

The following supplement accompanies the article

Linking phenological shifts to demographic change

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Supplement

Table S1. A summary of the 62 studies that link phenology and demography included in this review. ‘Data type’ denotes observational (O) or experimental (E) studies, and ‘Study type’ denotes the three approaches described in the results. Symbols for shifts are: advances or increases (+), no change (0), delays or decreases (-), not assessed due to complex outcomes (NA). Fecundity represents annual reproductive output or reproductive probability. Note that for vital rates, shifts of multiple types are possible within the same species if different vital rates show contrasting changes, or if the same vital rate shows contrasting changes across sites.

Taxonomic group	Data type	Phenol. shift	Shifts in vital rates				Population shift	Study type	Reference
			Survival	Fecundity	Growth	Recruitment			
Plant	E	+		+			Vital rate	Aerts R et al (2004) Global Change Biol 10:1599-1609	
Plant	E	+		+, 0			Vital rate	Alatalo JM & Totland Ø(1997) Global Change Biol 3:74-79	
Bird	O	-		-			Vital rate	Ambrosini R et al (2011) Clim Res 50:43-50	
Insect	E	+		NA			Vital rate	van Asch M et al (2007) Global Change Biol 13:1596-1604	
Bird	O	+				-	Population	Both C et al (2006) Nature 441:81-83	

Taxonomic group	Data type	Phenol. shift	Shifts in vital rates				Population shift	Study type	Reference
			Survival	Fecundity	Growth	Recruitment			
Bird	O	+		+				Vital rate	Both C & Visser M (2005) Global Change Biol 11:1606-1613
Mammal	O	+	-					Vital rate	Burthe S et al (2011) J Anim Ecol 80:1134-1144
Reptile	O	+			0			Vital rate	Cadby CD et al (2010) Integr Zool 5:164-175
Plant	O	+		+	+			Vital rate	Cleland EE et al (2012) Ecology 93:1765-1771
Mammal	O	+					-	Population	Cordes LS & Thompson PM (2013) Proc R Soc B 280:20130847
Bird	O	+					0	Population	Dálba L et al (2010) Ibis 152:19-28
Plant	E	-		-				Vital rate	Dorji T et al (2013) Global Change Biol 19:459-472
Bird	O	+	+				+	Combined	Doxa A et al (2012) Auk 129:753-762
Plant	E	+			0			Vital rate	Dunnett NP et al (1999) Funct Ecol 13:388-395
Plant	O	+		+			+	Combined	Ehrlén J & Münzbergová Z (2009) Am Nat 173:819-830
Bird	O	+					0	Population	Filippi-Codaccioni O et al (2010) J Ornithol 151:687-694
Bird	O	+	0	0				Vital rate	Fletcher K et al (2013) Ibis 155:456-463
Bird	O	+			-			Vital rate	Gaston AJ et al (2005) J Anim Ecol 74:832-841
Plant	E	-	-	0	-	-	-	Combined	Griffith AB & Loik ME (2010) Oecologia 164:821-832
Insect	E	+	0	0				Vital rate	Guo K et al (2009) Global Change Biol 15:2539-2548
Plant	E	+			+			Vital rate	Hollister RD et al (2005) Ecology 86:1562-1570

