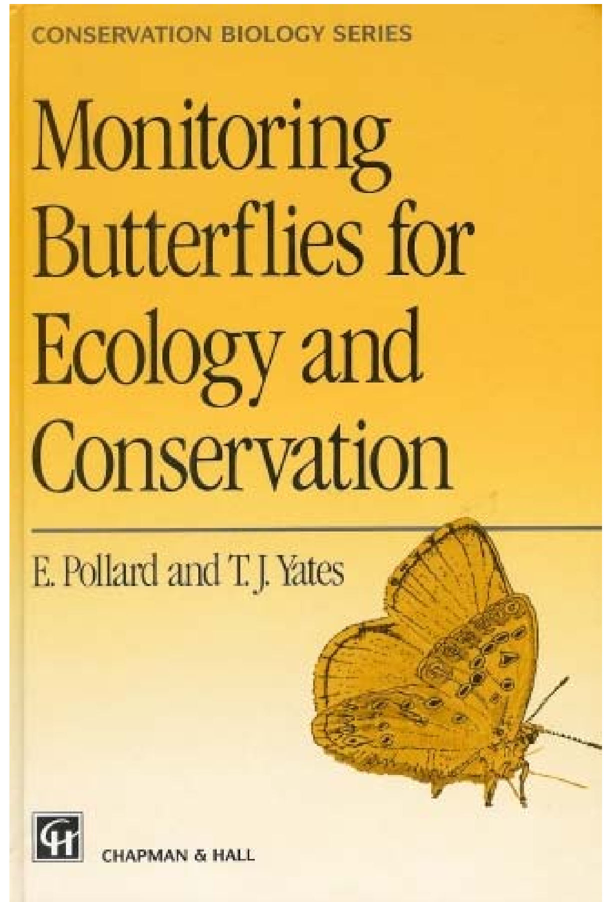


1986

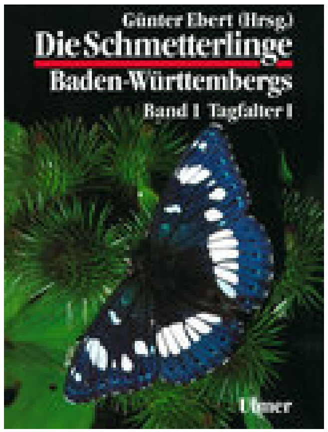


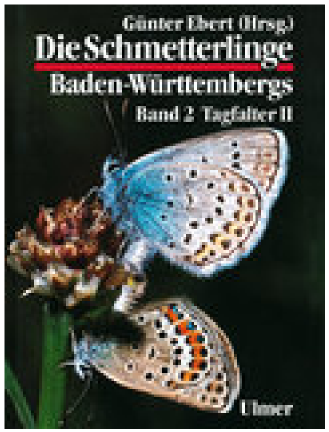
1993

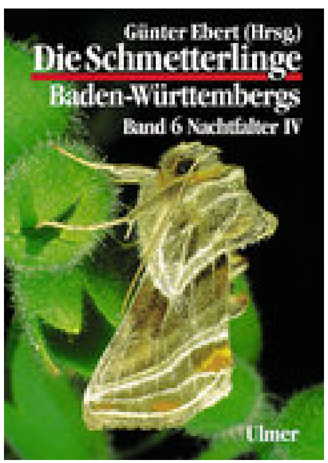
ISBN 0-412-40220-3

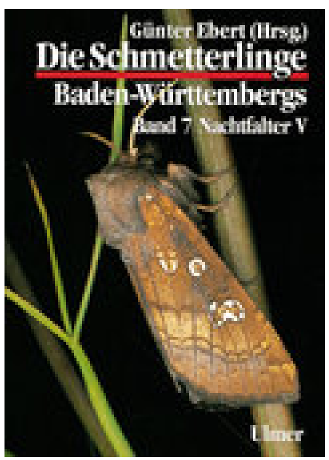
Die Schmetterlinge Baden-Württembergs

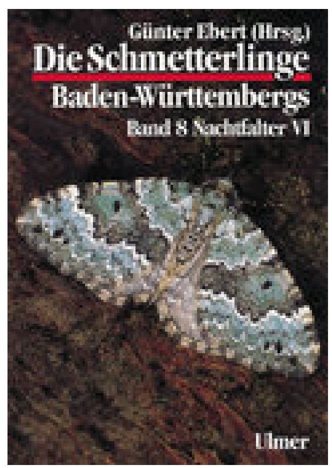
Verlag Eugen Ulmer, Hrsg. Günther Ebert

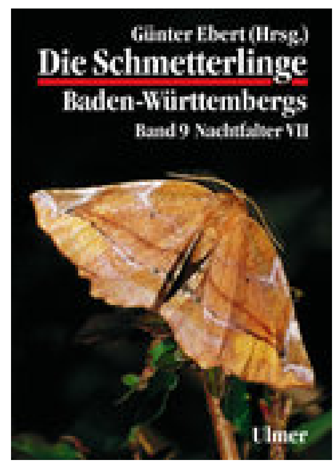




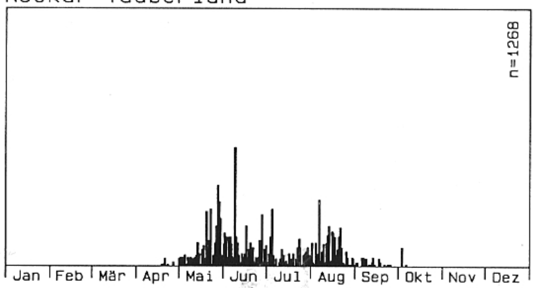




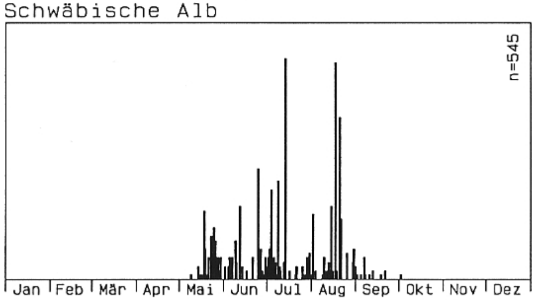




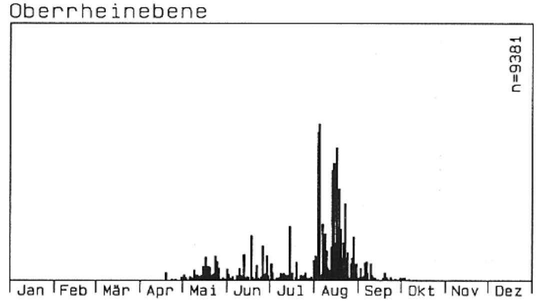
Neckar-Tauberland



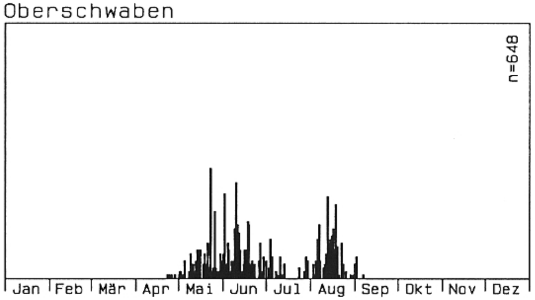
Schwäbische Alb



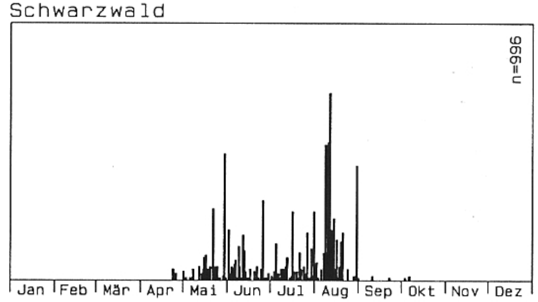
Oberrheinebene



Oberschwaben



Schwarzwald



Kleines Wiesenvögelchen (*Coenonympha pamphilus*)

Laufender Tag des Jahres vs. Phänologischer Tag

vgl. Ebert & Rennwald (1993, S. 42 ff. & 143 ff.)

Phänologisches Jahr = 366 Tage

Phänologischer Tag = einheitliche Festlegung des 1. März als Tag 61

d.h. in Schaltjahren weicht der „laufende Tag“ um den Wert "-1" ab

Phänologie ist die Lehre vom Einfluss der Witterung und des Klimas auf den jahreszeitlichen Entwicklungsgang und die Wachstums- bzw. Aktivitätsphasen der Pflanzen und Tiere.

Laufender Tag des Jahres vs. Phänologischer Tag

Monatsanfang, -mitte, -ende vs. Phänologische Dekade

	Anfang	Mitte	Ende	Anfang	Mitte	Ende
März	01.-10.03.	11.-20.03.	21.-31.03.	10	10	11
April	01.-10.04.	11.-20.04.	21.-30.04.	10	10	10
Mai	01.-10.05.	11.-20.05.	21.-31.05.	10	10	11
Juni	01.-10.06.	11.-20.06.	21.-30.06.	10	10	10
Juli	01.-10.07.	11.-20.07.	21.-31.07.	10	10	11
August	01.-10.08.	11.-20.08.	21.-31.08.	10	10	11
September	01.-10.09.	11.-20.09.	21.-30.09.	10	10	10
Oktober	01.-10.10.	11.-20.10.	21.-31.10.	10	10	11

\+ unkompliziert, vertrautes Denkmuster
\- letzte Dekade des Monats variabel (10/11)

Phänologische Dekade	Phänologische Tage (von-bis)	Datum (von-bis)
7	61-70	01.03.-10.03.
8	71-80	11.03.-20.03.
9	81-90	21.03.-30.03.
10	91-100	31.03.-09.04.
11	101-110	10.04.-19.04.
12	111-120	20.04.-29.04.
13	121-130	30.04.-09.05.
14	131-140	10.05.-19.05.
15	141-150	20.05.-29.05.
16	151-160	30.05.-08.06.
17	161-170	09.06.-18.06.
18	171-180	19.06.-28.06.
19	181-190	29.06.-08.07.
20	191-200	09.07.-18.07.
21	201-210	19.07.-28.07.
22	211-220	29.07.-07.08.
23	221-230	08.08.-17.08.
24	231-240	18.08.-27.08.
25	241-250	28.08.-06.09.
26	251-260	07.09.-16.09.
27	261-270	17.09.-26.09.
28	271-280	27.09.-06.10.
29	281-290	07.10.-16.10.
30	291-300	17.10.-26.10.

März	A	
	M	
	E	1 Tag Fehler
April	A	
	M	
	E	1 Tag Fehler
Mai	A	
	M	
	E	2 Tage Fehler
Juni	A	
	M	
	E	2 Tage Fehler
Juli	A	
	M	
	E	3 Tage Fehler
August	A	
	M	
	E	4 Tage Fehler
September	A	
	M	
	E	4 Tage Fehler
Oktober	A	
	M	
	E	5 Tage Fehler

