

# Migratory connectivity analysis

by EURING Migration Atlas

*Platalea leucorodia* (EURING code 01440)

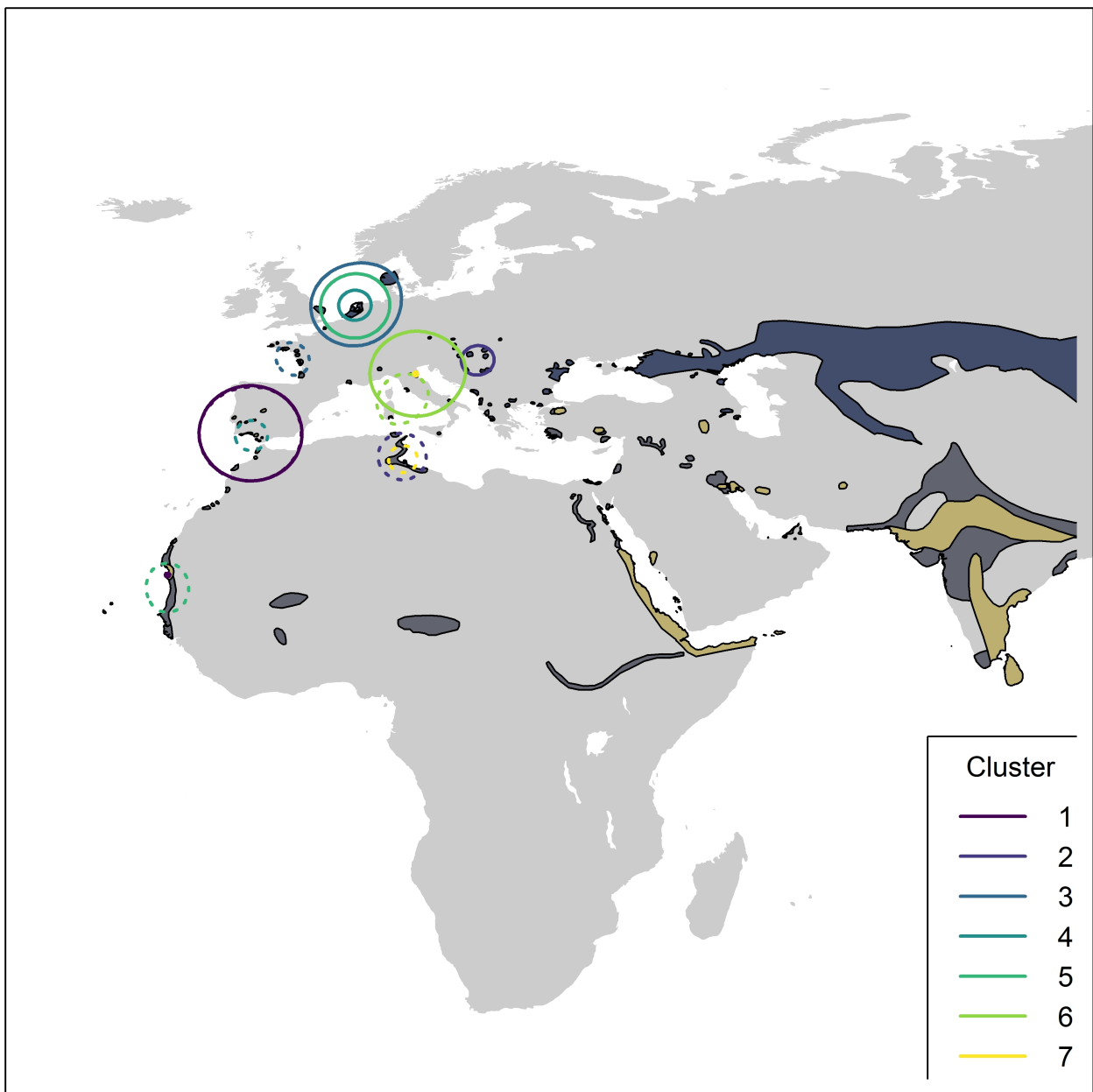
## 1.1 Connectivity between individuals

The analysis evaluated 817 individuals (1634 encounters) filtered from a total of 109915 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 = 7 (Table 01440-1; Figure 01440-1).

