Supporting Information

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SI Text: Spatial Autocorrelation

SI Methods. To test whether the models violated the basic assumption of the independence of errors of the observations due to spatial autocorrelation (1–3), the response variable entering the analyses, i.e., standardized alien species numbers in each region adjusted for the effect of area, and the residuals of the individual minimal adequate models (MAMs), were evaluated by Moran's I correlograms (4, 5) in SAM 3.0 (6).

Under the null hypothesis of no spatial autocorrelation, meaning that data collated from regions at some distances apart do not exhibit more similar/dissimilar records than expected by chance (2, 7), I has an expected value near zero, with positive and negative values indicating positive and negative autocorrelation, respectively. Because I does not vary strictly between −1 and +1, we standardized I by dividing by its maximum attainable value to yield I_{std}, which can be interpreted as a spatial autocorrelation index, enabling us to compare values of I among models (6, 7). Each distance class among regions was defined on the basis of decimal degrees of latitude and longitude, taken as the midpoint of each region from which the data were collated. These decimal degrees were converted into geodesic surface distances (km), assuming that the Earth is spherical, and taking into account the actual polar flattening of the Earth and the equatorial bulge. To ensure that the tests had approximately the same power across all distance classes, the tests were done with each distance class having a different range, but the number of sampling points being roughly the same (5, 6). The number of sampling points in each distance class ranged between 15 and 48 for the individual taxa and between 1,929 and 1,997 in tests across all taxa.

Bonferroni-corrected significance level ($P < 0.05$) was used to check whether the correlogram contains at least one autocorrelation statistic, which is significantly different from zero, and two-tailed sequential Bonferroni corrections for identifying the individual distances that are significantly autocorrelated (5). Because all tests for significant I's, including the response variable entering the analyses, were tests of residuals, testing of their significant departures from null expectations on spatial independence followed Lichstein et al.'s (7) permutations on ordinary least square residuals. These tests are appropriate for small samples and do not assume a normal sampling distribution of I. They were done based on a distribution of 1,000 values, which included 999 random permutations and the reference value (the observed value for which the test is desired; ref. 5). Morans's I for the comparable effects of alien species entering the analyses often violated the condition of second-order stationarity (5) and as such, should not be tested statistically (5). Following ref. 7, in these cases, values of I's are interpreted just as indicators of the presence or absence of spatial patterns, which is an acceptable use for descriptive purposes (5).

SI Results

For alien species numbers adjusted for the effect of area entering the analyses (Figs. S1 and S2A), there were tendencies for significant positive autocorrelations for neighboring regions and negative ones for distant regions. This pattern thus resembled a linear gradient with the similarity decreasing with increasing distance. However, for the individual taxa, residuals of all models had all of the spatial autocorrelations removed (Figs. S2B). Across all taxa (Fig. S1B), there remained a small although significant positive autocorrelation at the distance of about 150 km, and negative one at the distance about 2,200 km. However, the overall linear gradient of decreasing similarity with increasing distance was also reliably removed. The explained variability of models describing the adjusted alien species numbers thus did not, or only slightly, violate the statistical assumption of independently and identically distributed errors. This means that the explanatory variables were properly included in the models and adequately measured their effects on alien species.

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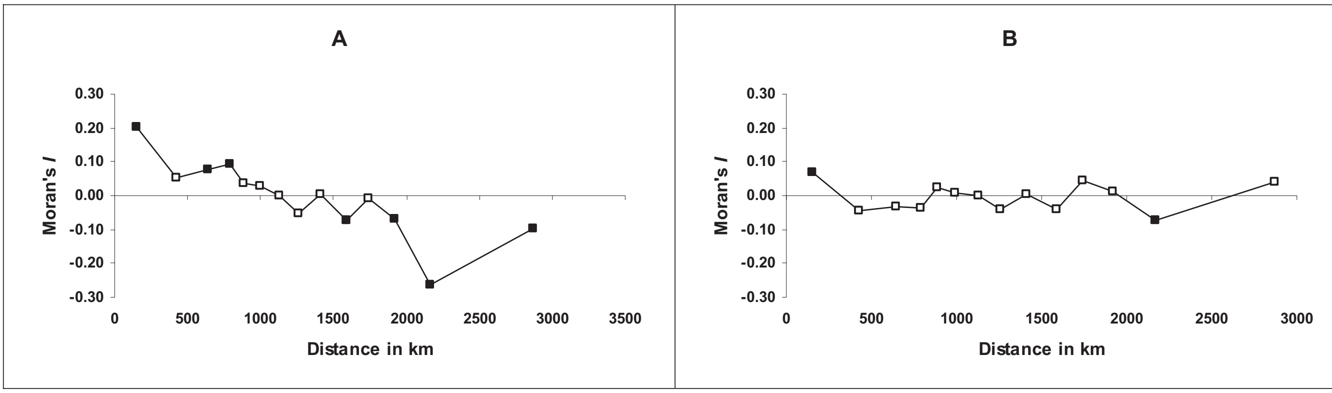


