

Supplemental Information for:

Phenotypic and environmental correlates of natal dispersal movements in fragmented landscapes. Hugo Robles, Carlos Ciudad, Zeno Porro, Julien Fattebert, Gilberto Pasinelli, Matthias Tschumi, Marta Vila and Martin U. Grüebler

Appendix S2: Identification of the first emigration from the natal area and the end of the first phase of the transfer stage

We identified the onset of dispersal and the end of the transfer stage for each individual trajectory by combining experts' classifications and Hidden Markov Model (HMM) results (see table and figure below). We defined the onset of dispersal (OD) as the time of first emigration from the natal area, either as forays returning to the natal range or as permanent emigration with no return to the natal area. We defined the end of the first phase of the transfer stage (ET) as the stop of directed movements away from the natal nest, which will result in starting exploration of the surroundings of a new area after permanent emigration. Experts' classifications were conducted by four experts (JF, MUG, GP, HR) through (blind to each other) visual inspection of graphs of (i) movement trajectories, (ii) daily net distances from the natal nests, and (iii) daily step lengths (i.e., velocity) for each individual. All experts have extensive experience with tracking dispersal movements in a variety of bird species (e.g., red kites, little owls, middle spotted woodpeckers) and with interpreting movement patterns arising from tracking data. All experts have worked in different environments and institutions, therefore bringing together a suite of independent education and knowledge on the topic.

To identify each dispersal stage, HMMs used the switches between consecutive movement modes, which were classified as three types of movements: (i) fast, long-distance movements away from the natal range (red triangles in the figure below); (ii) slow, short-distance movements usually associated with encamped behaviour (white circles); and (iii) intermediate movements in distance and velocity likely associated with prospecting behaviour either before or after permanent emigration and transfer (green crosses). Because HMMs often failed to identify cut-off points for the dispersal stages ('NA' in the table below), but experts' classifications were highly congruent with each other (see table), we gave prevalent value to the experts when experts' classifications differed from those of HMMs. The highlighted columns (OD, PE and ET) in the table show the final classifications used for further analyses after considering experts' classifications and HMM results.

IndID	onset of dispersal (OD)						permanent emigration (PE)						end of transfer (ET)					
	JF	MG	GP	HR	HMM	OD	JF	MG	GP	HR	HMM	PE	JF	MG	GP	HR	HMM	ET
101	42	42	42	42	42	42	42	42	42	42	42	42	45	45	45	45	45	45
103	46	46	46	46	46	46	46	46	46	46	46	46	48	48	48	48	NA	48
105	40	50	50	50	50	50	56	56	56	56	56	56	NA	NA	NA	NA	NA	NA
106	40	40	40	40	40	40	40	40	40	40	40	40	42	44	42	42	44	42
111	42	42	32	42	42	42	50	50	50	50	50	50	51	51	51	50	51	51
203	NA	53	53	53	56	53	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
204	50	50	50	50	49	50	59	59	59	59	59	59	61	61	61	61	61	61
205	59	59	59	59	59	59	59	59	59	59	59	59	61	61	61	61	NA	61
207	40	40	40	40	40	40	43	43	43	43	43	43	NA	NA	NA	NA	NA	NA
208	49	46	49	46	46	46	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
209	49	49	49	49	49	49	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
211	51	51	51	51	51	51	51	51	51	51	51	51	52	52	53	52	NA	52
212	38	41	41	41	41	41	38	41	41	41	41	41	42	42	42	42	42	42
214	42	42	42	42	42	42	44	45	45	45	45	45	47	47	47	47	55	47
215	47	47	47	47	47	47	47	47	47	47	47	47	51	52	51	53	51	51
216	38	38	38	38	38	38	38	38	38	38	38	38	39	42	39	39	44	39
221	45	45	26	45	45	45	47	47	45	47	47	47	51	51	59	51	65	51
222	36	36	36	36	35	36	36	36	36	36	35	36	37	37	37	37	37	37
223	36	36	36	36	36	36	36	36	36	36	36	36	37	37	37	37	37	37
224	34	34	34	34	34	34	34	34	34	34	34	34	35	35	35	35	35	35
229	41	41	41	41	55	41	41	41	41	41	55	41	42	42	42	42	58	42
232	42	42	42	42	41	42	42	42	42	42	41	42	43	53	43	43	43	43
234	41	41	41	42	41	41	49	49	NA	49	42	49	50	50	NA	50	NA	50
235	40	40	40	40	40	40	40	40	40	40	40	40	44	43	43	43	45	43
247	42	42	42	42	42	42	42	42	42	42	42	42	44	44	44	44	54	44
249	44	44	44	44	44	44	44	44	44	44	44	44	45	45	45	45	53	45
539	36	36	36	36	54	36	36	36	36	36	54	36	37	37	37	37	61	37
706	45	45	45	45	45	45	51	51	51	51	51	51	54	57	57	57	71	57
709	47	47	47	47	47	47	47	47	47	47	47	47	49	49	49	49	49	49
711	44	44	44	44	44	44	44	44	44	44	44	44	47	47	47	48	NA	47
712	46	46	31	46	44	46	48	48	48	48	48	48	49	50	49	49	56	49
724	50	50	50	50	50	50	50	50	50	50	50	50	64	57	57	57	80	57
729	31	31	NA	31	31	31	46	46	26	46	45	46	NA	NA	NA	NA	NA	NA
730	30	30	30	30	30	30	43	43	43	43	43	43	47	47	47	47	47	47
8162	28	28	28	28	28	28	28	28	28	28	28	28	29	29	29	29	29	29
8174	28	NA	36	36	36	36	46	48	48	46	46	46	48	48	48	48	NA	48
8183	46	47	46	46	48	46	46	47	46	46	48	46	52	52	52	52	101	52
8184	46	46	46	46	45	46	46	46	46	46	45	46	50	50	50	50	47	50
8191	37	37	37	37	37	37	40	40	40	40	40	40	41	41	41	41	41	41
8196	38	38	38	38	38	38	38	38	38	38	38	38	40	39	39	39	43	39
8197	44	44	41	44	41	44	52	52	52	52	52	52	55	55	55	55	79	55