\- kompliziert, ungewohntes Denkmuster
\+ numerisch korrekt

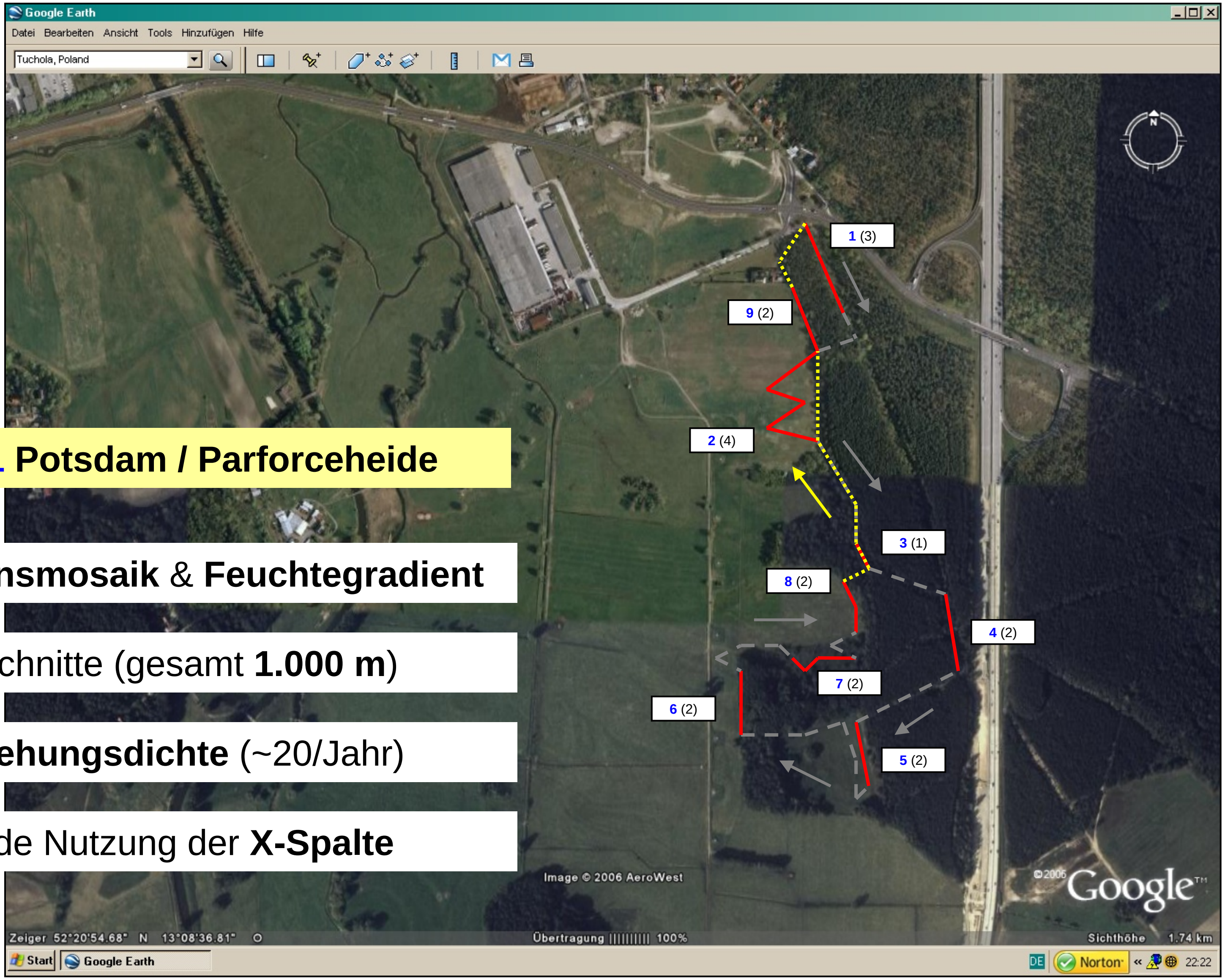
BB 3644-1 Potsdam / Parforceheide

Vegetationsmosaik & **Feuchtegradient**

20 Teilabschnitte (gesamt **1.000 m**)

Hohe **Begehungsdichte** (~20/Jahr)

Umfassende Nutzung der **X-Spalte**



BB-3644-1

Potsdam Parforceheide

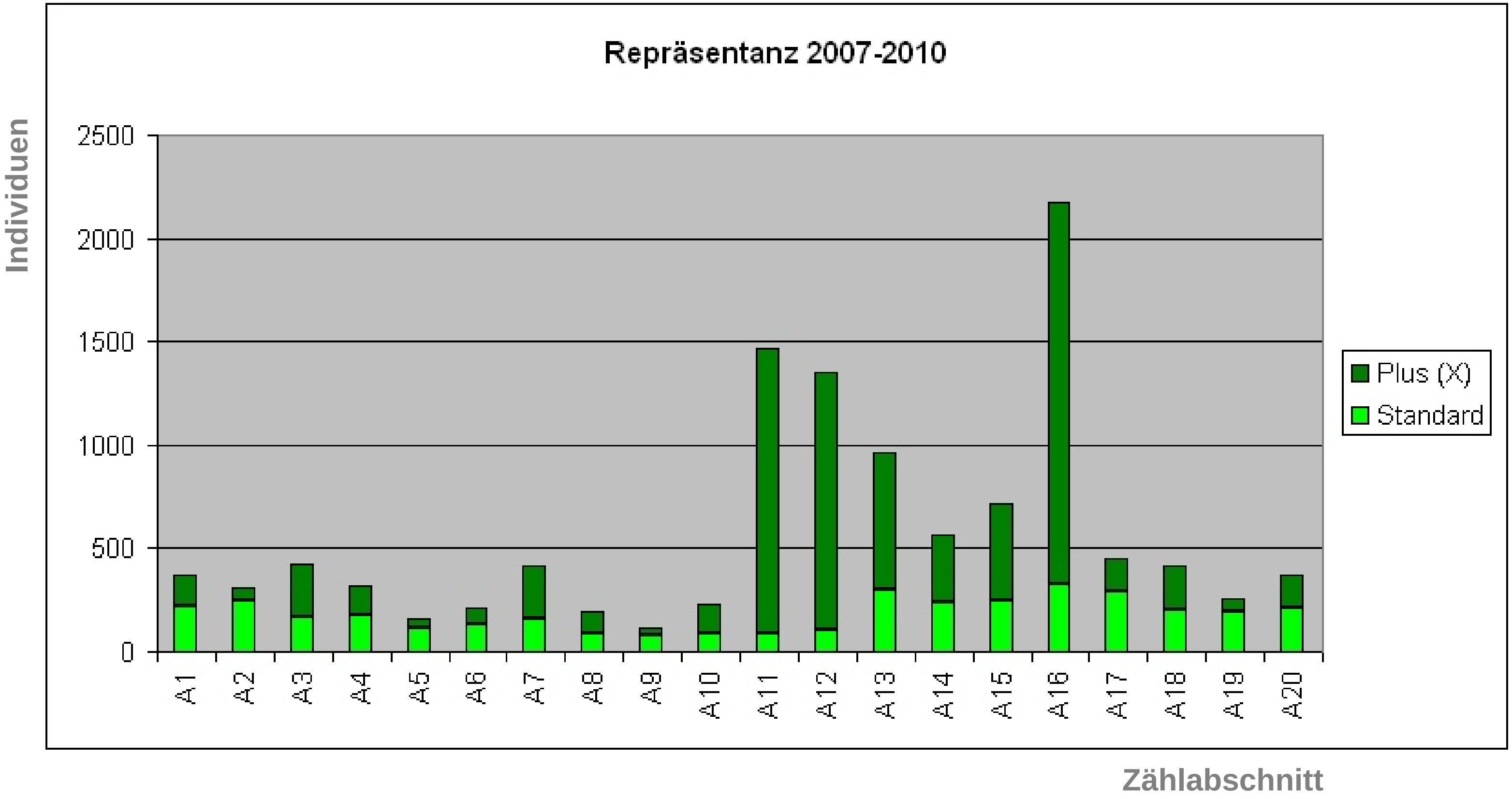
Taxon	Kumulativ	2006	2007	2008	2009	2010
Carcharodus alceae	1	0	0	0	1	0
Carterocephalus palaemon	1	0	0	1	0	0
Thymelicus lineola	1	1	1	1	1	1
Thymelicus sylvestris	1	0	1	1	1	1
Ochlodes sylvanus	1	1	1	1	1	1
Papilio machaon	1	1	1	1	0	0
Leptidea cf. sinapis	1	0	1	1	1	1
Anthocharis cardamines	1	1	1	1	1	1
Aporia crataegi	1	0	1	1	1	1
Pieris brassicae	1	1	1	1	1	1
Pieris rapae	1	1	1	1	1	1
Pieris napi	1	1	1	1	1	1
Pontia cf. edusa	1	1	1	1	1	1
Colias hyale	1	1	1	1	1	1
Gonepteryx rhamni	1	1	1	1	1	1
Lycaena phlaeas	1	1	1	1	1	1
Lycaena tityrus	1	1	1	1	1	1
Neozephyrus quercus	1	1	0	1	1	1
Strymonidia w-album	1	0	0	0	1	0
Celastrina argiolus	1	1	1	1	1	1
Aricia agestis	1	1	1	1	1	1
Polyommatus amandus	1	0	1	0	0	0
Polyommatus icarus	1	1	1	1	1	1
Argynnis paphia	1	0	0	0	1	1
Issoria lathonia	1	1	1	1	1	1
Brenthis ino	1	1	1	1	1	0
Boloria dia	1	1	1	1	1	1
Vanessa atalanta	1	1	1	1	1	1
Vanessa cardui	1	1	1	1	1	1
Nymphalis io	1	1	1	1	1	1
Nymphalis urticae	1	1	1	1	1	1
Polygonia c-album	1	1	1	1	1	1
Araschnia levana	1	1	1	1	1	1
Nymphalis antiopa	1	0	0	1	1	1
Melitaea cinxia	1	0	1	0	1	1
Melitaea athalia	1	1	1	1	1	1
Pararge aegeria	1	1	1	1	1	1
Coenonympha arcania	1	1	1	1	1	1
Coenonympha pamphilus	1	1	1	1	1	1
Aphantopus hyperantus	1	1	1	1	1	1
Maniola jurtina	1	1	1	1	1	1
Melanargia galathea	1	1	1	1	1	1
Artenzahl	42	32	36	37	39	36

Taxon	Kumulativ	2006	2007	2008	2009	2010
Carcharodus alceae	1	0	0	0	1	0
Carterocephalus palaemon	1	0	0	1	0	0
Thymelicus lineola	562	42	140	28	87	265
Thymelicus sylvestris	99	0	48	20	9	22
Ochlodes sylvanus	310	49	97	81	52	31
Papilio machaon	6	1	3	2	0	0
Leptidea cf. sinapis	25	0	11	4	4	6
Anthocharis cardamines	116	3	41	44	20	8
Aporia crataegi	16	0	2	2	2	10
Pieris brassicae	123	29	31	15	43	5
Pieris rapae	3.745	337	998	352	1.275	783
Pieris napi	0	s.o.	s.o.	s.o.	s.o.	s.o.
Pontia cf. edusa	121	9	39	4	40	29
Colias hyale	38	12	13	1	5	7
Gonepteryx rhamni	238	26	60	53	50	49
Lycaena phlaeas	363	27	116	26	154	40
Lycaena tityrus	293	22	142	36	73	20
Neozephyrus quercus	156	1	0	53	8	94
Strymonidia w-album	1	0	0	0	1	0
Celastrina argiolus	195	27	51	44	43	30
Aricia agestis	75	3	26	6	19	21
Polyommatus amandus	2	0	2	0	0	0
Polyommatus icarus	89	30	28	8	10	13
Argynnis paphia	5	0	0	0	4	1
Issoria lathonia	399	11	23	29	206	130
Brenthis ino	26	7	9	9	1	0
Boloria dia	72	8	13	8	37	6
Vanessa atalanta	70	10	22	2	8	28
Vanessa cardui	408	3	8	3	381	13
Nymphalis io	906	74	130	62	268	372
Nymphalis urticae	38	10	12	5	1	10
Polygonia c-album	93	10	14	8	8	53
Araschnia levana	178	33	89	13	17	26
Nymphalis antiopa	2	0	0	0	1	1
Melitaea cinxia	3	0	1	0	1	1
Melitaea athalia	408	193	86	64	27	38
Pararge aegeria	59	5	28	11	12	3
Coenonympha arcania	326	36	44	95	86	65
Coenonympha pamphilus	773	71	339	116	114	133
Aphantopus hyperantus	689	109	83	114	119	264
Maniola jurtina	1.807	180	618	262	389	358
Melanargia galathea	153	18	60	22	13	40
Individuenzahl	12.990	1.396	3.427	1.603	3.589	2.975

