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List of Odonates from the Floresta Nacional de São Francisco de Paula (FLONA - SFP), with two new distribution records for Rio Grande do Sul, Brazil

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Abstract: A survey of Odonata was carried out in the National Forest FLONA - SFP, Northeastern region of the Rio Grande do Sul state, Brazil. This conservation unit is mainly covered by Mixed Ombrophilous Forest (MOF), a subtype of Atlantic Forest biome, being also areas covered in planted *Pinus*, planted *Araucaria* and open fields. Our sampling efforts were conducted in thirty aquatic environments inside this reserve during the period between January 2014 and November 2014. The sampling sites were selected randomly, comprehending lakes, bogs, small streams and river sections, all inserted in the four vegetation types occurring in the reserve. Fortysix species of Odonata were collected and grouped into 23 genera and seven families. The dominant families were Coenagrionidae (32%), Libellulidae (32%), Aeshnidae (12%), and, Calopterygidae and Lestidae (9%). As expected, the findings revealed the presence of a highly diverse Odonate assemblage, mainly represented by generalist species in the most human disturbed sectors (*Pinus* and Open fields) and some specialist species in the pristine forest. Two species were registered for the first time in the state of Rio Grande do Sul, Brazil: *Libellula herculea* Karsch, 1889 (Libellulidae) and *Heteragrion luizfelipei* Machado, 2006 (Heteragrionidae).
Keywords: *Ecology, Odonata, inventory, Atlantic Forest, distribution.*

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Resumo: Uma pesquisa de Odonatas foi desenvolvida na Floresta Nacional de São Francisco de Paula (FLONA - SFP), Rio Grande do Sul, Brasil. Esta unidade de conservação é, em grande parte, coberta por Floresta Ombrófila Mista, um subtipo de floresta do Bioma Mata Atlântica, sendo também áreas cobertas com plantação de *Pinus*, *Araucaria*, além de áreas de campo aberto. Nossos esforços de coleta abrangeram 30 ambientes aquáticos dentro da reserva, no período de Janeiro de 2014 e Novembro de 2014. Os locais de coleta foram selecionados aleatoriamente, compreendendo lagos, banhados, pequenos arroios e seções de rio, todos inseridos nos quatro tipos de vegetação ocorrentes na reserva. Foram coletadas 46 espécies de Odonata, agrupadas em 23 gêneros e sete famílias. As famílias dominantes foram Coenagrionidae (32%), Libellulidae (32%), Aeshnidae (12%), e, Calopterygidae e Lestidae (9%). Como esperado, os resultados revelaram a presença de uma alta diversidade de Odonata, em sua maioria generalistas, encontrados nos setores mais impactados pelo homem (*Pinus* e Campos abertos) e algumas espécies especialistas na floresta primária. Duas espécies foram registradas pela primeira vez no estado do Rio Grande do Sul, Brasil: *Libellula herculea* Karsch, 1889 (Libellulidae) e *Heteragrion luizfelipei* Machado, 2006 (Heteragrionidae).
Palavras-chave: *Ecologia, Odonata, inventário, Floresta Atlântica, distribuição.*

Introduction

A big number of studies to describe the diverse fauna and flora in the Neotropics are already being published or under way. Even with so intense efforts, we are still far from the knowledge levels achieved in Europe and North America, or the northern hemisphere in general. In this part of the world, we even still lack reliable estimates of how many species occurs (May 1998, Scotland & Wortley 2003). Every day the information on the diversity of species becomes more relevant, as well as the knowledge on the species distribution and richness, which can provide several tools to put focus on human impact on these environments (Lewis 2006). To prioritize among areas under consideration for conservation, biologists and decision makers need concise information on species diversity, especially in threatened habitats like the Atlantic Forest (Kerr et al. 2000).

The Brazilian Odonata are still poorly described, despite a few publications with ecological approach, species lists are known only from São Paulo (Costa et al. 2000); Espírito Santo (Costa & Oldrini 2005); Minas Gerais (Souza et al. 2013) for Mata do Baú specifically; and Mato Grosso (Calvão et al. 2014) this last one being restricted only to a small region of the state. The most recent Odonata inventory for the state of Rio Grande do Sul is Renner et al. (2015), for the central region, and Kittel & Engels (2014), from a nature reserve (Pró-mata/PUCRS), with sampling performed only in open areas in forest surroundings and restricted to the Zygoptera suborder.

In this paper, we aim to improve the knowledge of the Odonata of the northeastern region of the Rio Grande do Sul state, acquiring a general overview of the species distribution over several types of aquatic environments distributed in Atlantic Forest at relatively high altitudes. As consequence we also expanded species distributions for this state.

