

<sup> Appendix 1: Information from 85 Tier 1 studies that met two of the three criteria (see text) and the direction of the expected change is known. The values include location of the study, taxa of the species examined, year in the 20th century when the study began and the length of the study, total number of species examined in each article, number of those species showing a statistically significant change (in bold) and those that show both significant and non-significant change, number of those species changing in the direction expected with temperature change for significantly changing (in bold) and the combination of significantly and non-significantly changing species, type of change, and the citation.

		Number of Species					Type of Change	Citation
		Starting yr /Total yrs	Sign./not sign		Change Expected			
Location	Taxa		Total	Sign.		Not Sign.		
Antarctic Ocean	Inverts	75/22	2	2/0	2/0	Density	1	
Antarctica	Bird	42/46	1	1/0	1/0	Density	2	
Antarctica	Bird	52/48	1	1/0	1/0	Density	3	
Antarctica	Birds	77/19	2	2/0	2/0	Density	4, 5, 6	
Antarctica	Vascular Plants	65/28	2	2/0	2/0	Density	7	
Asia	Plants	59/35	Many	Many	Many	Autumn Phenology	8	
Australia	Bird	68/22	1	1/0	1/0	Spring Phenology	9	
Central America	Reptiles	83/13	3	2/0	2/0	Density	10	
Central America	Birds	82/16	35	15/0	15/0	Range Shift	10	
Europe	Invert	40/38	1	1/0	1/0	Range Shift	11, 12	
Europe	Invert	52/49	Many	Many	Many	Spring Phenology	13	
Europe	Inverts	64/25	5	5/0	5/0	Spring Phenology	14	

<tblrow>	Europe	Inverts	64/28	5	5/0	5/0	Spring Phenology	15
<tblrow>	Europe	Invert	73/23	1	1/0	1/0	Spring Phenology	16, 17
<tblrow>	Europe	Inverts	75/20	104	Many	Many	Spring Phenology	18
<tblrow>	Europe	Invert	76/14	1	1/0	1/0	Spring Phenology	19
<tblrow>	Europe	Invert	76/16	1	1/0	0/0	Genetics	20
<tblrow>	Europe	Inverts	76/16	2	2/0	2/0	Density	21
<tblrow>	Europe	Inverts	76/22	35	13/17	13/13	Spring Phenology & Density	22, 23
<tblrow>	Europe	Invert	78/18	1	1/0	1/0	Morphology	24
<tblrow>	Europe	Inverts	variable	52	35/17	34/0	Range Shift	25
<tblrow>	Europe	Amphibs	79/17	6	5/1	5/1	Spring Phenology	26
<tblrow>	Europe	Birds	1850/138	2	2/0	0/0	Spring Phenology	27
<tblrow>	Europe	Birds	42/54	56	22/34	22/32	Spring Phenology	28, 29
<tblrow>	Europe	Birds	52/49	Many	Many	Many	Spring Phenology	13
<tblrow>	Europe	Bird	61/37	1	1/0	1/0	Spring Phenology	30
<tblrow>	Europe	Bird	61/37	1	1/0	1/0	Spring Phenology	31
<tblrow>	Europe	Birds	66/31	90	33/57	29/39	Spring Phenology	28, 29
<tblrow>	Europe	Bird	66/28	1	1/0	1/0	Fall Phenology	32
<tblrow>	Europe	Bird	66/22	1	1/0	1/0	Spring Phenology	33, 34
<tblrow>	Europe	Birds	68/24	101	Many	Many	Range Shift	35
<tblrow>	Europe	Bird	70/26	1	1/0	1/0	Spring Phenology	36
<tblrow>	Europe	Birds	70/26	3	3/0	3/0	Spring Phenology	37
<tblrow>	Europe	Bird	71/27	1	1/0	1/0	Spring Phenology	38
<tblrow>	Europe	Birds	71/25	65	21/44	20/30	Spring Phenology	39, 40
<tblrow>	Europe	Bird	71/25	1	1/0	1/0	Spring Phenology	41
<tblrow>	Europe	Birds	71/25	65	21/44	21/44	Spring Phenology	42, 40
<tblrow>	Europe	Bird	73/23	1	0/1	0/1	Spring Phenology	16, 17
<tblrow>	Europe	Bird	75/24	1	1/0	1/0	Spring Phenology	43
<tblrow>	Europe	Bird	75/18	1	1/0	1/0	Range Shift	44