Taxonomic group	Data type	Phenol. shift	Shifts in vital rates				Population shift	Study type	Reference
			Survival	Fecundity	Growth	Recruitment			
Plant	O	+					+	Population	Hulme P (2011) New Phytol 189:272-281
Bird	O	+		+				Vital rate	Husek P & Adamik P (2008) J Ornithol 149:97-103
Plant	O	+	-	-		+	+	Combined	Hutchings M (2010) J Ecol 98:867-878
Fish	O	+					0	Population	Kovach RP et al (2013) PlosOne 8:e53087
Plant	O	+		-				Vital rate	Kudo G et al (2004) Ecol Res 19:255-259
Bird	O	-		-				Vital rate	Laaksonen T et al (2006) Oikos 114:277-290
Mammal	O	-	-	-			-	Combined	Lane JE et al (2012) Nature 489:554-557
Bird	O	-					-	Population	Lee S-D et al (2011) Biol Conserv 144:2182-2187
Bird	O	+		0				Vital rate	Lehikoinen A et al (2006) Global Change Biol 12:1355-1365
Mammal	O	+		0				Vital rate	Lucan R K et al (2013) J Zool 290:151-159
Bird	O	+	-	-			-	Combined	Ludwig GX et al (2006) Proc R Soc B 273:2009-2016
Bird	O	+		-	0			Vital rate	Matthysen E et al (2011) Global Change Biol 17:1-16
Bird	O	+					0	Population	Mitrus C et al (2005) Ornis Fenn 82:13-19
Mammal	O	+	0		0			Vital rate	Moyes K et al (2011) Global Change Biol 17:2455-2469
Mammal	O	+	+		+		+	Combined	Ozgul A et al (2010) Nature 466:482-485
Plant	O	+	0	0	0		0	Combined	Picó XF et al (2002) Ecology

Taxonomic group	Data type	Phenol. shift	Shifts in vital rates				Population shift	Study type	Reference
			Survival	Fecundity	Growth	Recruitment			
								83:1991-2004	
Mammal	O	+	-					Vital rate Post E & Forchhammer MC (2008) Phil Trans R Soc B 363:2369-2375	
Plant	E	+		0				Vital rate Price MV & Waser NM (1998) Ecology 79:1261-1271	
Bird	O	-		0				Vital rate Proffitt FM et al (2004) Ibis 146:78-86	
Bird	O	+				-		Population Saino N et al (2011) Proc R Soc B 278:835-842	
Bird	O	+		0				Vital rate Sanz JJ (2002) Global Change Biol 8:409-422	
Bird	O	+		-				Vital rate Sanz JJ (2003) Ecography 26:45-50	
Bird	O	+		+				Vital rate Schaefer T et al (2006) J Ornithol 147:47-56	
Plant	E	+		-	-			Vital rate Scheepens JF & Stöckling J (2013) Oecologia 171:679-691	
Bird	O	-		-				Vital rate Senapathi D et al (2011) Proc R Soc B 278:3184-3190	
Plant	E	+			+, -			Vital rate Stenström A & Jonsdottir (2005) Nordic J Bot 24:355-371	
Plant	E	+			+			Vital rate Suzuki S & Kudo G (1997) Global Change Biol 3:108-115	
Bird	O	+		+				Vital rate Torti VM & Dunn (2005) Oecologia 145:486-495	
Bird	O	+		+				Vital rate Townsend AK (2013) PlosOne 8:e59467	
Bird	O	+		-				Vital rate Visser ME et al (2003) Proc R Soc Lond B 270:367-372	
Bird	O	+		0			+	Combined Wesolowski T (2011) J Ornithol 152:319-329	
Insect	O	+					0	Population Westgarth-Smith AR et al (2012)	

Taxonomic group	Data type	Phenol. shift	Shifts in vital rates				Population shift	Study type	Reference
			Survival	Fecundity	Growth	Recruitment			
								Ecol Entom 37:221-232	
Bird	O	+		+		0	0	Combined Wilson S & Arcese P (2003) Proc Natl Acad Sci USA 100:11139-11142	
Bird	O	+		+				Vital rate Winkel W & Hudde H (1997) J Avian Biol 28:187-190	
Bird	O	+		0				Vital rate Winkler DW et al (2002) Proc Natl Acad Sci USA 99:13595-13599	
Plant	E	+		+				Vital rate Wipf S (2010) Plant Ecol 207:53-66	
Plant	E	+		-	-			Vital rate Wipf S et al (2009) Clim Change 94:105-121	
Insect	E	+	+	0				Vital rate Wu TU et al (2012) PlosOne 7:e41764	
Bird	O	+					-	Population Zduniak P et al (2010) Clim Res 42:217-222	
Plant	E	+		+	+			Vital rate Zelikova TJ et al (2013) Ecol Evol 3:1374-1387	
Reptile	O	+		+				Vital rate Zhang F et al (2009) Anim Conserv 12:128-137	