Migratory connectivity analysis

by EURING Migration Atlas

Alcedo atthis **(EURING code 08310)**

1.1 Connectivity between individuals

The analysis evaluated 319 individuals (638 encounters) filtered from a total of 53477 records in the EURING databank which were considered for the Atlas. The species shows a significant connectivity from clustering, with a number of first-level clusters = 2 (Table 08310-1; Figure 08310-1).

Table 08310-1. Results from the migratory connectivity analysis. For each cluster, the degree of connectivity (r_M), its statistical significance (p-value) and 95% confidence interval limits are shown. When the p-value is less than or equal to 0.1, the degree of clustering structure (oasw) and the best number of clusters identified are reported.

Cluster name	Level of clustering	N individuals	Migratory connectivity (r_M)	p-value	Lower 95% confidence limit	Upper 95% confidence limit	Best number of clusters	oasw
0	0	319	0.948	0.001	0.912	0.977	2	0.614
1	1	252	0.902	0.001	0.844	0.955	4	0.563
2	1	67	0.945	0.001	0.832	1.000	8	0.705
11	2	34	0.928	0.001	0.851	0.981	2	0.667
12	2	95	0.717	0.001	0.568	0.821	6	0.508
13	2	82	0.888	0.001	0.864	0.986	7	0.510
14	2	41	0.646	0.001	0.400	0.911	5	0.458
21	2	10	-	-	-	-	-	-
22	2	6	-	-	-	-	-	-
23	2	12	-	-	-	-	-	-
24	2	13	-	-	-	-	-	-
25	2	14	-	-	-	-	-	-
26	2	1	-	-	-	-	-	-
27	2	6	-	-	-	-	-	-
28	2	5	-	-	-	-	-	-
111	3	31	0.976	0.001	0.899	1.000	8	0.480
112	3	3	-	-	-	-	-	-
121	3	25	0.201	0.101	0.047	0.587	-	-
122	3	25	0.577	0.001	0.357	0.800	8	0.299
123	3	9	-	-	-	-	-	-
124	3	1	-	-	-	-	-	-
125	3	4	-	-	-	-	-	-
126	3	31	0.034	0.340	-0.016	0.271	-	-
131	3	1	-	-	-	-	-	-
132	3	17	-	-	-	-	-	-
133	3	39	0.845	0.001	0.734	0.949	8	0.540
134	3	6	-	-	-	-	-	-

Cluster name	Level of clustering	N individuals	Migratory connectivity (r_M)	p-value	Lower 95% confidence limit	Upper 95% confidence limit	Best number of clusters	oasw
135	3	11	-	-	-	-	-	-
136	3	1	-	-	-	-	-	-
137	3	7	-	-	-	-	-	-