<tblrow>	Europe	Bird	75/25	1	1/0	1/0	Density	45
<tblrow>	Europe	Bird	80/21	1	1/0	1/0	Spring Phenology	46
<tblrow>	Europe	Bird	83/18	1	1/0	1/0	Spring Phenology	47
<tblrow>	Europe	Mt. Plants	1895/99	Many	Many	Many	Range Shift	48 , 49
<tblrow>	Europe	Trees	15/85	3	3/0	3/0	Range Shift	50
<tblrow>	Europe	Tree	36/47	1	1/0	0/0	Spring Phenology	51
<tblrow>	Europe	Trees	46/50	6	5/1	5/1	Spring Phenology	52
<tblrow>	Europe	Plants	48/48	9	6/3	6/3	Spring & Fall Phenology	53
<tblrow>	Europe	Forb, Shrub & Trees	51/46	11	11/0	11/0	Spring Phenology	54 , 55
<tblrow>	Europe	Plants	52/49	Many	Many	Many	Spring Phenology	13
<tblrow>	Europe	Plants	54/47	385	70/315	60/231	Spring Phenology	56 , 57
<tblrow>	Europe	Trees & Shrubs	59/35	Many	Many	Many	Spring & Fall Phenology	58 , 59 , 60 , 61
<tblrow>	Europe	Forbs	60/30	1	1/0	1/0	Spring Phenology	62
<tblrow>	Europe	Tree	61/32	1	1/0	1/0	Morphology	63
<tblrow>	Europe	Tree	61/30	1	1/0	1/0	Spring Phenology	64
<tblrow>	Europe	Plants	70/30	Many	Many	Many	Range Shift	65
<tblrow>	Europe	Lichen	79/22	329	216/?	136/?	Range Shift	66
<tblrow>	Europe	Tree	83/12	1	1/0	1/0	Spring Phenology	67
<tblrow>	Europe	Tree	88/13	1	1/0	1/0	Spring Phenology	16 , 17
<tblrow>	Europe	Trees	89/10	4	4/0	4/0	Spring Phenology	60 , 68
<tblrow>	Europe	Plants	?/20	14	??	??	Spring Phenology	69
<tblrow>	Europe	Plants	?/58	11	??	??	Spring Phenology	69
<tblrow>	Europe	Plants	46/53	16	??	??	Spring and Fall Phenology	52
<tblrow>	North America	Amphib	00/100	6	4/2	4/1	Spring Phenology	70

<tblrow>	North America	Amphib	Variable	4	0/1	0/0	Spring Phenology	71
<tblrow>	North America	Birds	36/63	19	9/9	8/7	Spring Phenology	72
<tblrow>	North America	Bird	59/33	1	1/0	1/0	Spring Phenology	73
<tblrow>	North America	Bird	68/19	1	1/0	1/0	Spring Phenology	74
<tblrow>	North America	Bird	71/28	1	1/0	1/0	Spring Phenology	75
<tblrow>	North America	Birds	75/25	4	3/1	3/1	Spring Phenology	76
<tblrow>	North America	Bird	80/19	1	1/0	1/0	Spring Phenology & Genetic Variability	77
<tblrow>	North America	Tree	01/97	1	1/0	1/0	Spring Phenology	78
<tblrow>	North America	Tree	03/82	1	1/0	1/0	Density	79
<tblrow>	North America	Tree	10/91	1	1/0	1/0	Morphology	80
<tblrow>	North America	Forbs	36/63	36	10/26	10/15	Spring Phenology	72
<tblrow>	North America	Trees	56/42	3	1/0	1/0	Spring Phenology	81
<tblrow>	North America	Bushes	57/38	1	1/0	1/0	Spring Phenology	82
<tblrow>	North America	Bushes	68/27	2	2/0	2/0	Spring Phenology	82
<tblrow>	Pacific Ocean	Inverts	31/66	62	18/4	15/2	Density	83

Intertidal								
<tblrow>	Pacific Ocean	Zooplankton	51/43	Many	Many	Many	Density	84
<tblrow>	Pacific Ocean	Zooplankton	70/27	1	1/0	1/0	Spring Phenology & Density	85

<supp> Appendix 2: Information from 58 Tier 2 studies that meet one of the criteria (see text) but the trends or associations are not statistically significant. The entries include location of the study, taxa of the species examined, year in the 20th century when the study started and the length (in years) of the study, total number of species examined, number of those species that showed a change, number of changing species changing in the direction expected with temperature change, type of change, and the citation. When a value is unknown, a "?" is used.

<tblrow>	<tblrow>			Number of Species			Type of Change	Citation
<tblrow>	Location	Taxa	Starting yr /Total yrs	Total	Chan	Expected		
<tblrow>	Antarctica	Birds	44/31	6	3	?	Density	86
<tblrow>	Antarctica	Birds	46/50	2	2	2	Range Shift	87
<tblrow>	Antarctica	Bird	79/12	1	1	1	Density	88
<tblrow>	Arctic	Bird	55/36	1	1	1	Density	89
<tblrow>	Asia	Dicots	53/38	10	8	8	Spring Phenology	90
<tblrow>	Asia	Tree	53/37	1	1	1	Spring Phenology	91
<tblrow>	Asia	Trees	53/38	2	2	2	Fall Phenology	90
<tblrow>	Europe	Inverts	37/57	12	12	?	Spring Phenology	92
<tblrow>	Europe	Invert	61/37	1	1	1	Density	93
<tblrow>	Europe	Inverts	61/36	Many	Many	Many	Density	94
<tblrow>	Europe	Invert	66/30	1	1	1	Spring Phenology	95
<tblrow>	Europe	Inverts	74/19	18	9	9	Range Shift	96
<tblrow>	Europe	Inverts	80/20	Many	Many	Many	Range Shift	97
<tblrow>	Europe	Inverts	Variable	4	4	4	Range Shift	98

