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ARTICLE

Ichthyofauna of Trairí river basin, Rio Grande do Norte state, northeastern Brazil: a century after the study of the naturalist Edwin Starks in the Papari lagoon

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Abstract. Fishes from the coastal basins of the Mid-Northeastern Caatinga ecoregion (MNCE) were first sampled by the Stanford expedition at the beginning of the 20th century, and published by Edwin C. Starks in 1913. This material included specimens from the Papary lake (= Papari lagoon) in the lower portion of the Trairí river basin, draining towards the eastern coast of Rio Grande do Norte State. In 1941, Henry Fowler provided a broad taxonomic study of the freshwater fishes from northeastern Brazil, including material from the Papari lagoon, besides describing four species assigned to this locality. However, these previous surveys focused only in the lower portion of the Trairí river basin and might be incomplete. Given this framework, the present study aimed at perform a wide ichthyofaunal inventory of Trairí river basin and compare with previously surveys performed in the regions. In 2013 and 2014, four expeditions along the whole basin, including the Papari lagoon itself, resulted in 28 species of fishes belonging to 17 families and seven orders. At Papari lagoon area 16 species were registered whereas 26 and 18 species were recorded by Starks and Fowler's studies, respectively. Considering all records, 50 species were documented in the basin with 14 (28%) new records, including *Serrapinnus potiguar,* whose distribution was extended to the south. Two species described by Fowler, *Pimelodella papariae* and *Pseudancistrus papariae,* were not found in this study or in any fish collection, and are only known from their type-material. These two species can be naturally rare, locally extinct, or there were inaccuracies in their type-locality. However, species of these genera are only found in larger basins of the MNCE, which drains to the north, corroborating the latter assumption. Although not being a definitive list, the recent extensive fish surveys conducted in the MNCE's coastal basins are helping to elucidate species' geographic distribution and little knowing taxonomic issues.

Key-Words. Mid-Northeastern Caatinga Ecoregion; Freshwater fishes; Coastal basins; Semiarid.

INTRODUCTION

The Mid-Northeastern Caatinga Ecoregion (MNCE), composed by coastal basins fully or partially inserted in the semiarid, was a knowledge gap in the diversity of freshwater fishes until recently (Lévêque *et al.,* 2008; Langeani *et al.,* 2009; Lima *et al.,* 2017). However, in the last decade many ichthyofaunal surveys and taxonomic studies were conducted in the ecoregion (Gurgel-Lourenço *et al.,* 2013; Novaes *et al.,* 2013; Paiva *et al.,* 2014; Silva *et al.,* 2014, 2017; Botero *et al.,* 2014; Lira *et al.,* 2015; Ramos *et al.,* 2013, 2016, 2017; Britzke *et al.,* 2016; Rodrigues-Filho *et al.,* 2016; Teixeira *et al.,* 2017; Zawadzki *et al.,* 2017; Costa *et al.,* 2017; Lima *et al.,* 2017). One of the first fish collections at the MNCE was undertaken by the Stanford Expedition in 1911 when a few drainages in Ceará and Rio Grande do Norte states were sampled (Starks, 1913). Among the sampled locations was the Papary lake (or 'Lago Papari'), located at the lower stretch of the Trairí river basin, draining to the eastern coast of Rio Grande do Norte State. Known since the 16th century, its native name means "fish jump", emphasizing the abundance of fish (Ferreira, 2011). In the vicinity

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of the lagoon, in Nísia Floresta Municipality, there was established a fishermen community which was mentioned by Edwin Chapin Starks (1913) as responsible for the large fish collection at this locality.

Later, Fowler (1941) provided a taxonomic study on the fishes collected by Rodolpho von Ihering in many localities throughout northeastern Brazil in 1936 and 1937, including the Papari lagoon. In such study many species were described and four of them had their type-locality assigned to the Papari lagoon: *Hypostomus papariae* (Fowler), *Pimelodella papariae* (Fowler), *Pseudancistrus papariae* Fowler, and *Psectrogaster saguiru* Fowler (Fowler, 1941). However, previous surveys focused only in the lower portion of the Trairí river basin and might have been incomplete. Besides that, our surveys provide fresh specimens from an historically important type-locality that might allow important material for future taxonomic reviews and molecular systematic studies. Thus, the main purpose of the present study is to provide a reliable ichthyofaunal inventory of the Trairí river basin and compare the results with those obtained by Starks (1913) and Fowler (1941). Furthermore, some hypotheses concerning incongruences on the occurrence of some species described by Fowler were provided.