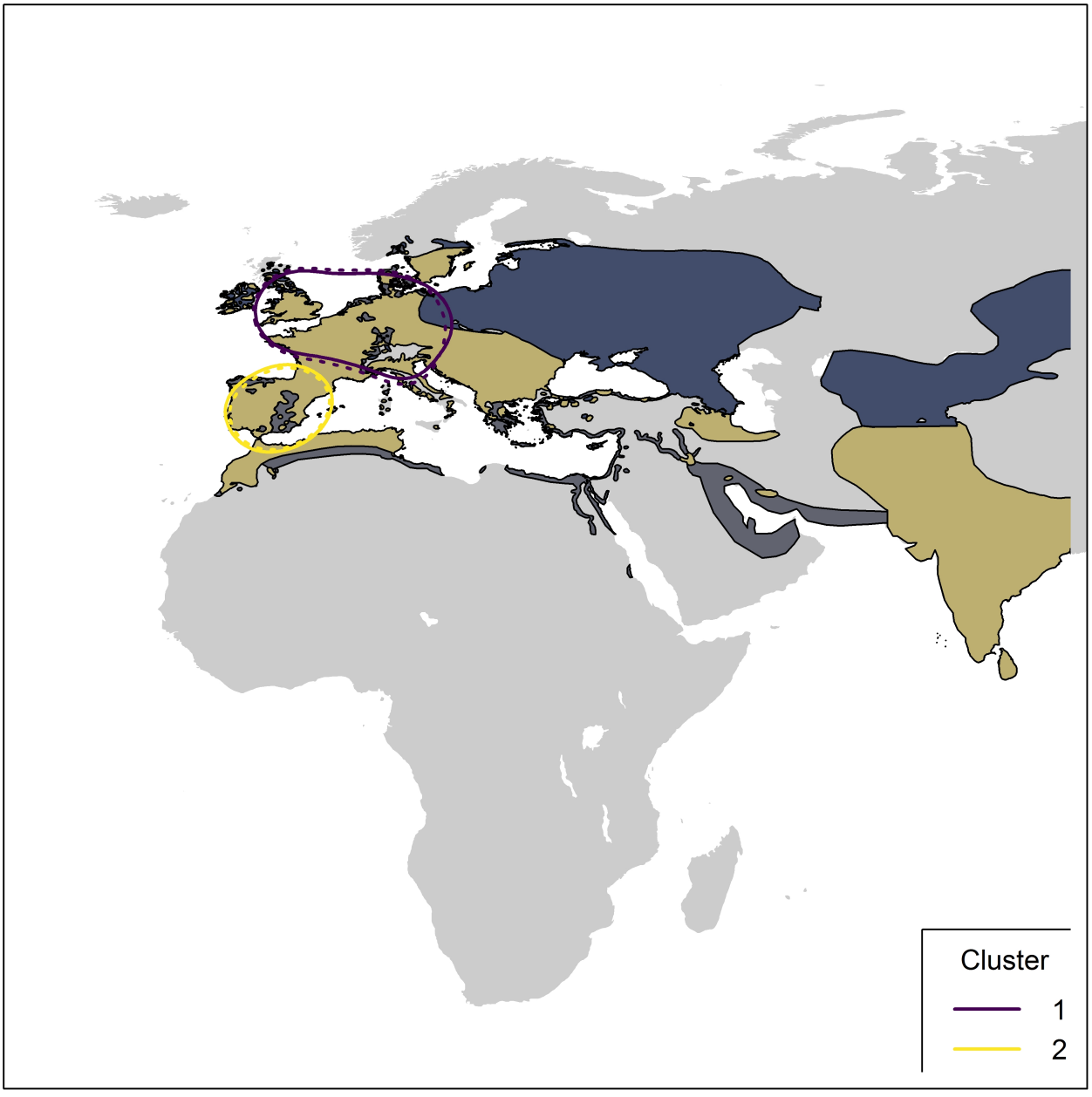

Figure 08310-1. Map showing 95% kernel contours of of first-level clusters identified by the migratory connectivity analysis, if any, or 95% kernel contours of all encounters, in case of no clustering structure. Solid lines indicate the clusters in the breeding range, dotted lines those in the non-breeding range. Different contour colours correspond to different clusters, as reported in legend. The species distribution range is also shown (breeding range: blue; non-breeding range: dark grey; resident range: beige; from BirdLife

International, 2019).

1.2 Sensitivity analysis

Results of power analysis and validation. Analyses at the species level were re-run on subsamples of individuals of decreasing size (100 repetitions per subsample size), according to simple random sampling of individuals (Figure 08310-2) and stratified sampling of individuals within the breeding range (Figure 08310-3) and the non breeding range (Figure 08310-4). For stratified sampling, we selected individuals with a probability inversely proportional to the number of observation in each country. Figures below report the results of the procedure.

