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EDITORIAL

Dear associates,

First of all, we would like to give our compliments to the former directorship, composed by Luiz Roberto Malabarba, Fernando Jerep and José Birindelli for the outstanding work they have been making for the last four years (2015-2019). We received the SBI directorship with great honor and thank for all the help provided during this transition. We hope to continue the job up to their level.

As our first editorial, we have in our hands this special edition of SBI Bulletin about scientific collections, an important and urgent topic to discuss. This series of manuscripts resulted from a section of the II Symposium on Phylogeny and Classification of Neotropical Fishes, organized by SBI and State University of Londrina, in October 2017. The scientific collections are the foundation stone of virtually all biological work. If one does not use collection material directly, she/he will rely on knowledge produced by someone who uses. Those collections are a continuous picture of the biodiversity, how taxa change through time, and allow us to tell stories about evolution, systematics, ecology, among other.

This edition counts with articles about 22 Brazilian fish collections and 17 other collections distributed around the world. Despite the different localities, one thing all articles have in common: our investment in sampling the neotropical fish biodiversity and an urge to discuss the slow (or rapid) dismounting of scientific collections, due to limited investment to their maintenance and care. Our former SBI President, Luiz Malabarba opens this bulletin with an article that questions the "chronicles of a death foretold" of museums and scientific collections, urging us to review our values regarding scientific and cultural patrimony.

As the new directorship, we would like to thank the contribution of several people in the making of this bulletin and invite the readers which are not members of SBI yet that join our Society. The Brazilian Ichthyology Society is made for you, and by you, getting stronger with the interaction of its members.

Maria Elina Bichuette
Veronica Slobodian
Carla Natacha Marcolino Polaz
SBI Board of Directors

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COMMUNICATION

Museums must be burned or cooked to a slow boil?

Luiz R. Malabarba

On Sunday, September 2nd, 2018, we were all shocked by the images broadcasted live of the fire at the National Museum and its collection. That shock became even more relevant to the media and general population when the information regarding the possible loss of over 20 millions artifacts in the collection was divulged. One of the most asked questions during the coverage of the tragedy was "what has been lost of importance?", one or a few items being chosen as an answer. However, the greatest loss in the fire was the knowledge that was yet to be discovered!

Museums are libraries of books and articles that haven't yet been written. They are not deposits of old and worthless things, but permanent fonts of information that must be discovered or reinterpreted under new paradigms or new technologies. Museums possess the most diverse collections gathered throughout decades or centuries and that are irreplaceable, and that allows us to tell the history of Earth, living beings, our own species, our cultural evolution and sometimes our own demise.

Museums are like anthills, built through time with the gathering of thousands of pieces, each one acquired, collected, prepared and researched by a different specialist – its little ants. And they are uncountable, the ants of Universities, Research institutes and other museums from all around the world (students, researchers, curators, professors) who constantly go to Museums to analyze, study and make new discoveries with each of those already existing pieces. The fire of the National Museum shocks the population due to the loss of its collection, but it certainly shocks far more deeply those little ants that have dedicated their lives to the construction of that archive, who sometimes know each piece and its potential to new discoveries and future projects, as well to the development of new thesis by our master and Ph.D. students.

But let us not be naive, the losses at the National Museum reflect the carelessness with culture, science and national patrimony. Authorities in different areas were eager to guarantee resources for the reconstruction of the National Museum after the fire, and we hope they actually follow through with it, but we have not heard clear propositions or the discussion of national politics regarding science, technology and the preservation of collections. Those are empty speeches. We need only to remember the recent fires at the Butantã Institute (2010), the Museum of Portuguese Language (2015) and the Brazilian Cinematec (2016).

Paradoxically to the speeches we've heard after the sad episode of the loss of collections of the National Museum, that we can blame on the carelessness and lack of resources, we find a sui generis example in the state of Rio Grande do Sul, where the extinction of the Zoobotanical Foundation, its Museum of Natural Sciences and its collection is state politics. Indifferent to the public manifestations of the scientific community regarding the relevance of these organizations and their collections not only to science, but to education, documentation, management and conservation of the biodiversity, the government persists in a crusade for their extinction. The match has been lit two years ago, with the dispatch of a law project for the extinction and its approval in the state's Legislative Assembly, and since then, the Zoobotanical Foundation, its Museum of Natural Sciences and their collections have been cooking in a slow boil. Surprisingly, one of the main motives for the Justice suspending the attempts of extinction is due to the lack of a plan, by the State, that guarantees the management of the collections. Tragic, isn't it?

The episode of the National Museum is sad for the students and professionals that work there, for students and researchers from all over the world that depend on the information in its collection, for all of the brazilians for the proof of carelessness for science and our history, and for the entire world due to the loss of an anthropological, archaeological, geological, paleontological, botanical, zoological and historical patrimony that does not belong to Brazil, but to the world. We hope for a union of the entire society in the construction of a National Museum true to its status and history.

We take then this cruel opportunity to discuss and review our values as a Society in relation to our scientific and cultural patrimony, as well as to demand from our governors effective measures for their protection, and not for their destruction or loss. We also hope that the outrage caused by the fire of the National Museum brings along a bit of enlightenment to the southern politicians, ending once and for all the idea of the extinction of the Zoobotanical Foundation, its Museum of Natural Sciences and their collections. A greater shame than to lose patrimony due to carelessness, is to lose it due to state politics.

Former Presidente da Sociedade Brasileira de Ictiologia
English version by Laura Malabarba

FISH COLLECTION

CAS
Collection of fishes of the California Academy of Sciences

Hudson T. Pinheiro, Jon Fong, David Catania, Mysi Hoang, B. Gabriela Arango, Claudia Rocha & Luiz A. Rocha

The California Academy of Sciences (CalAcademy) is situated in Golden Gate Park, San Francisco, California, and was founded in 1853. The first Curator of Ichthyology, William O. Ayres, started the fish collection in 1854, studying and describing new species from California. However, a great earthquake hit San Francisco in 1906, with destruction and fire ruining the CalAcademy and most of its fish collection. Thus, the foundation for the present collection resides in the holdings of the schooner Academy on its return from an expedition to the Galapagos also in 1906. Now over one century since the earthquake, the collections have grown substantially and benefited from the incorporation of several valuable collections from other institutions, which has given it worldwide scope. These include collections from Indiana University in 1929 (North American and South American freshwater fishes), the George Vanderbilt Foundation (GVF) in 1967 (western Pacific and Gulf of Thailand marine fishes), and Stanford University (SU) in 1969 (worldwide freshwater and marine fishes).

The fish collection is now housed in six environmentally controlled rooms that are state-of-the-art fire and earthquake safe, and equipped with shelves, tanks, and large vats on compactor carriages. The bulk of our wet collections with glass jars and other containers (generally less than 20-gal. capacity) occupy three adjoining rooms on the top floor of the east wing of the CalAcademy's Research and Administration (R&A) building (Figure 1). A fourth room on Level 2 (east wing of R&A) continues the run of smaller jars, and includes backlogged collections and all type specimens (Figure 1). A fifth room on Level 2 (west wing of R&A) houses our oversized containers, including large stainless steel tanks and vats. Our tanks and vats on compactor carriages, include two of 248x90x90 cm, 13 of 151x90x90 cm, 96 of 90x38x38 cm, and 16 of 46x38x38 cm. In total, we have for our smaller containers approximately 5,620 linear meters of 38-cm-wide shelving, with another 936 m (or 305 m^3) of "cupboard" space on the bottom of each tier for taller containers. Our skeletal collections are housed in a sixth room on Level 2. The fish tissue collection has two -80°C and one liquid nitrogen freezers. Today, the collection facility allows space for an estimated 10 to 20 years of growth.

The collection still has a darkroom and x-ray room, adjacent to the oversized-containers room. Staff offices and cubicles are located in the CalAcademy's west wing on Level B1 (second floor from bottom), with the prep lab, adjoining reprint room, and lab storage room down the hall near the western end of the building. Ichthyology's prep room is also equipped with a fume hood. Our extensive reprint collection, which includes David Star Jordan's reprints from Stanford University, is now housed on shelves in a room adjacent to our specimen-preparation room. Our valuable holdings of ichthyological books, which include many rare

Figure 1. Shelves containing glass jars in the rooms of the CalAcademy's Fish Collection (left side). The jaws of a tiger shark *Galeocerdo cuvier* (Péron & Lesueur, 1822) are also displayed (above, left). Shelves containing type specimens (above, right), and staff members of the CalAcademy's Fish Collection (below, right).

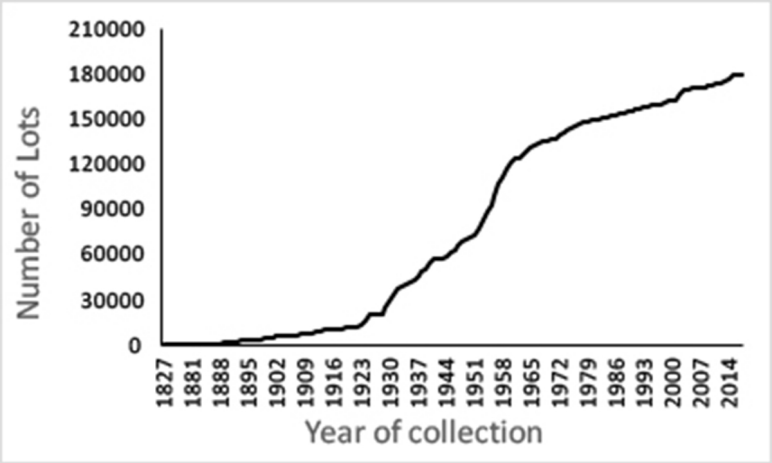

Figure 2. Accumulated number of lots deposited in the Fish Collection of the California Academy of Sciences (available in the on-line database).

volumes, are held in the Academy's main library, with the special, most-valuable books kept in a limited-access, rare-book section.

The CalAcademy's fish collection now numbers more than 225,000 cataloged lots and over 1,3 million specimens, continuing to grow through field activities of the Academy's curators and associates, as well as through deposition of specimens by others. Around 80% of the CalAcademy's lots are cataloged and available in the on-line database. The oldest specimen deposited at the CalAcademy dates back to 1827, however, the collection largest growth occurred between 1930 and 1970 (Figure 2). Among the lots, 7,739 regards to type specimens, with digital images and radiographs of our primary type holdings available. A total of 3,163 lots (6,639 specimens) are cleared and stained, and 1,227 lots (1,425 specimens) are skeletons. The CalAcademy's fish tissue collection contains samples of 1,381 species and 17,496 specimens.

About 67% of the lots represent marine species, and the remaining freshwater fishes. Most of the lots of marine taxa are from Indo-West Pacific (39%) and Northeastern Pacific (24%) (Table 1), while most of the lots containing freshwater specimens are from North (38%) and South (33%) America (Table 2). The CalAcademy has over 4,865 loans registered. In the last 10 years, CalAcademy's fish collection has received an average of 52 ichthyologist visitors a year, and performed 65 loans per year. The Academy's Fish Collection is currently one of the largest and most important in the world, and is designated as one of eight International Centers for Ichthyology in North America.

Figure 3. Localities of lots from the Central America and Caribbean deposited in the Fish Collection of the California Academy of Sciences.

Figure 4. Localities of lots from the South America deposited in the Fish Collection of the California Academy of Sciences.

Neotropical fishes at CalAcademy. Overall, the CalAcademy holds 44,901 lots and 285,655 specimens of 46 countries and islands from the Neotropical realm (Figure 3, 4; Table 3). A total of 24,161 lots and 142,978 specimens represent marine taxa. Most of the marine lots are from Southeastern Pacific (41% of the lots and 687 species) and Southwestern Atlantic (24% of the lots and 435 species). CalAcademy holds a total of 345 primary types (holotypes, syntypes, neotypes and lectotypes) covering a total of 334 neotropical marine species, and 914 secondary type lots (paratypes paralectotypes), from 404 species (Table 1). Regarding freshwater fishes, a total of 20,740 lots and 142,677 specimens are found at the CalAcademy's collection, mostly from the South America (90%), covering a total of 1918 species. CalAcademy's fish collection has a total of 496 primary type lots from 443 neotropical freshwater species, and 1350 secondary type lots from 761 species (Table 2).

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Table 1. Number of lots, specimens, species, primary types, lots and specimens of secondary types (paratypes) of marine fishes deposited in the Fish Collection of the California Academy of Sciences.

Marine	Lots	Specimens	Species	Primary Types	Secondary Types/ Lots	Secondary Types/Species
Antarctica	400	1891	53	6	16	4
Southern Ocean	94	230	11	0	0	0
Arctic Ocean	754	4292	114	3	1	1
Caribbean Sea	1638	6231	540	19	50	38
Gulf of Mexico	1962	8171	602	17	37	25
NE Atlantic	1412	4055	493	9	29	14
NW Atlantic	10447	31530	1060	37	108	63
SE Atlantic	1113	2372	268	4	16	13
SW Atlantic	2559	5916	435	9	30	17
Mediterranean Sea	428	1984	213	0	0	0
Red Sea	1342	3932	316	2	20	17
Indian Ocean	4907	21438	1393	37	190	131
Persian Gulf	48	186	34	0	0	0
Indo-West Pacific	59759	348340	3645	304	1031	542
NE Pacific	36179	240523	1943	371	893	359
NW & Central Pacific	9418	43933	2060	264	718	530
SE Pacific	4304	15185	687	84	252	129
South Pacific	15319	68356	1811	55	412	286

Table 2. Number of lots, specimens, species, primary types, lots and specimens of secondary types (paratypes) of freshwater fishes deposited in the Fish Collection of the California Academy of Sciences.

Freshwater	Lots	Specimens	Species	Primary Types	Secondary Types/ Lots	Secondary Types/Species
Africa	3772	16910	661	18	67	39
Asia	8646	70896	1600	101	351	209
Australia	148	904	94	0	0	0
Baltic Sea	1	2	1	0	0	0
Black Sea	1	5	1	0	0	0
Europe	493	3283	185	0	0	0
South America	17873	112745	1918	416	1164	620
Central America	1452	9423	363	23	56	41
West Indies	454	4573	194	14	13	8
North America	20573	284100	1506	118	369	226

Table 3. Number of lots and specimens for marine and freshwater fishes, from Neotropical countries and islands, deposited in the Fish Collection of the California Academy of Sciences.

Countries and islands	Marine Lots	Marine Specimens	Freshwater Lots	Freshwater specimens
Antigua and Barbuda	55	219	5	17
Argentina	80	227	211	1120
Aruba	1	1	0	0
Bahamas	121	247	5	13
Barbados	157	313	5	2010
Belize	15	64	11	23
Bolivia	0	0	444	5922
Brazil	2584	6100	5878	20714
British Virgin Islands	5	16	10	46
Cayman Islands	8	15	0	0
Chile	256	1005	283	6135
Colombia	290	1927	2020	20176
Costa Rica	1524	18348	100	536
Cuba	357	959	304	1996
Curacao	99	193	4	7
Dominica	14	47	0	0
Dominican Republic	16	48	2	4
Ecuador	3892	14863	357	6333
El Salvador	80	321	13	50
French Guiana	130	279	18	220
Grenada	3	24	0	0
Guadeloupe	6	9	0	0
Guatemala	28	464	210	1691
Guyana	50	224	1345	5318
Haiti	27	184	23	216
Honduras	128	247	32	60
Jamaica	289	1739	10	85
Martinique	1	3	0	0
Mexico	10986	72362	1294	17480
Montserrat	0	0	1	1
Netherlands Antilles	4	5	3	8
Nicaragua	137	488	199	2929
Panama	1581	17658	887	4134
Paraguay	0	0	325	751
Peru	380	2010	3385	25317
Puerto Rico	437	873	33	78

Saint Helena	4	4	0	0
Saint Kitts and Nevis	6	9	2	9
Saint Lucia	49	82	9	22
Saint Vincent and the Grenadines	5	28	1	2
Sint Maarten	1	1	0	0
Suriname	144	535	95	431
Trinidad and Tobago	111	535	29	73
Turks and Caicos Islands	1	2	0	0
Uruguay	5	9	25	101
Venezuela	94	291	3162	18649

Name and acronym	Collection of Fishes of the California Academy of Sciences (CalAcademy, CAS)
Institution	California Academy of Sciences
Address	Golden Gate Park, 55 Music Concourse Drive, San Francisco, CA, 94118
Curator(s) and contact(s)	Luiz A. Rocha; Lrocha@calacademy.org; p. 415.379.5370
Website	https://www.calacademy.org/scientists/ichthyology
Year of foundation	1853
Facilities and area of the collection	8 rooms
Number of visitors per year (average last 10 years)	52
Number of loaned lots per year (average last 10 years)	65
Specimens habitat (number of specimens)	502,000 freshwater and 808,000 marine fish
Specimens origin	44 neotropical countries and islands
Current cataloging method	Specify 6 (specifysoftware.org)
Total number of lots and number of lots from Neotropical region	~205,000 in the online database, ~45,000 from the Neotropical region
Total number of specimens and number of specimens from Neotropical region	~1,3 million specimens, ~300,000 from the Neotropical region
Total number of holotypes and number of holotypes from Neotropical region	~1,950 primary types, ~830 from Neotropical region
Total number of paratypes and number of paratypes from Neotropical region	~5,900 secondary types, ~1,260 from Neotropical region
Number of tissue samples	1,381 species; 17,496 specimens
Number of C&S specimens	6,639
Number of dry skeleton specimens	1,425

FISH COLLECTION

CIACOL
Colección Ictiológica de la Amazonia Colombiana

Astrid Alexia Acosta-Santos, Juan David Bogotá-Gregory & Edwin Agudelo Córdoba

The Colección Ictiológica de la Amazonia Colombiana-CIACOL, is part of the biological collections guarded by the Instituto Amazónico de Investigaciones Científicas SINCHI, which is a non-profit civil corporation, of a public nature created by Article 20 of the Law of 1993, linked to the Ministry of Environment and Sustainable Development.

The CIACOL is located in the city of Leticia in the department of Amazonas (Colombia), was created as a tool of the Aquatic Ecosystems Research Group, with the objective of documenting the fish fauna present in the Colombian Amazon, providing information related to the local environmental reality, taxonomic identification, species potentiality and vulnerability; as well as the commercial and ecological value of the specimens collected.

The collection has specimens collected in the mid-nineties under the umbrella of the projects of "Ornamental Fish of the Amazon" and "Fisheries resources tradable in the rivers Caquetá, Putumayo and Amazonas". It wasn't until 2010 that was formally registered with the Alexander von Humboldt Institute. Once it was accredited, extensive collection campaigns began in sectors of the Colombian Amazon where fish inventories were scarce or non-existent.

As of this year, specimens have been collected within the framework of the projects "Investigation of the current status of aquatic resources and their aquatic ecosystems in the Colombian Amazon", "Scientific Research for the Promotion of Shared Management of Ecosystems and Natural Resources of the Colombian Amazon", "Fish and gear used in fishing for local consumption in the Amazon basin. Phase I: subbasins and micro-watersheds of the Colombian Amazon", "Environmental Baseline in the field of extractive activities (hydrocarbons / mining) in the municipality of San José del Fragua (department of Caquetá - Colombia) LBA-CAQUETÁ", "Conservation and sustainable use of the biological, socioeconomic and cultural diversity of the Colombian Amazon" and "Colombia-Biodiversity Expedition to biodiversity in the Andean-Amazonian transition of the Department of Caquetá" and "Expedition Colombia-BIO to Apaporis 2018".

The CIACOL specimens have been collected in the upper and middle sectors of the Vaupés river basins (Cuduyarí, Paca, Papurí and Yi canals, Mituceño, Sangre), Caquetá (Pescado, Hacha, Consaya, Orotuya, Chorroso Fragua rivers) and in the piedmont, Guaviare (in tributary aquatic ecosystems of the Vaupés river and Guaviare river), Putumayo (sector of Puerto Leguízamo) and Apaporis (vicinity of the community of Buenos Aires and Cerro la Campana) and Amazonas in the vicinity close to Leticia and Puerto Nariño, in the sub-basins of the Amacayacu and Mata-Matá rivers and in the lagoon system of Yahuarcaca and its tributaries (**Figure 1**).

Most of these sectors are considered relevant geological regions because they present environments with one of the highest biological complexities in the world (Galvis *et al*. 2006) and in which there are few studies related to freshwater fish (Maldonado-Ocampo *et al*. 2008). Thus, CIACOL is an important collection that generates, maintains, organizes and disseminates fundamental information on the fish diversity of the hydrogeographic region of the Colombian Amazon.

Specimens were collected from a network of field stations using different mesh eye, trawls, hooks, electro-fishing equipment, and electric fish finders (Crampton *et al*. 2007). The use of different methods is a consequence of the heterogeneity of the Amazonian aquatic ecosystems and the objectives of each projects.

The taxonomic classification of species follows the proposal by Oliveira *et al*. (2011) for the Characiformes group while the remaining orders Siluriformes, Gymnotiformes and Perciformes follow the proposal of Reis *et al*. (2003). The species belonging to the family Potamotrygonidae are included in the order Myliobatiformes, eliminating the order Rajiformes, meanwhile, the

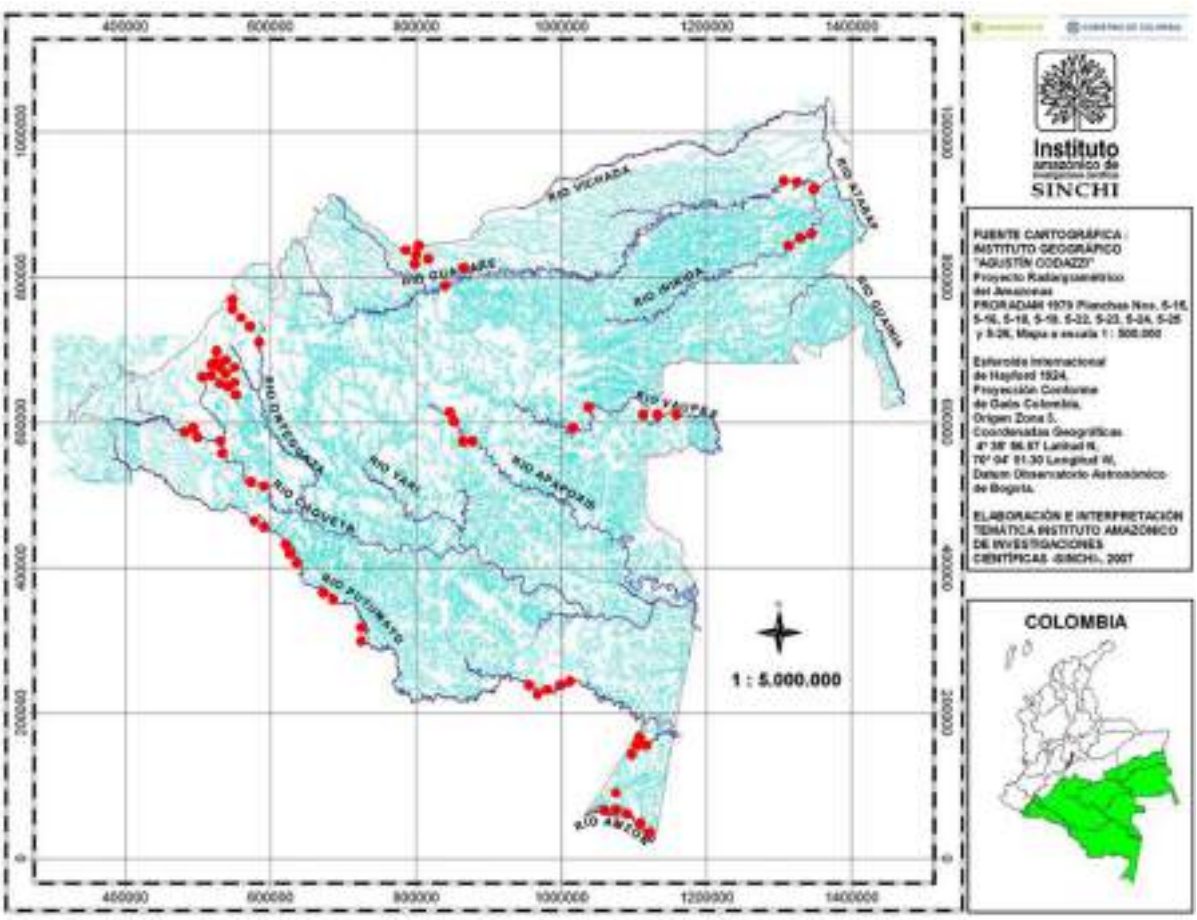

Figure 1. Geographical location of the region of the specimens stored in the CIACOL.

species of the genus *Ageneiosus* correspond to the family Auchenipteridae. The genera *Prochilodus* and *Semaprochilodus*, previously included in Curimatidae, are included in Prochilodontidae (Castro & Vari 2004). The validity of the identified species is confirmed through the Catalog of Fishes (Eschmeyer *et al*. 2018).

Regarding the organization and storage of the specimens, most of the specimens are stored in screw-top glass containers, PET-type containers and in 60-liter plastic tanks, with plastic and metallic rose caps. The use of such containers depends on the size and number of specimens in each batch. The material is stored in 70% alcohol and is organized according to the catalog number in compactors in space assigned to collections, with controlled temperature and humidity (Figure 2).

Currently, the CIACOL work team is made up of Edwin Agudelo Córdoba, PhD in Environmental Sciences from the Universidad Autonoma de Barcelona, responsible for the Collection and Leader of the Amazon Aquatic Ecosystems Research Group (AAERG), Astrid Acosta Santos, AAERG researcher and Curator, Student of the master's degree in Amazonian studies at the Universidad Nacional de Colombia and Juan David Bogotá-Gregory,

Figure 2. Storage of lots belonging to CIACOL.

AAERG researcher, taxonomist, PhD candidate in Conservation Biology at the University of Central Florida (Figure 3).

Currently the Ciacol has 18915 specimens grouped in 3432 lots, which in taxonomic terms correspond to 12 orders, 50 families, 276 genera and 574 species. As expected for Neotropical environments, most specimens correspond to the orders Characiformes and Siluriformes (Table 1). Similarly, the families Characidae, Loricariidae and Cichlidae dominate over the others, grouping 36%

Figure 3. CIACOL work team. From left: Edwin Agudelo, Astrid Acosta and Juan Bogotá.

of the species present in the Collection (Table 2).

The geographic representativeness of the species is dominated by the specimens collected in the sectors near Leticia and Puerto Nariño, which are direct tributaries of the Amazon River; as well as those from the Vaupés River (Figure 4).

From the collected specimens, the geographic distribution of 95 species reported for Brazil, Ecuador and / or Peru, and 110 for the region of the Colombian Amazon has been expanded. CIACOL currently hosts seven holotypes of the families Trichomycteridae, Heptapteridae and Crenuchidae which are in the process of being described. These figures demonstrate the importance of CIACOL as a collection of fish biodiversity, since unique specimens are deposited at the collections level.

The administration of the information is done through the "Aquatic Diversity Application" which is developed in the Microsoft Access environment, tending to the requirements of the Aquatic Ecosystems Group.

Despite being a recent collection, CIACOL hosts 60% of the species reported for the hydro geographic region of the Colombian Amazon

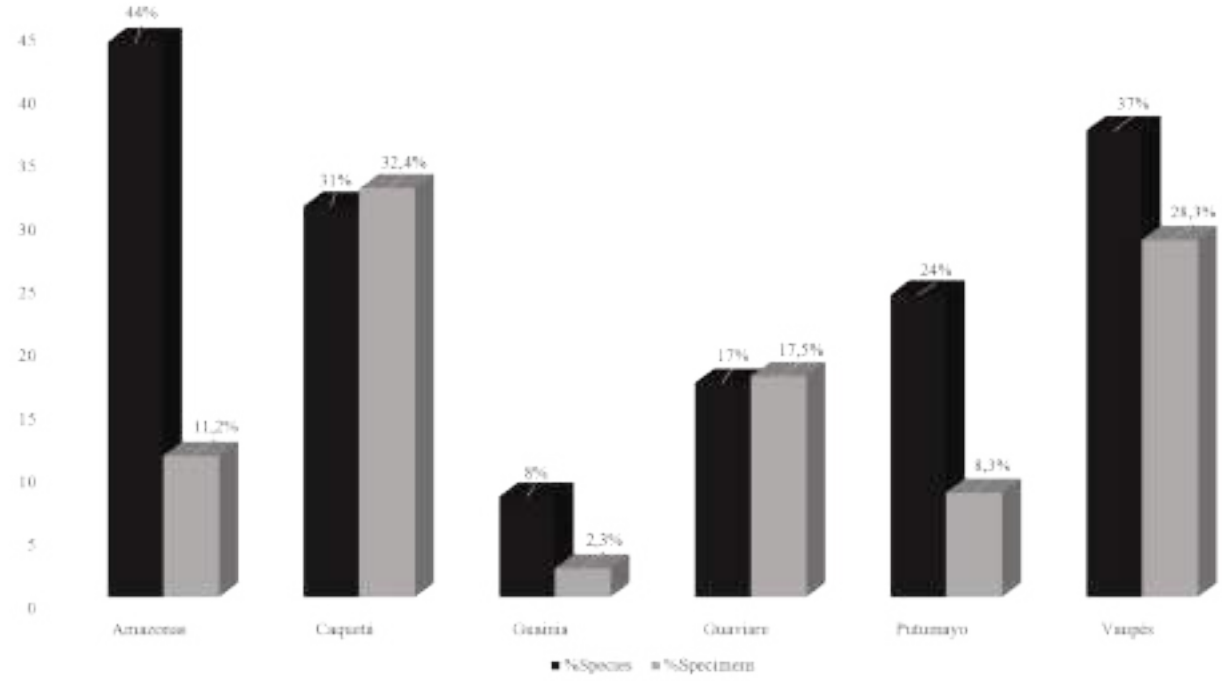

Figure 4. Percentage of individuals and species collected in each of the basins of the Colombian Amazon. The value of the species is presented in relation to the total of the species of the Collection.

Table 1. Number of families, species and specimens for each taxonomic order present in the CIACOL.

Orders	Families	%	Species	%	Specimens	%
Characiformes	18	35,8	293	50,9	13653	72,1
Siluriformes	11	24,5	178	31,1	3494	18,4
Gymnotiformes	5	9,5	32	5,5	398	2,2
Cyprinodontiformes	4	7,5	7	1,3	224	1,1
Perciformes	3	5,6	42	7,3	1014	5,4
Osteoglossiformes	2	3,8	2	0,4	9	0,1
Clupeiformes	2	3,8	5	0,8	16	0,1
Tetraodontiformes	1	1,9	1	0,2	8	0,1
Synbranchiformes	1	1,9	1	0,2	16	0,1
Pleuronectiformes	1	1,9	1	0,2	11	0,1
Myliobatiformes	1	1,9	8	1,4	31	0,1
Beloniformes	1	1,9	4	0,7	41	0,2
Total	**50**	**100**	**574**	**100**	**18915**	**100**

Table 2. Number of species and specimens for each family of fishes present in the CIACOL.

Family	Species	%	Family	Species	%
Characidae	118	20,5	Triportheidae	6	1
Loricariidae	50	8,8	Cetopsidae	5	0,9
Cichlidae	39	6,8	Chalceidae	5	0,9
Curimatidae	34	5,9	Ctenoluciidae	5	0,9
Pimelodidae	29	5	Gasteropelecidae	5	0,9
Doradidae	23	4	Apteronotidae	4	0,7
Anostomidae	20	3,4	Belonidae	4	0,7
Auchenipteridae	18	3,2	Chilodontidae	4	0,7
Heptapteridae	17	2,9	Cynodontidae	4	0,7
Callichthyidae	16	2,7	Cynolebiidae	4	0,7
Crenuchidae	14	2,4	Pristigasteridae	4	0,7
Serrasalmidae	14	2,5	Erythrinidae	3	0,6
Lebiasinidae	13	2,2	Osteoglossidae	2	0,4
Trichomycteridae	13	2,2	Parodontidae	2	0,4
Hemiodontidae	12	2	Pseudopimelodidae	2	0,4
Acestrorhynchidae	9	1,6	Scianidae	2	0,4
Hypopomidae	9	1,6	Achiridae	1	0,2
Iguanodectidae	9	1,6	Arapaimatidae	1	0,2
Potamotrygonidae	8	1,3	Astroblepidae	1	0,2
Rhamphichthyidae	8	1,3	Engraulidae	1	0,2
Bryconidae	7	1,3	Poeciliidae	1	0,2
Aspredinidae	6	1	Polycentridae	1	0,2
Gymnotidae	6	1	Rivulidae	1	0,2
Prochilodontidae	6	1	Synbranchidae	1	0,2
Sternopygidae	6	1	Tetraodontidae	1	0,2
			Total	574	100

(DoNascimiento *et al*. 2017), a number that, added to the geographical distribution of species, positions it as a reference important of the fish biodiversity present in this sector.

Acknowledgments. The CIACOL work team is grateful to Luz Marina Mantilla (SINCHI Institute General Director), Dairon Cárdenas (Director of

Natural Resources and Ecosystems Program, Sinchi Institute), William Castro (Aquatic Ecosystems, Vaupés), Sonia Sua (Biological Collections Manager Sinchi Institute), Jhon Jairo Potosí (support of the Collection) and Flavio CT of Lima and Carlos L. DoNascimiento for the revision of biological material.

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Name and acronym	Colección Ictiológica de la Amazonia Colombiana CIACOL
Institution	Instituto Amazónico de Investigaciones Científicas SINCHI
Address	Avenida Vásquez Cobo entre calles 15 y 16, Leticia, Amazonas, Colombia
Curator(s) and contact(s)	Astrid Acosta Santos (astridacostasantos@gmail.com); Juan David Bogotá Gregory (juandbogota@gmail.com); Edwin Agudelo Córdoba (eagudelo@sinchi.org.co); CIACOL (ciacol@sinchi.org.co)
Website	www.sinchi.org.co/ciacol
Year of foundation	2010
Number of visitors per year (average number considering 2015, 2016, 2017)	8
Specimens habitat	100 % Freshwater
Specimens origin	Amazon (87%) and Orinoco (13%, Guaviare river) basins
Current cataloging method /software and version in use if it is the case)	Aplicativo Diversidad Acuática, developed under Microsoft Access database management system
Total number of lots and number of lots from Neotropical region	Total number of lots: 3432 all from Neotropical region
Total number of holotypes and number of holotypes from Neotropical region	Total number of holotypes: 7 Number of holotypes from Neotropical region: 7
Total number of paratypes and number of paratypes from Neotropical region	Total number of paratypes: 7 Number of paratypes from Neotropical region: 7
Number of tissue samples from Neotropical fishes	820 approximately.
Number of C&S specimens	0
Number of dry skeleton specimens	0

FISH COLLECTION

CICCAA
Coleção Ictiológica do Centro de Ciências Agrárias e Ambientais (CICCAA) of the Universidade Federal do Maranhão (UFMA)

Felipe P. Ottoni[1,2,3,4], Erick C. Guimarães[1,3], Pâmella S. de Brito[1,3], Revangivaldo S. da Silva[1], Rayane G. Aguiar[1,2], Lucas O. Vieira[1], Marciara L. Silva[1] & Brenda C. Furtado[1]

Brief history of the collection and its constitution The Coleção Ictiológica do Centro de Ciências Agrárias e Ambientais (CICCAA) of the Universidade Federal do Maranhão (UFMA) is a scientific fish collection, physically located at the Chapadinha *campus* (Figure 1). It mainly specializes in small and medium size freshwater species. However, the collection also holds a less representative quantity of large and marine species. Its senior curator is Dr. Felipe Polivanov Ottoni, who also coordinates the Laboratório de Sistemática e Ecologia de Organismos Aquáticos. The Coleção Ictiológica do Centro de Ciências Agrárias e Ambientais of the Universidade Federal do Maranhão (CICCAA) was officially created with the subsidy of UFMA, in December 2016, with the approval of the research project titled "Criação da Coleção Ictiológica do Centro de Ciências Agrárias e Ambientais da Universidade Federal do Maranhão, campus Chapadinha, Estado do Maranhão, especializada em espécies de pequeno e médio porte de água doce" (see Resolution N°1517-CONSEPE - UFMA). However, this ichthyological collection already existed unofficially since September 2015, when the then director of CCAA destined to the professor the space of the former Laboratório de Reprodução Animal for him to create his own laboratory and scientific collection. Thus, the CICCAA already possess about three years of existence.

Figure 1. Coleção Ictiológica do Centro de Ciências Agrárias e Ambientais (CICCAA). A, cabinet with type material; B, part of the collection material; C, one of the three freezers with DNA samples; and D, material in process of identification and cataloguing.

Throughout these about three years of existence, there more than 3,000 fish lots deposited in the collection, specially from small and medium size freshwater groups, mainly coming from water systems of the states of Maranhão and Pará. However, less representative quantities of lots from several other states are also deposited in the collection (Figure 2). The specimens that are already present in the collection were obtained through: expeditions conducted by the team of Laboratório de Sistemática e Ecologia de Organismos Aquáticos, from the Universidade Federal do Maranhão; donations coming from several laboratories and collections around the country, and donations from environmental consulting campaigns. Besides the more than 3,000 fish already listed in the collection, there is about the same quantity already present at the Laboratório de Sistemática e Ecologia de Organismos Aquáticos, going through the process of sorting and identification to later be listed to the collection. All lots already deposited in the collection archives have already been digitalized in a virtual spreadsheet. This digitalization process is, however, a continuous job, since new lots are constantly added to the collection.

There are three modes of storage of the material in the collection: 1- Material conserved in 70% alcohol (previously fixated in 10% formaldehyde); 2- Material conserved in 100% alcohol (whole fish or just tissue extracted from the animal), which is destined to molecular studies and analyses, stored in freezers; and 3- cleared and stained material conserved in glycerin. With such a number of lots already listed in its archives, CICCAA is among the two larger scientific collections for fish in the state of Maranhão. It is worth mentioning that the CICCAA is recorded and considered as an ichthyological scientific taxonomic collection by the "Eschmeyer's Catalog of Fishes" (Fricke & Eschmeyer, 2019). This makes evident that the collection does not only hold importance and visibility at a national level, but also at the international level.

The taxonomic organization of the collection follows Nelson *et al*. (2016), with constantly updates following the classification proposals compiled by R. Fricke, W. Eschmeyer, R. van der Laan and J. Fong available in the Eschmeyer's Catalog of Fishes: Genera, species and references (http://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatmain.asp), and Eschmeyer's Catalog of Fishes: Species by Family/ Subfamily (http://researcharchive.calacademy.org/research/ichthyology/catalog/SpeciesByFamily.asp). The Coleção Ictiológica do Centro de Ciências Agrárias e Ambientais of the Universidade Federal do Maranhão (CICCAA) includes about 22,000 specimen, distributed in about 3,000 lots, representing 51 families, 173 genera and 300 species. All the collection species belong to classes Actinopterygii and Chondrichthyes. The three most common orders are Characiformes, with 120 species in 1.400 lots, Silurifomes with 60 species in 500 lots and Cichlidae with 70 species in 400 lots.

Figure 2. Sample sites of the Coleção Ictiológica do Centro de Ciências Agrárias e Ambientais (CICCAA).

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Name and acronym	Coleção Ictiológica do Centro de Ciências Agrárias e Ambientais (CICCAA)
Institution	Universidade Federal do Maranhão
Address	Universidade Federal do Maranhão, BR-222, km4, s/n, Bairro Boa Vista, Chapadinha, Maranhão, Brasil. CEP 6550-000.
Curator and contact	Senior curator: Dr. Felipe Polivanov Ottoni (fpottoni@gmail.com) Collaborating curators: Mr. Erick Cristofore Guimarães (erick.ictio@yahoo.com.br) and Mrs. Pâmella Silva de Brito (pamellabrito@hotmail.com)
Year of foundation	2016
Facilities and area of the collection	Two areas comprising 47m^2 and 6m^2 acclimatized with air conditioner, possessing: modular steel cabinets, one computer and three freezers
Number of visitors per year	two
Number of loaned lots per year	three
Specimens habitat	Freshwater 95% and marine 5%
Specimens origin	Brazil
Current cataloging method	Excel
Total number of lots and number of lots from Neotropical region	about 3,000
Total number of specimens and number of specimens from Neotropical region	about 22,000, all from the Neotropical region
Total number of holotypes and number of holotypes from Neotropical region	Two holotypes, both from the Neotropical region
Total number of paratypes and number of paratypes from Neotropical region	231, all from the Neotropical region
Number of tissue samples from Neotropical fishes	about 800
Number of C&S specimens	about 80
Number of dry skeleton specimens	-

FISH COLLECTION

CIUnB
Coleção Ictiológica da Universidade de Brasília (UNB)

Pedro De Podestà Uchôa de Aquino[1], Yan Felipe Figueira Soares[1,2] & Maria Júlia Martins Silva[1]

Breve histórico. A Coleção Ictiológica da Universidade de Brasília (CIUnB) foi iniciada em outubro de 2006, pela necessidade de se armazenar e ter como referência os peixes provenientes de trabalhos realizados em Brasília e entorno, fruto de pesquisas desenvolvidas por alunos da Universidade de Brasília. Inicialmente, a coleção se constituiu juntamente com o Laboratório de Invertebrados Aquáticos, do Departamento de Zoologia da UnB, coordenado pela professora Dra. Maria Júlia Martins Silva (Figura 1). Os primeiros exemplares tombados foram provenientes de três dissertações realizadas na Universidade de Brasília, dois trabalhos de Iniciação Científica, também pela Universidade de Brasília, e trabalhos provenientes do terceiro setor (consultorias).

Em 2012, com a mudança para o novo prédio do Instituto de Ciências Biológicas e com a aquisição de armários compactadores (Figura 2), a CIUnB foi transferida para o novo prédio do Departamento de Zoologia.

O curador da Coleção Ictiológica da UnB, desde 2008, é o biólogo Dr. Pedro De Podestà Uchôa de Aquino (Figura 1).

Estrutura física. Os lotes encontram-se armazenados em uma sala aclimatizada, com 9,96 m^2, no Departamento de Zoologia da UnB (bloco A, sala ASS 18-11). Os indivíduos encontram-se acondicionados em frascos padronizados de vidro com etiquetas impressas em impressora a lazer no

Figura 1. Professora Dr. Maria Júlia Martins Silva e Dr. Pedro De Podestà Uchôa de Aquino (biólogo curador da coleção).

Figura 2. Armários compactadores da CIUnB.

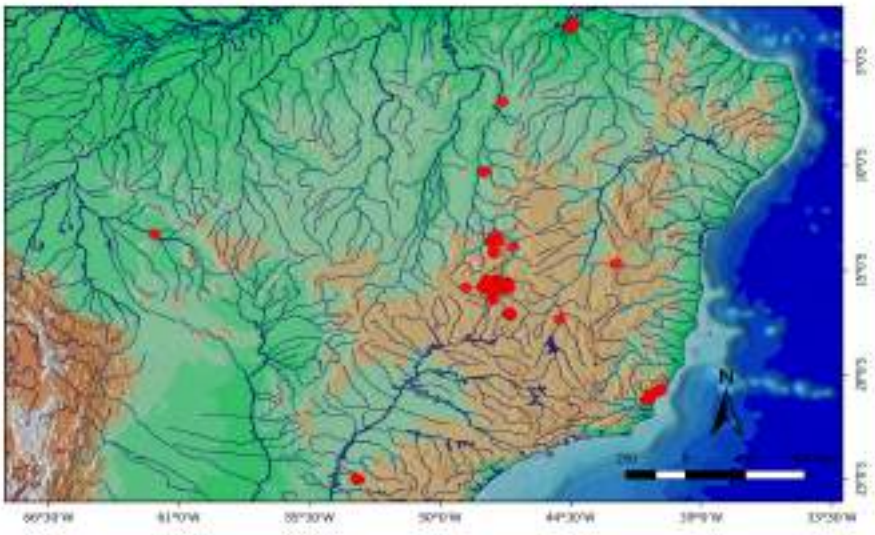

Figura 3. Mapa com a localização dos lotes tombados na CIUnB.

papel Resistall®. O processamento do material segue os padrões e métodos difundido em bibliografias especializadas, i.e., os peixes são fixados em formol 10% ou álcool 100% (no caso de amostras de tecido) e posteriormente conservados em álcool 70% ou álcool 100% (no caso de amostras de tecido).

A Coleção Ictiológica da Universidade de Brasília possui atualmente 1.488 lotes com 25.770 indivíduos. Esses exemplares encontram-se distribuídos em 15 ordens, 48 famílias, 142 gêneros e 310 espécies. A coleção possui ainda material preservado para análises moleculares (i.e., amostras de tecidos) de 83 espécies (seis ordens, 19 família e 56 gêneros), correspondendo a 1.348 indivíduos.

Figura 4. Parátipos da espécie *Ituglanis goya* tombado na CIUnB.

O gerenciamento da coleção é realizado através do programa Microsoft Excel onde todos os lotes estão georreferenciados. Os dados encontram-se tabulados de forma a facilitar a disponibilização e acesso das informações junto a banco de dados integrados de coleções.

Frente as atuais necessidades de expansão, prevista na UnB, e o crescente interesse por estudos ícticos em bacias do DF e entorno, há uma previsão para expressivo acréscimo do material destinado à CIUnB.

Abrangência geográfica dos lotes. A coleção possui principalmente exemplares representativos das cabeceiras das bacias do Cerrado do Planalto Central no Distrito Federal e Goiás (Figura 3). A importância desse material se justifica pela carência de informações para o grupo, visto sua localização biogeográfica (região de captura de cabeceiras) e necessidade de ações conservacionistas (forte pressão humana deletéria). Considerando as unidades hidrográficas, o material é testemunho da ictiofauna proveniente das cabeceiras das bacias hidrográficas do Tocantins-Araguaia (rios Paranã e Maranhão), Paraná (rios São Bartolomeu, Corumbá e Iguaçu), Atlântico Leste (rio Jequitinhonha), São Francisco, Atlântico NE Oriental (rio Itapecuru) e Alto Madeira (rios Guaporé e Corumbiara) (Figura 3).

Importância. A CIUnB possui um lote com três parátipos da espécie *Ituglanis goya* Datovo, Aquino & Langeani, 2016 (lote CIUnB159, Figura 4). A coleção possui, ainda, exemplares de espécies endêmicas e ameaçadas de extinção (Figura 5), como

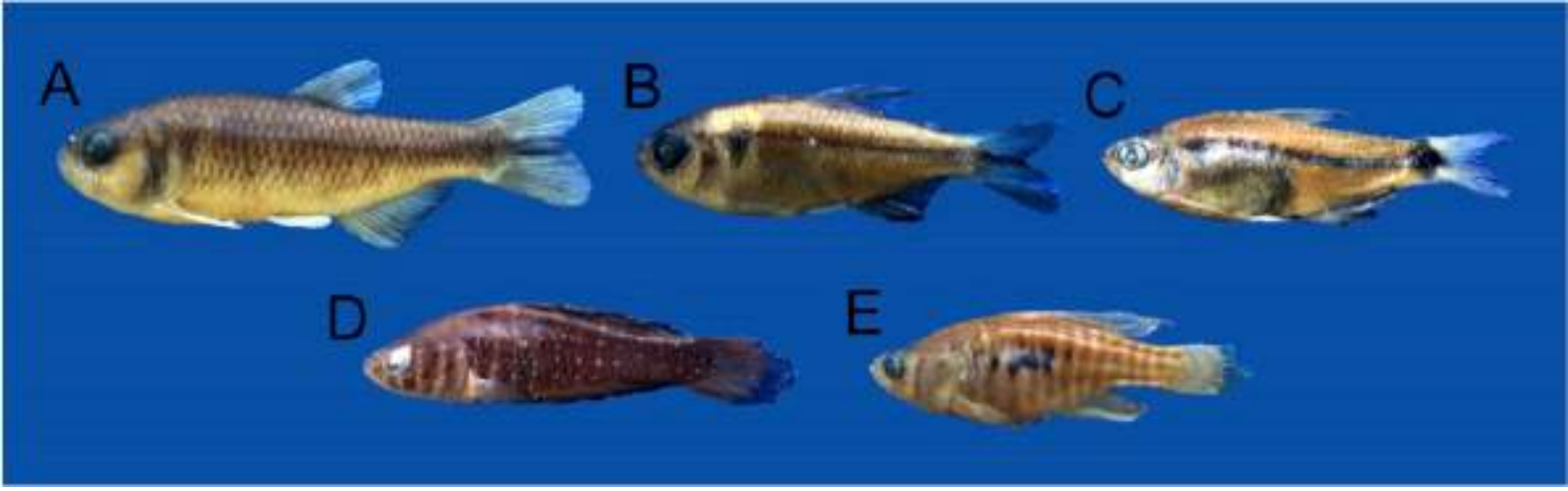

Figura 5. Exemplares representativos de espécies ameaçadas de extinção depositadas na CIUnB: A) *Hasemania crenuchoides* (CIUnB1040), B) *Hyphessobrycon coelestinus* (CIUnB838), C) *Kolpotocheirodon theloura* (CIUnB727), D) *Simpsonichthys boitonei* macho (CIUnB1039) e E) *Simpsonichthys santanae* fêmea (CIUnB426).

o pirá-brasília (*Simpsonichthys boitonei*, Figura 5D) espécie emblemática do DF. Esses exemplares podem ser acessadas para estudos futuros (estudos genéticos, morfológicos, tróficos, entre outros) buscando a compreensão de sua biologia e assim sua efetiva preservação. São, ainda, depositadas pelo menos 72 espécies (23,2% das espécies depositadas) novas para ciência, evidenciando a importância e o potencial desse material para estudos taxonômicos.

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Name and acronym	Coleção Ictiológica da Universidade de Brasília - CIUnB
Institution	Universidade de Brasília
Address	Campus Universitário Darcy Ribeiro, Instituto de Ciências Biológicas, Departamento de Zoologia, bloco A, sala ASS 18-11 Brasília, DF, Brasil, CEP 70910-900
Curator(s) and contact(s)	Dr. Pedro De Podestà Uchôa de Aquino pedropua@gmail.com
Website (include also websites that hold information on the collection specimens)	http://www.zoo.unb.br
Year of foundation	2006
Facilities and area of the collection	Armários compactadores e aparelho de ar condicionado em um gabinete de 9,96 m^2.
Number of visitors per year (average considering 2015, 2016, 2017)	30 por ano
Number of loaned lots per year (average number considering 2015, 2016, 2017)	100 indivíduos
Specimens habitat	100% peixes de água doce
Specimens origin	Brasil (bacias do Tocantins-Araguaia [rios Paranã e Maranhão], Alto Paraná [rios São Bartolomeu e Corumbá], Atlântico Leste [rio Jequitinhonha], São Francisco e Alto Madeira [rios Guaporé e Corumbiara])
Current cataloging method	Microsoft Excel
Total number of lots and number of lots from Neotropical region	1.488 lotes no total 1478 lotes da região Neotropical
Total number of specimens and number of specimens from Neotropical region	Total de 25.770 indivíduos Da região Neotropical 25.747 indivíduos
Total number of holotypes and number of holotypes from Neotropical region	Zero
Total number of paratypes and number of paratypes from Neotropical region	Três parátipos (lote CIUnB159)
Number of tissue samples from Neotropical fishes	1.348 amostras de tecidos
Number of C&S specimens	Zero
Number of dry skeleton specimens	Zero

FISH COLLECTION

CPFCM
La Colección de Peces de la Facultad de Ciencias de Montevideo

Marcelo Loureiro & José Bessonart

La colección de peces de la Facultad de Ciencias tiene su origen en la década de 1940 con la fundación de la Facultad de Humanidades y Ciencias y la contratación de Raúl Vaz Ferreira como Profesor de Zoología de Vertebrados. Vaz-Ferreira centró sus investigaciones principalmente en la familia Rivulidae, trabajando en colaboración con Blanca Sierra y Juan Soriano-Señorans (Vaz-Ferreira *et al*., 1964). También el aficionado alemán Emil Messner participó activamente en la colecta, depósito e identificación de especímenes (Messner, 1962). En la década de 1970 y principios de 1980, el Licenciado Carlos Ríos fue el principal encargado del ingreso de material. Además, los Licenciados Susana Maytía y Álvaro Abella trabajaron activamente en la colección depositando gran parte del material de origen marino que esta posee (Abella, 1973; Maytía de Scarabino, 1975). Lamentablemente, durante más de quince años (aprox. 1982-1998) la colección quedó prácticamente abandonada. A fines de la década de 1990 la investigación en Sistemática, Biogeografía y Ecología de peces de agua dulce dio un nuevo impulso a la colección, lo que la lleva en la actualidad a ser la más importante en cantidad de lotes depositados y representatividad de las especies y cuencas del país. En cambio, la colección de peces marinos ha quedado relativamente estancada debido a la falta de especialistas en esta área en el país. Aunque, debemos destacar que a partir de diversas campañas de muestreo entre 1970 y 1984 se realizó un importante ingreso al acervo de la colección de especies marinas de profundidad (Vaz-Ferreira *et al*., 1999).

Esta colección sufrió el clásico ciclo de las colecciones zoológicas, de pasar de ser particularmente valoradas durante las décadas de 1960 y 1970, a ser especialmente denostadas. Esto implicó que sólo más recientemente tuvieran un apoyo institucional real, luego de cierto tiempo de permanecer con atención mínima. Por otra parte, la colección fue mudada dos veces de edificio junto a la Facultad (década de 1980), lo que determinó la pérdida de material. De los últimos 15 años es importante destacar la incorporación de nuevos enfoques de trabajo que redundaron en la valoración y en la generación de proyectos de investigación y publicaciones respaldados en materiales de colección (Zarucki *et al*., 2010; Teixeira de Mello *et al*., 2011; Loureiro *et al*., 2013; Serra *et al*., 2014), en la sensibilización de colegas al respecto de este último aspecto, en la descripción de nuevas especies (González-Bergonzoni *et al*., 2009; Loureiro *et al*., 2004, 2011) y en la adopción de estándares internacionales para la conservación de muestras.

En la actualidad, cuenta con 14500 lotes, principalmente de peces dulceacuícolas (96.7%). Existen registros correspondientes a 16 países de América, Europa, África y Asia. Sin embargo, el 96% son registros de Uruguay y solamente 1.4% y 1.3%, pertenecen a Argentina y Brasil respectivamente. El material tipo incluye 14 holotipos, así como paratipos pertenecientes a 15 especies, todas ellas dulceacuícolas. El único material tipo correspondiente a una especie marina (*Carcharhinus rochensis* Abella, 1973) se encuentra perdido (Loureiro *et al*., 2018).

Agradecimientos. Agradecemos a los colegas y estudiantes de nuestras instituciones, por compartir el interés en el mantenimiento, desarrollo y uso de las colecciones ictiológicas nacionales. En particular, a las siguientes personas por su aporte desinteresado: Juan Caballero, Diego Díaz, Alejandro Duarte, Iván González-Bergonzoni, Sofía Paullier, Franco Texeira de Mello y Matías Zarucki.

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Figure 1. Instalaciones de la Colección de Peces de la Facultad de Ciencias de Montevideo.

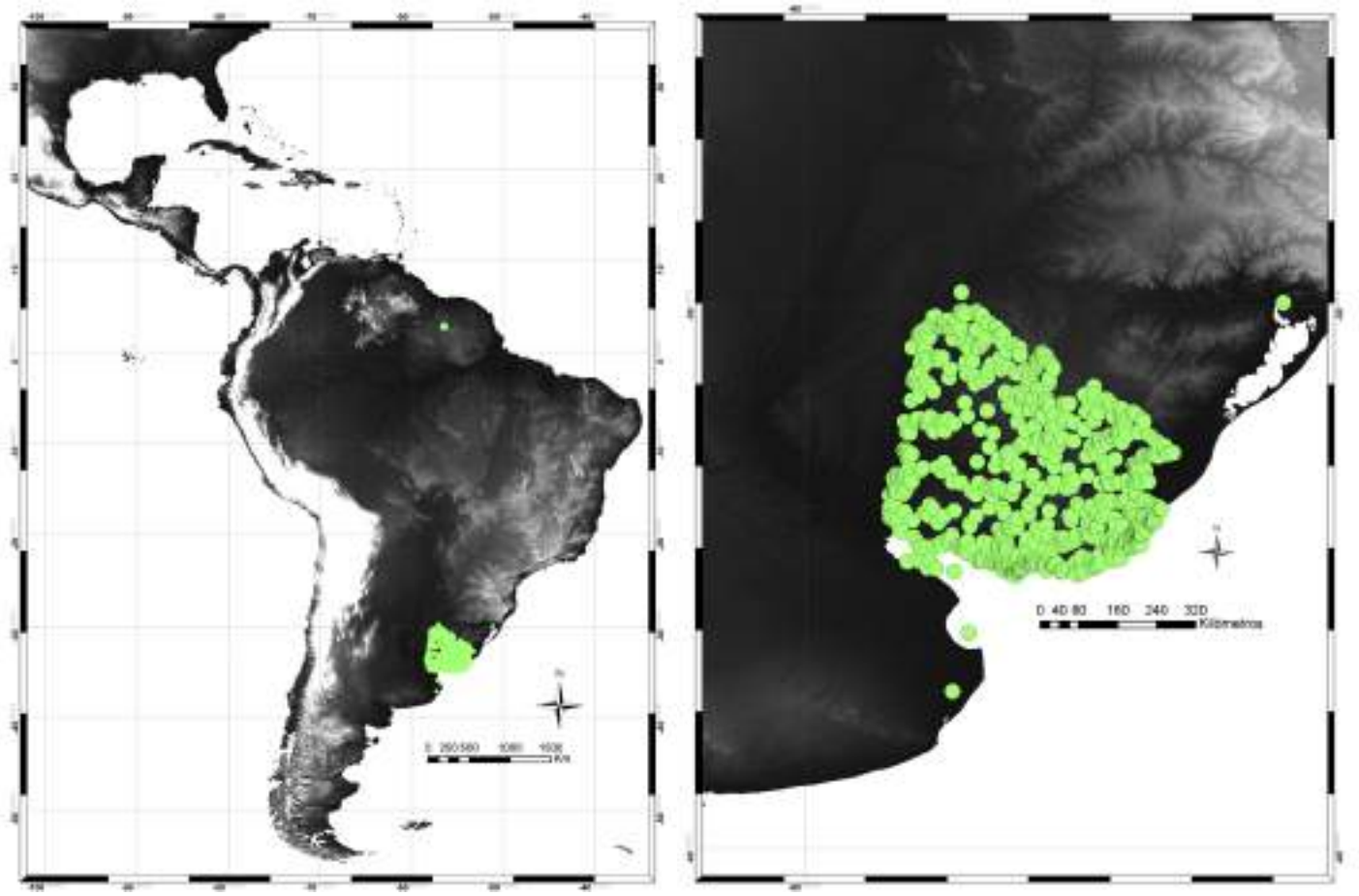

Figure 2. Localización geográfica de los registros de la Colección de Peces de la Facultad de Ciencias de Montevideo. Escala Neotropical (panel de la izquierda); Escala Regional (panel de la derecha).