**Table 01440-1.** 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	817	0.268	0.001	0.234	0.309	7	0.755
1	1	33	0.979	0.001	0.928	1.000	2	0.956
2	1	130	0.054	0.132	-0.011	0.168	-	-
3	1	87	-0.016	0.541	-0.060	0.066	-	-
4	1	219	0.277	0.005	-0.013	0.568	2	0.819
5	1	179	-0.009	0.320	-0.033	0.035	-	-
6	1	120	0.253	0.002	0.017	0.436	8	0.927
7	1	49	0.403	0.029	-0.080	0.888	2	0.903
11	2	5	-	-	-	-	-	-
12	2	28	0.579	0.001	0.409	0.885	2	0.874
41	2	209	0.050	0.132	-0.036	0.165	-	-
42	2	10	-	-	-	-	-	-
61	2	3	-	-	-	-	-	-
62	2	2	-	-	-	-	-	-
63	2	1	-	-	-	-	-	-
64	2	2	-	-	-	-	-	-
65	2	68	0.560	0.001	0.309	0.760	2	0.809
66	2	41	0.229	0.023	-0.020	0.558	9	0.723
67	2	2	-	-	-	-	-	-
68	2	1	-	-	-	-	-	-
71	2	48	-0.026	0.506	-0.100	0.237	-	-
72	2	1	-	-	-	-	-	-
121	3	27	0.591	0.001	0.428	0.864	8	0.677
122	3	1	-	-	-	-	-	-
651	3	64	0.133	0.050	0.028	0.258	9	0.784
652	3	4	-	-	-	-	-	-
661	3	5	-	-	-	-	-	-

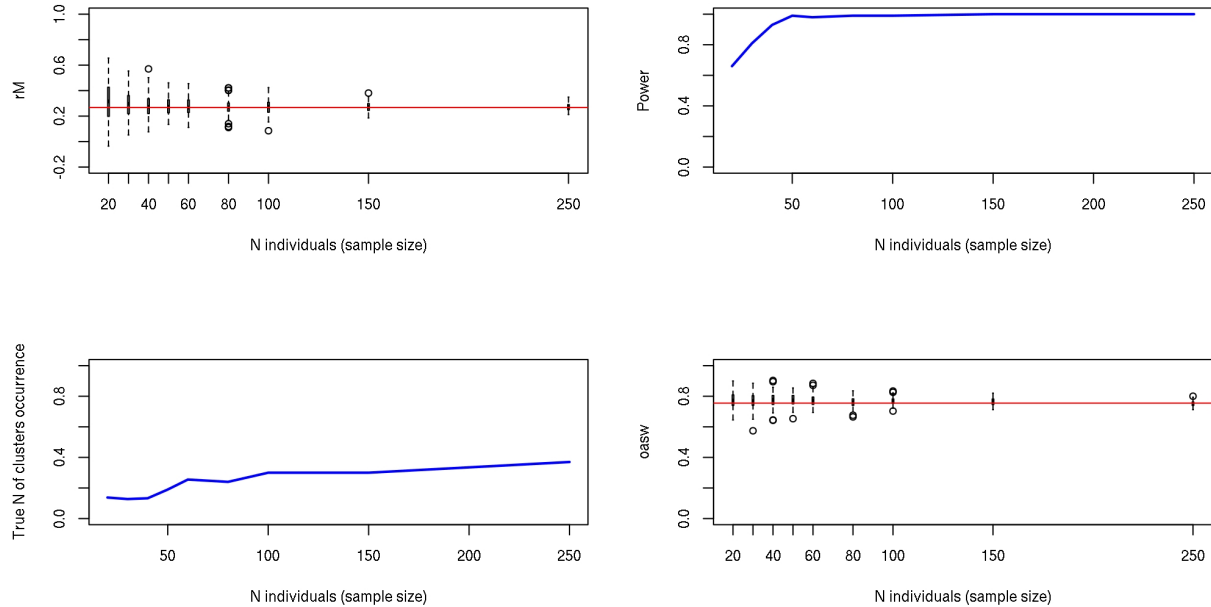
Cluster name	Level of clustering	N individuals	Migratory connectivity ( $r_M$ )	p-value	Lower 95% confidence limit	Upper 95% confidence limit	Best number of clusters	oasw
662	3	10	-	-	-	-	-	-
663	3	2	-	-	-	-	-	-
664	3	9	-	-	-	-	-	-
665	3	2	-	-	-	-	-	-
666	3	6	-	-	-	-	-	-
667	3	1	-	-	-	-	-	-
668	3	3	-	-	-	-	-	-
669	3	3	-	-	-	-	-	-



