ATLANTIC-FRUGIVORY: A PLANT-FRUGIVORE INTERACTION DATASET FOR THE ATLANTIC FOREST

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INTRODUCTION

Seed dispersal by animals is a crucial ecological process that has shaped the co-evolution of animals and plants for at least 80 My (Eriksson 2014). In tropical forests, plant-frugivore interactions are an ubiquitous component of biodiversity, where 70 to 94% of the woody plant species produce fleshy fruits that are both consumed and dispersed by animals (Howe and Smallwood 1982;Almeida-Neto et al. 2008;Jordano 2013). Moreover, most animals in tropical regions depend on fruits as a food source in some extent during their lifetime span (Fleming et al. 1987;Kissling et al. 2009), with intensive frugivory in many cases or during critical periods of their annual cycle (Wheelwright 1983).

Habitat loss, fragmentation, defaunation, and climate change may lead to critical changes in both frugivore and plant assemblages (Mokany et al. 2014;Morante-Filho et al. 2015;Neuschulz et al. 2016). The decline in frugivore populations affects the ecosystem functionality because it leads to a decline in seed removal rates (Pizo 1997), dispersal distances (Donatti et al. 2009), and survival probability (Rother et al. 2016). Therefore it can induce rapid evolutionary changes in seed size (Galetti et al. 2013), disrupt gene flow (Carvalho et al. 2016), and ultimately, affect key ecosystem services such as carbon storage (Bello et al. 2015;Peres et al. 2016).

These negative effects are becoming increasingly common in degraded tropical ecosystems (Arroyo-Rodríguez et al. 2015). For example, the Atlantic Forest, which is a hotspot of biodiversity (Morellato and Haddad 2000;Joly et al. 2014), has been highly threatened by forest fragmentation and overexploitation of its natural resources. Currently 80% of the Atlantic Forest fragments have less than 50 ha, and almost half of these forest remnants are composed mainly by edged and are highly defaunated areas (Ribeiro et al. 2009;Jorge et al. 2013). In this biome, frugivory plays an important role as up to 89% of the woody plants rely on animals to be dispersed (Almeida-Neto et al. 2008). Thus, the widespread defaunation and consequent changes in seed dispersal will likely affect the functionality of several ecosystem services (Banks-Leite et al. 2014;Dirzo et al. 2014).

The rapid frugivore decline creates an urgent need to understand the links that maintain seed dispersal processes and ecosystem services in the Atlantic Forest before further diversity is lost. To approach this need, we have created the ATLANTIC dataset. This dataset is a compilation of 8320 frugivory interactions reported for the Atlantic Forest of Brazil. It includes interactions among 331 vertebrate species and 788 plant species. The records are from plant-frugivore interactions where fruit consumption and handling may end up as actual consumption of the seed and posterior seed dispersal for the plant (endozoochory). In addition, we present some functional traits important to understand frugivore process, i.e. fruit and seed size, fruit color, frugivore's body mass and gape size (Levey 1987).

METADATA

CLASS I. DATA SET DESCRIPTORS

A. Data set identity:

Title: ATLANTIC-FRUGIVORY. A plant-frugivore dataset for the Atlantic Forest

B. Data set and metadata identification codes:

Suggested Data Set Identity Codes: ATLANTIC-frugivory.csv

C. Data set description

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Abstract: The dataset provided here includes 8320 frugivory interactions (records of pairwise interactions between plant and frugivore species) reported for the Atlantic Forest. The dataset includes interactions between 331 vertebrate species (232 birds, 90 mammals, five fishes, one amphibian and three reptiles) and 788 plant species. We also present information on traits directly related to the frugivory process (endozoochory), such as the size of fruits and seeds and the body mass and gape size of frugivores. Data were extracted from 166 published and unpublished sources spanning from 1961 to 2016. While this is probably the most comprehensive dataset available for a tropical ecosystem, it is arguably taxonomically and geographically biased. The plant families better represented are Melastomataceae, Myrtaceae, Moraceae, Urticaceae and Solanaceae. *Myrsine coriacea, Alchornea glandulosa, Cecropia pachystachya,* and *Trema micrantha* are the plant species with the most animal dispersers (83, 76, 76 and 74 species, respectively). Among the animal taxa, the highest number of interactions is reported for birds (3883), followed by mammals (1315). The woolly spider monkey or muriqui, *Brachyteles arachnoides*, and rufous-bellied thrush, *Turdus rufiventris*, are the frugivores with the most diverse fruit diets (137 and 121 plants species, respectively). The most important general patterns that we note are that larger seeded plant species (>12 mm) are mainly eaten by terrestrial mammals (rodents, ungulates, primates and carnivores) and that birds are the main consumers of fruits with a high concentration of lipids. Our dataset is geographically biased, with most interactions recorded for the southeast Atlantic Forest.

D. Key words: *Frugivory, Atlantic Forest, Plant-animal interaction, Fruit traits, Seed dispersal, Frugivores, Mutualism, Network.*

E. Description: The dataset includes 8320 plant-frugivore interactions involving 788 plant species and 331 frugivore species reported in 166 studies; however, some interactions are reported in more than one study in different locations, so in total there are 5240 unique interactions. Here, we present only the occurrence of fruit consumption events, excluding pulp consumption and seed predation interactions (Galetti 1993;Pizo et al. 1995). In addition, we do not record the strength of the interactions, so inferences about the frequency of an interaction or its actual outcome (i.e., whether the interaction resulted in successful seed dispersal and establishment) should not be made.

The dataset is restricted to the Atlantic Forest domain (Joly et al. 2014) but is mostly concentrated in the southeast of the Atlantic Forest (Figure 1). It includes 232 birds, 90 mammals, five fish, three reptiles and one amphibian interacting with 788 species of plants. The included plants are predominantly trees (68.2% of the species) and shrubs (21.5%), but palms (4%), lianas (3.1%), and epiphytes, herbs and parasites (<3%) are also present.

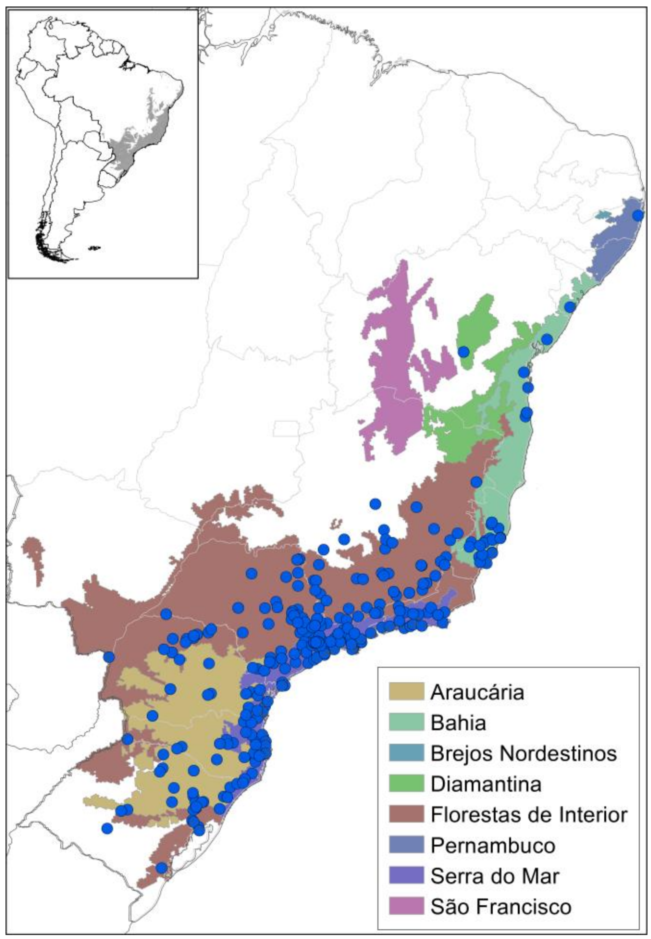

Figure 1. Distribution of the plant-frugivore interaction records according to the Bioregions of the Atlantic Forest biome. The colors show the domain of the Atlantic Forest classified to bioregions according to the map of (Olson et al. 2001). The dots show the locations of the original studies reporting plant-frugivore interactions. Light gray lines show the states of Brazil.

We found that in average each frugivore interacts with 15.8 (± 22.4) plant species, while each plant interacts with 6.6 (± 10.7) frugivore species. The plant families with most of the interactions are Melastomataceae (623 interactions), Myrtaceae (448 interactions), Moraceae (344 interactions), Urticaceae (228 interactions) and Solanaceae (214 interactions). *Myrsine coriacea*, *Alchornea glandulosa*, *Cecropia pachystachya*, and *Trema micrantha* are the plant species with the greatest number of dispersers (83, 76, 76 and 74, respectively). *Euterpe edulis* is the most cited species in the frugivory studies (367 times), but it only interacts with 54 species of frugivores (Figure 2).

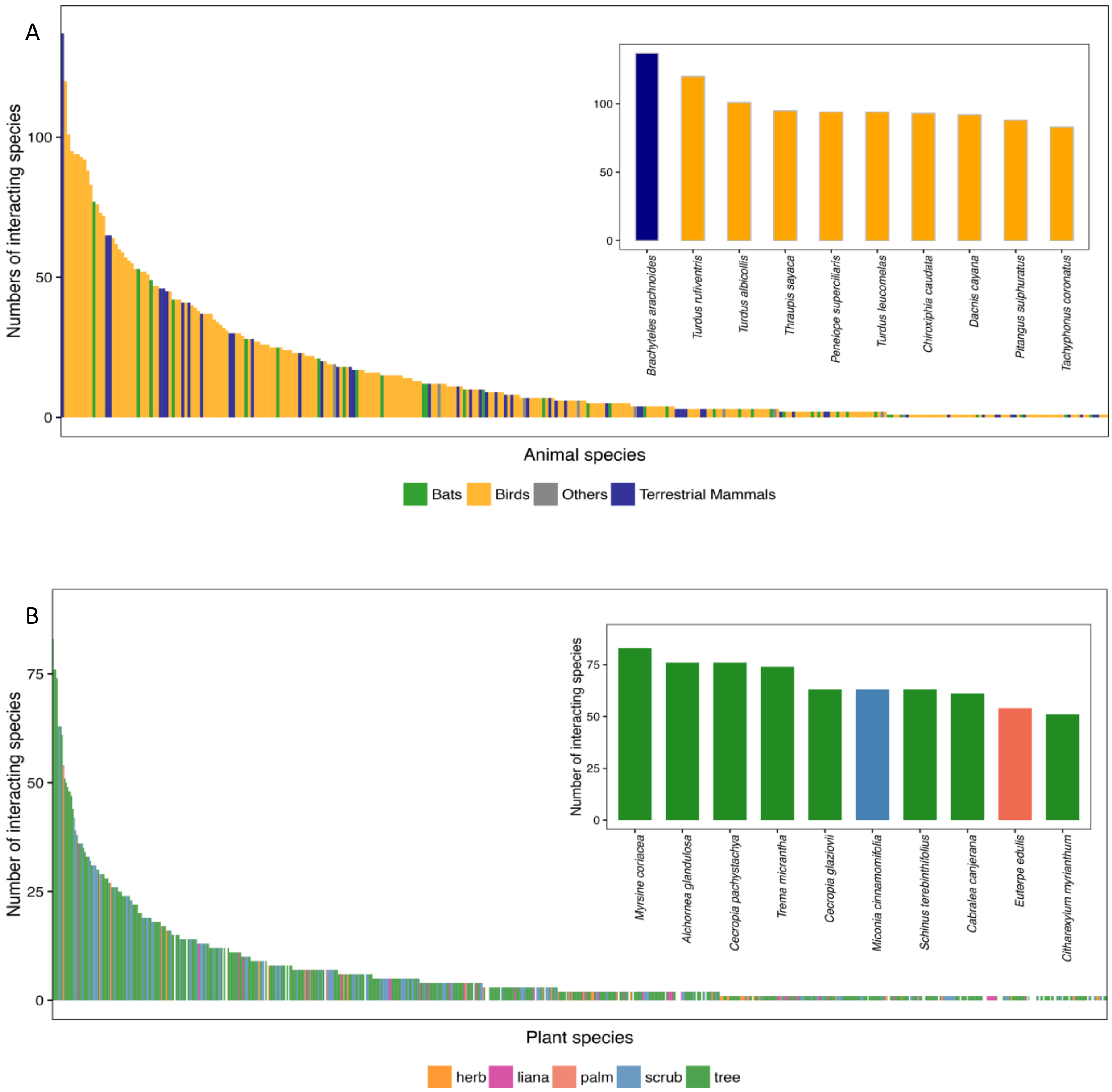

Figure 2. Rank plots of the number of interacting species for each species of animal (A) and plant (B). In the right corner, we show the top-ten species with the highest number of interactions. Animals are colored according to the main group they belong to: bats (green), birds (yellow), terrestrial mammals (primates, ungulates, rodents, carnivores, marsupials; blue), and others (gray). Plants are colored according to growth form: herbs (orange), lianas (purple), palms (pink), shrubs (blue), and trees (green).

Most of the interactions have been reported for birds (3883), followed by mammals (1315). The wooly spider monkey or muriqui, *Brachyteles arachnoides*, and the rufous-bellied thrush, *Turdus rufiventris*, are the animal species with the most diverse diets (137 and 121 plants species recorded, respectively) (Figure 2). The Atlantic Forest is a biome where all classes of vertebrates have been reported eating fruits, even amphibians. Although several species of lizards and fish have been reported to eat fruits in the Atlantic Forest, most of these studies do not identify the plant species and, therefore, these information sources were not included here.

The dataset includes trait information for most of the animal and plants species (Table 1). Regarding those traits that are known to mediate frugivory interactions and their immediate consequences (Levey 1987;Dehling et al. 2016), we report fruit- and seed-related traits for almost half of the plant species (Table 1) and body mass and mean gape size for 98% and 58% of the animal species, respectively. The correlations between the numerical trait of animal and plant species that can be expected to limit a frugivory event through physical constraints were positive and significant but not very strong (***seed diameter****:* body size $r = 0.22$, $p < 0.01$, gape size $r = 0.13$ $p < 0.01$; ***fruit diameter*****:** body size $r = 0.34$, $p < 0.01$, gape size $r = 0.23$, $p < 0.01$).

Table 1. Summary of the trait information presented in the ATLANTIC dataset. For each trait we show the number of species for which the trait is recorded (No spp. with info), the percentage of knowledge of each trait (No of spp. with information/Number of all plants/animal species in the dataset). For each metric trait, we show the mean ± standard deviation (minimum, maximum). For description of the traits, see the variable information section.

