Oikos

O18320

Pakanen, V.-M., Rönkä, A., Belda, E. J., Luukkonen, A., Kvist; L. and Koivula, K. 2010. Impact of dispersal status on estimates of local population growth rates in a Temminck's stint *Calidris temminckii* population. – Oikos 119: 1493–1503.

Appendix 1

Table 1. Year specific data used to calculate parameters.

Year	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	Mean	SE
Number of chicks / breeding attempt	3.02	2.32	0.92	1.52	**0.55**	**1.5**	**0.62**	**0.72**	**0.44**	**1.06**	**0.74**	1.7	1.17	0.8037	0.138
Number of recruited philopatric ind. born	2	5	1	2	**0**	**0**	1	1	2	3	2	6	0		
Number of philopatric ind.	0	1	2	6	6	10	6	6	6	6	6	9	17		
Number of philopatric ind. ringed	0	2	1	4	2	3	**0**	**0**	**0**	1	1	3	8		
Number of Immigrants males			4	20	10	29	27	22	18	20	20	22	18		
Number of Immigrants ringed males			4	17	2	19	10	6	3	8	6	10	7		
Number of males with unknown status	14	23	9	14	9	6	4	3	2	1	1	1	0		
Number of males with unknown status ringed	14	13	0	0	0	0	0	0	0	0	0	0	0		
Total number of males	14	24	15	40	25	45	37	31	26	27	27	32	35		
λ		1.714	0.625	2.667	0.625	1.800	**0.822**	**0.838**	**0.839**	**1.038**	**1.000**	**1.185**	**1.094**	0.974	0.054
% known to be philopatric		0.042	0.133	0.150	0.240	0.222	0.162	0.194	0.231	0.222	0.222	0.281	0.486	0.257	0.041

Modelling of juvenile survival 1998–2006, which was used in parameterising the matrix models.
Global model $\Phi(a_0/t, a_{1+}/c)\ p(a_0/t, a_{1+}/c)$, which included only age (a_0, a_{1+}) and time (t) for the juvenile class and constant (c) for adults fits the data ($p = 0.308$) with $\hat{c} = 1.16$. The best model with strong support (Δ-AIC = 7.66) for juvenile survival was constant (Table 2, model 1), which gave an estimate of 0.088 ± 0.026 for juvenile survival.

Table 2. Modelling results for juvenile survival for 1998 to 2006.

No.	Juvenile survival probability	Recapture probability	QAICc	Δ-QAICc	QAICc weight	Model likelihood	k	Deviance
1	a_0/c,a_{1+}/c	a_0/c,a_{1+}/c	155.10	0.00	0.963	1.000	4	46.1
2	a_0/t,a_{1+}/c	a_0/c,a_{1+}/c	162.76	7.66	0.021	0.022	10	40.8
3	a_0/c,a_{1+}/c	a_0/t,a_{1+}/c	163.42	8.32	0.015	0.016	10	41.5
4	a_0/t,a_{1+}/c	a_0/t,a_{1+}/c	169.43	14.32	0.001	0.001	15	36.1

Appendix 2

The structures of the matrix models (A, B, C and D with stages and transition elements) and their corresponding life cycle graphs are presented in boxes 1 to 4. All matrices are prebreeding models including three age classes. Juvenile survival is included in the fecundity transitions. Age variation in fecundities results from breeding probabilities. Adult survival includes two age classes with model averaged estimates from the capture-recapture analysis. Life cycle graphs illustrate the classes and transitions of the matrix. Nodes indicate age (1, 2 and 3+) and/or stage classes (P = philopatric individuals, I = immigrants). Arcs indicate transitions (fecundities, survival and immigration) between stages and/or age classes. The fecundities (F^i) express the average number of one year old birds in year t+1 per individual in age class i and are calculated following

$F_i = ½ (Pi \times b \times S_{(JUV)}) + Fn \times ½ (b \times S_{(JUV)})$

See Table A for description and estimates of the parameters. The S express adult survival rates from stage i to stage i+1. Modelling of immigration (I) is explained for each model.

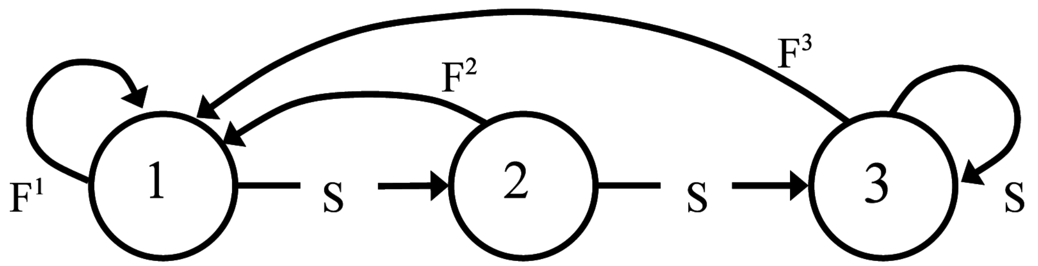
Table A. Means and standard errors for parameter estimates used in matrices.

