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HOT-SPOT FACTS AND ARTIFACTS—QUESTIONING ISRAEL'S GREAT BIODIVERSITY

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ABSTRACT

Israel's biological diversity has been praised as being particularly rich in relation to its size; however this assumption was never tested when taking into account the empirical form of the species–area relationship. Here we compared the species richness of different countries to see if the Israeli diversity is exceptionally rich when area is accurately accounted for. We compared richness of amphibians, birds, mammals, reptiles, flowering plants, conifers and cycads, and ferns in all the world's countries. We further tested the effects of mean latitude, altitude span, and insularity on species richness both for all world countries and just for Mediterranean countries. For all taxa and in all tests, Israel lies within the prediction intervals of the models. Out of 42 tests, Israel's residuals lie in the upper decile of positive residuals once: for reptiles, when compared to all world countries, taking all predicting factors into account. Using only countries larger than 1000 km^2, Israel was placed as top residual when compared to other Mediterranean countries for mammals and reptiles. We therefore conclude that Israel's species richness does not significantly exceed the expected values for a country its size. This is true when comparing it to either world or just Mediterranean countries. Adding more predicting factors does not change this fact.

Keywords: Biodiversity, diversity, Israel, Mediterranean, species–area relationship

INTRODUCTION

Identifying regions that hold high biological diversity is extremely important in conservation biology planning (Myers, 1988; Reid, 1998). Once such regions are identified, they can be better protected. However, despite a large body of work on this topic there are still many discrepancies between different researchers on the best methods to

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identify such hotspots, and consequently the regions they identify as holding high biodiversity (Ferrier, 2002; Mace et el., 2000; Brummit and Nic Lughadha, 2003; Myers, 2003; Whittaker at al., 2005; and references therein). For example, the Mediterranean basin is considered a biodiversity hotspot by some authors (Olsen and Dinerstein, 1998; Myers et al., 2000) but is not defined as such by others (Orme et al., 2005; Ulrich and Buszko, 2005).

Travelers and scientists over the years have often claimed that Israel has a particularly high biological diversity in relation to its area. Henry Baker Tristram was, perhaps, the first person to scientifically survey Israel's biodiversity in the middle of the ninetieth century (Tristram 1885). In the introduction to one of the books detailing his expeditions he states:

> In the geographical position and the geology of Palestine, we find special reasons why the consideration of its Fauna and Flora is exceptionally important; and a detailed examination discloses results even more interesting than could have been expected from the peculiar position of that region as an outlying portion of the great Palaearctic region. (Tristram, 1885, Preface p. i)

This idea was later mirrored by Aharoni (1929), who wrote that:

> ...this little Palestine… is a true miraculum mundi not only on account of its peculiar historical importance but also because of its unique fauna. I do not know so small a country anywhere on the globe which counts so many forms of animals among its exclusive and special natural production.

This belief of biological grandeur was echoed throughout the twentieth century, for example with regards to plants and reptiles in the volume dealing with Israel's natural conditions of the Hebrew Encyclopedia (Netanyahu, 1957). In the introduction to their book about the zoogeography of Israel, Tchernov and Yom-Tov (1988), state that:

> The great diversity of the Levantine biota may be exemplified even within the boundaries of the small area of Israel which greatly surpass any similar areas anywhere in the Palaearctic or Nearctic regions. It might be considered as one of the richest and most diverse natural regions in the temperate regions of the world relative to its size.

This extraordinarily high species richness (= gamma or regional diversity) was thought to come about mainly through the effects of high species turnover between biogeographic units along climatic and edaphic gradients (Netanyahu, 1957; Tchernov and Yom-Tov, 1988). In other words, a high beta diversity (species turnover), rather than a high local richness (= alpha diversity), is the cause of Israel's high regional diversity. However, to date, this basic assumption was never explicitly tested, or even supported by large comparative datasets. Another hypothesis is that the location of Israel, in an intercontinental crossroads, somehow also contributes to its high species richness, although whether this affects beta or alpha diversity was never clearly stated (Tchernov and Yom-Tov, 1988).

