APPENDIX 2

Functional traits explain amphibian distribution in the Brazilian Atlantic Forest

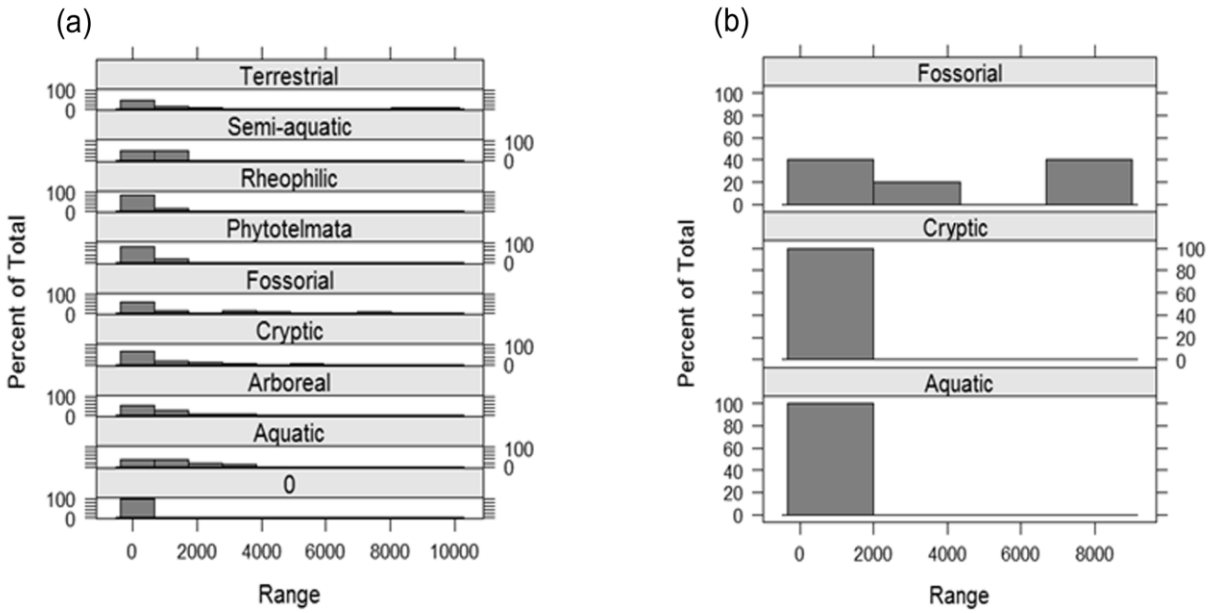

FIGURE 2.1 Histogram showing the percentage of species functional traits vs. distribution (range). (a) Anurans percentage habit, subtraits vs. range; (b) Gymnophionas percentage habit, subtraits vs. range.