Estimates for fecundity (F)	Estimate	Estimate derived from
Breeding success/breeding attempt (b):	0.804 ± 0.138	Appendix 1
Breeding probability (P1)	0.445	Results, Juv.survival and breeding prob.
Breeding probability (P2)	0.864	Results, Juv.survival and breeding prob.
Breeding probability (P3)	1.00	Results, Juv.survival and breeding prob.
Breeding probability, immigrants	1.00	Results, Juv.survival and breeding prob.
Juvenile survival ($S_{(juv)}$)	0.088 ± 0.026	Appendix 1
Prop. of females/male territory (Fn)	0.40 ±0.036	Results, Fecundity
Adult survival (S)	0.71 ± 0.031	Results, Model averaging
Philopatric individuals (S_P^1):	0.89 ± 0.048	Results, Model averaging
Philopatric individuals (S_P^{2+}):	0.88 ± 0.037	Results, Model averaging
Immigrants (S_I^1):	0.62 ± 0.050	Results, Model averaging
Immigrants (S_I^{2+}):	0.64 ± 0.040	Results, Model averaging
Immigration rate (I)	0.157 ± 0.025	Results, immigration rate

Box 1. Model A describes dynamics with average values of survival and fecundity and it does not include immigration.

Parameters
Adult survival (S)
In fecundities (F):
Juvenile survival ($S_{(juv)}$)
Breeding probabilities (P1 to P3)
Breeding success (b)
Prop. of females/male territory (Fn)

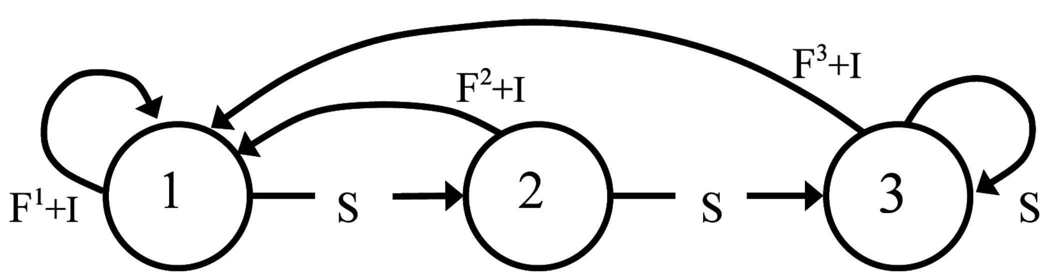
$$\begin{bmatrix} N_1 \\ N_2 \\ N_3 \end{bmatrix}_{t+1} = \begin{bmatrix} F^1 & F^2 & F^3 \\ S & 0 & 0 \\ 0 & S & S \end{bmatrix} \begin{bmatrix} N_1 \\ N_2 \\ N_3 \end{bmatrix}_{t}$$



Box 2. Model B represents an open population, which includes immigration in form of per capita rate. Immigration (I) is modelled by adding it to the fecundity transition, i.e. F + I.

Parameters:
Adult survival (S)
Immigration rate (I)
In fecundities (F):
Juvenile survival ($S_{(juv)}$)
Breeding probabilities (P1 to P3)
Breeding success (b)
Prop. of females/male territory (Fn)

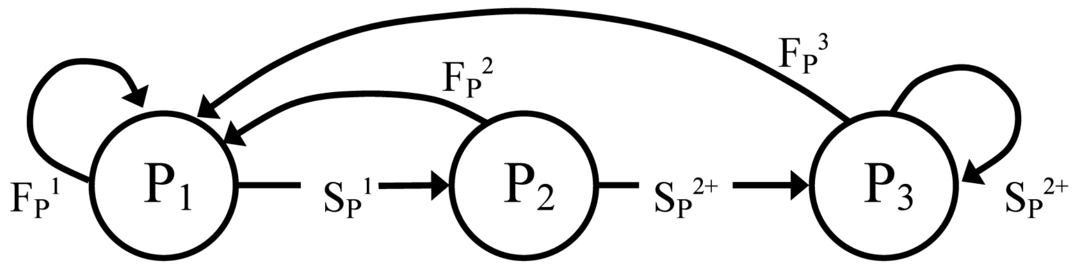
$$\begin{bmatrix} N_1 \\ N_2 \\ N_3 \end{bmatrix}_{t+1} = \begin{bmatrix} F^1+I & F^2+I & F^3+I \\ S & 0 & 0 \\ 0 & S & S \end{bmatrix} \begin{bmatrix} N_1 \\ N_2 \\ N_3 \end{bmatrix}_{t}$$



Box 3. Model C is equivalent to model A, but represents only the dynamics of philopatric individuals without immigration.