The idea of high species richness was seldom backed by quantitative data. Alon (1990), in his introduction to the comprehensive encyclopedia of the fauna and flora of

Table 1
Number of birds in a country compared to their areas, showing Israel's high species-to-area ratio. Note that all countries are at least an order of magnitude larger than Israel

Country	Size (km^2)	Number of bird species	Number of species per 1000 km^2
Israel	29,600	470	15.8
Great Britain and Ireland	244,400	489	2
Scandinavia	774,000	295	0.38
Germany	356,500	258	0.73
Poland	312,000	230	0.74
U.S.S.R	22,400,000	728	0.03
China	9,800,000	1198	0.12
Japan	370,000	533	1.44
Iraq	444,000	420	0.95
Egypt	990,000	427	0.43
Sudan	2,500,000	871	0.35

Modified from Alon (1990).

Israel, also coveys this idea. He displays two tables with bird and plant species numbers and respective areas for Israel and several large countries (e.g., Table 1). He calculates the simple ratio of species (S) to area (A) to show that Israel has a higher species density than all other countries in his sample. This might seem a reasonable conclusion if the expected species number a region holds increases linearly with area (i.e., if $S = cA$ where c is a constant). If that were the case, doubling a region's area would correspond to doubling the number of species present, and the ratio of species to area (S/A) would remain unchanged. The number of species in a region, however, does not increase linearly with area.

It has commonly been accepted for many decades that the species–area relationship takes the form of a power function

$$S = cA^z \tag{1}$$

where the coefficient c and the exponent z are constants (Arrhenius, 1921). That is, although we can expect larger areas to contain more species, the species–area relationship follows a power law ($z \neq 1$) rather than being linear ($z = 1$). Furthermore, the empirical value of the exponent z is nearly always less than one, usually ranging from 0.15 to 0.35 (Preston, 1962; MacArthur and Wilson, 1967; Rosenzweig, 1995).

In a realistic regime where $z < 1$, the ratio of species numbers to area is $S/A = cA^{(z-1)}$ and thus S/A will invariably decrease with increasing area. In Alon's (1990) table, all the countries Israel is compared to are at least an order of magnitude larger (see Table 1). Therefore his comparison based on S/A gives misleading conclusions.

Here we test whether Israel is indeed characterized by exceptionally high species richness for its size, while taking into account the species–area power-law relationship. We further account for other parameters known to be correlated with species richness:

latitude, altitudinal diversity, and insularity (e.g., Lomolino et al., 2005) to examine whether Israel stands out after this correction.

METHODS

We collected data on species richness per country for amphibians, birds, mammals, reptiles, fishes, flowering plants, conifers and cycads (treated together), and ferns from the Earthtrends website (earthtrends.wri.org/) (Table 1A in the Appendix). Israel's conifer and cycad species number is not included in the Earthtrends database, and was thus obtained from Heller and Livne (1982). Since fish species numbers did not show a significant species–area relationship ($R^2 = 0.0006$; p-value = 0.73) they were withdrawn from all further analysis. The United Nations web-site (www.un.org) provided data regarding country area. Species richness (S) and area (A) data were log-transformed in order to obtain a linear fit in the regressions of log (S) versus log (A) in accordance with eq 1. We also recorded the latitude mid-point, total altitude span, and its classification as an island or a mainland for each country. Analyses were conducted both for all world countries (for which there are data for each taxon), and separately for countries with Mediterranean climates, sharing Israel's largest biome. Mediterranean countries (n = 18) were categorized as those encompassing a Mediterranean climate in at least 25% of their area. Israel's value is 32% (categorization of Mediterranean climate was based on WWF global 200 database http://www.worldwildlife.org/science/ecoregions/global200.html).

We conducted an ordinary least squares (OLS) regression between (Log) species numbers and (Log) area per country for each taxon. For each test the prediction limits (Zar, 1999) of the model were calculated for a country of Israel's size, and we checked whether Israel's observed richness falls within these limits. The prediction limits enable us to know, with a probability of 95%, if a particular countries' species number is explained by the regression line of all countries' species richness. We then conducted a ranks analysis on all of the studentized residuals of countries from the regression fit, separating positive and negative residuals. Positive residuals were assigned to the top decile, top quartile, top half and bottom half positive residual (residuals were always assigned to the highest possible category they could belong to). Negative residuals were categorized accordingly to: lower decile, lower quartile, lower half, and top half negative residual.

In another analysis, mean latitude, altitude span, and insularity were added sequentially while performing a multiple regression analysis and in the final stage analysis of covariance (ANCOVA). The relative diversity of Israel was assessed with respect to the prediction limits for a country of its size and the location of its studentized residual when compared to other countries.