	Traits	**No spp. with info**	**% of knowledge**	**Mean ± standard deviation (min, max)**
PLANTS	Occurrence	754	95.6%	-
	Establishment	752	95.4%	-
	Habit	739	94.0%	-
	Form	749	95.0%	-
	Fruit diameter (mm)	436	55.3%	14.66 ±16.2 (1, 150)
	Fruit length (mm)	417	52.9%	21.43±35.45 (0.4, 405)

	Seed diameter (mm)	361	45.8%	6.4±5.91 (0.01,37.1)
	Seed length (mm)	304	38.6%	11.46±9.1 (0.4, 61.4)
	Fruit color	704	89.3%	-
	Lipid score	787	99.8%	-
	Presence in IUCN list	164	20.8%	-
ANIMALS	Body mass (g)	322	97.2%	1596.19 ±14987.15 (6,260000)
	Mean gape size (mm)	190	57.4%	12.26 ±9.94 (28, 123.3)
	Frugivory score	312	94.25%	-
	Migration	171	51.6%	-
	Presence in IUCN list	325	98.1%	-
	Population trend	299	90.3%	-

The dataset also includes 12 exotic plant species, nine cultivated species, 24 naturalized species and 14 invasive species. In terms of conservation status, 9% of the reported animal species and 3.5% of the plant species are listed under some category of threat according to the IUCN (Table 2). Among the frugivore species, 115 are classified as having populations in decline, whereas only 29 are classified as increasing its population size.

Table 2. IUCN conservation status of animals and plants species reported in the ATLANTIC dataset.

	Animals	**Plants**
Critically endangered (CR)	5	3
Endangered (EN)	10	11
Vulnerable (VU)	10	11
Near Threatened (NT)	19	8
Least Concern (LC)	277	131
Data Deficient (DD)	4	3
Not evaluated (NE)	6	624

The most common fruit colors are black (32%) and red (16%), whereas other fruit colors include blue and pink. Small birds are mostly associated with red fruits, bats with green fruits whilst primates and large birds eat fruits of any color (Figure 3).

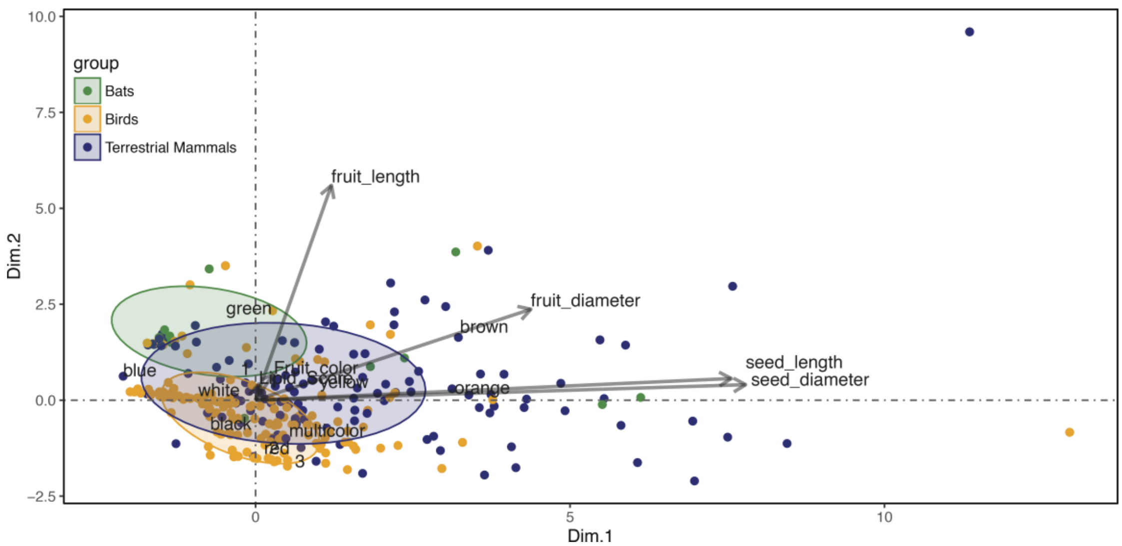

Figure 3. Factor analysis relating plant traits to animal groups. Plant traits included are seed diameter (seeddiam), seed length (seedlen), fruit diameter (fdiam), fruit length (flen), lipid concentration (Lipid_Score) and fruit color. The equiprobability ellipses include 80% of the plant species eaten by each group of animals. Arrows represent the relative magnitude of correlation of the main variables (amplified 10 times for graphical purposes) with the first two axes of the ordination. Large-seeded plant species are mostly located on the right-hand side of the plot and plants with large fruits are mostly located on the top of the plot.

We identify that ungulates, rodents, carnivores and primates are the main consumers of fruits with large seeds (Figure 3). Fruits with small seeds are more likely to be consumed by more frugivores than fruits with large seeds (Figure 4). Most of the fruits consumed by frugivores have a low lipid concentration, but birds and rodents are associated with lipid-rich fruits (Figure 5a). Frugivorous bats and rodents as well as large birds were the groups including the largest proportions of animal species with a high dependency on fruits, and they thus potentially perform a major role in seed dispersal (Figure 5b).

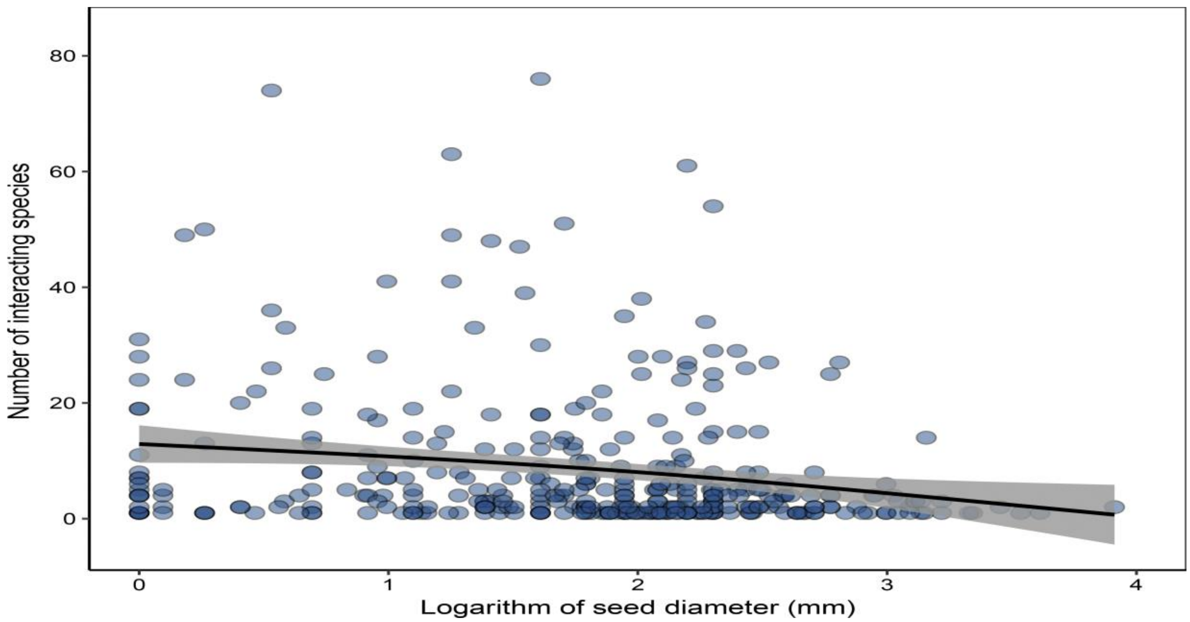

Figure 4. Relationship between seed diameter and the number of animal frugivore species recorded in interactions. Each point represents a plant species. The black line shows a non-parametric smoothing fit of the relation; the gray zone is the 95% interval of confidence.

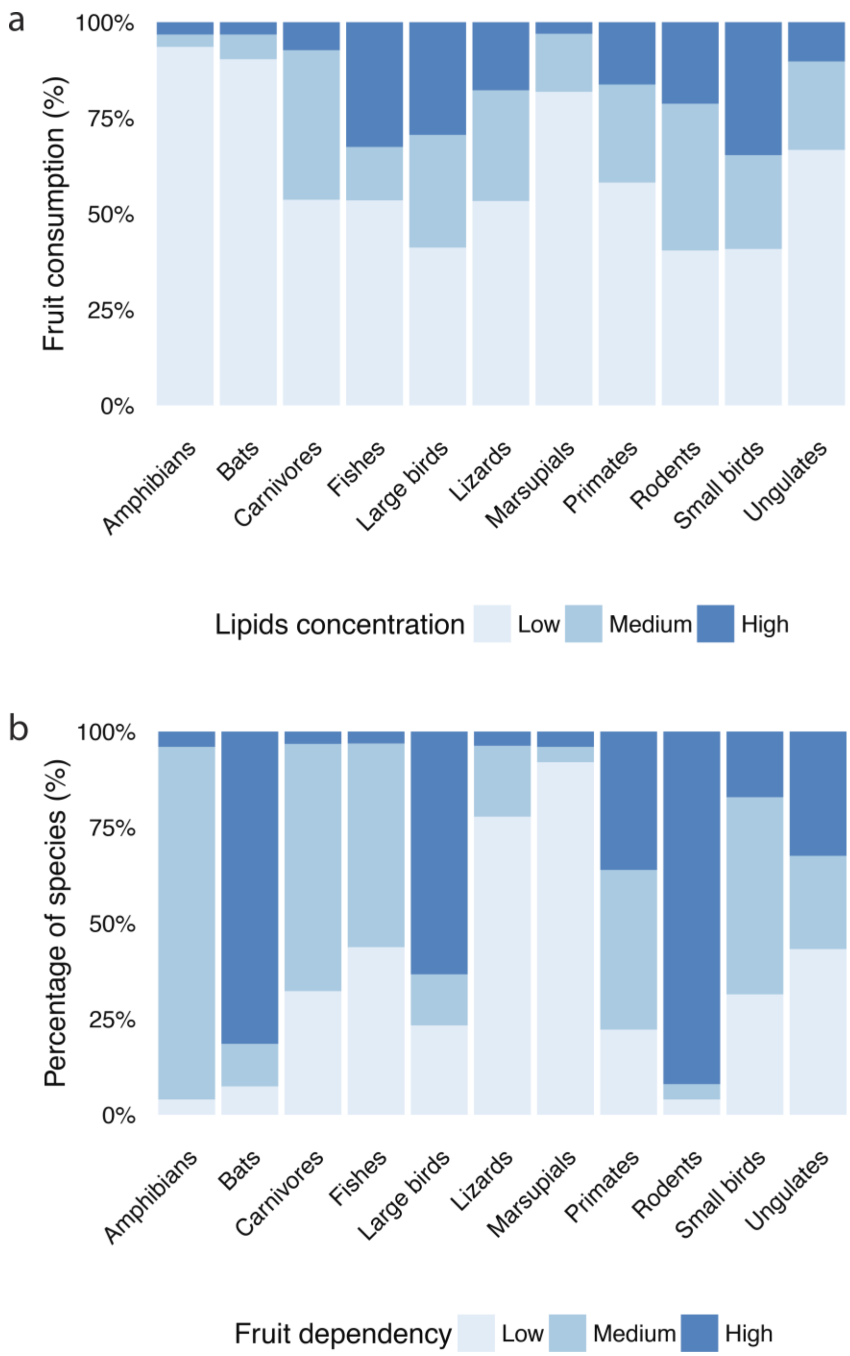

Figure 5. The lipid concentration of fruits consumed and the level of specialization to frugivory by each frugivore group. Panel a) shows the proportion of fruits consumed with low (0-10%), medium (10-20%) or high (>20%) lipid concentration for each frugivore group, where the percentages are relative to pulp dry mass. Panel b) shows the proportion of species for which the level of reliance on fruit in the diets is low (occasional consumer), medium (frequent consumer, but also consuming other kind of food) or high (strict frugivore) for each frugivore group.

The data have a geographical bias due to the variation in research effort across the Atlantic Forest bioregions (Figure 1). Geographical information is available for 62% of the interactions reported. Most of the locations are concentrated in the southeast of the Atlantic Forest mainly in the State of São Paulo (n= 3263, 60%) and Rio de Janeiro (n= 475, 8%). Among the bioregions, the Serra do Mar domain contains the largest amount of interactions (n= 2358, 45%), followed by the seasonal-semideciduous forests of Florestas de Interior (n= 2043, 39%). The dataset includes no information for the São Francisco bioregion.

CLASS II. RESEARCH ORIGIN DESCRIPTORS

A. Overall project description

Identity: A compilation of plant-frugivore interaction records reported for the Atlantic Forest.
Period of study: Dates of source publications range from 1961–2016.
Objectives: Our objectives for compiling the data for this Data Paper were to (1) summarize information on pairwise interactions between plant and animal species for fruit consumption in the Atlantic Forest biome and provide basic information on species traits, and (2) identify major patterns in the reported interactions and identify knowledge gaps to guide future sampling efforts. Our dataset represents a first attempt to obtain a large-scale catalogue of ecological interactions with application in macro-ecological studies of diversity patterns. The dataset can also be used as a reference baseline for studies of Atlantic Forest restoration, for the assessment of global change effects (e.g., forest fragmentation) and for future documentation of the interaction component of biodiversity over large spatial scales.
Abstract: Same as above.
Sources of funding: The compilation of this dataset was supported by the São Paulo Research Foundation (FAPESP) (Grant n° 2013/50421-2, 2013/22492-2, 2014/01986-0, 2014/50434-0, 2015/23770-1, 2015/19092-8, 2015/18381-6 and 2015/15172-7). MG and MAP received a research grant from the Brazilian Research Council (DUP-SCM-MCT/CNPq). OO was supported by funding from the Academy of Finland (grant 273253 and CoE grant 284601) and the Research Council of Norway (CoE grant 223257). PJ was supported by a Junta de Andalucía Excellence Grant (RNM-5731) as well as a Severo Ochoa Excellence Award (Spanish Min. Econ. Comp., SEV-2012-0262).

B. Specific subproject description

Site description: The Atlantic Forest is an important biodiversity hotspot (Galindo-Leal and Camara 2003). It comprises tropical and subtropical forests with highly heterogeneous environmental conditions. It supports up to 8% of the world's total species richness and has one of the highest rates of endemism in the world (Morellato and Haddad 2000;Joly et al. 2014). The Atlantic Forest supports at least 15,519 plant species (3343 trees) (BFG 2015), 891 bird species (Moreira-Lima 2014), 543 amphibians (Haddad et al. 2013), 200 reptiles, 350 fishes (Ministério do Meio

Ambiente 2010), and 298 mammals (Paglia et al. 2012). In addition, seed dispersal by vertebrates plays an important role in this biome, with 89% of all woody species depending on animals for their dispersal (Almeida-Neto et al. 2008).