MATERIAL AND METHODS

Study area

The Trairí river basin has an approximate area of 2.900 km^2, of which 99.63% are inserted in Rio Grande do Norte State (RN) and a small fraction of its upper portion in Paraíba State (ANA/SGI, 2014) (Fig. 1). It is located in the northeastern portion of the MNCE (Fig. 1), which is characterized by temporary rivers and lower species richness in comparison to the adjacent ecoregions, notwithstanding its high endemism (Albert *et al.,* 2011). The main course of the Trairí river emerges at Serra do Doutor (in Campo Redondo and Coronel Ezequiel municipalities, in RN) and flows to Guaraíras lagoon between Tibau do Sul and Senador Georgino Avelino municipalities, also in RN (IBGE, 1990). About 88% of the basin lies within the Caatinga and the remaining in the Atlantic Forest (ANA/SGI, 2014). Rains are more abundant in the coast, varying from 1,300 mm annually at the estuary to 500 mm in Santa Cruz municipality ("Agreste" portion of RN), and 700 mm close to the river's headwaters (SERHID, 2001).

Sampling design

Four expeditions were conducted between October 2013 and August 2014 during dry and rainy seasons, consisting of 27 sampling locations (Fig. 1 and Table 1) from the upper stretch to the lower portion of Trairí river basin. The sampling sites marked with an asterisk in Table 1 were at the border of the Papari lagoon.

Samplings were done during the day and, occasionally at night, under collection permit 30532-1/2011 from Instituto Chico Mendes de Conservação da Biodiversidade/Sistema de Autorização e Informação em Biodiversidade – ICMBio/SISBIO) and applying the AquaRAP methodology (Rapid Assessment Protocol in Aquatic Systems) proposed by Alonso & Willink (2011).

Table 1. Sampled locations and municipalities in Trairi river coastal basin. All sites are within Rio Grande do Norte state, Brazil. * Sampling sites at the Papari lagoon.

Locality	Elevation (m)	Geographic Coordinates
1. Unnamed stream, Vera Cruz	366 m	05°50'32.3"S; 36°12'07.5"W
2. Barro Branco reservoir, Coronel Ezequiel	487 m	06°22'02.6"S; 36°14'33.4"W
3. Unnamed reservoir in Coronel Ezequiel	362 m	06°19'22.7"S; 36°11'45.6"W
4. Trairí reservoir, Tangará	179 m	06°15'11.7"S; 35°49'40.2"W
5. Mãe D'Água reservoir, Campo Redondo	471 m	06°14'34.4"S; 36°11'27.7"W
6. Novo reservoir, Santa Cruz	238 m	06°13'33.4"S; 36°01'38.3"W
7. Unnamed stream, Lagoa de Pedra	120 m	06°12'34.9"S; 35°23'51.7"W
8. Tiquinho Miranda dam, Boa Saúde	90 m	06°09'43.1"S; 35°35'58.7"W
9. Unnamed stream, Brejinho	66 m	06°09'39.6"S; 35°19'34.1"W
10. Unnamed stream, Brejinho	34 m	06°08'40.5"S; 35°18'43.7"W
11. Papari lagoon, Nísia Floresta*	20 m	06°06'44.3"S; 35°11'15.6"W
12. Unnamed marginal lagoon, Lagoa Salgada	119 m	06°06'55.9"S; 35°31'16.9"W
13. Araraí river, São José de Mipibu	6 m	06°06'39.7"S; 35°14'02.4"W
14. Unnamed stream near Papari lagoon, Nísia Floresta	19 m	06°06'39.5"S; 35°12'07.7"W
15. Unnamed stream, Nísia Floresta*	12 m	06°06'36.7"S; 35°12'10.7"W
16. Corró Novo river, São José de Mipibu	35 m	06°06'26.3"S; 35°18'03.4"W
17. Unnamed stream, São José de Mipibu	15 m	06°06'24.3"S; 35°16'05.0"W
18. Edge North of Papari lagoon, Nísia Floresta*	10 m	06°06'13.9"S; 35°11'27.9"W
19. Papari lagoon, Nísia Floresta	10 m	06°07'14,7"S; 35°10'00,3"W
20. Trairí river, São José de Mipibu	13 m	06°06'03.5"S; 35°14'02.0"W
21. Unnamed stream, Nísia Floresta	17 m	06°05'39.5"S; 35°11'58.5"W
22. Trairí river, Lagoa Salgada	41 m	06°05'08.2"S; 35°22'59.4"W
23. Unnamed tributary of Trairí river, São José do Mipibú	10 m	06°04'55.4"S; 35°13'45.9"W
24. Unnamed stream, Monte Alegre	44 m	06°03'47.4"S; 35°18'41.6"W
25. Unnamed stream, Monte Alegre	37 m	06°03'35.7"S; 35°21'52.8"W
26. Vera Cruz stream, Vera Cruz	70 m	06°03'02.4"S; 35°23'25.7"W
27. Arenã stream, Vera Cruz	41 m	06°03'03.7"S; 35°20'57.4"W