For each analysis, we divided Israel's residual rank by the number of all positive or negative residuals (depending on Israel's residual placement) in the test. This figure (given as a percentage) was than averaged between analyses to obtain an averaged percentile in which Israel should be placed with respect to the model's prediction.

We also conducted the analysis of (Log) area versus (Log) species examining just countries that have an area of more than 1000 km^2. This was done as there has been criticism as to the linearity of the power-function species–area curve at smaller scales (Lomolino, 2000; Losos and Schluter, 2000). We conducted this analysis on all taxa both for all countries and just for those harboring Mediterranean climates.

Countries with zero values for a particular taxon were omitted from the analysis for this taxon, because we suspect this may represents false absences (e.g., Israel's conifers and cycads). All in all, we conducted 42 analyses: for seven taxa, each time against just area or with all predicting factors. This was carried out for all world countries, for Mediterranean countries, and repeated for countries with an area larger than 1000 km^2 (for the analysis of countries larger than 1000 km^2 the ANCOVA procedure was not conducted).

RESULTS

When examining all countries, Israel was placed in the upper decile of residuals only once (in 28 tests): in the reptile ANCOVA (Table 2). Across all analyses (of countries of all sizes), Israel's residual average rank value is the 77th percentile of positive residuals (or 23 percent "above the line"), with a standard deviation of 61%. Compared to world countries this value is in the 69±58 percentile of positive residuals, and for Mediterranean countries it is in the 84±65 percentile of positive residuals. Thus although Israel's diversity lies, on average, above the regression line, it is by no means significantly above it.

Of our 42 regressions and ANCOVA analyses, 40 were significant (Tables 3, 4); the two non-significant regressions were for Mediterranean countries, after omitting smaller

Table 2

Placement of Israel's residual compared to all other residuals—for countries of all sizes. Positive and negative residuals are treated separately. Positive residuals were assigned to: upper decile, upper quartile, upper half and bottom half positive residual—categorized as "above line" (the residual was assigned to the top most possible category). Bottom residuals were categorized accordingly to: lower decile, lower quartile, lower half and top half negative residual—categorized as "below line". Tests are divided between taxa, linear regression and ANCOVA and analysis on all world countries or just Mediterranean ones

	Linear regression		ANCOVA	
	All world	Mediterranean	All world	Mediterranean
Amphibians	below line	above line	below line	upper half
Birds	upper quartile	upper half	upper quartile	below line
Mammals	upper quartile	upper quartile	upper quartile	upper half
Reptiles	Upper half	upper quartile	upper decile	upper half
Flowering plants	above line	above line	upper half	upper half
Conifers and cycads	above line	lower quartile	above line	lower half
Ferns	lower quartile	lower half	lower half	below line

Table 3

Results of OLS regression analysis of species richness against country area and ANCOVA analysis of richness against several predicting factors (see text)—analyses of countries of all sizes. The table is divided into the seven taxa used, and between analysis on all world countries or just Mediterranean countries (Med.)

		Number of countries per taxa and geographical scope	Number of Israeli species per taxa and geographical scope	OLS regression *p*-Value	OLS regression R^2	Israel's probability inside OLS regression prediction limits (one-tailed)	ANCOVA *p*-value	ANCOVA R^2
Amphibians	All world	192	8	<0.0001	0.404	0.365	<0.0001	0.528
	Med.	15	8	0.0004	0.628	0.490	0.0002	0.872
Birds	All world	217	534	<0.0001	0.592	0.151	<0.0001	0.647
	Med.	16	534	0.0021	0.502	0.272	0.0122	0.660
Mammals	All world	215	115	<0.0001	0.711	0.145	<0.0001	0.778
	Med.	16	115	<0.0001	0.862	0.114	<0.0001	0.878
Reptiles	All world	212	99	<0.0001	0.434	0.189	<0.0001	0.778
	Med.	16	99	<0.0001	0.741	0.081	<0.0001	0.871
Flowering plants	All world	162	2780	<0.0001	0.450	0.293	<0.0001	0.573
	Med.	11	2780	<0.0001	0.834	0.391	0.0017	0.923
Conifers and cycads	All world	117	6	<0.0001	0.276	0.360	<0.0001	0.501
	Med.	10	6	0.0032	0.683	0.144	0.0291	0.846
Ferns	All world	129	25	0.0011	0.080	0.125	<0.0001	0.504
	Med.	10	25	<0.0001	0.867	0.101	0.0007	0.965