Name and acronym	Colección de Peces de Facultad de Ciencias. ZVCP
Institution	Facultad de Ciencias, UDELAR
Address	Iguá 4225, Montevideo 11400, Uruguay
Curator(s) and contact(s)	Marcelo Loureiro (mapy@fcien.edu.uy)
Website	-
Year of foundation	1940
Number of visitors per year (average 2015-2017)	2
Number of loaned lots per year (average number considering 2015, 2016, 2017)	20
Specimens habitat	Marine (3%), Freshwater (97%)
Specimens origin	Uruguay 96% (Middle and Lower Uruguay river basin 54%; Laguna Merin basin 20%; Río de la Plata coastal drainages 18%, Atlantic Ocean coastal drainages 8%)
Current cataloging method	Microsoft Excel 2007
Total number of lots and number of lots from Neotropical region	Total: 14500; Neotropical: 14477
Total number of specimens and number of specimens from Neotropical region	Total: aprox. 116000; Neotropical: aprox. 115816
Total number of holotypes and number of holotypes from Neotropical region	14 (all Neotropical)
Total number of paratypes and number of paratypes from Neotropical region	20 (all Neotropical)
Number of tissue samples from Neotropical fishes	2000
Number of C&S specimens	1000
Number of dry skeleton specimens	30

FISH COLLECTION

CUMV
The Cornell University Museum of Vertebrates holdings of fishes from South and Central American Waters

Casey B. Dillman, Charles M. Dardia, William E. Bemis & Amy R. McCune

A Brief History of the Cornell University Museum of Vertebrates (CUMV): In April of 1865, as the U.S. Civil War was ending, Ezra Cornell founded his namesake University in Ithaca, New York. During the very first semester of Cornell University´s existence, Louis Agassiz lectured extensively, and, on his advice, Cornell hired Agassiz's student, Burt Green Wilder, in 1867 to serve as the first professor of comparative anatomy, physiology, neurology, and vertebrate zoology. Before studying with Agassiz, Wilder had been a medical cadet and surgeon in the U.S. Civil War. At Cornell, Wilder had many students, among them David Starr Jordan, who is considered by many to be the father of North American Ichthyology.

Wilder was an enthusiastic collection-builder, acquiring what are now the beginnings of the Cornell University Museum of Vertebrates (CUMV). Specimens accessioned in the ichthyology collection, which dates back to 1869, include instantly recognizable names such as Jordan, Carl Eigenmann, Seth Meek, and C.F. Hartt. Wilder and Reed together mentored Albert H. Wright, who also became professor of Zoology at Cornell (1908-1947). Wright's major contributions to the vertebrate collections at Cornell, along with his partner, Anna Wright, were in Herpetology. Wright trained Edward C. Raney, who worked at Cornell from 1936 until his retirement in 1971. Raney trained more than 50 MS. and Ph.D. students during his time at Cornell and grew the collection extensively, adding some 40,000 Lots. The Raney Award from the American Society of Ichthyologists and Herpetologists (ASIH) takes its name from Edward Raney.

The Modern Era. After Raney's retirement, Mike Howell (1972-1974), and then Edward Brothers (1975 – 1983) were hired into the Section of Ecology and Systematics at Cornell. Under Ed's leadership Bob Schoknecht attempted the first computerized database of the fish collection on one of the *original* Apple computers. A grant was also received during this time to transfer all of the fishes into isopropanol. In 1983 Amy R. McCune was hired as Assistant Professor of Ecology and Systematics, (now the Department of Ecology and Evolutionary Biology, EEB), and at the time was the only active faculty curator for CUMV. She worked to raise the profile of the Museum by growing the number of curators and making them Ph.D. level positions. From McCune's earliest work on the systematics, evolution, and adaptive radiation of fossil semionotid fishes to studies of systematics and evolution of a variety of extant fishes, her work has been focused primarily on character evolution using a phylogenetic framework. Amy taught EEB's course "Biology of Fishes" from 1984 to 2010, at which time administrative duties precluded her continued involvement in the course. Biology of Fishes has a long history of close ties to

Figure 1. Map showing CUMV holdings of Fishes from South America.

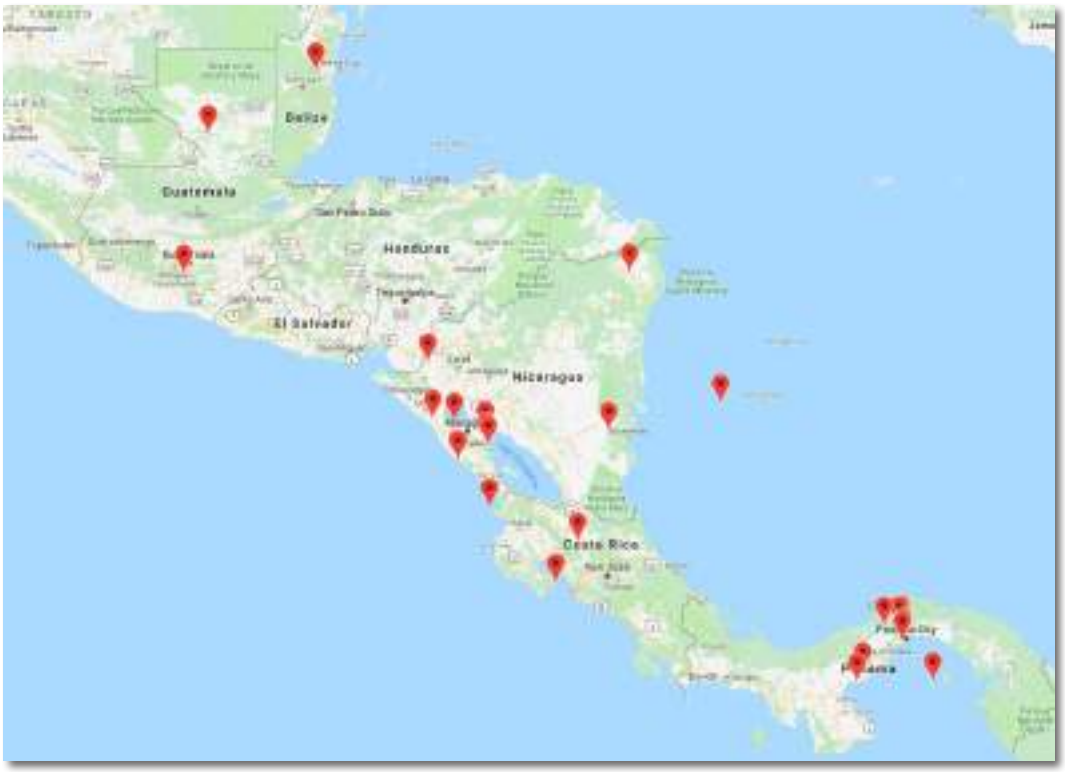

Figure 2. Map showing CUMV holdings of Fishes from Central America.

the CUMV and collection building from New York State.

Under McCune's leadership, Julian Humphries was the first PhD-level curatorial associate hired (1988-1993). Humphries was a principal architect of the collections database "MUSE," the precursor to Specify, that was sponsored by a grant from NSF to McCune and Humphries beginning in 1989.

John P. Friel arrived in 1998, and as part of the burgeoning NSF-funded PBI (Planetary Biodiversity Inventory) programs, he focused much of his research on catfishes from African freshwaters and at the same time focused CUMV collection-building efforts on specimens and tissues from freshwater fishes in Africa. He also taught Biology of Fishes in 2012 and 2014. John departed CUMV in 2015 to become Director of the Alabama Museum of Natural History. Other contributors to the freshwater holdings of Africa include Carl D. Hopkins and John P Sullivan. Hopkins and Sullivan also contributed more than 4000 cataloged electric organ discharge (EOD) data from African mormyrids into the Macaulay Library of Natural Sounds at the Cornell Lab of Ornithology. During this period, Alex Flecker, Professor in EEB and a leader in Neotropical ecology, actively contributed specimens to the CUMV from the Neotropical realm.

William E. Bemis (Willy), joined Cornell as Director of Shoals Marine Lab in June of 2005. After leaving the directorship in 2013, Bemis returned to teaching, research, and graduate training in Ithaca. Bemis's research is specimen-based, and he brought to CUMV more than 1200 dry skeletons, fossil fishes from the Eocene of the Green River, and developmental series of basal actinopterygian fishes including both whole organisms and serially sectioned materials. He is committed to growing the CUMV research and teaching collections. Much of his collection building over the last 15 years has focused on the Western North Atlantic, including both skeletal materials and fluid-preserved specimens, obtained as a result of his long-term collaboration with colleagues at NOAA's Northeast Fisheries Science Center in Woods Hole, Massachusetts. Willy took over teaching Biology of Fishes in 2016.

Charles Dardia, has been with the CUMV for nearly 30 years. He joined the full time staff as Collection Manager in 1991 after two years of internship. In addition to adding physical specimens, Dardia has actively worked in, and tirelessly contributed to, the growth, maintenance and organization of all four vertebrate collections. In addition, Dardia has been instrumental in helping to maintain the CUMV's satellite collection located in Stimson Hall on the Cornell Campus. These materials, collectively known as the Stimson Hall Vertebrate Teaching Collection, serve EEB's introductory course in vertebrate biology (The Vertebrates) as well as Biology of Fishes, Herpetology, Ornithology, and Mammalogy.

Casey Dillman joined the CUMV as Curator

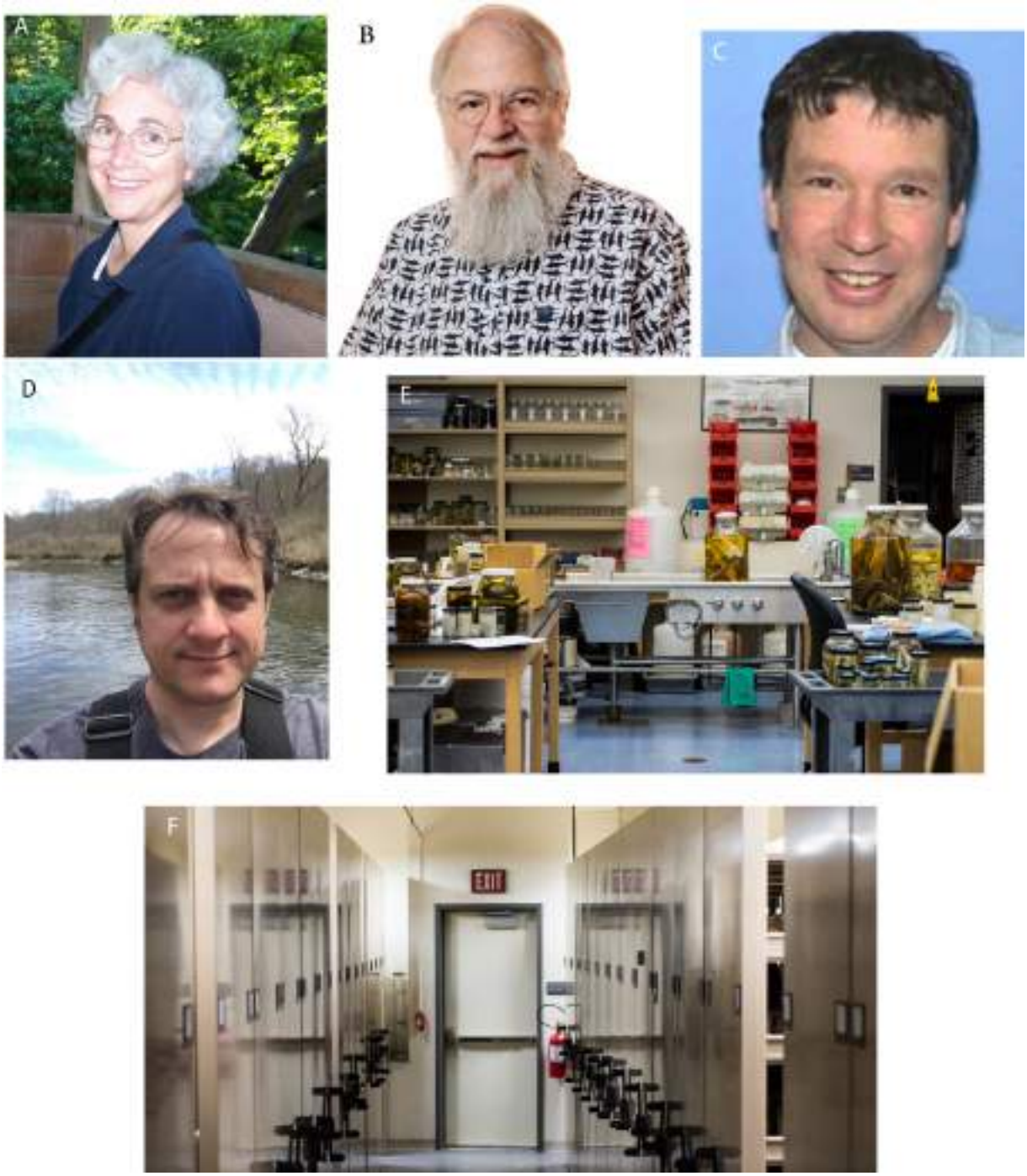

Figure 3. Ichthyological associates of the Cornell Museum of Vertebrates. A: Amy R. McCune, B. William (Willy) E. Bemis, C. Charles M. Dardia, D. Casey B. Dillman, E. Specimen Preparation Lab Space, F. Hallway and compactors for one of the rooms of fishes.

of Fishes, Amphibians, and Reptiles in Fall 2016. He is actively building the fluid-preserved, tissue, and cleared and stained collections, as well as CT resources at CUMV. He is Co-PI on a 5-year effort to sample unstudied reaches in the Amazon Basin and has deep interests in the use and utility of Natural History Collections. Dillman's current research focuses on characiforms and gymnotiforms; he is also studying fishes from eastern North America.

Collections Stability. The earliest ichthyology collection at Cornell was located in the Department of Zoology's museum in McGraw Hall. Burt G. Wilder (see above) also trained H.D. Reed who together with A.H. Wright wrote one of the earliest regional faunas based on specimens (Reed and Wright 1909). Reed, from 1899-1937, was also a professor in the Department of Zoology at Cornell. While Reed worked mainly on fishes and amphibians (e.g. Reed 1920), he was a broadly trained vertebrate zoologist, and taught Ornithology at Cornell in the early 1900s. One of his prominent students, Arthur Allen, became the founder of the Cornell Laboratory of Ornithology. McCune was the only active faculty

curator in the Vertebrate Collections after her arrival, which coincided with the department moving to a new building on campus and the collection at an off-campus facility on Brown Road in Ithaca. McCune stabilized funding for the collections, hired 2 PhD-level staff, and worked to move the collections into a better facility. McCune and Friel planned the new museum facility and they and others garnered funding to move the collections and install compactors for the wet collections. The CUMV has moved several times during the 20th century From McGraw Hall, to Fernow Hall, to Brown Road. The CUMV now has a very close association with the Lab of Ornithology and shares its modern facility about 4 miles off-campus. Moving the CUMV into this new facility was made possible by the Cornell Lab of Ornithology Director John Fitzpatrick's vision that recognized potential synergy between the Lab and the CUMV and his willingness to expand fundraising efforts to include housing the CUMV.

Museum of Vertebrates, Department of Ecology and Evolutionary Biology, Cornell University, 159 Sapsucker Woods Road, 14850 Ithaca, NY, USA. (CBD) cbd63@cornell.edu (corresponding author), (CMD) cmd7@cornell.edu, (WEB) web24@cornell.edu, (ARM) arm2@cornell.edu

Name and Acronym	Cornell University Museum of Vertebrates (CUMV)
Institution	Cornell University
Address	159 Sapsucker Woods Road, Ithaca, NY 14850, USA
Curator(s) and Contact(s)	Casey B Dillman, Curator; Charles M. Dardia, Collections Manager; Amy R. McCune, Faculty Curator; William E. Bemis, Faculty Curator
Website	www.cumv.cornell.edu, www.vertnet.org
Year of Foundation	1865
Facilities and area of the collection	6693 ft^2 specimen storage
Number of visitors per year (average number considering 2015, 2016, 2017)	38-40
Number of loaned lots per year (average number considering 2015, 2016, 2017)	Average 29 loans per year
Specimens habitat	Overwhelmingly Freshwater
Specimens origin	Primarily North American Freshwater Fishes, Followed by African and South American Freshwater Fishes
Current cataloging method	Specify 6.7.00
Total number of lots and number of lots from Neotropical region	91000- 2126 from neotropics
Total number of specimens and number of specimens from Neotropical region	1.4 million - 11,950
Total number of holotypes and number of holotypes from Neotropical region	79 -4 from neotropics
Total number of paratypes and number of paratypes from Neotropical region	505 - 25 from neotropics
Number of tissue samples from Neotropical fishes	250
Number of C&S specimens	3817
Number of dry skeleton specimens	1475

FISH COLLECTION

DZSJRP
The DZSJRP Fish Collection, UNESP São José do Rio Preto, São Paulo, Brazil

Francisco Langeani & Roselene Silva Costa Ferreira

The fish collection of the Department of Zoology and Botany of the São Paulo State University (UNESP), at São José do Rio Preto, State of São Paulo, Brazil (DZSJRP; Fig. 1), is one of the most representative freshwater fish collections of Brazil. The DZSJRP fish collection had its origins on the earlies of 1980 decade, from material collected by Valdener Garutti, starting as a professor at the Zoology Department, and with a main focus on surveys of the freshwater fishes from streams and small tributaries in the municipality of São José do Rio Preto and nearby areas.

The regular curation of the fish collection started at 1988, with Francisco Langeani, hired as a professor at the same Zoology Department an year before, and Roselene Silva Costa Ferreira, hired as department employee in 1990 and since then acting as the fish-collection manager (Fig. 1b). With this structure and personnel, the collection started to incorporate new samples, most resulting from ecological and taxonomical studies developed by Francisco Langeani, Valdener Garutti and, latter, also by Lilian Casatti, hired in 2006. At the beginning of the 1990 decade, collection started to receive visitors and to offer loans.

Presently, the fish collection hosts about 1,250 species, and proximately 286,000 specimens distributed in about 23,000 lots. Specimens are mainly freshwater; the great majority came from headwater streams of Brazil, in rivers draining the Brazilian Crystalline Shield, mainly the upper Rio Paraná drainage, but there are also samples from Chile, Colombia, Costa Rica, Paraguay, Surinam, and Venezuela (Fig. 2). Specimens currently serve

Figure 1. DZSJRP Fish Collection, UNESP, São José do Rio Preto, São Paulo, Brazil. a. Collection room 1 with mobile shelves, 60 m^2. b. Collection room 2 with fixed shelves, 40 m^2; Francisco Langeani (curator; left) and Roselene Silva Costa Ferreira (collection manager). In the wall sttuffed specimens of, respectively, *Pristis pristis* (left) and *Carcharhinus leucas* collected at Amazon basin.

Figure 2. Central and South America with the localities of about 20,000 georeferenced lots of the DZSJRP Fish Collection. Each point may represent more than one sample.

for systematics, ecological and morphological studies. Most exemplars are kept in small to medium glass bottles, whereas larger ones are maintained in 50 l plastic drums. Type specimens deposited include 20 holotypes and about 5,000 paratypes, which represent 53 species, all from Neotropical region. Other material include about 900 tissue samples for dna analysis, 256 lots of clear and stained specimens, and some stuffed fishes (Fig. 1b). Current cataloging uses Specify 6.6.04. Information about collection and searches could be developed at Centro de Referência em Informação Ambiental (CRIA) - www.splink.org.br. Collection facilities include: curator office, collection manager office, meeting room, triage space, research lab, and 100 m^2 area for fish collection. During the years 2015 to 2017, 44 lots were loaned and 10 researchers visited the collection.

Acknowledgements. To CNPq (processes 306566/2014-1, 401183/2014-9), FAPESP (processes 2012/23224-9, 2011/14660-7, 200600142-6, 2005/05203-0) and UNESP by financial support for maintaining the collection; to FINEP and UNESP by construction of the acarology and ichthyology building; to Centro de Referência em Informação Ambiental - CRIA by providing remote eletronic search of the material deposited in the collection; to Gabriel L. Brejão for making the figure 2.

UNESP, Universidade Estadual Paulista "Júlio de Mesquita Filho", Instituto de Biociências, Letras e Ciências Exatas, Departamento de Zoologia e Botânica, Laboratório de Ictiologia. Rua Cristóvão Colombo, 2265, Jardim Nazareth, 15054-000 São José do Rio Preto, SP, Brazil. (FL) francisco.langeani@unesp.br, (RSCF) roselene@ibilce.unesp.br

Name and acronym	Fish Collection of UNESP at São José do Rio Preto, State of São Paulo - DZSJRP
Institution	UNESP, São Paulo State University
Address	Rua Cristóvão Colombo, 2265, 15054-000, São José do Rio Preto, São Paulo, Brazil
Curator(s) and contact(s)	Francisco Langeani, francisco.langeani@unesp.br, 55 17 3221.2367
Website	http://www.splink.org.br/index?lang=pt
Year of foundation	1980
Facilities and area of the collection	curator office, collection manager office, graduate students and post-doc office, meeting room, triage space, research lab, and 100 m^2 area for fish collection
Number of visitors per year (average considering 2015, 2016, 2017)	10
Number of loaned lots per year (average number considering 2015, 2016, 2017)	15
Specimens habitat	Freshwater accounts for almost 100%
Specimens origin	Brazil, Chile, Colombia, Costa Rica, Paraguay, Venezuela
Current cataloging method	Specify 6.6.04
Total number of lots and number of lots from Neotropical region	22.877 / almost the same
Total number of specimens and number of specimens from Neotropical region	285.628 / almost the same
Total number of holotypes and number of holotypes from Neotropical region	20 / 20
Total number of paratypes and number of paratypes from Neotropical region	156 lots / 156 lots
Number of tissue samples from Neotropical fishes	866 / 866 from 274 species
Number of C&S specimens	256 / 256 from 143 species
Number of dry skeleton specimens	1 / 1

FISH COLLECTION

IAvH-P
Freshwater fish collection of the Instituto de Investigación de Recursos Biológicos Alexander von Humboldt, Colombia

Carlos DoNascimiento & Kevin Giancarlo Borja Acosta

The freshwater fish collection of the Instituto Humboldt (IAvH-P) was founded in 1971 in Bogotá by the naturalist Jorge Hernández Camacho. The collection was formerly affiliated to the Instituto de Desarrollo de los Recursos Naturales Renovables (Inderena). The first specimens mainly proceeded from inventories and monitoring programs developed by oil companies (*e.g.* British Petroleum) in their operational influence areas in Colombia, catches from fishing vessels, and from research programs of international organizations, *e.g.* Japan International Cooperation Agency (JICA) and Food and Agriculture Organization (FAO). Since 1985, the collection initiated their own inventories with the creation of the Fish and Wildlife Division of the Research Unit Federico Medem (Unifem). In 1993, the freshwater fish collection along with the remaining taxonomic collections of the Inderena was transferred to the Instituto de Investigación de Recursos Biológicos Alexander von Humboldt (IAvH), which replaced the official national functions of the Inderena. In 1995, the collection was moved from Bogotá to its current location in Villa de Leyva, where occupies a colonial religious building (cloister and church), dating from the end of the XVI century (Figs. 1A, B). At the moment of this movement, the collection comprised only 2691 lots (Maldonado-Ocampo *et al*., 2007), with a small fraction of marine species (197 lots) that were subsequently exchanged for the freshwater specimens housed at the Instituto de Investigaciones Marinas y Costeras (Invemar). The Instituto Humboldt and Invemar form part of the Environmental National System (SINA) of Colombia and are affiliated to the Ministerio de Ambiente y Desarrollo Sostenible of Colombia. In those early years, the IAvH-P collection also received the donation of around 350 lots from the fish collection of Museo del Mar (MM) of the Universidad de Bogotá Jorge Tadeo Lozano, which included the reference material collected by Darío M. Castro (mainly from the Amazon, Caquetá, and Meta rivers) along with some types of *Corydoras* species described by this author (Castro, 1987; DoNascimiento & Borja-Acosta, 2018). Nevertheless, during all this time, the collection remained without an ichthyologist in charge until August of 2003, when Javier Alejandro

Figure 1. A. Building facade of the Claustro de San Agustín that houses the freshwater fish collection of the Instituto de Investigación de Recursos Biológicos Alexander von Humboldt (IAvH-P) in Villa de Leyva, Colombia. B. Internal view of the Claustro de San Agustín. C. Sliding mobile storage of the IAvH-P collection. D. Individual shelf showing organization of jars by catalog number. E. Storage area for plastic barrels containing large specimens.

Maldonado-Ocampo became its first curator and shortly Juan David Bogotá-Gregory joined him as a researcher to help in the curatorial activities of the collection. Posterior to 2008, there was another hiatus with no ichthyologists associated to the collection, until 2014 when a curatorial position for the collection was formally opened, being filled by Carlos DoNascimiento. More recently, another two ichthyologists (Juan Gabriel Albornoz-Garzón and Alejandro Méndez-López) were hired as researchers to support multiple research field projects involving the IAvH-P collection.

The IAvH-P collection is the second largest ichthyological repository in Colombia with more than 22,000 catalog lots entirely systematized in the Specify software, representing around 3,100 unique sampled localities across all main river systems (Amazon, Orinoco, Magdalena-Cauca, and Caribe and Pacific versants) and all political departments of the Colombian territory (Fig. 2). In terms of taxonomic coverage of the native Colombian ichthyofauna, 1,155 species are represented which accounts around 74% of the total number of recorded species for this country. These facts have been essential and pivotal for the successful completion and continuous updating of the checklist of freshwater fishes of Colombia (DoNascimiento *et al*., 2017). The IAvH-P collection also holds specimens from other Neotropical countries: Brazil, Costa Rica, Ecuador, French Guiana, Guyana, Panama, Peru, and Venezuela (Fig. 2) and an important number of type specimens of more than 70 nominal species, with 18 of them represented by their respective holotypes (DoNascimiento *et al*., 2016; DoNascimiento & Borja-Acosta, 2018). The IAvH-P collection has become in an important supporting centre for research of Colombian and Neotropical fishes, being cited or acknowledged in more than 90 papers published in peer reviewed journals (Arbeláez *et al*., 2017) and has served to numerous dissertation works of Colombian and international students at undergraduate and graduate levels. Catalog information of records at IAvH-P is available in the Darwin Core format through the Colombian node of the GBIF, the SiB Colombia (http://ipt.sibcolombia.net/iavh/resource.do?r=peces_coleccion_instituto_humboldt). Recently, the electronic version of the catalog of type specimens of IAvH-P was made accessible online along with high resolution photographs of these specimens (https://sites.google.com/humboldt.org.co/tipospeces/). Currently, we are developing an online database to search and access the catalog data and associated multimedia content (photographs, radiographs, links to published DNA sequences, and files of bibliographic references) in a single website.

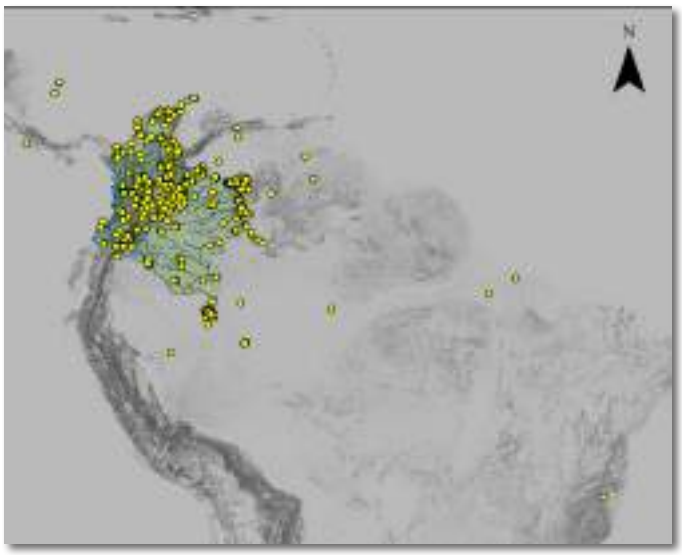

Figure 2. Map of South America showing collecting localities (yellow dots) of catalog lots of IAvH-P.

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Maldonado-Ocampo, J. A., J. D. Bogotá-Gregory, D. Perico-Manrique & A. C. J. Londoño. 2007. Colección de peces de agua dulce Instituto de Investigación de Recursos Biológicos Alexander von Humboldt (IAvH-P) (Capítulo II). Pp. 29-47. *In*: Maldonado-Ocampo, J. A. (Ed.), Colecciones ictiológicas colombianas, First Edition. Instituto Alexander von Humboldt, Bogotá D.C. 147 p.

Colecciones Biológicas, Instituto de Investigación de Recursos Biológicos Alexander von Humboldt, Claustro de San Agustín, Carrera 8 No. 15-08, Villa de Leyva, Boyacá, Colombia. cdonascimiento@humboldt.org.co

Name and acronym	Colección de Peces de Agua Dulce del Instituto de Investigación de Recursos Biológicos Alexander von Humboldt (IAvH-P)
Institution	Instituto de Investigación de Recursos Biológicos Alexander von Humboldt
Address	Claustro de San Agustín, Carrera 8 No. 15-08, Villa de Leyva, Boyacá, Colombia
Curator(s) and contact(s)	Curator: Carlos DoNascimiento (cdonascimiento@humboldt.org.co) Researchers: Juan Gabriel Albornoz-Garzón (jalbornoz@humboldt.org.co), Alejandro Méndez-López (amendez@humboldt.org.co) Collections database administrator: Kevin Giancarlo Borja Acosta (kborja@humboldt.org.co) Collection technician: Carlos Montaña (crmontana@humboldt.org.co)
Website	CEIBA (Data Infrastructure Portal of Instituto Humboldt): http://i2d.humboldt.org.co/ceiba/resource.do?r=peces_coleccion_instituto_humboldt Colombian Biodiversity Information System - SIB-Colombia (Colombian node of GBIF): https://ipt.biodiversidad.co/iavh/resource?r=peces_coleccion_instituto_humboldt Online Catalog of Types: https://sites.google.com/humboldt.org.co/tipospeces/
Year of foundation	1971
Facilities and area of the collection	Curator office, triage space, research lab, sliding mobile storage of the fish collection (Fig. 1C), organized in glass jars (100, 200, 400, 500, 1000, 4000 cc of capacity), arranged by catalog number (Fig. 1D) and storage area for large specimens in plastic barrels of 50, 100, 200 l of capacity (Fig. 1E) / 111.6 m^2
Number of visitors per year (average considering 2015, 2016, 2017)	13
Number of loaned lots per year (average number considering 2015, 2016, 2017)	147
Specimens habitat	98% freshwater, 2% marine
Specimens origin	Colombia (Amazon, Caribbean, Magdalena-Cauca, Pacific, and Orinoco hydrographic regions), Brazil, Costa Rica, Ecuador, French Guiana, Guyana, Panama, Peru, Venezuela
Current cataloging method	Specify Software 6.7.1 Wolverine
Total number of lots and number of lots from Neotropical region	22,300
Total number of specimens and number of specimens from Neotropical region	202,748
Total number of holotypes and number of holotypes from Neotropical region	18
Total number of paratypes and number of paratypes from Neotropical region	947 specimens in 148 lots representing 79 nominal species
Number of tissue samples from Neotropical fishes	1,556
Number of C&S specimens	55
Number of dry skeleton specimens	7

FISH COLLECTION

ICN-MHN
The fish collection of the Instituto de Ciencias Naturales of the Universidad Nacional de Colombia

Henry D. Agudelo-Zamora[1] & José Ivan Mojica[2]

A brief history. The fish collection of the Instituto de Ciencias Naturales was the fourth zoological collection created in the Instituto de Botanica (circa 1938) of the Universidad Nacional de Colombia. The institute initiated the zoological collections as part of the entomological service of the Ministry of National Economy. In 1939 the zoological collections of birds and mammals were curated by Carlos Lehmann (Londoño-Díaz 2002) and in 1940 the Botanic Institute (Instituto de Botanica in Spanish) changed its name to the current one (Instituto de Ciencias Naturales) under the direction of Professor Armando Dugand Gneco.

At that time, the only other zoological collections in Colombia were the Museo de La Salle (MLS) created in Bogotá by religious brothers of the Order of La Salle and the Colegio San José (CSJ), actually ascribed to the Instituto Tecnologio Metropolitano (ITM) in Medellín, which even today continues to provide services. Neverthless and as Cecil Miles wrote in a letter to George Myers …" *Unfortunately there is a certain amount of disorder, as brother Nicéforo has been absent in Cúcuta* …" (Smithsonian Institution Archives, 2017). For those reasons Miles got in touch with Professor Dugand to formally request the creation of the department of ichthyology in the Institute. Miles' proposal was viewed favorably by Dugand, given the support expressed by George Myers, who with great interest wrote to rector Julio Carrizosa (Dugand, 1942). That is how Miles (Fig. 1a) came to be named as first curator and oficial ichthyologist of the Universidad Nacional de Colombia.

For his part, Miles established the fish collection and deposited some of his type specimens there, like the holotype of *Pygidium totae* (Miles 1942), currently *Rhizosomicthys totae* under the acronym and catalog number I.C.N.B 20. He also deposited duplicate type specimens at MZC, SU, and USNM.

After Miles retired in 1947, there was period of little activity in the recently created ichthyology department until November of 1958 when George Dahl (Fig. 1b) was hired as professor of ichthyology by the Instituto de Ciencias Naturales (ICN 1958). As a result, Dahl made some important expeditions to the Serranía de la Macarena in the Orinoco River Basin and to the Atrato, San Juan and Baudo river basins along Colombia's Pacific slope (Dahl, 1961, Dahl, 1960). These expeditions produced the descriptions of many new species such as *Leyvaichthys castaneus* (Dahl, 1961), currently *Helogenes castaneus*, and *Pygidium metae guayaberensis* (Dahl, 1960), currently *Ituglanis guayaberensis* as well as *Brycon medemi* (Dahl, 1960), *Bryconamericus multiradiatus* (Dahl, 1960), *Characidium sanctjohanni* Dahl, 1960, and *Pseudancistrus atratoensis* (Dahl, 1960), currently *Dolichancistrus atratoensis*.

After Dahl´s resignation in 1962, his student Plutarco Cala (Fig. 1c) returned from Sweden (1968) and was hired by the Biology Department of the Sciences Faculty. Cala recovered some type specimens from other institutions (Cala, 1981), and increased the collection with Orinoco River Basin expeditions.

After Cala's retirement, Professor Germán Galvis assumed the job of curator (Fig. 1d) (circa 1980) and in 1997, his student José Iván Mojica took the position which he currently still holds. (Amat García, 2017). During the last 20 years, the collection has received constant scientific support from prominent ichthyologists from Venezuela, USA and recently from Brazil.

Relevant fish collection data. The collection contains more than 24,000 lots and >128,000 indivudual specimens, most of them conserved in ethanol, and which represent almost all of country's rivers basins. It contains 41 holotypes and 117 paratypes. Relevant data about the collection since its establishment until the present day is shown in Table 1. The collection can be accessed at the web page http://

Figure 1. Curators of the ICN-MHN fish collection from 1942 to 2018. a. Cecil W. Miles (photo by PISPESCA archives), b. George Dahl (photo by C. Ardila), c. Plutarco Cala (photo by C. Ardila), d. Germán Galvis (photo by L. Mesa).

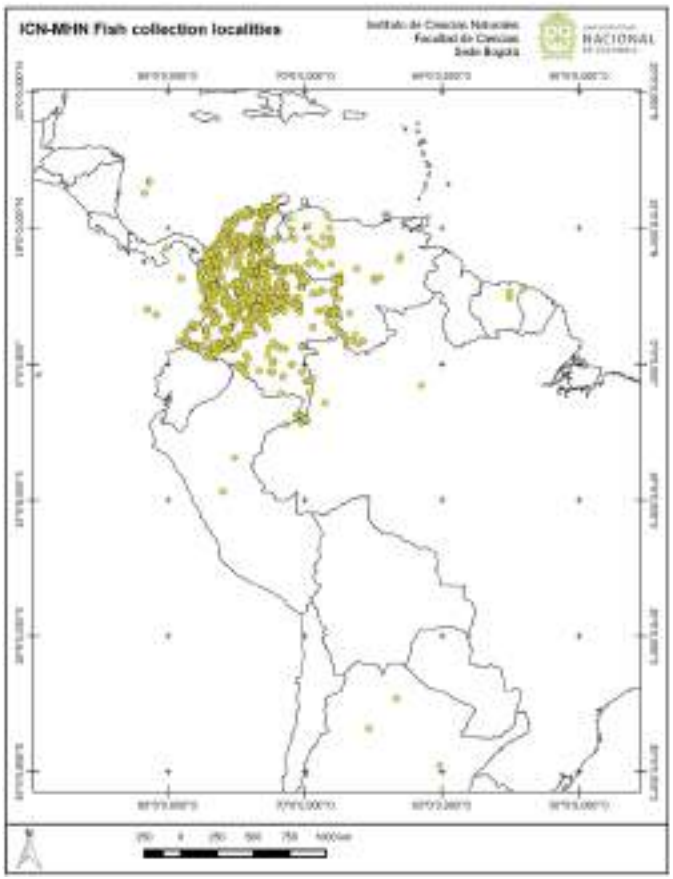

Figure 3. Map of ocurrence records holds in the ICN-MHN Fish collection. Records avaible from Mojica *et al.* (2017).

Figure. 2. Facilities of the ICN-MHN Fish collection at Universidad Nacional de Colombia, Bogotá Campus. a. Compactors for Characiforms, Gymnotiforms, Siluriforms Orders; b. Compactor for Perciforms Order; c. Tables and equipment; d. Compactor for Type material, red tape – Holotype, yellow tape - Paratypes (photos by H. Agudelo).

www.biovirtual.unal.edu.co. where photographs of the type material of the ICN collections can also be found. The Specify © database is used to organize the fish collection specimens of which around 18.000 lots have already been georeferenced (Fig. 3).

Acknowledgments. The authors thank the Instituto de Ciencias Naturales for all their support, the PISPESCA association for information about Cecil Miles and their assistance to HAZ during the visit to their facilities, to the Smithsonian Archives for access to correspondence, to ACICTIOS for the project of georeferencing data of all ichthyology collections, to Carlos Ardila for the photos and Plutarco Cala for information about the early years of the collection. We also express our thanks to our ichthyologist colleagues of Venezuela for their invaluable help with the fish collection, especially: Francisco Provenzano, Donald Taphorn, Ramiro Royero, Carlos Lasso, Carlos DoNascinento, Douglas Rodríquez and Otto Castillo, as well as the countless colleagues from Colombia who have contributed to the strengthening of the collection. Thanks to Donald Taphorn for the english review.

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Smithsonian Institution Archives. Record Unit 7222, Schultz, Leonard P,(Leonard Peter),1901-, Leonard Peter Schultz Papers. Washington, D.C.: Smithsonian Institution Archives; 2018.

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Name and acronym	Instituto de Ciencias Naturales (ICN-MHN)
Institution	Universidad Nacional de Colombia
Address	Carrera 30 # 45 -03 Edificio 425, Ciudad Universitaria, Bogotá D.C. Colombia
Curator(s) and contact(s)	José Ivan Mojica C. - Curator Henry D. Agudelo-Zamora Biodiversity Informatics Program
Website	http://www.biovirtual.unal.edu.co/
Year of foundation	1942
Facilities and area of the collection	Two rooms with compactors, 120m^2
Number of visitors per year (average considering 2015, 2016, 2017)	20 researchers/year
Number of loaned lots per year (average number considering 2015, 2016, 2017)	20 loans for national researchers
Specimens habitat (marine or freshwater)	Freshwater 90% / Marine 10%
Specimens origin (major river basins)	Choco biogeographic region, Ranchería and Catatumbo basins, Magdalena-Cauca River Basin, Orinoco and Amazon basins, Caribbean sea and Pacific ocean.
Current cataloging method (software and version)	Specify 6.5.03
Total number of lots (all from Neotropical region)	> 24.000
Total number of specimens (all from Neotropical region)	> 128.000
Total number of holotypes (all from Neotropical region)	41
Total number of paratypes (all from Neotropical region)	117
Number of tissue samples from Neotropical fishes	300
Number of C&S specimens	121
Number of dry skeleton specimens	20

FISH COLLECTION

IDSM
A coleção ictiológica do Instiuto de Desenvolvimento Sustentável Mamirauá

Alexandre Pucci Hercos

A coleção ictiológica do Instituto Mamirauá começou a ser formada no início da década de 1990 através de um intenso programa de pesquisas implantado para servir de subsídios para a regulamentação das normas do plano de manejo, também como base para influenciar políticas públicas para a recém criada Reserva de Desenvolvimento Sustentável Mamirauá, a primeira unidade de conservação desta categoria implementada no Brasil. As principais características do modelo de RDS, que se criava naquele período, eram o manejo participativo aliado à pesquisa científica que o subsidia. Os primeiros registros da coleção ictiológica do Instituto Mamirauá vieram dos inventários realizados pelos pesquisadores William Crampton e Peter Henderson, e se detiveram praticamente a região da cidade de Tefé (fig. 1) . A grande maioria do material coletado foi tombado em grandes coleções nacionais como a do Instituto Nacional de Pesquisa da Amazônia (INPA) e também do Museu de Ciências e Tecnologia da PUCRS, sendo composto por exemplares preservados em ETOH (70%), separados por lotes que representam lugares geográficos diferentes e / ou diferentes datas de coletas e / ou diferentes métodos de capturas. Uma parte do material foi organizado formando uma pequena coleção de referência que ficava armazenada no prédio do Instituto Mamirauá, na cidade de Tefé – AM.

Está coleção permaneceu alojada dentro do laboratório de pesquisa aquáticas do IDSM e neste momento, contava com 528 lotes. Até então, a

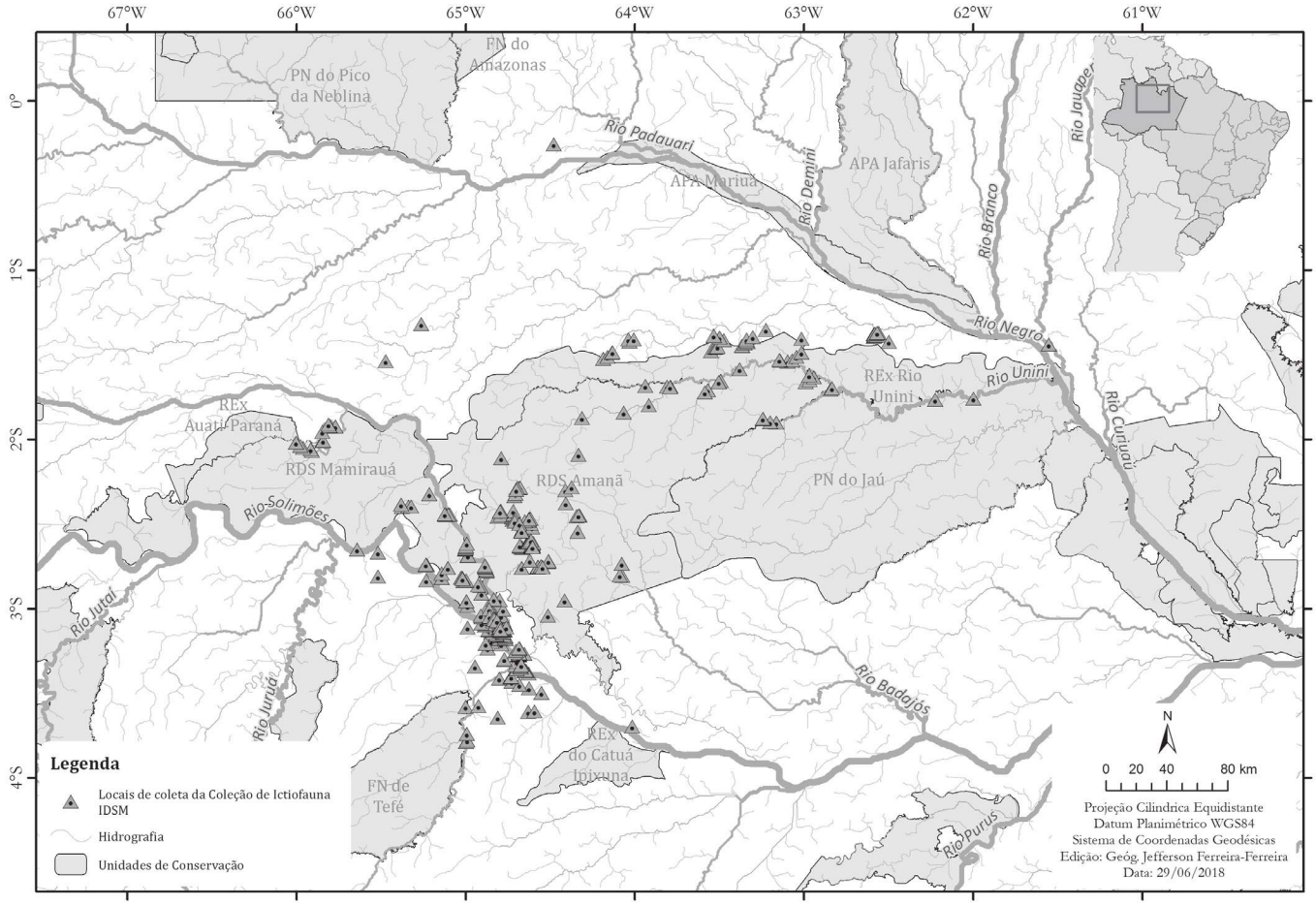

Figure 1. Localização das áreas onde houveram as coletas dos peixes tombados na coleção ictiológica do Instituto de Desenvolvimento Sustentável Mamirauá.

Figure 2. Imagens da estrutura física e atividades na coleção ictiológica do Instituto de Desenvolvimento Sustentável Mamirauá A. Sala de deposito com estantes deslizantes; B. Laboratório de triagem e identificação do material provenientes das pesquisas realizadas no Instituto Mamirauá; C. Laboratório de preparação dos lotes a serem tombados na coleção; D. Pesquisadoras realizando identificação de peixes coletados na Reserva de Desenvolvimento Sustentável Mamirauá.

coleção ainda não possuía um lugar definitivo para o seu armazenamento.

Já na primeira década do século 21 com o crescimento do Instituto Mamirauá diversos projetos de pesquisa foram realizados onde tem sido constante o depósito de novos lotes, levando a um crescimento substancial do acervo ictiológico do IDSM, passando para 2724 lotes atualmente, sendo a única coleção científica ictiológica em todo o Oeste Amazônico, tendo fornecido material para descrição de pelo menos cinco novas espécies, destas existem tombados no acervo quatro séries paratípicas. Além de estudos de pós-graduação em taxonomia de peixes neotropicais.

No início da presente década o Instituto de Desenvolvimento Sustentável Mamirauá em parceria com o ICMBio realizou diversos inventários em Unidade de Conservação Federais na região do Médio Solimões, além novas coletas na área subsidiária da Reserva de Desenvolvimento Mamirauá, ampliando sua área de abrangência e se consolidando como uma referência nos estudos sobre a ictiofauna do Médio Solimões. Todo este material encontra-se em processo de tombamento com cerca de 850 novos lotes, além de materiais provenientes de outras regiões da Amazônia onde nossos colaboradores realizaram trabalhos, como na bacia do rio Tapajós. No ano de 2014 foi inaugurado um prédio no Instituto Mamirauá destinado a armazenar todas as coleções biológicas, portanto a sala onde estão depositados os lotes da coleção de peixes possui estrutura adequada e foi dimensionada para abrigar uma grande quantidade de lotes de peixes, além de dois laboratórios. Um para identificação e triagem do material coletado e um segundo anexo a sala de depósito que serve para preparação dos lotes de peixes a serem depositados. Atualmente o Instituto Mamirauá está adquirindo um ultra-frezeer e partir do segundo semestre de 2018 estaremos iniciando a nossa coleção de tecidos.

Grupo de Biologia e Ecologia de Peixes, Instituto de Desenvolvimento Sustentável Mamirauá, Estrada do Bexiga, 2584, Fonte Boa, 69553-225 Tefé, AM, Brasil. (APH) alexandre.hercos@mamiraua.org.br

Nome e sigla	Coleção Ictiológica do Instituto Mamirauá
Instituição	Instituto de Desenvolvimento Sustentável Mamirauá
Endereço	Estrada do Bexiga n. Bairro Fonte Boa. Tefé -AM
Curador (es) e contato (s)	Alexandre Pucci Hercos alexandre.hercos@mamiraua.org.br
Website	www.mamiraua.org.br
Ano de fundação	1996
Instalações e área da coleção	1 sala de depósito (63m^2); 2 laboratórios (15 m^2; 60m^2)
Número de visitantes por ano (média considerando 2015, 2016, 2017)	15
Número de lotes emprestados por ano (média número considerando 2015, 2016, 2017)	5
Habitat de espécimes	100% Água Doce
Origem dos espécimes	Brasil / Bacia Amazônica
Método de catalogação atual	Banco de Dados SQL Desenvolvido pelo TI do Instituto de Desenvolvimento Sustentável Mamirauá
Número total de lotes e número de lotes da região Neotropical	2724 todos provenientes da região Neotropical
Número total de espécimes e número de espécimes da região Neotropical	11.942 todos provenientes da região Neotropical
Número total de holotipos e número de holótipos da região Neotropical	Nenhum
Número total de parátipos e número de parátipos da região Neotropical	Quatro
Número de amostras de tecido de Neotropical peixes	Em processo de implementação
Número de espécimes C & S	Nenhum
Número de espécimes de esqueleto seco	Nenhum

FISH COLLECTION

INIDEP
The fish collection of the Instituto Nacional de Investigación y Desarrollo Pesquero of Mar del Plata, Argentina

Santiago A. Barbini, María Berta Cousseau, Daniel E. Figueroa, & Claudio C. Buratti

The fish collection began in 1970, in the ex Instituto de Biología Marina (currently INIDEP) under the direction of Dr. Fernando Cervigón, eminent Spanish ichthyologist established in Venezuela (Cervigón & Cousseau, 1971).

The samples come mainly from the marine research cruises carried on by the INIDEP but there are also those delivered by fishing vessels crew and recreational fishermen. The specimens are fixed in water with 10 % formaldehyde and then preserved in a solution of 75 % ethyl alcohol and 25 % distilled water. The collection acronym is INIDEP (Sabaj, 2016). The collection is classified phylogenetically following Nelson *et al.* (2016). The principal origin area is the Southwestern Atlantic continental shelf between 34° - 55° S and adjacent areas, but it also contains samples from South Georgia and South Shetland Islands, Southern Ocean (Fig. 1). The data are digitized and they have been entered into the Sistema Nacional de Datos Biológicos (http://datos.sndb.mincyt.gob.ar/), Ministerio de Ciencia, Tecnología e Innovación Productiva de la Nación, Argentina.

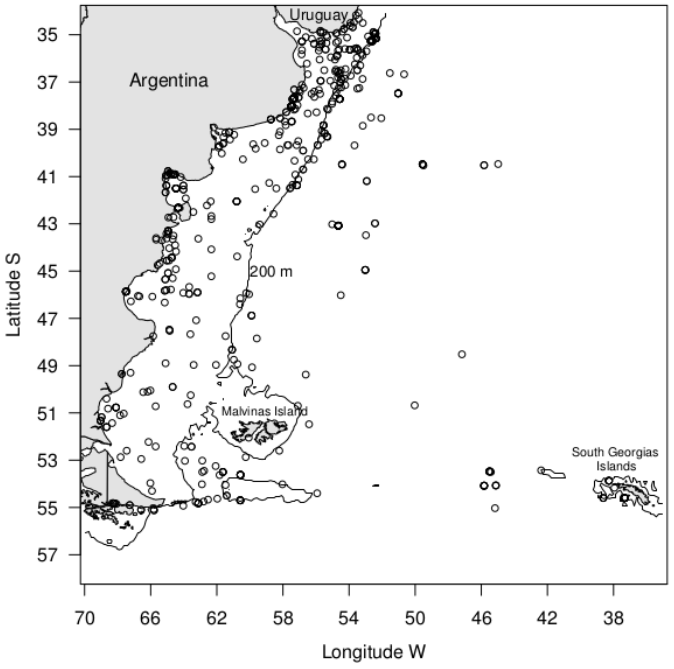

Figure 1. Map showing the locations where fishes were collected in the Argentinian continental shelf and adjacent areas.

The holotype and 16 paratypes of *Bathyraja cousseauae* (Díaz de Astarloa & Mabragaña, 2004), the holotype and 9 paratypes of *Dipturus argentinensis* (Díaz de Astarloa *et.al*. 2008) and 1 paratype of *Myliobatis ridens* (Ruocco *et al*. 2012), make all part of the collection. In total, the collection contains 839 lots, 395 species of 166 Families representing 66 % of the total number of species presently known as occurring in the abovementioned Southwestern Atlantic sector. The collection contains also 58 species of Antarctic origin (members of the Families Nototheniidae, Bathydraconidae, Chanichthyidae, Liparidae, among others), they constitute 21,3 % of the species mentioned by Gon & Heemstra (1990) for the Southern Ocean. On the continental shelf and adjacent areas 41 of those species have been captured (Cousseau *et al*. 2012), the rest (16 species, corresponding to 5 families) come from the Southern Ocean.

Figure 2. Storage room for fish specimens in Instituto Nacional de Investigación y Desarrollo Pesquero (INIDEP).

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Ruocco NL, Lucifora LO, Díaz de Astarloa JM, Mabragaña E, Delpiani SM. Morphology and DNA Barcoding Reveal a New Species of Eagle Ray from the Southwestern Atlantic: *Myliobatis ridens* sp. nov. (Chondrichthyes: Myliobatiformes: Myliobatidae). Zoological Studies. 2012; 51(6): 862-873.

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(MBC) Facultad de Ciencias Exactas y Naturales, Universidad Nacional de Mar del Plata (UNMdP) Funes 3350 - B7602AYL - Mar del Plata Argentina.
(DEF) Instituto de Investigaciones Marinas y Costeras (IIMyC), Facultad de Ciencias Exactas y Naturales, Universidad Nacional de Mar del Plata (UNMdP) Funes 3350 - B7602AYL - Mar del Plata Argentina. dfiguer@mdp.edu.ar
(CB) Universidad Nacional de Mar del Plata (UNMdP) Instituto Nacional de Investigación y Desarrollo Pesquero Paseo Victoria Ocampo nº 1, Escollera Norte, B7602HSA Mar del Plata, Argentina.