Material and Methods

1. Study area

All the sampling areas are located within the National Forest FLONA - SFP, at the São Francisco de Paula municipality (Figure 1). This reserve is a National Conservation Unit, administered by de ICMBio (Instituto Chico Mendes de Conservação da Biodiversidade) together with the Brazilian Environment Ministry (Ministério do Meio Ambiente). These units are part of a sustainability plan, being so, part of the total areas are cultivated with planted forest: *Araucaria angustifolia* (Bertol.) Kuntze and *Pinus elliottii* Engelm., producing commercial wood for economical purposes.

The climate in the region is classified as Cfb in the Koppen system, Mesothermic Humid, Temperate Subtropical, with well defined seasons, mean temperatures varying in between 12°C and 16°C, altitudes reaching from 900 m to 1,100 m ASL, and precipitation means above 2,000 mm annually (INPE 2014). The reserve area (1,572 ha) is mainly (720 ha) covered in pristine Mixed Ombrophilous Forest (MOF), a subtype of Atlantic Forest, some areas are covered in planted *Araucaria* (AR), planted *Pinus* (PN) and Open fields (OP), these areas being altered since the 1950's decade. In each of these four vegetation types, three types of aquatic environments were selected: rivers (R), lakes (L) and swamps (S) to provide an overall view of the species occurring in the area.

2. Data collection

In total 30 aquatic environments (Figure 1) were sampled: MOF (n = 12), AR (n = 8), PN (n = 6) and OP (n = 4). The aquatic environments were divided in 3 types: rivers (R) n = 14, lakes (L) n = 7 and swamps (S) n = 9. We sampled for dragonflies during the year of 2014, all the sampling sites were visited three times per year, once per season: summer (2 - 11 January); autumn (10 - 18 May); spring (2 - 11 November); excluding the winter season due to the lack of activity of adult Odonata in the low temperatures prevailing. Our sampling efforts were concentrated on adults of Odonata, since the larvae can present great difficulties to the determination work, as only scarce information is available for this region (Garrison et al. 2006). The sampling method used handhold insect nets, performed by a team of two persons, in sunny days, during the peak time of Odonata activities (between 09:00 h to 16:00 h), which is an adaptation of Renner et al. (2015). The collection authorization process was issued by IBAMA, through SISBio system under the number 38928-1.

Species richness was determined by the absolute number of collected specimens. Collection efforts and the number of sampled species were based on the richness percentage estimated by the mean of non-parametric estimator building the collector's curve by Jack1 and Chao1 to estimate the actual number of species. The indexes Jackknife1 and Chao1 were calculated using the Software Estimates (Colwell 2009), with 1000 repetitions. Our sampling efforts were also validated using the estimation of total richness according to Smith & van Belle (1984).

All specimens collected were immediately preserved in 96% ethanol and deposited in the MCNU, afterwards determined in the Evolution and Ecology Laboratory according to Garrison et al. (2006, 2010), Heckman (2006, 2010), Lencioni (2006) and original species descriptions. For the systematics classification, we followed Dijkstra et al. (2014).

Results

1. Species list

We found 46 species, belonging to 23 genera in seven families, collected in the 30 aquatic environments inside the National Forest FLONA - SFP, except two, which are located in the immediate surroundings (main access road). This is a relatively large number of species, reflecting the diversity of sampling sites, which includes three types of aquatic systems, and four types of vegetation. In total 454 specimens were collected. The estimated number of species through non-parametric indexes (Jacknife1 and Chao1) are shown in Figure 2, the total estimated number of species through Smith & van Belle (1984) was 55,67, showing we reached 82% (n = 46) of the total estimated number of species on the three sampling occasions.

The Odonate list records from the National Forest FLONA - SFP is presented in Table 1, each species accompanied by the acronym of the vegetation type and aquatic environments with occurrence and collection/voucher ID number.

The families with the higher number of species were Coenagrionidae (32%), Libellulidae (32%), Aeshindae (12%), Calopterygidae and Lestidae (both 9%), as shown in the Table 2. The most common genera were *Erythrodiplax* and *Oxyagrion*, represented by six and four species, respectively. *Erythrodiplax* was the most abundant genus, occurring virtually in all sampling sites. The rarest species found with only one occurrence and in only one season were *Macrothemis marmorata*, *Dasythemys m. mincki* and *Peristicta gauchae*.