Table 4
Results of OLS regression analysis of species richness against country area for countries with an area of more than 1000 km^2. The table is divided into the seven taxa used, and shows analysis of all world countries or just Mediterranean countries (Med.)

		n (countries)	*p*-Value	R^2	Israel's residual rank placement
Amphibians	All world	168	<0.0001	0.218	(–) 107
	Med.	12	0.0053	0.558	5
Birds	All world	179	<0.0001	0.401	22
	Med.*	12	0.1783	0.173	1
Mammals	All world	179	<0.0001	0.511	31
	Med.	12	0.0066	0.539	1
Reptiles	All world	176	<0.0001	0.238	34
	Med.	12	0.02467	0.411	1
Flowering plants	All world	146	<0.0001	0.298	46
	Med.	10	0.003	0.689	6
Conifers and cycads	All world	107	<0.0001	0.144	48
	Med.*	9	0.0852	0.364	(–) 8
Ferns	All world	116	0.0285	0.041	(–) 103
	Med.	9	0.005	0.699	(–) 8

*—non-significant regression. (–)—negative residual.

countries from the analysis (see below). Figure 1 provides plots of the linear regressions for each of the seven taxa for all world countries. The plots show a clear linear relationship for log species number versus log area in the observed data. In all 42 analyses, Israel always fell inside the prediction limits (Figs. 1, 2, Tables 3, 4) and was thus not unusual according to this test.

Looking at all world countries larger than 1000 km^2 did not change Israel's placement. For all taxa, Israel's value was never outside the prediction limits of the model and its residual was never ranked in the upper decile (Table 4). Repeating this analysis for Mediterranean countries gave some interesting results. This analysis placed Israel as the country with the highest residual (out of this smaller country list of 9 to 12 countries) for three taxa—mammals, reptiles, and birds (Table 4). The regressions, however, were not significant for birds (or for conifers and cycads).

DISCUSSION

The regular increase of species number with increasing area has been described as one of community ecology's few genuine laws (e.g., Schoener, 1976). That this relationship is not linear is common knowledge since the work of Arrhenius (1921, and possibly even earlier: Watson 1835). Much debate in the literature has dealt with the correct function of this relationship pertaining to different datasets (Rosenzweig, 1992, 1995; Gray et al.,

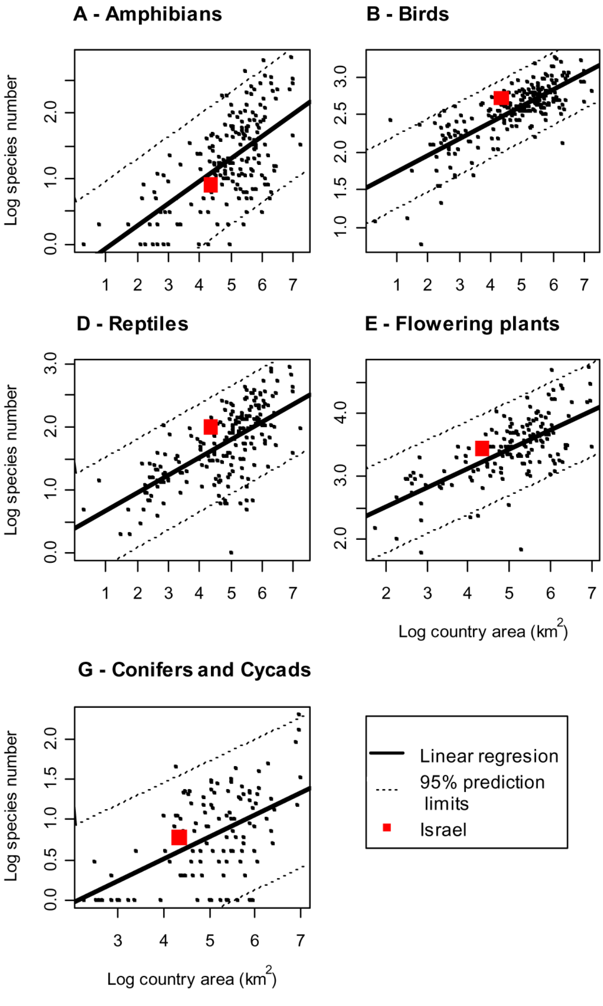

Fig. 1. OLS regressions of species against country area (after Log transformation), for seven different taxa, comparing all world countries. Israel is indicated by the large squares.