Name and acronym	INIDEP
Institution	Instituto Nacional de Investigación y Desarrollo Pesquero
Address	Paseo Victoria Ocampo nº 1, Escollera Norte, B7602HSA Mar del Plata, Argentina.
Curator(s) and contact(s)	Santiago A. Barbini sbarbini@mdp.edu.ar Daniel E. Figueroa dfiguer@mdp.edu.ar
Website	www.mdp.edu.ar/ictiologia/intranet
Year of foundation	1970
Facilities and area of the collection	Research Cruises, commercial fishing. Southwestern Atlantic Ocean and Southern Ocean
Number of visitors per year (average considering 2015, 2016, 2017)	Three visitors
Number of loaned lots per year (average number considering 2015, 2016, 2017)	Ten lots
Specimens habitat	Marine
Specimens origin	Southwestern Atlantic Ocean: -34º - -55º SL; -56º - -69º WL Southern Ocean: -53º - -65º SL; -38º - -60º WL
Current cataloging method	Digital cataloging
Total number of lots and number of lots from Neotropical region	838
Total number of specimens and number of specimens from Neotropical region	1572
Total number of holotypes and number of holotypes from Neotropical region	Total number of holotypes from Neotropical region: 2
Total number of paratypes and number of paratypes from Neotropical region	Total number of paratypes from Neotropical region: 26
Number of tissue samples from Neotropical fishes	4
Number of C&S specimens	0
Number of dry skeleton specimens	0

FISH COLLECTION

LISDEBE
The fish collection of the Laboratório de Ictiologia Sistemática do Departamento de Ecologia e Biologia Evolutiva of the Universidade Federal de São Carlos

Alexandre K. de Oliveira[1], Camila F. Perez[2] & Julio C. Garavello[3]

By their historical characteristics, biological collections are the obvious places where information on biodiversity composition and distribution is available to access. Collections that houses whole specimens, as fish collections do, also provide biological material to studies on comparative anatomy, systematics and morphological diversity. Besides the absolute taxonomical value, the collections serve as biodiversity knowledge repositories. Nowadays, the biological information of the collections and the technological possibilities of data analysis allow mapping taxa distribution in both time and space, also contributing to understand the consequences of environmental changes to species diversity and distribution. As stated by Dornelas *et al*. (2018), quantifying the changes in

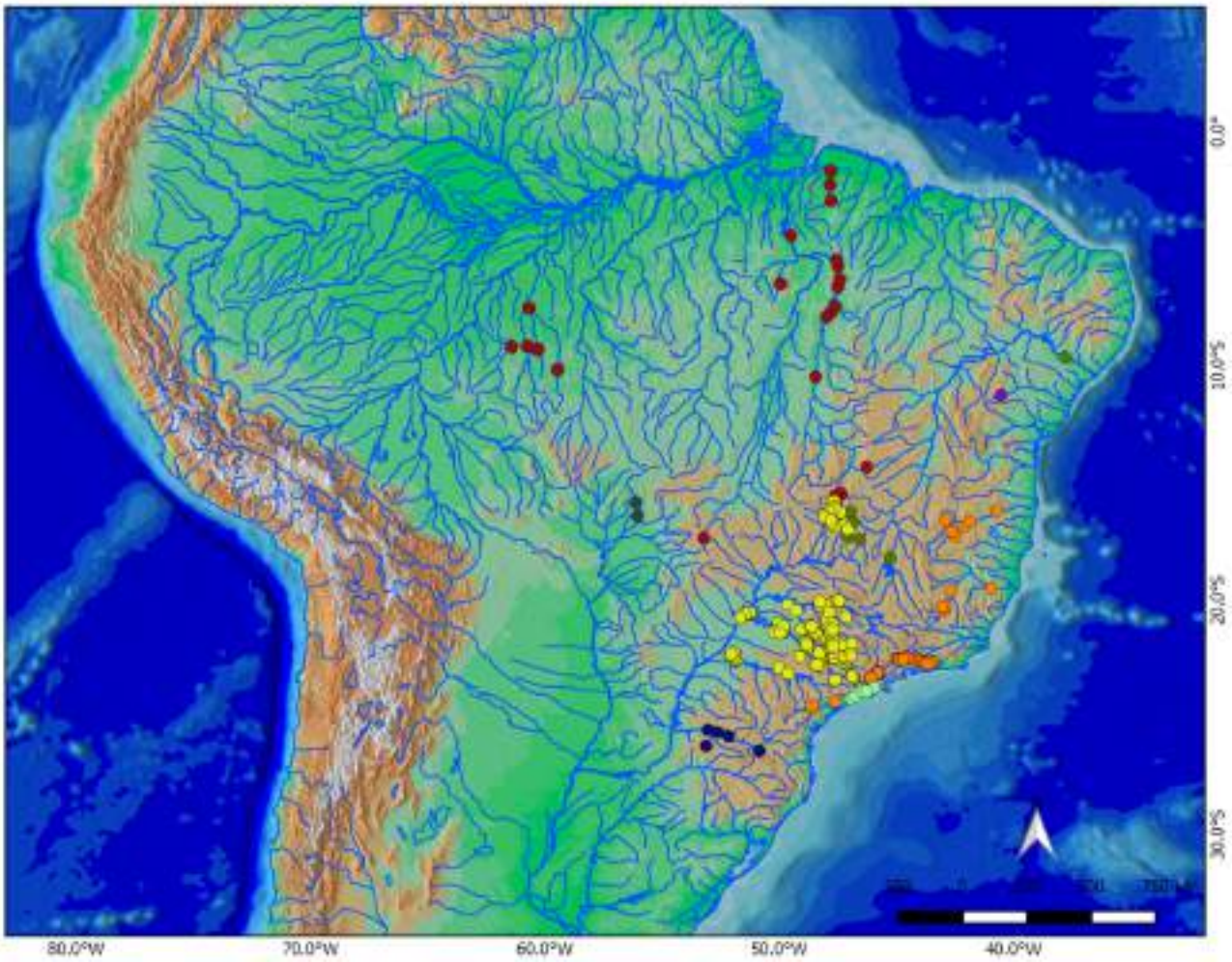

Figure 1. Map identifying the geo-referenced lots locations of LISDEBE-UFSCar. Color dots represent the following drainages: Upper Paraná (yellow); Jequitinhonha, Doce, Paraíba do Sul and Ribeira de Iguape basins, in the eastern Brazil (orange); Amazon (red); São Francisco (dark green); Iguaçu (dark blue); Paraguay (dark grey); Itapicuru in Bahia state (purple); São Paulo state small coastal basins (light green).

biodiversity is a key challenge of our time given the paucity of temporal and spatial data for most taxa on Earth. There is no doubt about the importance of collections to surpass the lack of basic knowledge in many aspects of biodiversity, but the large data sets are still to be adequately accessed and shared.

The Laboratório de Ictiologia Sistemática do Departamento de Ecologia e Biologia Evolutiva (LISDEBE) of the Universidade Federal de São Carlos (UFSCar) houses a fish collection of Brazilian rivers resulted from near 40 years of research about the Neotropical fish diversity. The research in taxonomy of freshwater fish groups initiated in the seventies by Dr. Julio C. Garavello and since has been developed in collaboration with other ichthyologists. In this communication, we briefly report the fish collection housed at UFSCar, stressing its main features in terms of historical importance, geographic extent and facilities.

The collection originated by the continuity of the studies focused in the taxonomy of freshwater fish groups, chiefly of the Anostomidae (genera *Leporinus* and *Schizodon*) and Loricariidae (Hypoptopomatinae and Hypostominae subfamilies). The amount of ichthyological material gathered during field expeditions (see below) also permitted the development of morphology based taxonomical studies in Characidae, Parodontidae, Doradidae, Trichomycteridae, Pimelodidae, Heptapteridae and Poeciliidae.The collection really houses material of much of the family level diversity of the Neotropical ichthyofauna, representing a valuable comparative material.

Allied to the taxonomical research, the ichthyological collection provides basis to studies about fish richness and composition in different river basins of Brazil, and this research that search to map the diversity arises from recent holdings and by the collection organization. Much of this fieldwork were performed in São Paulo state, southeastern Brazil. Thereby, LISDEBE houses an important regional collection of specimens gathered in tributaries of Grande and Tietê rivers, from the upper Paraná basin. This regional collection almost represents the entire ichthyofauna of São Carlos region and, as stressed by Martins (1994), is important to study accurately the fish distribution in this area. Additionally, it helps to fulfill the gaps of knowledge identified by Casatti *et al*. (2008) about fish composition and distribution in the central region of São Paulo state. Specimen's lots of other river drainages of Brazil are also housed in the collection, but the continuity of the specimen identifications and revision of the digitalized data is crucial to produce quality information about fish composition and distribution.

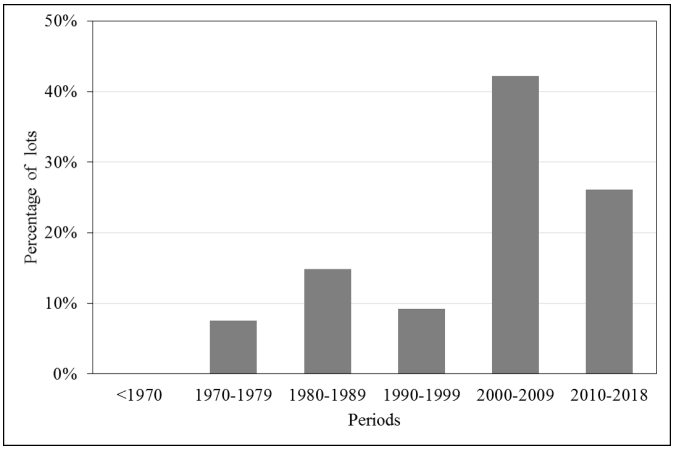

Figure 2. Proportion of number of lots by decade along the time extent of the LISDEBE fish collection.

In June 2018 there were 6,991 lots of fishes digitalized, representing near 70% of the estimated material of the collection. Near 78% of the collection already digitalized is represented by material collected in the upper rio Paraná basin, chiefly in the rio Grande, rio Tietê, rio Paranapanema and rio Paranaíba drainages (Table 1). The material from these rivers were gathered from the end of the 70's, when the Companhia Energética do Estado de São Paulo (CESP) collected fish during the constructions of dams for hydroelectric purposes, to the 2000's, with the intensification of fish collection in small rivers tributaries of those drainages.

Of the amount already digitalized, near 7% comprises lots of the Amazon basin (including material of the rio Araguaia-Tocantins basin, rio Capim, rio Aripuanã, of the rio Madeira basin, and rio Teles Pires, of the Tapajós basin). Near 12% of the digitalized material comprises isolated rivers of the Brazilian eastern region (including rio Itapicuru, in the Bahia state, rio Jequitinhonha, rio Doce, rio Paraíba do Sul, rio Ribeira de Iguape and isolated coastal rivers of São Paulo state). Material of the Paraná-Paraguai basin (excluding upper Paraná portion of the drainage) and rio Iguaçu represents near 2% of the digitalized lots.

The range distribution of the lots already digitalized may be seen in Figure 1, but as stated before, the LISDEBE fish collection houses many specimens collected in other Brazilian rivers, such as rivers of the Pantanal region; rio São Francisco basin; rio Tapajós, rio Tocantins and Ilha do Marajó, in the Amazonian system, for example. Most part of these lots is in process of identification and

Table 1. Number of lots, number of genera, number of individuals and geo-referenced lots in the distinct geographic areas covered by the LISDEBE fish collection.

Geographic area	Number of lots	Number of genera	Number of individuals	Geo-referenced lots
Upper Paraná Basin				
Rio Tietê	2,439	85	24,237	1,520
Rio Grande	590	69	2,786	297
Pardo-Mogi Guaçu Basin	1,289	72	11,653	935
Rio Paraná	269	63	2,176	158
Rio Paranapanema	594	63	3,442	160
Rio Paranaíba	338	67	4,822	155
Paraná-Paraguai Basin				
Rio Paraná-Paraguai	34	13	139	2
Rio Iguaçu	100	8	1,029	5
Rio La Plata	3	1	6	0
East Basins				
Small Coastal isolated rivers	129	43	735	115
Rio Ribeira de Iguape	159	41	1,520	0
Rio Doce	174	35	2,278	1
Rio Jequitinhonha	67	5	686	1
Rio Paraíba do Sul	298	42	2,375	264
Amazon Basin	456	115	1390	140
Northeast basins	8	3	94	1
Rio São Francisco Basin	44	18	1,850	6
Total	6,991	216	61,218	3,760

digitalization, representing an estimated number of more than 3,000 lots to be added in the databases.

The period extent of the collection ranges from 1948 to 2018, but only two lots were collected before 1970 and near 7% (515 lots) were gathered in the 70's (Figure 2). The majority of the lots digitalized are of the material collected after the 2000's (near 69% of the lots), followed by the lots gathered between 1980 and 1999 (near 24 % of the lots). There are still much material to be digitalized, chiefly collected in the 80's and 90's in the rio São Francisco, Jequitinhonha and Doce rivers in the eastern Brazil, Tocantins and Tapajós rivers in the Amazonian system, and in the Paraguay river basin in the Pantanal region. Therefore, the collection curatorship, with identification and digitalization of this material take importance because it houses part of the fish diversity extant in those basins.

Actually, the LISDEBE fish collection includes 47 lots of paratypes of the following freshwater species: *Steindachneridion melanodermatum* Garavello, 2005; *Leporinus geminis* Garavello & Santos, 2009; *Leporinus unitaeniatus* Garavello & Santos, 2009; *Pimelodus britskii* Garavello & Shibatta, 2007; *Hypostomus multidens* Jerep, Shibatta & Zawadzki, 2007; *Platydoras brachylecis* Piorski, Garavello, Arce & Sabaj Pérez, 2008; *Ituglanis mambai* Bichuette & Trajano, 2008; *Astyanax bifasciatus* Garavello & Sampaio, 2010; *Astyanax dissimilis* Garavello & Sampaio, 2010; *Astyanax longirhinus* Garavello & Sampaio, 2010; *Astyanax minor* Garavello & Sampaio, 2010; *Astyanax serratus* Garavello & Sampaio, 2010; *Microlepidogaster longicolla* Calegari & Reis, 2010; and *Hypostomus nigropunctatus* Garavello, Britski & Zawadzki, 2012.

Recently, field surveys in some type localities allowed the collection of topotypes of species described from the rio Grande and rio Tietê basins

Figure 3. Fish collection of the LISDEBE – UFSCar; lot housed in the LISDEBE; and topotypes recently collected in the upper Paraná river basin.

(Upper Paraná basin) and motivated the begin of a collection of tissue samples for molecular analysis accompanying the preserved whole specimens. Today, the collection has 137 tissue samples for molecular analysis, representing 52 fish species of the upper rio Paraná basin and 28 species of the rio Ribeira de Iguape basin. The collection and maintenance of tissue samples are now incorporated in the routine of the laboratory.

The physical structure of the LISDEBE fish collection, which includes three collection rooms (total area of 100m^2) and two microscopy rooms, has continuous maintenance, with sorting, identification and digitalization of the specimens lots (Figure 3). Today the data are stored in Microsoft Excel spreadsheet, and Microsoft Access is used to print the labels. In spite of adopted the Darwin Core terminology, the data management is still a challenge and need upgrading to allow the information use by researchers devoted to the biodiversity knowledge in a broad sense, as indicated by Walls *et al*. (2014). In this way, to the near future is planned the migration of the databases to the software Specify and provide the data online, probably in the SiBBr (Sistema de Informação sobre a Biodiversidade Brasileira - www.sibbr.gov.br) system.

In conclusion, the LISDEBE houses a relevant fish collection both to the knowledge of diversity in the region where it is located, as to repository of part of the fish fauna in other regions of Brazil. The material deposited in the collection and the associated information are available for scientific community and may help with the progress in many knowledge areas of Neotropical freshwater fish, such as taxonomy, systematics, biogeography, ecology and conservation.

Acknowledgements. Undergraduate and postgraduate students have contributed to maintenance of the LISDEBE ichthyological collection. Fenando Apone and Rodrigo Torres Cardoso helped with collection management. The Programa de Pós Graduação em Ecologia e Recursos Naturais and the Departamento de Ecologia e

Biologia Evolutiva, of the Universidade Federal de São Carlos, provide institutional support to the collection. Fapesp (processes 2011/50213-5 and 2018/04388-7) and CNPq (processes 475433/2007-6 and 373797/2010-9) provide grants that allowed field trips and collection maintenance.

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Name and acronym	Laboratório de Ictiologia Sistemática do Departamento de Ecologia e Biologia Evolutiva (LISDEBE)
Institution	Universidade Federal de São Carlos
Address	Rod. Washington Luís, km 235 - SP-310 - São Carlos; 13565-905
Curator(s) and contact(s)	Julio Cesar Garavello (garavelo@ufscar.br) and Alexandre Kannebley de Oliveira (pako@ufscar.br)
Website	www.ufscar.br
Year of foundation	1977
Facilities and area of the collection	Three collection and two microscopy rooms (area of 400 m^2)
Number of visitors per year (average considering 2015, 2016, 2017)	10
Number of loaned lots per year (average number considering 2015, 2016, 2017)	12
Specimens habitat	100% freshwater
Specimens origin	Most lots from Brazilian drainages, chiefly from upper Paraná basin
Current cataloging method	Excel
Total number of lots and number of lots from Neotropical region	7,306 lots (updated in 2019 July) all from Neotropical region
Total number of specimens and number of specimens from Neotropical region	62,848 specimens (updated in 2019 July), all from Neotropical region
Total number of holotypes and number of holotypes from Neotropical region	None
Total number of paratypes and number of paratypes from Neotropical region	641 specimens, all from Neotropical region
Number of tissue samples from Neotropical fishes	202 tissue samples (updated in 2019 July)
Number of C&S specimens	No C&S specimens
Number of dry skeleton specimens	No dry skeleton specimens

FISH COLLECTION

LIT - ABAM
The Coleção Ictiológica do Acervo Biológico da Amazônia Meridional, Laboratório de Ictiologia Tropical, Sinop, MT

Lucélia Nobre Carvalho[1]*, Shizuka Hashimoto[1], Fernando Gonçalves Cabeceira[1] & Fernando Rogério Carvalho[2]

A biological collection is a historical-temporal heritage (Rocha *et al*., 2014). The information contained in the cataloged records becomes more important when linked to correctly indexed and collected data, *e.g.*, location, precise geographic coordinates, and when these are available for analyses by specialists.

In 2008, with the intention of safeguarding northern Mato Grosso State biodiversity, the Acervo Biológico da Amazônia Meridional (ABAM), Sinop Regional Nucleus, was established, initially via a multi-institutional network, including the Instituto Nacional de Pesquisas da Amazônia (INPA), and through several research projects financed by public agencies, such as the Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) and the Fundação de Amparo à Pesquisa do Estado de Mato Grosso (FAPEMAT), through the Programa de Pesquisa em Biodiversidade (PPBio). The initial project, entitled "*Biodiversidade em três áreas na Amazônia meridional: integralizando informações para subsidiar planos de conservação*" was based on the Sinop *campus* of the Universidade Federal de Mato Grosso. The ichthyological collection of the Laboratório de Ictiologia Tropical (LIT) were linked to ABAM (as Coleção de Peixes do Acervo Biológico da Amazônia Meridional, ABAM-I). In addition to fish, ABAM houses the herbarium, and collections of mammals, birds, reptiles and amphibians, insects, myriapods, soil invertebrates, and arachnids. Together these collections aim to generate and disseminate collection-linked knowledge as well as

Figure 1. a) Aerial view of a section of rapids that disappeared with the filling of the reservoir of the hydroelectric plant of Sinop, MT. b) Team collecting in the stretches of rapids. c) Collection of fish from *Coleção Ictiológica do Acervo Biológico da Amazônia Meridional*. d) Team of the *Laboratório de Ictiologia Tropical*, composed of students and researchers.

to simultaneously expand, integrate and maintain the regional collections (Martins, 1994), thus promoting integration with international collections containing examples of Brazilian biodiversity, as well as providing teaching materials for undergraduate, graduate and research students.

The ABAM fish collection is housed in a new building, the Laboratório de Ictiologia Neotropical (LIT) (Figure 1). The LIT combines studies of general fish biology (diet, behavior, parasitology, reproduction) (*cf.*, Tesk *et al*., 2014; Cabeceira *et al*., 2015; Matos *et al*., 2016a; Matos *et al*., 2016b; Matos *et al*., 2017a; Matos *et al*., 2017b; Matos *et al*., 2018; Geoffroy *et al*., 2018) with training of specialized human resources to work with the regional ichthyofauna (Figure 1).

Construction of LIT began in September 2018 with resources from the project: ‘‘Monitoramento da Ictiofauna da UHE Teles Pires’’, as part of an agreement signed between the Universidade Federal de Mato Grosso and the Uniselva Foundation. Work was completed in April 2019 with approximately 200 m². The LIT has areas for sorting collections, experimental aquaria, and microscopy, as well as housing the Ichthyology Collection. Prior to construction of these dedicated facilities, ichthyological research activities were dispersed throughout the ABAM building, at the UFMT, Sinop *campus*.

The ABAM Ichthyology Collection has as curator Dra. Lucélia Nobre Carvalho, professor at UFMT, who has had the consistent support of Dr. Fernando R. Carvalho, of Universidade Federal de Mato Grosso do Sul (UFMS), a long-term collaborator on projects and publications. Systematics from different specialties and different Brazilian institutions (*e.g.*, INPA, MZUSP, UEM, UFMS, UFPA) also have strong links to the collection. Visits by such specialists guarantees high-quality and accurate identification of taxa in the collection.

The accessions that comprise the collection are derived from field collections in the north of the Brazilian state of Mato Grosso. The focus is the mid-part of the Teles Pires River basin. This is area otherwise rarely collected (SpeciesLink, CRIA 2019), but with a potentially highly unusual diversity pattern due to its location at the interface of the Amazon- Cerrado biomes, and its biogeographically proximity to the headwaters of the Xingu and Tapajós river basins, besides its several tributaries such as Verde, Curupi, Indio Possesso and Roquete rivers, and the Baixada Morena, Selma and Caldeirão igarapés (forest streams). In addition, the collection includes material from the Estação Ecológica do Rio Ronuro, Juruena River, Parque Estadual do Cristalino and from PPBio module collection sites (Figure 2).

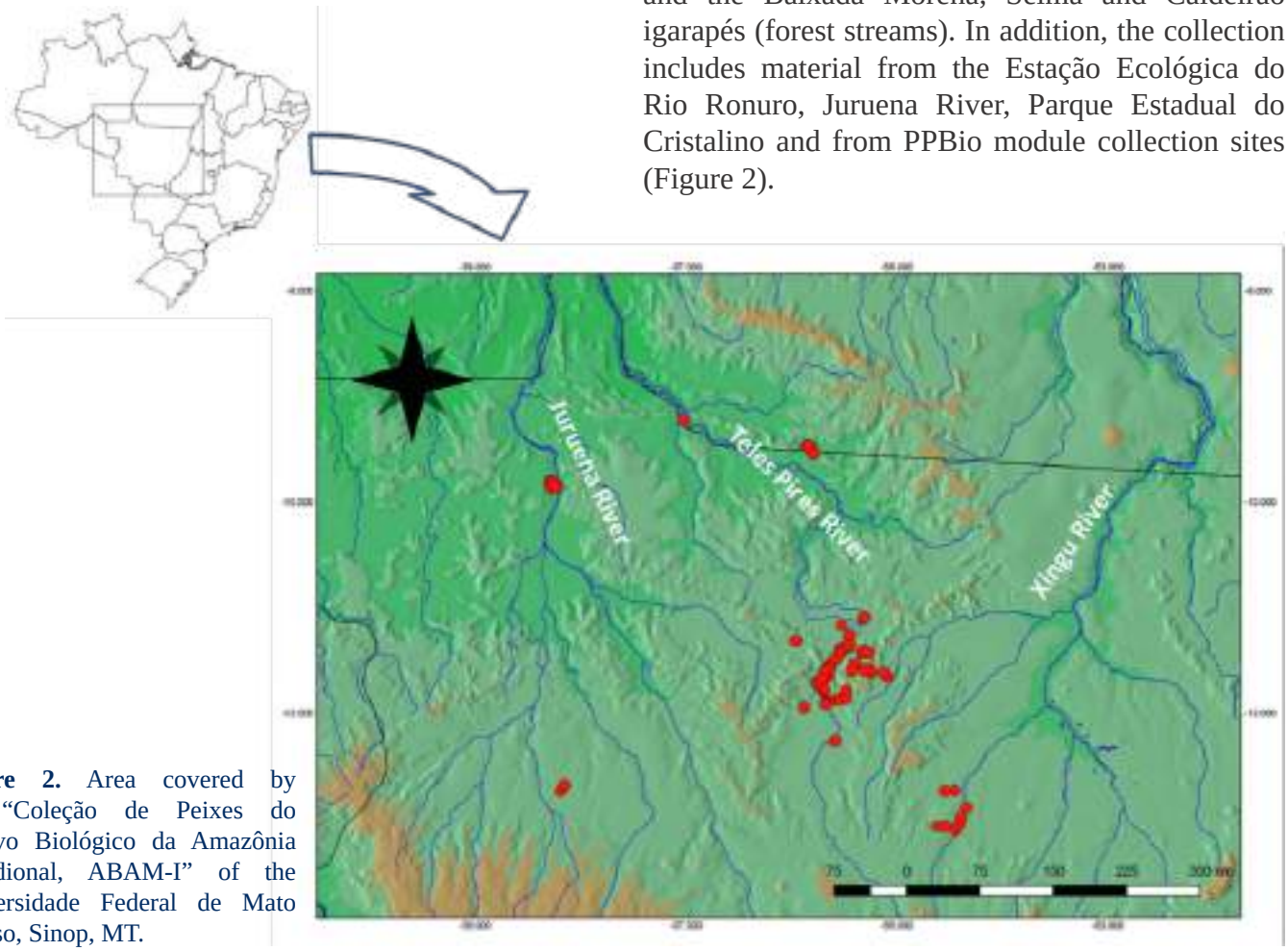

Figure 2. Area covered by the “Coleção de Peixes do Acervo Biológico da Amazônia Meridional, ABAM-I” of the Universidade Federal de Mato Grosso, Sinop, MT.

The collection currently houses 3,023 lots, comprising 19,309 specimens from 354 species, in 38 families. All are Neotropical continental freshwater, and are from the following orders: Myliobatiformes, Osteoglossiformes, Characiformes, Siluriformes, Gymnotiformes, Cyprinodontiformes, Cichliformes, Perciformes, and Synbranchiformes. The most well-representative families are Characidae, with 1,094 lots, followed by Loricariidae, with 341 lots and Cichlidae, 227 lots. The collection is organized according to systematic order following CLOFFSCA (Reis *et al*., 2003).

The species more abundat are: *Moenkhausia phaeonota* Fink, 1979 with 2214 specimens, *Jupiaba acanthogaster* (Eigenmann, 1911), with 1,356 specimens, *Moenkhausia lepidura* (Kner, 1858), with 1,327 specimens, *Pamphorichthys scalpridens* (Garman, 1895), with 834 specimens and *Curculionichthys luteofrenatus* (Britski & Garavello, 2007), with 770 specimens (Fig. 7). There are also fish larvae of: *Acestrorhynchus* sp., *Brycon* sp., *Hydrolycus* sp., and *Sorubim* sp. In addition, there are 1,235 tissue samples from several groups, available for molecular studies. The LIT also has a teaching collection for undergraduate use and outreach projects for visiting primary and secondary schools from the region.

Two new species have already been described from material collected in the region: *Centromochlus meridionalis* Sarmento-Soares, Cabeceira, Carvalho, Zuanon & Akama, 2013, a small Auchenipteridae sampled from the Teles Pires river affluents, near the cities of Cláudia and Sinop in Mato Grosso State (Sarmento-Soares *et al*., 2013), and *Hyphessobrycon pinnistriatus* Carvalho, Cabeceira & Carvalho, 2017, a small tetra (Characidae), collected by the LIT team in the streams in "Parque Estadual do Cristalino" and Teles Pires river tributaries, also near Sinop (Carvalho *et al*., 2017). Both species inhabit of first and second order streams in the Tapajós-Juruena ecoregion (*sensu* Abell *et al*., 2008).

Currently, the collection contains no types. All data from the LIT ichthyological collection will soon be made available in via the collections databases (SpeciesLink and SIBBr). This will allow analysis and exchange of the material with specialists, in addition to loan of materials. Loan applications may be made to the curator of LIT.

In summary, the ABAM ichthyological collection is an important collection of fish from the northern part of Mato Grosso State, with great potential for studies in fish systematics, biology and ecology of the region, and their effective conservation in the wild.

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Name and acronym	Coleção de Peixes do Acervo Biológico da Amazônia Meridional, ABAM-I
Institution	Universidade Federal de Mato Grosso, Câmpus Universitário de Sinop
Address	Av. Alexandre Ferronato, 1200, Setor Industrial. Cep: 78557-267. Sinop, Mato Grosso, Brasil.
Curator(s) and contact(s)	Lucélia Nobre Carvalho, carvalholn@yahoo.com.br
Website	None
Year of foundation	2010
Facilities and area of the collection	Own building, with material preparation area, equipment room with magnifying loupes and microscopes with cameras couplings for high definition imaging and videos. The building is 200m^2 in total area, with 65m^2 devoted to the collection.
Number of visitors per year (average considering 2015, 2016, 2017)	-
Number of loaned lots per year (average number considering 2015, 2016, 2017)	-
Specimens habitat	100% freshwater fishes
Specimens origin	Brazil, Teles Pires river basin
Current cataloging method	Not yet.
Total number of lots and number of lots from Neotropical region	3,023
Total number of specimens and number of specimens from Neotropical region	19,309
Total number of holotypes and number of holotypes from Neotropical region	None yet
Total number of paratypes and number of paratypes from Neotropical region	None yet
Number of tissue samples from Neotropical fishes	1,247
Number of C&S specimens	None yet
Number of dry skeleton specimens	None yet

FISH COLLECTION

LSU MNS
The Louisiana State University Museum of Natural Science Fish Collections: An important modern collection of Neotropical fishes and DNA

Prosanta Chakrabarty, William B. Ludt & Seth Parker

The Louisiana State University Museum of Natural Science (LSU MNS) was founded in 1936 but a Curator of Fishes was not hired until John Michael Fitzsimons in 1970. Most of the first 50 specimens Dr. Fitzsimons catalogued were from Mexico, beginning a great tradition of Neotropical ichthyological research at LSU. Soon after the retirement of Dr. Fitzsimons another University of Michigan graduate, Prosanta Chakrabarty took over curation of the collections in 2008. He is currently an Associate Professor in the Department of Biological Sciences at LSU, and the Curator of Fishes at the LSU MNS. The LSU MNS collections represent 46 countries including all Central American nations, which have been a focus of the Fish Lab at LSU since two major National Science Foundation grants were obtained (see Acknowledgments). Almost 10,000 DNA samples have also been added since 2008 making it one of the fastest growing DNA collections in the U.S. (H.J. Walker, Scripps Institution of Oceanography, pers. comm.). The DNA collection represents 1,417 species while the Fish Collections as a whole comprise 380,863 specimens representing 2,417 species from almost every major group of bony and cartilaginous fishes. The collections are searchable via GBIF, iDigBio, VertNet and FishNET2, (search under LSUMZ) and all collections data are entered through Specify 6.

A major component of the work done at the LSU MNS Fish Lab includes providing researchers around the globe with loans. In 2015, 71 lots were loaned, in 2016 - 28 lots, and in 2017 - 93 lots. The LSU Museum of Natural Science includes 3,439 lots of fishes from the Neotropics. The country with the most specimens in our collections, including the U.S., is Honduras. These Honduran collections stem largely from the efforts of former postdoctoral fellow Wilfredo Matamoros and former Ph.D. student Caleb McMahan. Our holdings include a single holotype specimen from the Neotropics, *Profundulus kreiseri*,

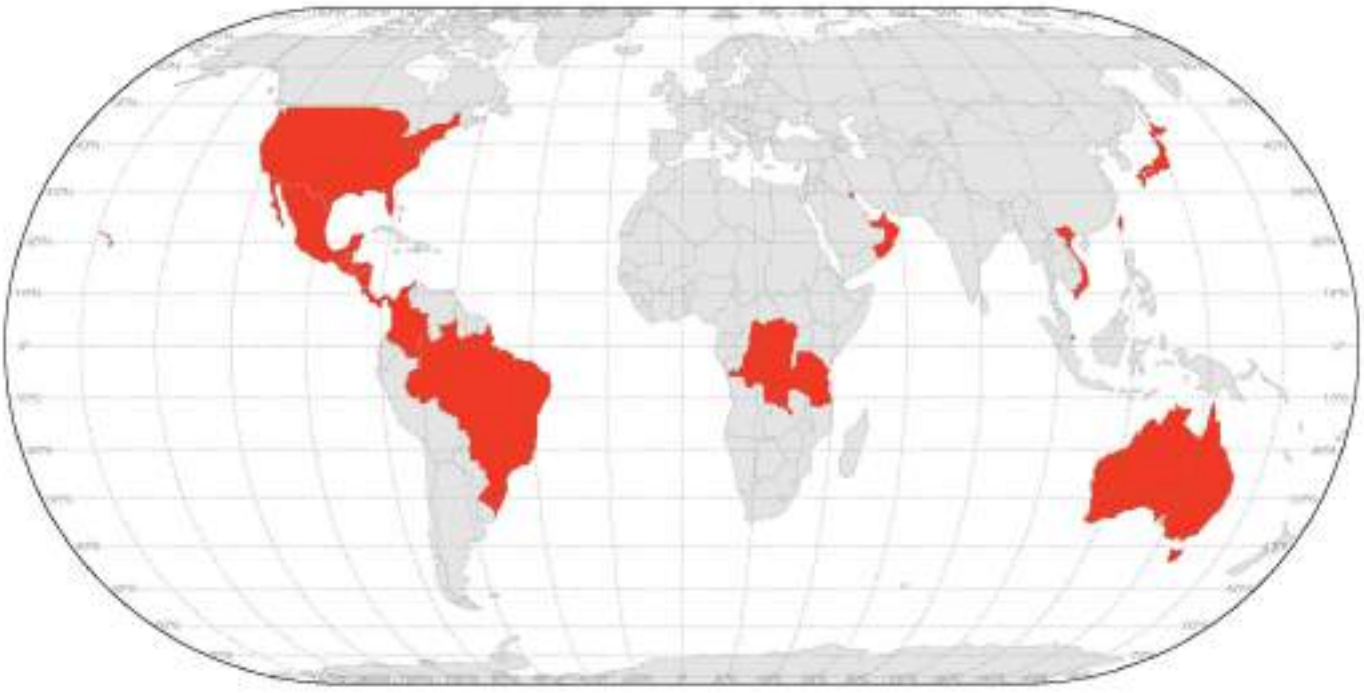

Figure 1. A map containing localities of countries represented in the LSU MNS Fish collection.

Figure 2. A map containing localities of lots in South and Central America in the LSU MNS Fish collection.

from Honduras (Matamoros *et al*. 2012) but holdings also include paratypes of *Caecieleotris moorsi* from Mexico (Walsh and Chakrabarty, 2016) and *Roeboides bussingi* from Costa Rica (Matamoros *et al*. 2013). There are 14 cleared and stained specimens, and 13 dried specimens in the collections. Internal anatomy is typically examined through dissection or radiographs and the Fish Section has a Faxitron x-ray cabinet. The Fish Section prep area includes 500 square feet of dedicated office/laboratory space fully equipped for morphological studies, data analysis, and photography. There is an Olympus SZX16 microscope equipped with a camera and a camera lucida; there are also several other smaller scopes.

There are over 5031 tissue samples from the Neotropics, representing more than half of the total DNA samples in LSU's Fish Collection. This also represents one of the largest collections of Neotropical fish DNA in the world, and perhaps the best from Central America. The LSU MNS molecular genetics laboratory is a fully equipped modern facility outfitted for all aspects of molecular population genetic and systematic work including nucleic acid isolation, PCR, cloning, and DNA sequencing of genomic fragments. There are several -20˚ C, and -80˚ C chest freezers (3' X 3' X 5') and several 5' standing refrigerators with freezer and cold storage compartment for storing molecular lab materials. The Museum's frozen tissues collection is one of the largest of its kind in the world and much of those are stored in liquid nitrogen tanks. Louisiana State University has a large shared genomics facility with an Ion Torrent, Illumina GAIIx, among other next-generation sequencing equipment.

Figure 3. Image of a portion of the newly renovated fish collections at Louisiana State University.

The Fish Section at the LSU MNS currently includes four PhD students, a Postdoctoral Fellow, and a Postdoctoral Research Associate, along with six undergraduate students. There is also a dedicated collections manager, who is split with the Herpetology Section. Besides the Neotropical collections the Fish Section of the LSU MNS has substantial holding from the northern Gulf of Mexico and Louisiana, the Hawaiian Islands, the Middle East and much of the Indo-West Pacific (https://prosantastravels.shutterfly.com/). More than 150 research papers, theses, and dissertations have been based wholly, or in part, on this collection of fishes. Forty graduate students (20 M.S. and 20 Ph.D.) completed degree programs with research based wholly, or in part, on the Museum's fish collection. Until recently, these collections were held in two large rooms (totaling 1200 sq ft) in the Gym Armory Building on LSU's Central Campus; the collections were moved in July 2019 into a new space in the Museum of Natural Science's Foster Hall; a space that is 2000 sq ft. The collections were also moved from static shelving to more modern compactors with an advanced fire-suppression system (Figure 3). This move has been supported by the National Science Foundation (see Acknowledgments) and the LSU administration.

In recent years, Neotropical research in the Fish Section has included the description of new species (Matamoros *et al.*, 2012, 2013; Walsh and Chakrabarty, 2016), higher taxonomy (McMahan *et al.*, 2015), discovery of invasives and non-natives (Matamoros *et al.*, 2016; Elías *et al.*, 2018), biogeography and phylogeography (Bacon *et al.*, 2015a, 2015b; Matamoros *et al.*, 2015; Bagley *et al.*, 2016; McMahan *et al.*, 2017; Ludt *et al.*, 2015, 2018; Tagliacollo *et al.*, 2017) phylogenomic research (Chakrabarty *et al.*, 2017; Burress *et al.*, 2018; Alda *et al.*, 2019), mitogenomics (Alda *et al.*, 2017, 2018), morphological studies (McMahan *et al.*, 2017b; Evans *et al.*, 2017) and behavior (Oldfield *et al.*, 2015). The main focus of the LSU MNS Fish Section is to carry out collections-based research to better understand the Fish Tree of Life in order to explain Earth history and evolution. The collections are also used in teaching classes, tours for the general public, and for other outreach activities.

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Louisiana State University, Museum of Natural Science, Department of Biological Sciences, Baton Rouge, Louisiana, USA 70803; E-mail: prosanta@lsu.edu (corresponding author)

Name and acronym	Louisiana State University Museum of Natural Science, LSU MNS; LSUMZ
Institution	Louisiana State University
Address	LSU Museum of Natural Science, 119 Foster Hall, Baton Rouge, Louisiana 70816 USA
Curator and Contact	Prosanta Chakrabarty (curator); Seth Parker (collections manager)
Website	http://www.lsu.edu/mns/collections/ichthyology.php
Year of Foundation	1970
Facilities and area of the collection	2000 sq ft
Number of visitors per year (average considering 2015, 2016, 2017)	100 (mostly student groups)
Number of loaned lots per year (average number considering 2015, 2016, 2017)	2015 (71 lots), 2016 (28 lots), 2017 (93 lots), 2018 (145 lots)
Specimens habitat	Both marine and freshwater; 60% freshwater, 40% marine
Specimens origin	Nearly 50 countries, Amazon, Mississippi, Persian Gulf, Gulf of Mexico, Atlantic, Indo-West Pacific
Current cataloging method	Specify 6.7
Total number of lots and number of lots from Neotropical region	20,998 lots (3,439 from the Neotropics)
Total number of specimens and number of specimens from Neotropical region	380,871 specimens (42,967 from the Neotropics)
Total number of holotypes and number of holotypes from Neotropical region	Holotypes (1) from Neotropics (1)
Total number of paratypes and number of paratypes from Neotropical region	Paratypes (17) from Neotropics (9)
Number of tissue samples from Neotropical fishes	5,031
Number of C&S specimens	14
Number of dry skeleton specimens	13

FISH COLLECTION

MBUCV-V
The Fish Collection at the Museo de Biología de la Universidad Central de Venezuela

Alberto Marcano, Ana Bonilla & Francisco Provenzano R.

Beginnings of the Fish Collection are linked to the creation of the Museo de Biología de la Universidad Central de Venezuela (MBUCV). Foundation date of MBUCV is pointed in the memoirs of the Central University of Venezuela (UCV), where this paragraph appears: *"Later, at the beginning of **1949**, Professor Janis Rácenis (Head of the Department of Zoology) and Bachelor Janis Roze, collected more than 3,500 specimens at Rancho Grande National Park. With the idea of maintaining, preserving and conserving the collected samples, the Biology Museum of the Central University of Venezuela (MBUCV) was founded in **September of same year**, by decision of Dean Rafael De León"* (Memoirs 1948-1951 ref 83, No. 100, Historical Archive of the Central University of Venezuela). Development and evolution of MBUCV, and the Fish Collection do not have a detailed written record. From its foundation until the year 1958, the MBUCV belongs to Department of Natural Sciences belonging to Faculty of Physics and Mathematics (today, Faculty of Engineering, UCV). The Department was transformed into a School of Sciences, directed by Tobias Lasser, with a manifest orientation towards Biology. In 1958, Faculty of Sciences (UCV) was founded and the MBUCV became part of Biology School, included into the new faculty. In September 1965, a group of professors and researches of the MBUCV founded the Institute of Tropical Zoology (Instituto de Zoología Tropical, IZT) and the MBUCV is ascribed of the new institute. Finally, in 2010, the IZT is reorganized and changes its name to Institute of Zoology and Ecology Tropical (Instituto de Zoología y Ecología Tropical, IZET) with three research centers, one of which is the Center Museum of Biology UCV (Centro Museo de Biología de la UCV or Centro MBUCV) which will be in charge of directing the MBUCV, together with the IZET management.

Figure 1. Storage area and detail of rolling shelves, MBUCV Fish Collection.

In its early period, Fish Collection of the MBUCV devoted more attention to collects in marine environment, but captures were also made in freshwater. Among first collectors are professors, students and technicians of the Department of Natural Sciences, School of Sciences and School of Biology, as well as collaborators of other institutions, among which we can mention: Janis Rácenis, Janis Roze, Agustín Fernández Yépez, Felipe Martín Salazar, Franz H. Weibezahn, José Luis Méndez Arocha, Gonzalo Medina Padilla, Manuel Vicente Ramírez, Charles Ventrillon and Antonio Bodini, among many others. Professors Franz H. Weibezahn and Francisco Mago-Leccia were in charge of the Fish Collection, but when IZT is created, Prof. Mago-Leccia take charge of Fish Collection and decides to give priority to the collects in freshwater environments, giving special attention to the savannas (llanos) region of Venezuela, Orinoco River basin. From that time, Laboratory of Ichthyology of the IZT, and Fish Collection of the MBUCV promote and carry out an appreciable amount of expeditions and projects throughout the geography of Venezuela, many with international cooperation, mostly US researches and colleagues. These expeditions allowed incorporating a large number of specimens that, today, make up and

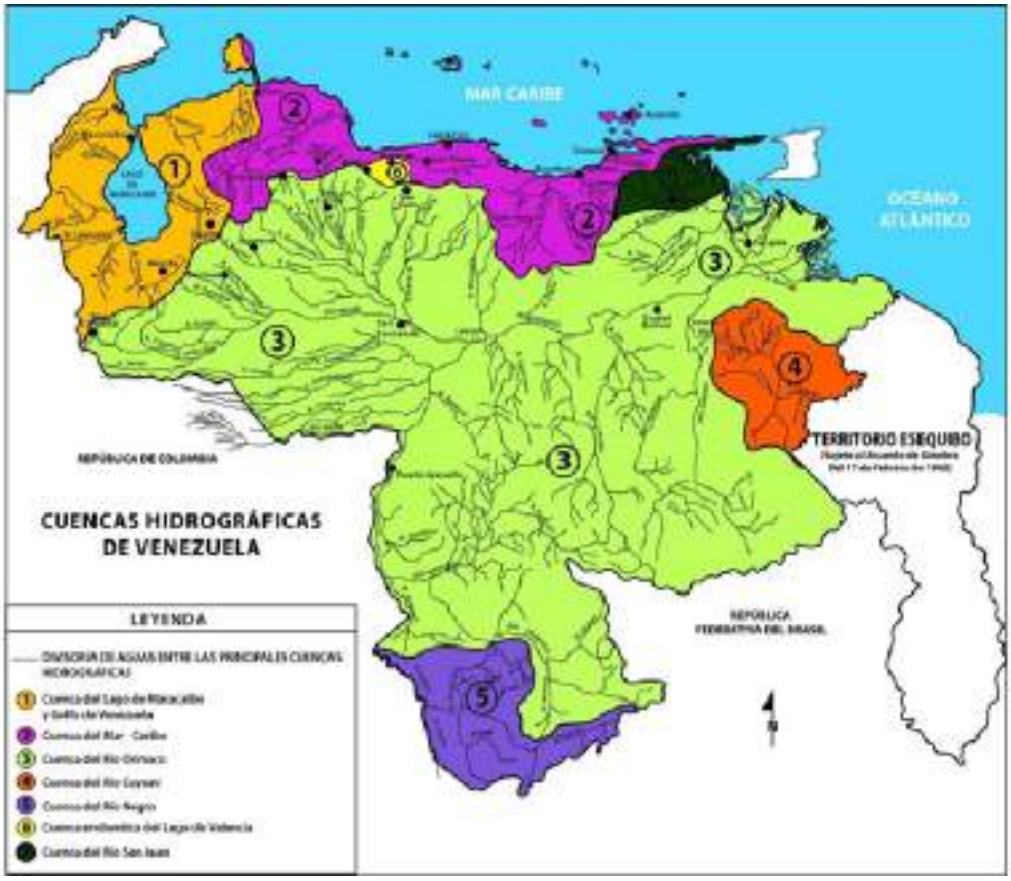

Figure 2. Principal hydrographic basins of Venezuela.

represent one of the best collections of freshwater fish in South America. The diversity of groups incorporated in the collection, added to the spatial and temporal variety of collections, determines that Fish Collection of the MBUCV is obligatory reference center in ichthyological studies at local, regional, and continental level.

Unfortunately, in recent years the activities, and the support provided by the Fish Collection of MBUCV to the national and international scientific community have been diminished due mainly to the political, social and economic situation in Venezuela. In spite of this, the collection and the information it houses are maintained thanks to the institutional support and the effort and mysticism of the professionals and technicians assigned to the Fish Collection and the Center MBUCV.

Description. Fish Collection of the MBUCV is located on the ground floor of the building of Instituto de Zoología y Ecología Tropical (IZET), Faculty of Sciences, UCV, Paseo Los Illustres, Los Chaguaramos, Caracas. It has a storage area of approximately 125 m^2. The cataloged lots are stored in numerical order in mobile shelves (Fig 1). All cataloged lots are stored in 70% ethanol, in transparent glass containers of various capacities or in large-capacity plastic containers. Each lot has its respective label with all available data and its respective catalog number. To date, there are more than 35,500 cataloged lots. The collection has a double cataloging system, physical on catalog books, and digital a database built on Microsoft Excel spreadsheets. All type specimens (holotypes and paratypes) are properly denoted (labeled with a red band) and stored in numerical order, on first shelve. The collection has more than 670 cataloged lots of type specimens. Additionally, the collection has two sub-collections; one with cleared and stained specimens, and another of dry skeletons. There are almost 2,400 C&S specimens, and some 350 dry skeletons. Thanks to ACSI project support, the type specimens of Order Siluriformes, deposited in Fish Collection MBUCV, were photographed and are available in a bank of images via internet. In addition, via internet, the list of all the type specimens at the Fish Collection is offered. It has not been possible to develop a tissue collection for molecular analysis.

Geographic and temporal representation of the Fish Collection at MBUCV is very significant. Samples come mainly from the Llanos of Venezuela, which are part of the Orinoco River basin, and extend to Colombia. The Llanos region possesses one of biggest richness of freshwater fish species

worldwide. Additionally, Guiana Shield region (Bolívar and Amazonas States), also belonging to the Orinoco river basin, contributes with a significant number of species and lots cataloged. Next, in order of importance in number of species and cataloged lots are: Maracaibo Lake Basin, the Caribbean Sea Basin (which groups several aquatic systems that flow directly into the sea), the Cuyuní River, the Negro River (Amazon River basin), the Gulf of Paria or San Juan River basin, and Valencia Lake (Fig. 2). Fish Collection at MBUCV also has cataloged lots of specimens from Colombia, Peru, Brazil, USA, among others.

Fish Collection at MBUCV, has counted and has a group of professionals and technicians who have allowed and allow its development, maintenance and operation. The curators of the collection were: Dr. Francisco Mago-Leccia, Dr. Antonio Machado-Allison and Dr. Francisco Provenzano Rizzi and the technicians: Mr. Luis Duque, Mr. Florencio Gil, Mr. Leonidas Aguana and Narciso Padilla. Currently, Dr. Ana L. Bonilla (ana.bonilla@ciens.ucv.ve) is the curator and Mr. Alberto Marcano (alberto.marcano@ciens.ucv.ve) the technician. The e-mail: peces.mbucv@gmail.com

Centro Museo de Biología, Instituto de Zoología y Ecología Tropical, Facultad de Ciencias, Universidad Central de Venezuela, Apartado 47058, Caracas 1041-A, Venezuela

Name and acronym	Museo de Biología de la Universidad Central de Venezuela. MBUCV-V
Institution	Universidad Central de Venezuela, Facultad de Ciencias, Instituto de Zoología y Ecología Tropical, Centro MBUCV
Address	Avenida Paseo Los Ilustres, Los Chaguaramos, Caracas, Venezuela. Apartado 47058
Curator(s) and contact(s)	Ana Bonilla (Curator) ana.bonilla@ciens.ucv.ve Alberto Marcano (Technician) alberto.marcano@ciens.ucv.ve
Website	izt.ciens.ucv.ve/mbucv/peces/ mail: peces.mbucv@gmail.com
Year of foundation	In 1949, Museo de Biología de la Universidad Central de Venezuela (MBUCV) is founded. In 1958, is ascribed to Facultad de Ciencias, UCV. From 1965, is part of IZET, UCV
Facilities and area of the collection	Facilities of the collection comprise a storage area of 125 m^2 with 15 rolling shelves, and 12 wooden and 6 metal shelves, fixed. Additionally, has an external area for washing and separating samples and a deposit. Storage area has a large meson where the cataloging process is carried out, and also is used for visitors work.
Number of visitor per year (2015, 2016, 2107)	Very few in the last years. 2 visitor/year in average
Number of loans per year (2015, 2016, 2017)	Very few in the last years. 10 lots/year in average
Specimens habitat	Freshwater 99.16% Marine and others 0.84%
Specimens origin	Mostly from Venezuela and from the Orinoco River basin, and some lots from other countries: Brazil, Colombia, Ecuador, Peru, Guyana, Suriname, Trinidad and Tobago, Panama, Bolivia, Argentina, Chile, French Guiana, Guatemala, Nicaragua and Uruguay
Current cataloging method	Traditional method, with books of catalog and a digital databases, using Microsoft Office Excel 2007
Total number of lots and number of lots from Neotropical region	Total 35,784 cataloged lots, 35.605 from Neotropical region
Total number of specimens and number of specimens from Neotropical region	Total 392,619 specimens, 391,531 from Neotropical region
Total number of holotypes and number of holotypes from Neotropical region	Total 128 Holotypes lots, all from the Neotropical region
Total number of paratypes and number of paratypes from Neotropical region	Total 548 Paratypes lots, all from the Neotropical region
Number of tissue samples from Neotropical fishes	
Number of C&S specimens	2,399 specimens C&S
Number of dry skeleton specimens	Nearly 350 specimens

FISH COLLECTION

MCN
Fish collection of Museu de Ciências Naturais

Vinicius A. Bertaco & Marco A. Azevedo

The ichthyological collection was initiated in 1955 with the creation of the Museu Rio-Grandense de Ciências Naturais subordinated to the Secretaria de Educação and Cultura do Estado. In 1972, with the establishment of the Fundação Zoobotânica do Rio Grande do Sul, the Museum changed its name to Museu de Ciências Naturais. The curators were Thales de Lema (1955-1976), Karin M. Grösser (1976-2005), Dr. Marco A. Azevedo (2005-2012), and Dr. Vinicius de Araújo Bertaco (since 2012). Over the decades, many projects developed in the Ichthyological Laboratory of the Museum helped to increase the fish collection, including inventories in conservation areas (Parque Estadual de Itapuã, Estação Ecológica do Taim, Parque Estadual do Delta do Jacuí, RS, and Parque Nacional da Chapada dos Veadeiros, GO) and hydroeletric power plants (Itaúba, RS, Itá RS/SC, Corumbá and Serra da Mesa, GO) (Figure 1). The collection has 20.073 ethanol preserved lots, including a few lots of skeletal, taxidermized and cleared and stained specimens (Figures 2-3).

The collection is represented by 28 orders, 130 families and about 1.000 species, all from Neotropical region. The type-collection is represented by 34 species (six holotypes and 95 lots of paratypes), near almost from South Brazil and the most described in the last decade. A new computer data bank is being installed now in the Museum in order to help maintenance and control of the institutional collections.

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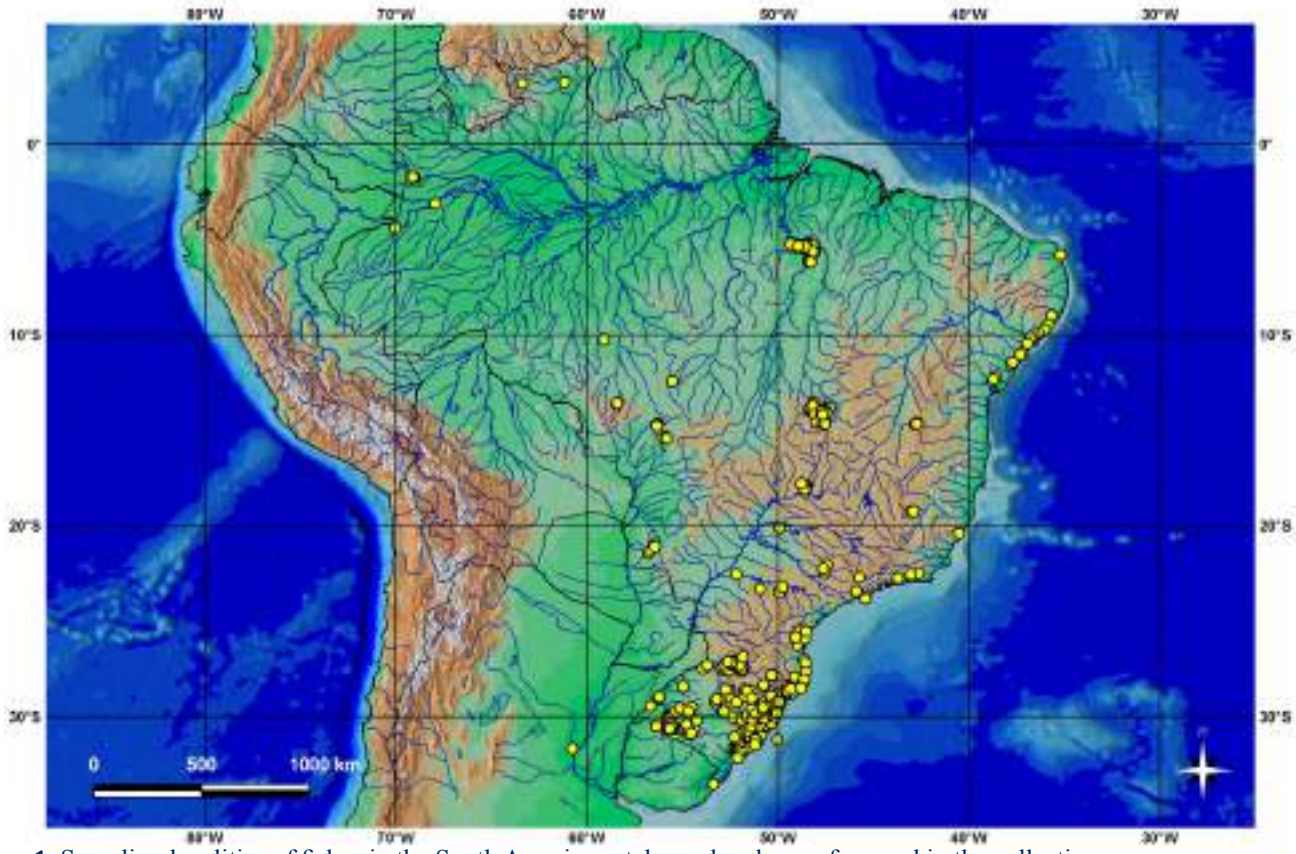

Figure 1. Sampling localities of fishes in the South America catalogued and georeferenced in the collection.

collected area in South America – a case study of the current knowledge of Neotropical fish diversity. Zootaxa, 4138 (3): 401-440.

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Figure 2. Fish collection room of Museu de Ciências Naturais.

Figure 3. Fish collection room of Museu de Ciências Naturais (200 liter gallons with large fish).

Name and acronym	Museu de Ciências Naturais, MCN
Institution	Fundação Zoobotânica do Rio Grande do Sul, Secretaria do Meio Ambiente e Infraestrutura
Address	Av. Dr. Salvador França, 1427, 90690-000 Porto Alegre, Rio Grande do Sul, Brazil
Curator and contact	Dr. Vinicius de Araújo Bertaco vinicius-bertaco@fzb.rs.gov.br
Website	http://www.mcn.fzb.rs.gov.br/
Year of foundation	1955
Facilities and area of the collection	Vertebrate collections room with about 200 m^2. The collection of fish types is in the ichthyology laboratory room.
Number of visitors per year	10
Number of loaned lots per year	05
Specimens habitat	94.8% freshwater; 5.2% marine
Specimens origin	95% of specimens are from Brazil, of which 81% are from Rio Grande do Sul State
Current cataloging method	Excel Software.
Total number of lots and number of lots from Neotropical region	20,073 lots; 20,055 lots
Total number of specimens and number of specimens from Neotropical region	81,037 specimens
Total number of holotypes and number of holotypes from Neotropical region	6
Total number of paratypes and number of paratypes from Neotropical region	309
Number of tissue samples from Neotropical fishes	No tissue samples
Number of C&S specimens	10
Number of dry skeleton specimens	36 specimens (incomplete)

FISH COLLECTION

MCP
The Fish Collection of the Museu de Ciências e Tecnologia of PUCRS

Zilda Margarete S. de Lucena, Carlos Alberto S. de Lucena & Roberto E. Reis

The fish collection of the Museu de Ciências e Tecnologia da Pontifícia Universidade Católica do Rio Grande do Sul (PUCRS) began in 1967, concomitant with the founding of the Museum, when the fish collection occupied an area of 18 m^2 in the Laboratório de Ciências do Mar. After 1995 the Museum was moved to a brand new building and the fish collection currently occupies five rooms in the building basement, totaling approximately 280 m^2, one of them exclusively to house type-specimens (Fig 1). The collection infrastructure is also composed of a 220 m^2 laboratory, with all necessary equipment for research and curation, including molecular work facilities.