<tblrow>	English Channel	Zooplankton	03/84	Many	Many	Many	Range Shift and Density	99
<tblrow>	English Channel	Intertidal invertebrates	50/44	Many	Many	Many	Range Shift and Density	99
<tblrow>	English Channel	Fish	Variable	Many	Many	Many	Range Shift and Density	99
<tblrow>	Europe	Fish	52/45	2	2	2	Spring Phenology	100
<tblrow>	Europe	Amphibs	83/11	1	1	?	Morphology	101
<tblrow>	Europe	Birds	52/45	2	2	2	Spring Phenology	100
<tblrow>	Europe	Bird	61/30	1	1	?	Migration Route	102
<tblrow>	Europe	Birds	62/27	39	9	8	Density	103
<tblrow>	Europe	Bird	64/19	1	1	1	Spring Phenology	104
<tblrow>	Europe	Bird	68/12	1	1	1	Density	105
<tblrow>	Europe	Birds	70/21	46	40	28	Fall Phenology	106
<tblrow>	Europe	Bird	78/20	1	1	1	Density	107
<tblrow>	Europe	Mammal	30/50	1	1	?	Density	108
<tblrow>	Europe	Mammal	69/15	1	1	?	Morphology	109 110
<tblrow>	Europe	Mammal	71/22	1	1	?	Morphology	111
<tblrow>	Europe	Tree	1896/60	1	1	1	Spring Phenology	112
<tblrow>	Europe	Trees & Shrub	19/78	4	4	4	Spring Phenology	100
<tblrow>	Europe	Forbs, Shrub, Vine & Tree	51/48	14	10	9	Spring & Fall Phenology	113 114
<tblrow>	Europe	Forb, Shrub & Trees	51/45	4	4	4	Spring Phenology	115
<tblrow>	Europe	Grass	62/31	Many	Many	Many	Spring Phenology	116

<tblrow>	Europe	Tree	70/29	1	1	1	Range Shift	117
<tblrow>	Europe	Forbs, Shrubs & Trees	75/24	207	105	105	Range Shift	118
<tblrow>	Europe	Tree	86/11	4	3	3	Spring Phenology	119
<tblrow>	Europe	Tree	88/10	1	1	1	Morphology	120
<tblrow>	New Zealand	Invert	69/20	3	1	1	Density	121
<tblrow>	New Zealand	Trees	30/61	4	3	3	Range Shift	122
<tblrow>	North America	Invert	59/46	1	1	1	Range Shift	123
<tblrow>	North America	Invert	72/25	1	1	1	Genetics % Fall Phenology	124
<tblrow>	North America	Invert	80/15	1	1	1	Range Shift	125
<tblrow>	North America	Birds	03/91	76	41	39	Spring Phenology	126
<tblrow>	North America	Birds	52/42	2	2	2	Spring Phenology	126
<tblrow>	North America	Birds	69/28	9	9	8	Density	127
<tblrow>	North America	Bird	75/21	1	1	1	Spring Phenology & Range Shift	128
<tblrow>	North America	Bird	76/26	1	0	0	Spring Phenology	129
<tblrow>	North America	Bird	78/20	1	1	1	Density	130
<tblrow>	North America	Bird	78/17	1	1	1	Density	131
<tblrow>	North America	Bird	80/20	1	1	1	Spring Phenology	132
<tblrow>	North	Mammals	65/24	4	4	4	Range Shift	133

<tblrow>	America North America	Mammal	76/24	1	1	1	Spring Phenology	129
<tblrow>	Northern Hemisphere	Tree	1881/100	Many	Many	Many	Morphology	134
<tblrow>	North America	Forbs	25/68	15	6	6	Spring Phenology	126
<tblrow>	North America	Plants	59/35	1	1	1	Spring Phenology	135
<tblrow>	North America	Tree	74/21	2	2	?	Morphology	136
<tblrow>	North America	Plants	78/13	Many	Many	Many	Spring Phenology	137
<tblrow>	Northern Hemisphere	Plants	81/11	Many	Many	Many	Spring Phenology	138 , 139
<tblrow>	North America	Sedges	83/16	1	1	?	Density	140
<tblrow>	North America	Grass	83/16	2	2	?	Density	140
<tblrow>	North America	Forbs	83/16	Many	Many	?	Density	140
<tblrow>	Russia	Birds	?/20	3	3	3	Spring Phenology	141
<tblrow>	Pacific Ocean	Fish	66/22	1	1	?	Return Rate	142
<tblrow>	North Sea	Phytoplankton	00/94	16	16	16	Range Shifts	143

<sup> Appendix 3: Information from 61 studies addressing changes in spring phenology since 1950. Only species or populations with a change of at least 1 day per decade or 1°C are listed here. Included are the taxa of the species examined, location and latitude of the study, scientific name of the species, number of years spanned by the data, correlation coefficients (when provided or information available to calculate the coefficient in the citation), P value of the correlation coefficients (when provided in the citation), sign of the relationship between species trait and year, the number of days of change either in 10 years or per 1°C warming, type of change observed and citation(s). An unknown value is indicated by “?”.