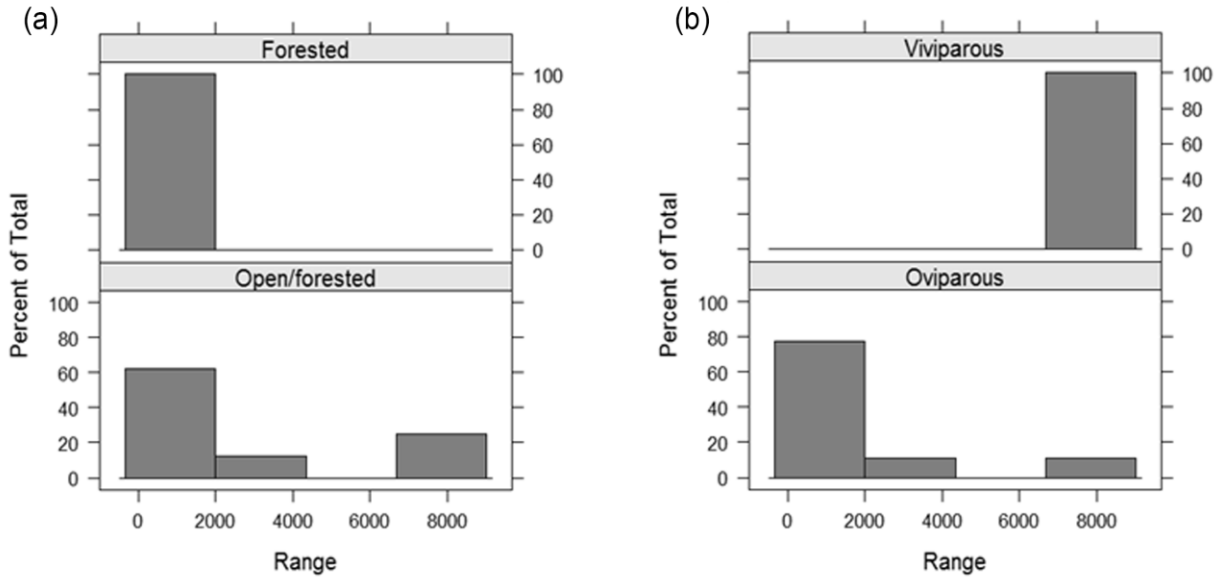

FIGURE 2.2 Histogram showing the percentage of species functional traits vs. distribution (range). (a) Gymnophionas percentage reproductive mode, subtraits vs. range; (b) Gymnophionas habitat, subtraits vs. range.

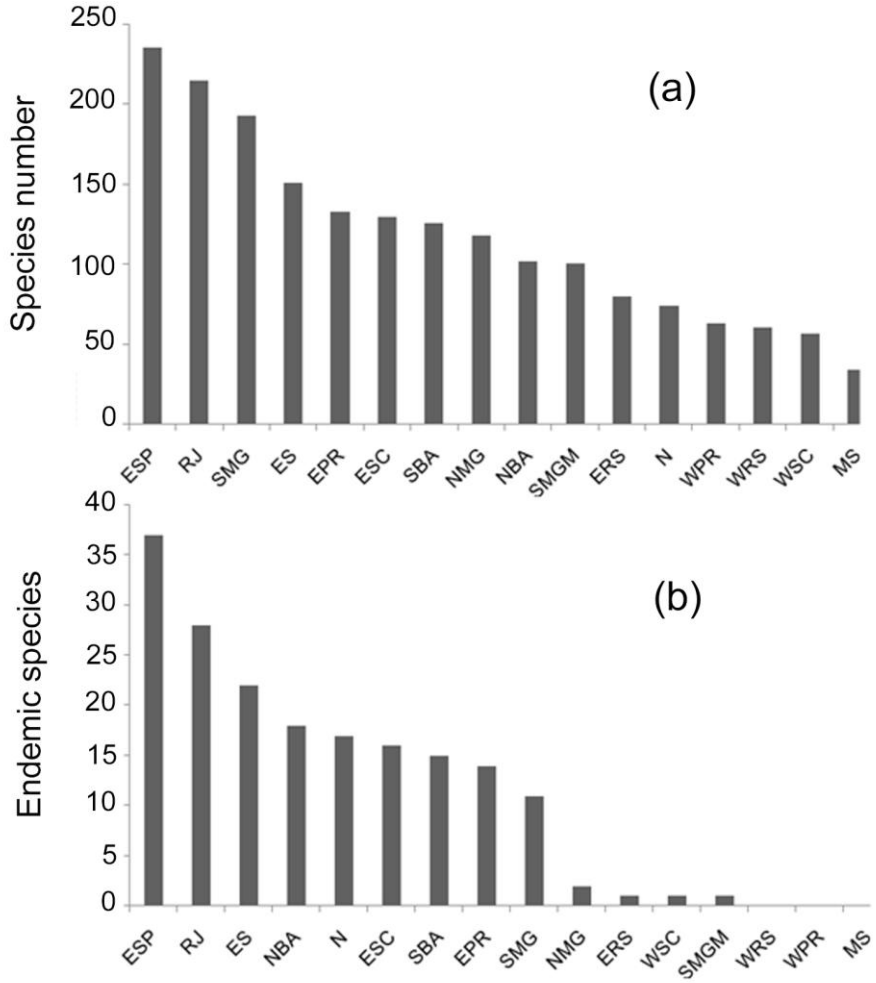

FIGURE 2.3 Total number of amphibian species (a), and amphibian endemic species (b), by study sites in the Brazilian Atlantic Forest.