Seventy-two percent of the Brazilian population lives in former areas of the Atlantic Forest domain (~145 million people) (IBGE 2013). Therefore, many past and present economic activities such as logging, sugarcane and coffee farming, agribusiness, industrialization and unplanned urban expansion have contributed to the deterioration of the ecosystem (Dean 1996). Currently, conservation of the Atlantic Forest is critical, with the natural remnants accounting for only 12% of the original biome and over 80% of these remnants occurring as < 50 ha fragments (Ribeiro et al. 2009). Of the remaining forest, 88% of the fragments are defaunated of large mammals (Jorge et al. 2013).

Experimental/Sampling design: The data were obtained from the published literature, including 166 papers, theses, scientific conference abstracts, technical reports, and photos on web sites (Wikiaves: http://www.wikiaves.com.br/), and our own unpublished observations. We searched for potential studies in the following sources: (i) online academic databases (e.g., ISI Web of Knowledge, Google Scholar, Scielo, Scopus, JStor), (ii) digital libraries of state and federal universities, (iii) references cited in "gray" literature, and (iv) email contacts with local experts. The terms used to search the online databases were "frugivorous", "seed dispersal", "diet", "frugivore networks", "focal observation" and "Atlantic Forest", which were combined in different ways using Boolean operators. Searches were conducted in English, Portuguese and Spanish.

Research methods: We included animal-oriented and plant-oriented studies that reported the occurrence of interactions (i.e., a particular animal species feeding on fruits of a particular plant species or analyses of the diet of a particular animal species). The records in which seed damage and/or seed predation was reported were carefully removed in order to maintain only fruit consumption events with potential for legitimate seed dispersal. However, some events that did not report detailed information can be found across a broad gradient covering the range from fully antagonistic interactions (e.g., pulp consumption with seeds being dropped to the ground) to mutualistic interactions (e.g., fruit/seed handling leading to legitimate seed dispersal). Overall, the records reflect instances of pairwise interactions between plants and animals in which successful endozoochorous seed dispersal might be expected.

We also included information from interaction network studies, which recorded an entire interaction network for a specific location. From these interactions, we recorded plant and animal taxonomy and compiled for each species the traits that can affect the interaction (i.e., size of fruit, gape size, fruit color, body mass). Trait data were extracted from the literature and our own measurements using herbarium and museum specimens. In addition, we recorded basic information from each study (author, title, year, journal, volume, publisher and the link or DOI to the document) and the geographical location when provided (latitude, longitude, locality, municipality and state).

Frugivory interactions were compiled from (Carvalho 1961;Silva 1988;Bonvicino 1989;Silva et al. 1989;Brozek 1991;Motta-Jr 1991;Galetti 1992;Moraes 1992;Rodrigues et al. 1993;Chiarello 1994;Figueira et al. 1994;Galetti and Morellato 1994;Hasui 1994;de Figueiredo and Perin 1995;Masteguin and Figueiredo 1995;Ferrari et al. 1996;Galetti and Pizo 1996;Kindel 1996;Laps 1996;Pizo 1996;Zimmerman 1996;Galetti et al. 1997;Heiduck 1997;Correia 1997 ;Argel de Oliveira 1999;Sabino and Sazima 1999;Galetti et al. 2000;Lopes 2000;da Costa Gondim 2001;Galetti 2001;Silva and Tabarelli 2001;Valente 2001;Zimmermann 2001;Alvarenga 2002;Cazetta et al. 2002;Guerra and Marini 2002;Mikich 2002a,b;Pizo et al. 2002;Silva et al. 2002;Zimmermann et al. 2002;Aguiar et al. 2003;Castro 2003;Côrtes 2003;Guimarães 2003;Manhães 2003;Manhaes et al. 2003;Passos et al. 2003;Scheibler and Melo-Júnior 2003;Vieiralves Linhares 2003;Alves-Costa et al. 2004;Augusto and Hayashi 2004;Castro and Galetti 2004;Fadini and De Marco 2004;Gridi-Papp et al. 2004;Pimentel and Tabarelli 2004;Pizo 2004;da Rosa and Marcondes-Machado. 2005;Rocha 2005;Silva 2005;Casella and Cáceres 2006;Da Silva and De Britto-Pereira 2006;Faustino and Machado 2006;Krügel et al. 2006;Muller 2006;Pascotto 2006;Pinto and Filho 2006;Zaca et al. 2006;Amaral 2007;Castro 2007;Jesus and Monteiro-Filho 2007;Pascotto 2007;Piccoli et al. 2007;Scherer et al. 2007;Silva et al. 2007;Alves 2008;de Freitas et al. 2008;Galetti et al. 2008;Izar 2008;Keuroghlian and Eaton 2008;Lapenta et al. 2008;Marques and Oliveira 2008;Alves et al. 2009;Athiê 2009;Catenacci et al. 2009;Cortes et al. 2009;Lapate 2009;Novaes and Nobre 2009;Oprea et al. 2009;Parrini et al. 2009;Reys et al. 2009;Vasconcellos-Neto et al. 2009;Brito et al. 2010;Bueno 2010;da Silva 2010;Hilário and Ferrari 2010;Martinelli and Volpi 2010;Morim Novaes et al. 2010;Parrini and Raposo 2010;Rabello et al. 2010;Ribeiro et al. 2010;Rother 2010;Andrade et al. 2011;Cardoso et al. 2011;Caselli and Setz 2011;Colussi 2011;Parrini and Pacheco 2011a;Parrini and Pacheco 2011b;Silva 2011;Weber et al. 2011;Alves 2012;Bredt et al. 2012;Mileri et al. 2012;Pires and Galetti 2012;Sartore and Reis 2012;Vilela et al. 2012;Bueno et al. 2013;Felix et al. 2013;Galetti et al. 2013;Ikuta and de Campos Martins 2013;O'Farrill et al. 2013;Silva et al. 2013;Camargo 2014;Cid et al. 2014;Figueira et al. 2014;Parrini and Pacheco 2014;de A. Moura et al. 2015;Gonçalves and Andrade 2015;Hernández-Montero et al. 2015;Robinson 2015;Rodrigues 2015;Bufalo et al. 2016) and our own observations.

Taxonomic data: We used plant taxonomic information according to the Flora (REFLORA 2014) for the plant species and the Catalog of Life (COL) (Roskov et al. 2015) for the animal species.

Plant traits: We focused on compiling information on those plant traits that are known to affect the success of frugivorous interactions and their potential outcomes for successful seed dispersal (fruit and seed length and diameter, plant geographical distribution, seed dispersal syndrome, fruit color, lipid concentration). We compiled this information from the literature (Martius et al. 1840-1906;Mez 1963;Cowan 1967;Berg 1972;Prance 1972;Rogers and Appan 1973;Landrum 1981;Pennington et al. 1981;Kaastra 1982;Kubitzki and Renner 1982;Forero 1983;Lima and

Lima 1984;Sleumer 1984;Hopkins 1986;Landrum 1986;Hekking 1988;Mori et al. 1990;Pennington 1990;Gentry 1992;Rohwer 1993;Delprete 1999;Henderson 2000;Knapp 2002) (Acevedo-Rodríguez 2003;Maas and Westra 2003;Maas et al. 2003;Madriñán 2004;Melo and Zickel 2004;Secco 2004;Mendonça-Souza 2006;de Moraes 2007;Grokoviski 2007;Marquete and Vaz 2007;Prance et al. 2007;Smith and Coile 2007;Almeida-Neto et al. 2008;Silva et al. 2008;Camargo et al. 2009;Lorenzi 2009;Boeira 2010;Moreira et al. 2010;Staggemeier et al. 2010;Alves-Araujo 2012;Dutra et al. 2012;Lobão et al. 2012;Mello-Silva et al. 2012;Rodrigues 2012;Santos 2012;Fabris and Peixoto 2013;Silva et al. 2013;CRIA 2014) and our own measurements in herbarium and private collections.

Animal traits. We compiled data on animal traits that are considered important for determining the effectiveness of frugivory, particularly mean gape size and body mass. We compiled this information from the literature (Gardner 1962;Davis 1976;Taddei and Reis 1980;Motta-Jr 1991;Hoyo et al. 1994;Argel de Oliveira 1999;Navas and Bó 2001;Dias et al. 2002;Velazco 2005;Zortéa and Tomaz 2006;Bonaccorso et al. 2007;Capusso 2007;Fonseca and Antunes 2007;Dias and Peracchi 2008;Fialho 2009;Marciente and Calouro 2009;Mottin 2011;Paglia et al. 2012;Reis et al. 2013;Louzada et al. 2015;Moratelli R 2015;Vilar et al. 2015) and our own measurements from specimens in museums (Museu de Zoologia de São Paulo-MZUSP and Museu Paraense Emilio Goeldi, Belém). Fruit dependency were obtained according to (Paglia et al. 2012) and expert knowledge.

Statistical analysis. We provide some preliminary, descriptive statistical analyses for an overview of the data. We used Pearson correlations, with the logarithmic transformation of the numerical traits, among variables that can limit the ingestion of the fruit (seed diameter, fruit diameter, body size, gape size). To explore the type of fruit eaten by each group of animals we performed a factor analysis with mixed data using the function FAMD from the package FactoMineR (Lê et al. 2008) in R. We included fruit diameter, fruit length, seed diameter, seed length, fruit color and the lipid score as analysis variables. The continuous variables were transformed and scaled to unit variance, and the categorical variables were transformed into a disjunctive data table (crisp coding) and then scaled using the specific scaling of MCA. We used the type of animal as a supplemental variable, with animal species classified into groups according to the taxonomic order level. For birds, we divided species into small (body mass < 80 g and gape size <12 mm) and large categories (body mass > 80 g and gape size >12 mm) according to (Galetti et al. 2013). We also explored the relationship between seed size (logarithmic transformation) and the number of frugivore species interacting using non-parametric smoothing. Finally, to assess the completeness of the interaction data coverage, we performed an accumulation curve analysis of the number of interactions reported as a function of the number of studies included (Jordano 2016).

C. Data limitations and potential enhancements

We recognize that documenting all frugivory interactions in a megadiverse ecosystem is a challenging task and that the present dataset is likely to include only a subset of those interactions. Therefore, caution is needed when drawing conclusions from this dataset. Biased data can lead to misidentification of ecological and evolutionary processes and the inefficient use of limited conservation resources (Hortal et al. 2015;Jordano 2016).

The first limitation of our data is its representativeness. Our dataset is arguably biased toward trees and shrubs, whereas interactions with many herbs, epiphytes and lianas are likely to be underrepresented. The dataset has a somewhat better representation of mammals known to eat fruits (e.g., primates) and birds. However, neither of these groups are comprehensively represented, as the data include 27.1% of the birds and 30.1% of the mammals reported for the Atlantic Forest (58% if we account only for the mammalian fruit-eaters) ((Paglia et al. 2012;Moreira-Lima 2014); Table 3).

Table 3. Representativeness of our database in relation to the species known to occur in Atlantic Forest. Number of species reported for each class was obtained from literature: Aves (Moreira-Lima 2014), Amphibia, Reptilia and Actinopterygii (Ministério do Meio Ambiente 2010), Mammalia (Paglia et al. 2012). For mammals and birds, we show the total number of species that are known to eat fruits (Frugivorous species and Omnivorous species).

Class	**Order**	**Number of species in the Atlantic Forest**		**Number of species in our dataset**
		All Species	Frugivores and Omnivorous	
AVES		891		242
AMPHIBIA		543		1
REPTILIA		200		3
ACTINOPTERYGII		350		5
MAMMALIA		291		92
MAMMALIA	Artiodactyla	6	6	3
	Carnivora	20	8	8
	Chiroptera	113	23	36
	Didelphimorphia	22	15	12
	Perissodactyla	1	1	1
	Primates	24	24	23
	Rodentia	98	74	7
	Cingulata	7	4	0
AVES	Accipitriformes	41	0	1
	Columbiformes	17	5	8

Coraciiformes	7	2	1
Craciformes	9	9	6
Cuculiformes	11	0	4
Falconiformes	14	0	1
Gruiformes	25	0	1
Passeriformes	476	147	187
Piciformes	36	17	17
Trogoniformes	5	5	4

Some interactions are missing due to the lack of detailed studies including the taxonomic identification of the plant species eaten. For example, some species of fish, amphibians and reptilians with well-studied diets are reported to eat “vegetable matter” (e.g., *Tropidurus, Mabuya, Brycon*) but may in fact be eating and actually dispersing seeds (Valido and Olesen 2007;Correa et al. 2015). However, as no taxonomic information is provided concerning the plant species, we did not report these interactions here. Two tortoise species that occur in the Atlantic Forest (*Chelonoidis carbonaria* and *C. denticulatus*) are known to be important seed dispersers (Strong and Fragoso 2006), but we did not find any frugivory information for the Atlantic Forest.

Our dataset lacks information on secondary seed dispersers. For example, ants are well known to be important seed dispersers in the Atlantic Forest (Pizo and Oliveira 2000;Passos and Oliveira 2002;Christianini and Oliveira 2009;Bieber et al. 2013), and other invertebrates may act as secondary seed dispersers as well (e.g., dung beetles; (Culot et al. 2013)). However, these interactions remain poorly studied and were not included in this dataset. Secondary dispersal by small mammals, raptors and parrots has been occasionally reported (Galetti and Guimaraes Jr 2004;Sazima 2008;Tella et al. 2016), but it information is poorly represented here. Only one invasive mammal species (wild boar, *Sus scrofa*) has been recorded eating fruits (F. Pedrosa et al., unpublished data).

Among the birds, we found that Passeriformes compose the majority of the interactions. The only Trogon specie that is not represented in the dataset is *Trogon collaris*. Interestingly, we found some occasional interactions of species of the orders Accipitriformes, Columbiformes Cuculiformes, Falconiformes and Gruiformes, that are not supposed to eat fruits (Table 3).