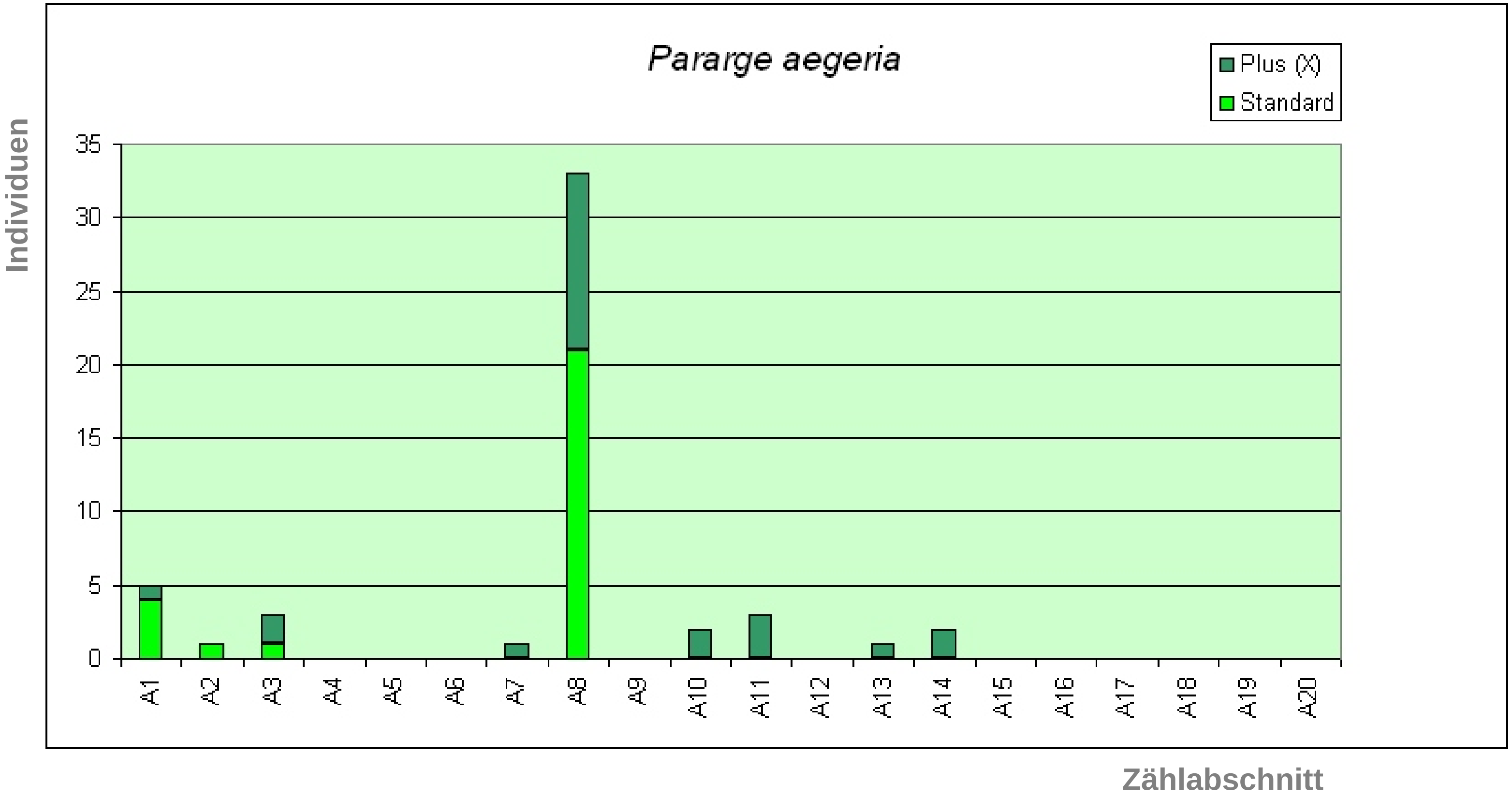
109 Begehungen

42 Arten

12.990 Individuen



Repräsentanz 2007-2010
Individuen
2500
2000
1500
1000
500
0
A1
A2
A3
A4
A5
A6
A7
A8
A9
A10
A11
A12
A13
A14
A15
A16
A17
A18
A19
A20
Plus (X)
Standard
Zählabschnitt


Pararge aegeria
Plus (X)
Standard
Individuen
0
5
10
15
20
25
30
35
A1
A2
A3
A4
A5
A6
A7
A8
A9
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A14
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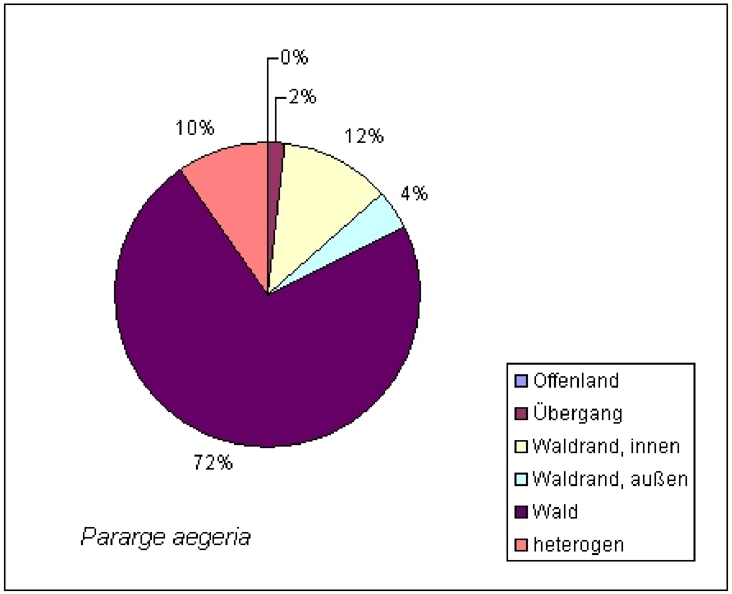
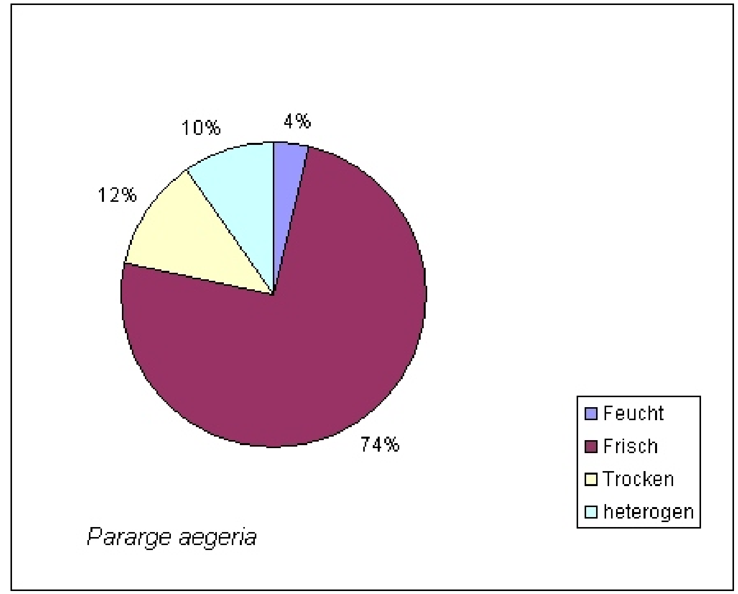
A16
A17
A18
A19
A20
Zählabschnitt


0%
2%
12%
4%
10%
72%
Offenland
Übergang
Waldrand, innen
Waldrand, außen
Wald
heterogen
Pararge aegeria

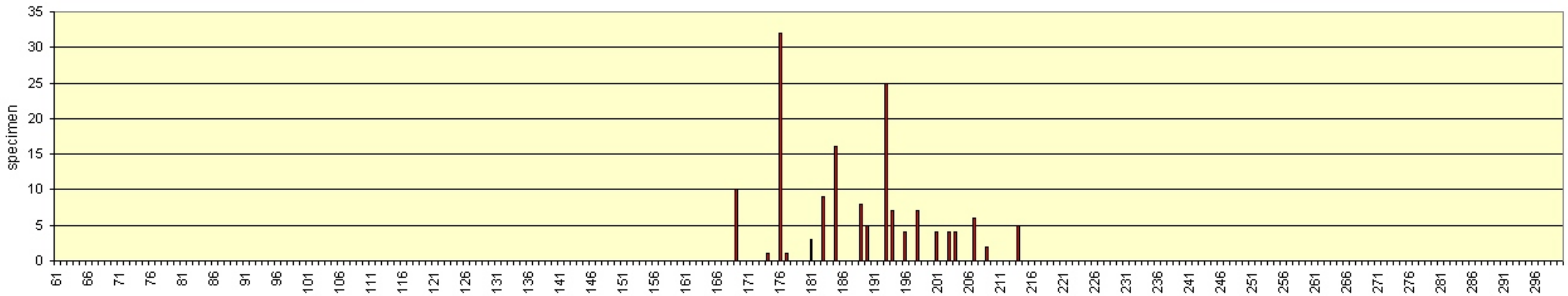

4%
10%
12%
74%
Feucht
Frisch
Trocken
heterogen
Pararge aegeria

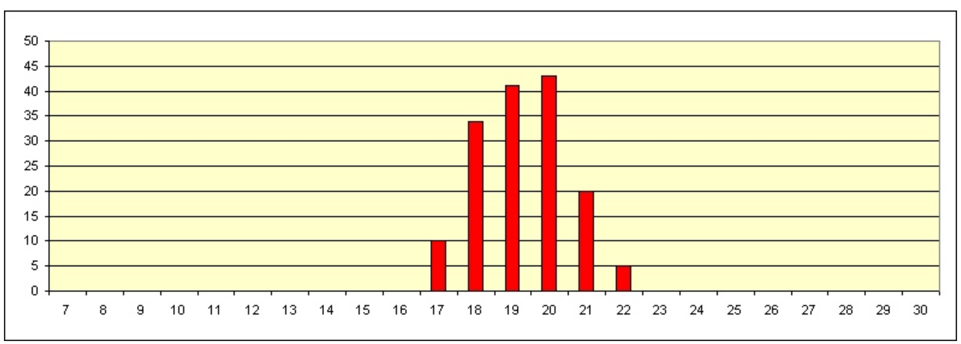
Taxon / Datum	18.04.2010	25.04.2010	17.05.2010	29.05.2010	04.06.2010	11.06.2010	17.06.2010	27.06.2010	03.07.2010	11.07.2010	19.07.2010	25.07.2010	01.08.2010	09.08.2010	20.08.2010	31.08.2010	11.09.2010	23.09.2010	06.10.2010		absolut	relativ
Pieris rapae / napi	11	38	45	11	3	6	6	19	50	169	94	88	40	51	70	42	25	12	3	-	783	26,32%
Nymphalis io	18	19	6	7	5	1	-	L	L	2	87	104	92	19	-	-	2	4	6	-	372	12,50%
Maniola jurtina	-	-	-	-	-	-	-	3	4	119	71	79	46	28	8	-	-	-	-	-	358	12,03%
Thymelicus lineola	-	-	-	-	-	-	-	-	13	218	30	4	-	-	-	-	-	-	-	-	265	8,91%
Aphantopus hyperantus	-	-	-	-	-	-	-	-	2	127	73	39	12	11	-	-	-	-	-	-	264	8,87%
Coenonympha pamphilus	-	-	-	6	4	9	11	15	13	3	2	4	9	17	21	2	13	4	-	-	133	4,47%
Issoria lathonia	-	2	-	-	-	-	1	4	-	1	-	12	67	9	20	5	6	3	-	-	130	4,37%
Neozephyrus quercus	-	-	-	-	-	-	-	-	3	64	16	10	1	-	-	-	-	-	-	-	94	3,16%
Coenonympha arcania	-	-	-	-	-	1	10	22	21	10	1	-	-	-	-	-	-	-	-	-	65	2,18%
Polygonia c-album	1	-	1	-	-	-	-	3	2	2	7	19	4	3	3	-	3	2	3	-	53	1,78%
Gonepteryx rhamni	5	6	3	9	1	-	2	-	2	3	3	-	9	3	1	-	-	2	-	-	49	1,65%
Melanargia galathea	-	-	-	-	-	-	-	-	2	25	4	6	3	-	-	-	-	-	-	-	40	1,34%
Lycaena phlaeas	-	-	1	2	1	-	-	-	-	-	2	1	3	2	4	8	5	6	5	-	40	1,34%
Melitaea athalia	-	-	-	-	-	-	-	2	8	23	4	1	-	-	-	-	-	-	-	-	38	1,28%
Ochlodes sylvanus	-	-	-	-	-	-	3	10	10	4	4	-	-	-	-	-	-	-	-	-	31	1,04%
Celastrina argiolus	1	3	-	-	1	-	1	-	4	8	6	2	3	1	-	-	-	-	-	-	30	1,01%
Pontia edusa / daplidice	-	-	-	-	-	-	-	1	-	-	1	1	1	1	7	3	12	2	-	-	29	0,97%
Vanessa atalanta	-	-	-	-	-	-	-	-	-	-	1	2	3	1	1	2	-	2	16	-	28	0,94%
Araschnia levana	-	-	2	3	-	-	-	-	-	10	6	5	-	-	-	-	-	-	-	-	26	0,87%
Thymelicus sylvestris	-	-	-	-	-	-	-	7	14	1	-	-	-	-	-	-	-	-	-	-	22	0,74%
Aricia agestis	-	-	-	-	2	-	1	-	-	-	-	3	5	4	-	-	3	3	-	-	21	0,71%
Lycaena tityrus	-	-	1	1	2	-	-	-	-	-	3	4	3	5	1	-	-	-	-	-	20	0,67%
Polyommatus icarus	-	-	-	-	-	-	-	-	-	-	-	-	10	-	3	-	-	-	-	-	13	0,44%
Vanessa cardui	-	-	-	-	-	-	-	-	-	-	-	3	6	2	1	-	-	-	1	-	13	0,44%
Aporia crataegi	-	-	-	-	2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	10	0,34%
Nymphalis urticae	1	-	-	-	-	-	-	2	-	-	-	1	6	-	-	-	-	-	-	-	10	0,34%
Anthocharis cardamines	-	4	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8	0,27%
Colias hyale	-	-	-	-	-	-	-	-	-	-	1	2	3	-	-	-	-	1	-	-	7	0,24%
Leptidea reali / sinapis	-	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	0,20%
Boloria dia	-	-	2	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-	-	6	0,20%
Pieris brassicae	-	-	-	-	-	-	-	-	-	-	1	3	-	-	-	1	-	-	-	-	5	0,17%
Pararge aegeria	-	-	1	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	3	0,10%
Nymphalis antiopa	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0,03%
Melitaea cinxia	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0,03%
Argynnis paphia	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1	0,03%
Phänologischer Tag	109	116	138	150	156	163	169	179	185	193	201	207	214	222	233	244	255	267	280			
	38	78	66	39	21	20	39	94	148	789	417	393	327	159	140	63	69	41	34		**2.975**	**Prüfsumme**

