

# Migratory connectivity analysis

by EURING Migration Atlas

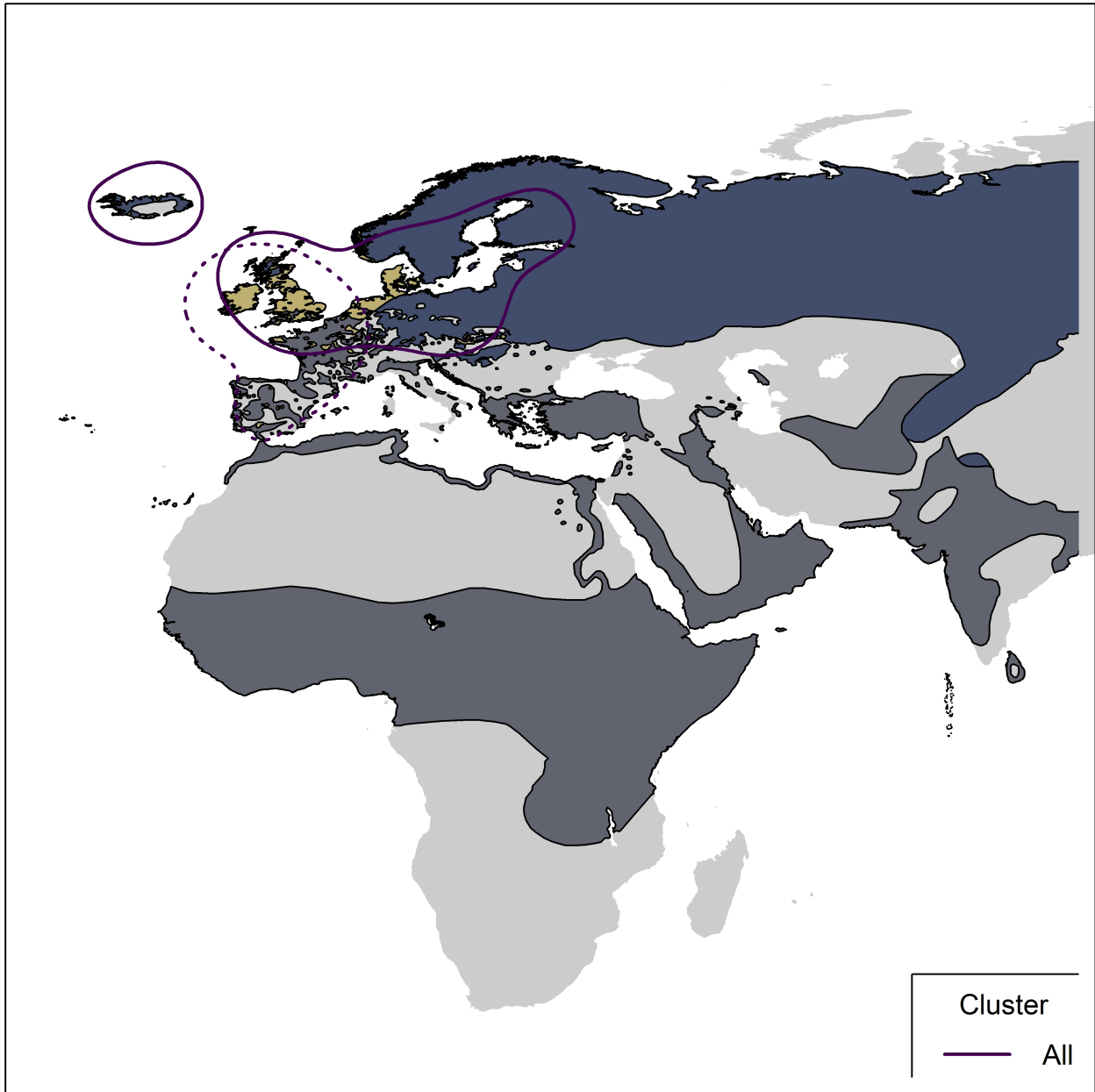
*Gallinago gallinago* (EURING code 05190)

## 1.1 Connectivity between individuals

The analysis evaluated 137 individuals (274 encounters) filtered from a total of 25774 records in the EURING databank which were considered for the Atlas. The species shows a significant connectivity from pattern transference (Table 05190-1; Figure 05190-1).