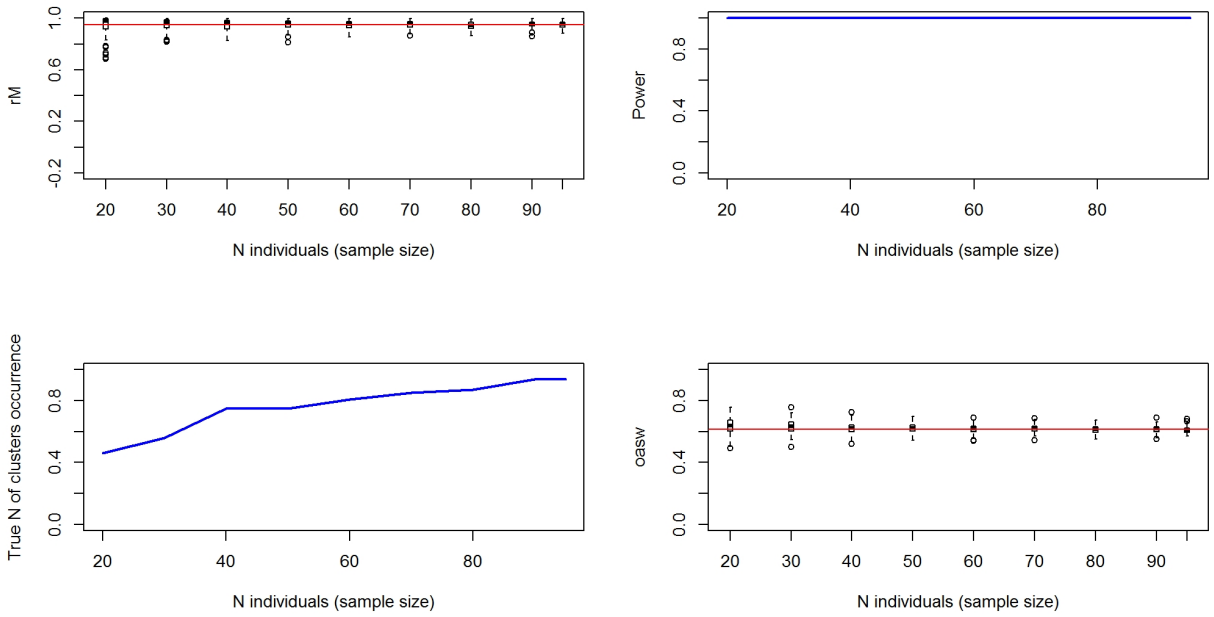

Figure 08310-2. Top left: simulated distribution (boxplots) and observed value (red line) of connectivity. Top right: Simulated power of the analysis (i.e. proportion of times the analyses on the subset of individuals was significant). Bottom left: Proportion of times the analysis provides the observed best number of cluster. Bottom right: simulated distribution (boxplots) and observed value (red line) of clustering intensity.

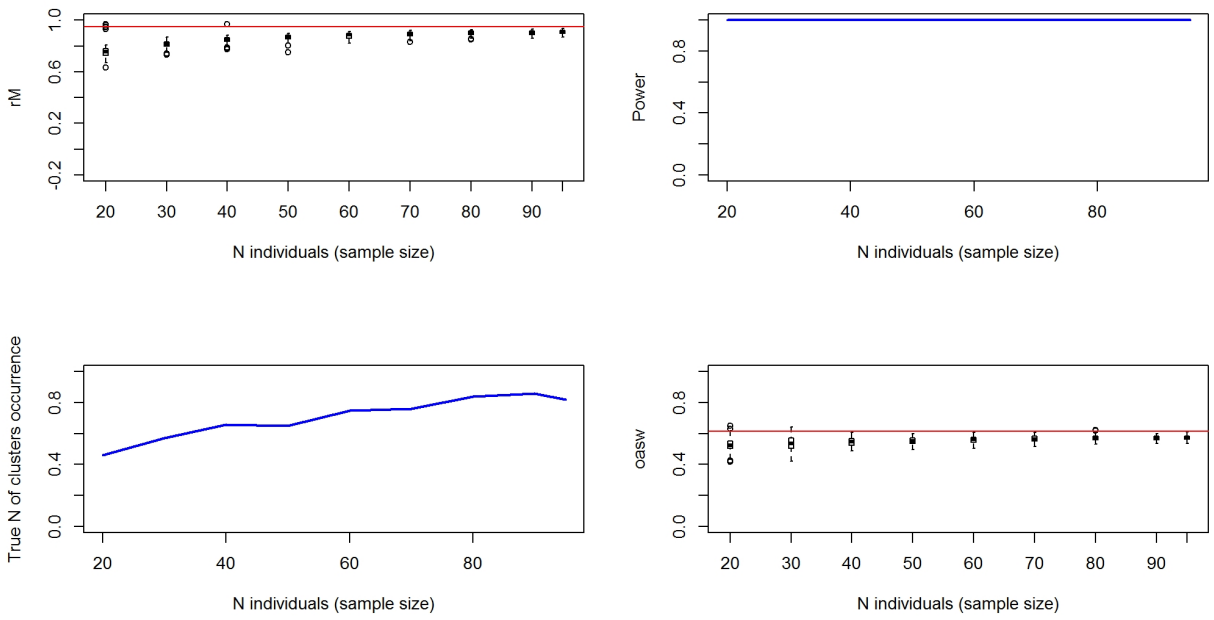

Figure 08310-3. Top left: simulated distribution (boxplots) and observed value (red line) of connectivity. Top right: Simulated power of the analysis. Bottom left: Proportion of times the analysis provides the observed best number of cluster. Bottom right: simulated distribution (boxplots) and observed value (red line) of clustering intensity.