2004; Scheiner 2004; Guilhaumon et al., 2008). Scheiner (2003) claims that the power-law relationship is particularly appropriate for discrete regions of varying sizes, and is thus suitable for different countries.

Failing to take into account the non-linearity of species accumulation with area has been noted by several authors as a problem that can easily lead to erroneous conclusions (Brummitt and Lughadha 2003, Ovadia 2003). To date, claims that Israel has an exceptionally diverse biota have neglected to take this nonlinearity into account. As spe-

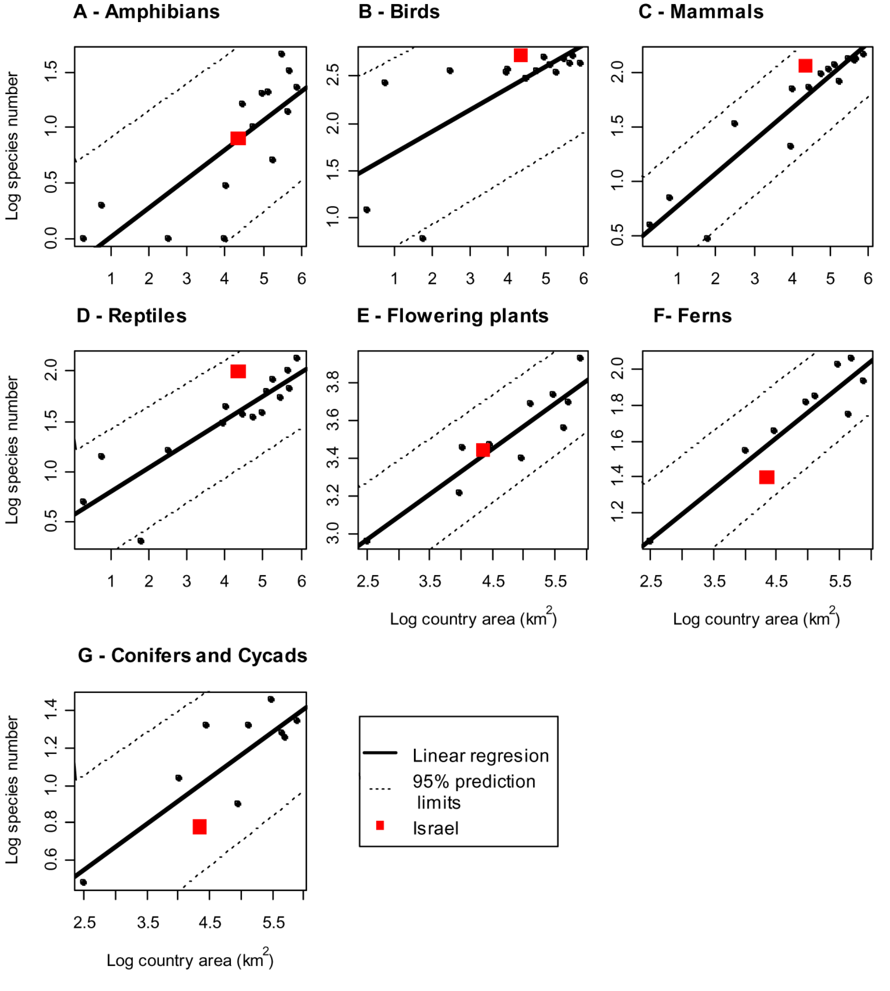

Fig. 2. OLS regressions of species against country area (after Log transformation), for seven different taxa, comparing just Mediterranean countries. Israel is indicated by the large squares.

cies per unit area was the measure of diversity in these works, and as Israel was always compared to larger countries, it is unsurprising that it emerged as particularly species rich. Correctly accounting for the non-linearity of species-area relationships we find that Israeli richness is well within the prediction limits for a country its size; or for its size, latitude, and altitudinal range.

We used several statistical methods, added various predicting parameters, and conducted the analysis separately on all world countries or just those with Mediterranean climates, and Israel failed to stand out in any of them. Only once (of the 28 tests taking countries of all sizes into account), was Israel placed in the upper decile of residuals: namely, when comparing its reptile richness to that of all the world's countries in the ANCOVA analysis—accounting for area, latitude, and altitudinal range. Even just among countries larger than 1000 km^2 Israel does not stand out, except when compared to Mediterranean countries.