The oldest collection lots, from 1911 to 1945, are originated from other countries and were obtained by exchange with foreign institutions. The oldest specimens from Brazil were collected in 1945 – paratype of *Gymnotus bahianus* from Bahia – and in the 1950´s. In the 1960´s and 1970´s, collection expeditions were mainly performed in south Brazil, in fieldwork of the Natural History undergrad course of the PUCRS, when most of the marine fishes in the collection were captured. During the 1980's the fish collection was incremented by means of fieldwork related to Environmental Impact Assessment for hydroelectric dam construction, especially in the Uruguay River. Among large expeditions are those in 1989 and 1991, which explored the drainages of Rio Grande do Sul and Santa Catarina, in partnership with the Smithsonian Institution (Neotropical Lowland Research Program) and Museu de Zoologia da Universidade de São Paulo. Almost 600 lots were obtained and new species from that material are still described today. In the 1990´s and 2000´s, most important were the expeditions to Bahia and Minas Gerais in 1992 and 1993, to Tocantins, Pará and Maranhão in 1998, to the Tapajós River and coastal drainages of Northeastern Brazil in 2001 and 2002, the Transcontinental Expedition in 2004 (Fig. 2) to the southern tributaries to the Amazon River, supported by the All Catfish Inventory Project and involving several Brazilian and North American institutions, and the Lower Amazon Inventory Survey in the lower Amazon River and its tributaries. A catalog of all marine fishes in the collection was published by Lucena & Lucena (1981, 1982), who listed above 7,000 lots, totaling 271 species. At that time, the collection had around 1,000 lots of 174 species of freshwater fishes, almost 40% collected in 1982. Currently, with 54,200 lots cataloged as of July 2019, totaling more than 515 thousand specimens (Tab. 1), the fish collection is among the largest in Brazil in number of catalogued lots, geographic coverage (Fig. 3), number of species (3,707), and number of type-specimens. The majority of the collection (96%) represents the Brazilian biodiversity (Fig. 4), 3% are from other countries in South and Central America, and 1% from other continents.

Figure 1. Type-specimens collection room.

Most of the lots cataloged are freshwater fish from Brazil, especially from south and southeast rivers drainages and the basins of the São Francisco, Amazonas, and Paraná-Paraguay rivers. There is also a good representation of marine species from the coast of Rio Grande do Sul and Santa Catarina states. The collection holdings contain 82% of the currently threatened species of the Rio Grande do

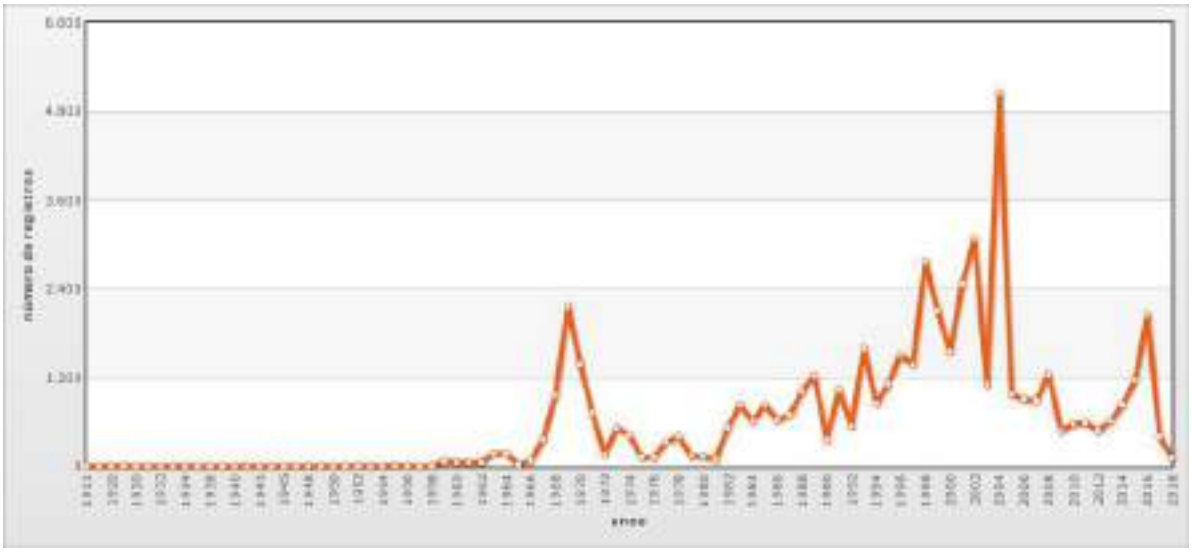

Figure 2. Number of lots per collection year. Available from: http://www.splink.org.br/

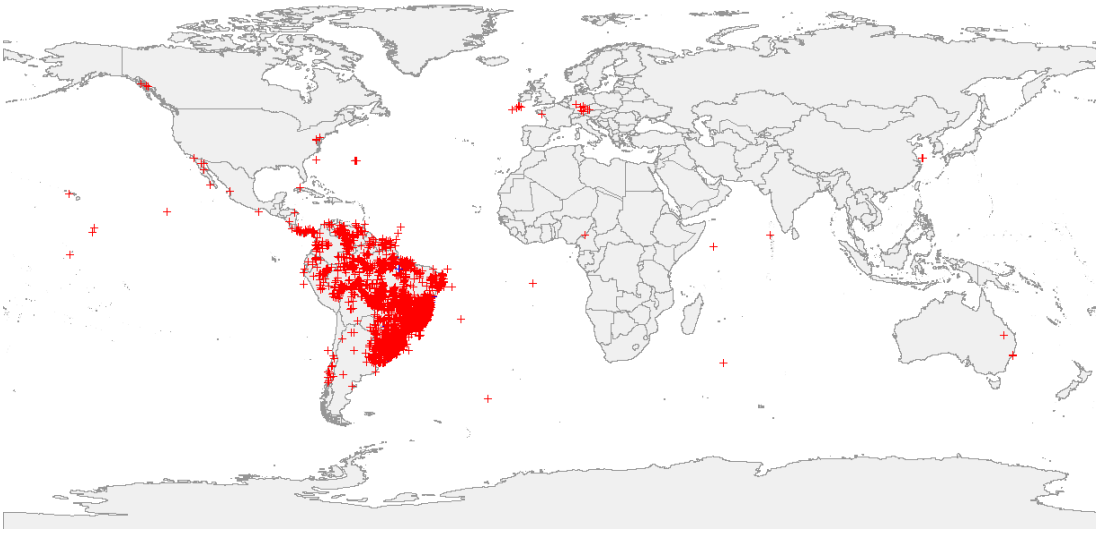

Figure 3. Geographic distribution of collection lots globally. Available from: http://www.splink.org.br/

Sul State, including 24 of the 26 threatened species of annual fishes (Rivulidae), and 36% of the threatened species officially listed for Brazil. The most highly represented family in the collection is Characidae (26% of the total), followed by Loricariidae (14.5%), and Cichlidae (7%) (Fig. 5), with a significant representation of Gymnotiformes. There are currently 320 primary types – 315holotypes and five neotypes – and 18,842 paratypes representing 655 species. High resolution images of the primary type specimens are

Figure 4. Geographic distribution of collection lots in South America. Available from: http://www.splink.org.br/

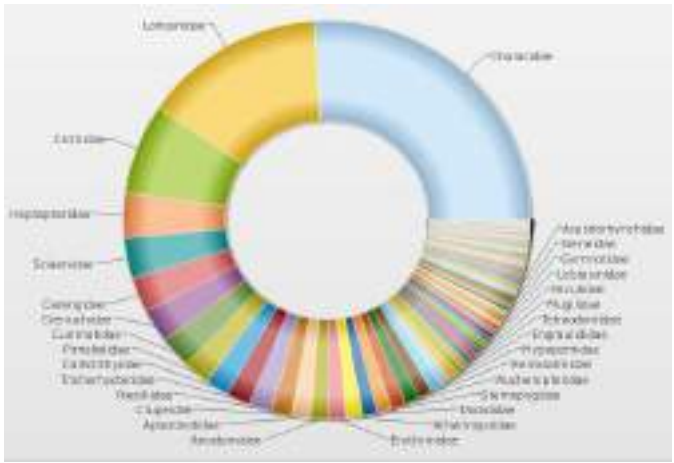

Figure 5. Proportion of collection lots by fish family. Available from: http://www.splink.org.br/

available on the museum website. Collection data used to be recorded in catalogue books until 1988, when collection data began to be computerized with the software MUSE. Computerization allowed the collection to be made available on the Internet after 1991, through the participation in the NEODAT project, which consisted in a distributed database of Neotropical freshwater fishes. Currently, all materials are catalogued and managed with the software Specify, and the online data can be accessed through the museum and the speciesLink websites.

Visitors are offered a room with stereomicroscope, internet access, and all necessary equipments and tools. Visits must be previously scheduled with one of the curators and logged on the website. The collection have actively contributed to the knowledge and conservation of the biodiversity of Rio Grande do Sul and Brazil, with the discovery, documentation and description of new species to science, in the assessment of threatened species, both at regional and global levels, and in the identification of priority areas for conservation. Within the University, the fish collection has a fundamental role and high interaction with the undergraduate course in Biological Sciences and the graduate program in *Ecologia e Evolução da Biodiversidade*, fostering research and formation of human resources. In addition, the fish collection actively participates in education actions and temporary exhibits for the general public, which improves the public awareness of the collection and the related research.

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PUCRS, Museu de Ciências e Tecnologia, Av. Ipiranga 6681, prédio 40, 90619-900 Porto Alegre, RS, Brazil. margarete@pucrs.br (ZML); lucena@pucrs.br (CAL); reis@pucrs.br (RR) (corresponding author)

Name and acronym	Coleção de Peixes do Museu de Ciências e Tecnologia da PUCRS – MCP
Institution	Pontifícia Universidade Católica do Rio Grande do Sul
Curators	Carlos Alberto Lucena (lucena@pucrs.br), Zilda Margarete Lucena (margarete@pucrs.br), Roberto Reis (reis@pucrs.br)
Website	Fish images: http://www.pucrs.br/mct/colecoes/ictiologia/ Database: http://webapp.pucrs.br/colecoesMCT Database: http://splink.cria.org.br/manager/detail?setlang=pt&resource=MCP-Peixes To register a visit: http://www.pucrs.br/mct/colecoes/formulario/
Year of foundation	1967
Facilities and area of the collection	500 m^2
Number of visitors per year (average 2016/ 2017)	16
Number of loaned lots per year	400
Specimens habitat	15% marine / 85% freshwater
Specimens origin	96% from Brazil (52% south, 22% north, 12% central, 10% southeast, 4% northeast region), 3% from others countries of South America and Central America, and e 1% from others places.
Current cataloging method	Specify 6.7
Total number of lots/ number of lots from Neotropical region (freshwater)	54,200 / 45,324
Total number of specimens/number of specimens from Neotropical region (freshwater)	519,772 / 483,429
Total number of holotypes/number of holotypes from Neotropical region	315 / 315
Total number of paratypes/number of paratypes from Neotropical region	18,842 lots (19,820 specimens)
Number of tissues samples from Neotropical region	7,013
Number of c&s specimens	3,869
Number of dry skeleton specimens	32

FISH COLLECTION

MEPN
La Colección de Peces del Ecuador Escuela Politécnica Nacional, Quito-Ecuador

Ramiro Barriga Salazar[1] & Pablo Argüello[2]

Before the arrival of the French mission to the National Polytechnic School (1941), the country did not have a collection of freshwater and marine fish. In 1946, Dr. Gustavo Orcés V., as Ecuadorian counterpart of the French mission, began the collection of freshwater and marine fish, whose results are reflected in the publication of the first list of marine fishes in Ecuador (Orcés V. , 1958). The beginnings are developed in a small infrastructure, which houses about two hundred lots of fish and begins the collection of specialized bibliography, fundamental element for taxonomic research. Progressively, adequate areas for laboratory work were obtained and the specimens were placed in a technical way, thanks to the support of foreign researchers who visited the Polytechnic and advised on the formation of the ichthyological collection. It is necessary to point out that your suggestions have been welcomed until the present time. The use of inputs, such as waterproof paper and India ink, was a radical change in the labeling process. Another fundamental step was the implementation of the physical catalog and, in recent years, the storage of the information in a digitized database. The improvement of the infrastructure has made it possible to better organize the collection, to the point of reaching 19,500 lots. At present, the site is insufficient to meet the technical requirements demanded by the increase of the collection, the research tasks and the implementation of an osteological collection and a molecular biology laboratory. We hope that in the near future, with the government help and the execution of research projects, our technical and scientific needs will be met.

For twenty-five years, the scientific works concerning the fluvial ichthyofauna of Ecuador, have increased the revisions of genera, ecological and fishing information, based on various national and international expeditions. The work carried out in the neighbouring countries, related to the Atlantic and Pacific slopes, has been beneficial for the knowledge of the continental fishes.

The English Günther (1864) published a descriptive catalog, in ten volumes, about the species known in the Neotropics and in Volume V the Ecuadorian freshwater species are described. The collections of J. Orton allowed Cope (1872 and 1878) to publish about the first commercial species of the Amazon; The trips of Buckley and Festae, to the center and south-east, favored so that Boulenger (1887 and 1898), increased the geographic registries and the new species of the native ictiofauna; Everman and Kendall (1905), made the first publications referring to the fish of the high Amazon; Regan (1913) included descriptions of new species and revisions of various genera and families based on the material obtained by Mounsey and the specimens belonging to the main museums of Europe and America; Fowler (1948) elaborated one of the first lists of the South American species, with its geographical distribution, in which new species and additions to the fish fauna of Ecuador were included; of the Academy of Natural Sciences of Philadelphia, Bôhlke (1958) processed the descriptions of the order Characiformes; Ovchynnyk (1968) published the first list of fish in Ecuador, which includes 276 species belonging to 144 genera and 38 families, among which some new species are described, later, in 1971, he published the second list with 306 species of 159 genera and 44 families; The French Gery (1972) generated descriptions of new species and relations of the characids, and the amendments made to the publication of Fowler (1948) are very meritorious. The mentioned publications were based on the fish collection of the National Polytechnic School.

One of the few works that relate to ecological aspects of Ecuadorian ictiofauna was held in Sta. Cecilia, Prov. Of Napo (Saul, 1975), which gathers information on habitat, food preferences and a list of fish collected in this place. The Ecuadorian scientist Gustavo Orcés V., initiated the collections of freshwater and marine fish that exist in our country and allowed him to publish descriptions of new species

and additions to the Ecuadorian ichthyofauna. The majority of these come from Ecuadorian central and south-eastern material; The same author registered new species from the central Ecuadorian Amazon of the genus *Xiliphius* and *Brochis* (Orcés V., 1962); In 1968, Orcés V. dedicated a work to new records of fish from the Santiago River., Prov. Esmeraldas. In 1977, Orcés V. published about the giant catfish of the subfamily Sorubuminae and included an annotated list of 11 species and the description of a new species.

Ibarra and Barriga (1982), in the late seventies and early eighties, conducted a study about the southern fish of Ecuador, for the first time made known their geographical distribution, altitudinal and fluvial hierarchy; Information on the Ecology and Biology of fish that live in diverse habitats of the dry forests of southern Ecuador was also added.

Between 1981 and 1983 the field research was carried out, about the fish from the northeast of Ecuador, in which participated: the department of ichthyology of the Field Museum of Chicago and the Ichthyology section of the National Polytechnic School. The objective of this project was to know the distributional ecology of the ichthyofauna of the Napo river basin. For the first time, 520 species were recorded in the northeastern aquatic environment (Stewart *et al*., 1987 and Barriga 2012); the results included new records of species and the description and revision of new genera and species. The richness and abundance of fish is remarkable to such an extent that the collected material continues to be studied.

Between 1984 and 1987 the ichthyofauna of the northwest of Ecuador was studied, the results (Barriga, 1994) allowed us to know in detail the systematics, ichthyogeography, ecology and biology of the fish of the Mira, Mataje, Santiago and Esmeraldas river basins.

A Rapid Biological Evaluation (RAP) of the ichthyofauna of the main rivers that irrigate the Cordillera de El Cóndorfue executed with the funding of Conservación Internacional de Washington D.C. Barriga, 1997 in: Schulemberg and Awbreyeds (2005).

Barriga (1991) published the third list of freshwater fish in Ecuador, in which 706 species corresponding to 307 genera and 61 families are recorded, distributed by Zoogeographic Floors (Albuja *et al*., 1980). This list confirms that the number of species of freshwater fish is doubled to the number of species published by Ovchynnyk (1971).

The longitudinal zonation of fish from the beaches of the Napo River (Ibarra and Stewart, 1989) is very valuable, since the composition of the community of fish that live on the banks of the fluvial axes is made known.

The Syracuse University and the National Polytechnic School, between the years of 1994 and 1998, studied fish communities and the migration of commercial species (Galacatos and Stewart, 1996). Other comparative studies between the fish communities on the banks of the rivers of the Napo River basin and those that live in the depths are also important (Stewart *et al*., 2002). Galacatos and collaborators (2004), published on the seasonality and habitats of the fish community of the lower Yasuní.

Of great importance is the binational study on the Pastaza river basin, in Ecuadorian and Peruvian territories, executed by the National Polytechnic School and the San Marcos University of Lima-Peru (Willink *et al*., 2005), in which obtained extensive information about the composition of the fish communities of a river in the upper Amazon; the total number of fish species in the basin is 395, which includes new records and new species for science. The aforementioned study contributed to the best taxonomic and ecological knowledge of the ichthyofauna of eastern Ecuador, whose investigations were initiated by Professor Gustavo Orcés V.

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Between 2002 and 2005, fishing potentialities were studied in the northeastern and central Ecuadorian coast (Barriga in prep.). In the sector of Guiyero, the middle basin of the Tiputini River, the ecological study of the fish of this river was carried out (Barriga, 2011). Since 2006 we are reviewing the species of the Astroblepidae family, between the Ichthyology Department of the American Museum of New York and the Ichthyology section of the EPN. At the end of 2012 the Division of Fishes of the Ontario-Canada Museum and Institute of Biological Sciences of the EPN, carried out the field work as part of the project "Systematic review of the genera *Chaetostoma* and *Cordylancistrus*, which inhabit the eastern and western foothills of the Ecuadorian Andes ". The execution of Trinational Projects (Ecuador, Colombia and Peru), carried out at the end of 2013 and the beginning of 2014, have contributed to the conservation of the large protected areas (Cuyabeno, Guepi and La Paya), which have a high diversity of fish , this field research increased the ichthyofauna collection of the EPN. The current knowledge of the Ecuadorian ichthyofauna, is due to the studies of matter from all the watersheds in which altitude is considered as the main variable. (Barriga, 2012).

As an example, the review of the genus *Hemiancistrus* (Provenzano & Barriga 2017) genus that inhabits the different watersheds of the Ecuadorian coast. In this ecological research was carried out in collaboration with the University of Tulane New Orleans, an ecological study was carried out in the Ecological reserve of Machichindul in the basin of the Esmeraldas river.

The Ichthyology section of the EPN also conserves marine ichthyofauna reference material, which was the basis for the publication of the first list of marine fishes in Ecuador and was carried out by Professor Gustavo Orcés V. (1959); So far, it is the only scientific collection, because the universities that were created on the coast, keep only didactic collections.

Figure 1. Main Gate of Biology Department of National Polytechnic School.

Personal. The Department of Biology of the Faculty of Sciences of the EPN staff participates partially in the teaching activities to the different faculties of the Polytechnic as: Agroindustry, Chemistry, Geology, Environmental and Sciences having. Undergraduate theses of Ecuadorian and foreign students have been directed at undergraduate, master's and doctorate levels in Ichthyology. Therefore, the main activity of the staff is research and, on certain occasions, lectures are given related to the richness of species, ecology, biology and fisheries of freshwater fish, which inhabit the different watersheds of Ecuador.

The funding source of the Institute of Biological Sciences, comes from the funds that the Ecuadorian government assigns to state universities to cover, salaries, maintenance of vertebrate collections, the purchase of supplies such as alcohol, jars and waterproof paper ; Another source of income comes from the execution of research projects and extension works in which environmental impact studies are included.

Within the staff working in the Ichthyology section there is a Curator (Dr. Ramiro Barriga Salazar) a digitizer who is responsible for the management of the database (Lic. Pablo Arguello and Mr. Ronny Hualpa) and a person who is responsible for the maintenance of the collection: level of alcohol, change of lids, jars and laboratory cleaning (Mr. Manuel Muñoz).

There is a guest ichthyologist Dr. Francisco Provenzano, fish curator of the Institute of Tropical Zoology of the Central University of Venezuela who accompanies us in the taxonomic research of the Loricariidae family.

The Ecuadorian ichthyology and especially the polytechnic community together with the Museum of Zoology of the University of Sao Paulo has had the pleasure of beginning the study in 2017 about the revision of the Cetopsidae, Trichomycteridae and Heptapteridae families. The previous year the first expedition of the aforementioned study in the hydrographic basins of the Ecuadorian coast was completed.

The collection. Most of the collection is preserved in liquid, some cleared and stained species and in skeletons and there is a collection of tissues that supports current and future studies of molecular systematics; The collection of fabrics is made based on the regulations established by the Ecuadorian government.

The specimens are immersed in 73° alcohol. Those that exceed a long standard greater than 40 cm are deposited in plastic tanks, with a capacity between 4 and 10 gallons of ethyl alcohol. The preserved fish are stored in glass jars and a few in plastic jars, the same ones that are secured with plastic lids. Each glass bottle corresponds to a lot and inside, has a waterproof paper label, which contains the name of the town, the field code, the province, watershed, date of collection, collectors and the catalog number.

In order to confirm the identification of some species, skeletons are prepared (in dermstars) and diaphanization is also carried out, according to established protocols (Taylor & Van Dick 1985); After carrying out this procedure, the specimens are stored in small plastic trays containing 80% glycerin. Additionally, to clarify the systematics of some species, we are resorting to the extraction of tissues, to proceed with the amplification and sequencing of DNA.

In the collection room there are specimens that were collected according to a distributional ecology: On the coast, from sea level (0 meters above sea level), to 3200 meters above sea level in the Ecuadorian highlands; In the Amazon, from 190 masl to 3300 masl. The collections, made and present in the halls, come from the different hydrographic basins and belong to all the Ictiohydrographic Zones of Ecuador (Barriga 2012). The specimens entered from the execution of national projects financed by the SENESCYT, the EPN, sectional governments such as PREDESUR, Provincial Councils; International projects funded by the Field Museum of Chicago, the American Museum of New York, Smithsonian, the Royal Ontario Museum of Canada, the Harvard Museum; They also contributed international conservation institutions such as Conservation International, WWF of Colombia and Ecuador, Alexander Von Humboldt Foundation.

The following curatorial data correspond to the fields contained in the physical catalog and database:

No. MEPN catalog:
Order
Family
Gener:
Species:
Degree of Alcohol:
Diafanization:
Skeleton:
No.Tissue:
Location:
Number of Individuals:
Standard length:
State of Type:
Loan:
Inventory:

Previous Number:
Field number:
Date:
Latitude:
Length:
Country:
Province:
Canton:
Location
Altitude
Date:
Manifold
Basin
Salinity
Entered by / year
Identified by:
Observations

The type specimens have their catalog number as well as the rest of the batches of the ichthyological collection is separated from the general collection in a closet, with security, destined only for this purpose.

The collection is located in an area of 250 m^2. The facilities of the Ichthyology section are divided into: the collection area, preparation laboratory, cataloging and offices. It has an entrance door and an emergency door. In the offices are shelves with literature (books and reprints) located in bookshelves and filing cabinets. The specimens are found in fixed metal shelves, those that exceed 40 cm in standard length, are deposited in large plastic containers.

The technical staff of the section has computer equipment and scanners that are used in the cataloging of the specimens; laboratory equipment such as: WILD brand microscopes, OLYMPUS, ZISSER; digital and mechanical callipers and dissection equipment. There is also a complete fishing equipment: trammel nets, cast nets, trawls, electric fishing, hand nets; GPS, compasses, cameras and water analysis equipment, as well as an ultra freezer for the storage of tissues.

The bibliography of the ichthyology section was started in the 1950s and currently receives copies of the scientific publications of the different magazines specialized in digital files pdf. Documentation of the section helps scholars of Ecuadorian ichthyology.

Preservation of specimens. Most of the collection is preserved in liquid, diafanization, skeletons and a tissue collection that support current and future studies of molecular systematics. The tissue collection is carried out based on the regulations established by the Ecuadorian government.

Specimens in liquid. The specimens are immersed in 73° alcohol. Specimens of a long standard greater than 30 cm are deposited in plastic tanks of capacity between 4 and 10 gallons of ethyl alcohol. The preserved fish are stored in glass jars and a few in plastic jars that are secured with plastic lids. A glass bottle corresponds to a lot and inside there is a label with waterproof paper that corresponds to the collection location where the field code, province, watershed, date of collection, collectors, the catalog number. These labels are made with a Thermal Printer

Diaphanized specimens. The osteological work of species that require confirmation of their identification and in the determination of a new species. The Taylor diaphanization protocol is performed in the osteology laboratory and the specimens are stored in small plastic trays containing 80% glycerin.

Dry Skeletons (Otoliths). The specimens brought from the field after being partially cleaned and drying the skeleton are located in the boxes of the debris where they are cleaned and then placed in the respective cardboard boxes are ordered with the locality labels and the respective identification. The osteology of the specimens has been carried out through the technique of disarticulation and digestion of the bones (Provenzano and Nass in preparation).

Collection of Fishes. In the collection we have specimens located in 405 genera and 64 families. Ichthyological projects that have among other objectives the taxonomic nature of the species that have difficulty in their immediate and mediate identification, collections of tissues are made to perform molecular studies.

Future of the ictiofaunistica collection. Among the perspectives of the fish collection will continue to be the center for the progress of the taxonomy, systematics, biology and fisheries of freshwater fish. The results of the aforementioned research will help the national authorities, through the Management Plans, to guarantee the sustainability of the ichthyofauna diversity that benefits the Ecuadorian rural population.

In a mediated way, the Ichthyology section has proposed to increase research projects and, obviously, the collection of fish from different river basins, where current sampling needs to be strengthened. Increase tissue collections to better

understand native fish genetics. Continue with the systematization of the database in which the town is included and its georeferencing.

Acknowledgement. We thank the directors of the National Polytechnic School for providing support to the maintenance and realization of the research projects, who for many years have helped to increase the collection and have, at the moment, a national inventory of the freshwater ichthyofauna and the first collection of marine fish in Ecuador.

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Figure 2. Hall of Collection of Ichthyology of Biology Department of National Polythecnich school.

Figure 3. Collection of Ichthyology of Biology Department of National Polythecnich school.

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Name and acronym	MEPN Museo Escuela Politécnica Nacional
Institution	Escuela Politécnica Nacional
Address	Ladrón de Guevara E 11-253 y Andalucia
Curator	ramiro.barriga@epn.edu.ec
Website	www.epn.edu.ec / Museo de Historia Natural
Year of foundation	12 february of 1946
Facilities and área collecction	300m^2
Number of visitors	Extranjeros: 12 /Nacionales: 10
Number of loaned	6
Specimen Habitat	Marine: 540 lots Freshwater: 19,150 lots
Specimens Origen	Ecuador and Napo Basin
Current cataloging method	Excel
Total number of lots Neotropical	19,850 lots
Total Number of Holotypes	25
Total number Paratypes	82
Number of C&S specimens	12
Number of dry skeleton specimen	110

FISH COLLECTION

MBML
The zoological collections at the Instituto Nacional da Mata Atlântica- INMA

Luisa M. Sarmento Soares[1,2], Ronaldo F. Martins-Pinheiro[3], Lorena Tonini[1] & Juliana P. Silva[1]

The zoological collections organized under the former Museu de Biologia Professor Mello Leitão, now Instituto Nacional da Mata Atlântica, exist since 1949. Collections of Birds were the first stablished, followed by Mammals, Reptiles and Amphibians. Otherwise, the fish collections were catalogued in 1987 only, by Rogério L. Teixeira, who organized the first book of records. Such an action formalized the maintenance of specimens already stored in the Museum. The older records of fishes in collections are from 1940 decade, being the ancient specimen record an *Gymnotus pantherinus* (Steindachner, 1908)- MBML 3768 – kept in 1948 by brothers Lauro and Haroldo Travassos. Together with Augusto Ruschi and a team of naturalists of his time, Travassos brothers visited northern Espírito Santo and sampled the rivers and small rivulets within dense ombrophylous forest. Those records are precious, as most of these areas are nowadays deforested, being mainly converted to pastures or large economical crops as *Eucalyptus* (Sarmento-Soares, Martins-Pinheiro, 2012; 2013). By the end of XX Century, the most important contributors to fish collections were João Luiz Gasparini and Rogério Luiz Teixeira, and several specimens captured by them served as base to marine and freshwater species descriptions respectively (e.g. Zaluar *et al*., 2004).

Figure 1. Team involved in curatorial activities of fish collection. From left to right: Lorena, Juliana, Maridiesse, Luisa, Leydiane and Renan.

In recent years a freshwater fish collection by José Luiz Helmer was permuted with the Marine Biology laboratory at Universidade Federal do Espírito Santo- UFES.

The indexed zoological collections are now composed by vertebrates as fishes, amphibians, reptiles, birds and mammals. The entomological collections are mainly from the Espírito Santo state, composed of about 8,000 catalogued specimens not yet available for electronic consult (Braun *et al*., 2016). Small collections of crustaceans are under organization. A didactic collection provides support in various educational activities which are already being held at the INMA, and completes the Collections Sector [Setor de Coleções- SeCol] (Tonini *et al*., 2016).

Institutional dataset and Curatorial maintenance. The zoological collections, including fishes, receive about ninety visitors per year, mainly from Bahia, Rio de Janeiro and São Paulo. In recent years we observed an increment on loan request. The zoological collections facilities include a guest house, to host students and researchers during their visits, which need to be scheduled in advance. A Leica stereomicroscope coupled to a computer is available for one researcher per time. Two additional stereomicroscopes for students and visitors are also available. A table for specimen photograph reproduction. Camera available for collective use. Visitors count with assistance of our curatorial team. It is important to note that neither Zoological Collections indeed have a Curator. The responsibility on guard of specimens is made by the administrative staff and collaborative researches act in curatorial management. As there is any proper curator, the increment of the fish collections along the last ten years was held by researchers temporarily joined to the institution as volunteer or associate researcher during the development of a project (Fig. 1). After the establishment of the INMA in 2014 it was possible

Figure 2. Zoological collections presentation at the Symposium and activity interactions of our team.

to include researchers granted by the Programa de Capacitação Institucional – PCI – a partnership between the ministry MCTIC and research council CNPq. These researchers worked in the zoological collections at INMA, improving it during the validity of their respective contracts. Several research and curatorial activities take place for collections (Fig. 2). We joined to produce this presentation for the II Symposium. The formation and interchange of taxonomists advanced as these researchers develop partnerships and collaborations.

The fish collections at the Instituto Nacional da Mata Atlântica are identified under the acronym MBML. The name is kept as historically employed, and in use even after the new denomination of the former Museu de Biologia Prof. Mello Leitão to the Instituto Nacional da Mata Atlântica- INMA. The fish records are available at "SpeciesLink" of Centro de Referência em Informação Ambiental-CRIA database. Available at speciesLink (http://splink.cria.org.br). Contact with the staff at the Sistema de Informação sobre a Biodiversidade Brasileira (SiBBr) were not yet effective regarding the availability of on line information, and currently only botanical collections are at this platform.

Mission. Taxonomy, the science of recognizing and delimiting species, adheres to the fundamental principles of documenting natural patterns and processes, and refining existing ideas and descriptions of nature. Discoveries of new organisms together with advances in methodology continue, and the advances on integrative approaches in taxonomy, lead us to a constant reevaluation of the boundaries between taxonomic entities (Thomson *et al.*, 2018). To attend the tendencies towards integrative taxonomic approaches, the fish collections have nowadays not only alcoholic specimens stored. Cleared and stained (C&S) specimens and frozen tissue samples are available (Fig. 3). The correct identification of a species and mapping its sampled locality is a priority task under elaboration of biological conservation systems.

Storage. Storage of specimens lots is organized numerically, kept in jars disposed on cement shelves. The reason for adoption of cement installations are explained below under Limitations section. The size of each jar is identified by number between jar I (100 ml) to jar VIII (1,500 ml). Large specimens are kept in hermetic tanks (50 l gallon).

A technical manual in use for instructions, catalog and curatorial management of the fish collection is available for internal use only (Tonini *et al.*, 2015). Database available for collections permit a rapid cataloguing of material, per species, genus, family, river basin and additional metadata information.

Catalog. In June 13th. 2018 the catalogued material under fish collections corresponds to 13.262 lots, conserving 97.475 specimens, distributed in 34 orders, 140 families, 438 genera and 920 species (Fig. 4; Table 1). Among these, 120 lots need further specific identification. Fifty seven specimens correspond to primary and secondary types. Most

Figure 3. Ichthyological collections. Left: Frozen tissue samples, storage of large sized specimens. Right: Alcoholic specimens, cleared and stained specimens, type specimens collection. Photos: Luisa Sarmento and Lorena Tonini.

Figure 4. Graphic representation of increase in fish collections. Red lines indicate georeferred lots.

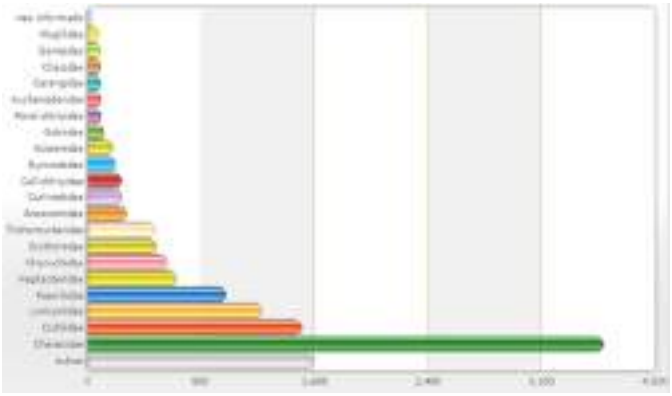

Figure 5. Representation of Fish families.

specimens are of freshwater fishes (corresponding to 10.927 lots) captured at aquatic environments especially at Northeastern Mata Atlântica ecorregion (Abell *et al*. 2008; Albert, Reis 2011). The major river basins represented in fish collections are rio Doce (1,538 lots); rio São Francisco (1,426 lots); rio Itapemirim (1,192 lots); rio de Contas (892 lots); rio São Mateus (577 lots); rio Santa Maria da Vitória (528 lots); rio Itaúnas (519 lots) and rio Reis Magos (504 lots) and remaining river basins represented by less than 500 lots.

The most representative families in collections are Characidae (3,733 lots), Cichlidae (1,549 lots) and Loricariidae (1,251 lots) (Fig. 5). The geographical precedence is mainly from the states of Espírito Santo (7,700 lots), Bahia (3,716 lots); Minas Gerais (488 lots) and Rio de Janeiro (399 lots) (Fig. 6).

Limitations. The fish collections occupy part of a 46 square meters room, with 326 linear meters of shelves, being in its limit of capacity. We reinforce the importance of collections for storage of biological specimens sheltered in an adequate place for development of investigation and research activities. Historically, the most fundamental aspect of collection management has been establishing and maintaining order among the elements that comprises the collection, thus reducing entropy (Simon, Munoz-Saba, 2003). These authors emphasize that collection deterioration is a much longer-term phenomenon than the working life of a curator.

Table 2. Fish collections dataset.

	Freshwater	Marine	Neotropical region	Total
Number of lots	86.03%	13.97%	100%	13,262
Number of specimens	92.11%	7.89%	100%	97,475
Number of holotypes	100.00%	0.00%	100%	1
Number of paratypes	82.14%	17.86%	100%	56
Number of tissue samples	99.36%	0.64%	100%	935
Number of C&S specimens	98.84%	1.16%	100%	86
Number of dry skeleton specimens	0.00%	0.00%	0,00%	0

Current cataloging method	Software application in Access data base
Specimens origin (Brazil, Espírito Santo and Bahia)	
Major river basins of most lots (Rio Doce- ES and Rio São Francisco- BA)	

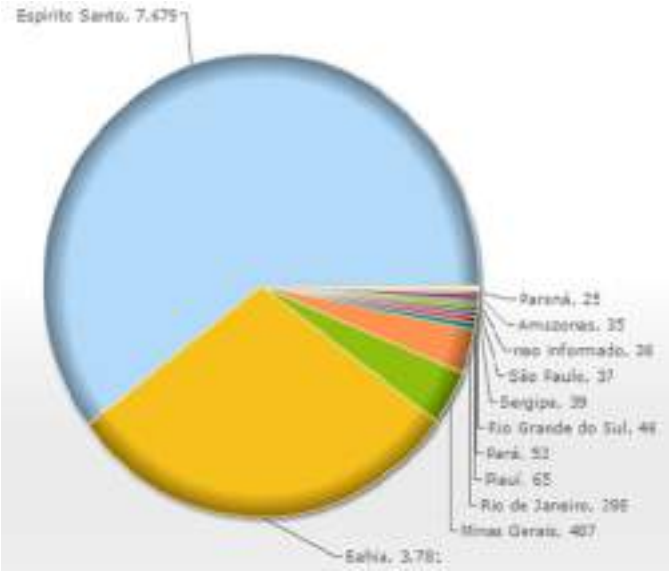

Figure 6. Brazilian states sampled in collections.

In this sense the zoological collections at the INMA remains problematic, as the pavilion with collections stored are victimized by seasonal flood of the nearby rio São Pedro. To minimize damage, cement shelves were constructed after a large flood, that inundated the collection and water destroyed wood furniture in year 2000. We recommend the convenience of immediate transfer of all the collections to a better safe place free of inundations and arranged in larger space, in order to assure its secure increment.

Perspectives. The transformation of a regional collection towards a national representative one is a progressive continued task, needing dedicated and focalized work. Although the fish collections increased in last ten years, it still keeps a strong regional representation (Silva *et al.*, 2015) (Fig. 7). About three quarters of samples in collections come from the Espírito Santo (Fig. 6).

In the last ten years such an interchange of fishes diversified the collection with representative fishes from Sergipe, Piauí and northwestern Bahia states were most achieved through specimens replacement between collections. Nowadays collections are representative in Mata Atlântica at Rio de Janeiro, Espírito Santo, Bahia and Sergipe, covering mainly the area within ecorregion Northeastern Mata Atlântica. Punctual records from remaining Mata Atlântica states, and also a few records from Amazon and Pantanal. As an example, a single large collecting effort provided by the Ferrovia de Integração Oeste Leste is visualized at map of Fig. 7 in the remote interior of Bahia towards Tocantins State. Such a collection increased the samples from western Bahia, and nowadays the Rio São Francisco valley is well sampled in its stretch along Bahia recorded in our files.

A national representation of fish samples in collections is a matter of importance for preserved areas technicians, specialists and managers in public politics to achieve an integrated reading. Collections serve as filters to identify objects of interest to conservation, recognize indicators of biodiversity, and suggest areas for conservation and other interfaces to be employed while accessing its database.

Species conservation requires a clear understanding of what species are and what distinguishes them from each other (Thomson *et al.* 2018). As libraries of life, the zoological collections are the place we can learn lessons from the past and to be prepared for the future. We need to keep them live as representing a fundamental space of research formation as well as scientific and cultural education.

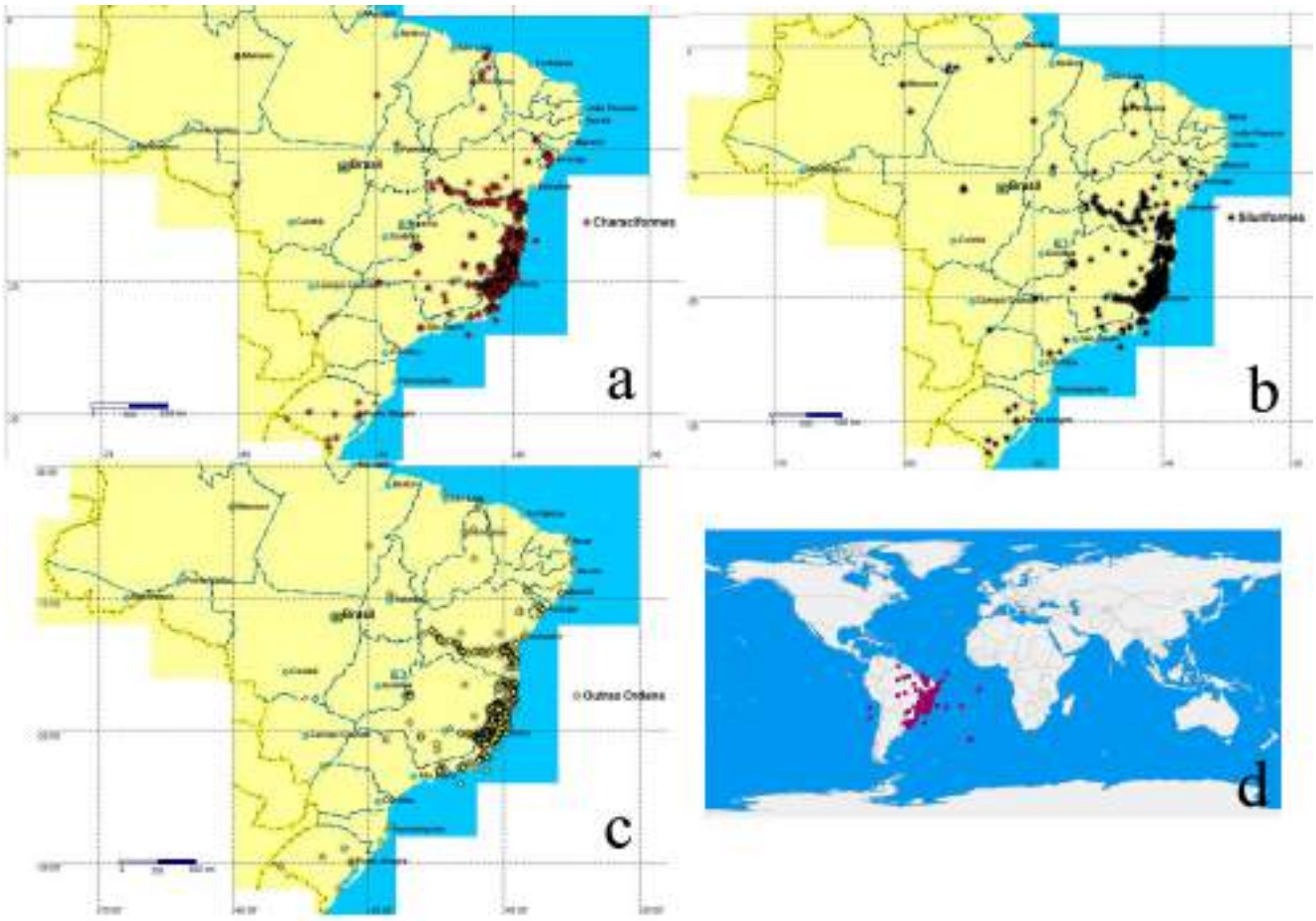

Figure 7. Map of Brazil illustrating the representative fishes in collections. a. Characiformes; b. Siluriformes; c. remaining freshwater fish orders; d. CRIA map of localities.

Acknowledgments. To Conselho Nacional de Desenvolvimento Científico e Tecnológico- CNPq for grant PCI- DA (LMSS) and PCI-DD (LT, JPS). To colleagues at INMA for help and dedication of time during processing the material captured along these years. To all people present at the II Symposium in Londrina who visited our presentation and changed ideas. To Sociedade Brasileira de Ictiologia- SBI team for the opportunity.

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Name and acronym	MBML
Institution	Instituto Nacional da Mata Atlântica [former Museu de Biologia Professor Mello Leitão]
Address	Avenida José Ruschi, 4- Centro, Santa Teresa- Espírito Santo, Brazil.
Contact	Setor de Zoologia <mbml.zoologia@inma.gov.br>
Website	Records available at CRIA http://www.splink.org.br
Year of foundation	1949
and area of the collection	Zoological sector including collections occupy an area of 190.5 m^2
Facilities	Leica stereomicroscope coupled to a computer is available for one researcher per time. Two additional stereomicroscopes for students and visitors
Number of visitors per year (averagedata)	90 visitors in collections
Number of loaned lots per year (average)	2015 - six invoices, 47 lots on loan 2016 - eight invoices, 70 lots on loan 2017 - twenty eight invoices, 196 lots on loan

FISH COLLECTION

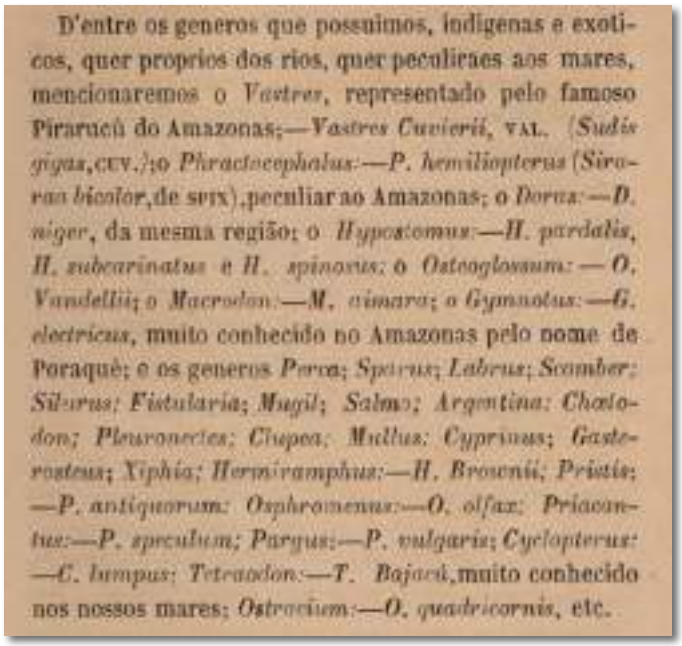
MNRJ
The National Museum Ichthyological Collection

Paulo A. Buckup, Marcelo R. Britto, Cristiano R. Moreira

Founded by Dom João VI, king of Portugal, in 1818, the Museu Nacional is one of the largest and oldest museums in Latin America. Its ichthyological collection is one of the most representative of South American fish diversity, comprising about 600,000 specimens in over 51,000 cataloged fish samples. The museum is currently a unit of the Universidade Federal do Rio de Janeiro, and the ichthyological collection is part of the Department of Vertebrates. Its faculty is part of the Graduate Program in Biological Sciences (Zoology).

History. The origin and development of the fish collection during the 19th Century is poorly known. The oldest reference to fish specimens housed in the Museum dates back to 1870, when the museum was still not yet located in its current buildings. According to Netto (1870), a new wing of the museum was erected in 1852 to accommodate the Zoology exhibits. Included in the zoology collection were marine fish prepared by João de Deus e Mattos in the Ilha d'Agua (baía de Guanabara, RJ). By 1870 the fish collection was exhibited in several cabinets of the main exhibition floor and included several species well known for their large size and morphological interest (Figure 1).

In the museum annual report for 1877, Ladislau de Souza Mello Netto recorded a significant increase of the collection, which included at that time 400 specimens, most probably collected by the Comissão Geológica do Império between 1875 and 1877. Part of those specimens may have survived to date among the approximately 500 stuffed specimens included in the public exhibit that was inaugurated in the early 20th Century, after the museum was moved to the former imperial palace, located in the Quinta da Boa Vista, but there are no surviving labels to support such hypothesis. In the late 19th century the collection expanded slowly through collections of naturalists hired by the Museu Nacional, such as Clément Jobert, who collected in the Amazon basin and northeastern Brazil northeastern Brazil



D'entre os generos que possuimos, indigenas e exoticos, quer proprios dos rios, quer peculiares aos mares, mencionaremos o *Vastres*, representado pelo famoso Pirarucú do Amazonas;—*Vastres Cuvierii*, VAL. (*Sudis gigas*, CUV.);o *Phractocephalus*:—*P. hemiliopterus* (*Silurus bicolor*, de SPIX), peculiar ao Amazonas; o *Doras*:—*D. niger*, da mesma região; o *Hypostomus*:—*H. pardalis*, *H. subcarinatus* e *H. spinosus*; o *Osteoglossum*:—*O. Vandellii*; o *Macrodon*:—*M. cinara*; o *Gymnotus*:—*G. electricus*, muito conhecido no Amazonas pelo nome de Poraquê; e os generos *Perca*; *Sparus*; *Labrus*; *Scomber*; *Silurus*; *Fistularia*; *Mugil*; *Salmo*; *Argentina*; *Chætodon*; *Pleuronectes*; *Clupea*; *Mullus*; *Cyprinus*; *Gasterosteus*; *Xiphia*; *Hemiramphus*:—*H. Brownii*; *Pristis*;—*P. antiquorum*; *Ospbromenus*:—*O. olfax*; *Priacantus*:—*P. speculum*; *Pargus*:—*P. vulgaris*; *Cyclopterus*:—*C. lumpus*; *Tetraodon*:—*T. Bajaci*, muito conhecido nos nossos mares; *Ostracion*:—*O. quadricornis*, etc.

Figure 1. Facsimile of the original report by Netto (1870) comprising a list of fish specimens displayed in the Museu Nacional by 1870.

between 1877 and 1878, even though most of these collections did not remain in the Museum (Miranda Ribeiro, 1945) .

The organization of fish specimens into a public exhibition and a scientific collection (initially known as "depósito") accelerated in the early 20th Century under leadership of Alípio de Miranda Ribeiro who was active from 1894 through 1939. The earlier ichthyological publications of Miranda Ribeiro included lists of fish specimens and descriptions of new species obtained in coastal surveys conducted by the Annie fishing boat and freshwater fishes from the Ribeira de Iguape valley in the State of São Paulo (Miranda Ribeiro, 1903; Schreiner & Miranda Ribeiro, 1903). Miranda Ribeiro, however, is best known for his monumental "Fauna Brasiliense" (1907-1918), a multivolume monograph including descriptions of all species of fish known to occur in Brazil at the time.

The consolidation of the Ichthyological Section of the National Museum as a modern research facility followed the Alípio de Miranda Ribeiro era,

with the cataloging of the ichthyological collection and the hiring of professional ichthyologists as part of the permanent staff. In 1939 the assignment of catalog numbers to the fish samples was started along with the registration of collection data in a ledger book. An important landmark in the history of the Ichthyology Section was the establishment of an international cooperation program during the Second World War (1939-1945). Following the death of Alípio de Miranda-Ribeiro in 1939. The director of the National Museum at the time, Heloísa Alberto Torres, started a series of negotiations between the governments of Brazil and the United States of America, which led to the long-term visit of already renowned ichthyologist George Sprague Myers, between 1942 and 1944. Myers was at the time the fish curator at the Natural History Museum of the Stanford University, where he was already studying Neotropical fishes. During his stay at the Museu Nacional, Myers organized the "Survey of Brazilian Marine Fishes of Commercial Importance" (SBMF), which performed an extensive inventory of species targeted by commercial fisheries along the Brazilian coast. He also conducted field work and developed taxonomic studies of freshwater fishes. He was instrumental to a new generation of Brazilian ichthyologists through his very popular course on Systematic Ichthyology. The SBMF project produced over two thousand lots of fishes which were catalogued in the collection. In 1944, William Alonzo Gosline, another North-American Ichthyologist, came to Brazil as Myers' assistant, and was hired by the Museu Nacional until 1945. Gosline introduced curatorial practices used in North American fish collections and catalogued significant amount of fishes. As an employee of the Museum he published a catalog of Central and South American catfishes (Gosline, 1945), and a pioneering phylogenetic study of loricariid fishes is also worth noticing (Gosline, 1947).

Paulo de Miranda Ribeiro, Haroldo Travassos, India Barbosa, and Gustavo W. Nunan followed suit as native Brazilian ichthyologists working in the ichthyological collection. Paulo de Miranda Ribeiro followed the steps of his father, producing taxonomic publications from 1939 to 1968. Haroldo Travassos was admitted in the National Museum in 1942 (Adler, 2012). Travassos published several studies about freshwater fishes. His publications apparently were modeled after those of George S. Myers, but there is no evidence that the two researchers were ever closely related at a personal level. Between 1944 and 1967, Travassos published descriptions of several species of fish based on specimens from the National Museum ichthyological collection. Gustavo Wilson Alves Nunan, along with the biologist Décio Ferreira de Moraes Junior was responsible for the enrichment of the marine fish collection with samples from oceanic islands, including important and rare specimen from the continental slope of eastern Brazil.

In the last decade of the 20th Century, Paulo Andreas Buckup (hired as an adjunct professor in 1994) promoted the reorganization of the ichthyological collection according to taxonomic groups and started the full computerization of the catalog and loan system through the inclusion of the National Museum in the international Inter-Institutional Database of Fish Biodiversity in the Neotropics (NEODAT), which was a pioneering initiative to provide public access to fish collection data through the Internet.

Currently the Ichthyology Section of the National Museum is comprised by three professors (Paulo A. Buckup, Marcelo R. Britto, Cristiano R. Moreira) who act as curators of the fish collection and are members of the faculty of the Graduate Program in Biological Sciences (Zoology). These researchers also provide training to undergraduate and high school students. The technical staff includes a biologist (Décio Ferreira de Moraes Junior).

Recently the Ichthyology Section of the Museu Nacional was designated as the repository of the historic documents of the Sociedade Brasileira de Ictiologia.

Taxonomic and Geographic Coverage. The fish collection of the Nation Museum has excellent geographic coverage of most Brazilian river drainages (Figure 2), as well as representative specimens of the main taxonomic groups from all continents and oceans, including, for example two specimens of the Australian lungfish (*Neoceratoruds forsteri*).

The Ichthyological Collection includes specimens from important expeditions and projects, such as the Expedition to the São Francisco River (G. Myers, P. Miranda-Ribeiro, and A. de Carvalho, 1942), the "Pólo Noroeste" expedition associated with the opening of the BR-364 road in western Brazil (1983/1986), the Jaíba project (1990), the "Expedição Leste" which surveyed rivers in eastern Brazil (2001), the biogeographic study of the Serra da Mantiqueira (2001-2002), the "Expedição Brasil

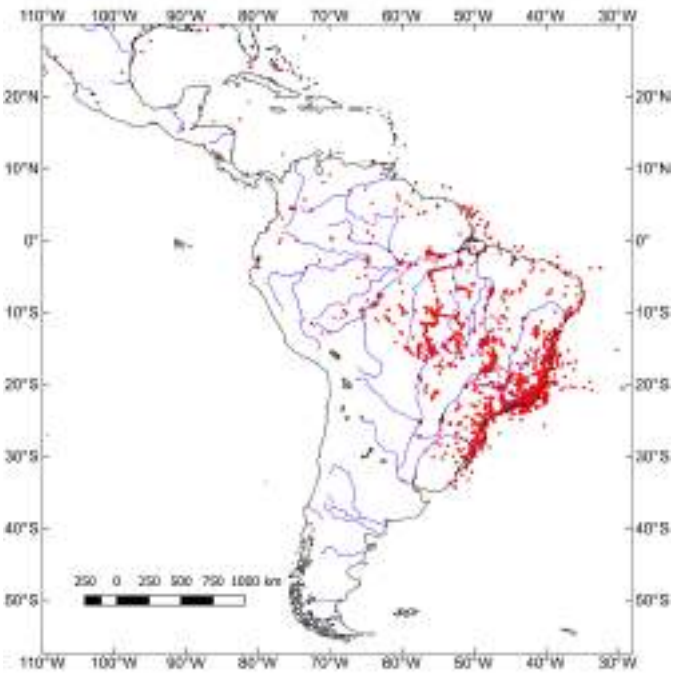


Figure 2. Georeferenced samples of Neotropical fish in the Ichthyological Collection of the Museu Nacional, Universidade Federal do Rio de Janeiro.

Central" (2001/2002), the "Expedição Xingu/ Tapajós (Projeto AquaRios, 2009), and extensive surveys associated with large hydroelectric power dams in the Tocantins river such as Serra da Mesa, and Estreito. The marine material includes extensive collections performed along the Brazilian coast by the Annie, Toko Maru e Riobaldo research ships, significant collections from the oceanic islands of Trindade, Fernando de Noronha, and Atol das Rocas, and the results from the oceanographic surveys carried out by the Thalassa, which was commissioned as part of the REVIZEE program. The collection has incorporated the totality of the fish material from the extinct Museu da Fauna and a significant portion of the fish collection of the Santa Úrsula University which was recently decommissioned as a research collection.