For the mammals, our dataset is positively biased towards primates. Only one of the 24 primate species reported for the Atlantic Forest has no data (*Callicebus personatus*). Other orders (e.g., Carnivora, Perissodactyla and Artiodactyla) are well represented, but the ruminants (Ruminantia suborder, Artiodactyla) have been less studied. It is important to mention that the carnivores are well represented in the dataset (Table 3). Of the eight omnivorous carnivores that frequently feed on fruits, we have information for five species (*Cerdocyon thous, Eira barbara, Lycalopex gymnocercus, Nasua nasua, Procyon cancrivorus*) but no information for *Potos flavus,* *Conepatus semistriatus*, or *Conepatus chinga*. Notwithstanding, the dataset contains information on frugivorous interactions of carnivores that are not recognized as fruit-eaters (*Leopardus tigrinus*, *Leopardus wiedii*, *Puma concolor*) or secondary seed dispersers (Sarasola et al. 2016). We also note that the role of Cingulata (*Dasypus hybridus, Dasypus novemcinctus*, *Dasypus septemcinctus* and *Euphractus sexcinctus*) as frugivores is completely missed in our dataset, although they have been recorded as sporadic fruit eaters elsewhere (Dalponte and Tavares-Filho 2004).

We recorded 32% of all bat species reported for the Atlantic Forest as frugivorous, including some genera well known as insectivores (e.g., *Noctilio, Trachops*) (Table 3), showing that, in general, bats can eat fruits more often than expected. Therefore, more efforts should be made to assess the compensatory role of bats when large frugivores are extirpated (Melo et al. 2007;Melo et al. 2009). The taxonomic bias in research imposes some limitations in the analysis of frugivory-related processes (Hortal et al. 2015). For instance, the lack of information for some groups can seriously limit our understanding of compensation effects in the ecological process of animal-mediated dispersal under the current disturbance scenarios in the Atlantic Forest (Bueno et al. 2013).

An additional important limitation is the number of interactions reported. Although the database characterizes the main diet of frugivores, it does not contain the entire spectrum of animal diets. Our dataset reports only 2.02% (5232) of all possible interactions that can occur based on 788 plants and 331 animals. A simple interaction-accumulation analysis (with the number of studies used as a proxy for samples) shows that the dataset does not converge to an asymptotic value as would be needed to estimate of the actual number plant-frugivore interactions in the Atlantic Forest system (Figure 6). Therefore, more studies are needed for a comprehensive representation of the interaction network.

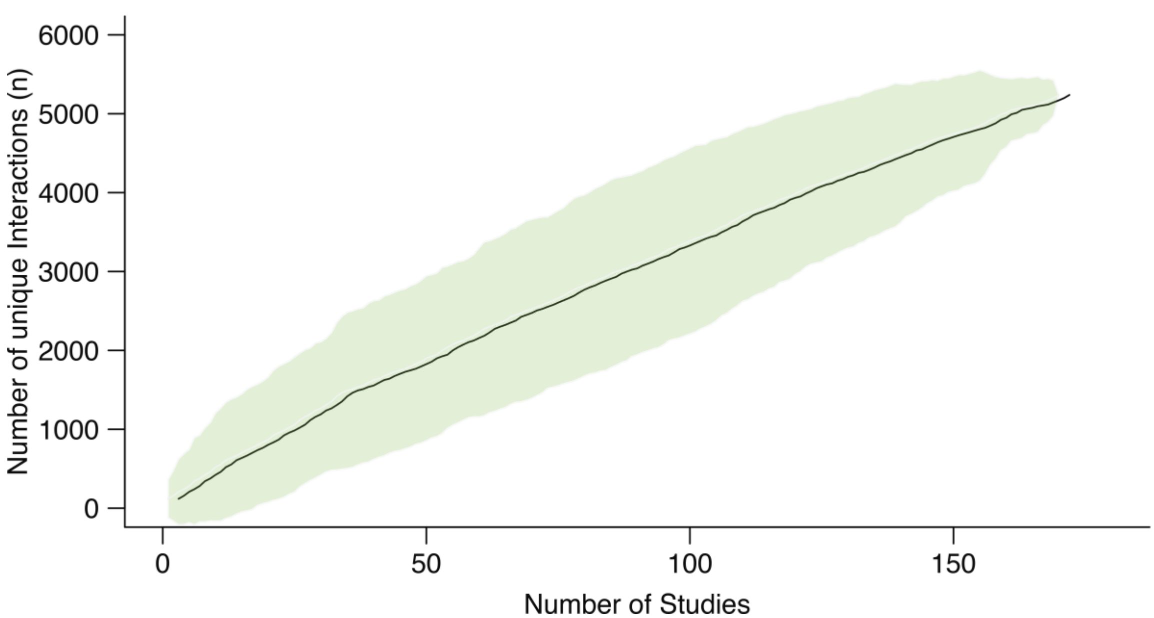

Figure 6. Number of interactions reported as a function of the number of studies included. The figure shows an accumulation analysis performed similarly as species diversity accumulation curve analysis (Jordano 2016). Here we considered each pairwise-interaction as a “species” and the different studies as sampling units. The mean expected value for 172 studies is 5151 distinct pairwise interactions; however, as the curve does not reach an asymptote, many more interactions can be expected to be found by further studies. Black line shows the mean estimate and the green shadow shows the 95% confidence interval around the estimate.

Recognizing all the above-mentioned limitations allows us to suggest guidelines for future research aimed to overcome these limitations. It is important to fill the gap in knowledge for several groups, such as bats, rodents, reptilians, fish, amphibians, cingulata and ruminants. While these groups are not strict frugivores, they may compensate for or complement the seed dispersal functions provided by large frugivores (Bueno et al. 2013). It is also important to understand the role of non-woody plants in the diets of frugivorous animals, e.g., as lianas and epiphytes can provide important fruit resources. In addition, more efforts are needed to obtain quantitative estimates of all plant-animal interactions in the complex Atlantic Forest ecosystem. These efforts need to be focused on the local scale in order to help us to understand the effectiveness of seed dispersal processes in more detail (Vidal et al. 2014).

We hope that the compilation of the Atlantic database encourages researchers to explore of the role of frugivorous interactions that shapes the diversity of species-rich assemblages and ecosystem services. Research on the diversity and functionality of animal-plant interactions complements research focused at the species-level. It further enables the study of ecosystem processes, such as how the loss of key interactions influences food-web organization (Valiente-Banuet et al. 2015). Therefore, more research should be conducted to examine the influence of frugivory in shaping the resilience of diversity and ecosystem services in a changing world. It is time to incorporate biotic interactions in the bigger ecological picture to understand resilience to environmental changes (Araújo et al. 2011;Morales-Castilla et al. 2015). Undoubtedly, there is a demand for forecasting the dynamics and functioning of novel ecosystems emerging from differential responses of species to global change (Montoya and Raffaelli 2010;Lessard et al. 2016).

CLASS III. DATA SET STATUS AND ACCESSIBILITY

A. Status

Latest update: October 2016

Latest archive date: October 2016

Metadata status: Last update October 2016, version submitted

Data verification: Data is mostly from published sources. We searched for extreme values, corrected any transcription errors and homogenized the taxonomic information.

B. Accessibility

Contact person: Carolina Bello or Mauro Galetti, Departamento de Ecologia, Universidade Estadual Paulista, Rio Claro, São Paulo, 13506-900, Brazil E-mail: caro.bello58@gmail.com; mgaletti@rc.unesp.br

Download link: https://github.com/pedroj/ATLANTIC

Copyright restrictions: None.

Proprietary restrictions: Please cite this data paper when the data are used in publications. We also request that researchers and teachers inform us of how they are using the data.

Costs: None.

CLASS IV. DATA STRUCTURAL DESCRIPTORS

A. Data set file

Identity: ATLANTIC-Frugivory.csv

Size: 8320 records, 3968 KB

Format and storage mode: comma-separated values (.csv)

Header information: See column descriptions in section B.

Alphanumeric attributes: Mixed.

Data anomalies: If no information is available for a given record, this is indicated as 'NA'.

B. Variable information

1) Table 4. Interaction information. Description of the fields related with the interaction reported in the Atlantic Forest.

Type of information	Field	Description	Levels	Example
INTERACTION	Record ID number	Identifier straight pins numbered of the interaction record	1 to 8320	15
	Frugivore_Species	Scientific name of the frugivore		*Turdus amaurochalinus*
	Plant_Species	Scientific name of the plant		*Aegiphila integrifolia*
	Type of Interaction	Describe the type of interaction included in the dataset. Mutualism refers to the act of ingesting the seed.	Mutualism	Mutualism

2) Table 5. Plant information. Description of the fields related with the plant involved in the interaction.

Type of information	Field	Description	Levels	Example
PLANT INFORMATION	Plant_family	Family taxonomic classification		Clusiaceae
	Plant_genus	Genus taxonomic classification		*Aegiphila*
	Plant_specific.epiteth	Specific epithet taxonomic classification		*integrifolia*
	Plant_distribution	Brazilian states in which the plants have been reported	AM; PA; MT; MG; BA; MS…	*RJ; BA; MG*
	Plant_origin	If the plant is native or introduced in Brazil	Native Naturalized Cultivated Invasive	Native
	fruit_diameter	Diameter in mm of the fruit		20.3
	fruit_length	Length in mm of the fruit		28.2
	seed_diameter	Diameter in mm of the seed		12.3
	seed_length	Length in mm of the seed		15
	Fruit_color	Color of the mature fruit		green
	Lipid_score		1: 0 to 10% of lipid. 2: 10 to 20% of lipid. 3: > 20% of lipid concentration in dry weight.	1

	Plants_IUCN	IUCN Classification for threatened plants	EX: Extinct EW: Extinct in the wild CR: Critically endangered EN: Endangered VU: Vulnerable NT: Near threatened LC: Least concern DD: Data deficient NE: Not evaluated	CR

3) Table 6. Animal information. Description of the fields related with the animal involved in the interaction.

Type of information	**Field**	**Description**	**Levels**	**Example**
ANIMAL INFORMATION	Frug_Class	Class taxonomic classification	Aves, Mammalia, Amphibia, Reptilia, Actinopterygii	Aves
	Frug_Order	Order taxonomic classification		Passeriformes
	Frug_Family	Family taxonomic classification		Pipridae
	Frug_Genus	Genus taxonomic classification		*Chiroxiphia*

	Frug_Group	Major type of frugivore	Amphibians, Bats, Carnivore Fish, Large Birds, Lizards, Marsupials, Primates, Rodents, Small birds, Ungulates, Tapir	Small Birds
	Frug_Body_Mass	Mean body mass of the frugivore in grams		63
	Frug_Mean_Gape_Size	Mean gape length of the frugivore in mm		12
	Frugivory_score	Grade of frugivory according to the amount of fruit in the animal diet	1: Occasional frugivore 2: Facultative frugivore 3: Strict frugivore	1
	Frug_Migration_status	Migration status	AM: Migratory R: Resident	R
	Frug_IUCN	IUCN Classification for threatened animals	EX: Extinct EW: Extinct in the wild CR: Critically endangered EN: Endangered VU: Vulnerable NT: Near threatened LC: Least concern DD: Data deficient NE: Not evaluated	EN
	Frug_Population_Trend	General population trend	Decreasing, Stable, Increasing	Stable

4) Table 7. Study information. Description of the fields related with the study that reports the interaction.

Type of information	Field	Description	Levels	Example
STUDY INFORMATION	Study reference	The study which report the interaction		Alves 2005
	Study_Method	The type of study according to the focus organisms of the study	Animal-oriented Plant-oriented Network	Animal_Oriented
	Study_Location	Specific location of the study		Carlos Botelho State Park
	Latitude	Decimal coordinates		-25.53122
	Longitude	Decimal coordinates		-47.961431
	Precision	Precision of the given coordinate	Precise Not-Precise City State Island	Precise
	DOI/Link/reference	DOI of the article, link or relevant information for accessing the study		10.4025/actascibiolsci.v32i3.5351

CLASS V. SUPPLEMENTAL DESCRIPTORS

A. Data acquisition

1. Data request history: None

2. Data set updates history: None

3. Data entry/verification procedures

G. History of data set usage

Bello et al. (2015) used the interactions and trait information to define which frugivores disperse large seeds in order to access how defaunation of large frugivores affects carbon stock in tropical forest. Bufalo et al. (2016) used the primate-plant interaction data to explore the implications for the conservation of primates in the Atlantic Forest. Culot et al. (unpublished data) used the frugivore interactions to assess the diet of wooly spider monkey, howler monkey, and black-fronted piping guan and analyze the synergistic effects of seed dispersers and predators on carbon storage in tropical rainforests. Emer et al (unpublished data) used the avian seed dispersal interactions to test how defaunation and habitat fragmentation are affecting network structure at the community level. Pizo et al. (unpublished data) used the data involving to explore the relationship between the overall diet of birds and the lipid content of the fruits they eat

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LITERATURE CITED IN METADATA

Acevedo-Rodríguez, P. 2003. Melicocceae (Sapindaceae): *Melicoccus* and *Talisia*. Flora Neotropica **87**:1-178.

Aguiar, L. d. M., N. R. d. Reis, G. Ludwig, V. J. Rocha, and J. M. D. Miranda. 2003. Dieta, área de vida, vocalizações e estimativas populacionais de *Alouatta guariba* em um remanescente florestal no Norte do estado do Paraná. Neoropical Primates **11**:78-86.

Almeida-Neto, M., F. Campassi, M. Galetti, P. Jordano, and A. Oliveira-Filho. 2008. Vertebrate dispersal syndromes along the Atlantic forest: broad-scale patterns and macroecological correlates. Global Ecology and Biogeography **17**:503–513.

Alvarenga, C. A. d. 2002. Estudo de uma população de *Sciurus ingrami* Thomas, 1901 (Rodentia, Sciuridae) na Reserva Particular do Patrimônio Natural Serra do Caraça, Minas Gerais, Brasil. Master Thesis. Pontifícia Universidade Católica de Minas, Belo Horizonte.

Alves-Araujo, A. 2012. Taxonomia e filogenia de *Pouteria* Aubl. (Sapotaceae) na Mata Atlantica setentrional PhD Thesis. Universidade Federal de Pernambuco Recife.

Alves-Costa, C. P., G. A. B. Da Fonseca, and C. Christofaro. 2004. Variation in the diet of the brown-nosed coati (*Nasua nasua*) in southeastern Brazil. Journal Of Mammalogy **85**:478-482.

Alves, A. d. S. 2012. Frugivoria e dispersão de sementes por *Chiroxiphia pareola* (Pipridae) em um brejo de altitude, nordeste do Brasil. Bachelor Thesis. Universidade Federal da Paraíba-UFPB, Areia, PB.

Alves, A. I., B. Vizioli, V. S. Orsini, A. G. Chiarello, G. E. I. Ximenes, and S. Talamoni. 2009. Registro de *Dasyprocta prymnolopha* em fragmento de mata urbana em Belo Horizonte, Minas Gerais e dados basicos de dieta. Anais do IX Congresso de Ecologia do Brasil, São Lourenço - MG.

Alves, K. J. F. 2008. Composição da avifauna e frugivoria por aves em um mosaico sucessional na Mata Atlântica. Master Thesis. UNESP, Rio Claro.