Regarding Israel's geographic location at an intercontinental crossroads, we point out that Israel is wholly nested within the Palaearctic realm, and as such may not be as unique a biogeographic (rather than purely geographic) transition zone as has sometimes been claimed. Israel is a little far removed from the actual boundary of the Afrotropical and Palaearctic realms, and is far away from the Oriental realm. Furthermore, while we acknowledge that placement within a transition zone is highly likely to promote phylogenetic or ecological diversity, we are unaware of studies suggesting it should also promote high species richness above and beyond influencing beta diversity. Faunal interchange has often been thought to promote extinction, rather than diversity (e.g., Vermeij, 1991), and thus it may be that the notion that Israel's location would mean increased diversity may be incorrect.

Israel's local species diversity (alpha diversity) has never been praised as unique. In fact, Werner (1987) and Kelt et al. (1996), who studied lizards and small mammals (respectively) in Israeli deserts, state that the alpha diversity in this region is actually relatively low. Israel has been claimed to have a high regional diversity because of its biogeographic location, its high soil, climatic and altitudinal diversity, and its particular geological history (Tchernov and Yom-Tov, 1988). These and other factors were suspected to lead to a high habitat heterogeneity, which in turn would lead to high species richness. In our research we examined neither alpha nor beta diversity; however, we do not find that their assumed manifestation in gamma diversity leads Israel to be exceptionally species rich.

The results of the current study echo the thoughts of Henry Baker Tristram while visiting this region nearly a century and a half ago:

> Though Palestine boasts in its productions neither the tropical splendour of India nor the gorgeous luxuriance of Southern America, yet from its fowls of the air are drawn for us our lessons of faith and trust, from the flowers of its fields our lessons of humility. (Tristram, 1865, Preface, p. vi)

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APPENDIX 1

Table 1A

The number of species in each taxa, for different countries. Data based on the Earthtrends web-site (earthtrends.wri.org/). Israel's conifer and cycad species number is not included in the Earthtrends database, and was thus obtained from Heller and Livne (1982)

Country	Amphibians	Birds	Mammals	Reptiles	Flowering plants	Conifers and cycads	Ferns
Afghanistan	7	434	144	109	3,500		
Albania	16	303	73	37	2,965	21	45
Algeria	13	372	100	97	3,100	18	46
American Samoa		36	10	9			
Andorra	2	119	15	4			
Angola	85	930	296	235	5,000		185
Antigua and Barbuda	2	178	8	21	766	1	33
Argentina	162	1,038	375	338	9,000	13	359
Armenia	7	302	78	53	3,300		
Aruba	1	88	4	12	460		
Australia	229	851	376	880	15,000	90	400
Austria	20	412	101	16	2,950	12	66
Azerbaijan	10	364	82	61			
Bahamas	5	316	31	54	1,172	3	43
Bahrain	1	196	14	18	195		
Bangladesh	23	604	131	113	5,000		
Barbados	1	223	13	11	542	0	30
Belarus	14	226	71	6	1,590	4	28
Belgium	17	427	92	12	1,400	2	50
Belize	46	544	147	140	2,750	10	134
Benin	12	485	159	99	2,000	1	200
Bermuda	2	235	8	5	147	0	20
Bhutan	2	625	92	29	5,446	22	
Bolivia	161	1,414	361	258	17,000	16	1,300
Bosnia and Herzegovina	8	312	78	27			
Botswana	28	570	169	133		0	15
Brazil	695	1,712	578	651	55,000	15	1,200
British Virgin Islands	5	125	5	26			
Brunei Darussalam	4	455	112	73	3,000		
Bulgaria	17	379	106	33	3,505	15	52
Burkina Faso	11	452	129	44	1,100	0	
Burundi	26	597	116	80	2,500		
Cambodia	11	521	127	116			
Cameroon	192	936	322	211	8,000	3	257
Canada	44	472	211	39	2,920	33	65
Cape Verde		160	26	20	740	0	34
Cayman Islands	2	209	12	26			
Central African Rep	29	663	187	131	3,600	2	
Chad	10	531	104	53	1,600		
Chile	50	445	159	121	5,125	17	150