**Table 05190-1.** 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	137	0.142	0.002	0.066	0.255	5	0.425

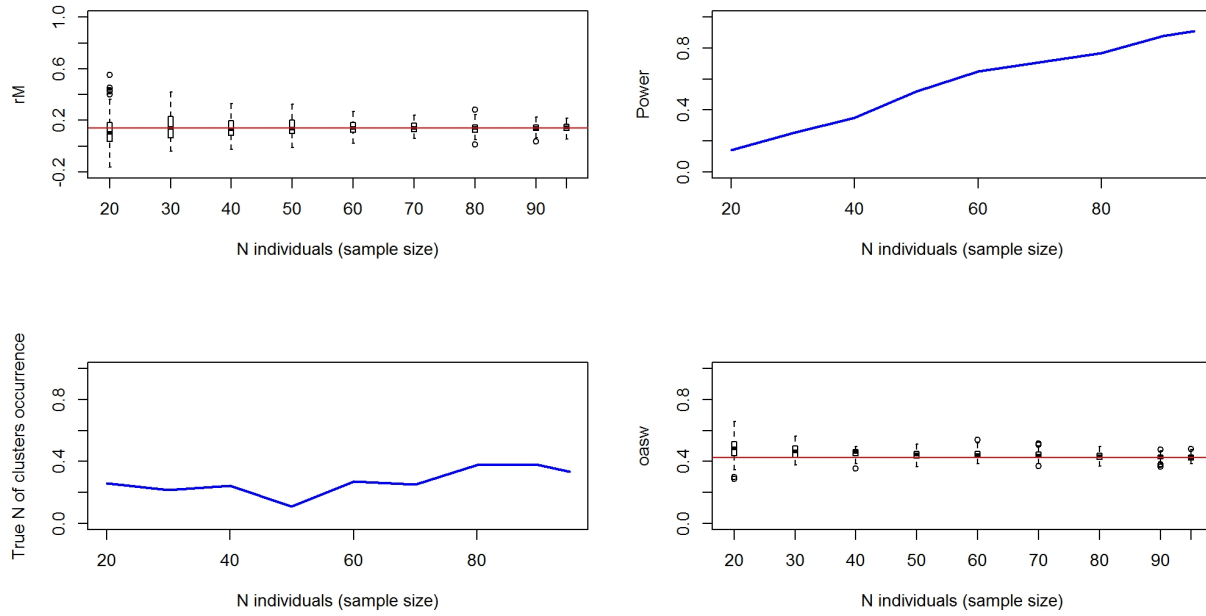


**Figure 05190-1.** Map showing 95% kernel contours of of first-level clusters identified by the migratory connectivity analysis, if any, or 95% kernel contours of all encounters, in case of no clustering structure. Solid lines indicate the clusters in the breeding range, dotted lines those in the non-breeding 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).