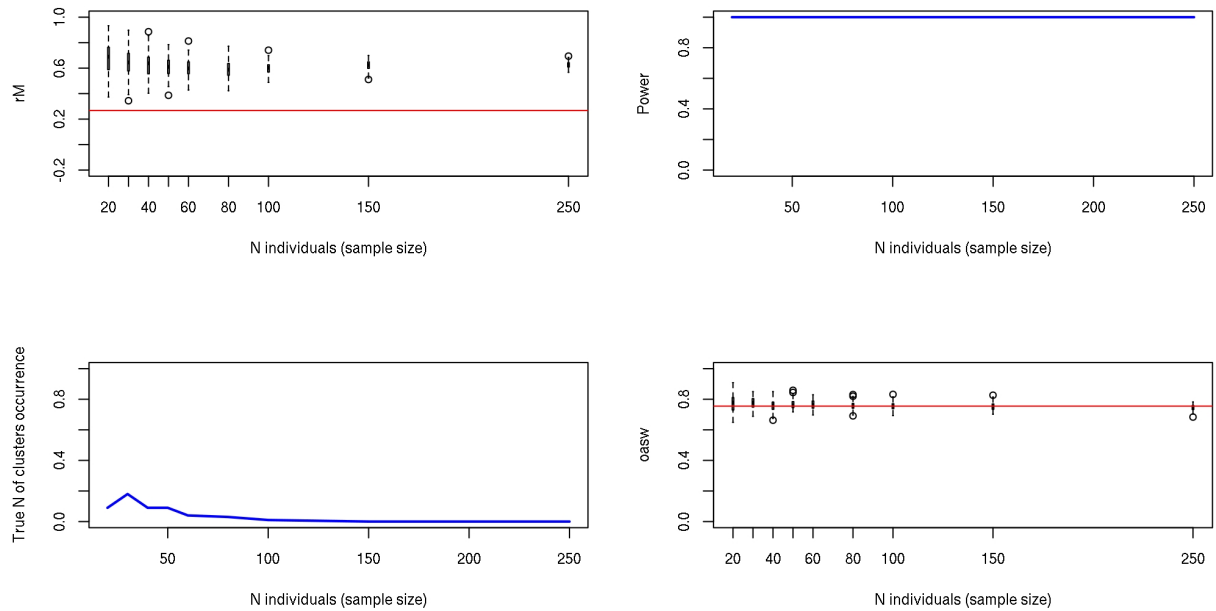
**Figure 01440-1.** Map showing 95% kernel contours of of first-level clusters identified by the migratory connectivity analysis, if any, or 95% kernel contours of all encounters, in case of no clustering structure. Solid lines indicate the clusters in the breeding range, dotted lines those in the non-breeding 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