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Country	Amphibians	Birds	Mammals	Reptiles	Flowering plants	Conifers and cycads	Ferns
China	340	1,221	502	424	30,000	200	2,000
Colombia	623	1,821	467	518	50,000	20	1,200
Comoros		138	15	28	660	1	60
Congo	58	597	166	149	4,350	7	
Congo, Dem Rep	218	1,148	430	304	2,867	7	381
Cook Islands		35	3	7			
Costa Rica	183	838	232	258	11,000	9	1,110
Côte d'Ivoire	54	702	229	131	3,517	0	143
Croatia	10	365	96	34			
Cuba	61	358	65	153	6,004	23	495
Cyprus	1	349	21	30	1,650		
Czech Rep	19	386	88	11			
Denmark	15	427	81	8	1,200	2	50
Djibouti	6	312	106	85	635	2	13
Dominica	3	164	16	19	1,027	1	200
Dominican Rep	38	224	36	117	5,000	7	650
Ecuador	428	1,515	341	419	18,250	12	1,100
Egypt	11	481	118	107	2,066	4	6
El Salvador	30	434	137	106	2,500	11	400
Equatorial Guinea	31	418	153	92	3,000	0	250
Eritrea	9	537	70	88			
Estonia	11	267	67	6	1,630	4	40
Ethiopia	76	839	288	205	6,500	3	100
Faeroe Islands		251	17				
Falkland Islands		203	27				
Fiji	3	112	15	34	1,307	11	310
Finland	6	421	80	5	1,040	4	58
France	39	517	148	46	4,500	20	110
French Guiana	90	644	198	132	5,300	5	320
French Polynesia		116	21	13			
Gabon	41	632	166	130	6,500	1	150
Gambia	14	535	133	58	966	0	8
Georgia	15	268	98	61			
Germany	20	487	126	15	2,600	10	72
Ghana	72	729	249	135	3,600	1	124
Gibraltar	2	270	7	14			
Greece	21	412	118	63	4,900	21	71
Greenland		133	33				
Grenada	6	148	33	25	919	1	148
Guadeloupe	5	189	23	30		1	261
Guam		61	10	13			
Guatemala	133	684	193	236	8,000	29	652
Guinea	48	640	215	95	3,000	0	
Guinea-Bissau	13	459	101	47	1,000	0	
Guyana	104	786	237	136	6,000	2	407

Country	Amphibians	Birds	Mammals	Reptiles	Flowering plants	Conifers and cycads	Ferns
Haiti	47	271	41	115	4,685	7	550
Honduras	101	699	201	213	5,000	30	650
Hong Kong	23	306	57	76			
Hungary	17	367	88	18	2,343	8	60
Iceland		305	33	1	340	1	36
India	233	1,180	422	521	15,000		1,000
Indonesia	285	1,604	667	749	27,500		1,875
Iran	23	498	158	220			
Iraq	11	396	102	99			
Ireland	4	408	63	6	892	2	56
Israel	8	534	115	99	2,780	6	25
Italy	45	478	132	55	5,463	29	106
Jamaica	24	298	35	49	2,746	4	558
Japan	64	592	171	92	4,700	42	630
Jordan	1	397	93	80	2,200		
Kazakhstan	15	497	145	51			
Kenya	76	1,103	407	261	6,000	6	500
Kiribati		50	1	6	60	0	
Kuwait		358	23	23	234		
Kyrgyzstan	7	207	58	30	70		
Laos	59	704	215	147			
Latvia	13	325	68	7	1,153	4	48
Lebanon	3	377	70	44	2,863	11	35
Lesotho	7	311	59	40	1,576	0	15
Liberia	42	576	183	80	2,200	0	
Libya	5	326	87	68	1,800	10	15
Liechtenstein	8	241	56	5			
Lithuania	12	227	71	6	1,328	3	21
Luxembourg	16	284	66	9	1,200	4	42
Macau		56	4	2			
Macedonia, FYR	5	291	89	29			
Madagascar	226	262	165	383	9,000	5	500
Malawi	56	658	207	108	3,600	4	161
Malaysia	200	746	337	388	12,500		1,100
Maldives		166	15	8			
Mali	32	624	134	107	1,741	0	
Malta	1	357	34	16	900	3	11
Marshall Islands		57	4	9	100	1	10
Martinique	3	168	18	18		1	259
Mauritania	3	521	94	74	1,100	0	
Mauritius	2	137	14	35	700	0	178
Mexico	358	1,026	544	837	25,000	48	1,000
Micronesia, Fed States		97	8	13			
Moldova	11	203	50	15			
Monaco	1	12	4	5			