Fig. S1. Autocorrelation statistics for adjusted alien species numbers entering the analyses (*A*) and for residuals of their minimal adequate models (*B*), plotted against distance classes (km) represented by geographic midpoints of regions in which the data on alien species were collated. Autocorrelation statistics are expressed as standardized Moran's *I* correlograms, which vary between +1 and –1; they have expected value near zero for no spatial autocorrelation, with negative and positive values indicating negative and positive autocorrelation, respectively. Each point on *y* axis represents the value of *I* calculated from all possible pairs of sample locations that are separated by the lag distance intervals on the *x* axis. Black squares indicate values of *I* that are significantly larger than the value expected under the null hypothesis of no autocorrelation (two-tailed test with $\alpha = 0.05$ adjusted using progressive Bonferroni correction); white squares are not significantly larger than the null expectation. Results across all taxa.

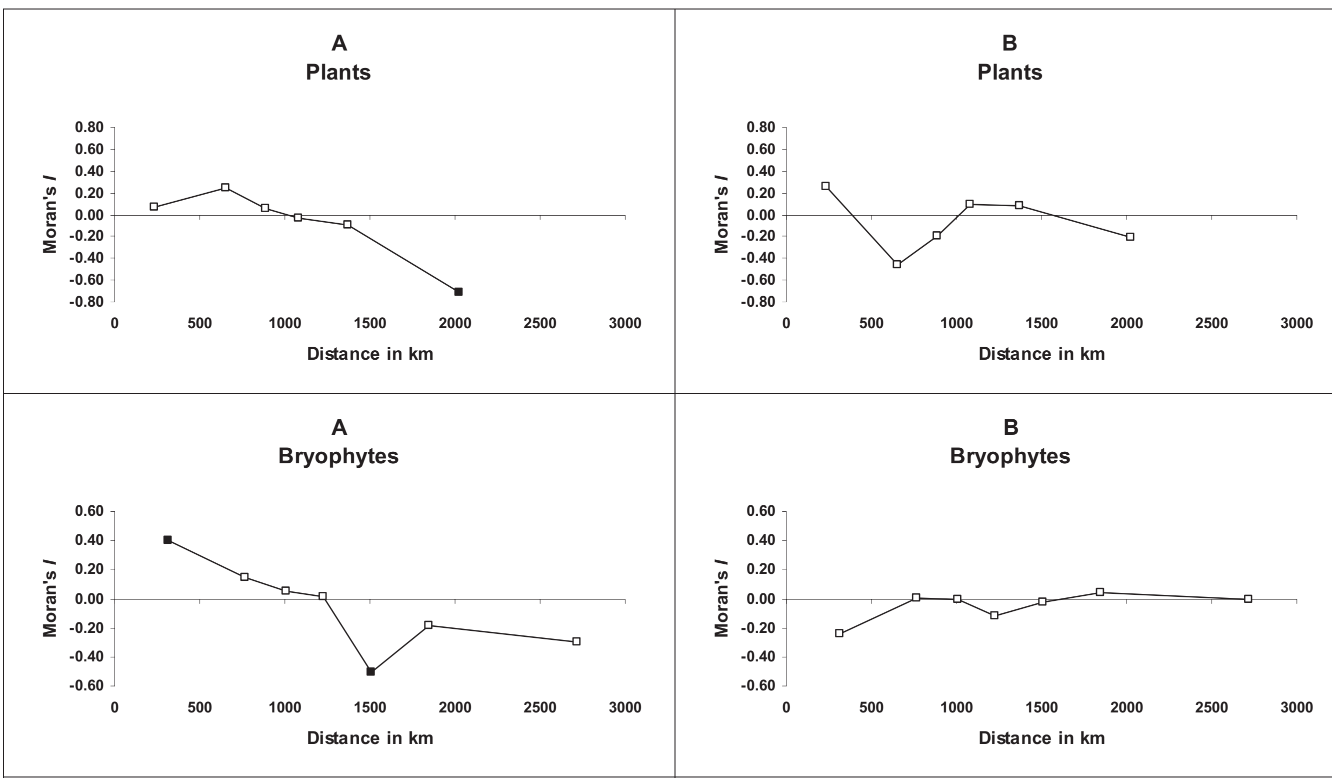
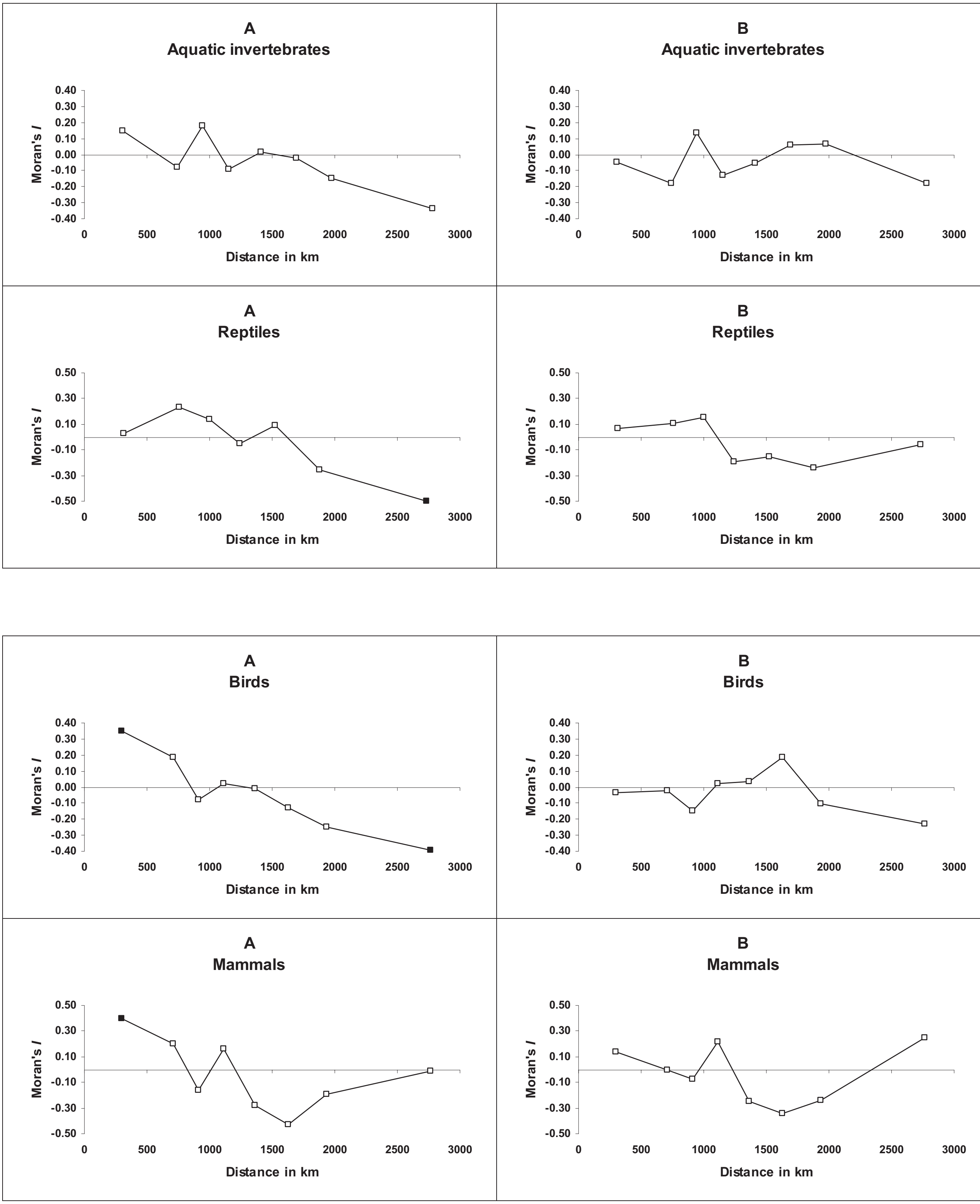