<tblrow>	Taxa	Location	Latitude	Species	# Years	Corr. Coef.	P	Sign	Amount of Change	Type of Change	Citation
<tblrow>	Invert	Europe	54.0	<i>Vanessa atalanta</i>	23	-0.63	<0.001	-	-15.8 days in 10 yr	Emergence Date	22
<tblrow>	Invert	Europe	54.0	<i>Polygonia c-album</i>	23	-0.60	<0.01	-	-13.2 days in 10 yr	Emergence Date	22
<tblrow>	Invert	Europe	54.0	<i>Inachis io</i>	23	-0.60	<0.01	-	-12.8 days in 10 yr	Emergence Date	22
<tblrow>	Inverts	Europe	52.5	Many	20	-0.58	0.000	-	-11.6 days in 10 yr	Peak Abundance	18
<tblrow>	Invert	Europe	54.0	<i>Lysandra bellargus</i>	23	-0.39	<0.05	-	-11.2 days in 10 yr	Emergence Date	22
<tblrow>	Invert	Europe	54.0	<i>Cynthia cardui</i>	23	-0.22	>0.05	-	-8.3 day in 10 yr	Emergence Date	22
<tblrow>	Invert	Europe	54.0	<i>Anthocharis cardamines</i>	23	-0.71	<0.001	-	-7.6 days in 10 yr	Emergence Date	22
<tblrow>	Invert	Europe	54.0	<i>Clossiana euphrosyne</i>	23	-0.52	<0.01	-	-6.7 days in 10 yr	Emergence Date	22
<tblrow>	Invert	Europe	54.0	<i>Pieris napi</i>	23	-0.57	<0.01	-	-6.6 days in 10 yr	Emergence Date	22
<tblrow>	Invert	Europe	54.0	<i>Pyrgus malvae</i>	23	-0.53	<0.01	-	-6.0 days in 10 yr	Emergence Date	22
<tblrow>	Invert	Europe	54.0	<i>Gonepteryx</i>	23	-0.49	<0.05	-	-5.3 days in	Emergence	22

<tblrow>	Invert	Europe	54.0	<i>rhamni</i> <i>Pararge aegeria</i>	23	-0.36	>0.05	-	10 yr -5.2 days in 10 yr	Date Emergence Date	22
<tblrow>	Invert	Europe	54.0	<i>Erynnis tages</i>	23	-0.41	<0.05	-	-5.1 days in 10 yr	Emergence Date	22
<tblrow>	Invert	Europe	54.4	<i>Sialis lutaria</i>	30	?	?	-	-5 days in 10 yr	Emergence Date	95
<tblrow>	Invert	Europe	54.0	<i>Melanargia galathea</i>	23	-0.48	<0.05	-	-4.6 days in 10 yr	Emergence Date	22
<tblrow>	Invert	Europe	54.0	<i>Aphantopus hyperantus</i>	23	-0.48	<0.05	-	-4.6 days in 10 yr	Emergence Date	22
<tblrow>	Invert	Europe	54.0	<i>Argynnis paphia</i>	23	-0.35	>0.05	-	-4.4 days in 10 yr	Emergence Date	22
<tblrow>	Invert	Europe	54.0	<i>Callophrys rubi</i>	23	-0.48	<0.05	-	-4.3 days in 10 yr	Emergence Date	22
<tblrow>	Invert	Europe	52.0	Caterpillar	23	?	<0.05	-	-3.9 days in 10 yr	Peak Abundance	16, 17
<tblrow>	Invert	Europe	54.0	<i>Ochlodes venata</i>	23	-0.33	>0.05	-	-3.7 days in 10 yr	Emergence Date	22
<tblrow>	Invert	Europe	54.0	<i>Limenitis camilla</i>	23	-0.26	>0.05	-	-3.1 days in 10 yr	Emergence Date	22
<tblrow>	Invert	Europe	54.0	<i>Celastrina argiolus</i>	23	0	>0.05	-	-2.9 days in 10 yr	Emergence Date	22
<tblrow>	Invert	Europe	54.0	<i>Drepanosiphum platanoidis, Elatobium abietinum, Microlophium</i>	25	?	0.0001	-	-2.6 days in 10 yr	Peak Abundance	14

				<i>carnosum,</i>							
				<i>Periphyllus</i>							
				<i>testudinace</i>							
				<i>us,</i>							
				<i>Phorodon</i>							
				<i>humuli</i>							
<tblrow>	Invert	Europe	54.0	<i>Aglais</i>	23	0	>0.05	-	-2.5 days in	Emergence	22
				<i>urticae</i>					10 yr	Date	
<tblrow>	Invert	Europe	52.5	<i>Pyronia</i>	14	?	0.009	-	-2.4 days in	Emergence	19
				<i>tithonus</i>					10 yr	Date	
<tblrow>	Invert	Europe	41.6	Many	49	?	?	-	-2.2 days in	Emergence	13
									10 yr	Date	
<tblrow>	Invert	Europe	54.0	<i>Maniola</i>	23	-0.10	>0.05	-	-2.0 days in	Emergence	22
				<i>jurtina</i>					10 yr	Date	
<tblrow>	Invert	Europe	54.0	<i>Clossiana</i>	23	0	>0.05	-	-1.8 days in	Emergence	22
				<i>selene</i>					10 yr	Date	
<tblrow>	Invert	Europe	54.0	<i>Quercusia</i>	23	0	>0.05	-	-1.7 days in	Emergence	22
				<i>quercus</i>					10 yr	Date	
<tblrow>	Invert	Europe	54.0	<i>Pyronia</i>	23	0	>0.05	-	-1.6 days in	Emergence	22
				<i>tithonus</i>					10 yr	Date	
<tblrow>	Invert	Europe	54.0	<i>Thymelicus</i>	23	0	>0.05	-	-1.4 days in	Emergence	22
				<i>sylvestris</i>					10 yr	Date	
			54.0								
<tblrow>	Invert	Europe		<i>Coenonym</i>	23	0	>0.05	-	-1.0 days in	Emergence	22
				<i>pha</i>					10 yr	Date	
				<i>pamphilus</i>							
<tblrow>	Invert	Europe	54.0	<i>Aricia</i>	23	0	>0.05	+	2.2 days in	Emergence	22
				<i>agestis</i>					10 yr	Date	
<tblrow>	Invert	Europe	54.0	<i>Lasiommat</i>	23	0	>0.05	+	2.9 days in	Emergence	22
				<i>a megera</i>					10 yr	Date	