Amaral, C. 2007. Dieta de duas espécies carnívoras simpátricas (graxaim-do-mato *Cerdocyon thous* (Linnaeus, 1766) e quati *Nasua nasua* (Linnaeus, 1766)) nos municípios de Tijucas do Sul e Agudos do Sul, Estado do Paraná. Master Thesis. Universidad Federal do Paraná, Curitiba, Brazil.

Andrade, P. C., J. V. L. Mota, and A. A. F. Carvalho. 2011. Interações mutualísticas entre aves frugívoras e plantas em um fragmento urbano de Mata Atlântica, Salvador, BA. . Revista Brasileira De Ornitologia **19**:63-73.

Araújo, M. B., A. Rozenfeld, C. Rahbek, and P. A. Marquet. 2011. Using species co-occurrence networks to assess the impacts of climate change. Ecography **34**:897-908.

Argel de Oliveira, M. M. 1999. Frugivoria por aves em um fragmento de floresta de restinga no Estado do Espírito Santo, Brasil. PhD Thesis. UNICAMP, Campinas, SP.

Arroyo-Rodríguez, V., F. P. L. Melo, M. Martínez-Ramos, F. Bongers, R. L. Chazdon, J. A. Meave, N. Norden, B. A. Santos, I. R. Leal, and M. Tabarelli. 2015. Multiple successional pathways in human-modified tropical landscapes: new insights from forest succession, forest fragmentation and landscape ecology research. Biological Reviews **92**:326–340.

Athiê, S. 2009. Composição da avifauna e frugivoria por aves em um mosaico de vegetação secundária em Rio Claro, região centro-leste do estado de São Paulo Master Thesis. UFSCar, São Carlos, SP.

Augusto, E. L., and M. M. Hayashi. 2004. Morcegos do Parque Chico Mendes, Osasco, São Paulo, como dispersores de sementes. Revista PIBIC **1**:15-19.

Banks-Leite, C., R. Pardini, L. R. Tambosi, W. D. Pearse, A. A. Bueno, R. T. Bruscagin, T. H. Condez, M. Dixo, A. T. Igari, A. C. Martensen, and J. P. Metzger. 2014. Using ecological thresholds to evaluate the costs and benefits of set-asides in a biodiversity hotspot. SCIENCE **345**:1041-1045.

Bello, C., M. Galetti, M. A. Pizo, L. F. S. Magnago, M. F. Rocha, R. A. F. Lima, C. A. Peres, O. Ovaskainen, and P. Jordano. 2015. Defaunation affects carbon storage in tropical forests. Science Advances **1**:e1501105.

Berg, C. C. 1972. Olmedieae Brosimeae (Moraceae). Flora Neotropica **7**:1-228.

BFG. 2015. Growing knowledge: an overview of seed plant diversity in Brazil. Rodriguésia **66**:1085-1113.

Bieber, A. G. D., P. S. Silva, and P. S. Oliveira. 2013. Attractiveness of fallen fleshy fruits to ants depends on previous handling by frugivores. Ecoscience **20**:85-89.

Boeira, A. S. P. 2010. O gênero *Sloanea* L. (Elaeocarpaceae) na Reserva Florestal Adolpho Ducke. Master Thesis. Instituto Nacional De Pesquisas Da Amazônia INPA, Manaus, Amazonas.

Bonaccorso, F. J., J. R. Winkelmann, D. Shin, C. I. Agrawal, N. Aslami, C. Bonney, A. Hsu, P. E. Jekielek, A. K. Knox, S. J. Kopach, T. D. Jennings, J. R. Lasky, S. A. Menesale, J. H. Richards, J. A. Rutland, A. K. Sessa, L. Zhaurova, and T. H. Kunz. 2007. Evidence for exploitative competition: comparative foraging behavior and roosting ecology of short-tailed fruit bats (Phyllostomidae). Biotropica **39**:249-256.

Bonvicino, C. R. 1989. Ecologia e comportamento de *Alouatta belzebul* (Primates: Cebidae) na mata Atlantica. Revista Nordestina de Biologia **6**:149-179.

Bredt, A., W. Uieda, and W. A. Pedro. 2012. Plantas e morcegos na recuperação de áreas degradadas e na paisagem urbana. Rede de sementes do cerrado.

Brito, J. E. C., J. Gazarini, and C. H. Zawadzki. 2010. Abundância e frugivoria da quiropterofauna (Mammalia, chiroptera) de um fragmento no noroeste do Estado do Paraná, Brasil Acta Scientiarum : Biological Sciences **32**:265-271.

Brozek, R. M. 1991. Observações sobre a ecologia alimentar e a dispersão de sementes pelo muriqui (*Brachyteles arachnoides* E. Geoffroy 1806 - Cebidae, Primates). Bachelor Thesis. Universidade Estadual Paulista, Rio Claro, SP, Brasil.

Bueno, R. d. S. 2010. Frugivoria e efetividade de dispersão de sementes dos últimos grandes frugívoros da Mata Atlântica: a anta (*Tapirus terrestris*) e o muriqui (*Brachyteles arachnoides*). Master Thesis. Universidade Estadual Paulista -UNESP, Rio Claro-SP. Brazil.

Bueno, R. S., R. Guevara, M. C. Ribeiro, L. Culot, F. S. Bufalo, and M. Galetti. 2013. Functional redundancy and complementarities of seed dispersal by the last neotropical megafrugivores. PLoS ONE **8**:e56252.

Bufalo, F. S., M. Galetti, and L. Culot. 2016. Seed dispersal by primates and implications for the conservation of a biodiversity hotspot, the Atlantic Forest of South America. International Journal of Primatology:1-17.

Camargo, E. A. d., C. M. F. d. Souza, M. K. Caddah, and R. Goldenberg. 2009. O gênero *Leandra*, seções Carassanae, Chaetodon, Niangae, Oxymeris e Secundiflorae (Melastomataceae) no estado do paraná. Rodriguésia **60**:595-563.

Camargo, P. H. S. A. 2014. Importância relativa da dispersão primária e secundária de sementes. Master Thesis. Universidade Federal de São Carlos, Sorocaba – SP.

Capusso, G. L. 2007. Análise morfométrica comparativa e biogeografia dos pequenos *Artibeus brasileiros* Leach, 1821 (Mammalia, Chiroptera, Phyllostomidae). Master Thesis. Universidade Estadual Paulista.

Cardoso, N. A., Y. Le Pendu, M. J. Lapenta, and B. E. Raboy. 2011. Frugivory patterns and seed dispersal by golden-headed lion tamarins (*Leontopithecus chrysomelas*) in Una Biological Reserve, Bahia, Brazil. MAMMALIA **75**:327-337.

Carvalho, C. S., M. Galetti, R. G. Colevatti, and P. Jordano. 2016. Defaunation leads to microevolutionary changes in a tropical palm. Scientific Reports **6**:31957.

Carvalho, T. C. 1961. Sobre los hábitos alimentarios de Phillostomideos (Mammalia, Chiroptera). Rev Biol Trop **9**:53-60.

Casella, J., and N. C. Cáceres. 2006. Diet of four small mammal species from Atlantic forest patches in south Brazilian. Neotropical Biology Conservation **1**:5-11.

Caselli, C. B., and E. Z. Setz. 2011. Feeding ecology and activity pattern of black-fronted titi monkeys (*Callicebus nigrifrons*) in a semideciduous tropical forest of southern Brazil. Primates **52**:351-359.

Castro, E. R. 2003. Variação espaço-temporal na fenologia e frugivoria do palmito juçara *Euterpe edulis* (Palmae) em três tipos de floresta Atlântica. Master Thesis. Unesp, Rio Claro.

Castro, E. R. 2007. Fenologia reprodutiva da palmito *Euterpe edulis* (Arecaceae) e sua influência na abundância de aves frugívoras na floresta Atlântica. PhD Thesis. Universidade Estadual Paulista, Rio Claro.

Castro, E. R., and M. Galetti. 2004. Frugivoria e dispersão de sementes pelo lagarto teiú *Tupinambis merianae* (Reptilia: Teiidae). Papeis Avulsos de Zoologia (Sao Paulo) **44**:91-97.

Catenacci, L. S., K. M. De Vleeschouwer, and S. L. G. Nogueira-Filho. 2009. Seed dispersal by golden-headed lion tamarins *Leontopithecus chrysomelas* in Southern Bahian Atlantic Forest, Brazil. Biotropica **41**:744-750.

Cazetta, E., P. Rubim, V. D. Lunardi, M. R. Francisco, and M. Galetti. 2002. Frugivoria e dispersão de sementes de *Talauma ovata* (Magnoliaceae) no sudeste brasileiro. Ararajuba **10**:199-206.

Chiarello, A. G. 1994. Diet of the brown howler monkey *Alouatta fusca* in a semi-deciduous forest fragment of southeastern Brazil. Primates **35**:25-34.

Christianini, A. V., and P. S. Oliveira. 2009. The relevance of ants as seed rescuers of a primarily bird-dispersed tree in the Neotropical cerrado savanna. Oecologia **160**:735-745.

Cid, B., L. Figueira, A. F. d. T. e Mello, A. S. Pires, and F. A. Fernandez. 2014. Short-term success in the reintroduction of the red-humped agouti *Dasyprocta leporina*, an important seed disperser, in a Brazilian Atlantic Forest reserve. Tropical Conservation Science **7**:796-810.

Colussi, J. e. N. P. P. 2011. Frugivoria realizada por aves em *Myrciaria trunciflora* (Mart) O. Berg. (Myrtaceae), *Eugenia uniflora* L. (Myrtaceae) e *Ilex paraguariensis* St. Hil. no norte do estado do Rio Grande do Sul Revista Brasileira De Ornitologia **19**:48-55.

Correa, S. B., R. Costa-Pereira, T. Fleming, M. Goulding, and J. T. Anderson. 2015. Neotropical fish-fruit interactions: eco-evolutionary dynamics and conservation. Biological Reviews of the Cambridge Philosophical Society **90**:1263-1278.

Correia, J. M. S. 1997 Utilização de espécies frutíferas da mata Atlântica na alimentação da avifauna da Reserva Biológica de Poços das Antas, RJ. . Master Thesis. Universidade de Brasília Brasília.

Côrtes, M. C. 2003. Frugivoria e dispersão de sementes de *Euterpe edulis* (Arecaceae) em três tipos florestais no Parque Estadual da Ilha do Cardoso – SP. Master Thesis. UNESP, Rio Claro-SP.

Cortes, M. C., E. Cazetta, V. G. Staggemeier, and M. Galetti. 2009. Linking frugivore activity to early recruitment of a bird dispersed tree, *Eugenia umbelliflora* (Myrtaceae) in the Atlantic rainforest. Austral Ecology **34**:249-258.

Cowan, R. S. 1967. *Swartzia* (Leguminosae, Caesalpinioideae Swartzieae). Flora Neotropica **1**:1-228.

CRIA. 2014. Species Link. CRIA, Brasil.

Culot, L., C. Bello, J. Ferreira Batista, H. Zarate do Couto, and M. Galetti. unpublished data. Synergistic effects of seed dispersers and predators modulate carbon storage in tropical rainforests. Scientific Reports.

Culot, L., E. Bovy, F. Zagury Vaz-de-Mello, R. Guevara , and M. Galetti. 2013. Selective defaunation affects dung beetle communities in continuous Atlantic rainforest. Biological Conservation **163**:79–89.

da Costa Gondim, M. J. 2001. Seed dispersal of *Trichilia* spp. (Meliaceae) by birds in a fragment of semideciduous forest, Rio Claro, SP, Brazil. Ararajuba **9**:101-112.

da Rosa, G. A. B., and L. O. Marcondes-Machado. 2005. Frugivoria por aves em *Cytharexylum myrianthum* Cham (Verbenaceae) em áreas de pastagens de Campinas, SP. Ararajuba **13**:113-115.

da Silva, F. R. 2010. Frugivory and seed dispersal of *Ficus organensis* (Moraceae) by birds in a Restinga Forest, Pelotas, RS. Revista Brasileira De Ornitologia **18**:19-25.

Da Silva, H. R., and M. C. De Britto-Pereira. 2006. How much fruit do fruit-eating frogs eat? An investigation on the diet of *Xenohyla truncata* (Lissamphibia: Anura: Hylidae). Journal Of Zoology **270**:692-698.

Dalponte, J. C., and J. A. Tavares-Filho. 2004. Diet of the Yellow Armadillo, *Euphractus sexcinctus*, in South-Central Brazil. Edentata:37-41.

Davis, W. B. 1976. Geographic Variation in the Lesser Noctilio, *Noctilio albiventris* (Chiroptera). Journal Of Mammalogy **57**:687-707.

de A. Moura, A. C., L. Cavalcanti, E. Leite-Filho, D. O. Mesquita, and K. R. McConkey. 2015. Can green iguanas compensate for vanishing seed dispersers in the Atlantic forest fragments of north-east Brazil? Journal Of Zoology **295**:189-196.

de Figueiredo, R. A., and E. Perin. 1995. Germination ecology of *Ficus luschnathiana* drupelets after bird and bat ingestion. **16**:71-75.

de Freitas, C. H., E. Z. F. Setz, A. R. B. Araujo, and N. Gobbi. 2008. Agricultural crops in the diet of bearded capuchin monkeys, *Cebus libidinosus* Spix (Primates : Cebidae), in forest fragments in southeast Brazil. Revista Brasileira De Zoologia **25**:32-39.

de Moraes, P. 2007. Taxonomy of *Cryptocarya* species of Brazil. Abc Taxa **3**:191.

Dean, W. 1996. A ferro e fogo: a história e a devastação da Mata Atlântica brasileira. Companhia das Letras, São Paulo.

Dehling, D. M., P. Jordano, H. M. Schaefer, K. Böhning-Gaese, and M. Schleuning. 2016. Morphology predicts species' functional roles and their degree of specialization in plant–frugivore interactions. Proceedings of the Royal Society B: Biological Sciences **283**:20152444.

Delprete, P. G. 1999. Rondeletieae (Rubiaceae): Part I (*Rustia*, *Tresanthera*, *Condaminea*, *Picardaea, Pogonopus, Chimarrhis, Dioicodendron, Molopanthera, Dolichodelphys,* and *Parachimarrhis*). Flora Neotropica **77**:1-225.

Dias, D., and A. L. Peracchi. 2008. Quirópteros da Reserva Biológica do Tinguá, estado do Rio de Janeiro, sudeste do Brasil (Mammalia: Chiroptera). Revista Brasileira De Zoologia **25**:333-369.