Currently the collection has over 51,000 formally registered lots of fish (~600,000 specimens), including 458 primary types and 7,383 secondary types. With an annual average increment of 5% in the last three years, it is estimated that in the next decade the collection may reach 70,000 cataloged samples.

Facilities. The main collection area occupies 350 square meters and is equipped with fixed and movable steel shelvings (Figure 3) for regular jar specimens, and closed cabinets for type-specimen storage (Figure 4). Additional areas are used for

Figure 3. Mobile shelving system used to store jar specimens in the Ichthyological Collection of the Museu Nacional, Universidade Federal do Rio de Janeiro.

housing stainless steel tanks (Figure 5), high-density polyethylene drums, and pure ethanol storage.

It addition to the collection areas, the Setor the Ictiologia has a main sample processing lab, rooms with individual research stations capable of simultaneously accommodating 30 students and researchers. Associated laboratories include a molecular laboratory (Laboratório de Pesquisa em Biodiversidade Molecular - MNLM), and a Laboratory for Digital Radiography, equipped with a Faxitron cabinet x-ray system.

Figure 4. Partial view of the type specimen storage of the Ichthyological Collection of the Museu Nacional, Universidade Federal do Rio de Janeiro.

Figure 5. Stainless steel tanks used for storage of large specimens in the Ichthyological Collection of the Museu Nacional, Universidade Federal do Rio de Janeiro. Each 2,000 litre tank is equipped with internal railings for attachment of plastic labels connected with guide strings to the specimens.

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E-mails: buckup@acd.ufrj.br, mrbritto@yahoo.com.br, moreira.c.r@gmail.com

Name and acronym	Coleção Ictiológica do Museu Nacional, MNRJ
Institution	Universidade Federal do Rio de Janeiro
Address	Setor de Ictiologia, Dept. de Vertebrados, Museu Nacional, Quinta da Boa Vista, 20940-040 Rio de Janeiro, RJ, Brazil
Curator(s) and contact(s)	Paulo Andreas Buckup, buckup@acd.ufrj.br Marcelo Ribeiro de Britto, mrbritto@mn.ufrj.br Cristiano Rangel Moreira, moreira.c.r@mn.ufrj.br
Website	http://www.mnrj.ufrj.br http://www.sibbr.gov.br
Year of foundation	1818 (Museu Real foundation by D. João VI), 27 Oct 1894 (Alípio Miranda Ribeiro hired)
Facilities and area of the collection	World wide coverage, with emphasis on Brazilian marine and freshwater species.
Number of visitors per year (average considering 2015, 2016, 2017)	26
Number of loaned lots per year (average number considering 2015, 2016, 2017)	200.7 lots/year
Specimens habitat	Freshwater – 38,033 (75%), Marine – 9,938 (20%), Brackish – 600 (1%), No information – 1,967 (4%)
Specimens origin	The origin of the specimens includes 75 countries. Most specimens are from Brazil, with extensive representation from coastal basis of the Southeast, the São Francisco, upper Paraguay, southern tributaries of the Amazon basin, as well as coastal areas of Western South Atlantic.
Current cataloging method	Muse Version #3.5.05
Total number of lots and number of lots from Neotropical region	50,862 lots (48,055 neotropical lots), on April 6, 2018
Total number of specimens and number of specimens from Neotropical region	600,000 specimens (580,000 neotropical specimens), estimated values
Total number of holotypes and number of holotypes from Neotropical region	327 lots of neotropical primary types, comprising 458 primary type specimens
Total number of paratypes and number of paratypes from Neotropical region	1,046 lots of neotropical secondary types, comprising 7,383 type specimens
Number of tissue samples from Neotropical fishes	13,182 samples
Number of C&S specimens	1,244 specimens
Number of dry skeleton specimens	208 specimens

FISH COLLECTION

MPEG
The Fish Collection of the Museu Paraense Emílio Goeldi: History and Actuality

Wolmar Benjamin Wosiacki

The Museu Paraense Emílio Goeldi (MPEG), located in Belém, State of Pará, Brazil, is a federal research institution within the brazilian Ministério da Ciência, Tecnologia, Inovação e Comunicação (MCTIC) and the first in the north of the country focused on research in natural and sociocultural systems of the Amazon (Crispino *et al*. 2005). Its collections cover areas of archeology, ethnography, linguistics, paleontology, minerals/rocks, botany and zoology. Among zoological collections, the fish collection of the Goeldi Museum covers the Neotropical region (Fig. 1), with representative coverage of the Amazon basin including specimens from the fish groups Chondrichthyes, Sarcopterygii, and majority Actinopterygii (Silva, *et al*., 2017).

The collection currently contains about 339,200 specimens representing 1,740 species distributed among 37,000 collection lots, including individuals preserved in liquid, dry skeletons, and diaphanized cartilage and bones. These include 308 lots of type material, of which 40 are holotypes and 268 paratypes (Table 01). The collection buildings include a central hall that is 6m high, composed of two floors, the ground floor, measuring 180m^2 and a mezzanine measuring 96m^2. Adjacent to the collections building is a 140m^2 annex, for a total area of 416m^2. The walls are insulated and the space is climate-controlled with seven "split" air conditioning units for a total of 60,000 BTUs. The annex contains three concrete tanks (1x1x3 m) with steel lids for conditioning large material. The material is stored on metal shelves, optimized for space and organized by alphabetical order of taxonomic groups, in the sequence Order, Family, Genus and Species (Fig. 2). Three metal cases hold type material (holotypes and paratypes).

The oldest collections date back to 1889, collected by H. Merwath, 1894 (without collector information) and 1901, collected by G. Hagemenn and J. Lobo, all from Pará state. Ichthyology studies at the Goeldi began in earnest in 1932 with the work of Carlos Estevão on fish farming, resulting in successful intensive reproduction of regional fish. Other important early contributors to the collections are Antônio Estevão de Oliveira, Sprague Myers, Alaba Maranhão, Inah Silveira, Rodolfo von Ihering and Paulo Sawaya, who organized exhibits about the regional fish fauna (Marque-Aguiar, pers. comm.)

Between 1945 and 1955, the collection program was interrupted by lack of funding and trained personnel. The collection became active again in 1955 thanks to the efforts of researchers and

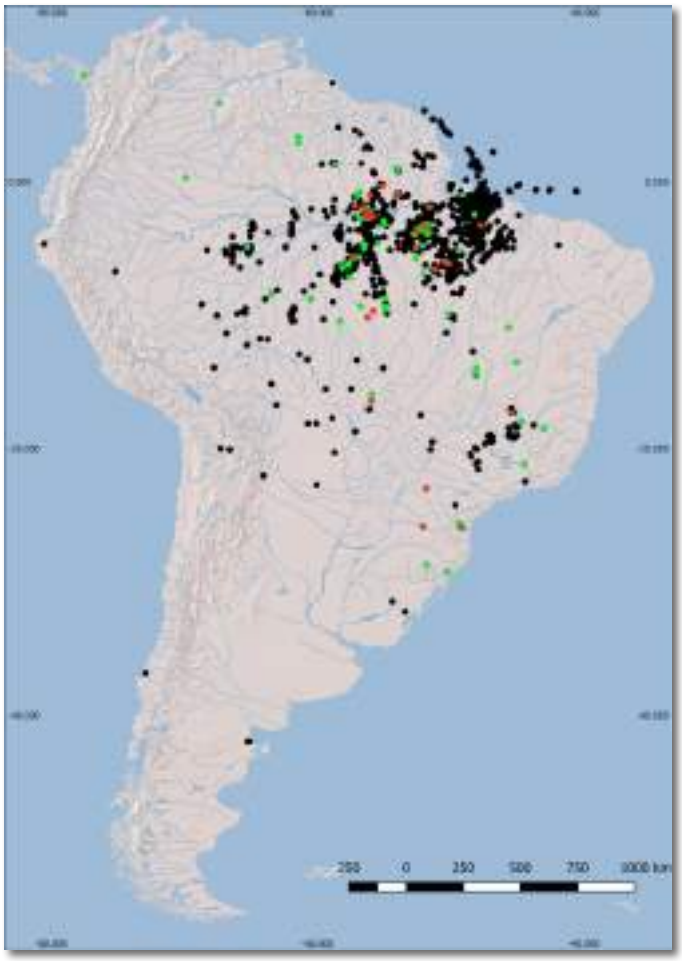

Figure 1. Map of the South America and South of the Central América showing the geographic distribution of the lots of the Fish Collection of the MPEG. Red dots are holotypes, green dots are paratypes lots, and black dots are regular lots. Some dots represents more the one lot.

technical staff who made significant contributions to the Amazonian ichthyofauna (Gorayeb, pers. comm.). However research was once again interrupted between 1960 and 1970. The 1980s saw a new period of intense collection activity owing to the work of Ronaldo Barthem and Michael Goulding on fish stocks and fishery biology in diverse regions of the Amazon. Ivaneide Assunção began working as a research assistant in 1986, contributing to the growth of the collections with material from Marajó island, and especially with the preparations of dried skeletons of Siluriformes and Gymnotiformes which are important to this day in studies of systematics, taxonomy and anatomy.

In 1994, Horácio Higuchi was hired as a researcher by the Goeldi Museum and took over the curatorship of the fish collections. With the assistance of the technician Alberto Bezerra, he modernized the organization and taxonomy of the ichthyology collections. From 1994 to 2003, Higuchi and Barthem digitized the collections on the Access platform, adding 5,750 collection lots into the database.

Figure 2. Fish Collection of the MPEG. Upper, hall of the building collection showing the metal cases of the type material and jars with large specimens/lots: botton, the material stored in glasses, on metal shelves. Alberto Bezerra staff.

Wolmar B. Wosiacki was hired in 2002 as a biologist and researcher in fish systematics and taxonomy, beginning his work in the ichthyology section in the Zoology Division of the Museum. In 2003, Higuchi left the curatorship of the fish collection for the Museology Department, and the curatorship was passed along to Wosiacki. An infrastructure reform was initiated, changing all glass-lids for standardized smooth glass jars with wide mouths, plastic screw caps and polexan sealant. The window-mounted air conditioning units in the main hall (totaling 18,000 BTU) were replaced with split-central air conditioning units totaling 60,000 BTUs. The walls were insulated and the ceiling was replaced with insulating, flame-retardant material. A freight elevator was installed, making transportation of specimens easier and safer. A horizontal (310 l) and a vertical (203 l) freezers were added to the infrastructure in order to facilitate work with tissue samples.

Collaborations and partnerships were formalized with governmental and private institutions and a diverse group of national and international scientists, resulting in a broad network of research projects and specimens from river basins throughout Brazil being incorporated into the collections. During this time, scientific material was also widely shared with national and international institutions through specimen loans, donations and transfers. These collaborations brought the Goeldi Museum ichthyology program to the forefront of taxonomic research, and resulted in a tremendous growth of the collections, which are now considered an essential source of reference material for work on Neotropical fish systematics.

A partnership with Petrobras in 2010 resulted in the expansion of the collections room through the construction of the annex for processing marine taxa that began arriving through research associated with oil platforms on the north coastal continental shelf of Brazil. Also in 2010, the collections database was migrated from Access to the Specify platform (Specify, 2016), a system designed especially for zoological collections. This migration was carried out simultaneously with the implementation of protected database management protocols concentrated in the Biogeoinformation Center (NBGI) at the Goeldi (da Silva, *et al*. 2017).

The Ichthyology section of the Goeldi Museum consists currently of the collection hall and annex (416m^2), plus a building with two offices

for permanent researchers, four offices for visiting researchers or students, a preparation laboratory, curatorial office and equipment deposit. The ichthyology section has two permanent researchers in systematics and taxonomy, Wolmar Benjamin Wosiacki (Curator) and Alberto Akama, hired in 2013, and two technicians, Ângelo Dourado and Alberto Bezerra de Souza. The laboratories serve as an active training ground for undergraduate student interns from different universities, CNPq scientific initiation grantees, students from the Goeldi's post-graduate programs in Zoology (PPGZOO-UFPA/MPEG) and Biodiversity and Evolution (PPGBE-MPEG), and visiting researchers and post-docs.

Acknowledgments. The author thanks to Suely Marques-Aguiar and Inocêncio Gorayeb (researchers-MPEG) by the important informations about the beginning of the fish collections of the MPEG. Thanks to Lorran Ramos by the production of the map. Thanks to G. Shepard for reviewing the final manuscript for grammar and style.

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Name and acronym	Fish Collection of the Museu Paraense Emílio Goeldi (MPEG)
Institution	Museu Paraense Emílio Goeldi (MPEG)
Address of the Collection	Museu Paraense Emílio Goeldi, Campus de Pesquisa, Av. Perimetral, 1901 – Terra Firme, CEP: 66077-530 - Belém - PA - Brasil
Curator and contact	Wolmar Benjamin Wosiacki - Museu Paraense Emílio Goeldi Dept. of Zoology, Section of Ichthyology, Curator, Campus de Pesquisa. Av. Magalhães Barata, 376. São Braz, Belém, PA, Brasil. 66040-170 wolmar@museu-goeldi.br Fone (55-91) 3075-6128/Fax(55-91) 3075 6104
Website	https://www.museu-goeldi.br/assuntos/colecoes/biologicas/colecoes-de-zoologica/colecao-de-ictiologia
Year of foundation of the MPEG	1866
Facilities and area of the collection	Collection hall and annex (416 m^2), a building with two offices researchers, four offices for visiting researchers or students, a preparation laboratory, curatorial office and equipment deposit.
Number of visitors per year	43 (2015); 56 (2016)
Number of loaned lots per year	408 (2015); 99 (2016); 457 (2017)
Marine specimens	2,091
Brazil	34,934
Colombia	23
Panama	4
Peru	19
Venezuela	5
Brazil	358,165
Colombia	109
Panama	20
Peru	20
Venezuela	7
Nº Holotypes	40
Nº Paratypes	268 lotes / 3,416 specimens
Nº C&S	239
Nº dry skeletons	34

FISH COLLECTION

MPUJ
Fish Collection Museo Javeriano de Historia Natural "Lorenzo Uribe, S.J."

Saúl Prada-Pedreros, Edgar Esteban Herrera-Collazos, Guido Alberto Herrera-R, Dimitri Forero & Javier A. Maldonado-Ocampo (In memoriam)

The history of the Fish Collection of the Javeriana Museum of Natural History is divided into three periods: the first one between 1937 and 1950, when the Jesuits brought the first copies to the Collection (four lots). The second, between 1950 and 1992, in which 198 lots were incorporated, and the third period begins in the second half of 1992 and goes to the present, when the first author of this document assumed the curatorship of the collection. During this period the collection shows its maximum growth, going from 202 to 12,235 lots.

Most of these lots correspond to samples collected during field trips during teaching practices and as results of diverse research projects lead mainly by SPP and JAMO. A small, but important part, are copies that have been obtained through donations or exchanges of material with other fish collections of national and international institutions. The Fish Collection is registered in the National Registry of Biological Collections, administered by the Alexander von Humboldt Research Institute (http://rnc.humboldt.org.co/wp/).

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Figure 1. Facilities fish collection MPUJ: a) space for visitors to study the specimens from the collection; b y c) mobile compactors; d) types room.

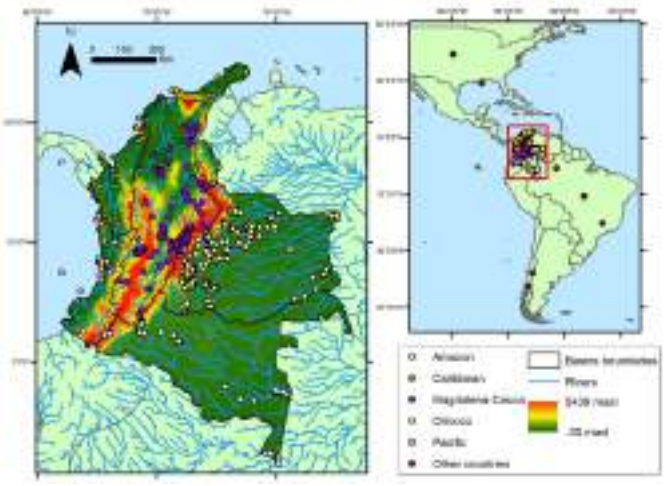

Figure 2. Map containing localities of lots deposited at MPUJ.

Name and acronym	Colección de Peces MPUJ – Museo Javeriano de Historia Natural "Lorenzo Uribe, S.J."
Institution	Pontificia Universidad Javeriana
Address	Carrera 7 # 40-62. Ed. 55 Bioterio y Colecciones Biológicas
Curator(s) and contact(s)	Saúl Prada Pedreros saul.prada@javeriana.edu.co Javier A. Maldonado O. maldonadoj@javeriana.edu.co
Website	http://ciencias.javeriana.edu.co/investigacion/colecciones-biologicas http://ipt.sibcolombia.net/sib/resource.do?r=puj-004-peces
Year of foundation	1993
Facilities and area of the collection	We have two ultra-freezers (-80°C) for the tissue collection; four stereomicroscopes, one with a digital DSLR camera for documentation; (soon) we will have a dedicated microscope with DIC and a drawing tube; a high resolution thermal printer to be used with a special film for preparing labels for ethanol specimens; a set of barcode high-resolution readers to facilitate reading barcodes of specimen labels; a large set of mobile compactors housed in a temperature and humidity controlled room; and a large space for visitors to study the specimens from the collection. The collection total area is around 65 m^2 plus a types room of 10 m^2 approximately (**Figure 1**).
Number of visitors per year (average considering 2015, 2016, 2017)	10 in average
Number of loaned lots per year (average number considering 2015, 2016, 2017)	2 loans (not number of lots) in average per year
Specimens habitat	Freshwater (12,084 lots, equivalent to 98.8%) Marine (151 lots, equivalent to 1.2%)
Specimens origin	**Countries**: Colombia (11780 lots, equivalent to 96.2%) Others: Brazil, Chile, Ecuador, United States, Ghana, Italy, Republic of Fiji, Russia (455 lots, equivalent to 3.7%) **Mayor hydrographic regions (See the map) for the lots with localities in Colombia** (**Figure 2**): Orinoco: 10,044 lots (85.2%) Magdalena-Cauca: 1,169 lots (9.92%) Amazon: 475 lots (4.03%) Caribbean: 46 lots (0.39%) Pacific: 46 lots (0.39%)
Current cataloging method	We are not using any collection management software. We will implement Specify in the next future. We currently process and publish all the associate data of each lot as a Darwin Core File (DwC-A), which is a standard format for sharing biodiversity data as a set of one or more data tables. All the records are free available through the MPUJ ipt (http://ipt.sibcolombia.net/sib/resource.do?r=puj-004-peces)
Total number of lots and number of lots from Neotropical region	12,235 lots 12,223 lots from the Neotropical region
Total number of specimens and number of specimens from Neotropical region	154,766 specimens 154,729 specimens from the Neotropical region
Total number of holotypes and number of holotypes from Neotropical region	5 all from the Neotropical region
Total number of paratypes and number of paratypes from Neotropical region	30 all from the Neotropical region
Number of tissue samples from Neotropical fishes	3,385
Number of C&S specimens	104
Number of dry skeleton specimens	The collection don´t have dry skeleton specimens

FISH COLLECTION

MUSM
Fish Collection of Natural History Museum at San Marcos University, Lima, Peru

Hernán Ortega[1], Vanessa Meza-Vargas[1,2] & Max Hidalgo[1]

The Museo de Historia Natural of the Universidad Nacional Mayor de San Marcos was founded in February 28 in 1918 by Dr. Carlos Rospligiosi to hold samples mainly collected during two expeditions to the Central Peruvian Amazon, the University Scientific Expedition of 1918 and the Swedish Peruvian Expedition1920, where Dr. Rospigliosi was part of the team. The first location was in Lima downtown center at San Marcos University main local until 1945. Posteriorly the museum was relocated to its own large local and was built with European style. The first Fish Collection was established in 1949 by Dr. Hans W. Koepcke, German ecologist. The specimens were mainly marine and commercial species, most of them: medium to bigger size and all taxidemized for public exhibition. Another part of the samples comes from continuous collections made by the first author in the Ucayali River basin for more than 15 years (1971-1987), which were maintained provisionally at Instituto Veterinario de Investigaciones Tropicales y de Altura (IVITA), in Ucayali state.

Initially, the samples were housed in the Freshwater Ichthyology laboratory (directorial resolution by Dr. Hernando de Macedo, 1982). Later, the Department of Ichthyology was created to house the Fish Collection (Direction Resolution - Dr. Gerardo Lamas, 1988), of which the first author

Figure 1. (A) Museo de Historia Natural MHN-UNMSM (B) Ichthyology department (C) Fish Collection MUSM.

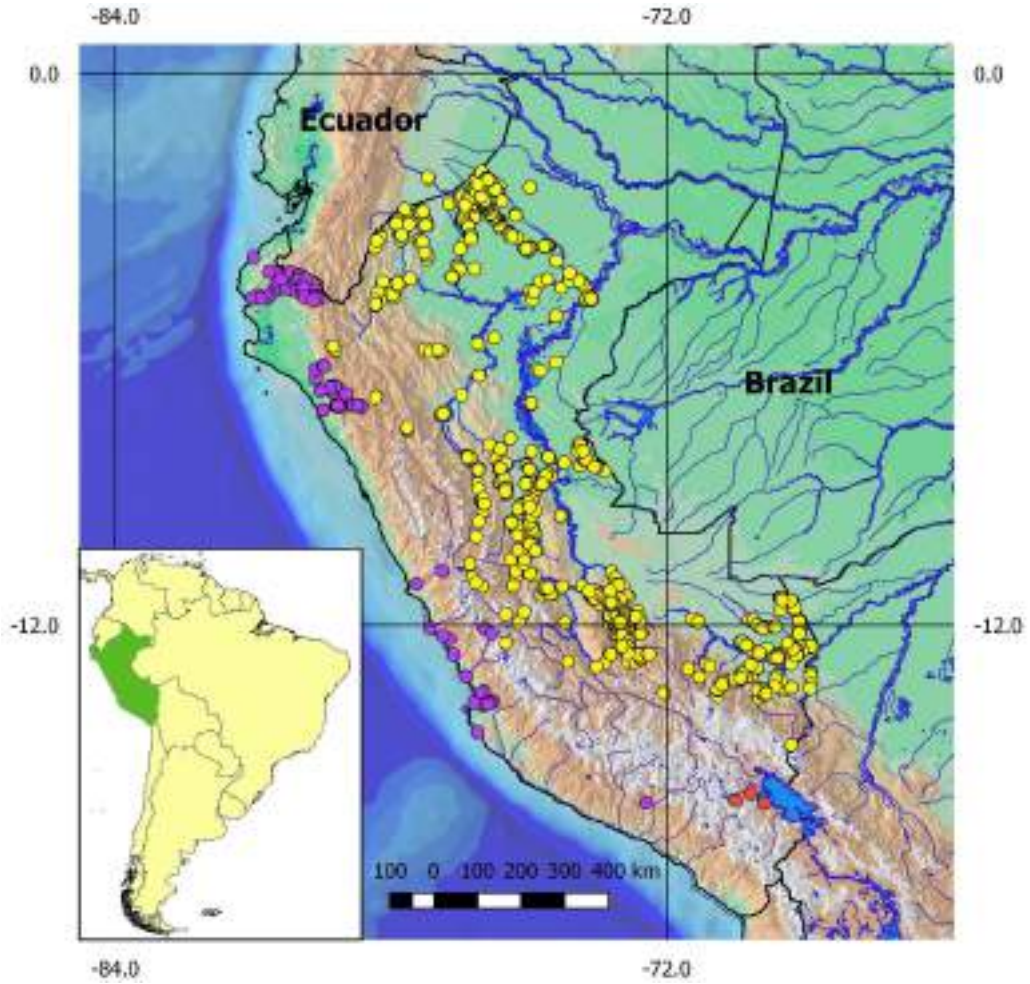

Figure 2. Fish samples from upper Amazon or sub basins in the Peruvian territory, Amazon basin (yellow), Pacific drainages (purple), Titicaca basin (red).

was the first chief (Ortega & Hidalgo, 2016).

We recognize as mentors to Dr. Heraldo Britski from MZUSP (Universidade de São Paulo), as well as Dr. Richard Vari from Division of Fishes (Smithsonian Institution) who shared their knowledge in the curatory, supporting the creation of the collection. The first Checklist was published in Smithsonian Contribution to Zoology, included 736 species (Ortega & Vari, 1986). Subsequently, updates in the Checklist were made, 995 species (Chang & Ortega, 1995) and the last one contained 1064 species (Ortega *et al*., 2012).

Currently, the ichthyologic collection of the Natural History Museum of the National University of San Marcos (Lima, Peru) - Fish MUSM - is located at the Ichthyology Department and is the largest in Peru (Fig. 1). However, the space and facilities were minimum until 2012 and with a good plan of saving, activities and some small donations we could get a new building. Finally, the project AMAZONFISH (ERANet-LAC) since 2016 have helped to develop and increase our infraestructure facilities, supporting also field work, especially to fill ichthyologic and geographical gaps.

Material and Methods. Most of the ichthyological material has been provided for several projects: collaboration with foreign colleagues, practical classes, environmental consulting work, thesis field work, etc. The collection can be easily traced back to 1971, where all specimens of Fish MUSM were collected in different freshwater habitats in Peru (aquatic freshwater coast habitats, highlands and rainforest lowlands) (Fig. 2). One of the first collections was in Ucayali (1971), at the Instituto Veterinario de Investigaciones Tropicales y de Altura (IVITA) – UNMSM, Pucallpa, supported by the Project: Fishculture with native species. It is important to mention the increase and develop of MUSM Fish collection is related to many outsanding ichthyological studies supported by Smithsonian or NSF founds, such as: BIOLAT, Ucamara Project, ACSI program, Astroblepid and Alto Purus National Park projects (Ortega & Hidalgo, 2016).

There are three type of collections: (1) dry collection, which include osteological and taxidermized, and (2) humid collection, that include samples in ethanol 70° represented 90% of total samples, and glycerin represented 5% of total. Also we have an incipient tissues collection which is

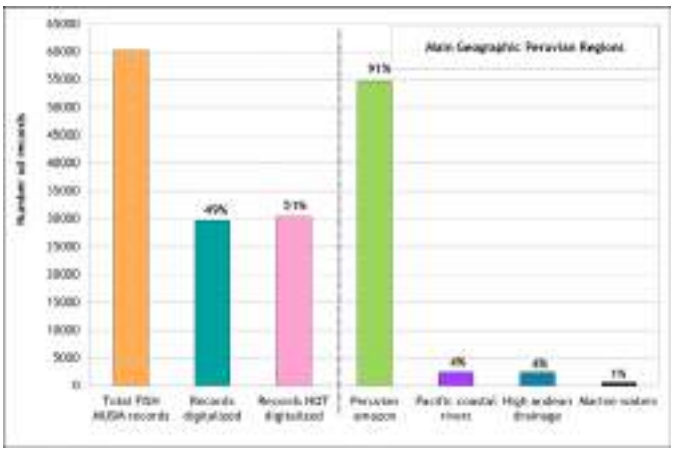

Figure 3. Total records database and geographical region.

under construction.

Results. Until the end of 2017, Fish MUSM has more than 61 thousands records, from which 49% has been digitalized and 51% still remains undigitalized (Fig. 3) but due to Amazonfish project this last percentage is going to decrease, expecting at the end of 2020 have digitalized all Fish MUSM records. Our database includes 65 field labels, following the DARWINCORE format.

The most important feature related to Fish MUSM is its representativeness, containing fishes from all the three main aquatic systems in Peru. This is showed in its hydrographic coverture, representing the Amazonian records the most inventoried region, and with less than 10% of records all rest of ichthyographic regions (high Andes mainly Titicaca Lake, pacific rivers and strictly marine records) (Fig. 3). Some of these areas are very difficult to access because of its remoteness, even though some have been visited once in a time and many years ago (such as Manu, Megantoni, Yavarí), needing more sampling efforts. Fish MUSM has also samples from neighboring countries (Ecuador, Colombia, Venezuela, Brazil and Bolivia) and others (Guyana and Panama). More than 54 thousands records correspond to Amazonian region, and among this the Ucayali, Marañón and Madre de Dios subsystems contains almost 30% of all Fish MUSM records (or over 20 thousand) and an raw estimate of more than 700 species (Fig. 4).

About diversity, Fish MUSM has very high value because includes among its samples very diverse and valuable taxonomic groups such as those associated with the high Andes (in both sides of the mountains), specially catfishes of *Astroblepus*, *Trichomycterus* genus but also several specimens of at least 15 species of Orestias, which even though some fish material collected from the beginning of the 20th century of *Orestias cuvieri*, actually considered extinct (in Bolivia; Perú has not evaluated its conservation status) . This Collection has specimens that represent almost all the genera and families of freshwater fishes of Peru.

One of the most valuable section is the type material collection (approximately 160 lots between holotypes and paratypes), those specimens on

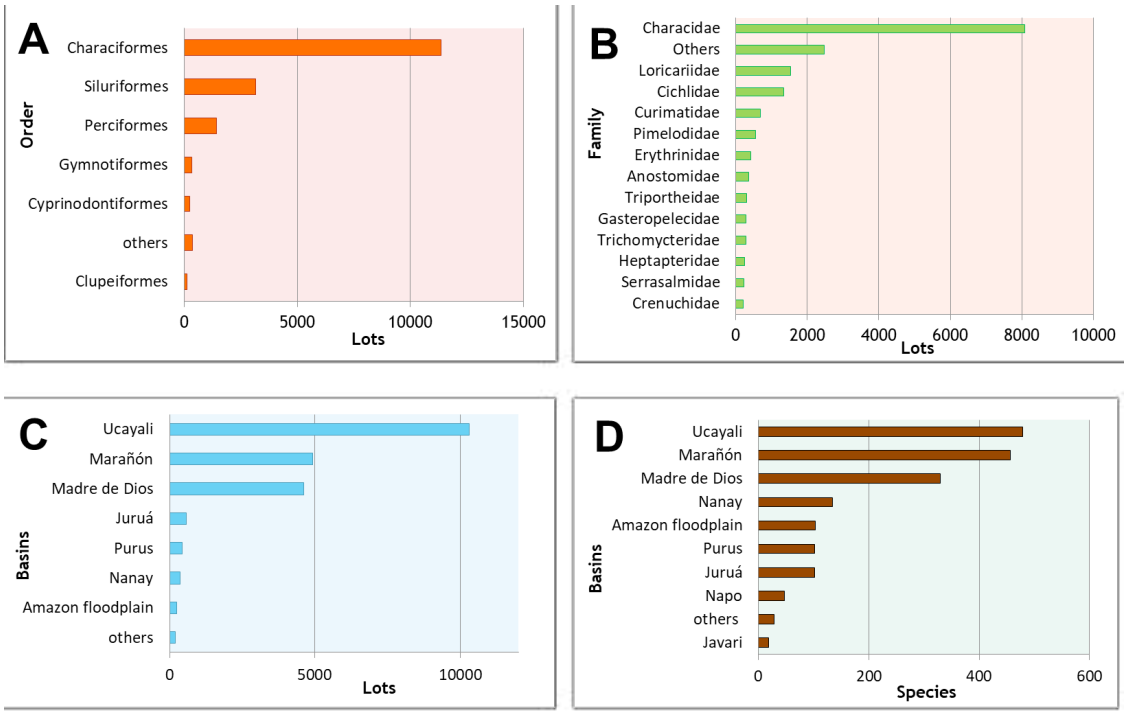

Figure 4. MUSM Fish Collection: (A) numbers of lots by orders and (B) by families. Basins: (C) represented by number of lots and (D) by number of species

which the description of the new species are based on, attributing more prominence to our collection for their significance for Neotropical fish diversity. Geographically, the records comprise 80% of Amazonian species, 90% of Pacific freshwater species and 70% of Andean species, with some few records from marine ecosystems, non-native species introduced and of neighboring basins outside Peru. Because of the high quality and quantity of the fish collection, many research ichthyologists come from several countries to examine the specimens. In recent years, due to the sampling collection efforts in scarcely explored or even never before explored areas, the scientific collection has grown significantly, with several species not yet described among the specimens collected right now deposited in the Fish MUSM.

Discussion. This collection is the most important source of information about freshwater fishes of Peru. It offers a great opportunity for researches and it has been explored by colleagues from different institutions from Brazil, USA or Europe revising different groups (characids, cichlids, astroblepisds, loricarids, pimelodids, heptapterids, cynolebids, and others) and in this way they might contribute to increase the Type material Collection and more publications for all the community. In the other hand, it is very important to increase field work, doing expeditions like to Biabo (Huallaga River Basin), or the valley of Apurimac, Ene and Mantaro Rivers (VRAEM), areas without scarce ichthyologic samples for different reasons. However, we are still getting more interesting samples with field campaigns with several students during Ichthyology and Limnology courses from lowland Peruvian Amazon (Loreto, Ucayali and Madre de Dios) as well in the last four years. We will try the same for middle and lower Marañón River: Santiago to Pacaya river and middle Ucayali River: Contamana - Sierra del Divisor, expecting to have field works along 2019 until 2020 in the near future.

Finally, we know that we need to do more major ichthyologic studies in places with gaps or few or older data and basins with ecological threats such dams, gold mining and could be best to work with colleagues from border countries or are sharing basins like: Putumayo, Heath, Purus, and Javari Rivers.

Acknowledgment. This update of information is part of AMAZONFISH (ERANet-LAC 203-2015), project initiated by our colleague and friend Javier Maldonado (in memoriam) to whom we dedicate the products of this work. We also thank to all members of Ichthyology department due to their volunteer and enthusiastic collaboration. Thanks to many ichthyologists for their continuous contributions to peruvian fish knowledge, among them several collegues from AMHN, ANSP, AUM, FMNH, IIAP, INPA, MCP, MHNG, MZUSP, NRM, ROM, UCF, UF, UFRGS, ULL, ZUEC, USNM and others institutions.

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Name and acronym:	Colección Ictiológica del MHN – UNMSM (MUSM)
Institution:	Universidad Nacional Mayor de San Marcos, UNMSM
Address:	Av. Arenales 1256, Lima 11, PERU
Curator(s) and contact(s):	Hernán Ortega hortega.musm@gmail.com Max Hidalgo mhidalgod@unmsm.edu.pe
Website:	http://museohn.unmsm.edu.pe/ictiologia.html
Year of foundation:	Museo - 1918, Ictiología - 1982
Facilities and area of the collection:	Two floors for Fish Collection, one more for process (300m^2) and another space as store (50 m^2). Nine good optical equipments.
Number of visitors per year (average considering 2015, 2016, 2017):	10
Number of loaned lots per year (average number considering 2015, 2016, 2017):	50
Specimens habitat	M (2%) and FW (98%)
Specimens origin:	Peru, Amazon basin. Mainly from Ucayali, Madre de Dios and Marañón systems.
Current cataloging method	DarwinCore standard
Total number of lots and number of lots from Neotropical region:	61,300 - 61,300
Total number of specimens and number of specimens from Neotropical region:	Aprox. 650,000
Total number of holotypes and number of holotypes from Neotropical region	60
Total number of paratypes and number of paratypes from Neotropical region:	120
Number of tissue samples from Neotropical fishes	250
Number of C&S specimens:	100
Number of dry skeleton specimens:	20

FISH COLLECTION

MZFS
Scientific Collection of the Division of Fishes at the Museu de Zoologia da Universidade Estadual Feira de Santana

Jailza T. Oliveira-Silva[1], Daniel Vinícius F. de Oliveira[2], Alexandre Clistenes de A. Santos[2] & Paulo Roberto D. Lopes[1]

The scientific collection of the Laboratory of Ichthyology (Departament of Biological Sciences) of the Universidade Estadual de Feira de Santana (UEFS) was started in August 1998, in a small room of the bioterium of the UEFS, ceded part time by the then retired prof. Orlando Bastos de Menezes, under the responsibility of prof. Paulo Roberto Duarte Lopes, assisted by volunteer trainees from the UEFS Biological Sciences course (LOPES *et al*., 1998). Later with the growth of the collection UEFS hired two biologists to develop curative activities and assist in field collections.

With the reform of the bioterium in 1992, the ichthyological collection, at the time with less than 600 lots of specimens, was transferred to a room of the Laboratory of Ichthyology. Since 2005, the scientific collection was definitely been transferred to the Fish Division of the Museum of Zoology of the UEFS (MZFS) - Museu de Zoologia da Universidade Estadual de Feira de Santana.

The fish division of the MZFS currently has 17,689 lots registered in its files. Among these, 16,757 have already been made available for consult through the speciesLink, corresponding to 1285 species (or morphospecies) in 577 registered genera. Most lots are of the specimens of fish populations of the Northeast region, followed by fishes of the Southeast, North and South. The most representative family for continental fish is Characidae, followed by Cichlidae and Erythrinidae. For marine fish, we can highlight Sciaenidae, Carangidae and Serranidae (Table 1; Figure 1).

Figure 1. Localities of lots of the Fish Division of Museu de Zoologia da Universidade Estadual de Feira de Santana.

Staff members: Curador Prof. MSc Paulo Roberto Duarte Lopes. Bachelor's degree in Biological Sciences (Zoology) in 1986 by the Federal University of Rio de Janeiro (UFRJ). He holds a Specialization in Oceanography (1990) from the Federal University of Pernambuco and a Master's Degree in Biological Sciences (Zoology) by UFRJ. Professor of Biological Sciences at the Feira de Santana State University (UEFS) since 1988. He conducts research on taxonomy and natural feeding of fish, mainly marine, in Brazil.

Biologist MSc Jailza Tavares de Oliveira Silva. Graduated in Biological Sciences (1993) and Specialist in Public Health (1998) by the Feira de Santana State University. Master's Degree in Ecology and Biomonitoring (2005) from the Federal University of Bahia. Biologist at the Division of Fishes of the Feira de Santana State University since 1988, developing research on taxonomy and ecology of fish, mainly marine, in Brazil.

Research associate Prof. Dr. Alexandre Clistenes de Alcântara Santos. He has a PhD in Biological Sciences (Zoology) and a Full Professor at the Feira de Santana State University (UEFS). He is a master's and doctoral advisor in the Postgraduate Programs in Ecology and Evolution of UEFS and Ecology and Biomonitoring of the Federal University of Bahia.

Figure 2. Facilities and staff of the Fish Division of Museu de Zoologia da Universidade Estadual de Feira de Santana. Clockwise: Front of the Museum; Collection overview, Biologist Jailza Tavares Silva and Prof. Alexandre Clistenes.

Reference

Lopes, P.R.D., Sena, M.P. & Oliveira-Silva, J.T. 1998. Dez anos (1988 – 1998) da coleção científica ictiológica do Laboratório de Ictiologia (Departamento de Ciências Biológicas) da Universidade Estadual de Feira de Santana. Sitientibus (18): 51 -65.

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[2]Laboratório de Ictiologia, DCBIO, UEFS. Av. Transnordestina, s/n, Novo Horizonte. CEP: 44036-900. BA, Brasil. alexandreclistenes@gmail.com

Name and acronym	Divisão de Peixes do Museu de Zoologia da Universidade Estadual de Feira de Santana - MZFS
Institution	Universidade Estadual de Feira de Santana
Address	Avenida Transnordestina, s/no. (km 03 – BR-116 Bairro: Novo Horizonte CEP 44036-900
Curator(s) and contact(s)	Paulo Roberto Duarte Lopes; andarilho40@gmail.com
Website	http://www2.uefs.br/ictiologia/
Year of foundation	August, 1988
Facilities and area of the collection	Area - 88.86 m²
Number of visitors per year (average considering 2015, 2016, 2017)	10
Number of loaned lots per year (average number considering 2015, 2016, 2017)	12.33
Specimens habitat	Marine - 75.62% Freshwater - 24.38%
Specimens origin	Country - Brazil Basins - Paraguaçu, São Francisco and Tocantins.
Current cataloging method	speciesLink
Total number of lots and number of lots from Neotropical region	17,689; 17,677 lots from Neotropical region and 12 lots from Celtic sea (France and Ireland)
Total number of specimens and number of specimens from Neotropical region	18 specimens from Celtic sea
Total number of holotypes and number of holotypes from Neotropical region	00
Total number of paratypes and number of paratypes from Neotropical region	2 from Neotropical region
Number of tissue samples from Neotropical fishes	0
Number of C&S specimens	0
Number of dry skeleton specimens	33

FISH COLLECTION

MZUEL
The Fish Collection of the Museu de Zoologia of the Universidade Estadual de Londrina

José L. O. Birindelli, Fernando C. Jerep, Heitor Frossard, Lenice Souza-Shibatta & Oscar Akio Shibatta

The Museu de Zoologia of the Universidade Estadual de Londrina (MZUEL) was established in 1980 with main goal to disseminate Zoology to school students of Londrina and nearby towns. During the end of the 1980's and beginning of the 1990's, a large scientific project involving researchers of the Departamento de Biologia Animal e Vegetal aiming to study distinct aspects of the Biology of the organism of the Tibagi river basin was responsible to greatly enlarge the collections of the MZUEL, especially through fishes and herpetological specimens. The specimens of the MZUEL were organized and catalogued for the first time in May 1991, whose fish species were identified by Julio Cesar Garavello. In the 1993, a researcher with background on Fish Systematics (OAS) was hired to the same department, and led the MZUEL into new scientific projects focusing on fishes. In the same time, three technicians (Mário Luis Orsi, Edson Santana and Aparecido de Souza) were hired to the MZUEL and helped collect, preserve and prepare specimens, including taxidermy specimens, as well as maintenance of the collections. In the last five years, two other researchers working on Fish Systematics (JLOB, FCJ) were hired to the same department and brought extra effort on collecting and cataloguing fish specimens. Last year, the team got another member: a biologist (HF) that used to work on the fish farm of the university and now helps curating the fish collection. In addition, a post-doc researcher working on Fish Systematics using molecular data (LSS) curates the tissue samples and molecular lab.

In the 1990's, the collection and laboratories

Figure 1. Laboratories and library of the MZUEL. Clockwise: student room; laboratory for preparations; researchers room; library; steromicroscope; desktop with collection databank.

Figure 2. Fish collection of MZUEL.

of the MZUEL occupied a single room of 30 m^2. In 1998, the collections were transferred to three rooms of 10, 20 and 40 m^2, the laboratories moved to two rooms of 20 m^2, and the library occupied a 20 m^2 room. In 2017, a new building funded by Financiadora de Estudos e Projetos (FINEP) received labs whose studies focused on Biological Assessments. The MZUEL labs and library moved to the new building totaling approximately 130 m^2 (Figure 1), whereas the collections spread to all rooms in the old building and occupies now 130 m^2, divided into three rooms for alcohol preserved specimens, one room for dry skeletons and stuffed specimens, one room for maintenance, and another room for exhibit (Figure 2). MZUEL also holds a molecular lab, which consists of a 20 m^2 room with freezers and equipment for extracting, and processing molecular samples prior to sequencing.

Currently, MZUEL is still engaged in disseminating Zoology to local community,

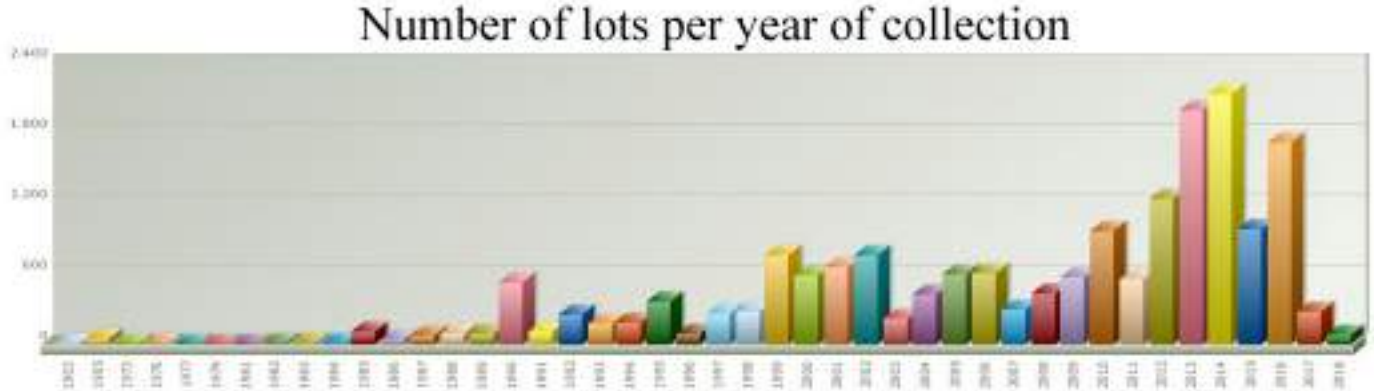

Figure 3. Number of lots per collection year. Available from: http://www.splink.org.br/.

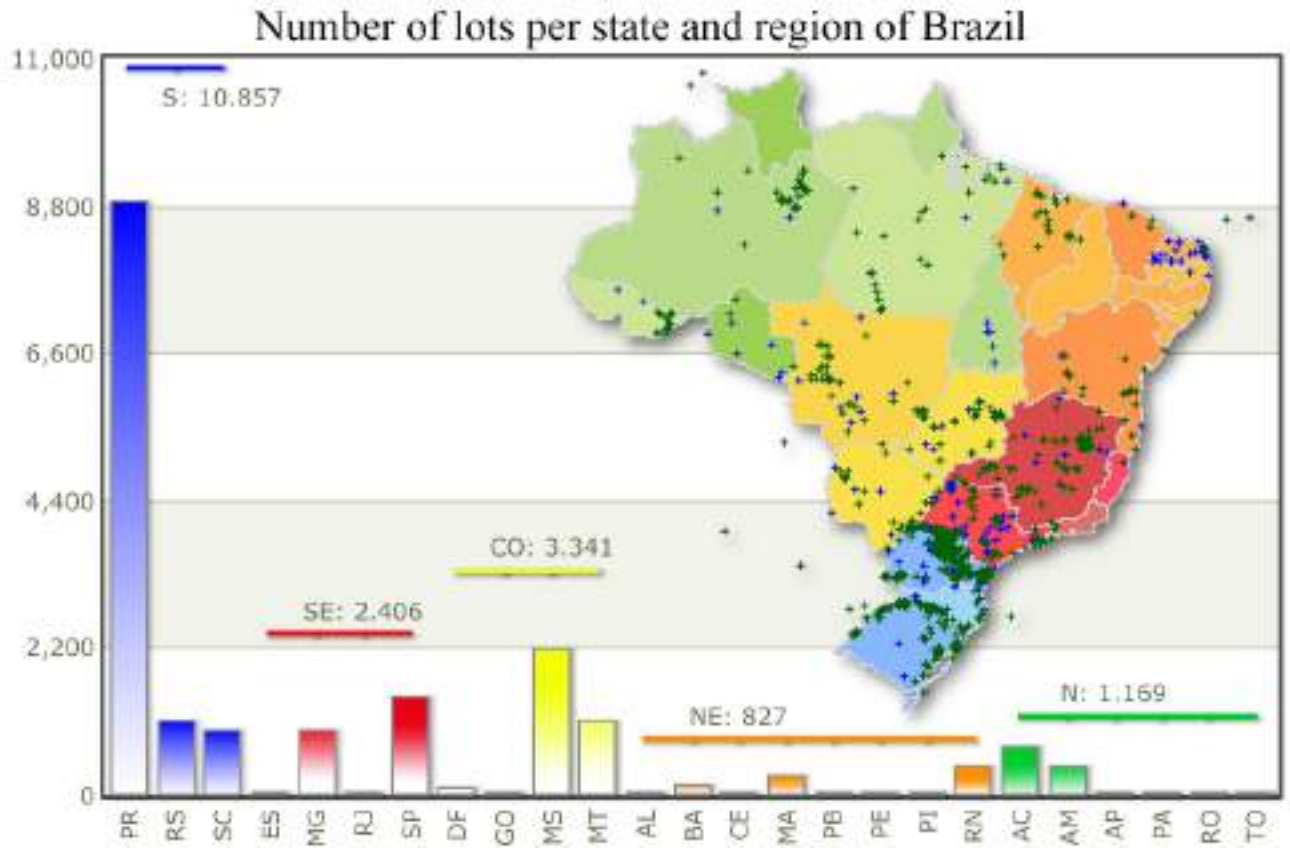

Figure 4. Geographic distribution of collection lots in South America. Available from: http://www.splink.org.br/. Brazilian geographic regions: S = Southern; SE = Southeastern; CO = Centralwestern; NE = Northeastern; N = Northern.

especially contributing in several local exhibits, and it is responsible to maintain the invertebrate and vertebrate collections used in undergraduate and graduate courses in the university. The fish collection of the MZUEL is by far the largest collection in the museum and it has grown exponentially in the last years. The number of catalogued lots grew from 867 in 1993 (when OAS was hired) to about 6.000 in 2012 (when JLOB and FCJ were hired) to a total of 20.000 today, with increase of sampling and cataloguing (Figure 3). The data of the fish collection is managed using Specify v. 6.7, and is available online through Species Link (http://splink.cria.org.br/) and SIBBr (http://www.sibbr.gov.br/). MZUEL houses today about 230.000 specimens of fish, catalogued in over 20.401 lots representing about 1.200 species. Most specimens are alcohol preserved, but at least 800 specimens are cleared and stained, and 150 were prepared as dry skeletons. MZUEL holds today 1.472 tissue samples representing 35 families, mainly of Characidae (29%) and Loricariidae (18%), and collected in the upper Paraná River basin (32%) and coastal drainages (38%). 400 MZUEL lots are currently on loan. The most important sampled areas include the Tibagi and Paranapanema rivers (upper Paraná basin), the Miranda river (Pantanal, Paraguay river basin), and the Uruguay river (Figure 4). Other smaller but important collections were made in rivers of northeast Brazil (especially in Rio Grande do Norte State), rivers in Acre state (Amazon basin), Juruena river and tributaries (Tapajós basin), Uatumã river (Amazon basin), Southern coastal rivers, Iguaçu river and Jequitinhonha and Contas rivers in eastern Brazil. The families that are better represented in the MZUEL, in number of lots, are: Characidae, Loricariidae, and Cichlidae (Figure 5). MZUEL houses the holotypes of *Hypostomus multidens*, *Isbrueckerichthys calvus*, *Isbrueckerichthys saxicola*, and *Rhyacoglanis paranensis* and paratypes of other 59 distinct species described since 2001, and lots of 20 species listed as endangered in Brazil, including: *Brycon nattereri*, *B. orbignyanus*, *Campellolebias chrysolineatus*, *Cnesterodon hypselurus*, *Gymnogeophagus setequedas*, *Hypsolebias adornatus*, *Isbruckerichthys saxicola*, *Lophiosilurus alexandri*, *Melanorivulus pinima*, *Myleus tiete*, *Neoplecostomus selenae*, *Pareiorhaphis nasuta*, *Pogonopoma obscurum*, *Prochilodus vimboides*, *Scleromystax macropterus*, *Simpsonichthys boitonei*, *Stegastes rocasensis*, *Steindachneridion scriptum*, *S. parahybae*. A website of the MZUEL is available at https://sites.google.com/site/museudezoologia/, and includes photographs of type specimens.

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Name and acronym	Coleção de Peixes do Museu de Zoologia da UEL
Institution	Universidade Estadual de Londrina
Curators	Oscar Akio Shibatta (oscar.shibatta@gmail.com), José Luís Olivan Birindelli (josebirindelli@yahoo.com), Fernando C. Jerep (fjerep@gmail.com)
Website	Homepage: https://sites.google.com/site/museudezoologia/ Database: http://www.splink.org.br/index?lang=pt
Year of foundation	1980
Facilities and area of the collection	150 m^2 and 130 m^2 respectively
Number of visitors per year (average 2016/ 2017)	5
Number of loaned lots per year	50 lots
Specimens habitat	5% marine / 95% freshwater
Specimens origin	99% from Brazil (57% south, 7% north, 18% central-west, 13% southeast, 5% northeast region), 0.8% from others countries of South America and Central America, and e 0.2% from others places.
Current cataloging method	Specify 6.7
Total number of lots/ number of lots from Neotropical region (freshwater)	20,401 / 19,980
Total number of specimens/number of specimens from Neotropical region (freshwater)	252,384 / 252,362
Total number of holotypes/number of holotypes from Neotropical region	4/4
Total number of paratypes/number of paratypes from Neotropical region	116 lots (representing 59 species)
Number of tissues samples from Neotropical region	1,472
Number of c&s specimens	800
Number of dry skeleton specimens	150

FISH COLLECTION

MZUSP
The Ichthyological Collection at Museu de Zoologia da Universidade de São Paulo

Manoela M. F. Marinho, Luiz Peixoto, Thiago Loboda, Mário de Pinna, Heraldo Britski, Naércio A. Menezes, José L. de Figueiredo, Osvaldo T. Oyakawa, Michel Gianeti & Aléssio Datovo

The birth of the Ichthyological Collection at Museu de Zoologia da Universidade de São Paulo (MZUSP) dates back to the late 19th century, from a private collection of Colonel Joaquim Sertório, known as Sertório Museum. That collection was highly heterogeneous, including multiple types of organisms, minerals, and historical objects. The Sertório Museum received many amateurs, journalists, travelers, naturalists, and prominent visitors, including members of the Brazilian Royal Family such as Emperor D. Pedro II and Princess Isabel. The importance of this collection is summarized by Carvalho (2014). In 1890, the Sertório collection was bought and donated to the São Paulo State government by Francisco de Paula Mayrink, thus forming the core of the Museu Paulista at the Ipiranga neighborhood, São Paulo. At that time, the collection was composed by 292 fish specimens, representing almost 100 species (Carvalho, 2014). The oldest specimens identified in the Ichthyological Collection at MZUSP were collected in 1890 (Figure 1). These include one freshwater species, *Astyanax laticeps* (two specimens), and two marine species, *Brevoortia pectinata* (two specimens) and

Figure 1. Oldest alcohol preserved fishes at MZUSP fish collection, all collected by H. Iheringi in 1890, Rio Grande do Sul State: a) MZUSP 2467, *Micropogonias furnieri*, Rio Camaquam (contrary to the label, the original registration indicates H. Iheringi as the collector, not his son, Rudolph Iheringi); b) MZUSP 1337, *Brevoortia pectinata*; and c) MZUSP 1708, *Astyanax laticeps*, Arroio São Lourenço.

Micropogonias furnieri (three specimens). They were sampled in Rio Grande do Sul State by the first director of the Museu Paulista, the German naturalist and physician Hermann von Ihering. These specimens most probably did not come from the Sertório Museum, but they surely witnessed the history of the collection from its earliest days to the present.

Menezes *et al*. (1997) described the main landmarks in the formation of the Ichthyological Collection at MZUSP (Fig. 2). With the incorporation of the Sertório Musem to the Museu Paulista, the zoological collection started not only to satisfy traveler's curiosity but also to attract the attention of naturalists to the importance of its holdings for research purposes. As director of the Museu Paulista for nearly two decades, H. von Ihering encouraged fieldwork and hired an excellent field naturalist, Ernst Garbe (Vanzolini, 1994), who collected all sorts of animals from 1902 to 1920. Garbe greatly contributed to the expansion of the fish collection. Records in MZUSP database indicate a total of 882 lots and ca. 3,690 specimens collected by Garbe in Brazilian river basins such as Amazonas, Doce, São Francisco, Prata, and small Atlantic coastal drainages. Approximately 100 fish specimens collected in the early 20th century by Garbe are currently designated as types at MZUSP.

In 1939, the Departamento de Zoologia was founded as a branch office of the Secretaria of Agriculture of the São Paulo government, having as its main task the maintenance of the zoological collections of the Museu Paulista. Growth of the fish collection was nearly stalled during subsequent decades. Right after the creation of Departamento de Zoologia, the fish collection was transferred to the current building (1941) located at Avenida Nazaré. At that time, the collection included 3,000 lots and ca. 10,000 specimens (Menezes *et al*., 1997). The situation changed dramatically in the 1960's, when Heraldo A. Britski and Naércio A. Menezes were hired as biologists and Izaurio A. Dias as assistant and field worker of the Fish Section of the Departamento de Zoologia. Under the direction of the herpetologist Paulo Vanzolini, who remained as director for 31 years (1963-1994), all zoological collections expanded with the incoming of freshly collected material from many field expeditions. The first field trips undertaken by Britski and Menezes to Eastern and Northeastern Brazil contributed to rapid growth. The number of specimens deposited in the fish collection had already doubled by the end of 1966 (Menezes *et al*., 1997).

One of the biggest contributions to the fish collection was a long-term field program named "Expedição Permanente à Amazônia" – EPA (Permanent Expedition to the Amazon), supervised by Vanzolini and intended to study the Amazonian fauna. Vanzolini, Britski, and Menezes headed several expeditions from 1967 to 1975 to rios Solimões, Amazonas and many of their tributaries. As a result of EPA activities, about 172,000 freshwater fishes were collected, representing more than the entire collection previously available. The marine fish collection was also greatly incremented through the activities of José Lima de Figueiredo, hired as biologist in 1970 to study marine fishes. Important additions to marine fish holdings happened in the late 1960's and early 1970's due to expeditions with the oceanographic vessel 'Prof. W. Besnard' along the Brazilian coast from Espírito Santo State to Uruguay (for example GEDIP-I and GEDIP-II cruises). About 17,000 specimens of marine fishes were incorporated to the collection (Menezes *et al*., 1997). By the middle 1970's, the collection comprised more than 25,000 lots, an order of magnitude larger than its pre-1960 figures.