	A	CX	CY	CZ	DA	DB	DC	DD	DE	DF	DG	DH	DI	DJ	DK	DL	DM	DN	DO	DP	DQ	DR	DS	DT	DU	DV	DW	DX	DY	DZ	EA	EB
1		09.06.	10.06.	11.06.	12.06.	13.06.	14.06.	15.06.	16.06.	17.06.	18.06.	19.06.	20.06.	21.06.	22.06.	23.06.	24.06.	25.06.	26.06.	27.06.	28.06.	29.06.	30.06.	01.07.	02.07.	03.07.	04.07.	05.07.	06.07.	07.07.	08.07.	09.07.
2																								Juli								
3		161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191
4	2006	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	3	0	0	0	0	0	8	0	0
5	2007	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	31	0	0	0	0	0	0	6	0	0	0	0	0	0	5	0
6	2008	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	3	0	0	0	11	0	0	0	0	0	0
7	2009	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0
8	2010	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
9	2011	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	2012	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	2013	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	2014	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	2015	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	2016	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	2017	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	2020	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	2021	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	2022	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	2023	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	2024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	2025	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24		0	0	0	0	0	0	0	0	10	0	0	0	0	1	0	32	1	0	0	0	3	0	9	0	16	0	0	0	8	5	0

	A	EC	ED	EE	EF	EG	EH	EI	EJ	EK	EL	EM	EN	EO	EP	EQ	ER	ES	ET	EU	EV	EW	EX	EY	EZ	FA	FB	FC	FD	FE	FF	FG
1		10.07.	11.07.	12.07.	13.07.	14.07.	15.07.	16.07.	17.07.	18.07.	19.07.	20.07.	21.07.	22.07.	23.07.	24.07.	25.07.	26.07.	27.07.	28.07.	29.07.	30.07.	31.07.	01.08.	02.08.	03.08.	04.08.	05.08.	06.08.	07.08.	08.08.	09.08.
2																								August								
3		192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222
4	2006	0	0	2	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	2007	0	0	0	0	4	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	2008	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
7	2009	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
8	2010	0	25	0	0	0	0	0	0	0	4	0	0	0	0	0	6	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0
9	2011	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	2012	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	2013	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	2014	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	2015	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	2016	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	2017	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	2020	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	2021	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	2022	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	2023	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	2024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	2025	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24		0	25	7	0	4	0	7	0	0	4	0	4	4	0	0	6	0	2	0	0	0	0	5	0	0	0	0	0	0	0	0

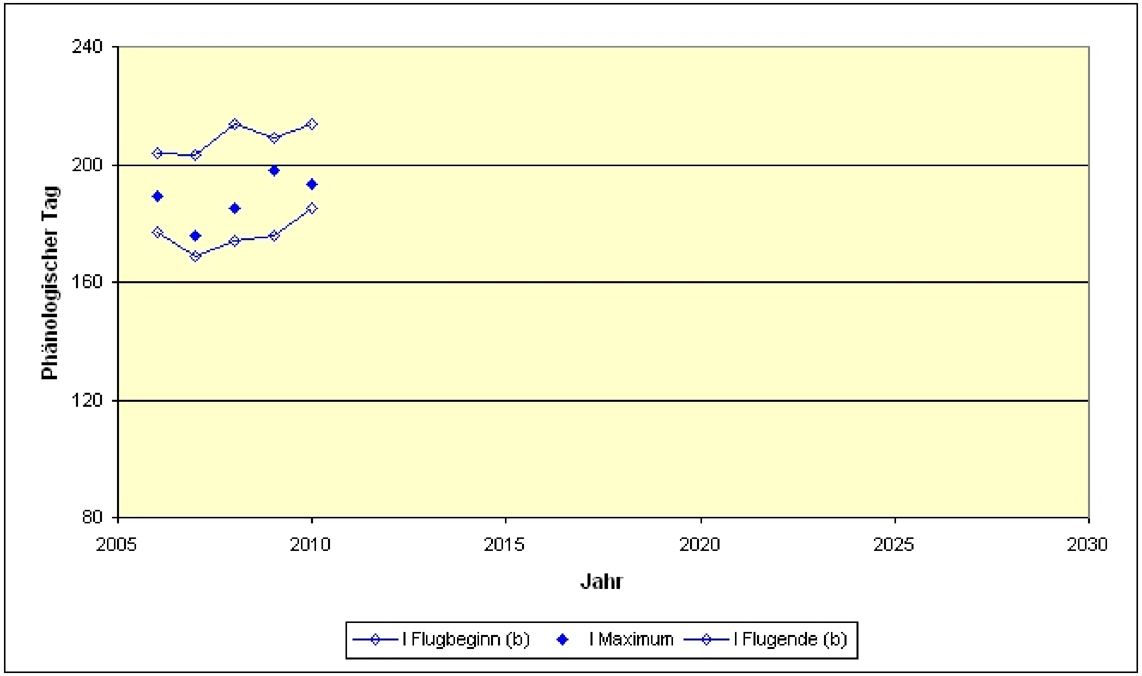
Schachbrett (*Melanargia galathea*)

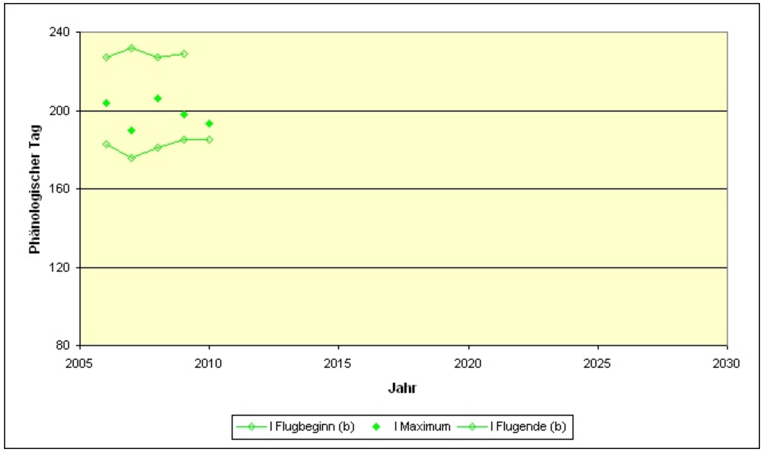




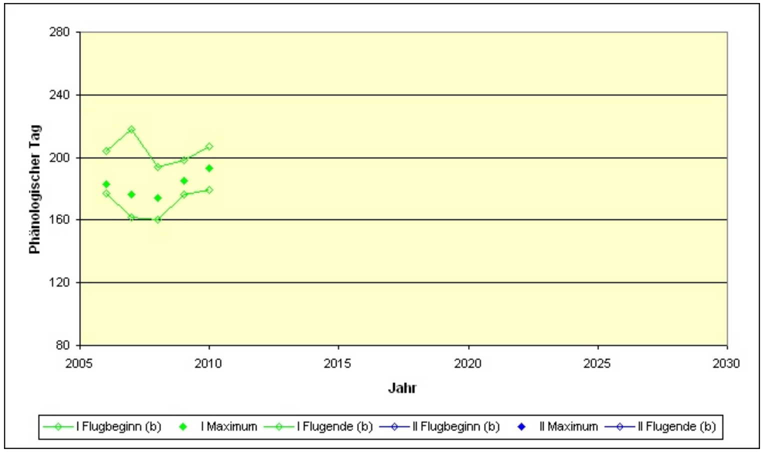
1. Generation	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
extrapoliert																				
Flugbeginn	177	169	174	176	185															
Maximum	189	176	185	198	193															
Flugende	204	203	214	209	214															
extrapoliert																				
Flugdauer	27	34	40	33	29															
korrigiert																				

Schachbrett (*Melanargia galathea*)

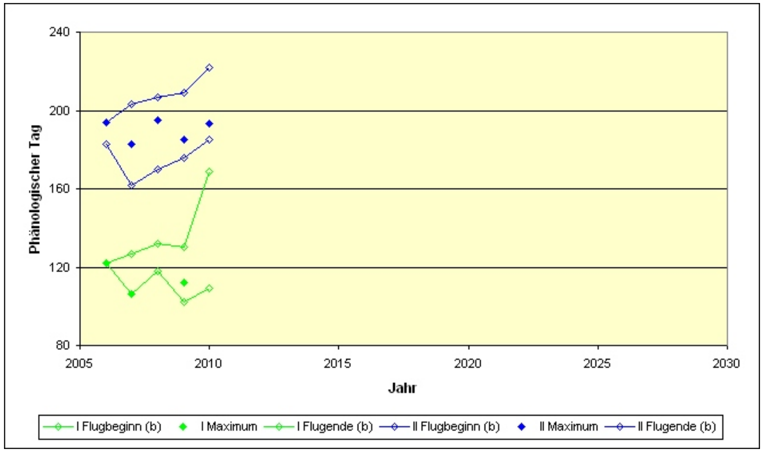




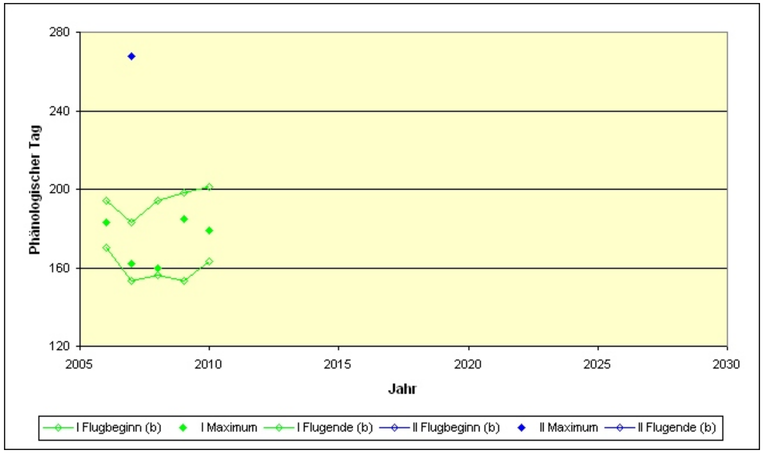
Schornsteinfeger
(*Aphantopus hyperantus*)