Dias, D., A. L. Peracchi, and S. S. P. d. Silva. 2002. Quirópteros do Parque Estadual da Pedra Branca, Rio de Janeiro, Brasil (Mammalia, Chiroptera). Revista Brasileira De Zoologia **19**:113-140.

Dirzo, R., H. S. Young, M. Galetti, G. Ceballos, N. J. B. Isaac, and B. Collen. 2014. Defaunation in the Anthropocene. SCIENCE **345**:401-406.

Donatti, C. I., P. R. Guimaraes, Jr., and M. Galetti. 2009. Seed dispersal and predation in the endemic Atlantic rainforest palm *Astrocaryum aculeatissimum* across a gradient of seed disperser abundance. Ecological Research **24**:1187-1195.

DUP-SCM-MCT/CNPq. Projeto Mamirauá. O desafio de preservar várzea Amazônica. Page 20.

Dutra, S. M., F. R. G. Salimena, and L. Menini Neto. 2012. Annonaceae na Serra Negra, Minas Gerais, Brasil. Rodriguésia **63**:785-793.

Eriksson, O. 2014. Evolution of angiosperm seed disperser mutualisms: the timing of origins and their consequences for coevolutionary interactions between angiosperms and frugivores. Biological Reviews of the Cambridge Philosophical Society **91**:168–186.

Fabris, L. C., and A. L. Peixoto. 2013. Sapotaceae das Restingas do Espírito Santo, Brasil. Rodriguésia **64**:265-283.

Fadini, R. F., and P. De Marco, Jr. 2004. Interactions among frugivorous birds and plants in an Atlantic Forest fragment of Minas Gerais State. Ararajuba **12**:97-103.

Faustino, T. C., and C. G. Machado. 2006. Frugivoria por aves em uma área de campo rupestre na Chapada Diamantina, BA. Revista Brasileira De Ornitologia **14**:137-143.

Felix, S., R. L. Morim Novaes, R. d. F. Souza, and R. T. Santori. 2013. Diet of *Tonatia bidens* (Chiroptera, Phyllostomidae) in an Atlantic Forest area, southeastern Brazil: first evidence for frugivory. MAMMALIA **77**:451-454.

Ferrari, S. F., H. Kátia, M. Corrêa, and P. E. Coutinho. 1996. Ecology of the “southern” marmosets (*Callithrix aurita* and *Callithrix flaviceps*). Pages 157-171 *in* M. Norconk, A. L. Rosenberger, and P. A. Garber, editors. Adaptive radiations of neotropical primates. Springer US.

Fialho, F. S. F. 2009. Análise morfométrica, morfológica e citogenética de morcegos do gênero *Artibeus* Leach, 1821 (Chiroptera, Phyllostomidae). Master Thesis. Universidade de Brasília, Brasilia.

Figueira, J. E. C., J. G. Vasconcellos-Neto, and A. L. T. M.A.; de Souza. 1994. Saurocory in *Melocactus violaceus* (Cactaceae). Biotropica **26**:295-301.

Figueira, L., R. Zucaratto, A. Pires, B. Cid, and F. Fernandez. 2014. Carrion consumption by *Dasyprocta leporina* (RODENTIA: DASYPROCTIDAE) and a review of meat use by agoutis. Brazilian Journal of Biology **74**:585-587.

Fleming, T. H., R. Breitwisch, and G. H. Whitesides. 1987. Patterns of tropical vertebrate frugivore diversity. Annual Review of Ecology and Systematics.

Fonseca, Y., and Z. Antunes. 2007. Frugivoria e predação de sementes por aves no Parque Estadual Alberto Loefgren, São Paulo. SP. Revista do Instituto Florestal **19**:81-91.

Forero, E. 1983. Connaraceae. Flora Neotropica **36**:1-207.

Galetti, M. 1992. Sazonalidade na dieta de vertebrados frugívoros em uma floresta semidecídua no Brasil. Master thesis. UNICAMP, Campinas.

Galetti, M. 1993. Diet of the scaly-headed parrot (*Pionus maximiliani*) in a semideciduous forest in southeastern Brazil. Biotropica **25**:419-425.

Galetti, M. 2001. Seasonal movements and diet of the Plumbeous pigeon (*Columba plumbea*) in a Brazilian Atlantic forest. Melopsittacus **4**:39-43.

Galetti, M., C. I. Donatti, M. A. Pizo, and H. C. Giacomini. 2008. Big fish are the best: Seed dispersal of *Bactris glaucescens* by the pacu fish (*Piaractus mesopotamicus*) in the Pantanal, Brazil. Biotropica **40**:386-389.

Galetti, M., R. Guevara, M. C. Côrtes, R. Fadini, S. V. Matter, A. B. Leite, F. Labecca, T. Ribeiro, C. S. Carvalho, R. G. Collevatti, M. M. Pires, P. R. G. Jr., P. H. Brancalion, M. C. Ribeiro, and P. Jordano. 2013. Functional extinction of birds drives rapid evolutionary changes in seed size. SCIENCE **340**:1086-1090.

Galetti, M., and P. R. Guimaraes Jr. 2004. Seed dispersal of *Attalea phalerata* (Palmae) by Crested caracaras (*Caracara plancus*) in the Pantanal and a review of frugivory by raptors. Ararajuba **12**:133-135.

Galetti, M., R. Laps, and M. A. Pizo. 2000. Frugivory by Toucans (Ramphastidae) at two altitudes in the Atlantic Forest of Brazil. Biotropica **32**:842-850.

Galetti, M., P. Martuscelli, F. Olmos, and A. Aleixo. 1997. Ecology and conservation of the jacutinga *Pipile jacutinga* in the Atlantic forest of Brazil. Biological Conservation **82**:31-39.

Galetti, M., and L. Morellato. 1994. Diet of the large fruit-eating bat *Artibeus lituratus* in a forest fragment in Brasil. MAMMALIA **58**:661-665.

Galetti, M., and M. A. Pizo. 1996. Fruit eating by birds in a forest fragment in southeastern Brazil. Ararajuba **4**:71-79.

Galindo-Leal, C., and I. d. G. Camara. 2003. The Atlantic Forest of South America: Biodiversity Status, Threats, and Outlook. State of the Hotspots. Island Press, London.

Gardner, A. L. 1962. A new bat of the genus *Glossophaga* from Mexico. Contributions in Science **54**:7.

Gentry, A. H. 1992. Bignoniaceae: Part II (Tribe Tecomeae). Flora Neotropica **25**:1-370.

Gonçalves, G. L., and A. L. P. Andrade. 2015. Avifauna da APA bacia córrego da velha, município de Luz, Minas Gerais, Brasil. Biota Amazônia **5**:91-98.

Gridi-Papp, C. O., M. Gridi-Papp, and W. R. Silva. 2004. Differential fruit consumption of two Melastomataceae by birds in Serra da Mantiqueira, southeastern Brazil. Ararajuba **12**:7-13.

Grokoviski, L. 2007. Estudo taxonômico do gênero *Piptocarpha* R. Br. (Asteraceae: Vernonieae) no estado Do paraná, Brasil. Universidade Federal do Paraná, Curitiba.

Guerra, T. J., and M. A. Marini. 2002. Bird frugivory on *Struthanthus concinnus* (Loranthaceae) in southeastern Brazil. Ararajuba **10**:187-192.

Guimarães, M. A. 2003. Frugivoria por aves em *Tapirira guianensis* (Anacardiaceae) na zona urbana do município de Araruama, estado do Rio de Janeiro, sudeste brasileiro. Atualidades Ornitológicas **116**:12.

Haddad, C. F. B., L. F. Toledo, C. P. A. Prado, D. Loebmann, J. L. Gasparini, and I. Sazima. 2013. Guia dos anfíbios da Mata Atlântica. Diversidade e biologia. Anolis Books Editora, Sâo Paulo.

Hasui, E. 1994. O papel das aves frugívoras na dispersão de sementes em um fragmento de floresta semidecídua secundária em São Paulo, SP. Master Thesis. USP, São Paulo- BR.

Heiduck, S. 1997. Food choice in Masked Titi Monkeys (*Callicebus personatus melanochir*): seletivity or opportunism? International Journal of Primatology **18**:487-502.

Hekking, W. H. A. 1988. Violaceae Part I: *Rinorea* and *Rinoreocarpus*. Flora Neotropica **46**:1-207.

Henderson, A. 2000. *Bactris* (Palmae). Flora Neotropica **79**:1-181.

Hernández-Montero, J. R., R. A. Saldaña-Vázquez, J. Galindo-González, and V. J. Sosa. 2015. Bat-fruit interactions are more specialized in shaded-coffee plantations than in tropical mountain cloud forest fragments. PLoS ONE **10**:e0126084.

Hilário, R. R., and S. F. Ferrari. 2010. Feeding ecology of a group of buffy-headed marmosets (*Callithrix flaviceps*): fungi as a preferred resource. American Journal Of Primatology **72**:515-521.

Hopkins, H. C. F. 1986. *Parkia* (Leguminosae: Mimosoideae). Flora Neotropica **43**:1-123.

Hortal, J., F. d. Bello, J. A. F. Diniz-Filho, T. M. Lewinsohn, J. M. Lobo, and R. J. Ladle. 2015. Seven Shortfalls that Beset Large-Scale Knowledge of Biodiversity. Annual Review of Ecology, Evolution, and Systematics **46**:523-549.

Howe, H. F., and J. Smallwood. 1982. Ecology of seed dispersal. Annual Review of Ecology, Evolution, and Systematics **13**:201-228.

Hoyo, J. d., A. Elliott, J. Sargatal, and D. A. Christie. 1994. Handbook of the Birds of the world. Lynx Edicions. BirdLife International.

IBGE, I. B. d. G. a. e. E.-. 2013. Atlas do censo demografico 2010. Ministério do Planejamento, Orçamento e Gestão, Rio de Janeiro.

Ikuta, K. G., and F. de Campos Martins. 2013. Interação entre aves frugívoras e plantas no Parque Estadual da Cantareira, estado de São Paulo. Atualidades Ornitológicas **172**:33-36.

Izar, P. 2008. Dispersao de sementes por *Cebus nigritus* e *Brachyteles arachnoides* em área de Mata Atlântica, Parque Estadual Intervales, SP. Aracaju **9**:8-24.

Jesus, S., and E. L. A. Monteiro-Filho. 2007. Frugivoria por aves em *Schinus terebinthifolius* (Anacardiaceae) e *Myrsine coriaceae* (Myrsinaceae). Revista Brasileira De Ornitologia **15**:585-591.

Joly, C. A., J. P. Metzger, and M. Tabarelli. 2014. Experiences from the Brazilian Atlantic Forest: ecological findings and conservation initiatives. New Phytologist **204**:459-473.

Jordano, P. 2013. Fruits and frugivory. Seeds: the ecology of regeneration in plant communities. 3rd ed (ed R.S. Gallagher) edition. Commonwealth Agricultural Bureau International, Wallingford, England.

Jordano, P. 2016. Sampling networks of ecological interactions. Functional Ecology:1-11.

Jorge, M. L. S. P., M. Galetti, M. C. Ribeiro, and K. M. P. M. B. Ferraz. 2013. Mammal defaunation as surrogate of trophic cascades in a biodiversity hotspot. Biological Conservation **163**:49-57.

Kaastra, R. C. 1982. Pilocarpinae (Rutaceae). Flora Neotropica **33**:1-197.

Keuroghlian, A., and D. P. Eaton. 2008. Fruit availability and peccary frugivory in an isolated Atlantic forest fragment: effects on peccary ranging behavior and habitat use. Biotropica **40**:62-70.

Kindel, A. 1996. Interações entre plantas ornitocóricas e aves frugívoras na estação ecológica de Aracuri, Muitos Capões, RS. Master Thesis. UFRGS, Porto Alegre.

Kissling, W. D., K. Boehning-Gaese, and W. Jetz. 2009. The global distribution of frugivory in birds. Global Ecology and Biogeography **18**:150-162.

Knapp, S. 2002. *Solanum* section Geminata (Solanaceae). Flora Neotropica **84**:1-404.

Krügel, M. M., M. I. Burger, and M. A. Alves. 2006. Frugivoria por aves em *Nectandra megapotamica* (Lauraceae) em uma área de Floresta Estacional Decidual no Rio Grande do Sul, Brasil. Iheringia. Série Zoologia **96**:17-24.

Kubitzki, K., and S. Renner. 1982. Lauraceae I (*Aniba* and *Aiouea*). Flora Neotropica **31**:1-124.

Landrum, L. R. 1981. A Monograph of the Genus *Myrceugenia* (Myrtaceae). Flora Neotropica **29**:1-135.

Landrum, L. R. 1986. *Campomanesia*, *Pimenta*, *Blepharocalyx*, *Legrandia*, *Acca*, *Myrrhinium*, and *Luma* (Myrtaceae). Flora Neotropica **45**:1-178.

Lapate, M. E. 2009. Frugivoria de *Ficus* (Moraceae) por aves em paisagens com diferentes níveis de fragmentação florestal no Estado de São Paulo. Master Thesis. Universidade de São Paulo.

Lapenta, M. J., P. Procopio-de-Oliveira, M. C. M. Kierulff, and J. C. Motta, Jr. 2008. Frugivory and seed dispersal of golden lion tamarin (*Leontopithecus rosalia* (Linnaeus, 1766)) in a forest fragment in the Atlantic Forest, Brazil. Brazilian Journal of Biology **68**:241-249.

Laps, R. R. 1996. Frugivoria e dispersão de sementes de palmiteiro (*Euterpe edulis*, Martius, Arecaceae) na Mata Atlântica, sul do estado de São Paulo. . Master Thesis. UNICAMP, Campinas-SP.

Lê, S., J. Josse, and F. Husson. 2008. FactoMineR: An R package for multivariate analysis. Journal of Statistical Software **25**:1-18.

Lessard, J. P., B. G. Weinstein, M. K. Borregaard, K. A. Marske, D. R. Martin, J. A. McGuire, J. L. Parra, C. Rahbek, and C. H. Graham. 2016. Process-based species pools reveal the hidden signature of biotic interactions amid the influence of temperature filtering. American Naturalist **187**:75-88.

Levey, D. J. 1987. Seed size and fruit-handling techniques of avian frugivores. American Naturalist **129**:471-485.

Lima, M. P. M. d., and H. C. d. Lima. 1984. *Parapiptadenia* Brenam (Leguminosae-Mimosoideae) - Estudio taxonomico das espécies brasileiras. Rodriguésia **36**:23-30.

Lobão, A. Q., R. d. Mello-Silva, and R. C. Forzza. 2012. *Guatteria* (Annonaceae) da Floresta Atlântica brasileira. Rodriguésia **63**: 1039-1064.