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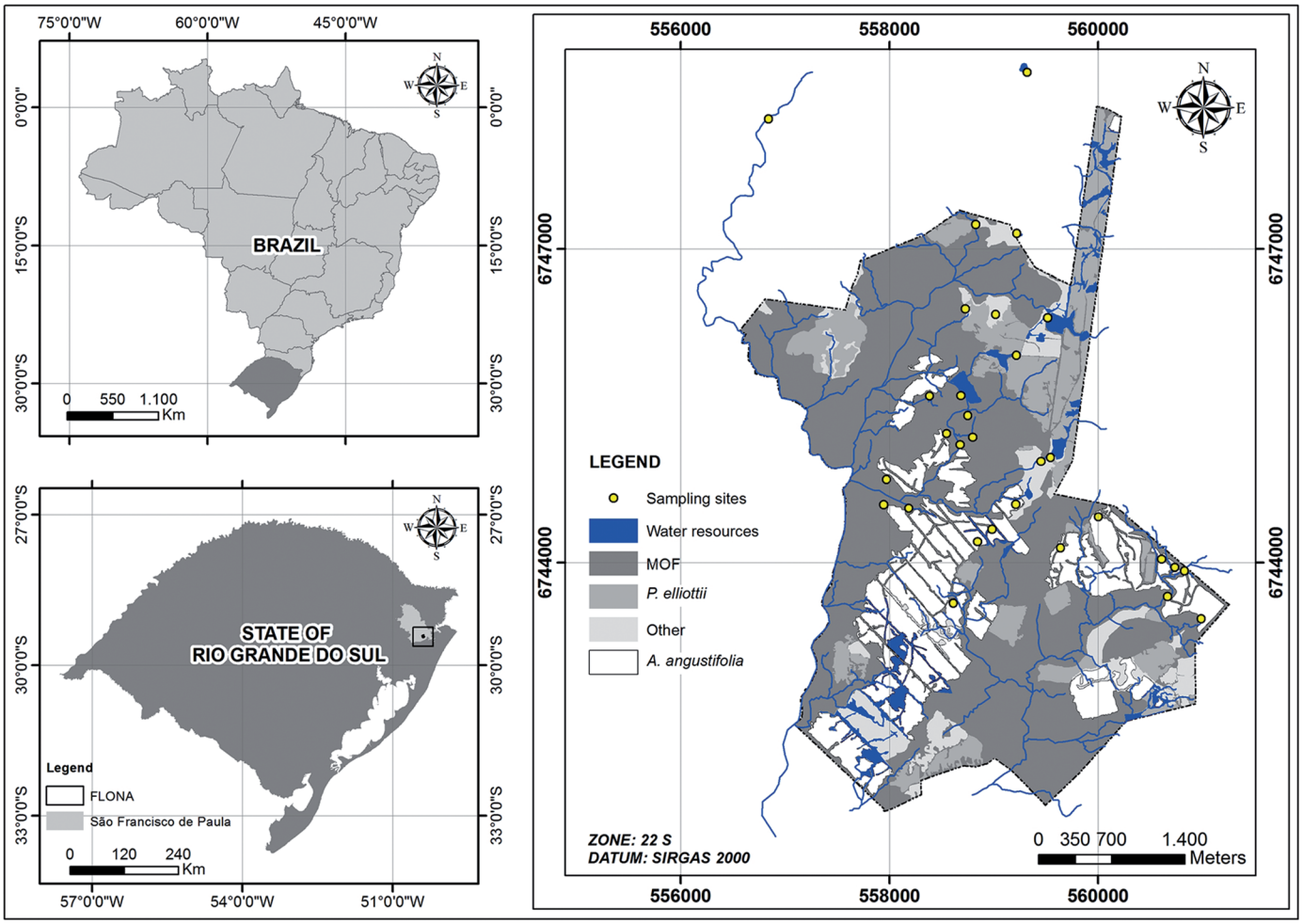

Figure 1. Brazilian map with the insets of the state of Rio Grande do Sul (RS); São Francisco de Paula municipality (light gray); and the complete map of National Forest FLONA - SFP, yellow dots representing the sampling sites in the reserve.