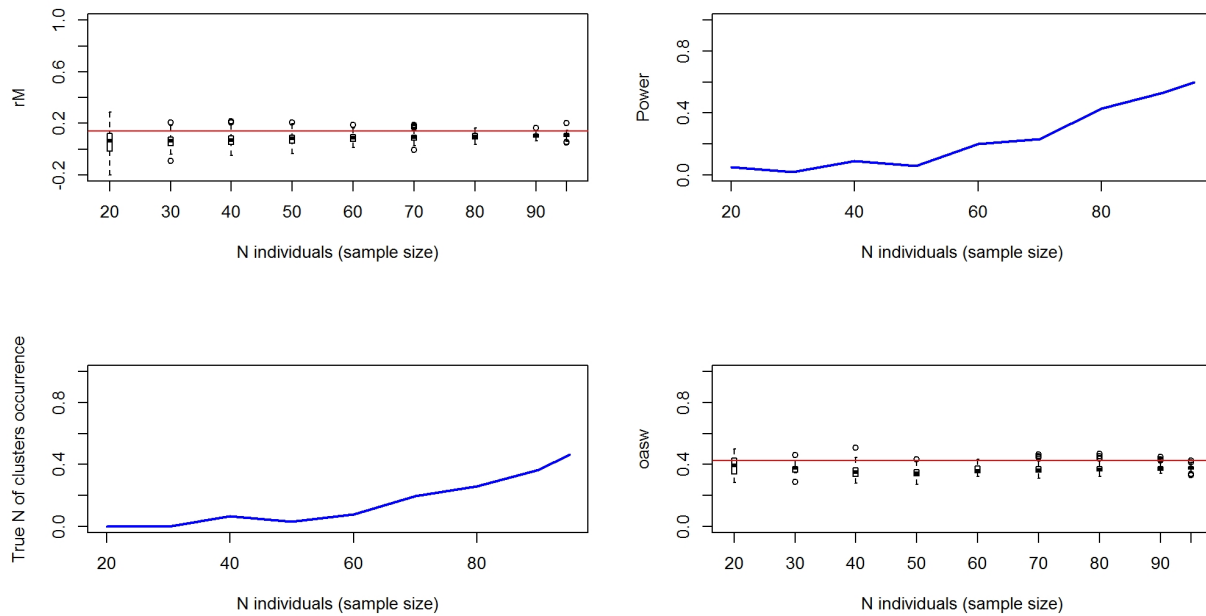
## 1.2 Sensitivity analysis

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 05190-2) and stratified sampling of individuals within the breeding range (Figure 05190-3) and the non breeding range (Figure 05190-4). 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.