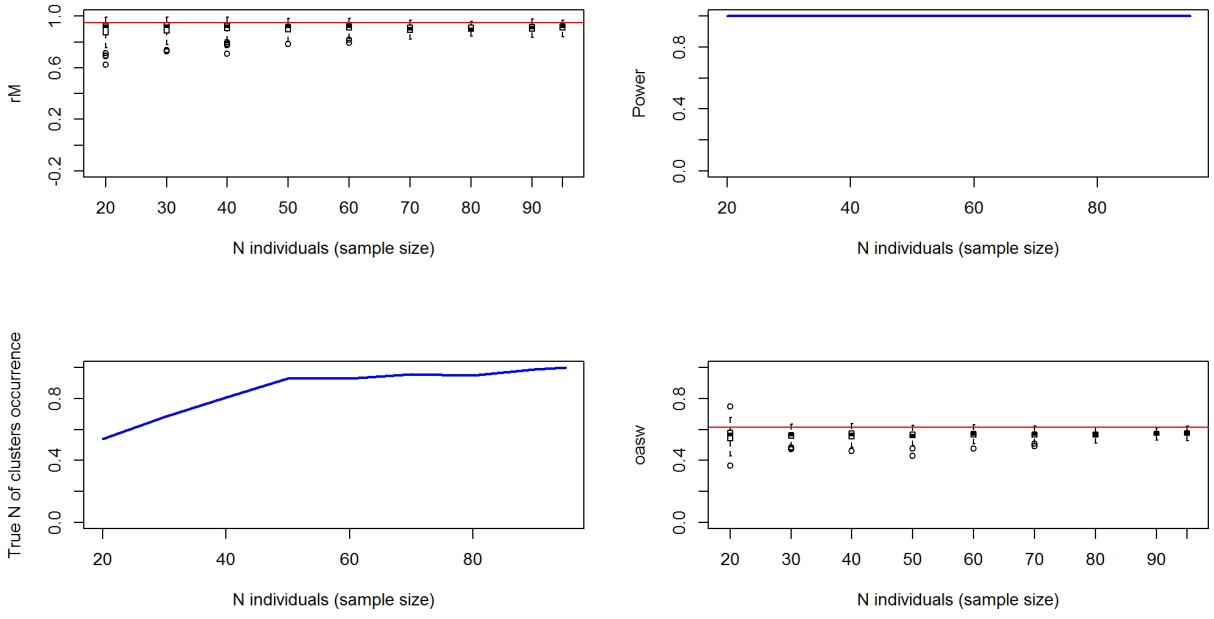

Figure 08310-4. Top left: simulated distribution (boxplots) and observed value (red line) of connectivity. Top right: Simulated power of the analysis. Bottom left: Proportion of times the analysis provides the observed best number of cluster. Bottom right: simulated distribution (boxplots) and observed value (red line) of clustering intensity.

The comparison between the bootstrapped distribution of r_M values from live recaptures and dead recoveries is not significant (p = 0.337); Figure 08310-5).