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Country	Amphibians	Birds	Mammals	Reptiles	Flowering plants	Conifers and cycads	Ferns
Mongolia	8	387	140	23	2,272		
Morocco	14	430	129	102	3,600	19	56
Mozambique	59	685	228	195	5,500	9	183
Myanmar	89	1,047	288	285	7,000		
Namibia	40	619	192	215	3,978	1	61
Nauru		13		0			
Nepal	50	864	203	123	5,160	28	380
Netherlands	17	444	95	13	1,170	3	48
Netherlands Antilles	3	259	41	37			
New Caledonia	1	150	28	96	3,017	44	261
New Zealand	6	351	73	54	2,160	22	200
Nicaragua	61	632	181	178	7,000	14	576
Niger	8	493	123	60	1,170	0	8
Nigeria	73	899	290	155	4,614	1	100
Niue		21	1	7			
North Korea	17	369	105	20	2,898		
Northern Mariana Islands		93	6	14			
Norway	5	442	83	7	1,650	4	61
Oman	3	483	74	69	1,182	4	14
Pakistan	17	625	195	190	4,929	21	
Palau	1	112	8	21			
Palestinian Territories							
Panama	182	904	241	242	9,000	15	900
Papua New Guinea	253	720	260	338	10,000		
Paraguay	76	696	168	144	7,500	1	350
Peru	361	1,781	441	354	17,121	24	1,100
Philippines	110	590	222	274	8,000	31	900
Poland	18	424	110	11	2,300	10	62
Portugal	20	501	105	38	2,500	8	65
Puerto Rico	24	310	38	65	2,128	1	364
Qatar		151	8	11	220		
Réunion	2	73	11	19	750	0	240
Romania	19	365	101	22	3,175	11	62
Russian Federation	32	645	296	95			
Rwanda	31	665	206	97	2,288	2	
Saint Helena	1	128	16	3			
Saint Kitts and Nevis	2	132	7	16			
Saint Pierre and Miquelon		308					
Samoa		49	6	19			
San Marino		6	3	2			
Sao Tome and Principe	9	112	14	15	744	1	150
Saudi Arabia	6	433	94	103	1,729		
Senegal	32	612	191	92	2,062	0	24
Serbia	10	381	96	35	3,905	19	68
Seychelles	12	238	25	38	1,139	1	90

Country	Amphibians	Birds	Mammals	Reptiles	Flowering plants	Conifers and cycads	Ferns
Sierra Leone	46	626	197	69	2,090	0	
Singapore	11	400	73	106	2,000	2	170
Slovakia	17	332	87	14			
Slovenia	18	350	87	29			
Solomon Islands	12	248	72	70	2,780	22	370
Somalia	32	642	182	222	3,000	2	26
South Africa	119	829	320	364	23,000	40	380
South Korea	14	423	89	24	2,898		
Spain	32	515	132	67	4,916	18	114
Sri Lanka	66	381	123	181	3,000		314
St. Lucia	3	162	13	23	909		119
St. Vincent and Grenadines	5	153	32	21	1,000	1	165
Sudan	15	952	302	162	3,132	5	
Suriname	86	674	203	141	4,700	3	315
Swaziland	41	490	124	111	2,636	8	71
Sweden	13	457	85	7	1,650	4	60
Switzerland	21	382	93	17	2,927	16	87
Syria	5	350	82	82			
Taiwan	42	392	94	111	2,983	20	565
Tajikistan	7	351	76	51			
Tanzania	132	1,056	375	335	10,000	8	
Thailand	103	971	300	341	11,000	25	600
Timor-Leste		1					
Togo	19	565	175	108	2,484	1	99
Tonga		46	5	18	360	1	102
Trinidad and Tobago	34	435	116	93	1,982	0	277
Tunisia	8	360	78	70	2,150	10	36
Turkey	23	436	145	133	8,472	22	85
Turkmenistan	7	318	103	97			
Turks and Caicos Islands	1	186	6	14			
Uganda	52	1,015	360	165	5,000	6	400
Ukraine	20	325	120	25			
United Arab Emirates	2	268	30	39			
United Kingdom	12	557	103	16	1,550	3	70
United States	285	888	468	360	16,302	125	549
Uruguay	48	414	118	79	2,184	1	93
Uzbekistan	5	343	91	55			
Vanuatu		108	22	25	870		
Venezuela	288	1,392	353	323	20,000	14	1,059
Vietnam	132	837	279	286	7,000		
Virgin Islands	5	223	11	23			
Western Sahara	2	163	28	30			
Yemen	7	385	74	100			
Zambia	66	770	255	143	4,600	1	146
Zimbabwe	40	661	222	180	4,200	6	234