The Departamento de Zoologia was incorporated into the Universidade de São Paulo in 1969. Britski, Menezes, and, a few years later, Figueiredo became Professors and began their academic careers as advisors at undergraduate and graduate levels. The three pioneer curators of the Fish Laboratory of MZUSP supervised and trained generations of Brazilian ichthyologists who subsequently founded new research centers across the country. Taxonomy of Neotropical fishes was the primary focus of the research conducted by these curators and their students, a tradition that persists to the present. Continuous research activity by the professors and their students resulted in a large inflow of material to the collection. Furthermore, several private and governmental agencies involved in environmental and inventorial studies deposited important material that contributed to the increase of the collection. In that period, the Fish Laboratory of MZUSP achieves international relevance and establishes long-term partnerships with foreign research institutions, especially the Smithsonian Institution. In the 1980's, a landmark addition was the incorporation of Amazonian fishes collected by W. Michael Goulding. As a researcher based in Manaus, and later in Belém, Goulding made extensive collections of fishes between 1977 and

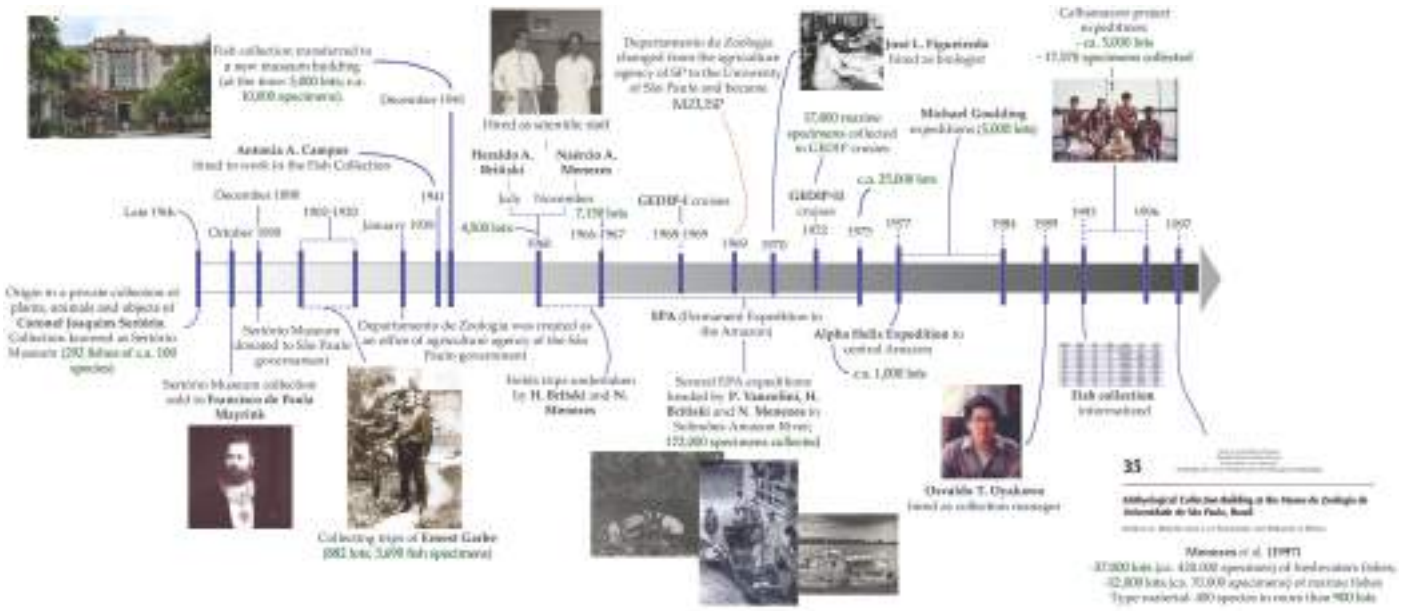

Figure 2. Timeline of Ichthyological Collection growth from its beginning to 1997 (part I). Credits: Photograph of E. Garbe derived from Abreu (2000).

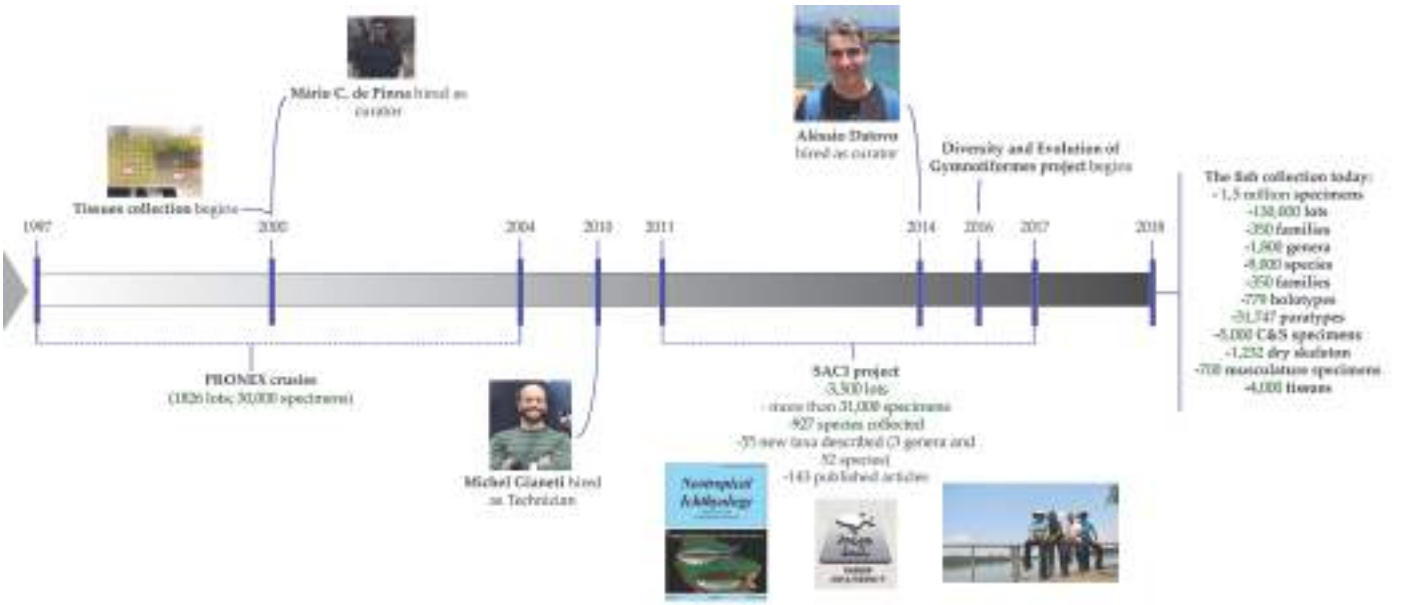

Figure 3. Timeline of Ichthyological Collection growth from 1997 to present days (part II).

1984 in several tributaries of the Amazon basin. A large part of his collections, about 5,000 lots, were incorporated into the MZUSP fish collection. In the late 1980's, Osvaldo T. Oyakawa was hired as Technician and Collection Manager of the Fish Laboratory of MZUSP. Oyakawa has dedicated his years of service to several activities involving management and basic maintenance of the collection, research activities, and participation in almost all subsequent field expeditions.

Among the various research projects undertaken in the years 1990's and 2000's in the Fish Laboratory of MZUSP, the Calhamazon and PRONEX (Programa de Apoio a Núcleos de Excelência) were responsible for the incorporation of the largest amount of material. The Calhamazon project (1993-1996) aimed to investigate the fish diversity in the main channels of the rio Amazonas. The project was funded by the National Science Foundation - NSF (USA) and the Conselho Nacional de Desenvovimento Científico e Tecnológico - CNPq (Brazil), and headed by John G. Lundberg (Duke University and The Academy of Natural Sciences of Drexel University, USA) and Menezes. With use of trawl nets, sections of the main channel were sampled between Santo Antônio do Içá, AM, and Belém, PA, with emphasis on the mouth of the main Amazon tributaries. A total of three large expeditions resulted in more than 360 species, most of which representing Siluriformes and Gymnotiformes and

including several new taxa. Most of the material was split between USA and Brazilian institutions, including INPA and MZUSP. The latter received ca. 4,720 lots and 17,570 specimens. The PRONEX project (1997-2004), coordinated by Menezes, was primarily designed to collect in poorly sampled and strategic areas in order to update the knowledge on marine and freshwater Brazilian fishes and subsidize conservational actions. Several Brazilian and foreign institutions participated and benefited from that project. Highlights include the Ichthyological Collection at Laboratório de Ictiologia de Ribeirão Preto LIRP/USP-Ribeirão Preto, which was renovated and expanded, and the Ichthyological Collection at MZUSP, which had its entire electrical system repaired and all old wood shelves replaced by steel ones. Many field trips were completed, with the help of members of the project and graduate students, to drainages of the Amazon, Parnaíba, São Francisco, and Ribeira do Iguape. The project yielded 1,826 lots and ca. 30,000 specimens to the Ichthyological Collection at MZUSP, and culminated with the publication of the "Catálogo de Peixes Marinhos e de Água Doce do Brasil" (Buckup & Menezes, 2003; Figure 3). The PRONEX project also contributed to the digitalization of the fish collection database of MZUSP and other Brazilian institutions.

Digitalization and databasing of the Ichthyological Collection at MZUSP started at 1993. Each lot was individually catalogued by technicians, graduate students and temporary staff. The first software used for collection management was MUSE (as a cooperative of "The Inter-Institutional Database of Fish Biodiversity in the Neotropics Project"- ANSP Philadelphia), replaced in 2003 by Specify (http://www.sustain.specifysoftware.org/) which is used to the present. Currently, a myriad of data may be associated to each catalogued lot, including geographic coordinates (nearly 70% of the records) and electronic files, such as photographs, radiographs, publications (pdf), and, more recently, CT-Scans.

Mário C. C. de Pinna was hired as Professor and Curator in 2000 and expanded the geographic range of the Ichthyological Collection, with the incorporation of important fish samples from other continents, especially Africa and Asia, along with collections from North America and other South American countries. Phylogenetic systematics is a prominent theme of the research conducted by de Pinna and his students, who have been encouraged to tackle research questions extrapolating Brazilian and neotropical limits. De Pinna also founded the Molecular Systematics Lab at MZUSP, which has been particularly instrumental for ichthyological research, and coordinated the organization of the Fish Lab tissue collection. Michel D. Gianeti was hired as Technician in 2010 and has greatly assisted not only with routine work in collection management but also with digitalization of large amounts of data. Since his hiring, Gianeti was responsible for cataloging over 8,000 lots. In 2014, Aléssio Datovo was hired as Professor and Curator. Datovo introduced a new line of research in the evolution of the skeletal musculature in major fish lineages. To date, Datovo and his students have assembled about 700 specimens of freshwater and marine fishes preserved with a special type of preparation for the study of muscles and other soft tissues.

With the accelerated growth of molecular systematics, the preservation and management of fish tissue samples became a priority for the Ichthyological Collection. Estimates indicate the possession of over 20,000 tissue samples in the collection, but until recently, only a small part of this material was catalogued in the database and cross-referenced with the vouchers. A new method of cataloguing, labelling, storage the molecular tissue samples has been implemented since October 2016. The percentage of catalogued tissue samples of the collection have been rapidly growing ever since.

In the 2010's, the greatest additions of material to the Ichthyological Collection at MZUSP came from the South American Characiformes Inventory - SACI Project, funded by the Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP). The main purpose of the project was to inventory the species of Characiformes in the continent and produce identification guides, atlases, catalogues, checklists, and contributions to the higher-level phylogeny of the order. A total of 34 participants from 17 Brazilian and foreign institutions were associated to the project that lasted six years (2011-2017). Eight expeditions were undertaken to several Amazonian drainages, in Brazil and Peru, and small coastal drainages of Mata Atlântica. The SACI project greatly benefited from the aid of graduate students at MZUSP in collecting, processing and identifying over 31,000 specimens (3,500 lots) belonging to 972 species. Tissue samples were taken for many representative taxa. Fifty-five new taxa were described to date based on the material collected by the SACI Project. One of the main products of the project is the Catalog of characiform fishes headed by Mônica Toledo-Piza,

Figure 4. Geographic distribution of lots deposited at Ichthyological Collection of MZUSP. Freshwater fishes correspond to 83% of lots; marine fishes 17%.

Professor of the Instituto de Biociências, USP, with the collaboration of other 43 ichthyologists. The project also made available photographs of nearly all primary types of characiforms species deposited worldwide and of hundreds of freshly collected specimens, showing life colors.

The fish collection today. Nowadays, the Ichthyological Collection at MZUSP houses ca. 130,000 lots and more than 1,5 million fish specimens belonging to over 350 families, 1,800 genera, and 9,000 species. The vast majority of this material, 99.7%, is from the Neotropics, especially from Brazil, Peru, and Venezuela. Freshwater species accounts for 83% of the total (Figure 4). The type material is composed of 779 holotypes and 31,747 paratypes. Alcohol-preserved specimens comprise the great majority of the lots, stored in glass jars, plastic drums, and steel tanks. Remaining material are clear and stained specimens (ca. 5,000), dry skeletons (1,232), musculature preparations (ca. 700), and refrigerated tissue samples (4,000 catalogued in the

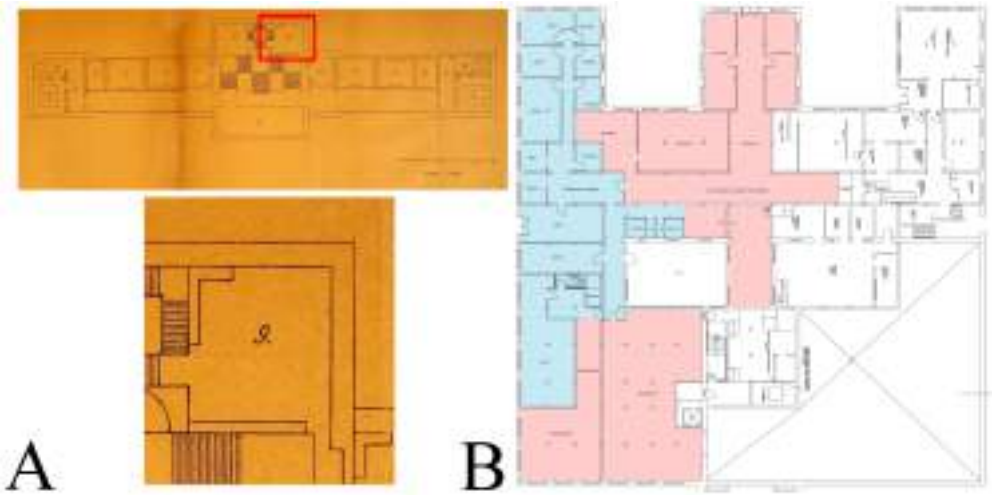

Figure 5. Architecture floorplan of the Museu Paulista published in von Ihering (1895) ["Sala de estudos de peixes" highlighted and numbered as "9"] (A); and the Ichthyological Collection of MZUSP today (B), with research offices and common areas marked in blue and collection rooms in red.

Figure 6. Ichthyological Collection equipment and collection facilities: A) inside collection view; B) compactor cabinet of type-material; C) stereomicroscope and photography studio; D) stainless steel containers; E) dry collection; F) tissues collection.

new organization from an estimated total of 20,000).

The Ichthyological Collection at MZUSP currently occupies about 700 m^2, a striking contrast with its beginning in a modest ca. 21 m^2 room named "Sala de Estudo de Peixes" at the Museu Paulista (Figure 5A). Specimens are distributed in eight major rooms of varied sizes (Figure 5B). Smaller alcohol-preserved specimens are stored in jars arranged in steel shelves; the larger specimens are stored in drums and tanks distributed in two rooms. Clear and stained material (except types) is kept separately from alcohol specimens in six closed iron compactor cabinets (Figure 6). Fish Laboratory also holds rooms for photography and stereomicroscopes, offices for professors, students, technicians, postdocs, visitors, and an open area for sorting and material preparation.

The continuous inflow of freshly collected fish material from many expeditions makes the identification and cataloguing an endless work for technical and temporary staff. In the last 13 years, 122,882 lots were catalogued at the Ichthyological Collection (Figure 7). The Fish Lab of MZUSP also

Figure 7. Number of catalogued lots (per year and total) in the last 13 years.

loans large amounts of material to other scientific institutions (ca. 120 invoices/year) (Figure 8). Currently, there are ca. 12,000 lots on loan, which correspond to almost 10% of all lots in the collection. These numbers tend to increase with the constant execution of large-scale projects, such as the recently implemented Thematic Project "Diversity and Evolution of Gymnotiformes" (DEGy), co-funded by FAPESP and Smithsonian Institution. The DEGy Project is a five-years research collaboration between MZUSP, National Museum of Natural History, and several other institutions involving 40+ researchers and students around the world. The project aims to describe several new taxa, build a comprehensive tree of life, and determine the tempo and mode of diversification of the Gymnotiformes. The project represents an opportunity to train a new generation of ichthyologists capable to integrate classical (morphology-based) and contemporary (DNA-based) approaches to study biodiversity and engage the general public through scientific outreach. Several expeditions will be conducted to unexplored or poorly sampled regions of the Neotropics, resulting in the addition of tens of thousands of specimens to the Ichthyological Collections at MZUSP and partner institutions. Another newly implemented project "Miniature Characiformes: evolution,

Figure 8. Number of exchanged lots and invoices in the last 10 years.

Figure 9. Professors, staff and some generations of fish students of Ichthyological Collection at MZUSP (left to right, top to bottom): **a.** M. Ghazzi, M. Britto and W. Wosiacki; **b.** V. Carvalho, M. de Pinna, N. Menezes, A. Datovo, M. Pastana, M. Gianeti, M. Marinho, O. Oyakawa, F. Pupo, V. Abrahão, L. Peixoto and A. de Lima; **c.** J. Figueiredo, H. Britski, F. Bockmann, A. Akama, A. Zanata, N. Menezes, R. Moura, O. Oyakawa, M. Ferraz, R. Lima, F. Fernandez, M. Triques, S. Favorito, and R. Ramos; **d.** M. Gianeti, O. Oyakawa, F. Dagosta, T. Teixeira, P. Camelier, N. Menezes and M. Loeb; **e.** C. Moreira and F. Lima; **f.** C. Campanario and M. de Pinna; **g.** Green circles indicate concentrations of employed researchers once supervised by Professors of Fish Laboratory of MZUSP. Photo B taken in front of MZUSP building (31 Sep 2018).

diversity and biogeography", funded by FAPESP, aims to investigate the evolution and diversity of miniature characiforms, using mostly ontogenetic and molecular data. This project is a four-years research collaboration between MZUSP and other Brazilian and foreign institutions. Expeditions will be performed focusing in miniature species and delicate eggs and larval specimens, which require special storage and maintenance, representing a new theme of research in the Ichthyological Collection of MZUSP.

The professors and curators of the Fish Laboratory of MZUSP have so far supervised a total of 86 graduate researchers (including 42 masters, 59 PhDs and 11 post docs). Many of these are now in academic positions in Brazilian universities or major museums, contributing to the formation of new generations of ichthyologists (Figure 9). All those numbers make the Ichthyological Collection of MZUSP the largest in Latin America and one of the most important in the world for Neotropical fishes. As a collection of reference, it receives ca. 80 research visitors per year. Biological collections play a central role in testimony the past and present biodiversity, and the Ichthyological Collection of MZUSP reaches its goals not only through fascinating scientific discoveries, but also in training new professionals who consolidate the progress of ichthyological research in the Neotropical region.

Acknowledgements. The authors are grateful to Vitor Abrahão (MZUSP) and Marcelo Britto (MNRJ) for providing some pictures used in the Figure 6. Photograph of F. Mayrink was taken from "Memória USP" (200.144.182.66/memoria/por/pessoa/517-Francisco_de_Paula_Mayrink); and the picture of MZUSP building was taken from "Imagens USP" (http://www.imagens.usp.br/?attachment_id=5534).

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Seção de Peixes, Museu de Zoologia da Universidade de São Paulo, Av. Nazaré, 481, Ipiranga, 04263-000 São Paulo, SP, Brazil. (MM) manoela.marinho@gmail.com (corresponding author), (LP) luizwp@yahoo.com.br, (AD) adatovo@usp.br, (MP) pinna@ib,usp.br, (HB) heraldo@usp.br, (NM) naercio@usp.br, (JF) zelima@usp.br, (OO) oyakawa@usp.br, (MG) michelgianeti@usp.br, (TL) lobodinha@gmail.com

Name and acronym	Museu de Zoologia da Universidade de São Paulo (MZUSP)
Institution	Universidade de São Paulo
Address	Av. Nazaré, 481, 04263-000, São Paulo, SP, Brazil
Curator(s) and contact(s)	Aléssio Datovo (adatovo@usp.br) e Mário de Pinna (pinna@ib.usp.br)
Website	http://mz.usp.br/ictio (under construction) http://splink.cria.org.br/
Year of foundation	Late 19th century
Facilities and area of the collection	Rooms: professors (5), students (3), visitors (1), staffs (1), opened preparation area (1), stereomicroscope and photography (1), fish collections (8) total of about 700m^2
Number of visitors per year (average considering 2015, 2016, 2017)	80
Number of loaned lots per year (average number considering 2015, 2016, 2017)	538
Specimens habitat	Freshwater (83%), marine (17%)
Specimens origin	Brazil, Peru and Venezuela
Current cataloging method	Specify 6.6.00, 2014
Total number of lots and number of lots from Neotropical region	Total: 123,828; from Neotropical region: 116,268
Total number of specimens and number of specimens from Neotropical region	Total: 1,545,642/ from Neotropical region: 1,541,432
Total number of holotypes and number of holotypes from Neotropical region	Total holotypes: 779; from Neotropical region: 779
Total number of paratypes and number of paratypes from Neotropical region	Total paratypes: 31,747; from Neotropical region: 31,672
Number of tissue samples from Neotropical fishes	1,931
Number of C&S specimens	5,118
Number of dry skeleton specimens	1,232

FISH COLLECTION

NRM
Brief history and description of the Ichthyological Collection of the Swedish Museum of Natural History, with emphasis on the Neotropical component

Sven Kullander & Erik Åhlander

The Swedish Museum of Natural History, Stockholm (Naturhistoriska riksmuseet, NRM) is a state museum and government agency, with collaborative academic ties to Stockholm University. The museum was formally founded in 1819, rapidly accommodating growing numbers of items from the Royal Swedish Academy of Sciences and local private natural history cabinets, all formally ceded to the Museum in 1848. An important acquisition was the collection of King Adolf Fredrik (1710–1771), which incorporated specimens from the collection of Albert Seba, and several items from Suriname. The King's collection was described by Linnaeus, and contains several Linnaean type specimens from several continents, including fish. Early major collection efforts were geared at the polar regions, including the Spitzbergen Expedition in 1903, and the South Polar Expedition in 1901–1903. The Vega Expedition (1878–1880), taking the northern route from the Atlantic to the Pacific Ocean, was the first to make the northern passage, collecting fish all the way. The only early round-the world expedition was

Figure 1. Current staff associated with the NRM fish collection, left to right Sven Kullander, Senior Curator, Andrea Hennyey, Senior Assistant (also FishBase), Bo Delling, Curator, Collections Manager, Erik Åhlander, Senior Assistant, Michael Norén, Curator (FishBase).

Figure 2. Map of South And Central America, showing collecting sites of Neotropical fishes in the Ichthyological Collection of the Swedish Museum of Natural History .

that of the Eguenie (1851–1853), mainly sailing the equatorial seas, including several stops in South America. Åhlander *et al*. (1997) provide an overview of the historical aspects of the NRM fish collection.

One of the earliest Swedish natural history collectors in South America was Eberhard Munck af Rosenschöld (1811–1868), resident in Paraguay, who made large collections of plants and animals for the Royal Academy of Sciences, but was murdered at the order of Francisco Solano López. No fishes from Munck af Rosenschöld reached Sweden. A very few collectors in the 18th and 19th Century brought back fish specimens from Saint Barthélemy in the Lesser Antilles, for some time a Swedish possession. Swedish captains, diplomats, explorers, researchers, and entrepreneurs made minor collections of fishes in different parts of South America from the early 19th century and on, especially in the Rio de Janeiro – Rio de la Plata area. The Swedish Amazonas Expedition 1924–1925 made one of the first important surveys of the upper Rio Negro drainage. Other early 20th Century expeditions collected general natural history including fishes, in southern South America (Carl Skottsberg: Tierra del Fuego, Claes Christian Olrog: Paraguay, Chile, Argentina) Notable efforts in the mid-20th century include those of Rolf Blomberg in Ecuador and Kjell von Sneidern in Colombia. Various collaborations (Brazil, Colombia, El Salvador, French Guiana, Paraguay, Peru Uruguay) were established from the 1980s onward and are reflected in a significant growth of the Neotropical component of the fish collection in this period.

Current research focuses on systematics of tropical freshwater fishes, with an "integrative" approach as far as possible. Professors and associate professors at the museum may supervise Master and PhD projects. The fastest growing part of the collection is the tissue collection with more than 10000 samples and growing. Visitor facilities are well equipped, and, supplementing photography, X-ray, and preparation labs for ichthyology, the museum has a molecular systematics laboratory, and access to electron microscopes.

Reference

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Swedish Museum of Natural History, POB 50007, SE-104 05 Stockholm, Sweden.

Name and collection code	Swedish Museum of Natural History, NRM
Institution	Swedish Museum of Natural History
Address	POB 50007, SE-104 05 Stockholm, Sweden
Curators and contacts	Sven Kullander, Bo Delling, Erik Åhlander, Andrea Hennyey, Michael Norén (FishBase)
Website	http://artedi.nrm.se/nrmfish
Year of foundation	1819
Facilies and area of the collection	About 300 sqm, including underground fluid collection space, bomb shelter for types and other particularly valuable specimens; freezers for tissue samples (-70–-80°. Other freezers, preparation rooms, glass storage room, alcohol storage, skin collection storage, part of osteological collection space; student/visitor labs, photography and X-ray labs; shared dermestarium and dissection lab for large objects
Visitors per year	5
Habitats	Global, mainly freshwater (70–80%), representation best for Sweden, South America, Asia, Africa
Loaned lots per year	8
Specimen origins	Global, particularly Sweden, Asia (China, Myanmar), South America (Peru, Paraguay, Uruguay), Africa (Lake Tanganyika)
Current cataloguing method	The Artedian v. 2
Total number of lots and number of lots from Neotropical region	Total 62,177 Neotropical 17,395
Total number of specimens and number of specimens from Neotropical region	Total 516,708 Neotropical 149,701
Total number of holotypes and number of holotypes from Neotropical region	Total 206 holotypes 44 Neotropical holotypes
Total number of paratypes and number of paratypes from Neotropical region	1,016 paratype objects total (7,645 specimens) 457 Neotropical paratype objects (2,881 specimens)
Number of tissue samples from Neotropical fishes	2,205
Number of C&S specimens	700
Number of dry skeleton specimens	248

FISH COLLECTION

NUP
Ichthyologic Collection of the Núcleo de Pesquisas em Limnologia, Ictiologia e Aquicultura (Nupélia) of the Universidade Estadual de Maringá (UEM)

Carla Simone Pavanelli & Marli Cristina Campos

As part of the Center of Research in Limnology, Ichthyology and Aquaculture (http://www.nupelia.uem.br, https://www.facebook.com/Nupelia/), the Nupélia's Ichthyologic Collection was created with the initial aim of keeping specimens of the Center of research. Over time, it has expanded its size, importance and scope. Currently, it houses comparative material from different localities, paratypes of several new species, as well as voucher specimens. All material is available to the scientific community. Loans, exchanges and other transactions have been carried out with different institutions from Brazil and other countries. Most of the collection is preserved in 70ºGL ethanol, but a set of cleared, stained and preserved in glycerin specimens is gradually increasing, as well as a tissue bank for molecular analysis.

The geographic representation of the Collection is Neotropical, with emphasis on the ichthyofauna of the rio da Prata basin. A little more than 20,000 lots of more than 2,000 species, more than 350 genera and 63 families of fish are in our database and many are yet to catalog. The Collection is part of the Network of Biological Collections of the Paraná State, Taxonline (http://taxonline.bio.br/index.php). The Ichthyologic Collection also houses a collection of ichthyoplankton from the main Brazilian hydrographic basins, with different stages of development of several freshwater fish species of our ichthyofauna, being one of the few such specialized laboratories in Brazil. Their data were incorporated into the Ichthyologic Collection and allowed the disclosure of the study of eggs and larvae of freshwater fish. Due to non-computerization of

Figure 2. Nupélia's fish collection shelves.

Figure 1. Nupélia's collections facilities.

Figure 3. Nupélia's fish collection jars.

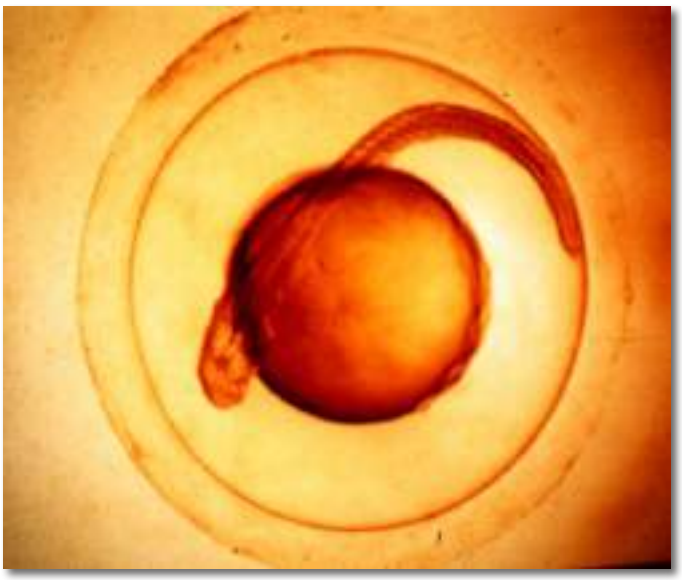

Figure 4. Egg of Nupélia's ichthyoplankton collection.

Figure 5. Larva of Nupélia's ichthyoplankton collection.

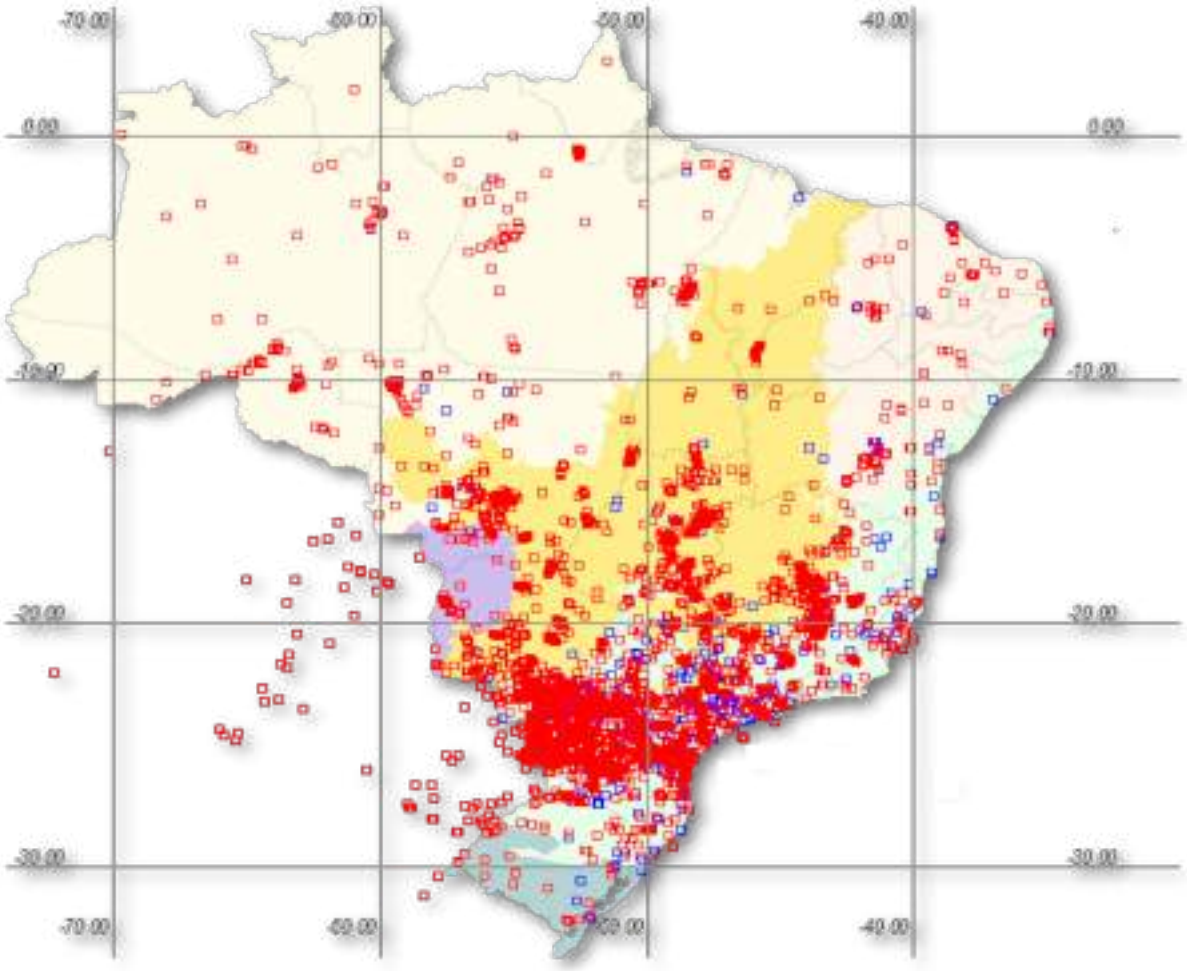

Figure 6. Map of localities of Neotropical lots of Nupélia's fish collection.

the collection data, only an estimate of its size can be provided, a rating of about 290,000 eggs, 370,000 larvae and 50,000 young. The larvae and youngsters are members of 35 families, encompassed by nine orders. This collection, in addition to serving as a reference for the development of projects in the region, has served in recent years researchers from different institutions of various Brazilian states and forums in Brazil, who seek advice on the development of their projects.

Coleção Ictiológica do Nupélia, Universidade Estadual de Maringá, Av. Colombo, 5790, 87020-900 Maringá, PR, Brazil. (CSP) carlasp@nupelia.uem.br, (MCC) marli@nupelia.uem.br

Name and acronym	Coleção Ictiológica do Núcleo de Pesquisas em Limnologia, Ictiologia e Aquicultura - NUP
Institution	Universidade Estadual de Maringá – UEM
Address	Nupélia, Universidade Estadual de Maringá, Av. Colombo, 5790, 87020-900 Maringá, PR, Brazil
Curator(s) and contact(s)	Dr Carla Simone Pavanelli (fishes), carlasp@nupelia.uem.br, phone +55 44-3011-4632, Dr Andréa Bialetzki (ichthyoplankton), bialetzki@nupelia.uem.br, phone +55 44-3011-4640, Marli Cristina Campos (collection manager), marli@nupelia.uem.br, phone +55 44-3011-5997
Website	Nupélia's Biologic Collections, http://www.splink.org.br/search?collectioncode=NUP
Year of foundation	1990 (fishes), 2010 (ichthyoplankton)
Facilities and area of the collection	The Nupélia's fish collection is housed in an area of about 700m^2, designed specifically to house the collections, with an infrastructure and specifications necessary for laboratory activities, air conditioning and a combo network for telephony and logic
Number of visitors per year (average considering 2015, 2016, 2017, 2018)	33 on average
Number of loaned lots per year (average number considering 2015, 2016, 2017)	89 on average
Specimens habitat	All freshwater
Specimens origin	Most specimens come from Brazil, but the following countries are also represented in the collection: Antarctica (Antarctica basin), Argentina (Paraná and Uruguay basins), Guyana (Amazon basin), Paraguay (Paraná and Paraguay basins), Peru (Madre de Dios basin), Poland (Vistula basin), Suriname (Atlantic basin), USA (Colorado River basin and Everglades)
Current cataloging method	Specify 7.2
Total number of lots and number of lots from Neotropical region	20,317 lots
Total number of specimens and number of specimens from Neotropical region	158,691 specimens, most from the Neotropics, with just one from Antarctica, 11 from Nearctic and one from Palearctic
Total number of holotypes and number of holotypes from Neotropical region	We only have paratypes
Total number of paratypes and number of paratypes from Neotropical region	357 paratypes and one paralectotype, all from the Neotropics, great majority from Brazil
Number of tissue samples from Neotropical fishes	781
Number of C&S specimens	245
Number of dry skeleton specimens	4

FISH COLLECTION

NPM
The Fish Collection of the Instituto de Biodiversidade e Sustentabilidade - NUPEM/UFRJ, Universidade Federal do Rio de Janeiro (UFRJ), Brazil

Paula A. Catelani[1], Arthur B. Bauer[1], Lorena S. Agostinho[1], Barbara T. Villarins[2], Allan P. B. Pozzobon[1], Pedro H. Carvalho[2], Luciano G. Fischer[2], Michael M. Mincarone[2] & Fabio Di Dario[2]

Scientific collections, whether associated with museums of natural history, public institutions or universities, are of the utmost importance as sources and keepers of biological information on which several scientific studies are based (Zaher & Young, 2003; Rocha *et al*., 2014; Bauer *et al*., 2016). Besides being fundamental to increasing the understanding of several aspects of biodiversity, Biological Collections are also crucial for studies focusing on evolution, environmental health, climate change, and species conservation (Rocha *et al*., 2014). Among the different types of zoological collections, regional collections are generally characterized by being located outside large city centers and by possessing specimens of a particular locality, area or geographic region (Papavero, 1994). These collections are important because they generally promote an increase in the local biological knowledge, especially when inserted in regions with highly diversified but still insufficiently known biota. In addition, regional collections contribute to the training of specialized personnel (Zaher & Young, 2003; Bauer *et al*., 2016). Specimens deposited in regional collections are also relevant to the establishment of public strategies aimed at the conservation and sustainable use, since they might reflect the abundance, richness and variation of populations over time in a given locality (Zaher & Young, 2003; Rocha *et al*., 2014).

The Fish Collection of the Instituto de Biodiversidade e Sustentabilidade - NUPEM/UFRJ, Universidade Federal do Rio de Janeiro (UFRJ), Brazil, was established in 2008. The original goal of the collection was to foster studies on taxonomy, phylogeny, biogeography and ecology of the diversified biota of the northern portion of the Rio de Janeiro state, southeastern Brazil. The coastal environments of the region compose a mosaic of lagoons, river streams and estuaries in sandy plains covered by the “Restinga” vegetation. In the more inland portion of the northern Rio de Janeiro state, several mountains with relatively well-preserved remnants of Atlantic Forest and associated fast-flowing rivers are, in turn, present. The adjacent marine region comprises a substantial portion of the Campos Basin, with a total surface area of approximately 100.000km^2 (ANP, 2015; Mincarone *et al*., 2016). Several stretches of the marine coastal region of the northern Rio de Janeiro state, such as the Santana Archipelago, which is located just at about 8 km of the city of Macaé, are still insufficiently known in terms of its marine fish biodiversity (Bauer *et al*., 2017).

In the last decades the natural ecosystems of the northern Rio de Janeiro state were significantly impacted by human activities, mostly related with the urbanization and industrial growth resulting from economic activities associated with the offshore oil exploration at the Campos Basin, which accounts for approximately 72% of the total oil production in Brazil (ANP, 2015). Despite its biological, economic and biogeographic relevance, just a few studies focused on the diversity of the ichthyofauna of the northern Rio de Janeiro state were conducted so far (e.g., Costa & Mincarone, 2010; Di Dario *et al*., 2011, 2013, 2014, 2017; Catelani *et al*., 2014; Costa *et al*., 2015; Bauer *et al*., 2017), highlighting the relevance of the NPM Fish Collection in the regional context.

Currently the NPM holds 6028 lots, composed by specimens belonging to 52 orders, 227 families and 1168 species of marine and freshwater

fishes. The Teleostei is represented by 1110 species in 207 families and 32 orders, according to the classification of Wiley & Johnson (2010), while the Chondrichthyes is represented by 58 species in 20 families and 11 orders, following Nelson *et al*. (2016). In the Teleostei, some of the more representative families of fishes are the Macrouridae (42 species), Clupeidae (29), Carangidae (29), Characidae (27), Sciaenidae (26) and Engraulidae (25) (Figure 1A). In the Chondrichthyes, the families with the largest number of species are the Rajidae (13), Scyliorhinidae (7) and Dasyatidae (4) (Figure 1B).

The collection has a strong regional focus, since a substantial portion of the specimens deposited was collected in both marine and continental environments in the Rio de Janeiro state and adjoining areas. However, the Fish Collection has been consistently growing since 2008 in terms of number of specimens, taxonomic diversity, and geographic coverage. As a result, the Collection now includes specimens from nine Brazilian states and 37 countries in four continents (Figure 2).

Almost all specimens deposited in the NPM Fish Collection, including those from other countries, were collected by the associated staff (students and professionals) in different scientific projects and expeditions. One example was the recently concluded "HABITAT Project", in which deep-sea expeditions were carried out in the continental slope off southeastern Brazil. In the activities associated with this study, specimens that are rarely collected given their natural depth of occurrence were captured and are now catalogued in the Collection (Figure 3). In addition, significant exchanges with other national and international collections are frequently made and include, in a few cases, the repatriation of specimens.

As a result of the "HABITAT Project" and similar initiatives, the NPM now holds a significant collection of deep-sea fishes from the Campos Basin,

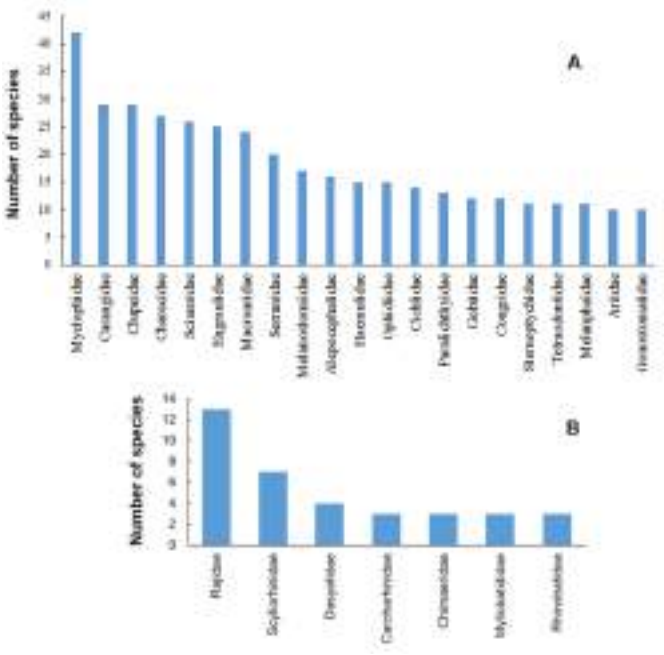

Figure 1. Number of species in the 21 families of Teleostei (A) and in the seven families of Chondrichthyes (B) more represented in the NPM Fish Collection.

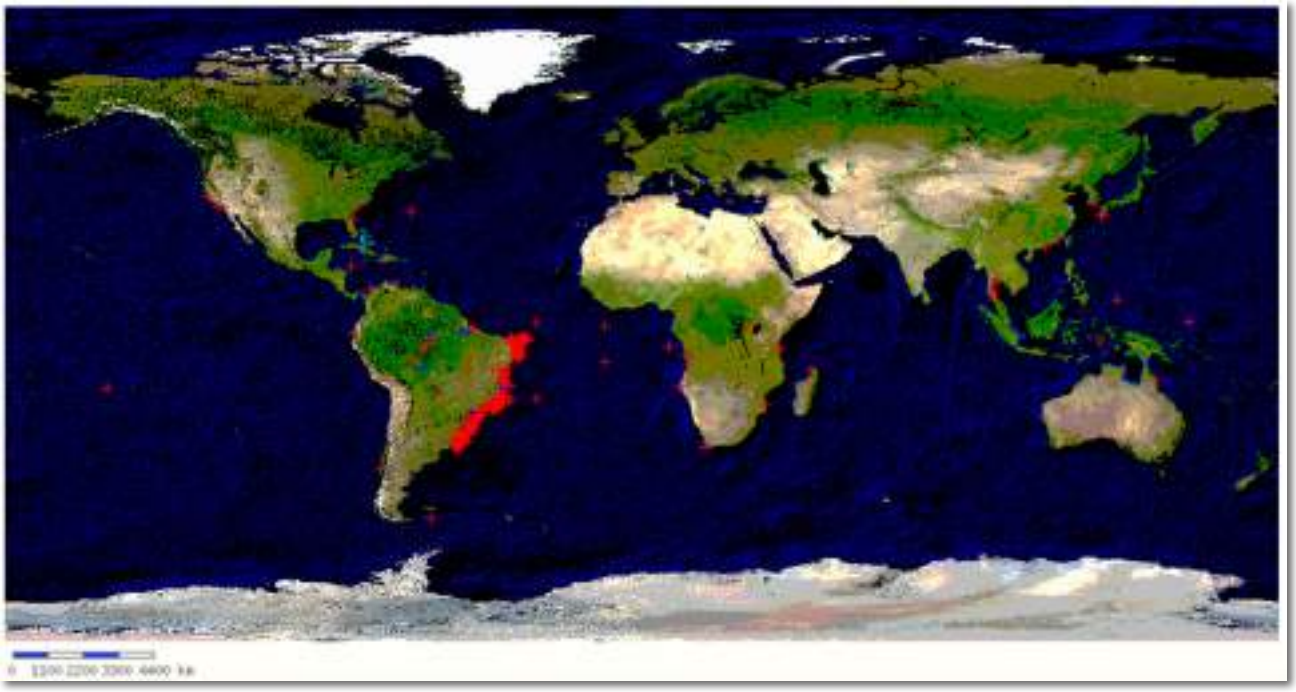

Figure 2. Distribution of georeferenced lots catalogued in the NPM Fish Collection. Original map provided by *species*Link (http://www.splink.cria.org).

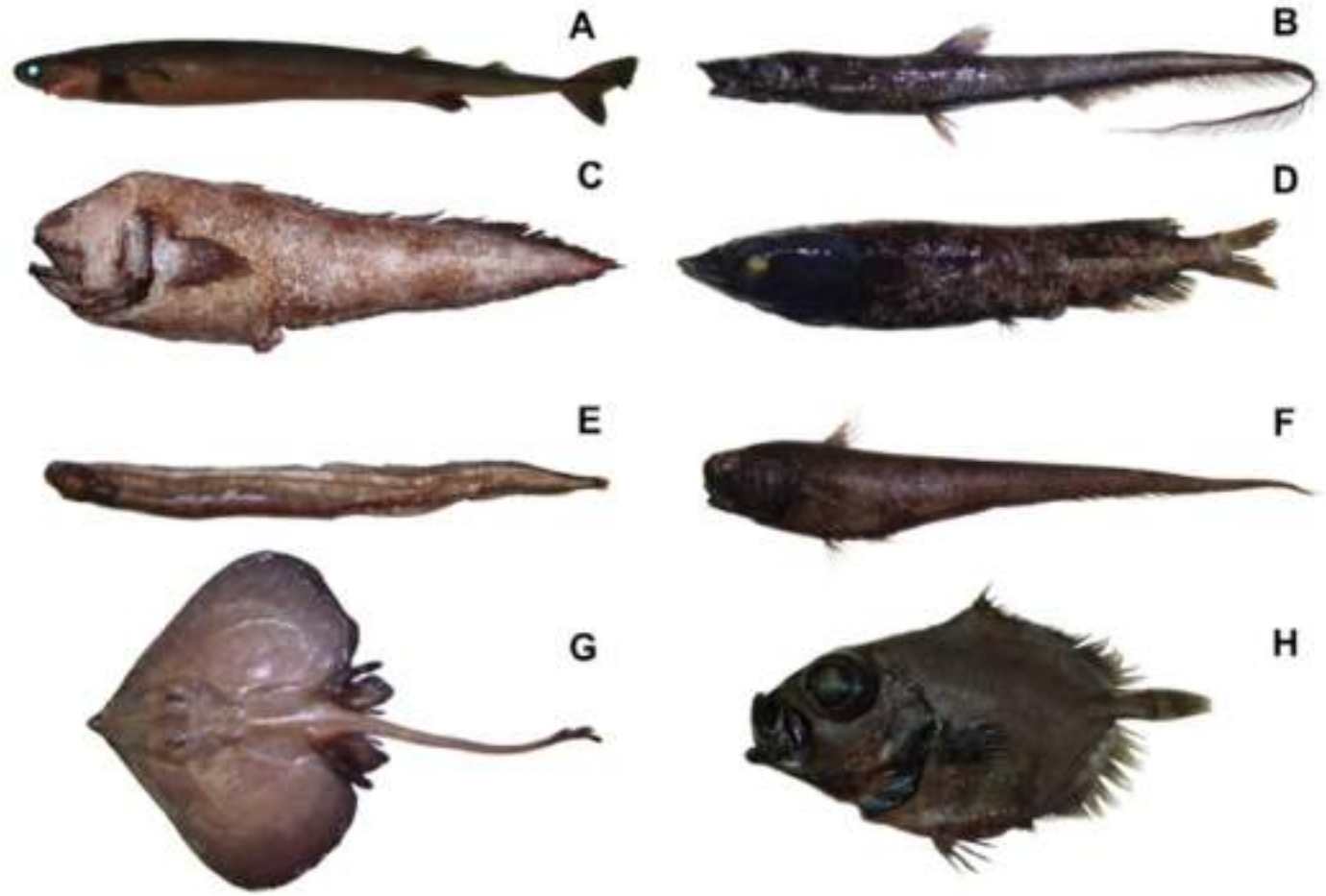

Figure 3. Specimens deposited in the NPM Fish Collection collected during the "HABITAT Project": *Isistius brasiliensis* (A); *Halosauropsis macrochir* (B); *Xyelacyba myersi* (C); *Conocara murrayi* (D); *Simenchelys parasitica* (E); *Trachonurus sulcatus* (F); *Malacoraja obscura* (G); *Allocyttus verrucosus* (H).

but other deep-sea portions of the Brazilian Exclusive Economic Zone are also relatively well represented. Some of the more well-represented orders of deep sea fishes are the Stomiiformes, Aulopiformes, Gadiformes, Ophidiiformes, Argentiniformes and the Myxiniformes, which together are represented by more than 100 species distributed in about 850 lots.

The NPM Fish Collection is also fully digitized through the free software Artedian 2.1.5 (Sven O. Kullander, Swedish Museum of Natural History), which operates in the Microsoft Access environment. In addition, the NPM database has been fully available online at the *species*Link platform since October 2012, and can be accessed at http://splink.cria.org.br/manager/detail?setlang=pt&resource=NPM. The number of records of the NPM Fish Collection available online at the *speciesLink* platform has actually increased substantially in the last four years (Figure 4).

Figure 4. Number of NPM records available in the *species*Link platform since 2012 (http://splink.cria.org.br/manager/detail?setlang=pt&resource=NPM).

The NPM Fish Collection also holds a tissue bank associated with voucher specimens that is gradually increasing in terms of total number of specimens and taxonomic coverage. The tissue bank of the collection was originally intended to provide support to taxonomic and phylogenetic studies, but more recently, sampling efforts have also been focused on fisheries and conservation genetics issues. The tissue collection now holds approximately 1800 catalogued samples encompassing 34 orders, 66 families and 177 species of the Teleostei, and 18 families and 41 species of the Elasmobranchii (Figure 5).

More than 1000 tissue samples, which represents about 40% of the total samples currently

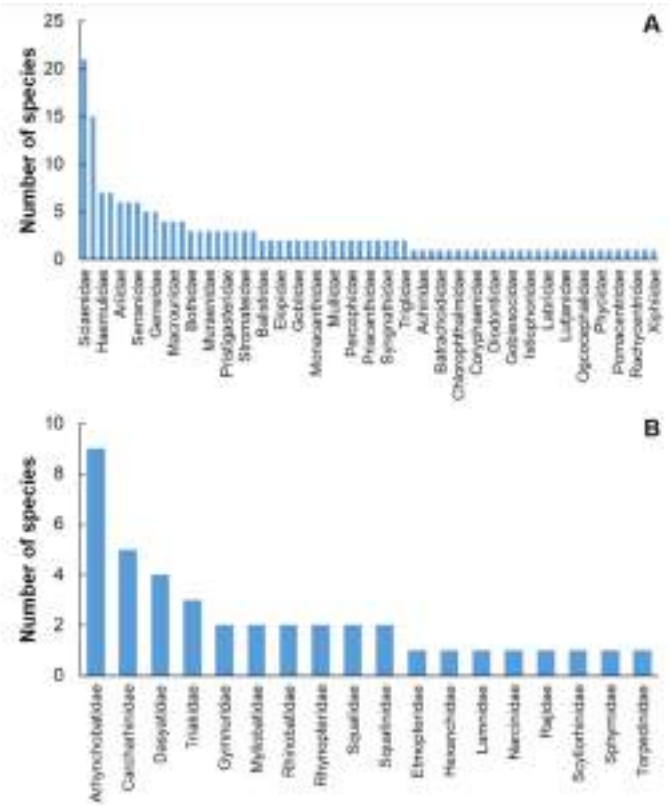

Figure 5. Number of species represented in the tissue bank of the NPM Fish Collection, in a total of 66 families and 177 species of Teleostei (A), and 18 families and 41 species of the Chondrichthyes (B).

associated with the NPM Fish Collection, is still being catalogued. Among the non-catalogued samples, about 500 were collected during the cruises associated with the "HABITAT Project", and include taxonomically-interesting species from the continental shelf and slope down to 2000 meters off the northeastern Rio de Janeiro state. An additional 400 tissue samples collected during the "ABRACOS Project" were also collected off the northeastern Brazilian coast and Fernando de Noronha and Atol das Rocas. Remaining uncatalogued samples included several species from marine and brackish environments from northeastern Rio de Janeiro state.

The NPM Fish Collection primarily supports scientific research in ichthyological studies, but its holdings are also relevant to the formation of several students of the Biological Sciences Undergraduate Course and the Graduate Program of Environmental Sciences and Conservation (PPG-CiAC), which are both offered in the Instituto de Biodiversidade e Sustentabilidade - NUPEM/UFRJ. In addition, the NPM is also integrated with distinct outreach projects that promote the diffusion of the biological knowledge in different segments of the local society (Bauer *et al.*, 2016). During outreach activities that involve the local community, interesting and scientifically relevant aspects of the fish diversity of the region are discussed based on the specimens deposited in the NPM Fish Collection.

Given the current pace of development of the NPM Fish Collection, one of the main challenges that the associated staff and students will certainly face in the near future is the necessity for expansion of the physical structure of the collection. The NPM Fish Collection is also still highly dependent on the passionate dedication of both undergraduate and graduate students, which, together with the curators and associated professionals, are responsible for the care and maintenance of its holdings. Such challenges are unfortunately common to most, if not all, regional biological collections that have emerged in the last decades in Brazil. With the undermining of scientific activities in general due to the extreme reduction of funding in the last years, which has only heightened the historical lack of support for taxonomic studies in Brazil, one can only wonder what will be the future of regional scientific collections such as NPM, in spite of their unique role in the process of assessment and conservation of the Neotropical biodiversity (The NPM Fish Collection is supported by Projeto MULTIPESCA, through FUNBIO, under Grant "Pesquisa Marinha e Pesqueira", contract 104/2016).

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Name and acronym	Fish Collecion of the Instituto de Biodiversidade e Sustentabilidade - NUPEM/UFRJ, Universidade Federal do Rio de Janeiro (UFRJ) - NPM
Institution	Universidade Federal do Rio de Janeiro (UFRJ)
Address	CP 119331, CEP 27910-970, Macaé, RJ, Brasil
Curator(s) and contact(s)	Fabio Di Dario (didario@gmail.com) Michael Maia Mincarone (mincarone@gmail.com);
Website	https://www.macae.ufrj.br/nupem/index.php/colecao-de-peixes-npm
Year of foundation	2008
Facilities and area of the collection	36 m², Faxitrom Digital X-Ray machine, microscopes/ stereoscopes
Number of visitors per year (average considering 2015, 2016, 2017)	scientific (students and staff from other institutions): 3/year; basic-scholar level students in outreach activities: more than 200/year
Number of loaned lots per year (average number considering 2015, 2016, 2017)	10 lots/year
Specimens habitat	87.55% marine; 12.45% freshwater
Specimens origin	97.37% Brazil; 0.46% Tanzania; 0.38% USA; 0.24% Mozambique; 0.24% Mexico.
Current cataloging method	Artedian 2.1.5
Total number of lots and number of lots from Neotropical region	6,028 total lots; 5,981 (97.74%) lots from Neotropical (marine and continental)
Total number of specimens and number of specimens from Neotropical region	78,472 total specimens; 77,960 (99.34%) specimens from Neotropical (marine and continental) region
Total number of holotypes and number of holotypes from Neotropical region	0
Total number of paratypes and number of paratypes from Neotropical region	2
Number of tissue samples from Neotropical fishes	about 2,800 tissue samples
Number of C&S specimens	about 50 specimens
Number of dry skeleton specimens	0

FISH COLLECTION

OMNH
Ichthyology Collection of The Sam Noble Oklahoma Museum of Natural History

Dahiana Arcila[1,2*] & Sara Cartwright[1]

Despite significant progress made in documenting the diversity of life, there are still about 86% of the species presently on Earth and approximately 91% of the existing species in the worldwide oceans awaiting to be discovered and described (Mora, C., Tittensor, D.P., *et al*. 2011). Globally, fishes are the largest group of vertebrates, representing 32,000 out of the 60,000 recognized species; they occupy all major aquatic ecosystems and have a similar numerical species diversity between freshwater (~16,000 spp.) and marine (~16,000 spp.) environments (Nelson, J.S. 2006, Nelson, J.S., Grande, T., *et al*. 2016).