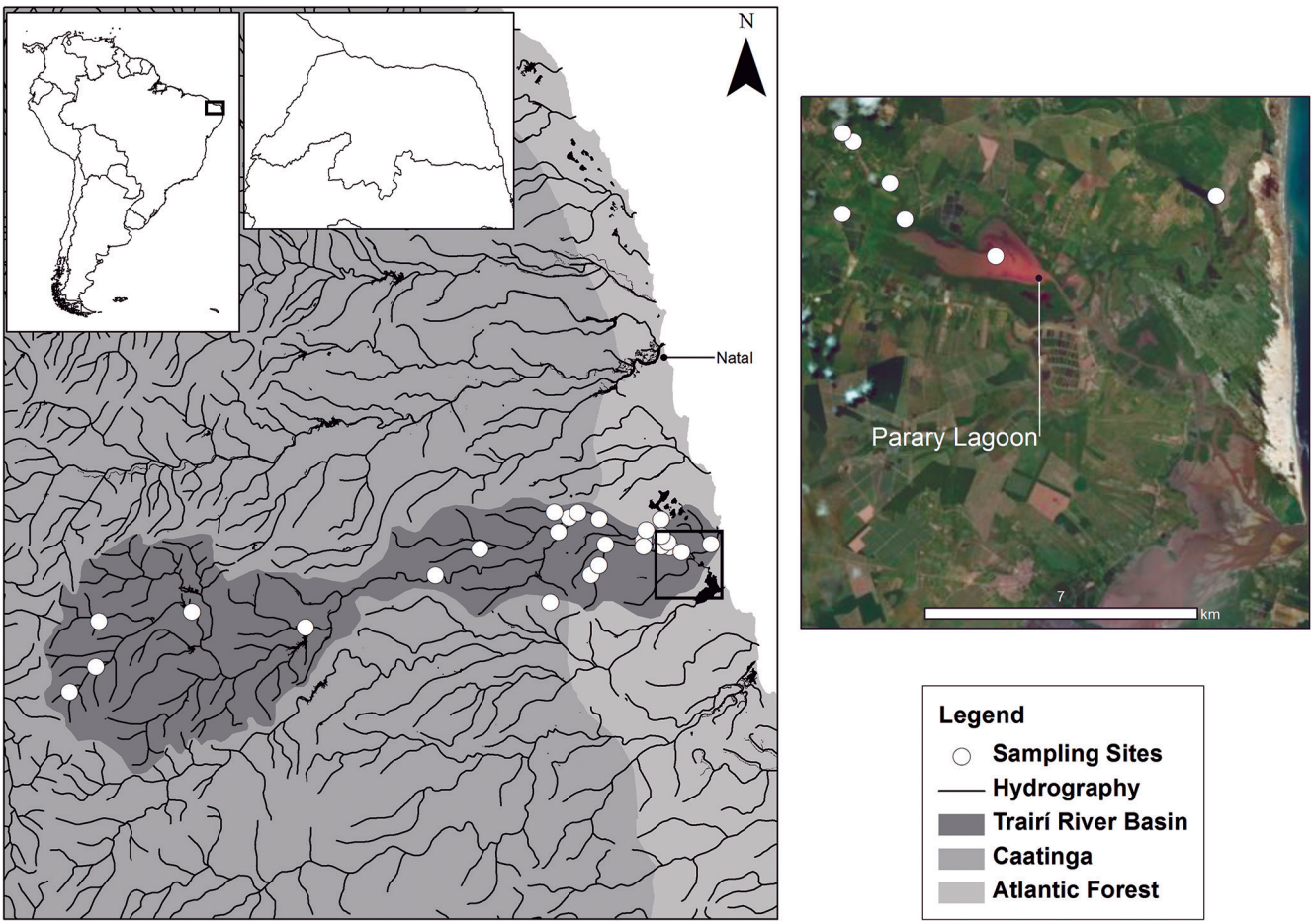

Figure 1. Map of sampling sites of the ichthyofaunal survey in Trairí river coastal basin, Rio Grande do Norte State, northeastern Brazil.

Fishes were collected using active sampling gear, such as trawl (4.1 × 2.2 m and 5.0 mm), sieve (0.8 m × 0.5 mm), cast net (1.5 m × 12.0 mm), and gill nets as passive sampling gear to embody the highest number of microhabitats and reduce method selectivity (Uieda & Castro, 1999; Sabino, 1999). Casting nets were also used in the middle of the Papari lagoon with the help of a local fisherman boat.

After collected, specimens were anesthetized in a 10% alcoholic eugenol solution (10 mL of clove oil; 90 mL of ethyl alcohol) (Lucena *et al.,* 2013), then fixed in 10% formaldehyde and posteriorly transferred to a 70% ethanol solution (Malabarba & Reis, 1987). Specimens' identification was done to the lower taxonomic level based on specialized literature (Britski *et al.,* 1984; Kullander, 1983; Marceniuk, 2005; Ploeg, 1991; Figueiredo & Menezes, 1980 and Carpenter, 2002), or specialists' support. The systematic classification and nomenclature of valid species followed Eschmeyer *et al.* (2017). Specimens were deposited at the ichthyological collection of the Universidade Federal do Rio Grande do Norte (UFRN).