<tblrow>	Invert	Europe	54.0	<i>Pieris rapae</i>	23	0.17	>0.05	+	3.6 days in 10 yr	Emergence Date	22
<tblrow>	Invert	Europe	54.0	<i>Pieris brassicae</i>	23	0	>0.05	+	3.7 days in 10 yr	Emergence Date	22
<tblrow>	Invert	Europe	54.0	<i>Myzus persicae</i>	28	?	<0.05	-	-9 days per °C	Peak Abundance	15
<tblrow>	Invert	Europe	54.0	<i>Sitobion avenae</i>	28	?	<0.05	-	-7 days per °C	Peak Abundance	15
<tblrow>	Invert	Europe	54.0	<i>Metopolophium dirhodum</i>	28	?	<0.05	-	-6 days per °C	Peak Abundance	15
<tblrow>	Invert	Europe	54.0	<i>Brachycaudus helichrysi</i>	28	?	<0.05	-	-5 days per °C	Peak Abundance	15
<tblrow>	Invert	Europe	54.0	<i>Elatobium abietinum</i>	28	?	<0.05	-	-3 days per °C	Peak Abundance	15
<tblrow>	Zooplankton	North Pacific Ocean	50.0	<i>Neocalanus plumchrus</i>	27	0.9	<0.05	-	-22 days in 10 yr	Peak Biomass	85
<tblrow>	Fish	Europe	59.0	<i>Abramis brama</i>	45	?	?	-	-1.5 days in 10 yr	Spawning Date	100
<tblrow>	Fish	Europe	59.0	<i>Esox lucius</i>	45	?	?	-	-1.1 days in 10 yr	Spawning Date	100
<tblrow>	Amphib	Europe	54.0	<i>Triturus vulgaris</i>	17	-0.78	<0.001	-	-7.8 days in 10 yr	Breeding Date	26
<tblrow>	Amphib	Europe	54.0	<i>Bufo calamita</i>	17	-0.71	<0.01	-	-7.1 days in 10 yr	Breeding Date	26
<tblrow>	Amphib	Europe	54.0	<i>Triturus helveticus</i>	17	-0.6	<0.02	-	-6.0 days in 10 yr	Breeding Date	26

<tblrow>	Amphib	Europe	54.0	<i>Triturus cristatus</i>	17	-0.59	<0.02	-	-5.9 days in 10 yr	Breeding Date	26
<tblrow>	Amphib	Europe	54.0	<i>Rana kl. esculenta</i>	17	-0.58	<0.05	-	-5.8 days in 10 yr	Breeding Date	26
<tblrow>	Amphib	North America	42.6	<i>Bufo fowleri</i>	19	0.44	0.08	+	6.3 days in 10 yr	Breeding Date	71
<tblrow>	Amphib	Europe	54.0	<i>Rana temporaria</i>	17	?	>0.05	-	-2.0 days in 10 yr	Breeding Date	26
<tblrow>	Bird	North America	58.4	<i>Chen caerulescens</i>	19	?	<0.05	-	-14 days in 10 yr	Laying Date	74
<tblrow>	Bird	Europe	52.5	<i>Ficedula hypoleuca</i>	21	?	<0.001	-	-11.0 days in 10 yr	Laying Date	46
<tblrow>	Bird	Australia	-39.0	<i>Eudiptula minor</i>	22	-0.5	<0.05	-	-9 days in 10 yr	Laying Date	9
<tblrow>	Bird	Europe	51.9	<i>Lanius collurio</i>	18	-0.61	0.007	-	-3.4 days in 10 yr	Arrival Date	47
<tblrow>	Birds	Europe	54	<i>Columba oenas</i>	25	?	<0.05	+	??	Laying Date	42, 40
<tblrow>	Birds	Europe	54	Haematopus ostralegus, Numenius arquata, Tringa totanus, Cinclus cinclus, Troglodytes troglodytes,	25	?	<0.05	20 -	-8.8 days in 10 yr	Laying Date	42, 40