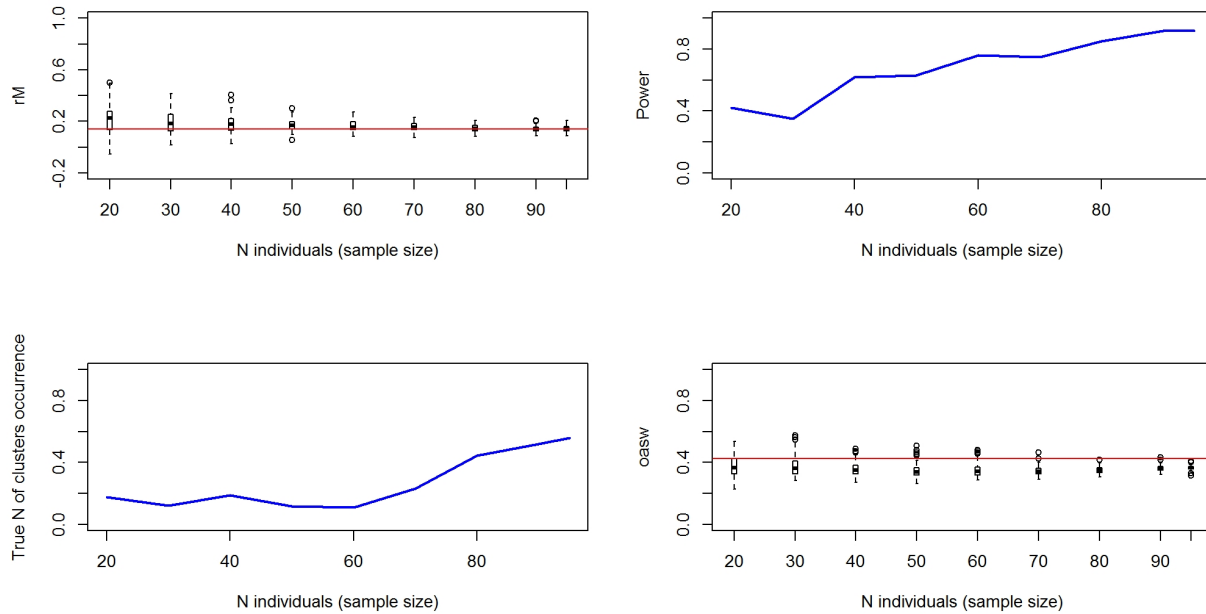


**Figure 05190-2.** Top left: simulated distribution (boxplots) and observed value (red line) of connectivity. Top right: Simulated power of the analysis (i.e. proportion of times the analyses on the subset of individuals was significant). Bottom left: Proportion of times the analysis provides the observed best number of cluster. Bottom right: simulated distribution (boxplots) and observed value (red line) of clustering intensity.



**Figure 05190-3.** 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 05190-4.** 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.

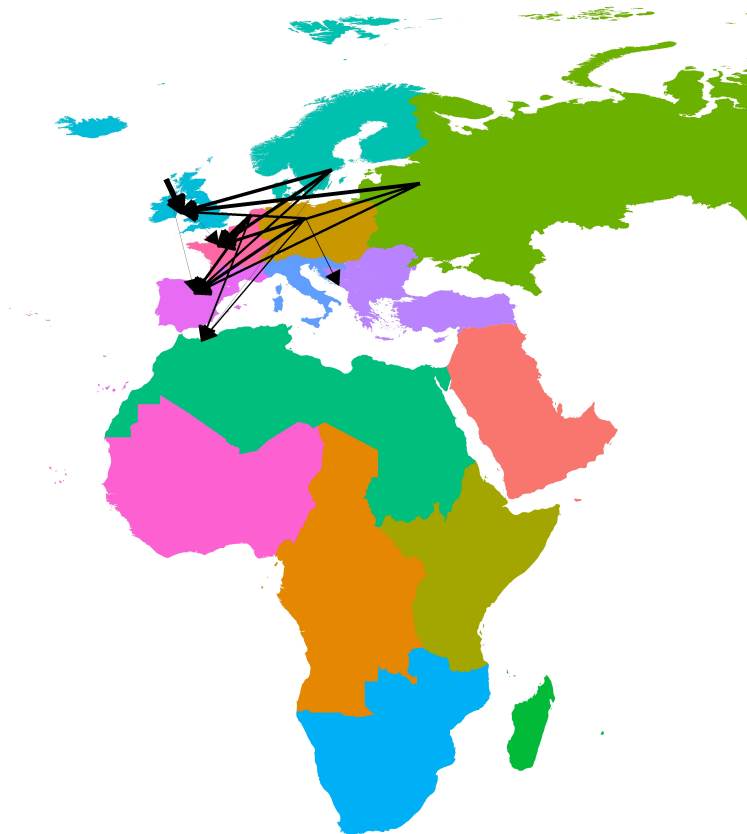
## 2. Connectivity between pre-defined regions

The species shows no connectivity ( $MC = -0.036$ ;  $MC = -0.041$  when adjusted for absolute abundance) between 5 breeding regions and 5 non breeding regions (Table 05190-2; Figure 05190-6).

**Table 05190-2.** 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	120481	North Africa	0.083
Central Europe	120481	North-west Europe	0.208
Central Europe	120481	South-central Europe	0.042
Central Europe	120481	South-west Europe	0.333
Central Europe	120481	West Europe	0.333
East Europe	6429137	North-west Europe	0.500
East Europe	6429137	South-west Europe	0.250
East Europe	6429137	West Europe	0.250
North Europe	648100	North Africa	0.023
North Europe	648100	North-west Europe	0.432
North Europe	648100	South-west Europe	0.182
North Europe	648100	West Europe	0.364
North-west Europe	528550	North-west Europe	0.966
North-west Europe	528550	South-west Europe	0.017

Breeding region	Abundance	Non breeding region	Transition probability
North-west Europe	528550	West Europe	0.017
West Europe	2410	North Africa	0.143
West Europe	2410	South-west Europe	0.286
West Europe	2410	West Europe	0.571



**Figure 05190-6.** 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>.