Recently collected data were compared to those recorded by Starks (1913) and Fowler (1941) (Table 2). An updated identification of this material was checked in the online database from the Stanford University (SU) at California Academy of Science (http://researcharchive.calacademy.org/research/Ichthyology/collection/index.asp), and the Academy of Natural Science of Drexel University (ANSP). The species collected by Starks and Fowler refers only to the Papari lagoon, while those collected throughout this survey in the lagoon are marked with an asterisk (Table 2).

Ecophysiological classification of salinity tolerance followed Myers (1949). The Brazilian list of endangered species (MMA, 2014) was used to discuss the conservation status of each species. Endemism of freshwater fishes, defined by occurrence in the MNCE, followed Rosa *et al.* (2003), Buckup *et al.* (2007), and Lima *et al.* (2017). Lastly, the list of exotic species followed Leão *et al.* (2011).

RESULTS

A total of 28 species belonging to 25 genera, 17 families, and six orders were recorded in our surveys. Primary freshwater species were predominant (16 spp., 57.1%), followed by secondary (7 spp., 25%) and peripheral (5 spp., 17.9%) (Table 2). The order Characiformes was the most representative with six families, nine genera, and 12 species (42.8%), followed by Siluriformes with five families, five genera, and five species (17.8%), and Cichliformes with one family, four genera and four species (14.3%). The order Synbranchiformes was represented by a single species.