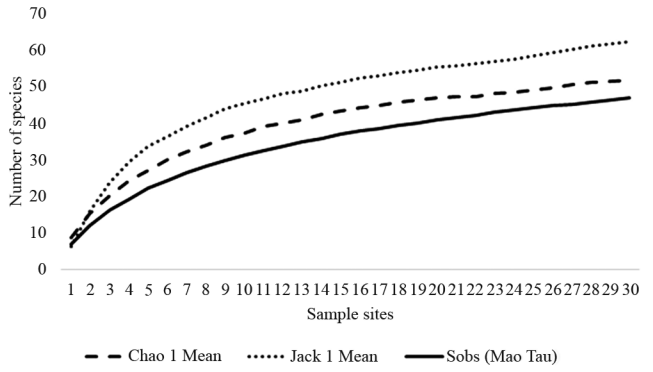

Figure 2. Number of species of Odonata collected (sobs) on the 30 sampling sites in relation to the number of species expected by Jacknife1 and Chao1 estimators in the National Forest FLONA - SFP, state of Rio Grande do Sul (RS), Brazil.

2. *New records*

We found two new records of odonate species for Rio Grande do Sul, one belonging to Libellulidae: *Libellula herculea* Karsch, 1889; and one belonging to Heteragrionidae: *Heteragrion luizfelipei* Machado, 2006.

2.1. *Libellula herculea* Karsch, 1889

Libellula is a Holarctic genus, which occurs also in Europe and Asia, in the New World its species are most diverse in North America: from Alaska and N Canada and to N Argentina in South America. The only species known to be widespread in South America is *Libellula herculea* (Garrison et al. 2006). According to Carle & Kjer (2002) this genus is well diagnosed and is considered a sister group of Orthemis, however an undescribed species is known from Brazil (Garrison et al. 2006). The two species belonging to the genus Libellula recorded here are: *Libellula herculea* and *Libellula* sp. both distributed widely in North, Central America and northern regions of South America, and with our records expanding their distribution southwards. The current distribution records were derived from De Marmels (1982) and Heckman (2006). According to Garrison (2006) the genus distribution ranges from North America to the Paraná state in Brazil, around 250 km northwards of our sampling site. Regarding *Libellula herculea*, the records from Brazil are from Marambaia, Ilha Grande and Itatiaia in the state of Rio de Janeiro (Santos 1970). Our specimens of *Libellula herculea* were found only in a permanent, highly vegetated swamp, inside the *Pinus* (PN) plantation (Figure 3a).

Table 1. Inventory list of Odonata species from the National Forest FLONA - SFP.

Suborder	Family	Species	Vegetation type	Env. type	Collection ID
Zygoptera	Calopterygidae	*Hetaerina longipes* Hagen *in* Selys, 1853	MOF, AR, OP	R, S	ZAUMCN928
		Hetaerina rosea Selys, 1853	MOF, PN	R, S	ZAUMCN929
		Mnesarete borchgravii (Selys, 1869)	MOF, AR	R	ZAUMCN930
		Mnesarete pruinosa (Hagen *in* Selys, 1853)	MOF, OP	R	ZAUMCN931
	Coenagrionidae	*Acanthagrion gracile* (Rambur, 1842)	OP	L	ZAUMCN932
		Acanthagrion lancea Selys, 1876	AR, PN, OP	L, S	ZAUMCN933
		Acanthagrion sp.	MOF, PN	R, L	ZAUMCN934
		Argentagrion ambiguum (Ris, 1904)	AR	S	ZAUMCN935
		Argia indocilis Navás, 1934 (j. syn. *A. croceipennis*)	MOF, AR, OP	R	ZAUMCN936
		Argia sp.	MOF	R	ZAUMCN937
		Homeoura chelifera (Selys, 1876)	AR, PN, OP	L	ZAUMCN938
		Ischnura capreolus (Hagen, 1861)	AR, PN, OP	L	ZAUMCN939
		Ischnura fluviatilis Selys, 1876	AR, PN, OP	L	ZAUMCN940
		Oxyagrion hempeli Calvert, 1909	OP	R	ZAUMCN942
		Oxyagrion microstigma Selys, 1876	PN, OP	R, L	ZAUMCN943
		Oxyagrion terminale Selys, 1876	MOF, AR, PN, OP	R, L, S	ZAUMCN944
		Oxyagrion sp.	MOF, AR, PN, OP	R, L, S	ZAUMCN945
		Peristicta gauchae Santos, 1968	OP	R	ZAUMCN946
		Telebasis theodori (Navás, 1934)	PN, OP	L	ZAUMCN947
	Heteragrionidae	*Heteragrion luizfelipei* Machado, 2006	MOF	R	ZAUMCN948
	Lestidae	*Lestes auritus* Hagen *in* Selys, 1862	PN, OP	L, S	ZAUMCN949
		Lestes bipupillatus Calvert, 1909	OP	S	ZAUMCN950
		Lestes pictus Hagen *in* Selys, 1862	PN	L	ZAUMCN952
		Lestes undulatus Say, 1840	PN, OP	L	ZAUMCN951
Anisoptera	Aeshnidae	*Castoraeschna* sp.	AR, PN	S	ZAUMCN953
		Limnetron sp.	MOF	R, S	ZAUMCN954
		Rhionaeschna bonariensis Rambur, 1842	MOF, AR, PN, OP	R, L, S	ZAUMCN956
		Rhionaeschna brasiliensis Ellenrieder and Costa, 2002	MOF, PN	R, L, S	ZAUMCN955
		Rhionaeschna planaltica (Calvert, 1952)	MOF, AR, PN, OP	R, L, S	ZAUMCN957
	Gomphidae	*Phyllogomphoides regularis* (Selys, 1873)	MOF	R	ZAUMCN958
		Progomphus gracilis Hagen *in* Selys, 1854	MOF, AR, OP	R	ZAUMCN959
	Libellulidae	*Dasythemis mincki mincki* (Karsh, 1890)	AR	S	ZAUMCN960
		Erythrodiplax atroterminata Ris, 1911	MOF	R	ZAUMCN961
		Erythrodiplax fusca (Rambur, 1842)	AR, PN, OP	L	ZAUMCN963
		Erythrodiplax hyalina Förster, 1907	MOF, AR, PN, OP	R, L, S	ZAUMCN964
		Erythrodiplax media Borror, 1942	MOF, AR, PN, OP	R, L, S	ZAUMCN965
		Erythrodiplax sp. (1)	MOF, AR, PN, OP	R, L, S	ZAUMCN962
		Erythrodiplax sp. (2)	OP	L	ZAUMCN966
		Libellula sp.	MOF, PN	S	ZAUMCN967
		Libellula herculea Karsch, 1889	PN	S	ZAUMCN968
		Macrothemis marmorata Hagen, 1868	AR	S	ZAUMCN969
		Micrathyria artemis Ris, 1911	MOF	R	ZAUMCN970
		Oligoclada laetitia Ris, 1911	AR, PN	L, S	ZAUMCN971
		Orthemis discolor (Burmeister, 1839)	PN	S	ZAUMCN972
		Perithemis icteroptera (Selys *in* Sagra, 1857)	PN	L	ZAUMCN973
		Perithemis mooma Kirby, 1889	PN	L	ZAUMCN974