Parameters:
Adult survival of philopatric ind. (S_{P1})
Adult survival of philopatric ind. (S_{P2+})
In fecundities (F):
Juvenile survival ($S_{(juv)}$)
Breeding probabilities (P1 to P3)
Breeding success (b)
Prop. of females/male territory (Fn)

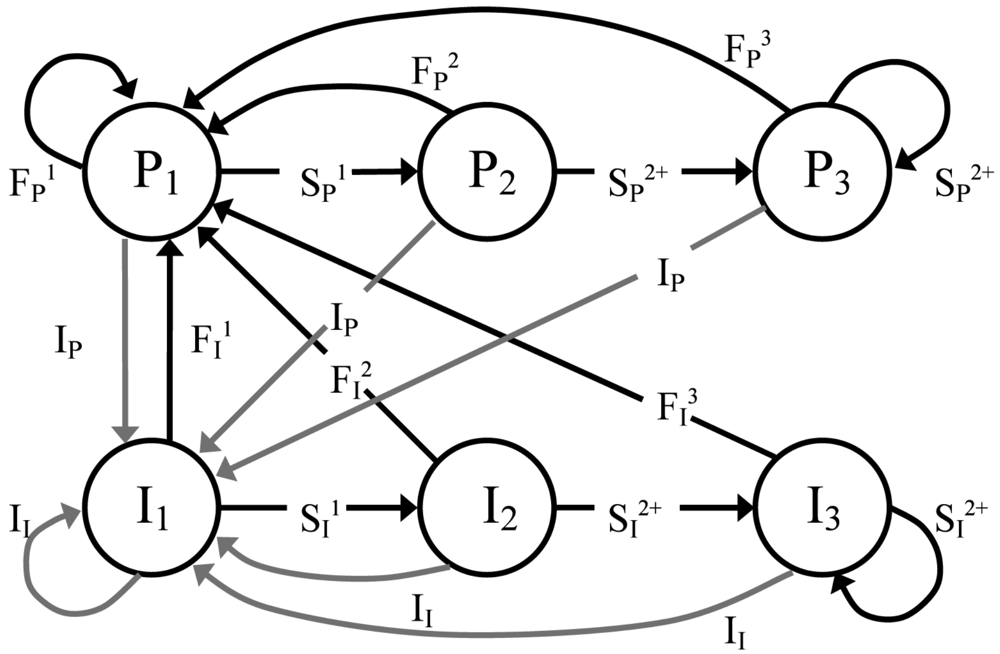
$$\begin{bmatrix} N_{P1} \\ N_{P2} \\ N_{P3} \end{bmatrix}_{t+1} = \begin{bmatrix} F_P^{1} & F_P^{2} & F_P^{3} \\ S_P^{1} & 0 & 0 \\ 0 & S_P^{2+} & S_P^{2+} \end{bmatrix} \begin{bmatrix} N_{P1} \\ N_{P2} \\ N_{P3} \end{bmatrix}_{t}$$



Box 4. Model D describes dynamics that considers immigrant status in life history traits, where philopatric individuals and immigrants represent different stages. The upper left side of the matrix describes dynamics of the philopatric individuals and the lower right side that of the immigrants. When immigration is zero, the matrix reduces to model C. The first row of the matrix includes fecundities (i.e. local recruitment, additions to the first philopatric group), which are produced in both philopatric and immigrant categories. The fourth row of the matrix describes additions to the first immigrant group. Immigration rates (I) (in gray) are expressed as per capita immigration rates. Therefore, in the fourth row of the matrix, immigration transitions are included to all stages (including immigrants (I_I) and philopatric individuals (I_P)). Subscripts in survival (S), fecundity (F) and immigration (I) transitions denote from which state is the transition starts, i.e. either philopatric individuals (P) or immigrants (I). Superscripts indicate age specific estimates.

Parameters:
Adult survival, philopatric ind.(S_P^1)
Adult survival, philopatric ind.(S_P^2)
Adult survival, immigrants (S_I^1)
Adult survival, immigrants (S_I^{2+})
Immigration rate (I)
In fecundities (F):
Juvenile survival ($S_{(juv)}$)
Breeding probabilities (P1 to P3)
Breeding probabilities (Immigrants)
Breeding success (b)
Prop. of females/male territory (Fn)

$$\begin{bmatrix} N_{P1} \\ N_{P2} \\ N_{P2} \\ N_{I1} \\ N_{I2} \\ N_{I3} \end{bmatrix}_{t+1} = \begin{bmatrix} F_P^1 & F_P^2 & F_P^3 & F_I^1 & F_I^2 & F_I^3 \\ S_P^1 & 0 & 0 & 0 & 0 & 0 \\ 0 & S_P^{2+} & S_P^{2+} & 0 & 0 & 0 \\ I_P & I_P & I_P & I_I & I_I & I_I \\ 0 & 0 & 0 & S_I^1 & 0 & 0 \\ 0 & 0 & 0 & 0 & S_I^{2+} & S_I^{2+} \end{bmatrix} \begin{bmatrix} N_{P1} \\ N_{P2} \\ N_{P2} \\ N_{I1} \\ N_{I2} \\ N_{I3} \end{bmatrix}_t$$