Sixteen species (57.1%) were collected in the Papari lagoon area, being nine primary freshwater (*Astyanax*

Table 2. Systematic list of fish species collected in Trairí river basin, Rio Grande do Norte. Material collected by Starks (1913) and Fowler (1941) from Papari lagoon. FPE: peripheral freshwater; FPR: primary freshwater; FSE: secondary freshwater; MAR: marine. E: endemic species from the Mid-Northeastern Caatinga Ecoregion; EX: exotic species; *Species collected at the Papari lagoon during this study. [VU]Vulnerable species, and [SI]*Species inquirenda.* ANSP: The Academy of Natural Sciences of Drexel University; SU: Ichthyological collection of Stanford University at California Academy of Sciences; UFRN: Universidade Federal do Rio Grande do Norte.

ORDER/Family/*Species*	Ecophysiology	Starks 1913	Fowler 1941	This study	Endemism	Voucher
ELOPIFORMES (2)						
Elopidae (1)						
Elops saurus Linnaeus, 1766	**MAR**	**X**				SU 22185
Megalopidae (1)						
Megalops atlanticus Valenciennes, 1847[VU]	**MAR**	**X**				SU 22175
CLUPEIFORMES (1)						
Engraulidae (1)						
Anchovia clupeoides (Swainson, 1839)	**FPE**	**X**				SU 22095
CHARACIFORMES (17)						
Crenuchidae (1)						
Characidium bimaculatum Fowler, 1941	**FPR**			**X***		UFRN 2361
Erythrinidae (2)						
Erythrinus erythrinus (Bloch & Schneider, 1801)	**FPR**			**X***		UFRN 2322
Hoplias malabaricus (Bloch, 1794)	**FPR**	**X**	**X**	**X***		UFRN 2396 ANSP 95881
Serrasalmidae (3)						
Metynnis lippincottianus (Cope, 1870)	**FPR**	**X**				SU 22183
Pygocentrus nattereri Kner, 1858	**FPR**		**X**			ANSP 87812
Serrasalmus rhombeus (Linnaeus, 1766)	**FPR**		**X**			ANSP 88500
Anostomidae (1)						
Leporinus piau Fowler, 1941	**FPR**		**X**	**X**		ANSP 69495, UFRN 1930
Curimatidae (2)						
Psectrogaster saguiru (Fowler, 1941)	**FPR**		**X**		**E**	ANSP 69461
Steindachnerina notonota (Miranda Ribeiro, 1937)	**FPR**	**X**	**X**	**X***		SU 22458, ANSP 69453, UFRN 2339
Prochilodontidae (1)						
Prochilodus brevis Steindachner, 1875	**FPR**		**X**	**X***	**E**	UFRN 2342, ANSP 96051
Triportheidae (1)						
Triportheus signatus (Garman, 1890)	**FPR**		**X**		**E**	ANSP 84094
Characidae (6)						
Astyanax aff. *bimaculatus* (Linnaeus, 1758)	**FPR**	**X**	**X**	**X***		SU 22176, ANSP 81920, UFRN 2360
Astyanax aff. *fasciatus* (Cuvier, 1819)	**FPR**			**X**		UFRN 2369
Hemigrammus marginatus Ellis, 1911	**FPR**			**X**		UFRN 2341
Serrapinnus heterodon (Eigenmann, 1915)	**FPR**			**X***		UFRN 2373
Serrapinnus piaba (Lütken, 1875)	**FPR**			**X***		UFRN 2362
Serrapinnus potiguar Jerep & Malabarba 2014	**FPR**			**X**	**E**	UFRN 3429
SILURIFORMES (7)						
Auchenipteridae (1)						
Trachelyopterus galeatus (Linnaeus, 1766)	**FPR**		**X**	**X**		ANSP 96050, UFRN 3430
Heptapteridae (2)						
Pimelodella papariae (Fowler 1941)[SI]	**FPR**		**X**		**E**	ANSP 69387
Rhamdia quelen (Quoy & Gaimard, 1824)	**FPR**			**X**		UFRN 3257
Ariidae (1)						
Bagre marinus (Mitchill, 1815)	**FPE**			**X***		UFRN 2319
Callichthyidae (1)						
Megalechis thoracata (Valenciennes, 1840)	**FPR**	**X**		**X***		SU 22163, UFRN 2363
Loricariidae (2)						
Hypostomus papariae (Fowler, 1941)[SI]	**FPR**		**X**	**X**	**E**	UFRN 2399, ANSP 69398
Pseudancistrus papariae Fowler, 1941[SI]	**FPR**		**X**		**E**	ANSP 69442
GYMNOTIFORMES (1)						
Gymnotidae (1)						
Gymnotus carapo Linnaeus, 1758	**FPR**	**X**				SU 22475
GOBIIFORMES (3)						
Eleotridae (2)						
Eleotris pisonis (Gmelin, 1789)	**FPE**	**X**		**X***		SU 22208, UFRN 2327
Dormitator maculatus (Bloch, 1792)	**FPE**	**X**		**X**		SU 22478, UFRN 3313
Gobiidae (1)						
Awaous tajasica Lichtenstein, 1822	**FPE**	**X**				SU 22154