TABLE 2.1 Association of amphibian species richness to environmental variables in the Brazilian Atlantic Forest by the PERMANOVA. The *P* value in bold indicate significant values ($P<0.01$).

Variables	df	*F* model	R^2	*P* value
Altitude	1	4.4	0.00017	0.036
AET - Evapotranspiration	1	38.3	0.0015	**0.001**
NPP - Net primary production	1	2198	0.08597	**0.001**
Precipitation	1	2917.4	0.11411	**0.001**
Temperature	1	10046.3	0.39294	**0.001**
Tree cover	1	10.9	0.00043	**0.001**
Residuals	10352	–	0.40489	–
Total	10358	–	1.00	–

TABLE 2.2 Association of amphibian species endemics to environmental variables in the Brazilian Atlantic Forest by the PERMANOVA. The *P* value in bold indicate significant values ($P<0.01$).

Variables	df	*F* model	R^2	*P* value
Altitude	1	413.2	0.02948	**0.001**
AET - Evapotranspiration	1	19.3	0.00137	**0.001**
NPP - Net primary production	1	4.1	0.00029	0.049
Precipitation	1	0.3	0.00002	0.578
Temperature	1	3202.0	0.22845	**0.001**
Tree cover	1	25.5	0.00182	**0.001**
Residuals	10352	–	0.73856	–
Total	10358	–	1.00	–

TABLE 2.3 Association of species range to the functional traits to Anuran in the Brazilian Atlantic Forest by the PERMANOVA. The *P* value in bold indicate significant values ($P<0.05$).

Variables	df	*F* model	R^2	*P* value
Activity	1	0.086	0.00014	0.772
Body size	1	22.14	0.03613	**0.001**
Toxicity	1	5.011	0.00818	**0.021**
Habit	1	12.056	0.01967	**0.002**
Habitat	1	57.575	0.09394	**0.001**
Reproductive mode	1	1.013	0.00165	0.312
Residuals	515	–	0.84029	–
Total	521	–	1.00000	–

TABLE 2.4 Association of species range to the functional traits to Gymnophionas in the Brazilian Atlantic Forest by the PERMANOVA. The *P* value in bold indicate significant values ($P<0.05$).

Variables	df	*F* model	R^2	*P* value
Body size	1	1.346	0.02823	0.282
Habit	1	2.674	0.05609	0.175
Habitat	1	32.126	0.67401	**0.001**
Reproductive mode	1	7.519	0.15775	**0.027**
Residuals	4	–	0.08392	–
Total	8	–	1.00000	–

TABLE 2.5 Association of species range to the functional sub-traits to anurans in the Brazilian Atlantic Forest by the ANOVA. The *P* value in bold indicate significant values ($P<0.05$).

Variables	df	F value	*P* value
Habit			
Arboreal	1	2.69	0.10
Phytotelmata	1	0.21	0.64
Terrestrial	1	8.97	**0.00**
Cryptic	1	0.56	0.45
Fossorial	1	2.76	0.09
Rheophilic	1	0.09	0.76
Semi-aquatic	1	0.26	0.61
Aquatic	1	1.22	0.27
Residuals	513		
Body size			
Miniature	1	0.05	0.80
Small	1	3.75	0.06
Medium	1	12.44	**0.00**
Large	1	3.15	0.09
Residuals	513		
Habitat			
Forested	1	0.65	0.41
Open area	1	12.66	**0.00**
Open forested	1	7.30	**0.00**
Residuals	518		
Poisonous			
Toxic	1	15.68	**0.00**
Unpalatable or bad odor	1	1.09	0.26
Non-toxic	1	9.51	**0.00**
Residuals	518		

TABLE 2.6 Association of species range to the functional sub-traits to Gymnophionas in the Brazilian Atlantic Forest by the Kruskal-Wallis ($P<0.05$).