Fig. S2. (Continued)



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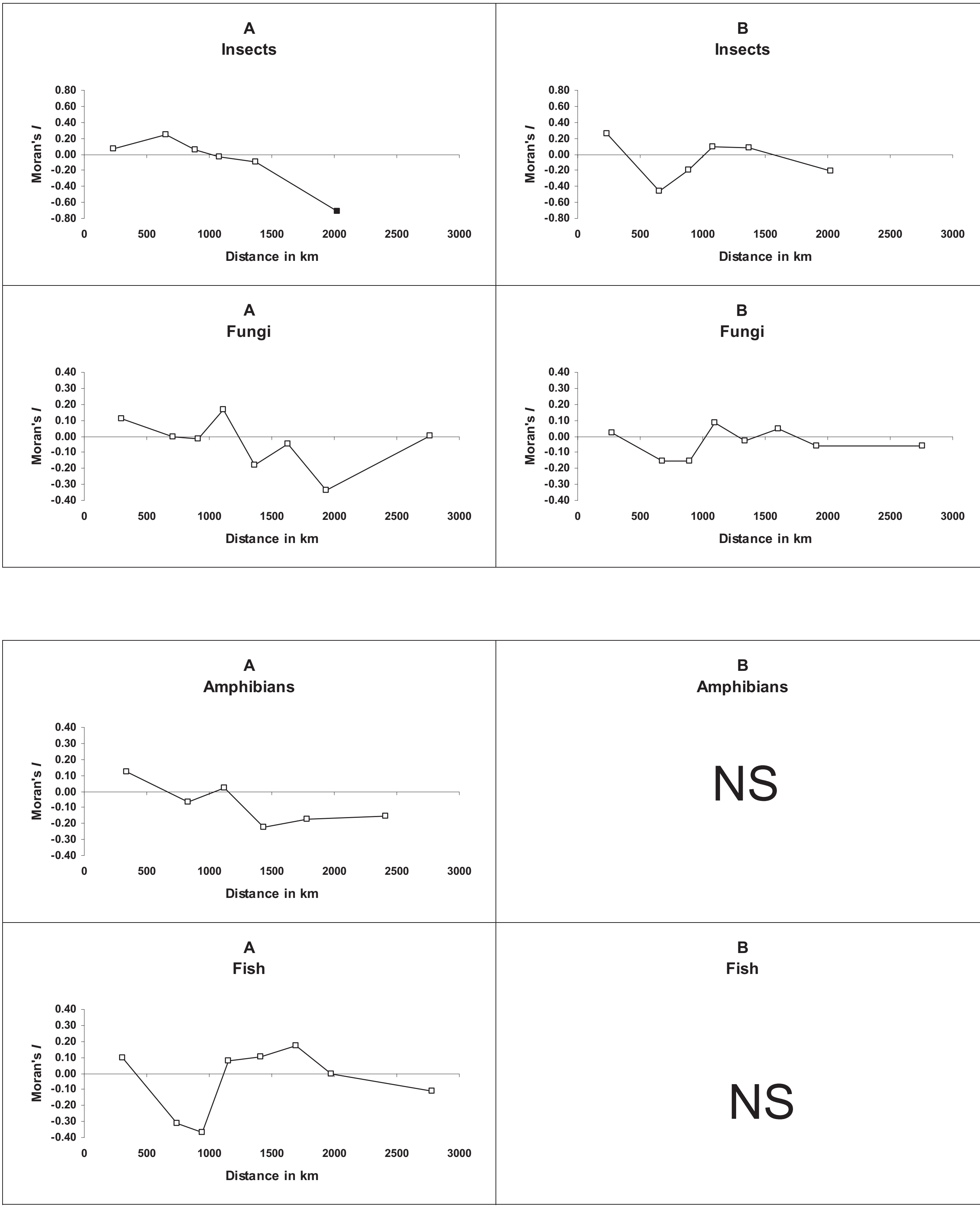

Fig. S2. Autocorrelation statistics for adjusted alien species numbers entering the analyses (*A*) and for residuals of their minimal adequate models (*B*), plotted against distance classes (km) represented by geographic midpoints of regions in which the data on alien species were collated. Results for the individual taxa, ordered according to the total variance explained by the individual minimal adequate models. NS for *B* are taxa with statistically insignificant minimal adequate models. Otherwise as in Fig. S1.