				Aegithalos caudatus, Sitta europaea, Sturnus vulgaris, Anthus trivialis, Phoenicuru s phoenicuru s, Sylvia communis , S. atricapilla, Phylloscop us sibilatrix, P. collybita, P. trochilus, Pica pica, Corvus corone, Fringilla coelebs, Carduelis chloris, Miliaria calandra, <i>Bucephala clangula</i>							
<tblrow>	Bird	Europe	54.1	25	-0.64	0.006	-	-8.8 days in 10 yr	Laying Date	41	
<tblrow>	Bird	North	50.9	25	?	?	-	-5.4 days in	Hatching	76	

		America		<i>Ptychorampus</i>				10 yr	Date		
<tblrow>	Bird	North America	50.9	<i>Cerorhinca monocerata</i>	25	?	?	-	-7.5 days in 10 yr	Hatching Date	76
<tblrow>	Bird	North America	50.9	<i>Fratercula cirrhata</i>	25	?	?	-	-8.8 days in 10 yr	Hatching Date	76
<tblrow>	Bird	North America	34.7	<i>Picoides borealis</i>	19	-0.52	<0.05	-	-2.0 days in 10 yr	Laying Date	77
<tblrow>	Bird	North America	50.9	<i>Uria aalge</i>	25	?	?	-	-24 days in 10 yr	Hatching Date	76
<tblrow>	Bird	North America	71.2	<i>Cepphus grylle</i>	21	?	?	-	-5 days in 10 yr	Laying Date	128
<tblrow>	Bird	North America	38.9	<i>Turdus migratorius</i>	26	-0.32	0.11	-	-8.4 days in 10 yr	Spring Arrival	129
<tblrow>	Bird	Europe	57.9	<i>Tringa nebularia</i>	19	?	?	-	-6 days in 10 yr	Laying Date	104
<tblrow>	Bird	North America	64.0	<i>Xema sabini</i>	20	?	?	-	-5 days in 10 yr	Breeding Date	132
<tblrow>	Bird	Europe	51.8	<i>Parus major</i>	27	-0.3	0.003	-	-4.4 days in 10 yr	Breeding Date	38
<tblrow>	Birds	Europe	52.6	<i>Riparia riparia</i>	54	?	<0.05	-	-4.2 days in 10 yr	Spring Arrival	28, 29
<tblrow>	Bird	Europe	52.0	<i>Parus major</i>	23	?	0.33	-	-3.9 days in 10 yr	Breeding Date	16, 17
<tblrow>	Bird	North American	31.9	<i>Aphelocoma ultramarina</i>	28	-0.15	0.05	-	-3.7 days in 10 yr	Breeding	75
<tblrow>	Bird	Europe	69.0	<i>Ficedula hypoleuca</i>	22	-0.39	0.07	-	-3.6 days in 10 yr	Breeding Date	33, 34

<tblrow>	Bird	Europe	52.2	<i>Ficedula hypoleuca</i>	24	-0.58	<0.01	-	-3.1 days in 10 yr	Breeding Date	43
<tblrow>	Bird	North America	49.0	<i>Tachycineta bicolor</i>	33	-0.64	0.001	-	-3.0 days in 10 yr	Breeding	73
<tblrow>	Bird	Europe	59.0	<i>Alauda arvensis</i>	45	?	?	-	-3.4 days in 10 yr	Spring Arrival	100
<tblrow>	Bird	Europe	59.0	<i>Motacilla alba</i>	45	?	?	-	-2.8 days in 10 yr	Spring Arrival	100
<tblrow>	Bird	Europe	51.7	<i>Sitta europaea</i>	26	-0.56	<0.01	-	-2.7 days in 10 yr	Hatching Date	36
<tblrow>	Bird	Europe	52.2	<i>Parus caeruleus</i>	26	-0.46	<0.05	-	-2.4 days in 10 yr	Hatching Date	36
<tblrow>	Bird	Europe	52.2	<i>Parus major</i>	26	-0.49	0.01	-	-2.4 days in 10 yr	Hatching Date	36
<tblrow>	Bird	Europe	47.7	<i>Acrocephalus scirpaceus</i>	37	?	?	-	-2.2 days in 10 yr	Spring Arrival	31
<tblrow>	Bird	Europe	52.2	<i>Ficedula hypoleuca</i>	26	-0.53	<0.01	-	-2.0 days in 10 yr	Hatching Date	37
<tblrow>	Bird	Europe	48.6	<i>Hirundo rustica</i>	37	?	?	+	1.8 days in 10 yr	Spring Arrival	30
<tblrow>	Bird	Europe	41.6	Many	49	?	?	+	3.1 days in 10 yr	Spring Arrival	13
<tblrow>	Bird	Europe	50.8	<i>Phylloscopus trochilus</i>	31	?	<0.05	-	-1.8 days per °C	Spring Arrival	28 , 29
<tblrow>	Birds	Europe	52.6	Unspecified	54	?	<0.05	21 -	?	Spring Arrival	28 , 29
<tblrow>	Birds	Europe	50.8	Unspecified	31	?	<0.05	28 -	?	Spring	28 , 29

