

Comparing the effects of release methods on survival of the Eurasian black vulture *Aegypius monachus* reintroduced in France

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Supplementary Material 1 Complete representation of the matrix framework used to estimate survival (Φ), resighting (P) and tag loss (Ψ) parameters for a reintroduced Eurasian black vulture *Aegypius monachus* population. The capture–recapture analysis used resighting data to account for tag loss, the banding status of individuals (plastic bands vs metal bands) and recovery data.

Initial State

to state	Alive plastic 1	Alive metal 2	Newly Dead 3
from state	1	0	0

Resighting P rates and recovery rate r

to state	Not observed	Alive plastic 1	Alive metal 2	Newly Dead 3
from state				
Alive plastic 1	1-P ¹	P ¹	0	0
Alive metal 2	1-P ²	0	P ²	0
Newly Dead 3	1-r	0	0	r
Dead	1	0	0	0

Tag loss Ψ

to state	Alive plastic 1	Alive metal 2	Newly Dead 3	Dead
from state				
Alive plastic 1	Ψ^{11}	1- Ψ^{11}	0	0
Alive metal 2	0	Ψ^{22}	0	0
Newly Dead 3	0	0	1	0
Dead	0	0	0	1

Survival rate Φ

to state	Alive plastic 1	Alive metal 2	Newly Dead 3	Dead
from state				
Alive plastic 1	Φ	0	1- Φ	0
Alive metal 2	0	Φ	1- Φ	0
Newly Dead 3	0	0	0	1
Dead	0	0	0	1

Supplementary Material 2

Parameter notation is defined as follows: the apparent annual survival probability (Φ^S_t) is the probability that an individual alive in state S at time t is still alive at time $t+1$; the resighting (P^Z_t) and dead recovery (r^Z_t) probabilities are the encounter probabilities that identify an individual in state Z at time t given that it has been encountered alive or dead, respectively; and the state transition probability (Ψ^{SZ}_t), i.e. tag loss, is the probability that an individual 'moves' from a banding state S at time t to a banding state Z at time $t+1$ conditional on its survival between t and $t+1$. The capture–recapture multi-state structure allows for the simultaneous estimation of Φ^S_t , P^Z_t , r^Z_t and Ψ^{SZ}_t .

Supplementary Table S1 Model selection in the preliminary analysis performed to identify the most likely age class pattern to use in the subsequent survival analysis of reintroduced black vultures.

Rank	Model	No. of parameters	Deviance	AICc	Δ AICc
1	Φ_{a4_5} Ψ_{band*a} $P_{t,both}$	36	649.09	728.77	
2	Φ_{a1_2} Ψ_{band*a} $P_{t,both}$	36	653.23	732.91	4.14
3	Φ_{a3_4} Ψ_{band*a} $P_{t,both}$	36	654.99	734.67	5.90
4	$\Phi_{a1_3_4}$ Ψ_{band*a} $P_{t,both}$	37	652.56	734.68	5.91
5	Φ_i Ψ_{band*a} $P_{t,both}$	35	659.24	736.48	7.71
6	Φ_t Ψ_{band*a} $P_{t,both}$	50	646.13	761.45	32.68
7	Φ_{a1_2*t} Ψ_{band*a} $P_{t,both}$	64	617.93	772.01	43.24
8	Φ_{a4_5*t} Ψ_{band*a} $P_{t,both}$	63	625.75	776.95	48.18
9	$\Phi_{a1_3_4*t}$ Ψ_{band*a} $P_{t,both}$	72	604.01	781.80	53.03
10	Φ_{a3_4*t} Ψ_{band*a} $P_{t,both}$	64	628.75	782.83	54.06

Supplementary Table S2 Notations and definitions for the age effect on survival (Φ) investigated in the preliminary analysis. Reference studies of given potential age class structure are also indicated.

Notation	Hypothesis definition	Reference
$a1_2$	1 year vs 2 years old	Schaub et al. (2009)
$a3_4$	1–3 years vs 4 years old	Sarrazin et al. (1994)
$a4_5$	1–4 years vs 5 years old	Oro et al. (2008)
$a1_3_4$	1 years vs 2–3 years old vs 4 years old	Authors (pers. obs.)