ORDER/Family/*Species*	Ecophysiology	Starks 1913	Fowler 1941	This study	Endemism	Voucher
SYNBRANCHIFORMES (1)						
Synbranchidae (1)						
Synbranchus aff. *marmoratus* Bloch, 1795	**FSE**	**X**	**X**	**X**		SU 22202, UFRN 2347
PLEURONECTIFORMES (1)						
Achiridae (1)						
Achirus achirus (Linnaeus, 1758)	**MAR**	**X**	**X**			SU 22127, ASNP 73985
CICHLIFORMES (4)						
Cichlidae (4)						
Cichlasoma orientale Kullander, 1983	**FSE**	**X**	**X**	**X***		SU 22449, ANSP 84124, UFRN 2358
Crenicichla brasiliensis (Bloch, 1792)	**FSE**	**X**	**X**	**X***		SU 22476, ANSP 96047, UFRN 2308
Geophagus brasiliensis (Quoy & Gaimard, 1824)	**FSE**			**X**		UFRN 2283
Oreochromis niloticus (Linnaeus, 1758)[EX]	**FSE**			**X***		UFRN 2305
ATHERINIFORMES (1)						
Atherinopsidae (1)						
Atherinella brasiliensis (Quoy & Gaimard, 1825)	**FPE**	**X**				SU 22101
CYPRINODONTIFORMES (2)						
Poecilidae (2)						
Poecilia reticulata Peters, 1859[EX]	**FSE**			**X**		UFRN 2359
Poecilia vivipara Bloch & Schneider, 1801	**FSE**			**X***		UFRN 2357
BELONIFORMES (1)						
Belonidae (1)						
Strongylura marina (Walbaum, 1792)	**FPE**	**X**				SU 64920
MUGILIFORMES (1)						
Mugilidae (1)						
Mugil liza Valenciennes, 1836	**MAR**	**X**	**X**			SU 13241
PERCIFORMES (8)						
Centropomidae (2)						
Centropomus mexicanus (Bocourt, 1868)	**FPE**	**X**				SU 22103
Centropomus undecimalis (Bloch, 1792)	**FPE**	**X**		**X***		SU 22115, UFRN 2320
Gerreidae (5)						
Diapterus auratus (Ranzani, 1842)	**FPE**	**X**				SU 22140
Diapterus rhombeus (Cuvier 1829)	**FPE**	**X**				SU 22091
Eucinostomus gula (Quoy & Gaimard, 1824)	**MAR**	**X**				SU 22143
Eucinostomus jonesii (Günther 1879)	**MAR**	**X**				
Eugerres brasilianus (Cuvier, 1830)	**MAR**	**X**				SU 22144
Sciaenidae (1)						
Plagioscion squamosissimus (Heckel, 1840)[EX]	**FPE**			**X**		UFRN 2307
Total/excluding introduced species (50/47)		**26**	**18**	**28**		

aff. *bimaculatus, Characidium bimaculatum, Erythrinus erythrinus, Hoplias malabaricus, Megalechis thoracata, Prochilodus brevis, Serrapinnus heterodon, S. piaba,* and *Steindachnerina notonota*), four secondary (*Cichlasoma orientale, Crenicichla brasiliensis, Poecilia vivipara* and *Oreochromis niloticus*), and three peripheral (*Bagre marinus, Centropomus undecimalis* and *Eleotris pisonis*) (Table 2).