<tblrow>	Birds	Europe	52.6	Unspecified	54	?	>0.05	32 –	?	Arrival Spring Arrival	28 , 29
<tblrow>	Birds	Europe	50.8	Unspecified	31	?	>0.05	39 –	?	Spring Arrival	28 , 29
<tblrow>	Birds	Europe	50.8	Unspecified	31	?	<0.05	4+	?	Spring Arrival	28 , 29
<tblrow>	Birds	Europe	52.6	Unspecified	54	?	>0.05	2 +	?	Spring Arrival	28 , 29
<tblrow>	Birds	Europe	50.8	Unspecified	31	?	>0.05	18 +	?	Spring Arrival	28 , 29
<tblrow>	Bird	Russia	55.0	<i>Cuculus canorus</i>	20	?	?	–	?	Breeding Date	141
<tblrow>	Bird	Russia	55.0	<i>Sturnus vulgarius</i>	20	?	?	–	?	Spring Arrival	141
<tblrow>	Bird	Russia	55.0	<i>Alauda arvensis</i>	20	?	?	–	?	Breeding Date	141
<tblrow>	Bird	North America	42.0	<i>Seiurus motacilla</i>	42	?	>0.05	–	?	Arriving time	126
<tblrow>	Bird	North America	42.0	<i>Vireo solitarius</i>	42	?	>0.05	–	?	Arriving time	126
<tblrow>	Birds	Europe	54.0	30 species	25	?	>0.05	30–	?	Laying Date	39 , 40
<tblrow>	Birds	Europe	54.0	20 species	25	?	<0.05	20–	?	Laying Date	39 , 40
<tblrow>	Birds	Europe	54.0	14 species	25	?	>0.05	14+	?	Laying Date	39 , 40
<tblrow>	Bird	Europe	54.0	1 species	25	?	<0.05	+	?	Laying Date	39 , 40
<tblrow>	Mamma l	North America	38.9	<i>Marmota flaviventris</i>	24	-0.48	0.03	–	-9.6 days in 10 yr	Emergence Date	129
<tblrow>	Grass	Europe	52.3	Many	31	?	?	–	-3.4 days in 10 yr	Pollinating	116
<tblrow>	Plants	Europe	41.6	Many	49	?	?	–	-3.3 days in	Budding	13

<tblrow>	Forb	Europe	46.0	<i>Taraxacum officinale</i>	30	?	?	-	10 yr -2.4 days in 10 yr	Date Flowering Date	62
<tblrow>	Forb	Europe	59.0	<i>Anemone nemorosa</i>	45	?	?	-	-2.9 days in 10 yr	Flowering Date	100
<tblrow>	???	Europe	54.0	60 Species	47	?	<0.05	-	?	Flowering Date	56, 57
<tblrow>	???	Europe	54.0	171 Species	47	?	>0.05	-	?	Flowering Date	56, 57
<tblrow>	???	Europe	54.0	10 Species	47	?	<0.05	+	?	Flowering Date	56, 57
<tblrow>	???	Europe	54.0	84 Species	47	?	>0.05	+	?	Flowering Date	56, 57
<tblrow>	Plants	Europe	47.0	<i>Corylus avellana</i> , <i>Anemone nemorosa</i> , <i>Aesculus hippocastanum</i> , <i>Larix decidua</i> , <i>Taraxacum sp.</i> , <i>Sambucus nigra</i> , <i>Tilia platyphyllos</i> , <i>Tilia cordata</i>	48	?	<0.05	-	-11.6 days in 10 yr	Leaf Unfolding & Flowering Date	113
<tblrow>	Forb	Europe	49.5	<i>Galanthus nivalis</i>	45	?	?	-	-3.7 days in 10 yr	Flowering Date	115
<tblrow>	Plants	North	42.0	Many	13	-0.66	0.009	-	-10 days in	Spring	137

<tblrow>	Plants	America Northern Hemisphere	57.5	Many	11	?	?	-	10 yr -7 days in 10 yr	Green Spring Greening	138 , 139
<tblrow>	Plants	Europe	54.0	Many	20	?	?	-	?	Budding Date	69
<tblrow>	Vascular Plants	Europe	55.0	Many	35	?	?	-	-2.1 days in 10 yr	Leaf Unfolding	58 , 59 , 60
<tblrow>	Plants	North America	42.0	<i>Syringa vulgaris</i>	35	?	<0.05	-	-1.8 days in 10 yr	Leaf Unfolding	135
<tblrow>	Bush	Europe	59.0	<i>Syringa vulgaris</i>	45	?	?	-	-2.4 days in 10 yr	Flowering Date	100
<tblrow>	Bush	Europe	49.5	<i>Forsythia</i> sp.	45	?	?	-	-3.4 days in 10 yr	Flowering Date	115
<tblrow>	Bush	North America	40.0	<i>Lonicera tatarica</i> & <i>L. korolkowii</i>	27	?	?	-	-3.8 days in 10 yr	Flowering Date	82
<tblrow>	Bush	North America	40.0	<i>Syringa vulgaris</i>	38	?	?	-	-2.0 days in 10 yr	Flowering Date	82
<tblrow>	Tree	Europe	51.3	<i>Betula pubescens</i> & <i>Prunus avium</i> & <i>Sorbus aucuparia</i> & <i>Ribes alpinum</i>	10	?	?	-	-8 days in 10 yr	Leaf Unfolding	60
<tblrow>	Tree	Europe	42.5	<i>Salix chrysochom</i>	11	0.36	<0.05	-	-5.9 days in 10 yr	Flowering Date	119