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Table 2. Number of Odonata species collected per family in the National Forest (FLONA - SFP).

FAMILY	Nº	%
ZYGOPTERA		
Coenagrionidae	15	32
Lestidae	4	9
Calopterygidae	4	9
Heteragrionidae	1	2
ANISOPTERA		
Libellulidae	15	32
Aeshnidae	5	12
Gomphidae	2	4
TOTAL	46	100%

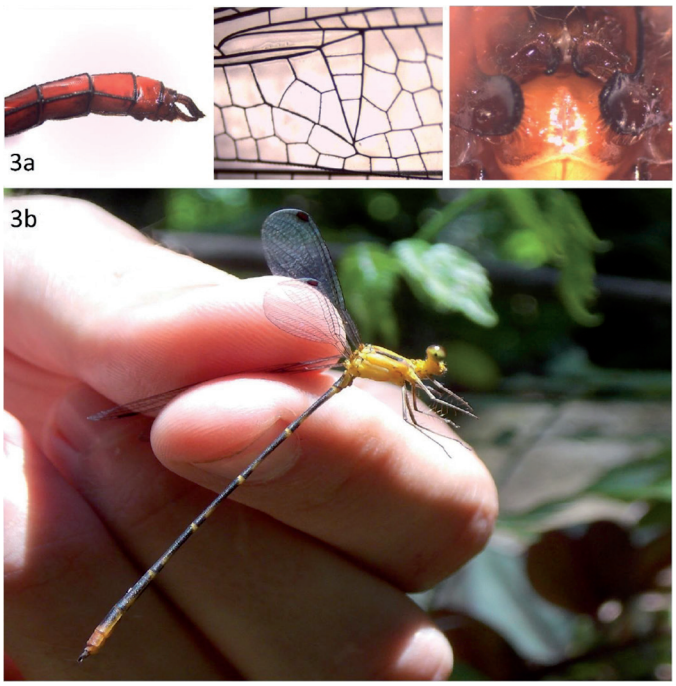

Figure 3. a) Main features of *Libellula herculea*: Male cercus (lateral view); FW base, arculus sectors separated; Genital fossa, ventral view. b) *Heteragrion luizfelipei*, adult male.