Of these 28 species herein registered (Table 2), 14 had already been recorded in previously studies (*i.e.,* Starks, 1913; Fowler, 1941). Therefore, 14 species (*Astyanax* aff. *fasciatus, Bagre marinus, Characidium bimaculatum, Erythrinus erythrinus, Geophagus brasiliensis, Hemigrammus marginatus, Oreochromis niloticus, Plagioscion squamosissimus, Poecilia reticulata, P. vivipara, Rhamdia quelen, Serrapinnus heterodon, S. piaba* and *S. potiguar*), most of which are freshwater, are new records for the basin, raising its richness to 50 species. Besides, three of them were introduced: the Nile tilapia (*Oreochromis niloticus*), the silver croaker (*Plagioscion squamosissimus*), and the guppy (*Poecilia reticulata*). No threatened species was recently collected; however, Starks recorded *Megalops atlanticus* Valenciennes, 1847, which is evaluated as 'vulnerable' (MMA, 2014).

DISCUSSION

Starks described the Papari lagoon as a large, shallow, and muddy estuarine water body with abundant superficial vegetation, which made it laborious to trawl fishes (Starks, 1913). Being aided by local fishermen, he intensively sampled the lagoon during several days, collecting 26 species, most of which were estuarine (Table 2) (six primary freshwater fish species, three secondary, ten peripheral, and seven marine) (Starks, 1913). In 1936, von Ihering collected 18 species at the same locality (Table 2) (13 primary freshwater, three secondary, and two marine), being eight previously recorded by Starks (*Achirus achirus, Astyanax* aff. *bimaculatus, Cichlasoma orientale, Crenicichla brasiliensis, Hoplias malabaricus, Mugil liza, Steindachnerina notonota,* and *Synbranchus* aff. *bimac-*

ulatus), and ten were new records (*Hypostomus papariae, Leporinus piau, Pimelodella papariae, Prochilodus brevis, Psectrogaster saguiru, Pseudancistrus papariae, Pygocentrus nattereri, Serrasalmus rhombeus, Triportheus signatus,* and *Trachelyopterus galeatus*) (Fowler, 1941). These studies together accounted for 36 fish species in the Papari lagoon (Table 2). The updated taxonomic list of the fish species herein provided allowed a comparison between these previous studies in the Papari lagoon.

Considering the records of Starks (1913), Fowler (1941), and those of the recent surveys, 50 species were documented in the Trairí river basin. Among the 14 new records, it is remarkable the occurrence of *Serrapinnus potiguar,* which was only known from the Ceará-Mirim river basin (Jerep & Malabarba, 2014), located about 55 km to the north of Trairí river basin, expanding southward the distribution of this recently described species. However, since the Papari lagoon is situated at the estuarine portion of Trairí river basin and it is directly influenced by tides, as reported by Jenkins & Branner (1913), the records of *Gymnotus carapo, Hypostomus papariae, Metynnis lippincottianus, Pimelodella papariae, Psectrogaster saguiru, Pseudancistrus papariae, Pygocentrus nattereri,* and *Serrasalmus rhombeus* are dubious, and might have been captured upstream, as they are characterized as freshwater species and have low salinity tolerance (Myers, 1949).

Starks (1913) and Fowler (1941) did not register any introduced species in the Papari lagoon, suggesting a scenario of environmental degradation over the last decades, since in recent samplings three introduced species were recorded: two from fish farming or aquaculture (*Oreochromis niloticus* and *Plagioscion squamosissimus*), and one from aquarium trade (*Poecilia reticulata*) (Leão *et al.,* 2011). In addition to the introduction of exotic species of fish, the lagoon has been suffering from environmental impacts due to intense development of shrimp farming in Rio Grande do Norte State (Santos & Coelho, 2002). Some stretches have been greatly modified at the lower portion of Trairí river basin as a result of the removal of riparian vegetation and riverbed sand for building shrimp farms, contributing for the lagoon's silting. Besides, waste (antibiotics and organic matter) coming from those farms are dumped into the Papari lagoon without any prior treatment (Santos, 2005). According to Santos (2005), the small height of dikes has been contributing for the overflow of farms in the rainy seasons and for the invasion of the exotic shrimp species *Litopenaeus vannamei* (Boone) into the Papari-Guaraíras lagoon complex.