Table S1. Numbers of naturalized (established) alien species in 55 European countries/regions analyzed

Region	Vascular plants	Bryophytes	Fungi	Mammals	Birds	Reptiles	Amphibians	Fish	Terrestrial insects	Aquatic invertebrates
Albania (AL)			2	2	1			11	237	4
Austria (AU)	276	2	37	8	8	0	0	17	265	50
Azores (Az)		2	6	2	5	0	1		204	
Baleares (Ba)		0	2	2	4	11	3		50	
Belarus (BR)			8	5	3			15	49	11
Belgium (BE)	447	3	30	8	16	0	3	12	185	7
Bulgaria (BG)			20	5	3	0		19	246	
Canary Islands (Ca)		2	5	6	9	2	2		195	
Corse (Co)		0	6	3	4	4	1		138	
Crete (Cr)			5			1	1		38	
Croatia (CR)	59		30	7	3	0	0	18	100	4
Czech Republic (CZ)	229	2	30	8	6	0		10	329	23
Denmark (DK)		4	25	5	9	0	1	12	293	13
Estonia (ES)	125		9	5	4		1	6	91	11
Faroe Islands (Fa)		1	0		1				7	
Finland (FI)		2	14	7	9	0		13	140	6
France (FR)		3	61	10	20	2	5	12	575	44
Germany (GE)	450	3	55	9	15	0	1	31	438	53
Gibraltar (Gi)					2	1				
Greece (GR)	112	0	26	3	6	2	1	17	178	0
Greenland (Gr)		0			0				2	
Hungary (HU)	145	1	34	5	4	0		19	196	17
Iceland (IC)		1	0	3	2			1	24	2
Ionian Islands (Ii)			1		1	3			7	
Israel (IS)				3	13	1	0		180	
Italy (IT)	440	2	54	7	19	3	4	36	601	57
Latvia (LA)		1	10	4	6			15	93	6
Lithuania (LT)	256	1	22	7	6	0		7	108	8
Luxembourg (LX)		1	0	4	3				43	
F.Y.R.O. Macedonia (MC)			27	4	1			1	44	1
Madeira (Ma)		2	3	1	3	2	2		166	
Malta (ML)			2	1	0	3	1	2	147	5
Moldova (MO)			7	7	3			7	53	
Montenegro (Mn)			31					19	46	
Netherlands (NL)	154	3	29	7	13	0	2	13	195	9
Northeast Aegean Islands (Nae)			1		1				11	
Norway (NO)		1	21	7	8			13	122	5
Poland (PL)	259	1	34	6	6	0		12	183	23
Portugal (PG)	250	2	25	2	6	1		20	220	20
Republic of Ireland (IR)		6	24	6	7	1	2	15	87	41
Romania (RO)	113		27	6	3			30	158	14
Russia (European part) (RU)	149		27	12	6		1	27	111	27
Sardinia (Sa)	70	0	5	3	5	1	0		148	
Serbia (SB)			30			0		26	96	8
Sicily (Si)			10		5	1	1		262	
Slovakia (SK)	182	0	23	7	5	0		28	126	
Slovenia (SL)			31	5	7	1		11	129	3
South Aegean Islands (Sae)			0	2	1	0			18	
Spain (SP)		1	33	5	18	5	4	30	333	30
Svalbard (Sv)			0	1	0				7	
Sweden (SW)		3	23	8	13	0	2	10	189	14
Switzerland (SU)	170	1	47	5	7	1	0	16	302	27
Turkey (European part) (TK)					4			23		0
Ukraine (UR)	297		27	8	6	1		34	99	96
United Kingdom (UK)	857	14	55	9	23	3	5	14	391	50

Empty cells indicate that data are not available. Data sources (see www.europe.aliens.org for species lists): vascular plants (1); bryophytes (2); fungi: various (see ref. 3 for details); mammals: various (see ref. 4 for details); birds, reptiles, and amphibians: various (see ref. 5 for details); fish, aquatic invertebrates (6); and terrestrial insects: various (see ref. 7 for details). State names refer to mainland.

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