Appendix 3

A list of avian studies that compare adult survival in relation to dispersal behaviour excluding the studies concerning the transient phase. The 'Effect'-column indicates the superior group (P = philopatric individuals, I = immigrant or nd = no difference). Method column expresses how dispersers and non-dispersers have been categorized (S, immigrant or philopatric at the breeding site; DS, dispersers or non-dispersers from the natal or breeding site; D, dispersal distance). Mode column indicates natal (N) or breeding dispersal (B). Periods column refers to the time scale for which survival is estimated for (Y = year, S = breeding season). Migration column indicates migration status of the species. Geo column indicates the geographic nature of the study site, i.e. continuous mainland (M) or isolated (I). Sex column indicates sex (male = M, female = F). References are listed below.

Species	Effect	Method	Mode	Period	Migration	Geo	Sex	Ref.
Acrocephalus arundinaceus	P	S[a]	N	Y	yes	I	M	1.
Parus major[d]	P	S	N	Y	partial	I	F	2A.
Parus major[d]	P	S	N	Y	partial	I	F	2B.
Parus major	nd	S	N	Y	partial	M	M,F	3.
Melospiza melodia	I	S	N	Y	no	I	M	4.
Passer domestica[e]	I	S	N	Y	no	I	M,F	5.
Passer domestica[e]	nd[b]	S	N	Y	no	I	M,F	6.
Aegithalos caudatus	nd	S	N	Y	no	M	M,F	7.
Poecile montanus	nd	S	N	Y	no	M	M,F	8.
Cyanistes caeruleus	nd	S	N	Y	no	M	M,F	9.
Picoides borealis	nd	DS	N	Y	no	M	M,F	10.
Picoides borealis	P	S	B	Y	no	M	F	11.
Lagopus lagopus	nd	D	B	Y	no		M,F	12.
Aix sponsa	nd	D	B	Y	yes		F	13.
Dendragapus obscures	nd	DS	N	S	no		M,F	14.
Pica pica	nd	DS	N	Y	no		M,F	15.
Ficedula albicollis	P	D	B	Y	yes		F[c]	16.
Turdus merula	P	D	N	Y	partial		M	17.
Poecile palustris	I	D	B	Y	no		F	18.
Larus occidentalis	I	D	N	Y	yes		M	19.
Ficedula albicollis	nd	D	N	Y	yes		F	20.

a = immigrants categorised to either long or short distance, b = no significant difference found in survival but lifespan was longer for philopatric males, c = only previously successful females, d and e = same population.

References: Hansson et al. (2004) Evolution 58: 2546–2557, 2A. Verhulst and van Eck (1996) J. Evol. Biol. 9: 771–782, 2B. Postma and van Noordwijk (2005) Nature 433: 65–68, 3. Clobert et al. (1988) J. Anim. Ecol. 57: 287–306, 4. Marr et al. (2002) Evolution 56: 131–142, 5. Altwegg et al. (2000) J. Anim. Ecol. 69: 762–770, 6. Pärn et al. (2009) J. Anim. Ecol. 78: 1216–1225, 7. Maccoll and Hatchwell (2004) J. Anim. Ecol. 73: 1137–1148 , 8. Orell et al. (1999) J. Evol. Biol. 12: 283–295, 9. Juillard et al. (1996) Acta Oecol. 17: 487–501, 10. Pasinelli et al. (2004) Am. Nat. 164:660–669, 11. Daniels and Walters (2000) Ecology 81: 2473–2484, 12. Shiek and Hannon (1989) Oecologia 81: 465–472, 13. Hepp and Kennamer (1992) Auk 109: 812–818, 14. Hines (1986) Condor 88: 43–49, 15. Eden (1987) Ibis 129: 477–490, 16. Pärt and Gustafsson (1989) J. Anim. Ecol. 58: 305–320, 17. Greenwood and Harvey (1976) Ringing Migration 1: 75–77, 18. Nilsson (1989) J. Anim. Ecol. 58: 619–636, 19. Spear et al. (1998) J. Anim. Ecol. 67: 165–179. , 20. Pärt (1991) Am. Nat. 138: 790–796.