Fowler (1941) described many species from several type localities along the Brazilian northeast. At the Papari lagoon he described four species of which three are catfishes (*Hypostomus papariae, Pimelodella papariae,* and *Pseudancistrus papariae*) and one is a characin (*Psectrogaster saguiru*). However, except the latter, Fowler's descriptions do not exhibit any diagnostic characters that allow their differentiation from congeners, including those of the same study. There have been some doubts regarding the taxonomic validity and geographic distribution of the species *Pseudancistrus papariae* and *Pimelodella papariae* once they have not been recorded in coastal basins that flow to the eastern coast of the MNCE and are only known from their type-series (Lima *et al.,* 2017).

Possible locality mislabeling or erroneous identifications of lots assigned to the Papari lagoon by Fowler (1941) are realistic possibilities, as already mentioned by Vari (1989) and Ramos *et al.* (2017). These authors noticed that the localities attributed to *Psectrogaster saguiru* (Lago Papary, Rio Grande do Norte) and *Hypostomus eptingi* (Fortaleza, Ceará) belong to the basins of the Jaguaribe and Parnaíba rivers, respectively. This could also have happened to further fishes of the Papari lagoon, based on the same kind of observation: the absence of some species (*e.g., Pimelodella papariae* and *Pseudancistrus papariae*) despite recent and previous surveys in the Trairí river basin, and the presence of some relatively large-sized species (*e.g., Psectrogaster saguiru, Pygocentrus nattereri, Serrasalmus rhombeus,* and *Triportheus signatus*) that are more common in the larger basins of the MNCE. These factors also contribute to questionings concerning the actual provenance of such species.

In northeastern Brazil, specimens of *Pseudancistrus* are only known from the two largest basins of the MNCE, which drain to the north, Jaguaribe and Piranhas-Açu rivers, and are usually identified as *P. genisetiger* (Lima *et al.,* 2017). Between 1936 and 1937, von Ihering and his team collected in many drainages in northeastern Brazil, including these MNCE's large basins (Fowler, 1941); therefore, the material assigned as *Pseudancistrus papariae* might have come from these drainages. Starks (1913) also did not record any specimen of this genus in Papari lagoon or in any sampling site. Due to the virtual absence of representatives of the genus in Trairí river basin and in other MNCE's eastern coastal drainages, Lima *et al.* (2017) suggested that it might have been some location mislabeling in the lots supposedly assigned to the Papari lagoon.

Fowler (1941) also described eight species currently allocated in the genus *Pimelodella* in northeastern Brazil, besides recognizing *P. gracilis* (Valenciennes). Six of those are from the MNCE (*P. dorseyi, P. enochi, P. gracilis, P. papariae, P. witmeri,* and *P. wolfi*); however, these descriptions do not establish a clear distinction among the proposed species, sometimes belonging to the same drainage (Slobodian, 2018). The same seems to apply to Fowler's *Hypostomus* species, with *H. papariae* being difficult to be distinguished from *H. pusarum* Starks based on the original description. Meanwhile, *H. papariae, Pimelodella papariae,* and *Pseudancistrus papariae* were listed as *species inquirendae* by Lima *et al.* (2017).

Taxonomic uncertainties caused by brief descriptions, locality mislabeling in Fowler's study (1941), and complex nomenclature emphasize the need of taxonomic revisions of the genera *Hypostomus, Pseudancistrus,* and *Pimelodella* from northeastern Brazil basins. This is paramount to determine their taxonomic validity, including some species supposedly described from the Papari lagoon, in the Trairí river basin. Although not definitive, the extensive surveys of freshwater fish species from the

MNCE's coastal basins are providing more knowledge to solve the taxonomic problems. It also helps in gathering fresh material for morphological and molecular studies, as well as to assess the anthropogenic impacts, mainly in drainages with historical inventories and which are the type locality of some species.

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