2.2. *Heteragrion luizfelipei* Machado, 2006

This species (Figure 3b) have its current distribution restricted to southern and southeastern Brazil, from São Paulo (Machado, 2006), and Paraná to its southern limit in the Santa Catarina state as reported by Lencioni (2013). Here we expand the distribution around 250 km southwards in the Rio Grande do Sul state. No further reported records could be found for this species. Possibly the lack of sampling efforts in the Atlantic coastal zones covered by the Atlantic Forest biome can explain why no sighting of this species have taken place in this region, as it is known as a typical forest genus (Loiola & De Marco 2011). The specimens were collected in the proximities of a slow flowing stream (ca. 50 - 100 cm wide), with boulder/gravel bottom, mostly shaded by the dense pristine Atlantic Forest (MOF).

Most of the biodiversity in the Atlantic Forest still unknown, especially so in the MOF subtype (Southern Brazil), and more studies are needed as shown by the discovery of these two new records. The order Odonata in the Neotropics in general is in need of many taxonomic revisions which will only be made possible through sampling and inventory studies as this one. We also strongly recommend the creation of more protected areas in the region, since it is considered a "hotspot" for biodiversity.

Discussion

The size of regional species pools for dragonflies has only been studied in certain regions of the world. In temperate regions of northern Europe, specifically southern and central Sweden, several studies have reported a regional species pool of between 24 and 30 (Wittwer et al. 2010; Flenner & Sahlén 2008). According to studies from Brazil, Pires et al. (2013) found 30 genera of dragonfly larvae in the Jacuí River Basin; De Marco et al. (2014), listed a species pool of 56, in central Brazi; Monteiro et al. (2013), noted 32 species in Manaus, Amazonas; Anjos-Santos & Costa (2006), registered 77 species, from Rio de Janeiro; and Souza et al. (2013) recorded 47 in Mata do Baú, Minas Gerais. Thus, 46 species fit well into the general pattern for a Subtropical zone, although there may be some additional rare species occurring in the region, the estimated indexes indicate that the size of the species pool is correctly estimated although up to ten more species might occur.

The big numbers of Libellulids occurring in the PN and OP (the most human impacted areas) consists to large part by widespread generalists, a fact that can be attributed to the mosaic of forest and open areas, which by its time favors the occupation by the fast and agile flying dragonflies corroborating the findings from Machado (2001).

There are clear relations between environmental factors (biotic and abiotic) and species composition, these factors acting as determinants of presence and absence of some species due to ecological and physical restrictions (Paulson 2006, Juen et al. 2007). In most preserved areas or bigger forested areas it is expected to find a bigger number of Calopterygids and Heteragrionids, which have more environmental restrictions and ecological needs to occur (Carvalho et al. 2013).

Despite that the occurrence of rare species was mostly restricted to the MOF and AR sectors, the finding of a good number of Coenagrionids in the other sectors (PN, OP) can also mirror good conditions, since some genera have also ecological restrictions related to aquatic vegetation and water quality (e.g. *Homeoura*, *Argia*, *Oxyagrion*) as stated by Garrison et al. (2010).

Regarding the occurrence indicator species, we found a selection which could fit into an indicator of general species richness for fragmented Atlantic forest biome, following Renner et al. (2015), as for example *Ischnura capreolus* and *Homeoura chelifera*, occurring only in the non-natural environments (AR, PN and OP). No endangered species were found, since most of the records are now attributed to "Least concern" or "Data deficient", according to the IUCN.

The Atlantic forest is one of the most endangered ecosystems in South America, and in this case, more specifically, the Mixed Ombrophilous Forest, one of the less known forest subtypes was explored. For these environments, species inventories can produce a

decisive tool for the management actions in order to keep and restore forests and natural resources. This survey made a deepened approach of the poorly known Odonata from Southern Brazil, showing that a great diversity is still occurring despite the human impacted habitats included in this study. This knowledge is useful in providing support data for future conservation measurements in the studied landscape.

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Literature cited

ANJOS-SANTOS, D. & COSTA, J.M. 2006. A revised checklist of Odonata (Insecta) from Marabaia, Rio de Janeiro, Brazil with eight new records. Zootaxa 1300:37-50.