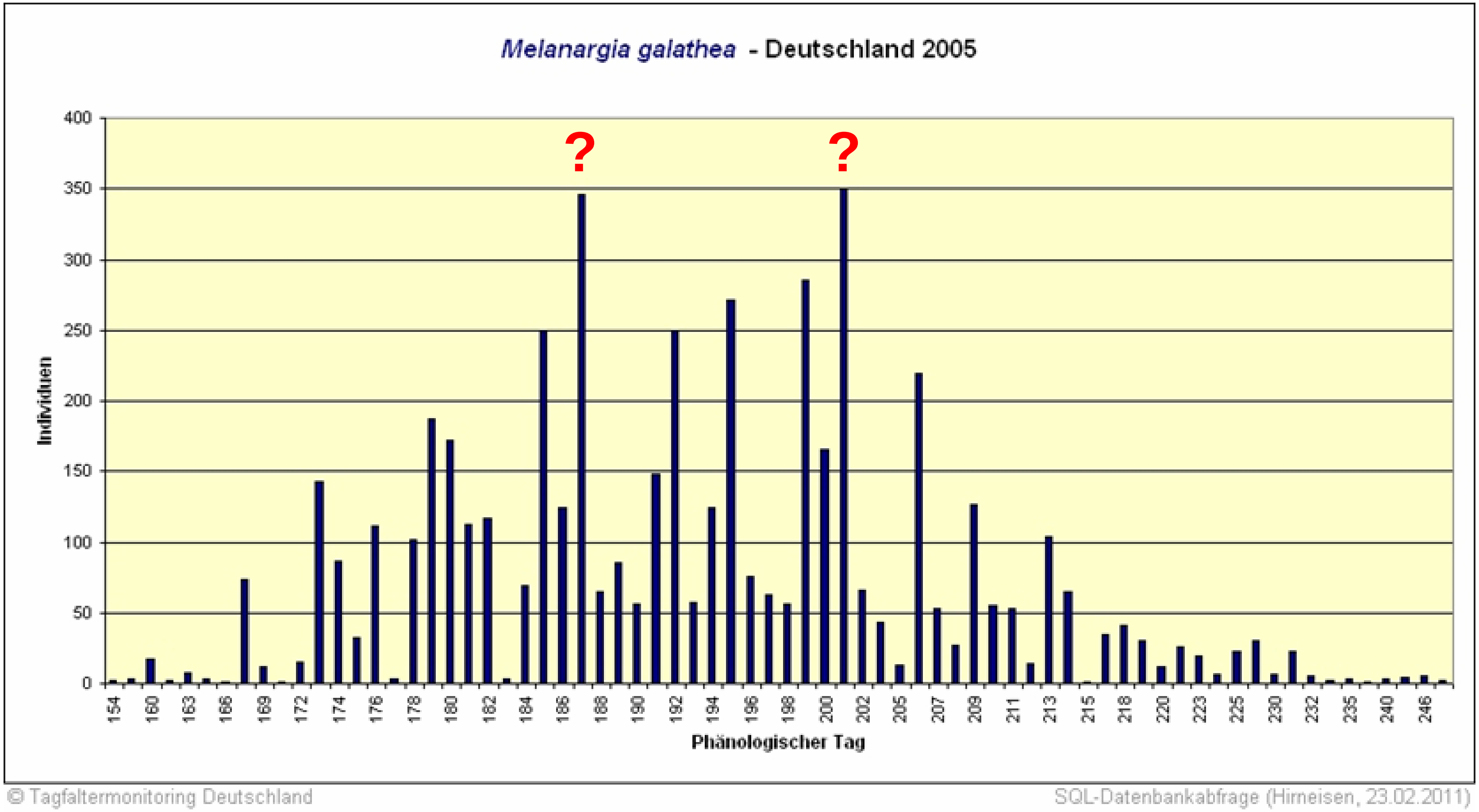
Wachtelweizen-Scheckenfalter
(*Melitaea athalia*)



Faulbaum-Bläuling
(*Celastrina argiolus*)



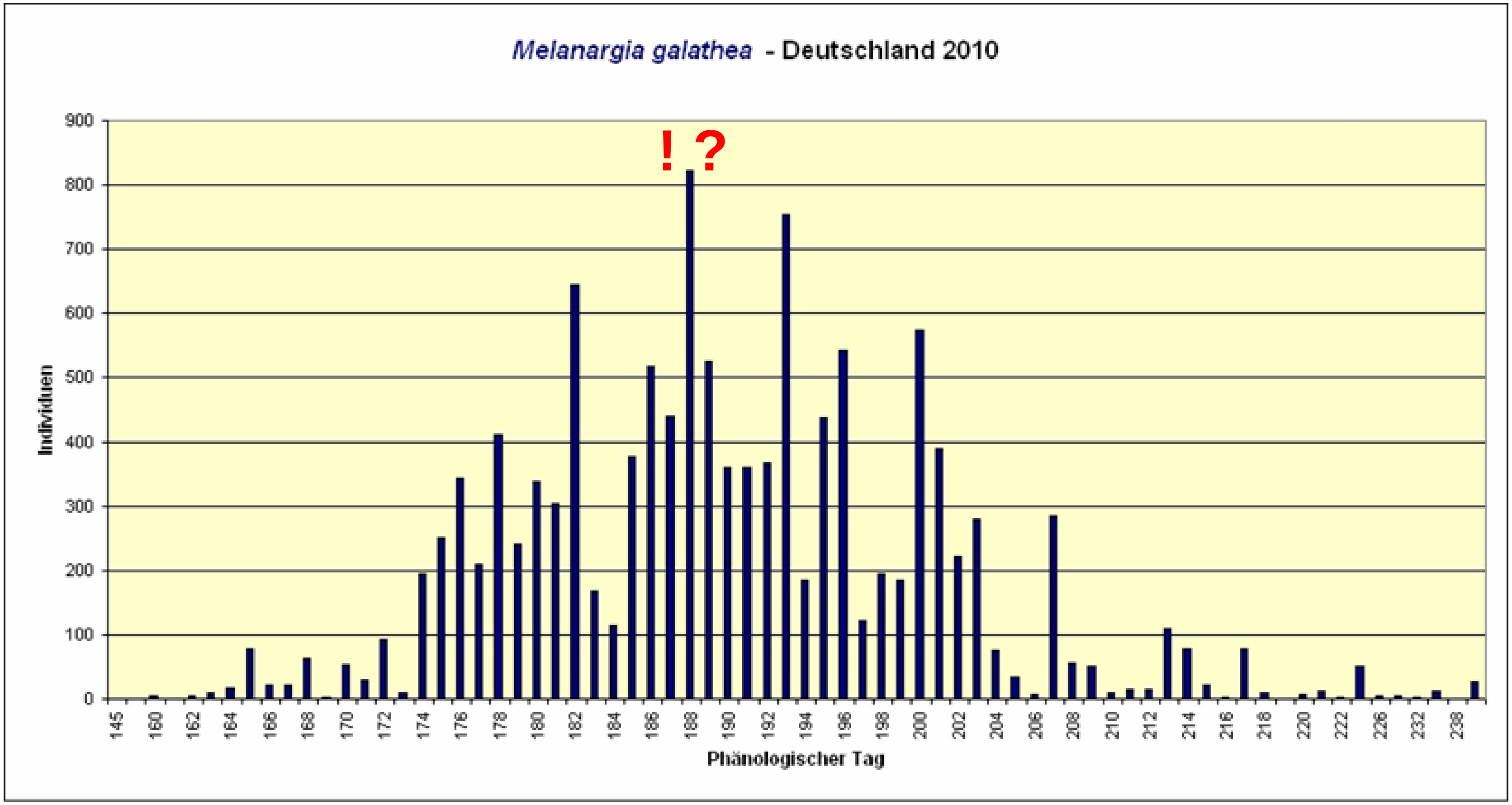
Weißbindiges Wiesenvögelchen
(*Coenonympha arcania*)



Phänologischer Tag **154**
(2. Juni XXXX)

Phänologischer Tag **247**
(3. September XXXX)

„Flugperiode" 93 Tage

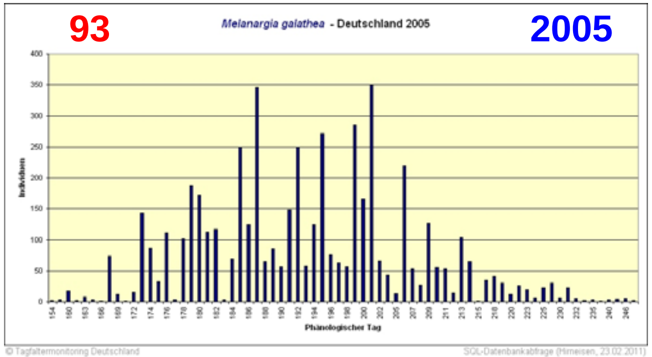


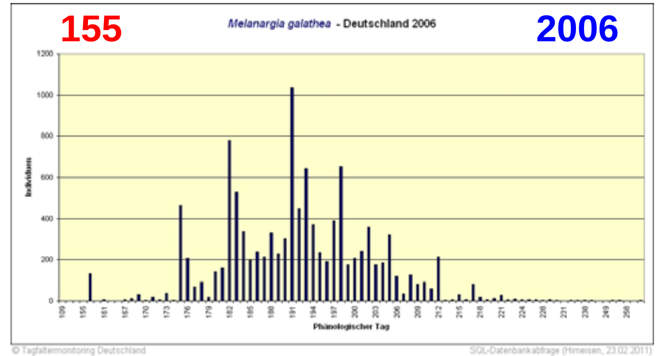
SQL-Datenbankabfrage (Hirneisen, 23.02.2011)

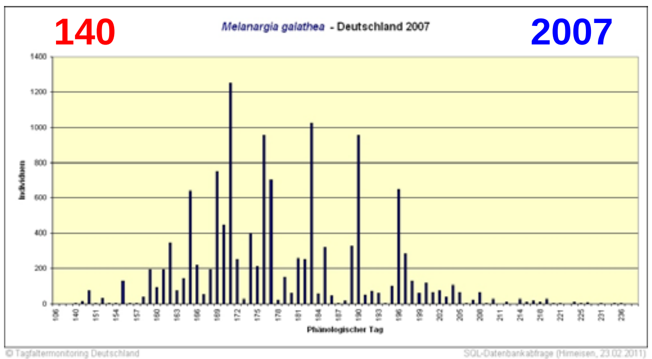
Phänologischer Tag **145**
(24. Mai XXXX)

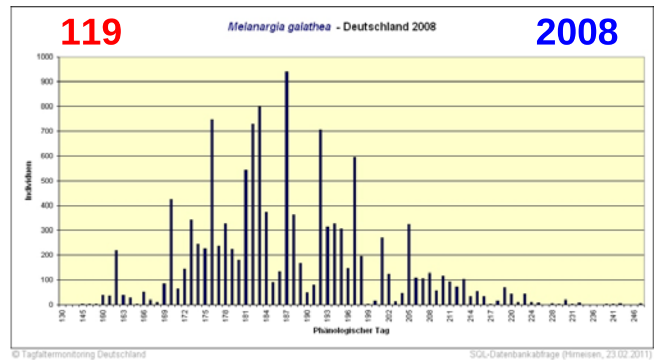
Phänologischer Tag **274**
(26. August XXXX)

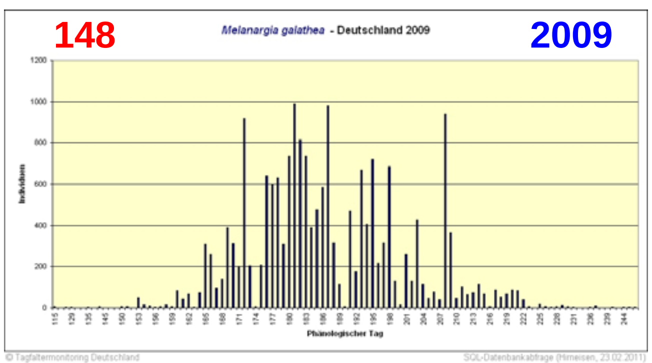
„Flugperiode“ 129 Tage

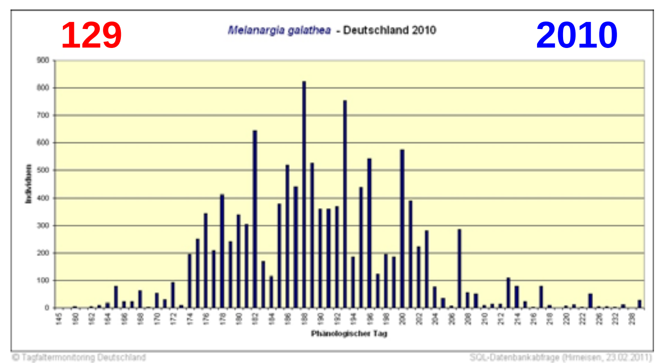

93
Melanargia galathea - Deutschland 2005
2005
Individuen
Phänologischer Tag
© Tagfaltermonitoring Deutschland
SQL-Datenbankabfrage (Hirneisen, 23.02.2011)


155
Melanargia galathea - Deutschland 2006
2006
Individuen
Phänologischer Tag
© Tagfaltermonitoring Deutschland
SQL-Datenbankabfrage (Hirneisen, 23.02.2011)


140
Melanargia galathea - Deutschland 2007
2007
Individuen
Phänologischer Tag
© Tagfaltermonitoring Deutschland
SQL-Datenbankabfrage (Hirneisen, 23.02.2011)


119
Melanargia galathea - Deutschland 2008
2008
Individuen
Phänologischer Tag
© Tagfaltermonitoring Deutschland
SQL-Datenbankabfrage (Hirneisen, 23.02.2011)