				<i>a</i>							
<tblrow>	Tree	Europe	59.0	<i>Malus domestica</i>	45	?	?	–	-1.4 days in 10 yr	Flowering Date	100
<tblrow>	Tree	Europe	59.0	<i>Padus racemosa</i>	45	?	?	–	-1.9 days in 10 yr	Flowering Date	100
<tblrow>	Tree	Europe	42.5	<i>Robinia pseudoacacia</i>	11	-0.34	<0.05	–	-7.7 days in 10 yr	Flowering Date	119
<tblrow>	Tree	Europe	42.5	<i>Myrtus communis</i>	11	-0.71	<0.05	–	-14.3 days in 10 yr	Flowering Date	119
<tblrow>	Tree	Europe	49.5	<i>Malus domestica</i>	45	?	?	–	-1.2 days in 10 yr	Flowering Date	115
<tblrow>	Tree	Europe	49.5	<i>Prunus avium</i>	45	?	?	–	-1.3 days in 10 yr	Flowering Date	115
<tblrow>	Tree	North America	41.6	<i>Ulmus americana</i>	42	?	<0.01	–	-1.9 days in 10 yr	Flowering Date	81
<tblrow>	Tree	Europe	43.6	<i>Olea europaea</i>	13	?	?	–	-3.3 days in 10 yr	Floweriing Date	64
<tblrow>	Forb	Europe	51.0	<i>Galanthus nivalis</i>	46	?	<0.05	–	-4.8 days in 10 yr	Flowering	54
<tblrow>	Shrub	Europe	51.0	<i>Forsythia suspensa</i>	46	?	<0.05	–	-4.8 days in 10 yr	Flowering	54
<tblrow>	Tree	Europe	51.0	<i>Betula pendula</i>	46	?	<0.05	–	-3.4 days in 10 yr	Leaf Unfolding	54
<tblrow>	Tree	Europe	51.0	<i>Aesculus hippocastanum</i>	46	?	<0.05	–	-3.3 days in 10 yr	Leaf Unfolding	54
<tblrow>	Tree	Europe	51.0	<i>Prunus avium</i>	46	?	<0.05	–	-1.0 days in 10 yr	Flowering	54
<tblrow>	Tree	Europe	51.0	<i>Fagus sylvatica</i>	46	?	<0.05	–	-1.7 days in 10 yr	Leaf Unfolding	54

<tblrow>	Tree	Europe	51.0	<i>Malus domestica</i>	46	?	<0.05	-	-0.8 days in 10 yr	Flowering	54
<tblrow>	Tree	Europe	51.0	<i>Picea abies</i>	46	?	<0.05	-	-2.2 days in 10 yr	Needle Emergence	54
<tblrow>	Tree	Europe	51.0	<i>Tilia platyphyllos</i>	46	?	<0.05	-	-2.4 days in 10 yr	Flowering	54
<tblrow>	Tree	Europe	51.0	<i>Sambucus nigra</i>	46	?	<0.05	-	-3.0 days in 10 yr	Fruit Ripening	54
<tblrow>	Tree	Europe	51.0	<i>Quercus robur</i>	46	?	<0.05	-	-2.3 days in 10 yr	Leaf Unfolding	54
<tblrow>	Tree	Europe	52.0	<i>Quercus robur</i>	23	?	?	-	?	Bud Burst	17, 17
<tblrow>	Tree	Asia	36.0	<i>Camellia japonica</i>	38	-0.91	<0.05	-	-7.2 days per °C	Flowering Date	90
<tblrow>	Tree	Europe	47.0	<i>Robinia pseudoacacia</i>	12	-0.78	<0.01	-	-6.8 days per °C	Flowering Date	67
<tblrow>	Tree	Asia	36.0	<i>Prunus mume</i>	38	-0.85	<0.05	-	-6.8 days per °C	Flowering Date	90
<tblrow>	Tree	Asia	36.0	<i>Taraxacum</i> species	38	-0.67	<0.05	-	-4.5 days per °C	Flowering Date	90
<tblrow>	Tree	Asia	36.0	<i>Ginkgo biloba</i>	38	?	?	-	-4.2 days per °C	Flowering Date	90
<tblrow>	Tree	Asia	36.0	<i>Hydrangea macrophylla</i>	38	?	?	-	-4.1 days per °C	Flowering Date	90
<tblrow>	Tree	Asia	37.0	<i>Prunus yedoensis</i>	37	?	?	-	-4 days per °C	Flowering Date	91
<tblrow>	Tree	Asia	36.0	<i>Prunus yedoensis</i>	38	-0.78	<0.05	-	-3.7 days per °C	Flowering Date	90
<tblrow>	Tree	Asia	36.0	<i>Wistaria</i>	38	?	?	-	-3.2 days	Flowering	90

			36.0	<i>floribunda</i>				per °C	Date		
<tblrow>	Tree	Asia		<i>Rhododendron kaempferi</i>	38	?	?	-	-3.1 days per °C	Flowering Date	90

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