CALVÃO, L.B., DE MARCO, P. & BATISTA, J.D. 2014. Odonata (Insecta) from Nova Xavantina, Mato Grosso, Central Brazil: Information on species distribution and new records. Check List 10:299-307. http://dx.doi.org/10.15560/8670

CARLE, F.L. & KJER, K.M. 2002. Phylogeny of Libellula Linnaeus (Odonata: Insecta). Zootaxa 87:1-18. http://216.92.145.68/zootaxa/2002f/zt00087.pdf

CARVALHO, F.G., PINTO, N.S., OLIVEIRA, J.M.B. & JUEN, L. 2013. Effects of marginal vegetation removal on Odonata communities. Acta Limnol. Bras. 25:10-18. http://dx.doi.org/10.1590/S2179-975X2013005000013

COLWELL, R.K. 2009. EstimateS: statistical estimates of species richness and shared species from samples, version 6.0 b1: user's guide and application. Storrs: University of Connecticut. World Wide Web publication. http://viceroy.eeb.uconn.edu/estimates2009. Accessed on July 2014.

COSTA, J.M. & OLDRINI, B.B. 2005. Diversidade e distribuição dos Odonata (Insecta) no Estado do Espírito Santo, Brasil. Publ. Av. Mus. Nac. 107:1-15. http://dx.doi.org/10.1590/S0085-56262011000100014

COSTA, J.M., A.B.M. MACHADO, F.A.A. LENCIONI & T.C. SANTOS. 2000. Diversidade e distribuição dos Odonata (Insecta) no Estado de São Paulo, Brasil: Parte I - Lista das espécies e registros bibliográficos. Publ. Av. Mus. Nac. 80:1-27. http://www.angelfire.com/mn/janira/trabalhos/pa80.pdf

DE MARCO, P., NOGUEIRA, D.S., CORREA, C., VIEIRA, T.B., SILVA, K.D., PINTO, N.S., BICHSEL, D., HIROTA, A.S.V., VIEIRA, R.R.S., CARNEIRO, F.M., OLIVEIRA, A.A.B., CARVALHO, P., BASTOS, R.P., ILG, C. & OERTLI, B. 2014. Patterns in the organization of Cerrado pond biodiversity in Brazilian pasture landscapes. Hydrobiologia 723:87-101. http://dx.doi.org/10.1007/s10750-013-1695-2

DE MARMELS, J. 1982. Cuatro náyades nuevas de la familia Libellulidae (Odonata: Anisoptera). Boletín de Entomología Venezolana 2:94-101.

DIJKSTRA, K.B., KALKMAN, V.J., DOW, R.A., STOKVIS, F.R. and VAN TOL, J. 2014. Redefining the damselfly families: a comprehensive molecular phylogeny of Zygoptera. Systematic entomol. 39:68-96. http://dx.doi.org/10.1111/syen.12035

FLENNER, I. & SAHLÉN, G. 2008. Dragonfly community re-organisation in boreal forest lakes: rapid species turnover driven by climate change? Insect Conserv. Div. 1:169-179. http://dx.doi.org/10.1111/j.1752-4598.2008.00020.x

GARRISON, R.W., VON ELLENRIEDER, N. & LOUTON, J.A. 2006. Dragonfly genera of the new world: an illustrated and annotated key to the Anisoptera. The John Hopkins University Press, Baltimore, USA, 368 p.

GARRISON, R.W., VON ELLENRIEDER, N. & LOUTON, J.A. 2010. Damselfly genera of the new world: an illustrated and annotated key to the Zygoptera. The John Hopkins University Press, Baltimore, USA, 490 p.

HECKMAN, C.W. 2006. Encyclopedia of South American aquatic insects: Odonata - Anisoptera. Springer, Dordrecht, The Netherlands, 725 p.

HECKMAN, C.W. 2010. Encyclopedia of South American aquatic insects: Odonata - Zygoptera. Springer, Washington DC, USA, 691 p.

INPE - Instituto Nacional de Pesquisas Espaciais. 2014. Centro de Previsão de Tempo e Estudos Climáticos, Banco de Dados Meteorológicos. Ministério da Ciência e Tecnologia. World Wide Web publication. http://bancodedados.cptec.inpe.br/. Assessed on March 2014.

JUEN, L., CABETTE, H.S.R. & DE MARCO, P. 2007. Odonate assemblage structure in relation to basin and aquatic habitat structure in Pantanal wetlands. Hydrobiologia 579:125-134. http://dx.doi.org/10.1007/s10750-006-0395-6

KERR, J.T., SUGAR, A. & PACKER, P. 2000. Indicator taxa, rapid biodiversity assessment and nestedness in an endangered ecosystem. Conserv. Biol. 14:1726-1734. http://dx.doi.org/10.1111/j.1523-1739.2000.99275.x

KITTEL, R.N., ENGELS, W. 2014. Diversity of damselflies (Odonata: Zygoptera) of the state of Rio Grande do Sul, Brazil, with four new records for the state. Notulae odonatologicae 8(3):49-55.