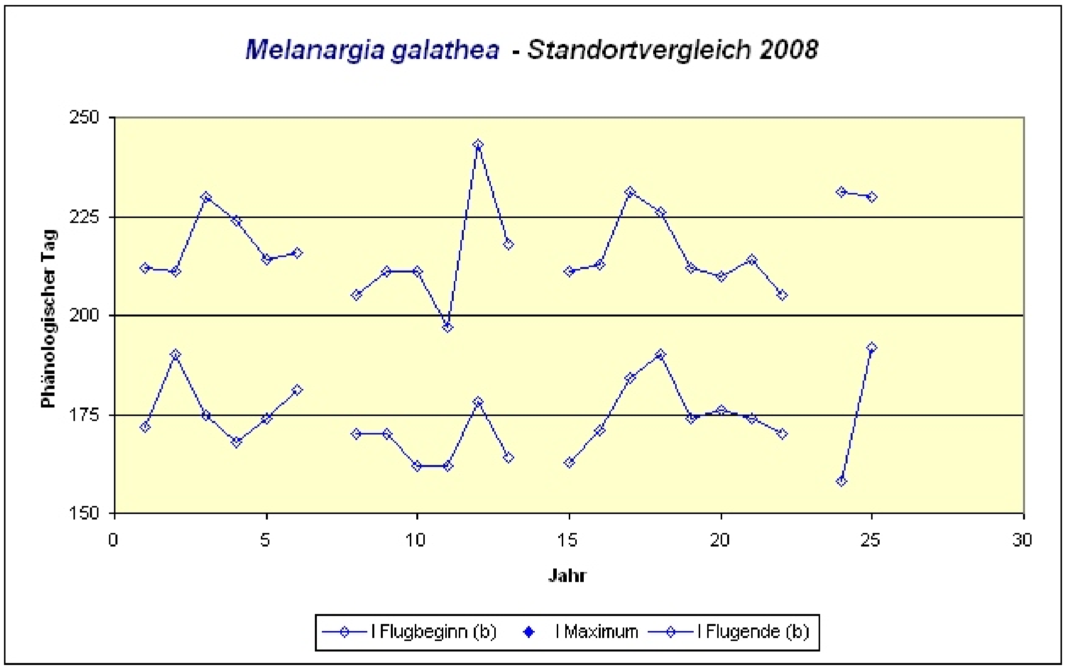

148
Melanargia galathea - Deutschland 2009
2009
Individuen
Phänologischer Tag
© Tagfaltermonitoring Deutschland
SQL-Datenbankabfrage (Hirneisen, 23.02.2011)


129
Melanargia galathea - Deutschland 2010
2010
Individuen
Phänologischer Tag
© Tagfaltermonitoring Deutschland
SQL-Datenbankabfrage (Hirneisen, 23.02.2011)

	A	CP	CQ	CR	CS	CT	CU	CV	CW	CX	CY	CZ	DA	DB	DC	DD	DE	DF	DG	DH	DI	DJ	DK	DL	DM	DN	DO	DP	DQ	DR	DS	DT	DU	DV	DW	DX	DY	DZ	EA	EB	EC	ED	EE	EF	EG	EH	EI	EJ
1	Einheitsdatum	01.06.	02.06.	03.06.	04.06.	05.06.	06.06.	07.06.	08.06.	09.06.	10.06.	11.06.	12.06.	13.06.	14.06.	15.06.	16.06.	17.06.	18.06.	19.06.	20.06.	21.06.	22.06.	23.06.	24.06.	25.06.	26.06.	27.06.	28.06.	29.06.	30.06.	01.07.	02.07.	03.07.	04.07.	05.07.	06.07.	07.07.	08.07.	09.07.	10.07.	11.07.	12.07.	13.07.	14.07.	15.07.	16.07.	17.07.
2	**Monat**	**Juni**																														**Juli**																
3	Phänologischer Tag	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199
4	NI [ID 33447] Nienburg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	15	0	0	0	0	0	0	0	0	0	0	0	0	0	18	0	0	0	0
5	NI [ID 15187] Uelzen	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2	0	0
6	ST [ID 744] Zeitz	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	BB [ID 71013] Lübben	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	17	0	0	0	0	0	0	35	0	0	0	0	0	0	9	0	0	0	0	0	0	8	0	0	0
8	BB [Cd 3644-1] Potsdam / Parforceh.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	3	0	0	0	11	0	0	0	0	0	0	0	0	5	0	0	0	0	0
9	BB [ID 17408] Wensickendorf	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	6	0	0	0	0	0	0	89	0	0	0	0	0
10	SL [ID 14971] Saarbrücken	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	108	0	0	0	0	0	0	0	0	0	0	0	187	0	0	0	0	0	0	0	0	0	72	0	0	0	0	0	0	0
11	RP [ID 14902] Messersbacherhof	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	44	0	0	0	0	74	0	0	0	0	0	0	61	0	0	0	0	0	0	36	0	0	0	0	0	0	0	30	0	0
12	RP [ID 30145] Wackernheim	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	46	0	0	0	0	56	0	0	0	35	0	0	0	0	0	0	0	0	46	0	0	0	0	0	0	0	17	0	0	0
13	HE [ID 21347] Griesheim	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	26	0	0	0	0	0	0	0	0	35	0	0	0	0	22	0	0	0	0	0	0	0	0	8	0	0	0	0	3	0	0
14	TH [ID 17525] Uthleben	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22	0	0	0	0	0	0	0	0	51	0	0	0	0	0	0	40	0	0	0	0	0
15	SN [ID 31703] Leipzig	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	13	0	0	0	0	0	50	0	0	0	0	0	0	0	47	0	0	0	0	0	0	0	47	0	0	0	0	21	0	0
16	BW [ID 14821] Mosbach	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	96	0	0	0	0	0	91	0	0	0	187	0	0	0	0	0	0	0	0	85	0	0	0	0	42	0	0
17	BW [ID 17603] Neuenburg Zienken 4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	19	0	0	0	0	0	0	0	34	0	0	0	23	0	0	0	0	0	8	0	0	0	0	5	0
18	BW [ID 15112] Trochtelfingen	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	19	0	0	0	0	20	0	0	0	0	0	0
19	BW [ID 15114] Upflamör	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	28	0	40	0	0	0	0	43	0	0
20	BY [ID 14762] Altenmünster	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	28	0	0	0	0	0	0	0	0	63	0	0	0	0	0	0	0	0	77	0	0	0	0	0	0	0
21	BY [ID 14789] Kaufering	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	0	0	0	0	0	0	90	0	0	0	0	0	0	0	0	100	0	0	0	0	40	0	0
22	BY [ID 31269] Laber/Endorf	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	15	0	0	0	0	0	36	0	0	0	0	0	28	0	0	0	0	0	0
23	BY [ID 15043] Leinach	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	8	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	18	0	0	0	0	23	0	0
24	AT [ID 22340] Korneuburg	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1	0	0	0	0	0	0	0	0	0	1	0
25	AT [ID 72756] St. Leonhard / Hornerw.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19	0	0	0	0	0	0	0

	A	EF	EG	EH	EI	EJ	EK	EL	EM	EN	EO	EP	EQ	ER	ES	ET	EU	EV	EW	EX	EY	EZ	FA	FB	FC	FD	FE	FF	FG	FH	FI	FJ	FK	FL	FM	FN	FO	FP	FQ	FR	FS	FT	FU	FV	FW	FX	FY	FZ	GA
1	Einheitsdatum	13.07.	14.07.	15.07.	16.07.	17.07.	18.07.	19.07.	20.07.	21.07.	22.07.	23.07.	24.07.	25.07.	26.07.	27.07.	28.07.	29.07.	30.07.	31.07.	01.08.	02.08.	03.08.	04.08.	05.08.	06.08.	07.08.	08.08.	09.08.	10.08.	11.08.	12.08.	13.08.	14.08.	15.08.	16.08.	17.08.	18.08.	19.08.	20.08.	21.08.	22.08.	23.08.	24.08.	25.08.	26.08.	27.08.	28.08.	29.08.
2	**Monat**																				**August**																												
3	Phänologischer Tag	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242
4	NI [ID 33447] Nienburg	18	0	0	0	0	0	0	0	0	0	16	0	0	0	0	0	0	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	NI [ID 15187] Uelzen	0	0	2	0	0	1	0	0	0	0	0	3	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	ST [ID 744] Zeitz	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
7	BB [ID 71013] Lübben	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	BB [Cd 3644-1] Potsdam / Parforceh.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	BB [ID 17408] Wensickendorf	0	0	0	0	0	0	16	0	0	0	33	0	0	0	16	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	SL [ID 14971] Saarbrücken	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	RP [ID 14902] Messersbacherhof	0	0	30	0	0	0	0	0	0	0	0	1	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	RP [ID 30145] Wackernheim	0	17	0	0	0	0	0	0	0	0	5	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	HE [ID 21347] Griesheim	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	TH [ID 17525] Uthleben	0	0	0	0	0	0	12	0	0	0	4	0	0	0	0	0	0	0	2	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	SN [ID 31703] Leipzig	0	0	21	0	0	0	0	0	0	0	18	0	0	0	0	0	10	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	BW [ID 14821] Mosbach	0	0	42	0	0	0	0	0	0	0	0	5	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	BW [ID 17603] Neuenburg Zienken 4	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	BW [ID 15112] Trochtelfingen	0	0	0	0	0	0	48	0	0	0	23	0	0	0	0	20	0	0	0	0	26	0	0	0	0	13	0	0	0	0	0	4	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0
19	BW [ID 15114] Upflamör	0	0	43	0	0	0	51	0	0	0	0	32	0	0	0	23	0	0	0	0	8	0	0	0	13	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	BY [ID 14762] Altenmünster	0	0	0	0	0	0	57	0	0	0	0	0	19	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	BY [ID 14789] Kaufering	0	0	40	0	0	0	0	0	0	0	8	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	BY [ID 31269] Laber/Endorf	0	0	0	0	0	0	22	0	0	0	0	0	10	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	BY [ID 15043] Leinach	0	0	23	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	AT [ID 22340] Korneuburg	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
25	AT [ID 72756] St. Leonhard / Hornerw.	0	0	0	0	0	20	0	0	0	7	0	0	0	9	0	20	0	0	3	4	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0

Ort	Nienburg	Uelzen	Zeitz	Lübben	Potsdam	Wensickendorf		Saarbrücken	Messersbacherhof	Wackernheim	Griesheim	Uthleben	Leipzig		Mosbach	Neuenburg Zienken	Trochtelfingen	Upflamör	Altenmünster	Kaufering	Laber/Endorf	Leinach		Korneuburg	St. Leonhard
Land	NI	NI	ST	BB	BB	BB		SL	RP	RP	HE	TH	SN		BW	BW	BW	BW	BY	BY	BY	BY		AT	AT
extrapoliert																									
Flugbeginn	172	190	175	168	174	181		170	170	162	162	178	164		163	171	184	190	174	176	174	170		158	192
Maximum																									
Flugende	212	211	230	224	214	216		205	211	211	197	243	218		211	213	231	226	212	210	214	205		231	230
extrapoliert																									
Flugdauer	40	21	55	56	40	35		35	41	49	35	65	54		48	42	47	36	38	34	40	35		73	38
korrigiert																									



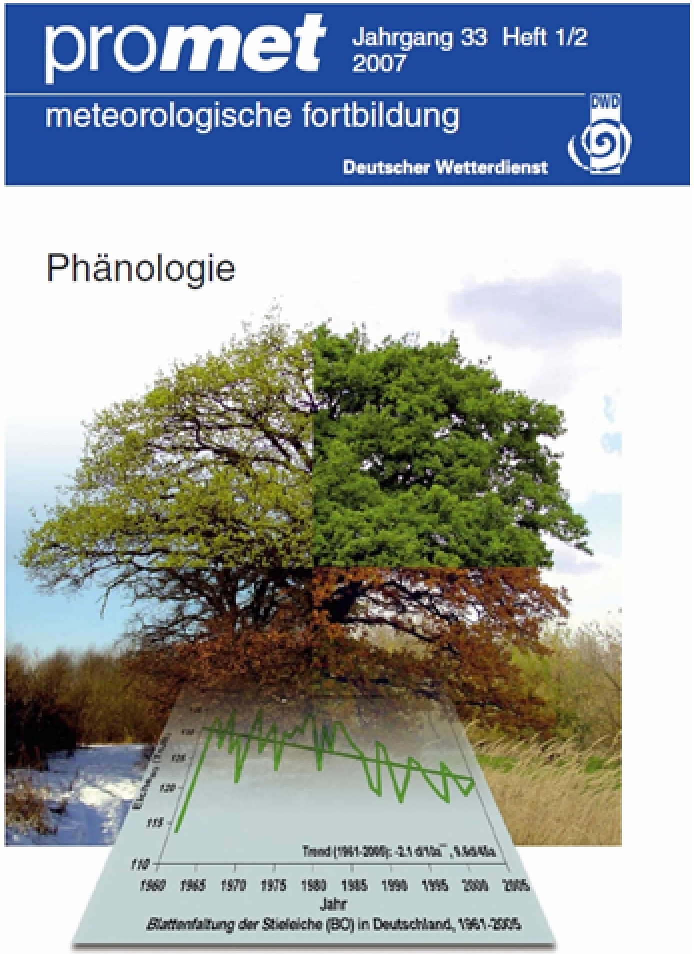
SQL-Datenbankabfrage (Hirneisen, 24.02.2011)
Datenaufbereitung (Kühling, 03.03.2011)

Standortvergleiche

- Voraussetzungen (Begehungsdichte, Stichprobengröße)
- Ähnlichkeit der Phänologien im gleichen Naturraum / Höhenstufe (Möglichkeit zur Aufwandsbeschränkung / Clusterbildung)
- Unterschiede in den Höhenstufen und Unterschiede quer durch Deutschland (Möglichkeit der raumbezogenen phänologischen Darstellung, Abbildung der unterschiedlichen Witterungs- bedingungen im jeweiligen Jahr; Verständnis der Veränderungen in den Gradienten Atlantisch-Kontinental / Tiefland-Gebirge / Süd- Nord)

„Best Practice“ Lösungen anstreben !