Lopes, R. F. 2000. Frugivoria e dispersão de sementes através da avifauna, em quatro espécies de vegetais na região de Botucatu – SP. Master Thesis. ESALQ/USP, Piracicaba-BR.

Lorenzi, H. 2009. Árvores brasileiras. Manual de identificacao e cultivo de plantas arboreas nativas do Brasil. Nova Odessa- Instituto Plantarum de Estudos da Flora.

Louzada, N. S. V., A. C. d. M. Lima, L. M. Pessôa, J. L. P. Cordeiro, and L. F. B. Oliveira. 2015. New records of *Phyllostomid* bats for the state of Mato Grosso and for the cerrado of midwestern Brazil (Mammalia: Chiroptera). 2015 **11**.

Maas, P. J. M., and L. Y. T. Westra. 2003. Revision of the Neotropical genus *Pseudoxandra* (Annonaceae). Blumea - Biodiversity, Evolution and Biogeography of Plants **48**:201-259.

Maas, P. J. M., L. Y. T. Westra, and L. W. Chatrou. 2003. *Duguetia* (Annonaceae). Flora Neotropica **88**:1-274.

Madriñán, S. 2004. *Rhodostemonodaphne* (Lauraceae). Flora Neotropica **92**:1-102.

Manhães, M. A. 2003. Dieta de Traupíneos (Passeriformes, Emberizidae) no Parque Estadual do Ibitipoca, Minas Gerais, Brasil. Iheringia. Série Zoologia **93**:59-73.

Manhaes, M. A., L. C. de Souza Assis, and R. M. de Castro. 2003. Frugivory and seed dispersal of *Miconia urophylla* (Melastomataceae) by birds in a fragment of secondary Atlantic forest in Juiz de Fora, Minas Gerais State, Brazil. Ararajuba **11**:173-180.

Marciente, R., and A. M. Calouro. 2009. Mammalia, Chiroptera, Phyllostomidae, *Lampronycteris brachyotis* (Dobson, 1879): First record in Acre, Brazil. Check List, Campinas **5**:886–889.

Marques, M. C. M., and P. Oliveira. 2008. Seasonal rhythms of seed rain and seedling emergence in two tropical rain forests in southern Brazil. Plant Biology **10**:596-603.

Marquete, R., and A. M. S. d. F. Vaz. 2007. *Casearia* no estado do Rio de Janeiro. Rodriguésia **58**:705-738.

Martinelli, M. M., and T. A. Volpi. 2010. Diet of raccoon *Procyon cancrivorus* (Carnivora, Procyonidae) in a mangrove and resting area in Espírito Santo state, Brazil. Natureza on line **8**:150-151.

Martius, C. F. P. v., A. W. Eichler, and I. Urban. 1840-1906. Flora Brasiliensis. Jardim Botânico de Missouri . Departamento de Botânica do Instituto de Biologia da Unicamp. Centro de Referência em Informação Ambiental (CRIA), Alemania.

Masteguin, M. A., and R. A. Figueiredo. 1995. Consumo de frutos de *Prunus sellowii* Koehne (Rosaceae) por aves em um fragmento florestal em Jundiaí, SP Ciência e Natura **17**:51-56.

Mello-Silva, R. d., J. d. C. Lopes, and J. R. Pirani. 2012. Flora da Serra do Cipó, Minas Gerais: Annonaceae. Boletim de Botânica **30**:37-56.

Melo, F. P. L., B. Rodriguez-Herrera, R. L. Chazdon, R. A. Medellin, and G. G. Ceballos. 2009. Small tent-roosting bats promote dispersal of large-seeded plants in a neotropical forest. Biotropica **41**:737-743.

Melo, F. P. L., B. Rodriguez-Herrera, A. Rodriguez, G. Ceballos, and R. Medellin. 2007. The last of the mohicans: Would neotiropical bats maintain seed dispersal services for large-seeded plants in defaunated landscapes? Bat Research News **48**:264.

Melo, M. d. F. F., and C. S. Zickel. 2004. Os gêneros *Zanthoxylum* L. e *Esenbeckia* Kunth (Rutaceae) no Estado de Pernambuco, Brasil. Acta Botanica Brasilica **18**:73-90.

Mendonça-Souza, L. R. d. 2006. *Ficus* (Moraceae) no Estado de São Paulo Instituto de Botânica da Secretaria do Meio Ambiente, São Paulo.

Mez, C. 1963. Lauraceae americanae monographice descriptae, New York.

Mikich, S. B. 2002a. A dieta dos morcegos frugívoros (Mammalia, Chiroptera, Phyllostomidae) de um pequeno remanescente de Floresta Estacional Semidecidual do sul do Brasil. Revista Brasileira De Zoologia **19**:239-249.

Mikich, S. B. 2002b. A dieta frugívora de *Penelope superciliaris* (Cracidae) em remanescentes de floresta estacional semidecidual no centro-oeste do Paraná, Brasil e sua relação com *Euterpe edulis* (Arecaceae). Ararajuba **10**:207-217.

Mileri, M., M. Passamani, F. Eutrópio, and A. Oliveira. 2012. Removal of seeds of exotic jackfruit trees (*Artocarpus heterophyllus*, Moraceae) in native forest areas with predominance of jackfruit trees in the Duas Bocas biological reserve, southeastern Brazil. International Journal of Ecosystem **2**:93-98.

Ministério do Meio Ambiente. 2010. Mata Atlântica: patrimônio nacional dos brasileiros. Ministério do Meio Ambiente. Secretaria de Biodiversidade e Florestas. Núcleo Mata Atlântica e Pampa, Brasilia.

Mokany, K., S. Prasad, and D. A. Westcott. 2014. Loss of frugivore seed dispersal services under climate change. Nature Communications **5**:3971.

Montoya, J. M., and D. Raffaelli. 2010. Climate change, biotic interactions and ecosystem services. Philosophical Transactions of the Royal Society of London B: Biological Sciences **365**:2013-2018.

Moraes, P. L. R. 1992. Dispersão de sementes pelo Mono-Carvoeiro (*Bracthyles arachnoides* E. Geoffroy, 1806) no Parque Estadual de Carlos Botelho. Revista do Instituto Florestal **4**:1193-1208.

Morales-Castilla, I., M. G. Matias, D. Gravel, and M. B. Araújo. 2015. Inferring biotic interactions from proxies. Trends in Ecology & Evolution **30**:347-356.

Morante-Filho, J. C., D. Faria, E. Mariano-Neto, and J. Rhodes. 2015. Birds in anthropogenic landscapes: the responses of ecological groups to forest loss in the Brazilian Atlantic forest. PLoS ONE **10**:e0128923.

Moratelli R, D. D. 2015. A new species of nectar-feeding bat, genus *Lonchophylla*, from the Caatinga of Brazil (Chiroptera, Phyllostomidae). ZooKeys **514**:73-91.

Moreira-Lima, L. 2014. Aves da Mata Atlântica: riqueza, composicão, status, endemismos e conservacão. Universidade de São Paulo, São Paulo.

Moreira, A. C. C., A. A. d. Souza, D. C. Reis, M. d. M. S. Conde, and R. C. Alves. 2010. Seeds and other diaspores of Marambia Island, Rio de Janeiro.

Morellato, L. P. C., and C. F. B. Haddad. 2000. Introduction: The brazilian atlantic forest. Biotropica **32**:786-792.

Mori, S. A., G. T. Prance, and C. H. d. Zeeuw. 1990. Lecythidaceae, Part 2. The Zygomorphic-Flowered New World Genera (*Couroupita*, *Corythophora*, *Bertholletia*, *Couratari*, *Eschweilera* and *Lecythis*), With a Study of Secondary Xylem of Neotropical Lecythidaceae. Flora Neotropica **21**:1-373.

Morim Novaes, R. L., L. F. Menezes, Jr., A. C. Duarte, and C. Soares Facanha. 2010. Consumption of *Psychotria suterella* Muell. Arg. (Rubiaceae) of by bats in southeastern Brazil. Chiroptera Neotropical **16**:553-556.

Motta-Jr, J. C. 1991. A exploração de frutos como alimento por aves de mata ciliar numa região do Distrito Federal. Master Thesis. Instituto de Biociências, UNESP, Rio Claro-SP.

Mottin, V. 2011. Análise morfométrica craniana comparativa entre quatro espécies de *Artibeus* Leach, 1821. Bachelor Thesis. Universidad Federal do Paraná, Curitiba.

Muller, E. S. 2006. Frugivoria por aves em quatro espécies arbóreas no Parque Nacional dos Aparados da Serra/RS, sul do Brasil. Master Thesis. UNISINOS, São Leopoldo – RS.

Navas, J. R., and N. A. Bó. 2001. Aportes al conocimiento de la distribución, la cría y el peso de aves de las provincias de Mendoza y San Juan, República Argentina. Segunda parte (Aves: Falconidae, Scolopacidae, Thinocoridae, Columbidae, Psittacidae, Strigidae, Caprimulgidae, Apodidae, Furnariidae, Rhinocryptidae y Tyrannidae). Hornero **16**:31-37.

Neuschulz, E. L., T. Mueller, M. Schleuning, and K. Böhning-Gaese. 2016. Pollination and seed dispersal are the most threatened processes of plant regeneration. Scientific Reports **6**:29839.

Novaes, R. L. M., and C. C. Nobre. 2009. Dieta de *Artibeus lituratus* (Olfers, 1818) em área urbana na cidade do Rio de Janeiro: frugivoria e novo registro de folivoria. Chiroptera Neotropical **15**:487-493.

O'Farrill, G., M. Galetti, and A. Campos-Arceiz. 2013. Frugivory and seed dispersal by tapirs: an insight on their ecological role. Integrative Zoology **8**:4-17.

Olson, D. M., E. Dinerstein, E. D. Wikramanayake, N. D. Burgess, G. V. N. Powell, E. C. Underwood, D. A. J. A., I. Itoua, H. E. Strand, J. C. Morrison, C. J. Loucks, T. F. Allnutt, T. H. Ricketts, Y. Kura, J. F. Lamoreux, W. W. Wettengel, P. Hedao, and K. R. Kassem. 2001. Terrestrial ecoregions of the world: a new map of life on Earth. BioScience **51**:933-938.

Oprea, M., C. E. L. Esberard, T. B. Weira, P. Mendes, V. T. Pimenta, D. Brito, and A. D. Ditchfield. 2009. Bat community species richness and composition in a restinga protected area in Southeastern Brazil. Brazilian Journal of Biology **69**:1073-1079.

Paglia, A., G. Fonseca, A. Rylands, G. Herrmann, L. Aguiar, A. Chiarello, Y. Leite, L. Costa, S. Siciliano, and M. Kierulff. 2012. Annotated checklist of Brazilian mammals. 2a edition. Occasional Papers in Conservation Biology **6**:2-82.

Parrini, R., and J. F. Pacheco. 2011a. Frugivoria por aves em *Alchornea triplinervia* (Euphorbiaceae) na Mata Atlântica do Parque Estadual dos Três Picos, estado do Rio de Janeiro, Brasil. Atualidades Ornitológicas **162**:33-41.

Parrini, R., and J. F. Pacheco. 2011b. Frugivoria por aves em seis espécies arbóreas do gênero Miconia (Melastomataceae) na Mata Atlântica do Parque Nacional da Serra dos Órgãos, Região Sudeste do Brasil Atualidades Ornitológicas **159**:51-58.

Parrini, R., and J. F. Pacheco. 2014. Aspectos da frugivoria por aves em *Cupania oblongifolia* (Sapindaceae) na Mata Atlântica do Parque Nacional da Serra dos Órgãos, estado do Rio de Janeiro, Brasil. Atualidades Ornitológicas **178**:55-62.

Parrini, R., J. F. Pacheco, and L. Haefeli. 2009. Observações de aves se alimentando dos frutos de *Miconia sellowiana* (Melastomataceae) na Floresta Atlântica Alto-Montana do Parque Nacional da Serra dos Órgãos e do Parque Nacional do Itatiaia, região sudeste do Brasil. Atualidades Ornitológicas **146**:4-7.

Parrini, R., and M. A. Raposo. 2010. Aves se alimentando de *Alchornea glandulosa* (Euphorbiaceae) na Mata Atlântica do sudeste do Brasil. Boletim do Museu de Biologia Mello Leitão.Nova Série **27**:75-83.

Pascotto, M. C. 2006. Avifauna dispersora de sementes de *Alchornea glandulosa* (Euphorbiaceae) em uma área de mata ciliar no estado de São Paulo. Revista Brasileira De Ornitologia **14**:291-296.

Pascotto, M. C. 2007. *Rapanea ferruginea* (Ruiz & Pav.) Mez. (Myrsinaceae) como importante fonte alimentar para as aves em uma mata de galeria no interior do Estado de São Paulo. Revista Brasileira De Zoologia **24**:735-741.

Passos, F. C., W. R. Silva, W. A. Pedro, and M. R. Bonin. 2003. Frugivoria em morcegos (Mammalia, Chiroptera) no Parque Estadual Intervales, sudeste do Brasil. Revista Brasileira De Zoologia **20**:511-517.

Passos, L., and P. S. Oliveira. 2002. Ants affect the distribution and performance of seedlings of *Clusia criuva*, a primary bird dispersed rain forest tree. Journal of Ecology **90**:517-528.

Pennington, T. D. 1990. Sapotaceae. Flora Neotropica **52**:1-770.

Pennington, T. D., B. T. Styles, and D. A. H. Taylor. 1981. Meliaceae, with Accounts of Swietenioideae and Chemotaxonomy. Flora Neotropica **28**:1-470.

Peres, C. A., T. Emilio, J. Schietti, S. J. M. Desmoulière, and T. Levi. 2016. Dispersal limitation induces long-term biomass collapse in overhunted Amazonian forests. Proceedings of the National Academy of Sciences **113**:892-897.

Piccoli, G. C. O., H. A. Rocha-Jr., F. Fernandes, J. M. Reis-Filho, and F. G. Taddei. 2007. Riqueza e dieta de morcegos (Mammalia, Chiroptera) frugívoros em um fragmento de mata ciliar do noroeste do estado de São Paulo. Anais do VIII Congresso de Ecologia do Brasil:1-2.

Pimentel, D., and M. Tabarelli. 2004. Seed dispersal of the palm *Attalea oleifera* in a remnant of the Brazilian Atlantic forest. Biotropica **36**:74 - 84.

Pinto, D., and H. O. Filho. 2006. Dieta de quatro espéces de filostomídeos frugívoros (Chiroptera, Mammalia) do Parque Municipal do Cinturão Verde de Cianorte, Paraná, Brasil. Chiroptera Neotropical **12**:274-279.