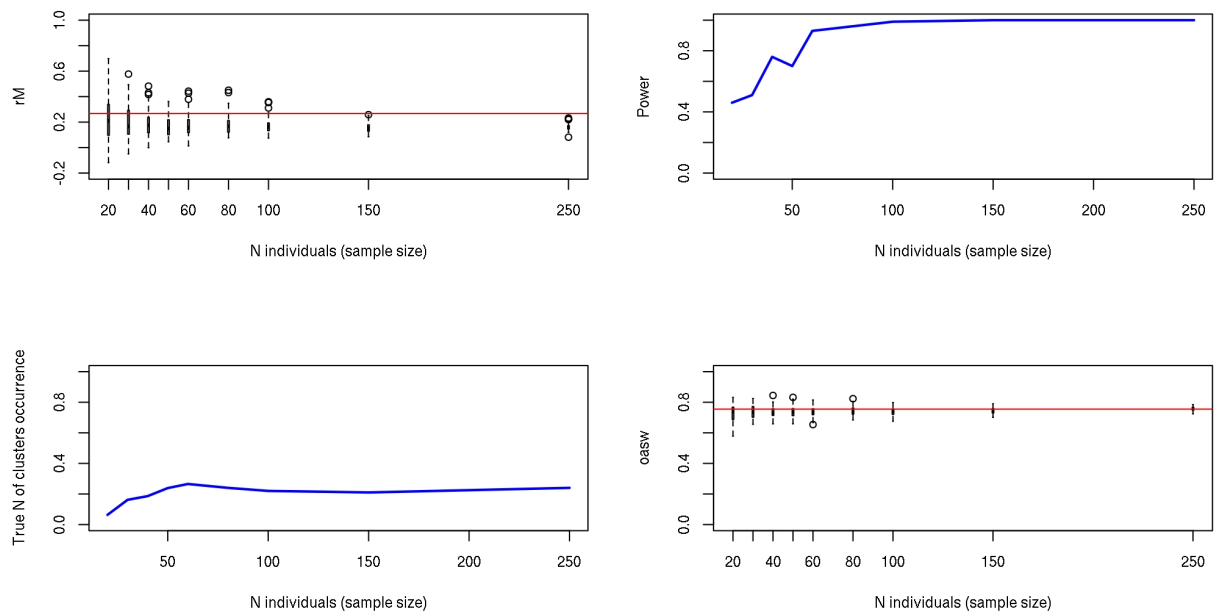
Results of power analysis and validation. Analyses at the species level were re-run on subsamples of individuals of decreasing size (100 repetitions per subsample size), according to simple random sampling of individuals (Figure 01440-2) and stratified sampling of individuals within the breeding range (Figure 01440-3) and the non breeding range (Figure 01440-4). 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 01440-2.** 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.

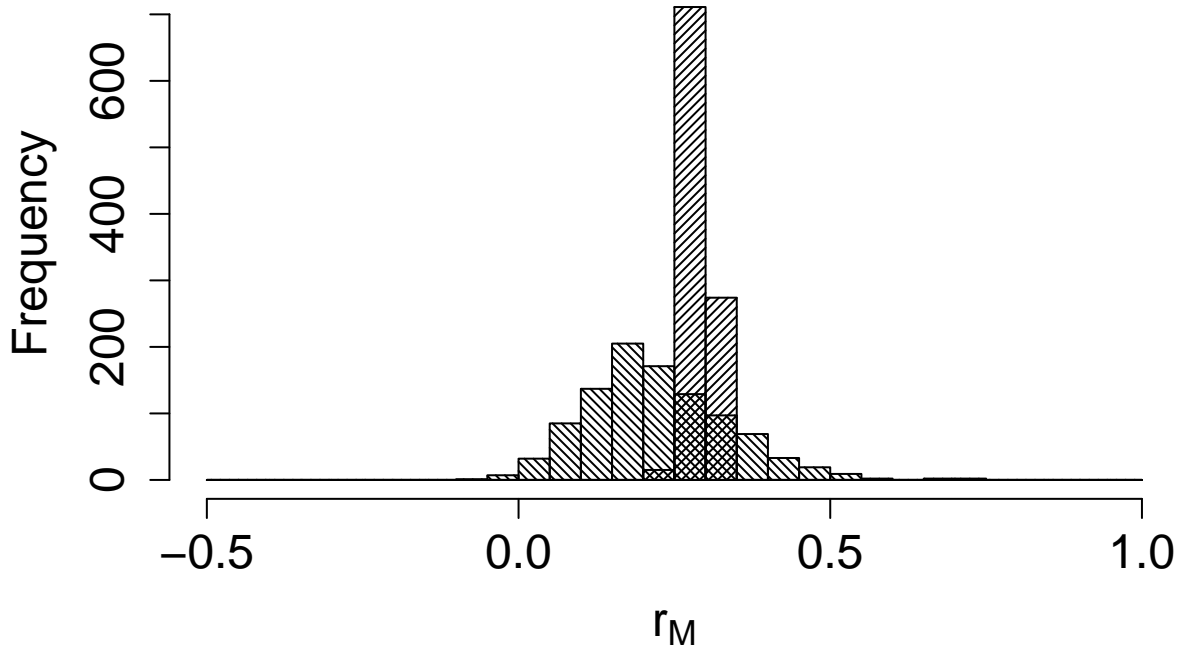


**Figure 01440-3.** Top left: simulated distribution (boxplots) and observed value (red line) of connectivity. Top right: Simulated power of the analysis. Bottom left: Proportion of times the analysis provides the observed best number of cluster. Bottom right: simulated distribution (boxplots) and observed value (red line) of clustering intensity.