- Qualitätssicherung
  - Strenge Einhaltung der Standardbedingungen!
  - Ausreißer! ~ Fehler? ~ Schreibfehler!
- Daten-Aggregation zur Schärfung (lokale / regionale Stichproben) oder zur Verwischung (Verlust Feinstrukturen) von Aussagen
- Extrapolation am Beginn oder am Ende (J/N) / Mathematische Algorithmen / Modellierung
- Methodische Passfähigkeit
  - mit dem Phänologie-Messnetz des DWD
  - mit den europäischen Partnern



promet, Jahrg. 33, Nr. 1/2, 2-6 (Januar 2007)

E. BRUNS

1 Phänologische Beobachtungsnetze heute und gestern

Phenological networks today and yesterday

Zusammenfassung
Im Deutschen Wetterdienst wurde man sich in den vergangenen Jahren der wachsenden Bedeutung der Phänologie für das Klimamonitoring und für die operationelle Agrarmeteorologie neu bewusst. In der Agrarmeteorologie traten neben der Steuerung von Vorhersagemodellen auch Aspekte der Ertragsprognosen in den Vordergrund. Das phänologische Beobachtungsnetz des Deutschen Wetterdienstes ist wesentlicher Stützpfeiler im Verbund der Beobachtungsnetze anderer Länder in Europa; die Kriterien zur Qualitätsprüfung der Daten sind

promet, Jahrg. 33, Nr. 1/2, 7-13 (Januar 2007)

A. HENSE, M. MÜLLER

2 Geostatistische Modellierung und Qualitätskontrolle von phänologischen Beobachtungen

Geostatistical modeling and quality control of phenological observations

promet, Jahrg. 33, Nr. 1/2, 14-19 (Januar 2007)

P. BISSOLLI, G. MÜLLER-WESTERMEIER, C. POLTE-RUDOLF

3 Aufbereitung und Darstellung phänologischer Daten

Processing and Visualisation of phenological data

Zusammenfassung
Phänologische Daten reflektieren die Auswirkungen von Witterungs- und Klimaeinflüssen auf Pflanzen und Tiere. Sie lassen sich ähnlich wie Klimadaten mit Hilfe der Zeitreihen- und Häufigkeitsanalyse sowie der räumlichen Interpolation auswerten bzw. darstellen. Zusätzlich lässt sich aber noch der jahreszeitliche Ablauf der verschiedenen Phasen für witterungsklimatologische Studien und vielfältige praktische Anwendungen nutzen.

Abstract
Phenological data reflect the impact of weather and climate on plants and animals. They can be evaluated and displayed like climate data, using methods of time series and frequency analysis, but also spatial interpolation. In addition, the seasonal course of various phenological phases can be used for climatological studies and manifold practical applications.

http://www.dmg-ev.de/gesellschaft/publikationen/pdf/promet/Promet_Vol-33_1-2.pdf

Global Change Biology (2000) 6, 407–416

Phenology of British butterflies and climate change

D. B. ROY* and T. H. SPARKS
Institute of Terrestrial Ecology, Monks Wood, Abbots Ripton, Huntingdon, Cambridgeshire PE17 2LS, UK

Abstract

Data from a national butterfly monitoring scheme were analysed to test for relationships between temperature and three phenological measures, duration of flight period and timing of both first and peak appearance. First appearances of most British butterflies has advanced in the last two decades and is strongly related to earlier peak appearance and, for multibrooded species, longer flight period. Mean dates of first and peak appearance are examined in relation to Manley's central England temperatures, using regression techniques. We predict that, in the absence of confounding factors, such as interactions with other organisms and land-use change, climate warming of the order of 1 °C could advance first and peak appearance of most butterflies by 2–10 days.

Keywords: butterflies, climate change, emergence, flight period, monitoring, phenology

Received 21 May 1999; resubmitted and accepted 7 October 1999

Table 1 Trends over time (1976–98) for mean first appearance, peak flight date and length of flight period. Table reports R^2 and significance values from regressions of flight period characteristics on year. Values for change per decade are number of days.

		Mean first appearance			Mean peak appearance			Mean length of flight period		
		R^2 (%)	sig.	Change (+10 y)	R^2 (%)	sig.	Change (+10 y)	R^2 (%)	sig.	Change (+10 y)
(a) species with one flight period each year										
Thymelicus sylvestris (Poda.)	small skipper	0	ns	−1.4	0	ns	−1.6	0	ns	−0.9
Ochlodes venata (Br. & Grey)	large skipper	11	ns	−3.7	1	ns	−2.3	31	**	4.4
Erynnis tages (L.)	dingy skipper	17	*	−5.1	6	ns	−3.4	18	*	4.3
Pyrgus malvae (L.)	grizzled skipper	28	**	−6.0	11	ns	−4.4	12	ns	3.4
Anthocharis cardamines (L.)	orange tip	50	***	−7.6	39	**	−7.0	1	ns	1.2
Callophrys rubi (L.)	green hairstreak	23	*	−4.3	21	*	−4.7	0	ns	−0.2
Quercusia quercus (L.)	purple hairstreak	0	ns	−1.7	7	ns	−3.8	0	ns	−0.4
Lysandra coridon (Poda.)	chalk-hill blue	0	ns	0.0	0	ns	−0.3	0	ns	0.0
Limenitis camilla (L.)	white admiral	7	ns	−3.1	4	ns	−2.5	0	ns	0.4
Clossiana selene (D. & S.)	small pearl-bordered fritillary	0	ns	−1.8	0	ns	−0.5	0	ns	1.6
Clossiana euphrosyne (L.)	pearl-bordered fritillary	27	**	−6.7	11	ns	−4.7	0	ns	1.8
Argynnis aglaja (L.)	dark green fritillary	0	ns	0.0	0	ns	−0.5	0	ns	−1.8
Argynnis paphia (L.)	silver-washed fritillary	12	ns	−4.4	0	ns	−2.3	14	*	3.5
Melanargia galathea (L.)	marbled white	23	*	−4.6	9	ns	−3.2	6	ns	1.7
Hipparchia semele (L.)	grayling	0	ns	0.4	4	ns	−2.7	30	**	−4.6
Pyronia tithonus (L.)	hedge brown (gatekeeper)	0	ns	−1.6	2	ns	−2.0	0	ns	−1.1
Maniola jurtina (L.)	meadow brown	1	ns	−2.0	0	ns	−0.8	6	ns	2.1
Aphantopus hyperantus (L.)	ringlet	23	*	−4.6	10	ns	−3.2	28	**	4.6
(b) species with two flight periods, but only one generation										
Gonepteryx rhamni (L.)	brimstone	24	*	−5.3	0	ns	−2.6	20	*	5.7
Inachis io (L.)	peacock	36	**	−12.8	15	*	−8.1	18	*	10.4

ns $P > 0.05$, * $0.05 > P > 0.01$, ** $0.01 > P > 0.001$, *** $0.001 > P$

United Kingdom
Butterfly Monitoring Scheme

ANNUAL REPORT 2008

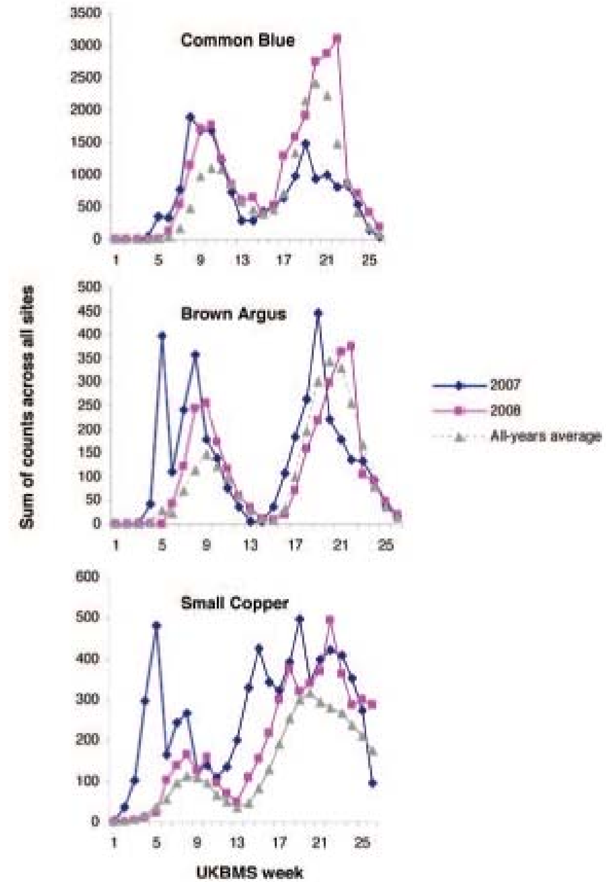
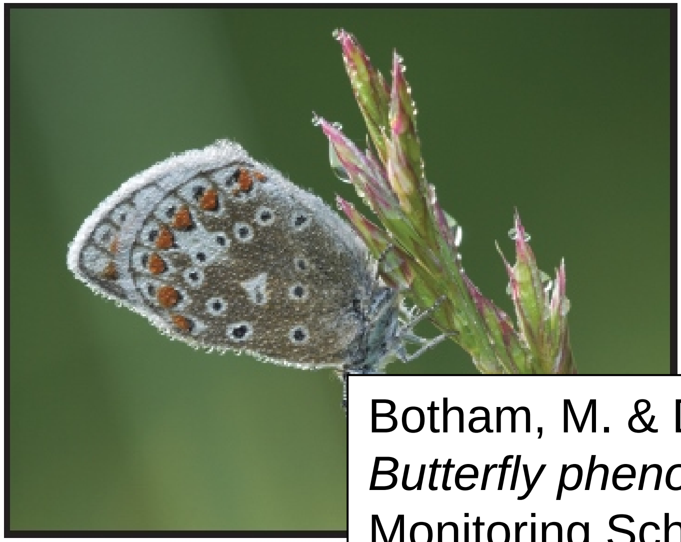


Figure 5. Flight times of Common Blue, Brown Argus and Small Copper counted on UKBMS transects. Note week 1= 1-7 April, week 26 = 23-29 September

United Kingdom
Butterfly Monitoring Scheme

ANNUAL REPORT 2008



and 10 (uniformly short, species poor improved pasture) support very few butterflies in most years, other than when patches of Creeping Thistle, Cirsium arvense, escape spot spraying and prove attractive to nectaring Nymphalids.

How was 2008 for butterflies?
Average, rather than poor. It was a good year for Green-veined White (habitat quality along Section 1 has improved, with a greater growth of crucifers along the ditch) with a six-fold increase over 2007, whilst Large White, Comma and Speckled Wood did reasonably well. In contrast, it was a poor year for Small White, the worst in the series with only four counted. Notable absentees included Small Copper (last record 2004), Holly Blue and Small Tortoiseshell. It was a poor year for migrants.