Pires, A. S., and M. Galetti. 2012. The agouti *Dasyprocta leporina* (Rodentia: Dasyproctidae) as seed disperser of the palm *Astrocaryum aculeatissimum*. Mastozoologia Neotropical **19**:147-153.

Pizo, M. A. 1996. Frugivoria e dispersão de sementes por aves. Anais do V Congresso Brasileiro de Ornitologia:163-170.

Pizo, M. A. 1997. Seed dispersal and predation in two populations of *Cabralea canjerana* (Meliaceae) in the Atlantic Forest of southeastern Brazil. Journal Of Tropical Ecology **13**:559-578.

Pizo, M. A. 2004. Frugivory and habitat use by fruit-eating birds in a fragmented landscape of southeast Brazil. Ornitologia Neotropical **15**:117-126.

Pizo, M. A., and P. S. Oliveira. 2000. The use of fruits and seeds by ants in the Atlantic forest of southeast Brazil. Biotropica **32**:851-861.

Pizo, M. A., W. R. Silva, M. Galetti, and R. Laps. 2002. Frugivory in cotingas of the Atlantic forest of southeast Brazil. Ararajuba **10**:177-185.

Pizo, M. A., I. Simão, and M. Galetti. 1995. Diet and flock size of sympatric parrots in the atlantic forest of Brazil. Ornitologia Neotropical **6**:87-95.

Prance, G. T. 1972. Chrysobalanaceae. Flora Neotropica **9**:1-409.

Prance, G. T., V. Plana, K. S. Edwards, and R. T. Pennington. 2007. Proteaceae. Flora Neotropica **100**:1-218.

Rabello, A., F. N. Ramos, and E. Hasui. 2010. Effect of fragment size on *Copaifera langsdorffii* seeds dispersal. Biota Neotropica **10**:47-54.

REFLORA. 2014. Lista de Espécies da Flora do Brasil. Jardim Botânico do Rio de Janeiro.

Reis, N. R. D., M. N. Fregonezi, A. L. Peracchi, and O. A. Shibatta. 2013. Morcegos do Brasil. Guia de Campo. Technical Books, Londrina-BR.

Reys, P., J. Sabino, and M. Galetti. 2009. Frugivory by the fish *Brycon hilarii* (Characidae) in western Brazil. Acta Oecologica-International Journal Of Ecology **35**:136-141.

Ribeiro, L. F., L. O. Machado Conde, and M. Tabarelli. 2010. Predation and removal of seeds from five species of palms by *Guerlinguetus ingrami* (Thomas, 1901) in an urban fragment of the montane Atlantic Forest Revista Arvore **34**:637-649.

Ribeiro, M. C., J. P. Metzger, A. C. Martensen, F. J. Ponzoni, and M. M. Hirota. 2009. The brazilian atlantic forest: How much is left, and how is the remaining forest distributed? Implications for conservation. Biological Conservation **142**:1141-1153.

Robinson, V. 2015. Índice de importância das aves como dispersoras de sementes para uma comunidade vegetal reflorestada em Piracicaba. Bachelor Thesis. UNESP, Rio Claro, Brazil

Rocha, L. E. C. 2005. Historia narutal de *Penelope obscura bronzina* (Hellmayr, 1914) (Galliformes: Cracidae) no campus da Universidade Federal de Viçosa, Minas Gerais. Master Thesis. Universidade Federal de Viçosa.

Rodrigues, M., F. Olmos, and M. Galetti. 1993. Seed dispersal by tapir in southeastern Brazil. MAMMALIA **57**:460-461.

Rodrigues, M. C. 2012. Bignoniáceas de dezoito fragmentos florestais remanescentes no noroeste paulista, Brasil Master Thesis. Universidade Estadual Paulista UNESP, Botucatu-SP.

Rodrigues, S. B. M. 2015. Redes de interações entre aves frugívoras e plantas em três diferentes áreas da Floresta Atlântica do estado de São Paulo. Master Thesis. Universidade Federal de São Carlos, Sorocaba.

Rogers, D. J., and S. G. Appan. 1973. *Manihot*, Manihotoides (Euphorbiaceae). Flora Neotropica **13**:1-272.

Rohwer, J. G. 1993. Lauraceae: *Nectandra*. Flora Neotropica **60**:1-332.

Roskov, Y., L. Abucay, T. Orrell, D. Nicolson, T. Kunze, A. Culham, N. Bailly, P. Kirk, T. Bourgoin, R. E. DeWalt, W. Decock, and A. De Wever. 2015. Species 2000 & ITIS Catalogue of Life, 2015 Annual checklist. . Species 2000: Naturalis, www.catalogueoflife.org/annual-checklist/2015.

Rother, D. C. 2010. Dispersão de sementes e processos de limitação demográfica em ambientes com e sem bambus na Floresta Pluvial Atlântica. PhD Thesis. Programa de Pós-graduação em Biologia Vegetal, UNESP, Rio Claro-BR.

Rother, D. C., M. A. Pizo, and P. Jordano. 2016. Variation in seed dispersal effectiveness: the redundancy of consequences in diversified tropical frugivore assemblages. OIkos **125**:336-342.

Sabino, J., and I. Sazima. 1999. Association berween fruit-eating fish and foraging monkeys in western Brazil. Ichthyological Exploration of Freshwaters **10**:309-312.

Santos, S. D. O. 2012. Lauraceae Juss. Ao norte da Floresta Altlantica. Master Thesis. Universidade Federal de Pernambuco.

Sarasola, J. H., J. I. Zanón-Martínez, A. S. Costán, and W. J. Ripple. 2016. Hypercarnivorous apex predator could provide ecosystem services by dispersing seeds. Scientific Reports **6**:19647.

Sartore, E. R., and N. R. d. Reis. 2012. Relacionando dieta e horários de captura entre duas espécies de morcegos frugívoros (Chiroptera, Phyllostomidae, Stenodermatinae). Semina: Ciências Biológicas e da Saúde **33**:65-76.

Sazima, I. 2008. The parakeet Brotogeris tirica feeds on and disperses the fruits of the palm Syagrus romanzoffiana in southeastern Brazil. Biota Neotropica **8**:231-234.

Scheibler, D. R., and T. A. Melo-Júnior. 2003. Frugivory by birds on two exotic *Ligustrum* species (Oleaceae) in Brazil. Ararajuba **11**:89-91.

Scherer, A., F. Maraschin-Silva, and L. R. d. M. Baptista. 2007. Padrões de interações mutualísticas entre espécies arbóreas e aves frugívoras em uma comunidade de Restinga no Parque Estadual de Itapuã, RS, Brasil. Acta Botanica Brasilica **21**:203-212.

Secco, R. D. S. 2004. *Alchorneae* (Euphorbiaceae) (*Alchornea*, *Aparisthmium* e *Conceveiba*). Flora Neotropica **93**:1-194.

Silva, G. G. d., P. A. d. Souza, P. L. D. d. Morais, E. C. d. Santos, R. D. Moura, and J. B. Menezes. 2008. Caracterização do fruto de ameixa silvestre (*Ximenia americana* L.). Revista Brasilera Fruticacao Jaboticabal **30**:311-314.

Silva, H. R., M. C. Britto-Pereira, and U. Caramaschi. 1989. Frugivory and seed dispersal by *Hyla truncata*, a neotropical tree-frog. Copeia **3**:781-783.

Silva, L. B., A. V. Leite, and C. C. d. Castro. 2013. Frugivoria por aves em *Miconia prasina* D. C. (Melastomataceae) em um fragmento de Mata Atlântica no nordeste do Brasil. Atualidades Ornitológicas **174**:4-7.

Silva, M. G., and M. Tabarelli. 2001. Seed dispersal, plant recruitment and spatial distribution of *Bactris acanthocarpa* Martius (Arecaceae) in a remnant of Atlantic forest in northeast Brazil. Acta Oecologica-International Journal Of Ecology **22**:259-268.

Silva, P. A. 2005. Predação de sementes pelo maracanã-nobre (*Diopsittaca nobilis*, Psittacidae) em uma planta exótica (*Melia azedarach*, Meliaceae) no oeste do Estado de São Paulo, Brasil. Revista Brasileira De Ornitologia **13**:183-185.

Silva, R. F. d. M. 2011. Interações entre plantas e aves frugívoras no campus da Universidade Federal Rural do Rio de Janeiro. Bachelor Thesis. Universidade Federal Rural do Rio de Janeiro, Rio de Janeiro.

Silva, W., P. Guimarães Júnior, S. Dos Reis, P. Guimarães, A. Dennis, E. Schupp, R. Green, and D. Westcott. 2007. Investigating fragility in plant-frugivore networks: a case study of the Atlantic Forest in Brazil. Seed dispersal: theory and its application in a changing world:561-578.

Silva, W. R. 1988. Ornitocoria em *Cereus peruvianus* (Cactaceae) na Serra do Japi, Estado de São Paulo. Revista Brasileira de Biologia **48**:381-389.

Silva, W. R., P. De Marco, Jr., E. Hasui, and V. S. M. Gomes. 2002. Patterns of fruit-frugivore interactions in two Atlantic forest bird communities of south-eastern Brazil: implications for conservation. Pages 423-435 *in* D. Levey, W. Silva, and M. Galetti, editors. Seed dispersal and frugivory: ecology, evolution and conservation. CABI Publishing, Wallingford.

Sleumer, H. O. 1984. Olacaceae. Flora Neotropica **38**:1-158.

Smith, G. L., and N. C. Coile. 2007. *Piptocarpha* (Compositae: Vernonieae). Flora Neotropica **99**:1-94.

Staggemeier, V. G., J. A. F. Diniz-Filho, and L. P. C. Morellato. 2010. The shared influence of phylogeny and ecology on the reproductive patterns of *Myrteae* (Myrtaceae). Journal of Ecology **98**:1409-1421.

Strong, J. N., and J. Fragoso. 2006. Seed dispersal by *Geochelone carbonaria* and *Geochelone denticulata* in northwestern Brazil. Biotropica **38**:683-686.

Taddei, V. A., and N. R. d. Reis. 1980. Notas sobre alguns morcegos da ilha de Maracá, Território Federal de Roraima (Mammalia, Chiroptera). Acta Amazonica **10**:363-368.

Tella, J. L., F. V. Dénes, V. Zulian, N. P. Prestes, J. Martínez, G. Blanco, and F. Hiraldo. 2016. Endangered plant-parrot mutualisms: seed tolerance to predation makes parrots pervasive dispersers of the Parana pine. Scientific Reports **6**:31709.

Valente, R. d. M. 2001. Comportamento alimentar de aves em *Alchornea glandulosa* (Euphorbiaceae) em Rio Claro, São Paulo. Iheringia. Série Zoologia.

Valido, A., and J. Olesen. 2007. The importance of lizards as frugivores and seed dispersers. Pages 124-147 *in* D. AJ, S. EW, G. RJ, and W. DA, editors. Seed dispersal: theory and its application in a changing world. CAB International, Wallingford.

Valiente-Banuet, A., M. A. Aizen, J. M. Alcántara, J. Arroyo, A. Cocucci, M. Galetti, M. B. García, D. García, J. M. Gómez, P. Jordano, R. Medel, L. Navarro, J. R. Obeso, R. Oviedo, N. Ramírez, P. J. Rey, A. Traveset, M. Verdú, and R. Zamora. 2015. Beyond species loss: the extinction of ecological interactions in a changing world. Functional Ecology **29**:299-307.

Vasconcellos-Neto, J., L. B. d. Albuquerque, and W. R. Silva. 2009. Seed dispersal of *Solanum thomasiifolium* Sendtner (Solanaceae) in the Linhares Forest, Espírito Santo state, Brazil. Acta Botanica Brasilica **23**:1171-1179.

Velazco, P. M. 2005. Morphological phylogeny of the bat genus *Platyrrhinus* Saussure, 1860 (Chiroptera: Phyllostomidae) with the description of four new species / Paul M. Velazco. Field Museum of Natural History, Chicago.

Vidal, M. M., E. Hasui, M. A. Pizo, J. Y. Tamashiro, W. R. Silva, and P. R. Guimarães. 2014. Frugivores at higher risk of extinction are the key elements of a mutualistic network. Ecology **95**:3440-3447.

Vieiralves Linhares, K. 2003. Esquilos *Sciurus alphonsei* (Mammalia: Rodentia) como dispersores de *Attalea oleifera* (Arecaceae) em remanescente da Floresta Atlântica Nordestina, Brasil. Master Thesis. Universidade Federal de Pernambuco, Recife-PE.

Vilar, E. M., H. Nunes, J. L. Nascimento, and P. C. Estrela. 2015. Distribution extension of *Ametrida centurio* Gray, 1847 (Chiroptera, Phyllostomidae): first record in the Brazilian Atlantic Forest. 2015 **11**:1503.

Vilela, F. d. S., K. M. Flesher, and M. Ramalho. 2012. Dispersal and predation of *Eschweilera ovata* seeds in the Atlantic Forest of Southern Bahia, Brazil. Journal Of Tropical Ecology **28**:223-226.

Weber, M. d. M., J. L. Steindorff de Arruda, B. O. Azambuja, V. L. Camilotti, and N. C. Caceres. 2011. Resources partitioning in a fruit bat community of the southern Atlantic Forest, Brazil. MAMMALIA **75**:217-225.

Wheelwright, N. T. 1983. Fruits and the ecology of resplendent quetzals. Auk **100**:286-301.

Zaca, W., W. R. Silva, and F. Pedroni. 2006. Diet of the rusty-margined Guan (*Penelope superciliaris*) in an altitudinal forest fragment of southeastern Brazil. Ornitologia Neotropical **17**:373-382.

Zimmerman, C. E. 1996. Observações preliminares sobre a frugivoria por aves em *Alchornea glandulosa* (Endl. & Poepp.) (Euphorbiaceae) em vegetação secundária. Revista Brasileira De Zoologia **13**:533-538.

Zimmermann, C. 2001. O uso da grandiúva, *Trema micrantha* Blume (Ulmaceae), na recuperação de áreas degradadas: o papel das aves que se alimentam de seus frutos. Tangara **1**:177-182.

Zimmermann, C., D. Santos, C. Santos, and L. Assunção. 2002. O uso de poleiros naturais para recuperação de florestas ciliares. SIMPÓSIO REGIONAL DE MATA CILIAR **1**:70-75.

Zortéa, M., and L. A. G. Tomaz. 2006. Dois novos registros de morcegos (Mammalia, Chiroptera) para o cerrado do Brasil central. Chiroptera Neotropical **12**:280-285.