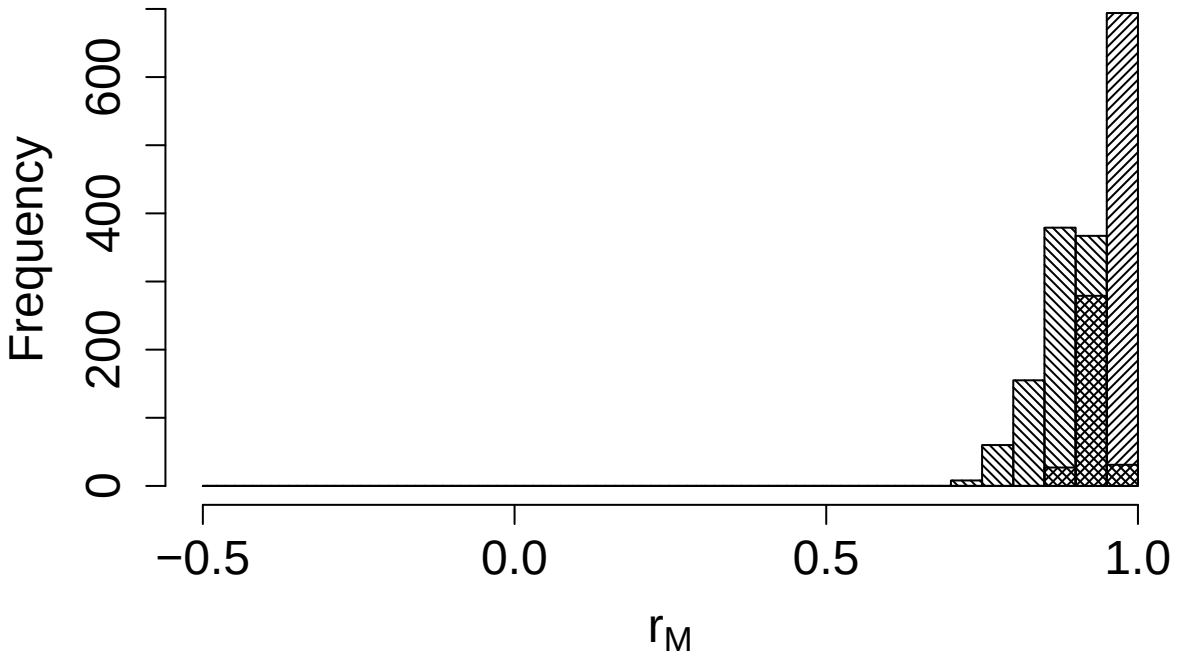

Figure 08310-5. Comparison between the bootstrapped distributions of connectivity value for alive recaptures (filling lines with angle=45°) and dead recoveries (filling lines with angle=375°).

2. Connectivity between pre-defined regions

The species shows high connectivity (MC = 0.945; MC = 0.945 when adjusted for absolute abundance) between 8 breeding regions and 7 non breeding regions (Table 08310-2; Figure 08310-6).

Table 08310-2. Transition probabilities between pre-defined regions. Estimated abundance (number of individuals) in each breeding region is also reported.

Breeding region	Abundance	Non breeding region	Transition probability
Central Europe	38009	Central Europe	0.824
Central Europe	38009	South-central Europe	0.012
Central Europe	38009	South-west Europe	0.047
Central Europe	38009	West Europe	0.118
East Europe	64213	North Europe	1.000
North Europe	1031	Central Europe	0.333
North Europe	1031	North Europe	0.667
North-west Europe	11599	North-west Europe	1.000
South-central Europe	24237	South-central Europe	1.000
South-east Europe	33924	South-east Europe	1.000

Breeding region	Abundance	Non breeding region	Transition probability
South-west Europe	62505	South-west Europe	1.000
West Europe	22507	Central Europe	0.075
West Europe	22507	South-west Europe	0.019
West Europe	22507	West Europe	0.906

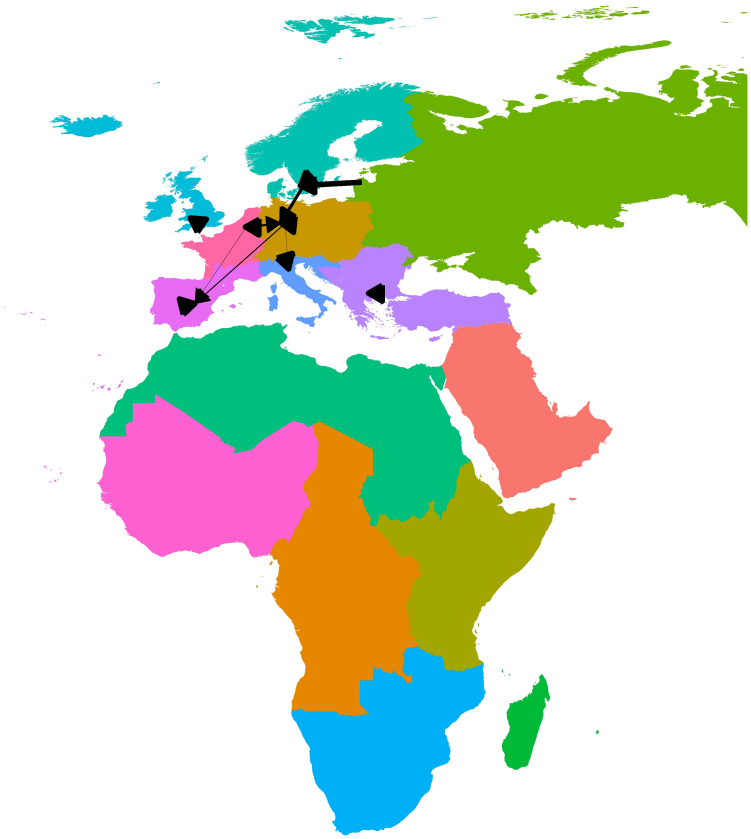

Figure 08310-6. Map showing pre-defined regions in different colours, with black arrows linking centroids of individual encounters in different regions. Arrow width is proportional to transition probability.

Reference

BirdLife International and Handbook of the Birds of the World (2019). Bird species distribution maps of the world. Version 2019.1. Available at http://datazone.birdlife.org/species/requestdis.