Understanding the global and regional patterns of fish diversity is a major priority not only for studying their evolutionary history but also for developing strategies of conservation for vulnerable and threatened species. Natural history collections play a fundamental role as biorespositories of this diversity and provide verifiable and permanent records of wildlife and environmental conditions (Clemann, N., Rowe, K.M., *et al*. 2014). Although there are over 510 ichthyology collections around the world (Fricke, R. and Eschmeyer, W.N. 2018), there are still major gaps in our understanding of the Fish Tree of Life, with at least 104 out of 514 recognized families being underrepresented in museum collections and lacking robust phylogenetic information (Betancur, R.R., Wiley, E.O., *et al*. 2017, Eschmeyer, W.N., Fricke, R., *et al*. 2017), and approximately 15 families lack any genetic sequence data (Clark, K., Karsch-Mizrachi, I., *et al*. 2016).

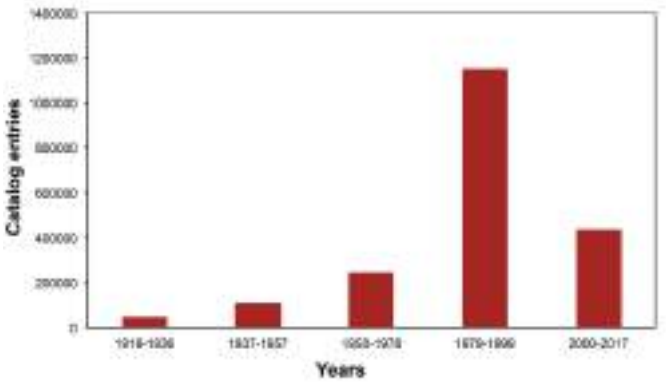

Figure 1. Growth of the Fish Collection at the Sam Noble Oklahoma Museum of Natural History.

Herein, we provide an overview of the Ichthyology Collection at the Sam Noble Oklahoma Museum of Natural History and its role in documenting regional and global fish diversity.

History of the fish collection. The ichthyology collection of the Sam Noble Oklahoma Museum of Natural History (OMNH) was established in 1924 - 1934 through the collecting efforts of the herpetologist Arthur Irving Ortenburger. While Ortenburger directed the field, Carl L. Hubbs (University of Michigan) examined fishes from those expeditions with material being divided between the Sam Noble Oklahoma Museum of Natural History (then Museum of Zoology at University of Oklahoma) and the University of Michigan Museum (Ortenburger, A.I. and Hubbs, C.L. 1926, Hubbs, C.L. and Ortenburger, A.I. 1929a, Hubbs, C.L. and Ortenburger, A.I. 1929b). The first curator of the collection was Carl D. Riggs, who made extensive collections from 1950 to 1980 in North America, and specialized in the study of the white bass, gars and the bowfin.

During the last 40 years, curators William J. Matthews and Edie Marsh-Matthews substantially expanded the collection through multiple biological surveys of the streams of Oklahoma and Arkansas assessing the ecology of various fish communities (Figure 1; Ross, S.T., Matthews, W.J., *et al*. 1985, Marsh-Matthews, E. and Matthews, W.J. 2000, Matthews, W.J., Marsh-Matthews, E., *et al*. 2013, Matthews, W.J. and Marsh-Matthews, E. 2016). Beginning in the 1970's the collection also grew through the efforts of the conservationist Jimmie Pigg in river drainages in southern Oklahoma (especially the Kiamichi and Muddy Boggy drainages), and in the early 2000's due to the support of the Oklahoma Department of Environmental Quality.

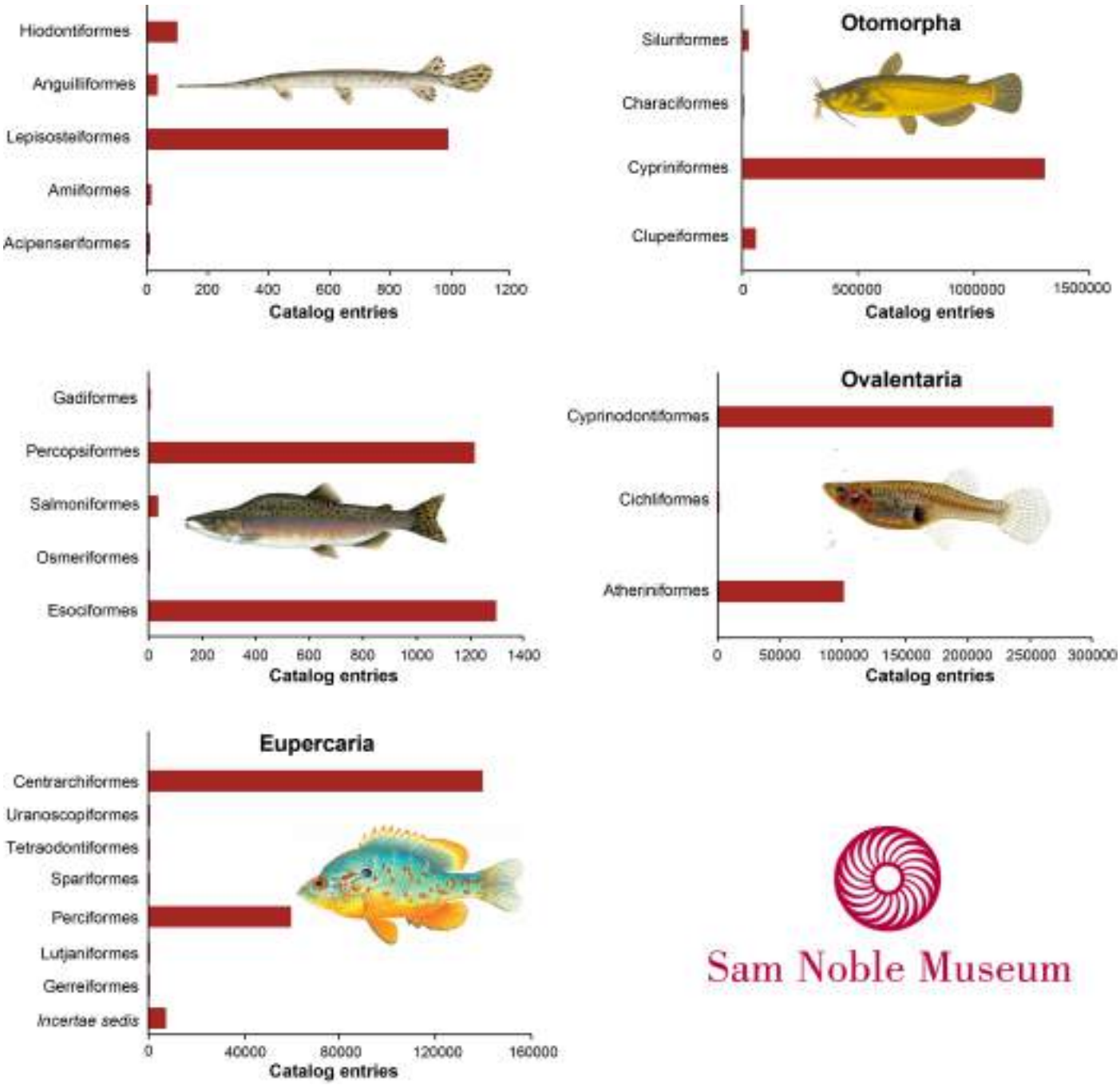

Figure 2. Catalog entries of specimens by order deposited at the Sam Noble Oklahoma Museum of Natural History.

Others contributing substantially to the Sam Noble collection (then Stovall Museum) in 1960's to the 1970's included Anthony Echelle, William Shelton, Loren G. Hill, Gordon Hall, and Hague Lindsay, either through class collections or fieldwork surveys. For many years, the fish collection was housed at the University of Oklahoma until it was move to the new Sam Noble building in 1998.

The significance of the fish collection. The ichthyology collection encompasses two million specimens representing 38 out of 72 orders and 72 out of 514 fish families (Figure 2; following the fish classification by Betancur, R.R., Wiley, E.O., *et al.* 2017). The collection contains more than 58,000 catalogued lots from North America, including large holdings from Arkansas, Missouri, Texas, Virginia and Tennessee, as well as Mexico (Figure 3). Currently, more than 90% of the specimens are cataloged and georeferenced in different biological databases including VertNet, GBIF, and iDigBio.

The OMNH fish collection provides a unique database for investigating changes in the structure of freshwater fish communities because these specimens were systematically collected during the last four decades with repetitive sampling in the same localities (Figures 1 and 2). This historical fish collection data has provided a powerful tool in investigations of the effects of climate change and habitat disturbance in fish assemblages across

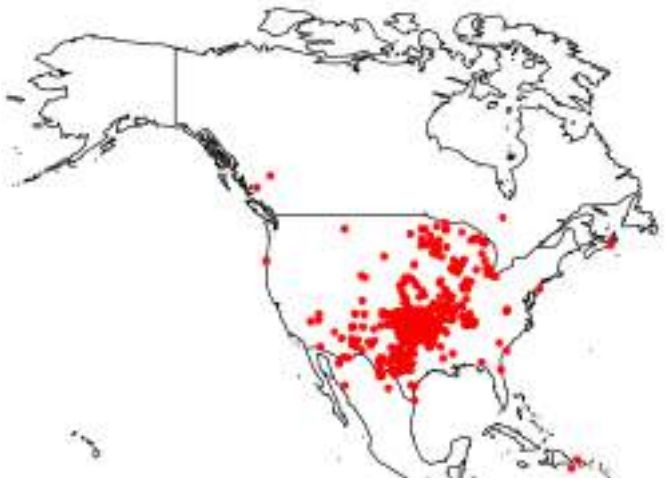

Figure 3. Collection localities of fishes deposited in the Ichthyology Collection at the Sam Noble Oklahoma Museum of Natural History.

different localities and periods of time (Matthews, W.J., Marsh-Matthews, E., *et al*. 2013, Matthews, W.J. and Marsh-Matthews, E. 2016).

During the forthcoming years, the fish collection will continue conducting biological surveys in Oklahoma and the rivers of the Great Plains and will also expand its taxonomic focus to the Neotropical, Afrotropical and Indo-Pacific regions, emphasizing collecting tissues in order to increase the research potential of the collection. Also, to anticipate the needs of the upcoming generations of ichthyologists, the collection will emphasize fieldwork expeditions in regions with presently under-represented fish families and genera, and in regions where future collecting may be challenging due to potential habitat degradation or overfishing. Metadata information associated to each specimen, and high-resolution photographs, will continue as a major task of the collection.

List of type specimens

Cypriniformes

***Erimystax x-punctatus* Hubbs & Crowe, 1956**
Paratypes: OMNH 26244 (14) Oklahoma, Cherokee, Illinois River, Sec 27/T19N/R23E, 36.0902, -94.8346, 17 August 1946.

***Notropis girardi* Hubbs & Ortenburger, 1929**
Paratypes: All from USA: OMNH 5946 (100) Oklahoma, Cleveland, Lower Canadian 4.5 miles SW of Norman, 35.1672, -97.4565, 30 October 1924. OMNH 5948 (7), Oklahoma, Cleveland, Canadian River, South of Norman, 35.1907, -97.4831. OMNH 6196 (1), Oklahoma, Roger Mills, Canadian River, Durham 6 MI. N.W., 35.8793, -99.9996, 1926. OMNH 6205 (215), Oklahoma, Texas, Coldwater Creek, Guymon, 9 MI. S.W., 36.589, -101.361, 1 July 1926. OMNH 6211 (90), Oklahoma, Cimarron, Cimarron River, 3 miles NW of Kenton, 36.926, -102.9591, 27 July 1926. OMNH 6252 (1000), Oklahoma, Alfalfa, Salt Fork of Arkansas River, 7 miles east, 2 miles north of Ingersoll, 36.8311, -98.3072, 11 July 1926. OMNH 6260 (11) Oklahoma, Cimarron, West Carrizo Creek, 3.5 miles north of Kenton, 36.9535, -102.9424, 7 July 1926.

***Macrhybopsis australis* Hubbs & Ortenburger, 1929**
Paratypes: OMNH 6337 (600), Oklahoma, Harmon, Red River, 7 miles SW of Hollis, 34.5775, -99.9571, 16 June 1926.

Centrarchiformes

***Etheostoma flavum* Etnier & Bailey, 1989**
Paratypes: OMNH 43325 (4) Kentucky, Logan, Whippoorwill Creek, Hwy 80/68 east of Daysville, 36.8151, -87.0093, 10 August 1980.

***Etheostoma pyrrhogaster* Etnier & Bailey, 1988**
Paratypes: OMNH 43396 (6) Tennessee, Henry, Terrapin Creek, Below Hwy 69, 36.4975, -88.4900, 18 September 1981.

***Etheostoma radiosum* Hubbs & Black, 1941**
Paratypes: OMNH 26154 (83), Oklahoma, Pontotoc, Little Blue River, 34.4901, -96.6292, 5 April 1947. OMNH 26155 (15), Oklahoma, Bryan, Cedar Creek, 7 miles east, 1 mile south of Durant, Hwy 70, 34.4901, -96.6292, 5 April 1947. OMNH 26156 (19), Oklahoma, Pontotoc, Clear Boggy System (Jack Fork), S of ADA, 34.709, -96.643, 16 April 1949. OMNH 26157 (36), Oklahoma, Latimer, Buffalo Creek, 21 miles south of Wilburton, 34.7231, -95.2688, 17 April 1949.

***Etheostoma zonistium* Etnier & Bailey, 1988**
Paratypes: OMNH 43326 (5) Tennessee, Henry, Blood River, County Road 8160, 36.4731, -88.1956, 28 May 1971.

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Name and acronym	OMNH (also as OMNH-N); previously proposed abbreviation UOMZ (Leviton *et al*. 1985) not adopted; alternative abbreviations OKMNH (Leviton & Gibbs 1988) not adopted but cited in publications for fishes; also as UOMNH (not adopted)
Institution	University of Oklahoma, The Sam Noble Oklahoma Museum of Natural History [formerly Stovall Museum]
Address	2401 Chautauqua Avenue, Norman, Oklahoma 73072, USA
Curators	Carl Riggs 1954 - 1966
	Loren G. Hill 1966 - 1982
	William J. Matthews 1982 - 2003
	Edie Marsh-Matthews 2003 - 2014
	Dahiana Arcila 2018-
Website	http://samnoblemuseum.ou.edu/collections-and-research/ichthyology/
Year of foundation	1924-1934
Facilities and area of the collection	Library (279 sq. ft.)
	Wet lab (401 sq. ft.)
	Collection storage (2090 sq. ft.)
	Preparation lab (440 sq. ft.)
	Field storage (223 sq. ft.)
Number of visitors per year	~35
Number of loaned lots per year	3
Specimens habitat	Freshwater, marine
Specimens origin	Mexico, Canada, Greater Caribbean, and large holdings from the Great Plains
Current cataloging method	Microsoft Access
Total number of lots from Neotropical region	3
Total number of holotypes and number of specimens from Neotropical region	0
Total number of paratypes and number of paratypes from Neotropical region	7/0
Number of tissue samples from Neotropical fishes	412 (collected as of 2019)
Number of C&S specimens	50
Number of dry skeleton specimens	53

FISH COLLECTION

ROM
Central and South American Fish Holdings of the Royal Ontario Museum, Canada

Hernán López-Fernández[1,2,3], Erling Holm[1], Mary E. Burridge[1], Margaret E. Zur[1] & Don Stacey[1]

The ROM Ichthyology collection is considered to be the leading collection of its kind in Canada. The wet collection is housed in an off-site location and has over one million specimens of approximately 9,000 species from around the world. In addition to specimen collections, the ROM holds the largest frozen fish tissue collection in Canada. Catalogued holdings of the collection are listed in a regularly updated database and most are available on the web through search portals in Fishnet, Vertnet, the Canadian Biodiversity Information Facility, and the Global Biodiversity Information Facility. The collection is at the centre of active research programs by ROM curators, and University of Toronto professors and their graduate and undergraduate students and postdoctoral research associates in the Department of Ecology and Evolutionary Biology.

Collection History. The Royal Ontario Museum of Zoology (ROMZ) was formed in 1914. Approximately 150 lots of preserved and mounted fish specimens had been donated from individuals and organizations including J. H. Garnier (1882), and the British Museum of Natural History (1901). In 1934, J.R. Dymond was appointed Director of ROMZ, and also Head of the Fish Division. During this period, Dymond increased the fish collections through his many connections with the Toronto Normal School, Provincial Museum, Marine Biological Station in eastern Canada, Go Home Bay Laboratory on Lake Huron, and Ontario Fisheries Research Laboratory. During Dymond's period, 33 Ontario and 20 out-of-province field expeditions were conducted for research, teaching, and documenting the poorly known diversity of fishes, particularly in Ontario. By Dymond's retirement in 1949, over 17,000 lots of fishes were catalogued into the ROM collection. In 1948, W.B. Scott became Curator of the fish collection, participating in Canadian freshwater expeditions outside of Ontario, as well as 18 cruises in the North Atlantic Ocean from Canada to the Caribbean Sea. By his departure in 1977, the fish collection had increased in size to 40,000 lots, approximately 5,000 of which were neotropical marine (Fig. 1).

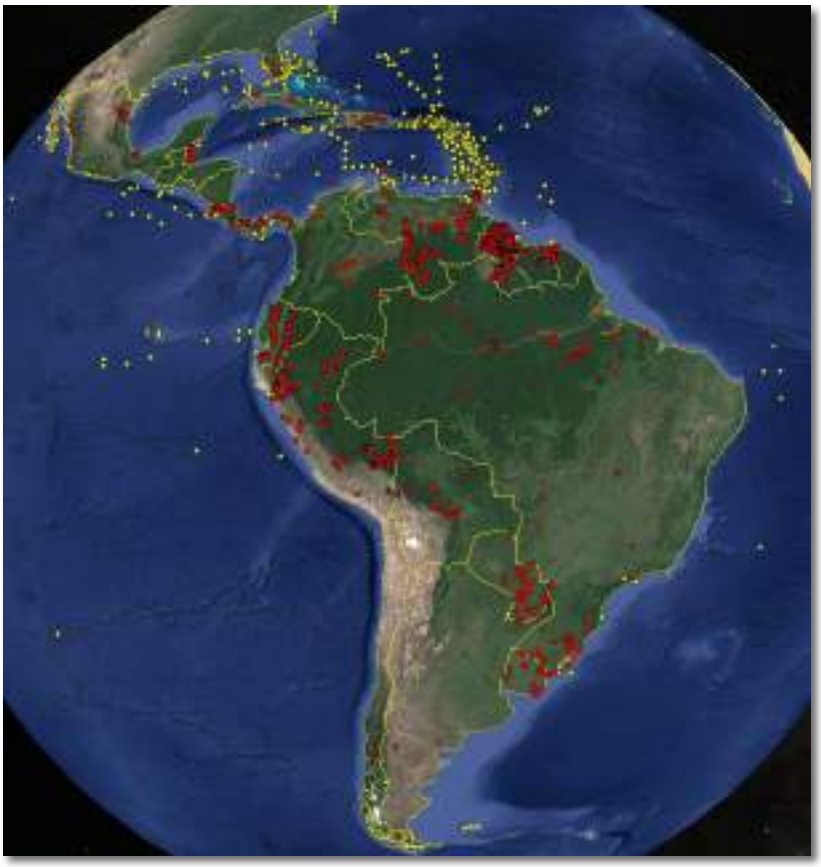

Figure 1. Neotropical fish collections of the Royal Ontario Museum, Canada. Red dots: freshwater collections; yellow dots: marine collections.

A period of expansion occurred in the staffing of the ichthyology department from the late 1950s to the 1990s; at the height of this period three Curators were employed: E.J. Crossman

(1957-1995), A.R. Emery (1963-1984), and R. Winterbottom (1976-2010). Collection growth was rapid, with almost 40,000 lots added to the collection. Of particular interest here are the first neotropical coral-reef collections from the Barbados, Saint Vincent and the Grenadines, and Trinidad and Tobago made by A.R. Emery, with over 1,000 lots being added to the collection.

In 2008, H. López-Fernández joined the ROM, specializing in cichlid fishes from South and Central America. In his 10 years at the ROM he directly increased the collection by over 9,000 lots and 13,000 tissue samples. H. López-Fernández left the ROM in December 2017 and is now Curator of Fishes at the University of Michigan, Museum of Zoology. At present, there is no ichthyology Curator at the ROM. Assistant Curators also played a distinguished role in the collecting and research activities of the ROM's fish division. Most notable are expeditions to the Indo Pacific and Suriname (Mary Burridge), to Guyana, Perú and Trinidad and Tobago (Erling Holm), and especially the publication of the landmark volume "Field Guide to the Fishes of Ontario" (Holm *et al*. 2010).

Scope of the collections. The ichthyology collections have specimens from all continents and all oceans, with particular strengths in Canadian, Indo-Pacific coral reef, and Central and South American fishes. Of the 445 families of fishes, the ROM has representative species from 430. Of the approximately 32,000 species of fishes, the ROM houses over 9,000 (Tab. 1).

Wet Collection. The wet collection is located in an off-site facility, west of Toronto. This facility is approximately 15 years old and houses over one million specimens of fishes, as well as other wet collections from the Department of Natural History, ROM (Fig. 2). The collection currently holds over 105,000 catalogued lots, including 147 holotypes and 1,300 paratypes. The ROM houses the largest and most diverse collection of Canadian freshwater fishes in existence. Of the 232 known fish species in Canada, the ROM collection presently holds 212, or over 91%, and provides a critical tool for studies on disappearing wildlife. The collection contains significant holdings of 74 potentially threatened species, including 3 identified as extinct, and is used on a continuing basis for the designation of vulnerable, threatened, or endangered species, as well as for analyses of historical trends in the distribution of Canadian and Ontario fishes. With some material dating back to the 1850s, the ROM's preserved collection of fishes has great historical significance. Among these are the last remaining

Figure 2. Erling Holm, Collection Manager, working in the Royal Ontario Museum fish collection.

specimens of the now extirpated Atlantic Salmon from Lake Ontario. Analyses of historical trends in the collection records as well as tissues, stable isotopes and stomach contents can detect changes in the distribution and habitats of particular species. This is an important tool in determining the impacts of human-related activities such as climate change, watershed modification and urbanization on fish populations.

The ROM ichthyology collection is also renowned for its holdings of coral-reef fishes, which represent approximately 20% of its holdings. Particularly strong are the holdings from the Indo-Pacific and the Caribbean. This collection exemplifies the diversity of such areas as the Chagos Archipelago, Palau, Indonesia, and the Philippine Islands. Of the 701 species known to occur in Chagos, the ROM collection has 585 species, or 85%. From the more diverse habitat of the Philippines, the collection has 586 species (or 50%) of the approximately 1,200 known.

The Neotropical (South and Central American) freshwater fish collection has been an area of rapid growth in the past decade (Fig. 1) with the incorporation to the ROM of freshwater fish Curator Hernán López-Fernández (2008-2017). The ROM ichthyology collection today holds one of the three largest collections of freshwater fishes from Guyana, one of the most biodiverse countries of South America. The most remarkable collections from Guyana include those from the upper Mazaruni River basin and the Berbice River. The upper Mazaruni contains a unique fish fauna with nearly 80% of species new to science and between 67% and 95% rate of endemism. The basin is under increasing environmental pressure from extensive gold mining operations along the main Mazaruni channel. The Berbice River collection stands out as the only comprehensive ichthyological collection from that basin anywhere. The ROM collection also includes one of the two North American collections of fishes from the Xingu River basin in the Brazilian Amazon before the extensive transformation initiated with the construction of the new Belo Monte "mega dam", which is transforming the nature of the river and will likely imperil many of its unique species. With over 15,000 samples, the ROM holds one of the largest collections of Neotropical fish frozen tissues for DNA analyses anywhere.

Cleared and stained collection. There are over 1,700 cleared and stained specimens catalogued and data based into the ROM collection. These are preserved in glycerine, and housed with the wet collection. Cleared and stained material is an important tool for researchers who study the internal morphology of fishes. Most fish families represented in the wet collection are also in the cleared and stained collection.

Tissue collection. The ROM holds the largest frozen fish tissue collection in Canada. There are over 25,000 lots with voucher specimens housed in the alcohol collection. Most Canadian freshwater species are represented, as are many Neotropical freshwater and Indo-Pacific coral reef species. Most Canadian species and members of the family Gobiidae have been "bar coded" by sequencing a short section of mitochondrial DNA in collaboration with University of Guelph Barcode of Life Project. The tissue collection of Neotropical freshwater fishes exceeds 15,000 samples from Guyana, Venezuela, Brazil, Bolivia, Ecuador, Peru, Mexico and Costa Rica, making it one of the most extensive collections of its kind anywhere.

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Name and acronym	Royal Ontario Museum (ROM)
Institution	Royal Ontario Museum (ROM)
Address	100 Queen's Park, Toronto, Ontario, Canada M5S 2C6
Curator(s) and contact(s)	Hernan Lopez-Fernandez Curator 2008-2017, hlopezf@umich.edu; Erling Holm Assistant Curator, erlingh@rom.on.ca; Mary Burridge Assistant Curator, maryb@rom.on.ca
Websites	ROM (www.rom.on.ca); Fishnet (www.fishnet2.net/index.html); Vertnet (www.vertnet.org/index.php); Canadian biodiversity information facility (www.cbif.gc.ca/home_e.php); Global biodiversity information facility (www.gbif.org)
Year of foundation	1914 (with dried fish specimens dating back to 1850)
Facilities and area of the collection	offsite alcohol storage, 3 rooms: 750m²
Number of visitors per year (average of 2015, 2016, 2017)	3-year average: ROM: 1.35 million; ichthyology collection: 24
Number of loaned lots per year (average of 2015, 2016, 2017)	3-year average: 25 alcohol; 25 tissue
Specimens habitat	59% freshwater, 41% marine
Specimens origin	Neotropical countries: Antigua & Barbuda, Barbados, Belize, Bermuda, Brazil, Cayman I, Chile, Colombia, Costa Rica, Cuba, Dominica, Ecuador, Grenada, Guadeloupe, Guyana, Haiti, Honduras, Jamaica, Martinique, Mexico, Netherlands Antilles, Nicaragua, Panama, Paraguay, Peru, Puerto Rico, St. Kitts & Nevis, St. Lucia, St. Vincent & the Grenadines, Suriname, The Bahamas, Trinidad & Tobago, USA, Uruguay, Venezuela, Virgin I (UK), Virgin I (USA)
Current cataloguing method	Access 2010, in the process of converting to TMS (The Museum System)
Total number of lots and number of lots from Neotropical region	Total lots: 105,000; Neotropical lots: 23,000
Total number of specimens and number of specimens from Neotropical region	Total specimens: 1.15 million; Neotropcial specimens: 226,000
Total number of holotypes and number of holotypes from neotropical region	Total holotypes: 147; Total neotropical holotypes: 4
Total number of paratypes and number of paratypes from neotropical region	Total paratype lots: 1,297; Total neotropical paratype lots: 175 (total neotropical paratype spms: 1,353)
Number of tissue samples from Neotropical fishes	15,400
Number of C&S specimens	Total C&S lots: 1,760; spms: 5,400; Total neotropical C&S lots: 165; spms: 240
Number of dry skeleton specimens	1,000 (mostly Canadian)

FISH COLLECTION

TCWC
The Collection of Fishes at the Biodiversity Research and Teaching Collections, Texas A&M University

Heather L. Prestridge & Kevin W. Conway

The Biodiversity Research and Teaching Collections (BRTC) was established in 1936 by the Department of Wildlife Management (now Department of Wildlife and Fisheries Sciences) at Texas A&M University, College Station Texas, USA. The BRTC was originally named the Texas Cooperative Wildlife Collection and we continue to use TCWC as our official collection abbreviation (Sabaj, 2016). Under the direction of William B. Davis (a mammologist and chair of the Dept. Wildlife Management) and ornithologist Walter P. Taylor, holdings of the BRTC grew rapidly through both the research activities of its curators and through the acquisition of regional material via the US Geological Surveys. Early accessions into the collection were predominantly specimens of mammals and birds and it was not until the Department of Wildlife Management hired its first ichthyologist in the 1970s (R. Kirk Strawn, 1959–1992) that the Collection of Fishes saw significant growth. Today, the BRTC is the largest collection of vertebrates in Texas and one of the largest University-based natural history collections in the United States (ranked 10th), with over one million preserved specimens divided across four sub-collections: (1) Fishes (Figure 1); (2) Amphibians and Reptiles; (3) Birds; and (4) Mammals.

The Collection of Fishes currently houses 828,178 specimens distributed across 57,530 catalogued lots. This equates to 3,940 species, 1,548 genera and 364 families of fishes, representing 54 of the 57 orders recognized by Nelson *et al.* (2016). This collection includes specimens from 71 countries, representing all continents and all major oceanic basins. Catalogued lots of fishes at the BRTC are divided almost equally between freshwater (50.4%) and saltwater (49.6%) taxa, but in terms of total numbers of specimens, freshwater fishes are more numerous and comprise 76.9% of the total collection (Table 1). All specimens housed within the Collection of Fishes at the BRTC are electronically databased using a Microsoft Access platform and can also be accessed online via FishNet2, VertNet, iDigBio, and GBIF. 97% of specimens in the collection are fluid preserved and stored in 70% ethanol. The remaining 3% of specimens are represented by skeletal preparations, including dry dermestid prepared skeletons (2%) or cleared and double stained specimens (1%) (Figure 3). 7% of our lots are accompanied by tissue samples suitable for genetic analysis and stored in ultra-cold (-80°C) freezers on site. In some cases, multiple specimens from the same lot have been sampled for tissues prior to fixation in 10% formalin and subsequent preservation in ethanol. The majority of our specimens are stored in glass jars up to 1 gallon in volume on metal shelving. Specimens that are too large to fit inside of 1 gallon jars are stored in metal,

Figure 1. One of the 22 rows of fish specimens in the TCWC Fish Collection.

plastic, or wooden coffins ranging from 16 to 3,500 gallons in volume.

Growth of the Collection. Accessions from the 1930s through the 1960s to the Collection of Fishes primarily included material from Texas and surrounding states, collected through field work associated with undergraduate student courses offered by the Department of Wildlife and Fisheries Sciences (WFSC), especially those instructed by Strawn. These classes added ca. 1500 lots of freshwater fishes from Arkansas, Florida and Texas. An expedition to Mexico in 1964 by students of WFSC resulted in a small collection of fishes from the Río Papaloapan in Veracruz, which also represent the first international specimens to be added to the collection. Under the direction of Willis and Linda Pequegnat, the Department of Oceanography at Texas A&M also established a collection of natural history specimens, including fishes and deep sea invertebrates from the Gulf of Mexico obtained through the research activities of the Research Vessel Alaminos, which was stationed in Galveston, Texas. After the retirement of the Pequegnats in the 80s, ca. 3,200 lots of marine fishes collected through the activities of the Research Vessel Alaminos (mostly from the Gulf of Mexico but also from the Caribbean) were transferred from the Department of Oceanography to the Collection of Fishes at the BRTC.

In 1973, WFSC hired John D. McEachran as Ichthyologist and Faculty Curator of Fishes. McEachran obtained his Ph.D. from the Virginia Institute of Marine Sciences (VIMS) under the supervision of Jack Musick. McEachran's research interests were (and continue to be) focused on elasmobranch fishes (and batoids in particular) and this resulted in the growth of the elasmobranch material housed at the BRTC. This material was obtained largely from the Smithsonian Oceanographic Sorting Center and the Mediterranean Marine Sorting Center but McEachran also arranged a number of specimen exchanges with other collections, including the Natural History Museum, London (BMNH) and the National Museum of Nature and Science of Japan (NMST-P). One major product of McEachran's tenure at Texas A&M was the completion of the Fishes of the Gulf of Mexico (McEachran & Fechhelm, 1998, 2010), a two-volume set of books includes keys and illustrations to the species of marine and estuarine fishes known to occur in the Gulf of Mexico at that time. The addition of Kirk O. Winemiller, a prominent fish ecologist, to the WFSC faculty in 1992 resulted in major additions of neotropical fishes to the Collection of Fishes at the BRTC, most notably large collections of freshwater fishes from the Cinaruco River, Venezuela. Graduate students in the Winemiller lab continue to add material to the collection, including recent large collections from Brazil, Cambodia, Benin and Belize. In 2010, Conway replaced McEachran as WFSC Ichthyologist and Faculty Curator of Fishes. Conway's interests in freshwater and intertidal marine fishes have resulted in the addition of several new families, genera, and species to the

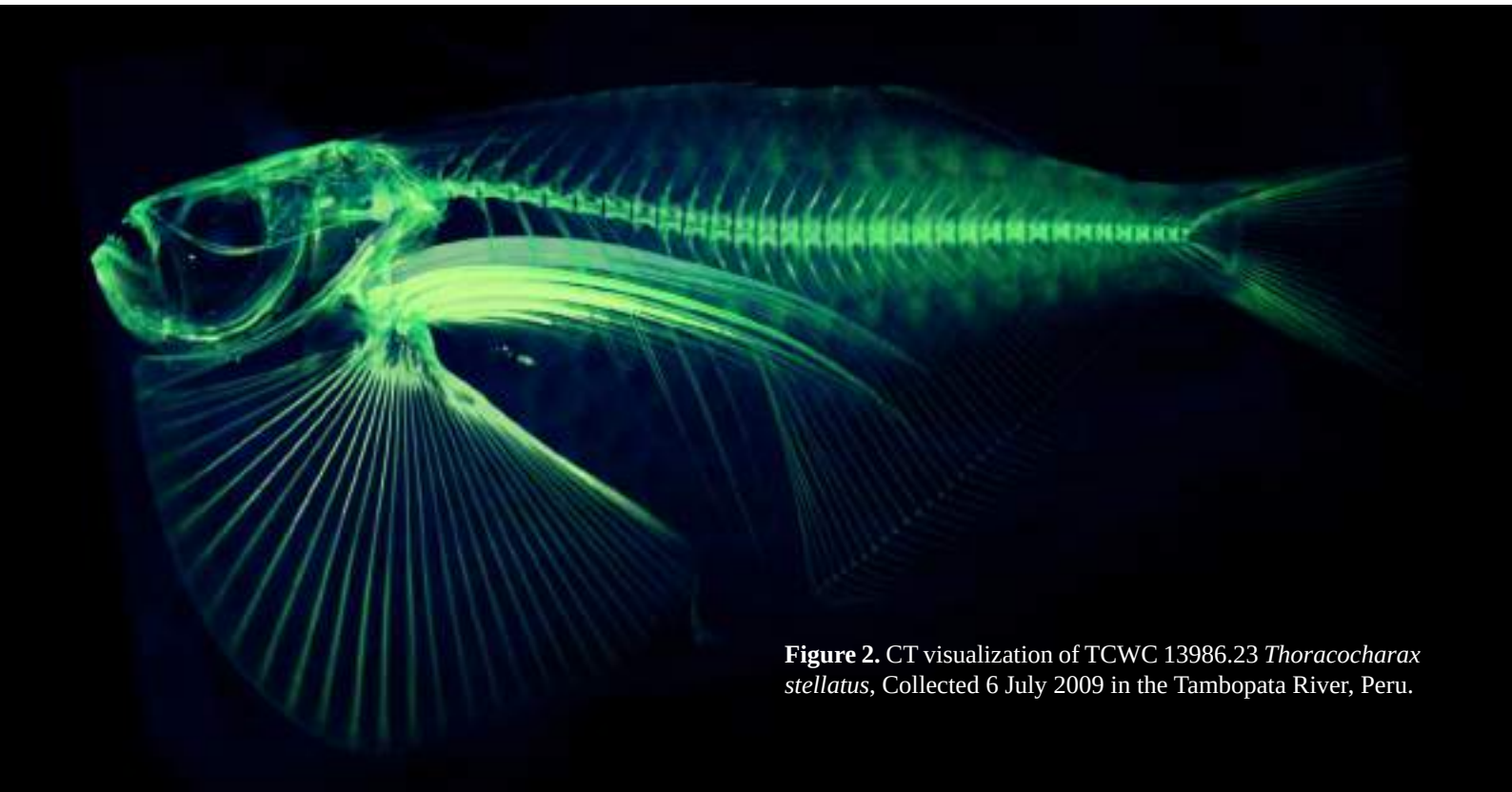

Figure 2. CT visualization of TCWC 13986.23 *Thoracocharax stellatus*, Collected 6 July 2009 in the Tambopata River, Peru.

Figure 3. TCWC 19753.01 *Corydoras panda*, cleared and stained specimen. Photo courtesy of Kole Kubicek.

Collection of Fishes over the last nine years. Some of the products of Conway's research program include the description of new species, paratypes of which are typically deposited at the BRTC (e.g., Conway *et al*., 2011, 2017), and large numbers of skeletal preparations (e.g., Kubicek & Conway, 2017). Prestridge currently serves as the Staff Curator (equivalent of Collections Manager at other US institutions) for the Collection of Fishes at the BRTC and, together, Conway and Prestridge established the Ichthyological tissue repository in 2011 that contains muscle or fin clips obtained from vouchered specimens deposited within the collection. This genetic resource is growing rapidly and represents one of the largest ichthyological genetic resources in the southern United States, with tissues from 5,788 individual specimens, representing 438 species.

Neotropical Fishes at the BRTC. As of December 2018, the BRTC holds 144,885 specimens of freshwater and marine fishes from the Neotropics, distributed across 9,025 lots. This equates to 17.7% of the total number of specimens and 15.8% of the total number of lots. Neotropical holdings at the BRTC include material from South America (all countries excluding Paraguay and Uruguay), Central America (all countries excluding Guatemala), and the Caribbean (Cuba, Dominica, Dominican Republic, St. Lucia, Trinidad and Tobago, U.S. Virgin Islands and Puerto Rico). Major holdings from the Neotropics include over 83,000 specimens (3,945 lots) from the Orinoco drainage in Venezuela. These collections were amassed from the mid-1990s through the early 2000s by Kirk Winemiller and his students resulting in over 22 publications to date (e.g., Hoeinghaus DJ *et al*. 2004; Jepsen DB *et al*. 1997; López Fernández H & Winemiller KO, 2003). One recent and large accession of Neotropical material includes 5,595 specimens (1,336 lots) from the Brazilian Amazon (Pará state) resulting from the graduate research of Caroline Arantes on the effects of floodplain deforestation on species diversity (Arantes *et al*. 2018). Other neotropical highlights of the collection include the holotype of *Crenicichla zebrina* (Montaña, López-Fernández & Taphorn 2008; TCWC 16300.01; Venezuela; Rio Ventuari en el puerto del Campamento Cucurital, 26 June 2002, collected by C. Montaña), ~100 batoids representing nine families from freshwater and shallow coastal marine areas (Atlantic and Pacific) of South America, paratypes of *Heterandria tuxtalensis* (McEachran & Dewitt, 2008; TCWC 762.03; Mexico; Río Papaloapan drainage, 11 August 1964, collected by J. V. Conner and J. R. Meyer), and 2 historical specimens of *Pristis pectinata* (TCWC 13465.01 and 13466.01; Brazil, Bahia Collected in 1894 by Taylor, Zachary & Neighbor, Rev. R.E.).

The BRTC currently houses 482 tissues from Neotropical fishes. The majority of these samples are from Trinidad and Tobago (85 lots), with smaller portions from El Salvador (19 lots), Nicaragua (19 lots), Dominica (9 lots) and Peru (4 lots). Though not particularly large, this collection of tissues from the neotropics is diverse, representing 49 species from 27 families. BRTC is also one of 16 institutions involved with the NSF funded oVert project (lead institution University of Florida), which aims to CT scan 20,000 vertebrates based on material in US collections (Cross, R. 2017). CT scans of over 230 specimens from the BRTC Collection of Fishes have been completed to date and are freely available via MorphoSource.org. This includes a growing number of CT scans of species of neotropical fishes, ranging from osteoglossids to gobiesocids. The availability of these scans is allowing a broader audience of Ichthyologists and vertebrate morphologists to examine our material. For example, Marrama & Carnevale (2017) utilized the publically available CT scan of *Thoracocharax stellatus* (TCWC 13986.23) as part of their study examining the morphology of the extinct *Gasteroclupea*.

Around 20% of our material from the

Neotropics (especially Venezuela) has been identified only to the level of genus or family. This includes a number of smaller-bodied species such as the sleeper gobies of the genus *Microphilypnus*, smaller species of *Characidium*, aspredinids, and trichomycterids (many of which are identified only to the level of family). A few larger specimens also have yet to be identified to the species level, including some impressive gymnotiformes from Peru. We welcome visiting researchers to the BRTC and consider requests for specimen loans on a regular basis. For countries where shipping of specimens is difficult we are able to provide high quality images, x-rays and CT scans of specimens to facilitate research.

Acknowledgements. We thank Texas Sea Grant College Program (Award # 02-S150261) and NSF (DBI 1702442, DBI 1458281) for recent financial support to the Collection of Fishes. This is publication number 1607 of the Biodiversity Research and Teaching Collections.

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Biodiversity Research and Teaching Collections, Texas A&M University, TAMU 2258, 77843 College Station, TX, USA. (HLP) hlprestridge@tamu.edu (corresponding author), (KWC) kevin.conway@tamu.edu

Name and acronym	Biodiversity Research and Teaching Collections; TCWC
Institution	Texas A&M University, Department of Wildlife and Fisheries Sciences
Address	Biodiversity Research and Teaching Collections, Texas A&M University, 2258 TAMU, College Station, TX 77843 USA
Curator(s) and contact(s)	Dr. Kevin W. Conway; kevin.conway@tamu.edu; Ms. Heather L. Prestridge, hlprestridge@tamu.edu
Websites	brtc.tamu.edu
Year of foundation	1936
Facilities and area of the collection	~10,000 sq ft including wet lab and processing area.
Number of visitors per year (average of 2015, 2016, 2017)	920 (~20 research visitors; ~900 undergraduate students)
Number of loaned lots per year (average of 2015, 2016, 2017)	400
Specimens habitat (marine or freshwater, use percentage of lots)	Freshwater 50.39% (lots), 76.85% (specimens); Marine 49.61% (lots), 23.14% (specimens)
Specimens origin (mention Country and /or major river basins)	Freshwater fishes from 71 countries; marine fishes from all ocean basins
Current cataloguing method (software version in use if it is the case)	Microsoft Access 2016
Total number of lots and number of lots from Neotropical region	57, 073; 9,025 from Neotropical region.
Total number of specimens and number of specimens from Neotropical region	819,462; 144,885 from Neotropical region.
Total number of holotypes and number of holotypes from neotropical region	1 (from Neotropical region)
Total number of paratypes and number of paratypes from neotropical region	98; 49 from Neotropical region.
Number of tissue samples from Neotropical fishes	482
Number of C&S specimens	1,137; 133 form Neotropical region.
Number of dry skeleton specimens	1,889; 17 from Neotropical region.

FISH COLLECTION

UCO
Ichthyology Collection of the Universidad Católica de Oriente Antioquia, Colombia

Maria Isabel Ríos-Pulgarín, Luisa María Rocha Marín & Valerya Luna Marín

Colombia is a country with great diversity of fish species, in close relationship with its wealth in water resources. However, much of these diversity only recently it has been documented or systematized. Regarding the freshwater fish fauna, for example, in Colombia it went from 1435 species reported in 2008 (Maldonado-Ocampo, Vari, & Usma, 2008) to 1494 in 2017 (DoNascimiento, *et al*, 2017), showing the progress made by collections and curators in taxonomic and geographic validation, which allows a better estimation of fish diversity

Fish collections are a great source of knowledge, from which information can be extracted not only about the distribution of a species, but also about its environmental requirements and biological interactions. This information is very useful for both basic research and for applications in the conservation of species and ecosystems and allows the resolution of strategic questions about the status, threats and opportunities of biodiversity (Colombian Congress of Zoology, 2010). However, the usefulness of the information depend to its availability. This is a fundamental element to comply with the objectives of communication, cooperation and information management the Convention on Biological Diversity undertake to comply with (UNEP / CBD / COP / 10/15).

In this context, the fish collection of the Universidad Católica de Oriente was created. located in the municipality of Rionegro (Antioquia, Colombia); this is a relatively young collection, however is recognized for its representativeness, including the departments of Antioquia, Bolivar, Boyacá, Caldas, Cesar, Chocó, Huila, La Guajira, Magdalena, Meta, Nariño, Putumayo, Santander, Sucre and Tolima. Likewise, given its articulation with the Information System on Biodiversity of Colombia (SiB) it provides information for the national biodiversity inventory, which supports important decisions for the conservation of species and ecosystems.

History. The collection of fish from the Universidad Católica de Oriente born as an initiative of the research group in Limnology and Water Resources; that from the 2000s had been collecting specimens from numerous research and consulting works in Colombian aquatic ecosystems. These specimens entered in 2007 to the national registry of collections of the Research Institute of Biological Resources Alexander von Humboldt. In 2014, under a cooperation agreement with the Institute, the collection was registered in the Biological Information System (SIB) Colombia. The official record of the collection, strengthens the processes of geographic and taxonomic validation of the specimens, likewise favored its visualization at national and interna-

Figure 1. Installations of the ichthyology collection.

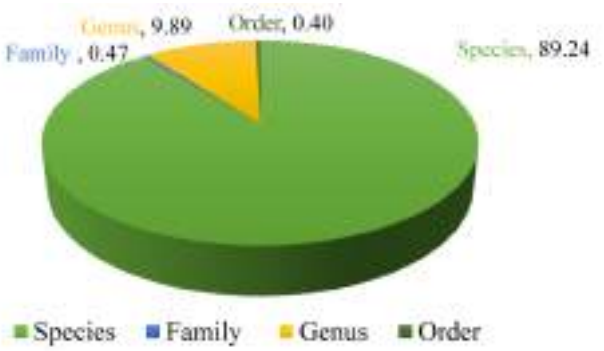

Figure 2. Percentage of representativity by taxonomic level of the Ichthyology collection.

tional level (GBIF: http://ipt.biodiversidad.co/sib/resource?r=uco-001) and additionally contributing whit an improve aspects of the infrastructure.

In terms of infrastructure, the most remarkable aspects are that although the collection has an area of only 60m^2, it has a rolling file for collections in liquid, with a capacity of 8,000 batchs and the possibility of expansion, as well as a wet area, Stereoscopes and 3 jobs (Figure 1).

Currently the collection has 14 orders, 59 families, 161 genera, contributing in total about 3002 registered batch, from 10 macrobasins, 52 watersheds and 398 locations (SIB, 2015), of which most are part of the Colombian Andean zone (Fig 3). Among these batchs stand the paratypes of 3 new species trasandean of seven localities, that are in process of systematization. *Pseudopimelodus nigercauda*, *Pseudopimelodus magnus* and *Creagrutus dulima*. The Figure 2 shows the percentage of batchs identified by taxonomic level, of which 89.94% is identified up to species level.

The Figure 3 shows the geographical location of the deposited batchs. Most of the deposited batchs are in the basins of the Cauca and Magdalena rivers.

The greater representation of the Andean region is due to the greater effort of sampling, facilitated by the better accessibility and by an important presence of hydroelectric projects that involve fish monitoring studies (Figure 4 and figure 5). While the most remote areas, many of them occupied by armed groups for decades, are the least represented, even though they can represent more than half of the country's fish diversity (DoNascimiento *et al*., 2018 in press). A summary of information of the collection is presented in Annex

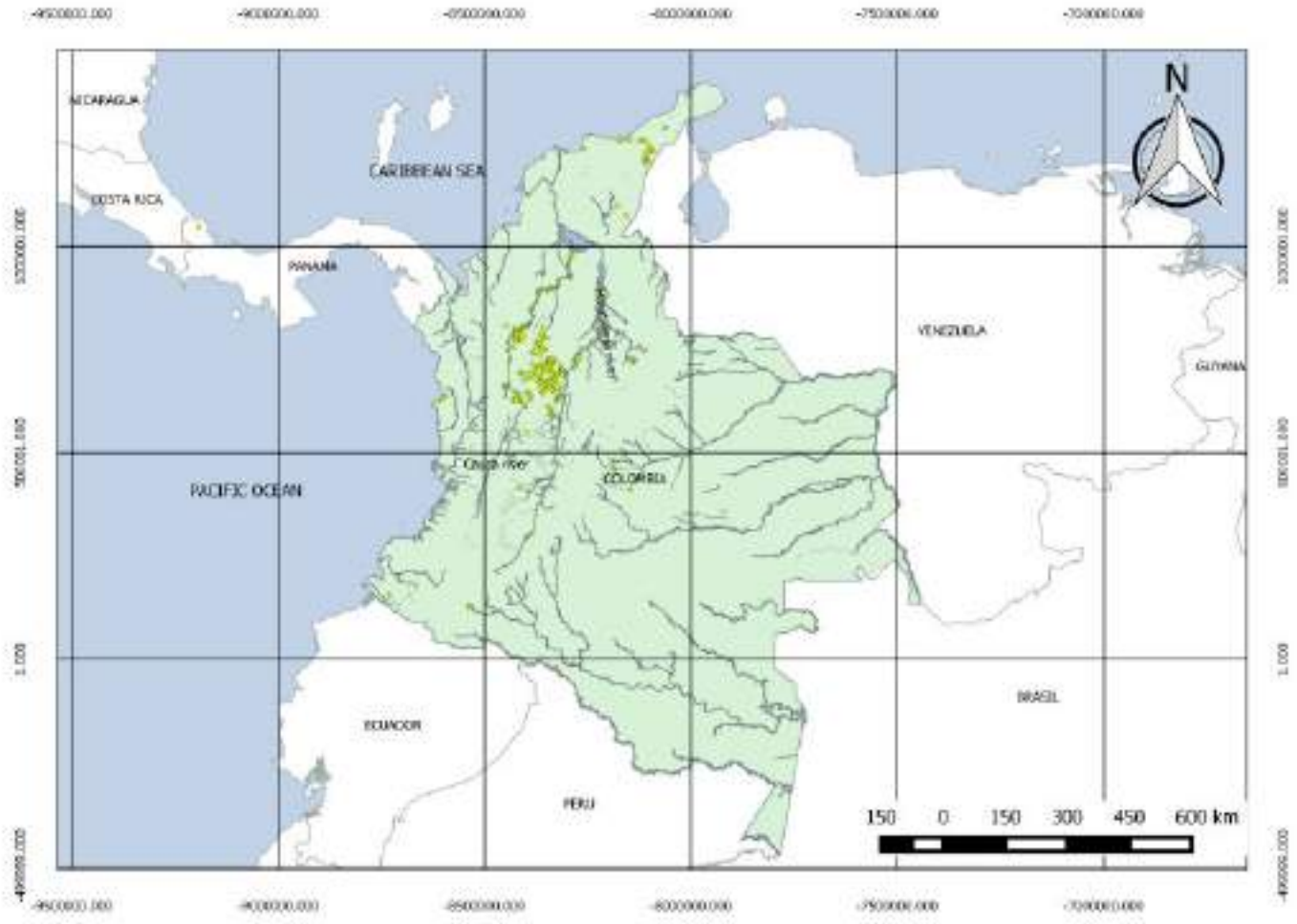

Figure 3. Geographical location of the deposited Batchs.

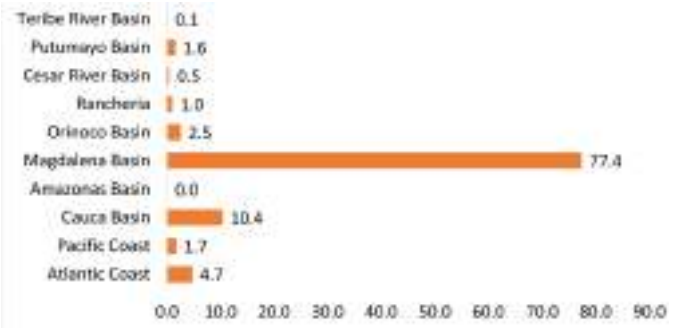

Figure 4. Percentage of representativeness by basins of the Ichthyology Collection.

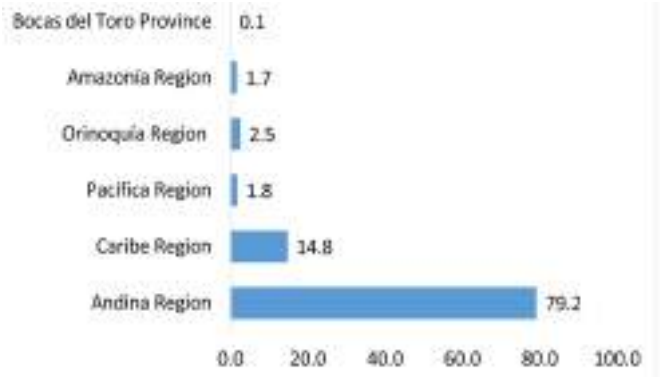

Figure 5. Percentage of representativeness by regions of the Ichthyology Collection.

1.

Interaction with the Humboldt Institute and with other collections has also favored the incorporation of good practices in the maintenance and administration of collections, as evidenced by the protocols annexed (Annexes 2 and 3). However, we believe that the greatest advantage of this articulate working and the publication online at SIB Colombia, is that it facilitates the systematic updating and permanent interaction with other collections and environmental authorities. So that it serves as available and verifiable evidence of Colombian fish diversity and in this way contributes to the decision making on species or areas that are a conservation priority. This good experience should be replicate.

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Research Group in Limnology and Water Means Environmental Engineering Program. Universidad Católica de Oriente, east-Sector 3, Carrera 46 No. 40B-50

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Anexe 1. Deposit protocol

To deposit material in the CP-UCO collection, the following requirements must be met:

1. The collection permit granted by the competent environmental authority must be presented.
2. The specimens should be fixed in 10% formaldehyde and then washed with water for 24 hours with replacement
3. The batches must be properly stored in glass jars with airtight lid and kept in 70% alcohol and must have labels on parchment paper indicating the information about the order, family, genus, species, number of individuals, place of capture (country, sub-sequence, location, geographical coordinates), date of capture, who captured (collected) and who identified (determined).
4. The deposit format established by the laboratory in which the biological registration ID with which you will enter the collection must be filled out. It must be accompanied with the respective collection permit and with a document that details the habitat characteristics of the sampling sites.

Protocol of entry of batchs and systematization of information.

After complying with the entry requirements established in the deposit protocol, it begins with the procedure described below.

1. The biological registration ID is assigned and the official label printed on heavyweight parchment paper is prepared with the information provided by the depositor. This label replaces the one delivered during the deposit.
2. Enter the Excel matrix, taking into account order, family, species, number of individuals, place of capture (country, sub-sequence, location, geographical coordinates), date of capture, who captured (collected) and who identified (determined)
3. The batch is stored in the corresponding place in the rolling file.
4. Each batch is assigned a code following a consecutive established in the laboratory.
5. The coordinates provided by the depositor are verified using the radio-point method, to subsequently enter the Darwin Core matrix.
6. The publication is made in SiB Colombia.

(Gbif:http://ipt.sibcolombia.net/sib/resorce.do?=uco-001)

Name and acronym	CP-UCO Fish Collection
Institution	Universidad Cátolica de Oriente
Address	http://www.uco.edu.co/Paginas/home.aspx
Curator(s) and contact(s)	Maria Isabel Ríos Pulgarín
Website	https://www.gbif.org/dataset/5099e00c-b9bc-41eb-8bc1-8bffda8878fe http://ipt.sibcolombia.net/sib/resource.do?r=uco-001
Year of foundation	2014
Facilities and area of the collection	The collection has a rolling file for liquid collections with a capacity of 8,000 batchs, two stereoscopes, processing area and area prior to income.
Number of visitors per year (average considering 2015, 2016, 2017)	20 visitors per year
Specimens habitat	Freshwater - 96.76 Fresh and brackish water - 2.34 Freshwater, estuarine, marine - 0.07 Fresh water, brackish, marine - 0.70 Brackish water - 0.07 Marine - 0.07
Specimens origin	Most of the batchs are located in Colombia in the Magdalena and El Cauca rivers.
Current cataloging method	The storage of the information is in the Darwin Core matrix according to the requirements of the SIB Colombia. The method of validation of the coordinates corresponds to radio point.
Total number of batchs and number of batchs from Neotropical region	3,002
Total number of holotypes and number of holotypes from Neotropical region	0
Total number of paratypes and number of paratypes from Neotropical region	7
Number of tissue samples from neotropical fishes	0
Number of C&S specimens	0
Number of dry skeleton specimens	0

FISH COLLECTION

UFBA
The fish collection of the Museu de Zoologia da Universidade Federal da Bahia, Salvador, Bahia, Brazil

Angela M. Zanata, Rafael Burger, George Vita, Leonardo Oliveira-Silva, Dario E. Silva-Junior & Priscila Camelier

Historical overview. The Zoological Collection of the Museu de Zoologia of the Universidade Federal da Bahia (MZUFBA), located in the municipality of Salvador, Bahia, Northeastern Brazil, began in 1940, with the incorporation of the butterflies' collection belonging to Dr. Pedro de Araújo (Hamdan *et al*., 2013). At that time, the collection was housed in the former Faculdade de Filosofia, Ciências e Letras da Universidade Federal da Bahia (UFBA) being posteriorly moved to the Instituto de Biologia of UFBA (IBio), where it stands up to date. Nowadays, it houses about 141,000 specimens catalogued and about 150,000 yet to be included in the MZUFBA's database.