Monitoring other insects
Day-flying moths, dragonflies, grasshoppers and crickets are also monitored weekly along the transect and many species have bell-shaped flight periods like butterflies. About 20 dragonfly species have been recorded, chiefly eutrophic species around the lake and oligotrophic species on the feeder stream. Rarities recorded have included Small Red-eyed Damselfly, Scarce Chaser and Red-veined Darter. With increased algal pollution several species have declined in abundance, including Emerald Damselfly (waterfowl have also declined substantially). Influxes of Silver Y moths occur from time to time, whilst other day-flying species recorded have included Bordered Straw, Scarlet Tiger and Hummingbird Hawkmoth.

Conclusions
Though not the most exciting of transects, Lulworth Lake has served its purpose well. It has provided insights into how land management and weather impact on butterfly abundance, whilst providing valuable training opportunities for new staff joining BC HQ. Importantly, for established staff, it provides an opportunity to escape from the computer and remind them of how fabulous butterflies are!

Butterfly phenology

Marc Botham and David Roy (CEH)

Background
Phenology is the study of periodic events such as bud burst and leaf fall. In butterflies we can measure when each species is first on the wing (first appearance), what time of year each species reaches its peak, when a species is last seen on the wing (last appearance) and for how long (flight period). Many of these measurements can be calculated from the UKBMS data. Butterfly phenology is a good indicator of the impact of climate change since butterflies are poikilothermic and as such their development is strongly dependent on temperature. Studies from the UK and north-west Spain have shown the effects of climate on the timing of flight periods tends to be remarkably consistent, with most species showing advanced timing of first appearance and peak abundance with warmer temperatures (Sparks and Yates 1997; Roy and Sparks 2000; Stefanescu et al. 2003). It has been suggested that such marked changes in butterfly phenology will have pronounced effects on a species' ecology although published evidence is still lacking. Effects may be both beneficial and detrimental.

Analysing phenology data
There are certain limitations in what measurements we can calculate accurately from the UKBMS data. First and last appearance data, from which we could make simple calculations of length of flight period (Roy and Sparks 2001), are not likely to be accurate since transects are not walked until the first week of April and finish at the end of September. In addition, because weeks within this period are often missed because of poor weather etc., the date on which the peak abundance of a species is recorded is also likely to be inaccurate. For this reason, we use alternative measurements of phenology which are highly correlated to these and less sensitive to the UKBMS methodology. A measurement which is highly correlated to both date of first appearance and the date on which the peak abundance is recorded is the mean flight date, calculated as the weighted mean date of the counts (Stefanescu et al. 2003). This can be used to measure the timing of flight periods and is less sensitive to variation in recording intensity. The standard deviation (SD) around this mean is a measure of the degree of synchronization (length) of the flight period. In this article we report on these two measurements. Many UK butterflies have more than one generation per year. However, for some of these species the generations overlap (e.g. speckled wood, *Pararge aegeria*) and it is not possible to separate flight period data accurately. For these species we report on phenology measures derived for the whole flight period. For ten multivoltine species it is possible to split the data

Botham, M. & David Roy, D. (2008): *Butterfly phenology*. UK Butterfly Monitoring Scheme. Annual Report 2008, pp. 32-38

Table 7a. Trends in mean flight date and length of flight period for those species with one distinct flight period. Levels of statistical significance are also given: * P < 0.05, ** P < 0.01, *** P <0.001.

Species	Change in date of mean abundance (days)	Change in Flight Period length (days)	No. Years of transect monitoring	Mean flight date	Mean flight period (days)
Skippers					
Chequered Skipper	-9	-3	19	16-May	46
Small Skipper	-6*	-2**	33	19-Jun	36
Essex Skipper	-12**	-1**	33	18-Jun	31
Lulworth Skipper	-11	-2	31	2-Jul	68
Silver-spotted Skipper	-6	2	33	6-Jul	26
Large Skipper	-6	0	33	6-Jun	32
Dingy Skipper	-12**	1	33	11-May	32
Grizzled Skipper	-14***	-2	33	8-May	32
Swallowtails					
Swallowtail	-3	2	32	31-May	34
Whites					
Wood White	-7	-3	33	27-May	43
Clouded Yellow	-6	10*	32	3-Jul	53
Brimstone	-12*	2*	33	30-Jun	35
Orange Tip	-21***	0	33	29-Apr	29
Lycaenids					
Green Hairstreak	-12***	0	33	8-May	32
Brown Hairstreak	-3	-7*	27	8-Jul	30
Purple Hairstreak	-10*	-1	33	21-Jun	32
White-letter Hairstreak	-16***	-6**	33	16-Jun	28
Black Hairstreak	-23***	0	28	30-May	22
Silver-studded Blue	-15**	-2	33	28-Jun	57
Northern Brown Argus	-11*	-2	31	7-Jun	36
Chalk-hill Blue	-6*	0	33	11-Jul	56
Metalmarks					
Duke of Burgundy	-16***	-2*	33	7-May	26
Nymphalids (excluding Fritillaries)					
White Admiral	-12**	-1	33	11-Jun	28
Purple Emperor	-14**	0	31	10-Jun	26
Red Admiral	-20***	12***	33	25-Jun	69
Painted Lady	-12*	7	33	22-Jun	69
Small Tortoiseshell	-19**	-6**	33	8-Jun	65
Peacock	-13**	0	33	30-Jun	34
Comma	-12*	15***	33	13-Jun	63
Fritillaries					
Small Pearl-bordered Fritillary	-3	-3*	33	28-May	30
Pearl-bordered Fritillary	-12**	-3**	33	11-May	31
High-brown Fritillary	-7*	-2	33	15-Jun	30
Dark-green Fritillary	-6	-2*	33	15-Jun	35
Silver-washed Fritillary	-6	2**	33	20-Jun	31
Marsh Fritillary	-11**	1	30	19-May	33
Glanville Fritillary	5	-4*	16	15-May	34
Heath Fritillary	-13**	-1	29	3-Jun	47
Browns					
Speckled Wood	-10*	9***	33	21-Jun	57
Mountain Ringlet	7	-2	29	15-Jun	50
Scotch Argus	0	0	32	16-Jul	59
Marbled White	-13***	1*	33	16-Jun	35
Grayling	-6*	-4***	33	27-Jun	35
Gatekeeper	-9**	0	33	3-Jul	42
Meadow Brown	-2	1*	33	3-Jul	52
Small Heath	4	-1	33	13-Jun	55
Large Heath	5	-5*	32	4-Jun	29
Ringlet	-13***	2***	33	18-Jun	35

Table 7b. Trends in mean flight date and the length of flight period for those species with two distinct flight periods for both flight periods (FP1 and FP2) separately. Levels of statistical significance are also given: *P < 0.05, **P <0.01, *** P < 0.001.

Species	Change in date of mean abundance (days)		Change in Flight Period (days)		Mean Flight Date		Mean Flight Period (days)		No. Years of transect monitoring	
	FP 1	FP 2	FP 1	FP 2	FP 1	FP 2	FP 1	FP 2	FP 1	FP 2
Large White	-14***	-10**	-3**	4***	9-May	26-Jun	35	35	33	33
Small White	-9***	-6	-4***	3*	6-May	3-Jul	36	37	33	33
Green-veined White	-10***	-6	0	5***	5-May	29-Jun	32	35	33	33
Small Copper	-15***	-3	-1	1	9-May	6-Jul	34	39	33	33
Small Blue	-11**	8	-1	1	19-May	24-Jun	27	32	33	31
Brown Argus	-14**	-10**	-1	1	15-May	4-Jul	32	29	33	33
Common Blue	-14***	-11**	-1	1	21-May	5-Jul	32	35	33	33
Adonis Blue	-14**	-7	1	1	20-May	19-Jul	43	48	33	33
Holly Blue	-10**	-6	2	1	29-Apr	25-Jun	31	28	33	33
Wall Brown	-10***	-14***	-3***	-2	11-May	4-Jul	31	30	33	33

Below, we will describe some of the most interesting trends in individual species within each butterfly family.

Species with one distinct flight period

Skippers: It is the skipper that flies earliest in the year, the Grizzled Skipper, which has shown the greatest advance in mean flight date, advancing by two weeks since 1976 (see Figure 16). There has been no significant change in the length of flight period for the Grizzled Skipper suggesting that the whole flight period has advanced over time. The other spring-flying skipper, the Dingy Skipper, has also shown a significant advance in date of mean abundance, of almost two weeks.

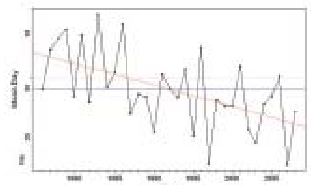
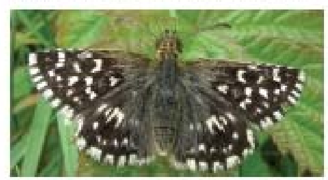


Figure 16. The change in mean flight date for the Grizzled Skipper since 1976



The mean flight date of the Grizzled Skipper has advanced by two weeks since 1976. Photograph by *Charlotte Bewick*

Swallowtails: Both the timing and duration of the flight period for our single UK species of this family, the Swallowtail, have changed very little since 1976. There has been a non-significant advance in the mean flight date of just three days and a non-significant increase of two days in the length of flight period.

Neither the timing or duration of flight period in the Swallowtail have changed significantly since 1976. Photograph by *Matthew Berry*

Whites: The Orange Tip has shown the most significant advance of three weeks (Figure 17) whilst the length of its flight period has not changed since 1976, suggesting that the entire flight period from start to finish has become earlier.

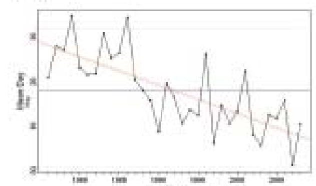


Figure 17. The change in mean flight date for the Orange Tip since 1976

Table 7a. Trends in mean flight date and length of flight period for those species with one distinct flight period. Levels of statistical significance are also given: * P < 0.05, ** P < 0.01, *** P < 0.001.

Species	Change in date of mean abundance (days)	Change in Flight Period length (days)	No. Years of transect monitoring	Mean flight date	Mean flight period (days)
Browns					
Speckled Wood	-10*	9***	33	21-Jun	57
Mountain Ringlet	7	-2	29	15-Jun	50
Scotch Argus	0	0	32	16-Jul	59
Marbled White	-13***	1*	33	16-Jun	35
Grayling	-6*	-4***	33	27-Jun	35
Gatekeeper	-9**	0	33	3-Jul	42
Meadow Brown	-2	1*	33	3-Jul	52
Small Heath	4	-1	33	13-Jun	55
Large Heath	5	-5*	32	4-Jun	29
Ringlet	-13***	2***	33	18-Jun	35

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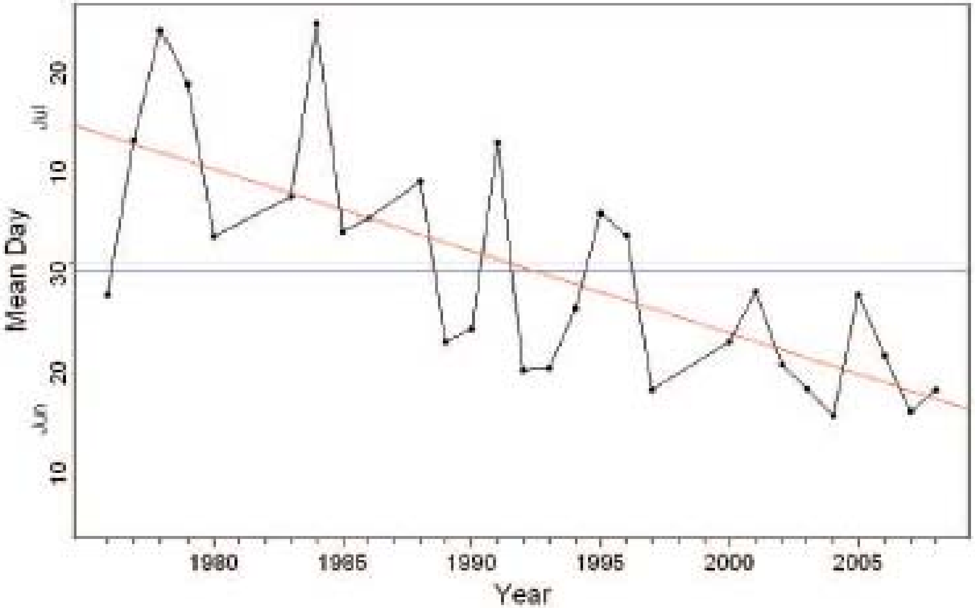

Figure 18. The change in mean flight date for the Black Hairstreak since 1976

The flight period of the Black Hairstreak has advanced by over three weeks in less than thirty years. Photograph by *Marc Botham*

Vielen Dank!

mkuehling@t-online.de