Variables	Chi-squared	df	*P* value
Habit	55.236	2	0.063
Habitat	33.409	1	0.067
Reproductive Mode	14.848	1	0.223

TABLE 2.7 Partitioning of amphibian beta diversity. Analyses were made from the territory with greater species richness for the other subsets. A mean of the results of each territories of each group and presented for evaluation difference between the species similarity groups. In bold shown the greatest diversity beta values.

	Sørensen (βsor)				**Nestedness (**βnes)				**Turnover (**βsim)			
Groups					ESP							
Group1	All altitudes	0-300m	300-700m	700-2000m	All altitudes	0-300m	300-700m	700-2000m	All altitudes	0-300m	300-700m	700-2000m
ESP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
RJ	0.282	0.263	0.263	0.269	0.035	0.016	0.029	0.039	0.247	0.247	0.234	0.229
SMG	0.329	**0.403**	0.268	0.314	0.075	0.195	0.069	0.060	0.254	**0.416**	0.199	0.254
Mean	0.203	0.222	0.177	0.194	0.037	0.070	0.033	0.033	0.167	0.332	0.217	0.242
DP ±	0.178	0.205	0.153	0.170	0.037	0.108	0.035	0.031	0.144	0.119	0.025	0.017
Group2a												
SMGM	0.460	0.751	0.446	0.448	0.361	0.551	0.381	0.357	0.099	0.200	0.065	0.091
WPR	0.666	0.719	0.736	0.654	0.459	0.452	0.444	0.460	0.206	0.267	0.210	0.194
WSC	0.734	0.713	0.727	0.741	0.418	0.436	0.393	0.447	0.316	0.277	0.333	0.294
MS	0.770	0.750	0.757	0.000	0.682	0.574	0.669	0.000	0.088	0.176	0.088	0.000
WRS	0.744	0.710	0.749	0.785	0.367	0.330	0.353	0.460	0.377	0.379	0.397	0.326
Mean	**0.675**	**0.729**	**0.683**	**0.657**	**0.457**	**0.469**	**0.448**	**0.431**	0.217	0.260	0.218	0.226
DP ±	0.126	0.020	0.133	0.150	0.132	0.098	0.128	0.050	0.128	0.079	0.146	0.106
Group2b												
EPR	0.491	0.248	0.457	0.499	0.197	0.248	0.237	0.194	0.293	0.154	0.220	0.305
ESC	0.612	0.148	0.592	0.595	0.158	0.148	0.181	0.168	0.454	0.429	0.410	0.427
ERS	0.747	0.250	0.736	0.733	0.247	0.250	0.256	0.281	0.500	0.478	0.480	0.452
Mean	**0.616**	0.215	**0.595**	**0.609**	0.201	0.215	0.225	0.214	0.**416**	0.353	0.370	0.395
DP ±	0.128	0.058	0.140	0.118	0.044	0.058	0.039	0.059	0.109	0.175	0.134	0.079

Group3												
ES	0.576	0.511	0.546	0.567	0.119	0.095	0.142	0.153	0.457	0.416	0.404	0.414
SBA	0.702	0.673	0.693	0.679	0.130	0.091	0.152	0.268	0.571	0.582	0.541	0.412
NBA	0.757	0.718	0.743	0.765	0.159	0.144	0.187	0.258	0.598	0.574	0.556	0.507
NMG	0.599	0.576	0.589	0.589	0.201	0.199	0.207	0.243	0.398	0.378	0.382	0.346
N	0.787	0.757	0.791	0.798	0.233	0.195	0.245	0.281	0.554	0.562	0.545	0.517
Mean	**0.684**	**0.647**	**0.672**	**0.680**	0.168	0.145	0.187	0.241	**0.516**	**0.502**	**0.486**	**0.439**
DP ±	0.094	0.102	0.103	0.103	0.048	0.052	0.042	0.051	0.085	0.098	0.085	0.072