**Figure 01440-4.** 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 ( $p = 0.241$ ); Figure 01440-5).



**Figure 01440-5.** Comparison between the bootstrapped distributions of connectivity value for alive recaptures (filling lines with angle=45°) and dead recoveries (filling lines with angle=375°).

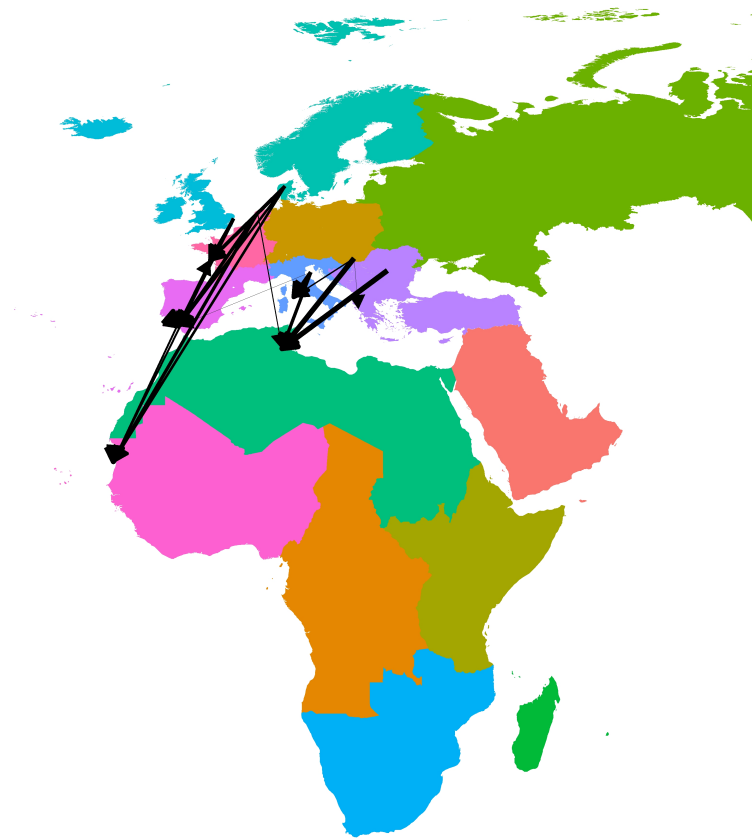
## 2. Connectivity between pre-defined regions

The species shows moderate connectivity ( $MC = 0.457$ ;  $MC = 0.456$  when adjusted for absolute abundance) between 8 breeding regions and 6 non breeding regions (Table 01440-2; Figure 01440-6).

**Table 01440-2.** 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	3150	North Africa	0.902
Central Europe	3150	South-central Europe	0.088
Central Europe	3150	South-east Europe	0.010
North Europe	202	South-west Europe	0.250
North Europe	202	West Africa	0.250
North Europe	202	West Europe	0.500
North-west Europe	4	South-west Europe	0.500
North-west Europe	4	West Africa	0.167
North-west Europe	4	West Europe	0.333
South-central Europe	780	North Africa	0.400

Breeding region	Abundance	Non breeding region	Transition probability
South-central Europe	780	South-central Europe	0.595
South-central Europe	780	South-west Europe	0.005
South-east Europe	3627	North Africa	1.000
South-west Europe	3578	South-west Europe	0.818
South-west Europe	3578	West Africa	0.152
South-west Europe	3578	West Europe	0.030
West Africa	1500	West Africa	1.000
West Europe	5736	North Africa	0.037
West Europe	5736	South-west Europe	0.437
West Europe	5736	West Africa	0.360
West Europe	5736	West Europe	0.166



**Figure 01440-6.** 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>.