LENCIONI, F.A.A. 2006. The Damselflies of Brazil: An Illustrated Identification Guide 2 - Coenagrionidae. All Print Editora, São Paulo, Brazil, 419 p.

LENCIONI, F.A.A. 2013. Diagnoses and discussion of the group 1 and 2 Brazilian species of *Heteragrion*, with descriptions of four new species (Odonata: Megapodagrionidae). Zootaxa 3685(1):001-080. http://dx.doi.org/10.11646/zootaxa.3685.1.1

LEWIS, O.T. 2006. Climate changes, species-area curves and the extinction crisis. Philosophical Transactions of the Royal Society 361:163-171.

LOIOLA, G.R., DE MARCO, P. 2011. Behavioral ecology of *Heteragrion consors* (Odonata, Megapodagrionidae): a shade-seek Atlantic forest damselfly. Rev. Bras. Entomol. 55(3):373-380. http://dx.doi.org/10.1590/S0085-56262011005000036

MACHADO, A.B.M. 2001. Studies on neotropical protoneuridae (Odonata, Zygoptera). Rev. Bras. Zool. 21:333-336. http://dx.doi.org/10.1098/rstb.2005.1712

MACHADO, A.B.M. 2006. Three new species of *Heteragrion* Selys, from Brazil with redescription of the holotype of *H. dorsale* Selys (Odonata, Megapodagrionidae). Rev. Bras. Zool. 23(4):1062-1070. http://dx.doi.org/10.1590/S0101-81752006000400012

MAY, R.M. 1998. How many species are there on Earth? Science 241:1441-1449. http://www.ciesin.org/docs/002-253/002-253.html

MONTEIRO, C.S., COUCEIRO, S.R.M., HAMADA, N. & JUEN, L. 2013. Effect of vegetation removal for road building on richness and composition of Odonata communities in Amazonia, Brazil. Intern. J. Odonatology 16:135-144. http://dx.doi.org/10.1080/13887890.2013.764798

PAULSON, D. 2006. The importance of forests to neotropical dragonflies. In: CORDERO RIVERA, A. (ed.) Forest and Dragonflies - 4th WDA International Symposium of Odonatology. Pensoft Publishers, Sofia, Bulgaria, p.79-101.

PIRES, M.M., KOTZIAN, C.B., SPIES, M.R. & NERI, D.B. 2013. Diversity of Odonata (Insecta) larvae in streams and farm ponds of a montane region in Southern Brazil. Biota Neotrop. (13)3:259-267. http://www.biotaneotropica.org.br/v13n3/en/abstract?inventory+bn01813032013.

RENNER, S., PÉRICO, E., SAHLÉN, G., SANTOS, D.M. & CONSATTI, G. 2015. Dragonflies (Odonata) from the Taquari River valley region, Rio Grande do Sul, Brazil. Check List 11(5):1740. http://dx.doi.org/10.15560/11.5.1740

RENNER, S., SAHLÉN, G. & PÉRICO, E. 2015. Testing Dragonflies as Species Richness Indicators in a Fragmented Subtropical Atlantic Forest Environment. Neotrop. Entomol. 45:231-239. http://dx.doi.org/10.1007/s13744-015-0355-9

SANTOS, N.D. 1970. Odonatas de Itatiaia (Estado do Rio de Janeiro) da Coleção Zikan. do Institudo Oswaldo Cruz. Atas da Sociedade de Biologia do Rio de Janeiro 13:203-205.

SCOTLAND, R.W. & WORTLEY, A.H. 2003. How many species of seed plants are there? Taxon 52:101-104. http://wiki.eol.org/download/attachments/5276955/Plants-Seedplants-ScotlandWortley2003.pdf

SMITH, E. & VAN BELLE, G. 1984. Non parametric estimation of species richness. Biometrics 40:119-129.

SOUZA, M.M., SOUZA, B., PEREIRA, M.C.S.A. & MACHADO, A.B.M. 2013. List of Odonates from Mata do Baú, Barroso, Minas Gerais, Brazil. Check List 9:1367-1370. http://dx.doi.org/10.15560/9.6.1367

WITTWER, T., SAHLÉN, G. & SUHLING, F. 2010. Does one community shape the other? Dragonflies and fish in Swedish lakes. Insect Conserv. Div. 3:124-133. http://dx.doi.org/10.1111/j.1752-4598.2010.00083.x

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