Particularly, the fish collection of the MZUFBA started in the mid-1970's to accommodate coastal marine fishes collected in the vicinities of Salvador, Bahia. Important contributions were initially provided by Dr. Virginia Almeida, as a collector and fish curator. At the end of her contribution to MZUBA, the fish collection counted with about 1,700 lots of fishes, basically from marine and estuarine origins. After that, no subsequent large input of specimens has been made in the marine section of the collection.

Around 30 years later, the representativeness of the collection, especially of freshwater fishes, was increased by the samplings performed in the São Francisco and Paraná river basins, headed by the ichthyologist Dr. Rosana Souza Lima. She developed the project "Ictiofauna da região dos mares de areia do médio São Francisco, Bahia", between the years of 2000 and 2002, and gathered about 500 lots from that river basin. In turn, from the rio Paranapanema, about 300 lots were deposited in the MZUFBA by this researcher, between the years 2002 and 2003, during the project "Ictiofauna do médio curso do rio Paranapanema" also coordinated by her. Thus, by the end of 2003, the ichthyological collection reached about 2,500 lots of fishes. Consequently, a demand of space and better conditions to accommodate the new biological material sampled emerged. Fortunately, financial support linked to the project "Adequação e modernização do laboratório de pesquisa para a ampliação e manutenção da coleção ictiológica do Museu de Zoologia da UFBA", headed by Dr. Pedro L. B. da Rocha and Dr. Rosana Sousa Lima, and supported by the Fundação de Amparo à Pesquisa do Estado da Bahia (FAPESB), allowed the restructuration and standardization of the physical space to make the MZUFBA official in 2004. Moreover, the fish collection was included in a database program entitled Programa de Cadastramento Zoológico (CadZoo, based on Microsoft Access) developed by Dr. Marcelo Felgueiras Napoli. Nowadays, the MZUFBA has joined the Herbarium Alexandre Leal Costa (ALCB), also located at IBio, to compose the Museu de História Natural da Bahia (MHNBA), which is represented by the zoological collections (former MZUFBA), botany collections (ALCB), and an educational sector. As this change has not yet been formalized, we will continue to use MZUFBA here.

A new era of expansion of the MZUFBA's freshwater fish collection has begun in 2003, with the cataloging of the previous deposited specimens in the CadZoo and new expeditions, aiming to obtain a broad taxonomic and geographic coverage of freshwater species from coastal drainages of the Northeastern Mata Atlântica freshwater ecoregion (NMAF; *sensu* Abell *et al*., 2008). The expeditions have been headed by Dr. Angela Zanata and counted with the participation of several students and researchers from UFBA and other Brazilian institutions. In general, the main focus of those field trips was to collect on areas poorly explored scientifically, as headwaters of all coastal river basins within the NMAF. Furthermore, some particular expeditions and sampled localities were

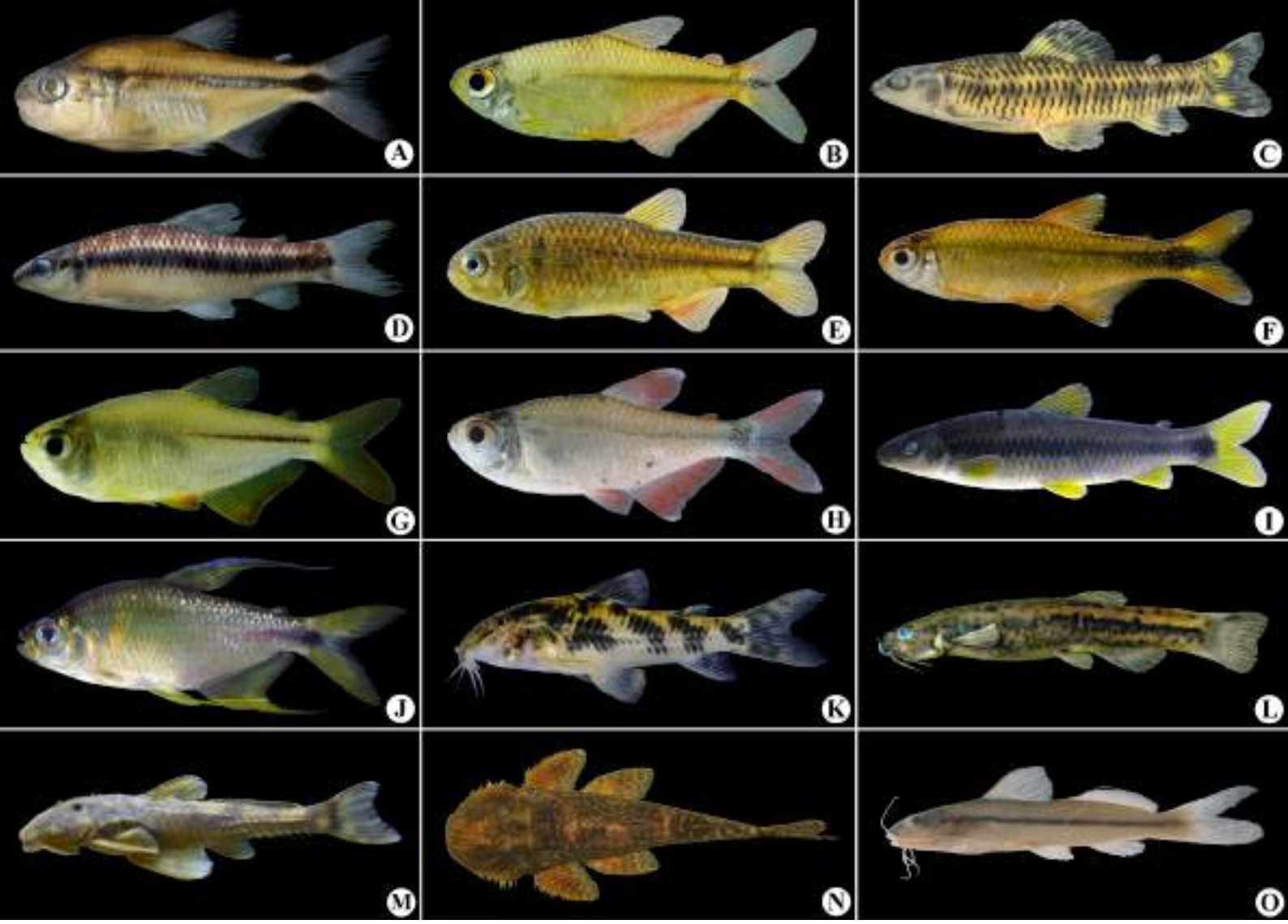

Figure 1. Representative fish species of the fish collection of the Museu de Zoologia da Universidade Federal da Bahia. A. *Astyanax brucutu*; B. *A. vermillion*; C. *Characidium kamakan*; D. *C. samurai*; E. *Hasemania piatan*; F. *Hyphessobrycon brumado*; G. *H. itaparicensis*; H. *H. parvellus*; I. *Leporinus melanopleurodes*; J. *Nematocharax venustus*; K. *Aspidoras kiriri;* L. *Copionodon elysium*; M. *Hirtella carinata*; N. *Pareiorhaphis lophia*; O. *Pimelodella itapicuruensis*.

mainly devoted to getting specimens of taxa already described but in need of extra material for studies in development by various ichthyologists. To illustrate, among the first expeditions headed by Dr. Angela Zanata, one performed in 2005, was financed by the National Science Foundation (USA) through the project All Catfish Species Inventory (NSF DEB 0315963) and named "Expedição Paraguaçu Itapicuru (EPI)". That expedition was planned to redo partially the itinerary performed by the ichthyologist Jonh Haseman at the beginning of the XX century in the headwaters of Paraguaçu and Itapicuru rivers. The EPI's main goals were to gather taxa considered poorly represented in collections which were necessary to ongoing studies such as *Kalyptodoras bahiensis* Higuchi *et al*. and *Parotocinclus bahiensis* (Miranda-Ribeiro). The expedition lasted about 10 days and was performed by six participants from the Museu de Zoologia da Universidade de São Paulo (MZUSP), Universidade Estadual de Feira de Santana (UEFS), and UFBA. The results of the EPI include the publication of about 10 new species up to date and benefitted directly various studies pending on specific taxa gathered, as the redescription of *Parotocinclus bahiensis* (Britski & Garavello, 2009) and definition of the phylogenetic position of *Kalyptodoras bahiensis* (Birindelli, 2014). From that point, the team of the Laboratório de Ictiologia da UFBA (LAIC), coordinated by Dr. Angela Zanata, performed about 15 expeditions, with sampling localities distributed in all coastal river basins draining Bahia state. About 5,800 lots of fishes were added to the collection and a collection of tissues for molecular studies was started. Also, photographs of the majority of the species sampled were produced (see Figure 1 for examples).

The financial support was derived from a series of approved projects of the "Programa de Capacitação em Taxonomia" (PROTAX – Capes/CNPq/MCT) and various editions of "Edital Universal" supported by the CNPq. That support was imperative to perform the field expeditions, along with basic structure to store the material sampled within the facilities of MZUFBA, such

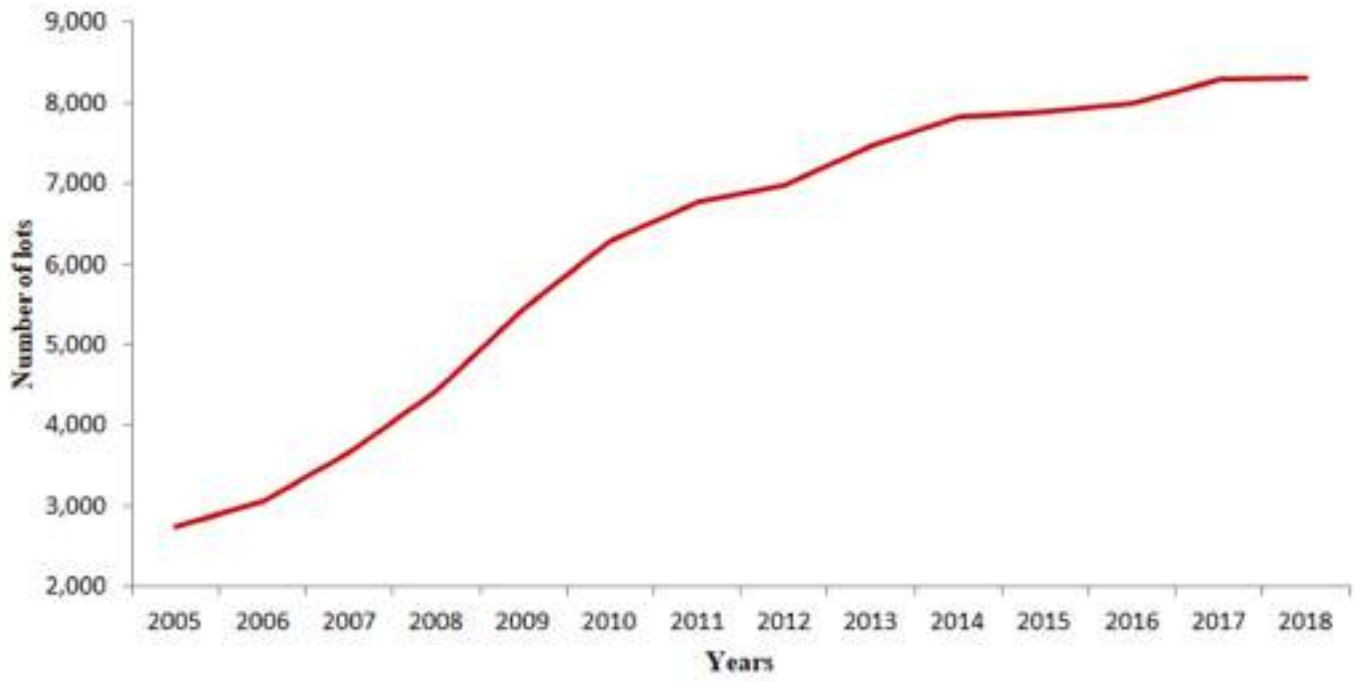

Figure 2. Curve of accumulation of the lots of fish species catalogued in the Museu de Zoologia da Universidade Federal da Bahia, starting with number of lots accumulated before 2005.

as alcohol and jars. Furthermore, the fellowships provided to students of the LAIC, from technical to doctorate degree, was indispensable to obtain the human resources to help in samplings and curatorial activities of the MZUFBA's fish collection.

In parallel to the rapid increase in number of lots (Figure 2) added to the taxonomic and geographic coverage of the fish collection (see also 'Collection and representativeness' below), a number of new species and some new genera were revealed (see 'Ichthyological publications' below) and various monographs, dissertations, and thesis were based on that material. Thus, for the last 15 years, the activities of the MZUFBA's fish collection has primarily focused on: 1) to acquire and catalog as many species as possible, in order to increase the research potential of the collection; 2) to accumulate significant holdings in taxonomic groups and geographic areas appropriate to the research interests of the current students and researchers; and 3) to serve as a depository for important voucher specimens upon request by outside investigators. From now on, these objectives will be maintained, added to make the collection database available online, to increase the geographic coverage of the collection to adjacent ecoregions, and to provide better structure and representativeness of the tissue collection of MZUFBA to molecular studies (see below 'Ongoing projects').

Collection and its representativeness. A total of 88,972 specimens of fishes within 8,124 catalogued lots, from about 1,000 localities (Figure 3), are deposited in the fish collection of MZUFBA. From those, 6,008 lots (74%) are from freshwater, containing 73,925 specimens. Marine or estuarine species perform 2,116 lots (26%), assembling 15,047 specimens. The whole fish collection houses about 820 species, distributed in 31 orders, 126 families, and 385 genera. The total number of species is possibly underestimated, once lots identified at generic level were excluded from the counting.

Estuarine or marine environments are represented by 400 species and freshwater fishes are represented by 420 species. According to the number of species, Perciformes is the most representative marine order, with 227 species, followed by Anguilliformes (27 species), Clupeiformes (25), Tetraodontiformes (20), Pleuronectiformes (17), and Gasterosteiformes (14) (Fig. 4). In turn, among marine families, the most speciose in the collection is Gobiidae (26), followed by Sciaenidae (20), Carangidae (18), and Serranidae (17). The great majority of the lots are from coastal areas around Salvador and Ilha de Itaparica, Bahia. The best represented freshwater fish orders, in number of species, are Characiformes (210 species), Siluriformes (147), Cichliformes (35), Cyprinodontiformes (17), and Gymnotiformes (11) (Figure 4). The best represented families are Characidae (123 species), followed

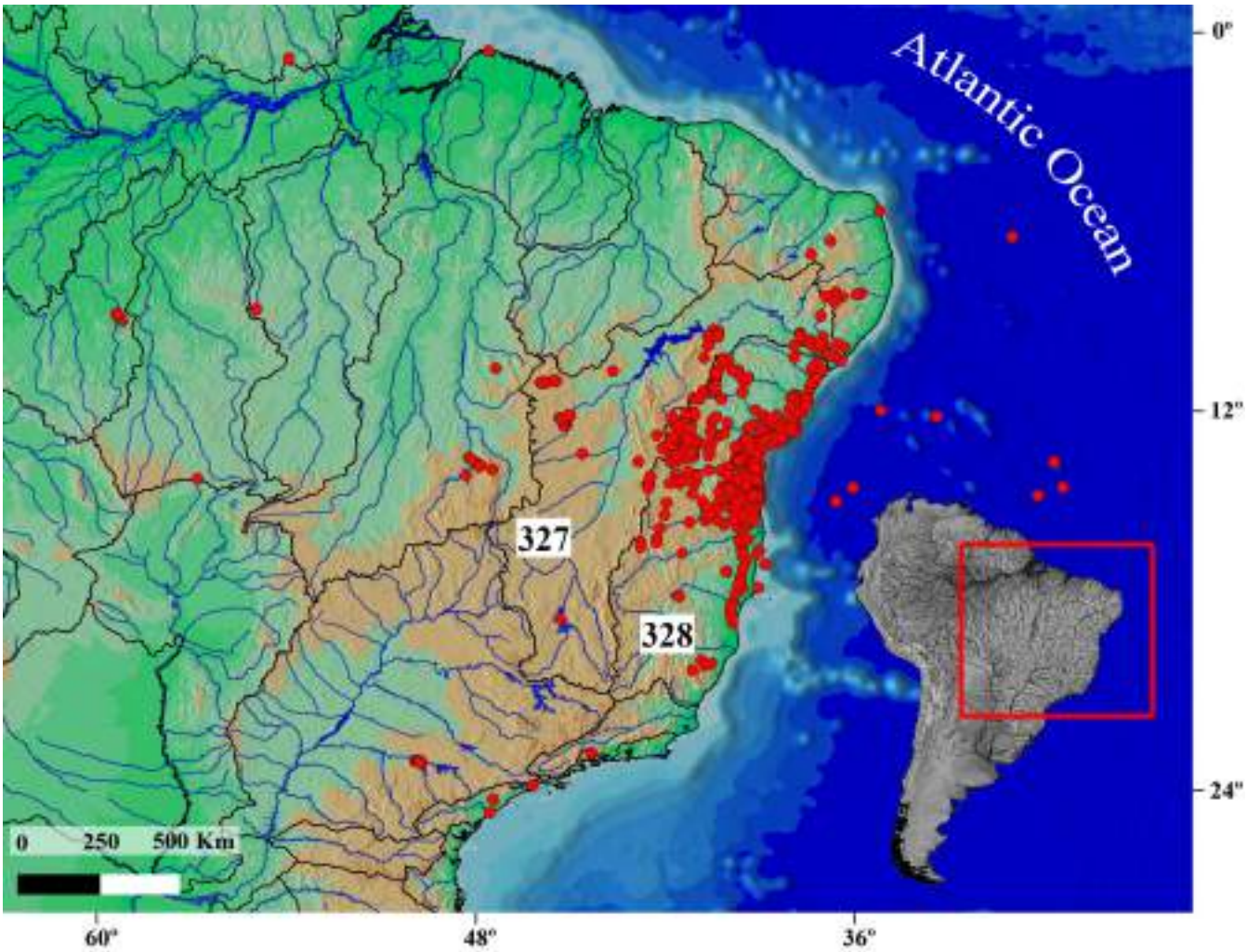

Figure 3. Distribution map of the catalogued lots (red dots) of the fish collection of the Museu de Zoologia da Universidade Federal da Bahia. Number 327= São Francisco freshwater ecoregion and 328= Northeastern Mata Atlântica freshwater ecoregion, according to Abell *et al*. (2008).

by Loricariidae (55), Cichlidae (35), Anostomidae (29), Heptapteridae (20), and Callichthyidae (17). The most representative genera, in number of lots, are *Astyanax* Baird & Girard (1,252 lots), followed by *Geophagus* Heckel (349), *Characidium* Reinhardt (318), and *Poecilia* Bloch & Schneider (312). When it comes to the number of collected specimens, *Astyanax* is also the best represented genus, with 27,527 specimens deposited in the collection, followed by *Hemigrammus* Gill (6,292), *Poecilia* (5,270), and *Serrapinnus* Malabarba (4,357).

The high percent of the freshwater fish lots is from coastal drainages comprised between the rio São Francisco in the north to the rio Mucuri in the south. The best represented rivers in numbers of lots are the São Francisco itself (with 1,244 mainly from its middle and lower portions), followed by rio Paraguaçu (1,028), rio de Contas (665), small coastal basins that are gathered in the Recôncavo Sul basin (644), and rio Itapicuru (613) (Figure 5).

The collection contains 2,531 specimens of paratypes of 28 species of freshwater fishes and one marine, all described and deposited in the collection after 2007. The type collection includes most of the species of *Astyanax*, *Characidium*, and *Hypostomus* Lacepède recently described form the NMAF, and other taxa as *Copionodon elysium* de Pinna *et al*., *Cyphocharax pinnilepis* Vari *et al*., *Hasemania piatan* Zanata & Serra, *Hirtella carinata* Pereira *et al*., *Leporinus brinco* Birindelli *et al*., *Pareorhaphis lophia* Pereira *et al*., and *Serrapinnus zanatae* Jerep *et al*.

Although small, when compared to other national fish collections, the MZUFBA's is one of the most representative of the Northeastern Brazil, with many species collected in the NMAF ecoregion, including various taxa classified as rare or endemic. To illustrate, the endemic subfamily Copionodontinae de Pinna is represented in the collection by five of the six species, with 52 lots

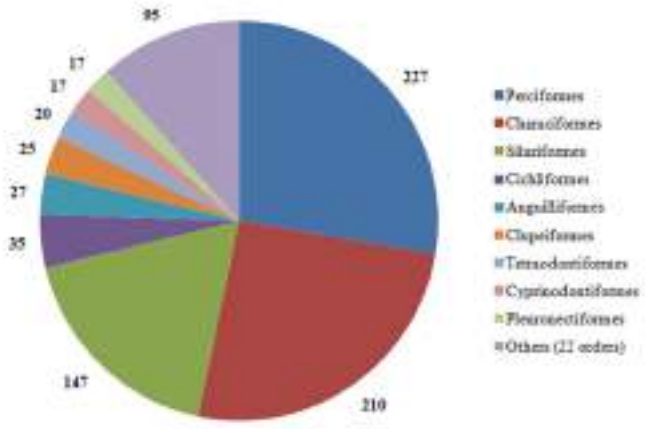

Figure 4. Representativeness of fish species within the orders included in the collection of the Museu de Zoologia da Universidade Federal da Bahia.

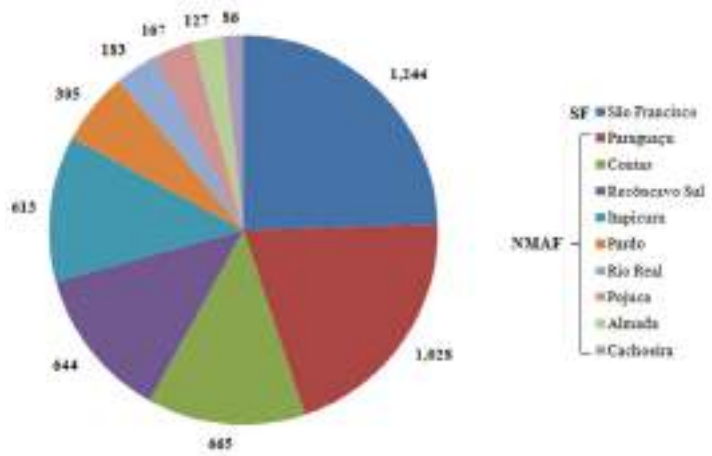

Figure 5. Representativeness of the number of fish lots of the main river basins in the collection of the Museu de Zoologia da Universidade Federal da Bahia. SF = São Francisco freshwater ecoregion; NMAF= Northeastern Mata Atlântica freshwater ecoregion (main river basins).

and 828 specimens. Other endemic genera and/or species include *Hasemania piatan* (218 specimens), *Kolpotocheirodon figueiredoi* Malabarba *et al.* (235), *Lepidocharax diamantina* Ferreira *et al.* (30), *Lignobrycon myersi* (Miranda Ribeiro) (125), *Nematocharax venustus* Weitzman *et al*. (1,476), and *Phalloptychus eigenmanni* Henn (20). The MZUFBA's collection has the highest number of lots and specimens of these and various other taxa endemic to the NMAF.

The alcohol preserved fish tissue collection for molecular studies is still shy, with about 260 vouchers being processed for proper accommodation. Nevertheless, this collection has been providing biological material for the development of a series of projects of doctorate and post-doctorate, focused mainly in studies of integrative taxonomy and phylogeography of freshwater fishes. Expansion of this collection is underway (see 'Ongoing projects' below).

Facilities and loaning. The MZUFBA's fish collection occupies a space of about 60 square meters refrigerated and without direct incidence of light. The room has 17 sliding files (Figure 6a), of which five are directed to the fish lots accommodated in jars containing alcohol 70%, as well as large canisters for the storage of larger specimens. Our holdings of specimens are organized by orders and families, with genera and species shelved alphabetically. All lots in the files are catalogued in the CadZoo program and have labels printed directly from that program. The management of the collection is done through the program and printed lists of contents are also available. Together with the ichthyologists Dr. Angela Zanata and Dr. Priscila Camelier from UFBA, various students have helped in the expansion and management of the fish collection (Figure 6b).

The fish collection is open to all visitors between 8:30 am and 5:00 pm Monday through Friday (except holidays). Visitors should contact the fish curator previously, in order to schedule their visit to the collection. All visitors must sign in at the museum security desk and be escorted to the collection. The MZUFBA loans materials to institutions and professional researchers, provided that adequate facilities are available for care of the specimens while on loan. The loans are normally provided for a one-year period, term which is extendable upon request.

Ichthyological publications. A series of studies based on the material sampled in the last decades and deposited in the MZUFBA's fish collection was published (*e.g.*, Birindelli *et al.*, 2007; Zanata & Camelier, 2009; Zanata & Serra, 2010; Vari *et al.*, 2010; Burger *et al.*, 2011; Camelier & Zanata, 2014; Pereira & Zanata, 2014; Zanata & Pitanga, 2016; Zanata *et al.*, 2017; de Pinna *et al.*, 2018), resulting in at least 24 new species described by researchers hosted or directly linked to UFBA. Most represented genera with new species are *Astyanax* with eight new species, *Characidium* with four, *Hypostomus* with three, along with the new monotypic genus *Hirtella* Pereira *et al.* Nationwide ichthyologists also took advantage of the results of the last decade samplings, with use of the MZUFBA's fish collection in various publications (*e.g.*, Dagosta *et al.*, 2014; Barreto *et al.*, 2016; Jerep *et al.*, 2016; Rossini *et al.*, 2016). Also, a comprehensive biogeographical study based mainly on that collection was performed by Camelier & Zanata (2014).

Figure 6. **A**. Sliding cabinets of the collection of the Museu de Zoologia da Universidade Federal da Bahia; **B**. Shelves of the collection with fish lots; **C**. Team of the Laboratório de Ictiologia da Universidade Federal da Bahia, September 2018.

The MZUFBA's fish collection also provided biological material for the development of a series of monographs of undergraduate students, dissertations, and theses. Eight dissertations directly dependent of the collection were produced and two theses are in development under the Programa de Pós Graduação em Biodiversidade e Evolução of IBio-UFBA (former Diversidade Animal). Also, various students outside UFBA have utilized the collection for their morphological or molecular studies.

Ongoing projects. For the next years, we plan to continue the samplings and the increase of the MZUFBA's fish collection. Financial support, to cover unsampled or poorly sampled localities of coastal rivers within the NMAF and other ecoregions on Northeastern Brazil, is imperative. As previously noted, a series of new species was described based on the samplings of the last decade, but the material gathered also revealed many taxonomic problems yet to be solved and material to describe new species. Complementation of the number of specimens and/or better information about the distribution of many lineages depends on future samplings. The Laboratório de Ictiologia of UFBA already gathered initial financial support from CNPq to develop an ongoing project entitled "Taxonomia e aspectos de conservação da ictiofauna do médio rio São Francisco, com ênfase nos seus tributários", aiming expand the representativeness of the collection on the São Francisco river basin. As previously mentioned, the fish collection database is in process of being available online.

Turning to the fish tissue collection, the next

years will be devoted to organize appropriately and catalog the material already collected, and to increase its taxonomic and geographic coverage. A method of sample management with standardized procedures will be implemented, similar to those made in larger collections. The basic principles of this system are the absolute correlation sample-voucher and the partial independence from the "main collection".

Thus, MZUFBA's fish collection with associated curators and students will continue studies on systematic of freshwater and marine fishes, including new species descriptions, taxonomic revisions, along with morphological and molecular phylogenetic analyses.

Acknowledgements. Thanks to a number of persons who helped during field expeditions and for the technical support of the MZUFBA's fish collection. Thanks also to various researchers that helped in the identification of many taxa. Thanks to the MZUFBA's coordinator, Marcelo Felgueiras Napoli, for his continuous support to the fish collection and to the curators who provided information about the zoological collections under their care. Collecting expeditions were mainly funded by CNPq (309840/2003-1, 476449/2007-3, and 476495/2010-5) and the All Catfish Species Inventory (NSF DEB-0315963).

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Name and acronym	Museu de Zoologia da Universidade Federal da Bahia (UFBA)
Institution	Universidade Federal da Bahia
Address	Rua Barão de Geremoabo, nº 147, Ondina, 40170-115, Salvador, BA, Brazil
Curator(s) and contact(s)	Angela Maria Zanata (zanata.angela@gmail.com) (freshwater fish collection) Priscila Camelier (pricamelier@gmail.com) (marine fish collection)
Website	http://www.mzufba.ufba.br/WEB/Welcome_A.html
Year of foundation	Mid-1970's
Facilities and area of the collection	60m²
Number of visitors per year (average considering 2015, 2016, 2017)	5 per year
Number of loaned lots per year (average number considering 2015, 2016, 2017)	37
Specimens habitat	Marine: 26% Freshwater: 74%
Specimens origin	São Francisco, Paraguaçu, Contas, Recôncavo Sul, and Itapicuru
Current cataloging method	CadZoo version 1.1 (based on Microsoft Access)
Total number of lots and number of lots from Neotropical region	Total number: 8,139 Neotropical region: 8,124
Total number of specimens and number of specimens from Neotropical region	Total number: 89,009 Neotropical region: 88,972
Total number of holotypes and number of holotypes from Neotropical region	No holotypes
Total number of paratypes and number of paratypes from Neotropical region	2,531
Number of tissue samples from Neotropical fishes	260
Number of C&S specimens	235
Number of dry skeleton specimens	No dry skeletons

FISH COLLECTION

UFPB
Forty years of the Ichthyological Collection of Universidade Federal da Paraíba

Yuri G. P. Carvalho-Rocha, Gabriel B. M. Beltrão, Creuza S. Cortez, Jeanneson Sales, Jessé M. Figueiredo-Filho, Natan D. A. Freitas, Telton P. A. Ramos, Leonardo Oliveira-Silva, Robson T. C. Ramos & Ricardo S. Rosa

The Ichthyological Collection of the Universidade Federal da Paraíba (UFPB) was initiated in 1977 by Graciela Cannella and Ricardo de Souza Rosa, in the Biology Department of UFPB, and has completed forty years of existence. Currently, it is located in the Department of Systematics and Ecology, Campus of João Pessoa, and is considered the second largest regional collection in number of species lots and possibly the most representative collection in number of fish species of Northeast Brazil. The collection was accredited in 2001 as an official depository of samples of the Brazilian genetic patrimony. It is divided into two collection rooms, one containing the Myxine, Petromyzontia, Chondrichthyes and marine and estuarine Osteichthyes, and the other, the freshwater Osteichthyes.

Figure 1. Geographical representation (green dots) of Neotropical specimens at the UFPB fish collection. Each symbol may represent more than one locality or species lot.

Methods. The records were compiled from the manuscript catalogs of the UFPB Ichthyological collection and the computerized database. The specimens are treated according to standard curation procedures, most being preserved in 75º GL ethanol; double-distilled glycerin with thymol crystals is used for cleared and stained materials, and dry storage for preserved skeletal pieces. The collection records are in the process of being computerized on the Specify platform, and will be available for online access.

Results and discussion. The collection contains 11,836 registered lots, including 200 type-specimens, 13 of which are holotypes. Freshwater fishes comprise 5,739 cataloged lots, corresponding to 283 species distributed in 139 genera, 42 families and eight orders. Marine and estuarine fishes comprise 6,097 cataloged lots, corresponding to 409 species, distributed in 250 genera, 56 families and 31 orders (Table 1). Additionally, the collection has 57,000 uncatologed freshwater fish specimens from Northern portion of the Caatinga environment. The geographical representation of samples covers predominantly northeastern Brazil, but also includes other Brazilian regions and foreign countries (Argentina, Canada, Colombia, United States, Japan, Paraguay, Uruguay and Venezuela). The geographical coverage of Neotropical specimens of the UFPB fish collection is depicted in Figure 1. The density of species lots per km² is represented in Figure 2. Important national marine ecosystems represented in the collection include islands (Fernando de Noronha, Atol das Rocas,

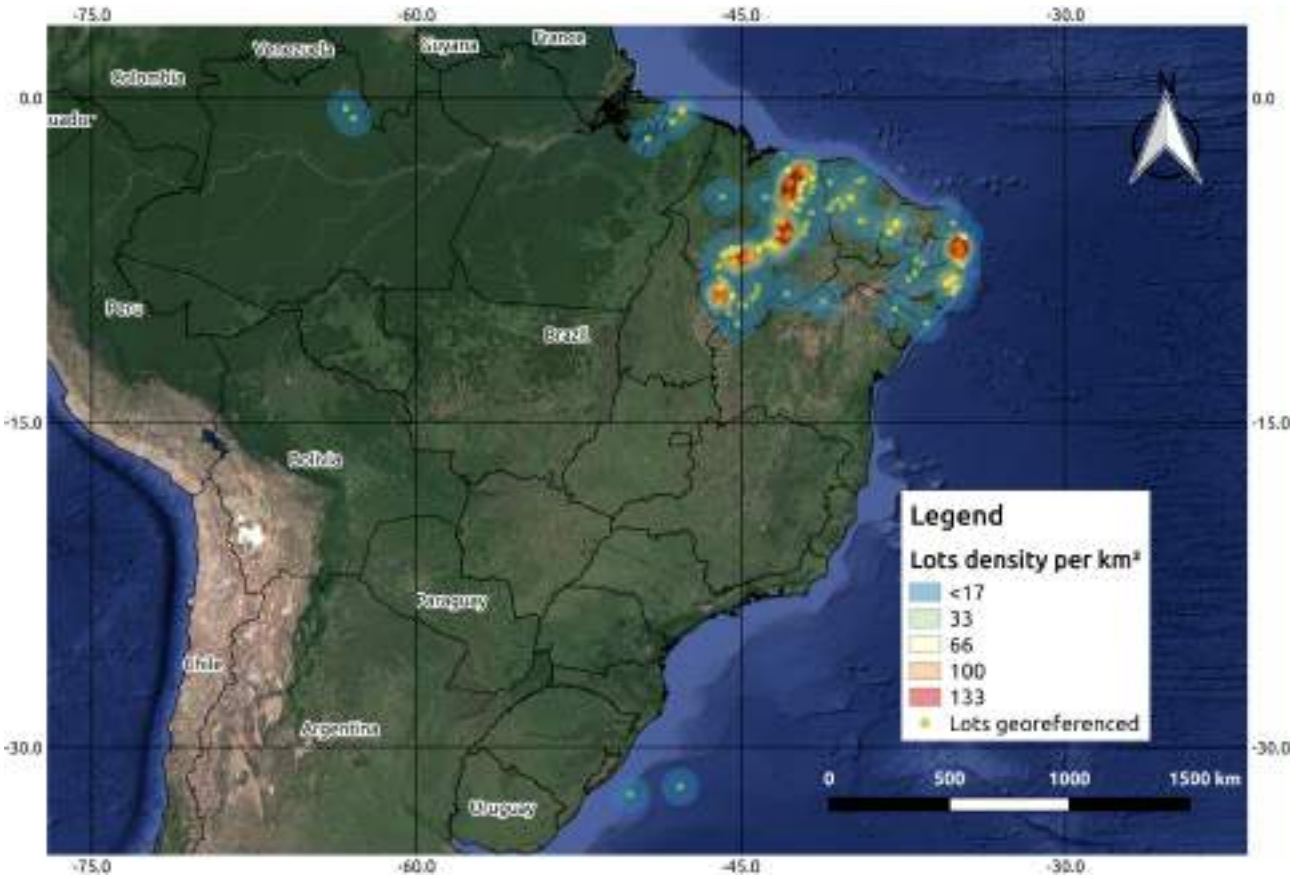

Figure 2. Geographical representation of the density of species lots per km² at the UFPB fish collection.

Figure 3. a. Example of species lot deposited in UFPB fish collection. **b.** Example of shark jaw deposited in UFPB fish collection. **c.** General view of species lots on shelves. **d.** UFPB fish collection staff, curators, students and volunteers who authored this publication.

Table 1. Quantitative record of specimens at the UFPB Fish Collection.

	Lots	Species	Genera	Families	Orders
Freshwater Fishes	5,739	283	139	42	8
Marine/ Estuarine Fishes	6,097	409	250	56	31
Total	11,836	692	389	98	39

Abrolhos, São Pedro and São Paulo and Trindade), artificial ecosystems such as shipwrecks (Alice and Queimado in PB, Ana Cristina - MA, São Luiz - RN), underwater formations (Risca do Zumbi and Parrachos de Maracajú in the RN), and marine parks such as Areia Vermelha-PB and Parcel of Manuel Luís-MA. The collection also harbors materials obtained in important research projects (Algas Project and ReviZEE).

As a reflection of its dominance in the Neotropical region, taxa of the order Characiformes predominates in the collection. The most representative families are Characidae, with 1,541 species lots, followed by Loricariidae, with 628 species lots.

The UFPB Ichthyological Collection has been continuously serving as a repository and a source of materials (Figure 3) for systematic research and scientific publications, especially regarding the ichthyofauna of the Brazilian northeast region.

Acknowledgements. The UFPB fish collection has been supported by several grants from Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) since the 1980's, the latest grant being from MCTI/CNPq/FNDCT Ação Transversal - nº 67/2013 (Processo: 406091/2013-7 - Coleções biológicas da UFPB: modernização, preservação e divulgação de seus acervos).

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Name and acronym	Coleção Ictiológica da UFPB - UFPB
Institution	Universidade Federal da Paraíba
Address	Departamento de Sistemática e Ecologia – CCEN Campus Universitário I – Cidade Universitária 58051-900 João Pessoa PB
Curators and contacts	Robson Tamar da Costa Ramos robtamar@gmail.com
Website	www.ccen.ufpb.br/museubiologia
Year of foundation	1977
Facilities and area of the collection	Two laboratories and two collections rooms/135m²
Number of visitors per year	4
Number of loaned lots per year	54
Specimens habitat	Freshwater 46,35% Marine 53,65%
Specimens origin	Brazil
Current cataloging method	Specify 6.6.06
Total number of lots and number of lots from Neotropical region	11,836/11,821
Total number of specimens and number of specimens catalogued from Neotropical region	72,667 (freshwater, catalogued) 57,000 (freshwater, uncatalogued) 45,609 (marine, catalogued) Total: 175,276
Total number of holotypes and number of holotypes from Neotropical region	13/13
Total number of paratypes and number of paratypes from Neotropical region	187/187
Number of tissue samples from Neotropical fishes	-
Number of C&S specimens	58
Number of dry skeleton specimens	20

FISH COLLECTION

UFRJ
The Ichthyological collection of the Institute of Biology, Federal University of Rio de Janeiro

Wilson José Eduardo Moreira da Costa, Axel Makay Katz, Beatrizz Mesquita, Elisabeth Henschel, José Leonardo O. Mattos & Pedro Fasura de Amorim

The fish collection of the Institute of Biology, Federal University of Rio de Janeiro (UFRJ), is presently housed in the Laboratory of Systematics and Evolution of Teleost Fishes, formerly named Laboratory of General and Applied Ichthyology, founded in 1990. This collection comprises both Department of Zoology collections made along three decades prior to 1990 and more recent collections mostly directed to freshwater environments.

This fish collection today comprises 12,265 lots, mainly characterized by its scientific purpose (Figure 1a). It has contributed to the development of numerous papers, books, book chapters, doctoral theses, master degree dissertations, and undergraduate studies. Taxonomy, phylogeny, biogeography and conservation of teleost fishes are the main research areas that benefit from this collection. These lots are also used for education (consisting in practical lessons of evolution and biodiversity of fishes to undergraduate students) and extension projects (such as classes for public schools).

Describing the fish collection. This fish collection is mostly directed to small-sized teleosts inhabiting shallow freshwater and estuarine environments, but also comprises a minor section of marine fishes. Cyprinodontiformes, Cichlidae and Trichomycteridae are the most representative groups, which is nowadays the most complete when regarding cyprinodontiforms. Included taxa are widely distributed throughout all continents except Antarctica, as well as all Brazilian geographical regions are greatly represented as a result from nearly 30 years of extensive fieldworks (Figure 2), besides permutes and donations in cooperation with other institutions.

A significant portion of the specimens is representative not only from the major hydrographic basins of the Neotropics (e.g. Orinoco, Amazonas, Paraná-Paraguai and São Francisco), but also from

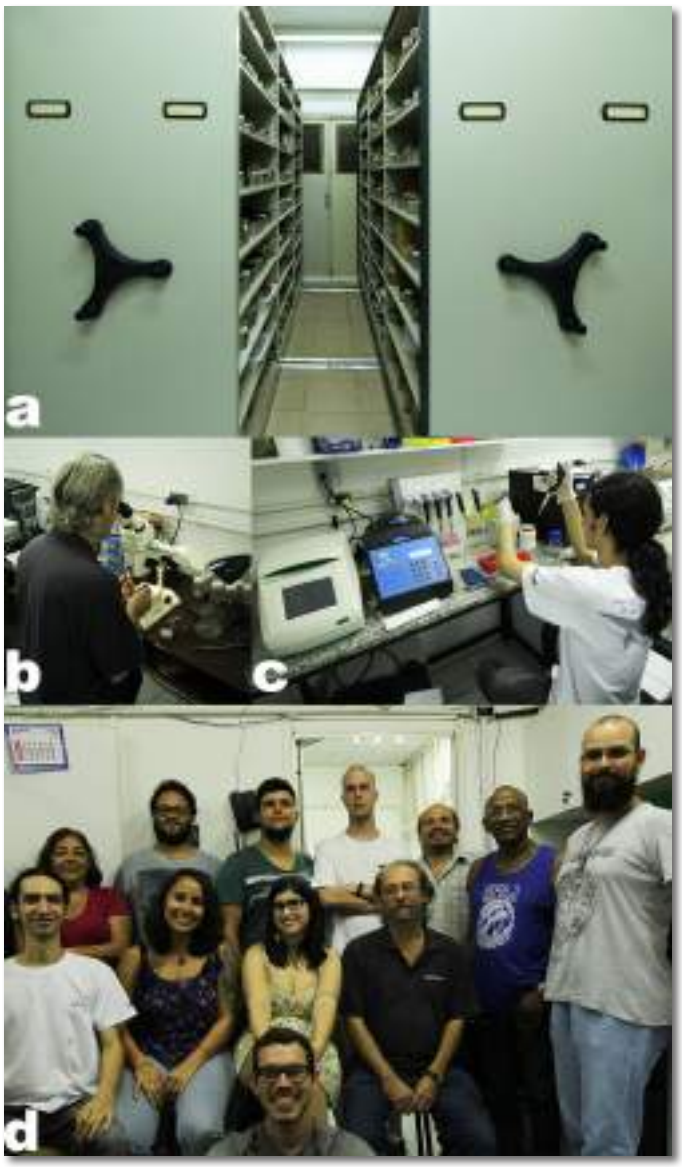

Figure 1. Coleção Ictiológica da Universidade Federal do Rio de Janeiro compactor (a); the curator, Wilson Costa on morphological benchwork (b); postdoctoral researcher José Mattos on molecular benchwork (c); Ichthyological collection of the Institute of Biology, Federal University of Rio de Janeiro (UFRJ); (d) staff.

Figure 2. Fieldwork team, photo by J.L. Ignácio.

smaller isolated areas of the Brazilian coastal basins, Pantanal, Paraguayan Chaco, Pampas, Caatinga and high altitude environments (e.g. Bolivian Altiplano and Lake Titicaca) (Figure 3; Table 1). South America is represented in this collection through specimens from Argentina, Brazil, Bolivia, Colombia, Ecuador, French Guyana, Peru, Uruguay and Venezuela. Specimens from Central America (Costa Rica, Guatemala, Haiti, Nicaragua and Panama), Caribbean islands (Cuba, Grenada, Haiti and Martinica) and the southern region of North America (Mexico and United States of America), are also sampled in the Institute Biology ichthyological collection. In this way, the Neotropical region is the most well represented biogeographical realm in this fish collection.

A considerable portion of the collection is dedicated to the African ichthyofauna, and individuals from both eastern and western Africa, the Great Lakes, Nile river basin and Indian Ocean islands are represented. African specimens allocated in this collection are from Cameroon, Chad, Democratic Republic of Congo, Gabon, Ivory Coast, Kenya, Malawi, Mozambique, Nigeria, Senegal, Uganda and Zambia. Asia is represented by specimens from Bahrain, India, Indonesia, Iran, Israel, Kuwait, Laos, Saudi Arabia, Sri Lanka, Thailand and Turkey. European lots found in the collection are from Albania, Croatia, Italia, Greece and Spain. Specimens originated from Australia and Papua New Guinea represent Oceania in this collection. Another important feature from the Institute of Biology fish collection is that it comprises many taxa that inhabit specific microhabitats such as small streams, buriti grooves and temporary pools that are usually scarce in huge collections.

The collection material supports several studies concerning different research topics: comparative anatomy, biogeography, taxonomy and systematics, evolution, ecology, conservation and others. These lots served as the main basis from 18 monographs, 23 master's degree dissertations, 10 doctoral thesis, 10 book chapters and about 300 scientific papers so far. It comprises 12.265 lots, of which 158 are holotypes and 6.084 paratypes and 1 neotype. The Fish Collection of the Institute of Biology of the Federal University of Rio de Janeiro is open to research purposes visitation and usually receives Brazilian and foreign researchers and students.

Operation and organization. The fish collection of the Institute of Biology, UFRJ, is actually maintained by its curator, Dr. Wilson Costa (Figure1b), with help of the biologist technician Orlando Simões, four postdoctoral researchers, four PhD students

Figure 3. Distribution of lots from Neotropical region cataloged in the Ichthyological collection of the Institute of Biology, red dots indicate approximated distribution of the lots.

and two undergraduate students (Figure 1c, d). After every new acquisition, material is catalogued in a Logbook and in a digital database. Every lot (corresponding to specimens of a certain species and locality) is registered under a numerical code followed by the collection acronym (UFRJ) and then stored in a sealed glass bottle, with a hand-written label, containing the following data: catalogue number, species, locality, collection data, collectors, determiner, number of specimens and status. Other data, such as geographical coordinates and other observations are reported in the Logbook and in the digital database. Actually the digital database is under construction in the software Microsoft Office Access 2010.

During fieldworks, every collected specimen is euthanized by submersion in a buffered solution of tricaine methane sulphonate (MS-222) at a concentration of 250 mg/L, for a period of 10 min, following the guidelines of the Journal of the American Veterinary Medical Association (AVMA Guidelines) (Leary *et al*., 2013) and European Commission DGXI consensus for fish euthanasia (Close *et al*., 1996, 1997). Specimens that will be used for DNA extraction are fixed and preserved in absolute ethanol while the ones used for morphological studies are fixed in formalin for a period of 14 days and then transferred to 70% ethanol. For accessing osteological features, the material is prepared according to Taylor & Van Dyke (1985), preserved in glycerine 100%, receiving an independent registration number.

The collection is allocated in four-module compactor, where lots are stored according to a taxonomy-based organization. The compactor occupies an area of 12.5 m² in a 19.1 m² room (Figure

1a). The same room also possesses a workbench and a chapel for screening and preparing the material. Type-material (holotypes, paratypes and neotypes) are allocated in a distinct closet, in which they are organized following a taxonomy-based organization.

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Taylor WR, Van Dyke OC. Revised procedures for staining and clearing small fishes and others vertebrates for bone and cartilage study. Cybium. 1985; 9: 107–109.

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Correspondence Wilson J. E. M. Costa, Laboratory of Systematics and Evolution of Teleost Fishes, Institute of Biology, Federal University of Rio de Janeiro, Rio de Janeiro, Brazil. Email: wcosta@acd.ufrj.br

Name and acronym	Ichthyological collection of the Institute of Biology, Federal University of Rio de Janeiro (UFRJ)
Institution	Federal University of Rio de Janeiro (UFRJ)
Address	Avenida Carlos Chagas Filho, 373; Centro de Ciências da Saúde; Instituto de Biologia; Departamento de Zoologia, Bloco A, Sala A0-120
Curator(s) and contact(s)	Wilson José Eduardo Moreira da Costa; wcosta(at)acd.ufrj.br
Website	http://www.lasept.intranet.biologia.ufrj.br/
Year of foundation	1990
Facilities and area of the collection	3 computers, 3 benchworks, 3 stereoscopic microscopes, 4 PCR machines, 1 chapel, 1 compactor. Area of collection comprehending 19.1m².
Number of visitors per year (average considering 2015, 2016, 2017)	10
Number of loaned lots per year (average number considering 2015, 2016, 2017)	30
Specimens habitat	95% freshwater; 5% marine
Specimens origin	Albania, Argentina, Australia, Bahrain, Brazil, Bolivia, Cameroon, Chad, Colombia,, Costa Rica, Croatia, Cuba, Democratic Republic of Congo, Ecuador, French Guyana, Gabon, Greece, Grenada, Guatemala, Haiti, India, Indonesia, Iran, Israel, Italy, Ivory Coast, Kenia, Kuwait, Laos, Martinica, Mexico, Mozambique, Nicaragua, Nigeria, Panama, Papua New Guinea, Peru, Saudi Arabia, Senegal, Spain, Sri Lanka, Tanzania, Thailand, Turkey, Uganda, United States of America, Uruguay, Venezuela, Zambia
Current cataloguing method	Microsoft Office Access 2010
Total number of lots and number of lots from Neotropical region	Total number of lots: 12,265; Total number of Neotropical lots 11,500
Total number of specimens and number of specimens from Neotropical region	Total number of specimens: 114,000; Total number of Neotropical specimens: 113,000
Total number of holotypes and number of holotypes from Neotropical region	Total of holotypes: 158; Total of Neotropical holotypes: Characiformes: 2; Cichliformes: 14; Siluriformes: 15; Cyprinodontiformes: 124; Gymnotiformes: 2
Total number of paratypes and number of paratypes from Neotropical region	Total of paratypes: 6,084; Total of Neotropical holotypes: Characiformes: 184; Cichliformes: 218; Siluriformes: 311; Cyprinodontiformes: 5,354; Gymnotiformes: 17
Number of tissue samples from Neotropical fishes	5,050
Number of C&S specimens	4,630
Number of dry skeleton specimens	-

FISH COLLECTION

UFRN
Coleção Ictiológica da Universidade Federal do Rio Grande do Norte: um relevante acervo de peixes da Caatinga e áreas adjacentes

Silvia Yasmin Lustosa Costa, Flávia de Figueiredo Petean, Thais Ferreira Pinto de Araújo, Lucas Silva de Medeiros, Luciano de Freitas Barros-Neto, Roney Emanuel Costa de Paiva, Ana Beatriz Alves Bennemann, Yuri Gomes Abrantes, Mateus Germano Souza Lira & Sergio Maia Queiroz Lima

Por muito tempo, os rios do nordeste brasileiro foram negligenciados devido à escassez de água, regime hídrico intermitente e predominância do clima semiárido na região da Caatinga, o único bioma exclusivamente brasileiro. Supostamente a riqueza e o endemismo de espécies de peixes dessa região seriam baixos como consequência destas condições hidrológicas (Paiva & Campos 1995). Assim, as expedições no nordeste do Brasil com o objetivo de inventariar a fauna de peixes se intensificaram a partir do século XX (Lima *et al*. 2017), porém parte do material coletado, que conta a história ictiológica da região, encontra-se depositado em instituições fora do Brasil, incluindo o material tipo de diversas espécies (Paiva & Campos 1995; Rosa *et al*., 2003). No início do século XXI as pesquisas no nordeste aumentaram, resultando na expansão de grupos, centros de pesquisa e, por conseguinte, número de instituições depositárias na região. Atualmente, a região apresenta instituições com acervos de grande importância ictiológica regional, tais como as coleções da Universidade Federal da Paraíba (UFPB), do Museu de Zoologia Universidade Estadual de Feira de Santana (MZUEFS) e da Universidade Federal da Bahia (UFBA), principalmente de peixes da Caatinga e áreas adjacentes.

Em 2011 foi criada a Coleção Ictiológica da Universidade Federal do Rio Grande do Norte (CIUFRN) a partir de um pequeno acervo disponível. Situada em Natal, capital do estado, sob curadoria e responsabilidade do Prof. Sergio Lima, abriga mais de 4.500 lotes dos grupos Actinopterygii e Chondrichthyes, com espécimes de água doce, estuarinas e marinhas, além de cerca de 4 mil tecidos biológicos com o objetivo de análises moleculares, depositados em um acervo complementar (TIUFRN). Os espécimes coletados e depositados na coleção foram fixados em formol 10% e preservados em etanol 70%, ou fixados e preservados em etanol 96% para estudos moleculares, e identificados até o menor nível taxonômico (Malabarba & Reis, 1987). Estes encontram-se separados em lotes e acondicionados em potes de vidro ou sacos plásticos em galões de polietileno, de acordo com o comprimento total dos exemplares. Cada lote possui etiquetas com as seguintes informações: número de tombo, nome da espécie ou gênero, número de exemplares, tipo de fixação, localidade (91,7% dos lotes georreferenciados), coletores, data e determinador(es). Já o acervo de tecidos para análises moleculares encontra-se depositado em freezers horizontais, com as amostras preservadas em álcool 96% em criotubos devidamente etiquetados, alocados em caixas de armazenamento específicas numeradas e identificados de acordo com o tombamento digital. Além disso, em 17,8% dos lotes, os táxons foram identificados como *sp.*, *cf.* ou *aff.*, pois não puderam ser identificados até o nível específico. Assim, vale ressaltar a importância da visita de pesquisadores especialistas, principalmente, nas ordens com mais lotes identificados apenas até o nível genérico (Siluriformes - 42,2% e Characiformes - 37,7%) a fim de auxiliarem a resolução de incertezas taxonômicas.

Desde o início de 2018, a coleção está em processo de mudança para o Museu de Ciências Morfológicas Professor Hiram Diogo Fernandes, na Universidade Federal do Rio Grande do Norte, que

Figura 1. Logotipo do Laboratório de Ictiologia Sistemática e Evolutiva, e armários de aço em que os lotes da CIUFRN estão depositados dentro do Museu de Ciências Morfológicas Professor Hiram Diogo Fernandes, na Universidade Federal do Rio Grande do Norte.

abrigará todas as coleções biológicas da instituição. A área em que está a CIUFRN é de 80 m², em ambiente refrigerado e protegido da luminosidade. Os lotes estão majoritariamente organizados dentro de armários de aço e por grupos taxonômicos classificados por ordem, família, gêneros e espécies de acordo com a proposta de Eschmeyer *et al.* (2017) e Eschmeyer & Fong (2018) (Figura 1).

A partir do ano de 2012, com o financiamento de projetos de pesquisa, houve um acréscimo na quantidade de lotes depositados na CIUFRN (Figura 2) até o início do segundo semestre de 2017, contabilizando 4.707 lotes. Destes, 11,9% são representados por ordens marinhas e 88,1% dulcícolas, totalizando 96.929 indivíduos tombados: 140 espécies marinhas e 182 de água doce, alocados em 51 e 38 famílias, respectivamente (Figura 3). A grande diversidade de espécies marinhas é resultado de estudos com peixes recifais criptobentônicos da costa e ilhas oceânicas brasileiras, das parcerias

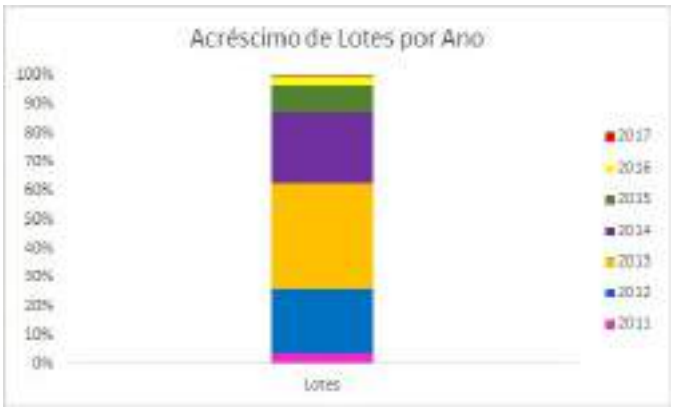

Figura 2. Gráfico da porcentagem de depósito de novos lotes por ano, de 2011 a 2017 na Coleção Ictiológica da Universidade Federal do Rio Grande do Norte.

realizadas com outros grupos de pesquisa, espécies coletadas em ambientes estuarinos e acervo prévio obtido por outros pesquisadores da UFRN.

Os lotes mais antigos são datados de 1992 e provenientes de doações de pesquisadores parceiros, enquanto os mais recentes, entre 2011 e 2018, foram coletados pelos integrantes do Laboratório de Ictiologia Sistemática e Evolutiva (LISE) ou depositados por pesquisadores com projetos em instituições regionais. A partir do ano de 2011,

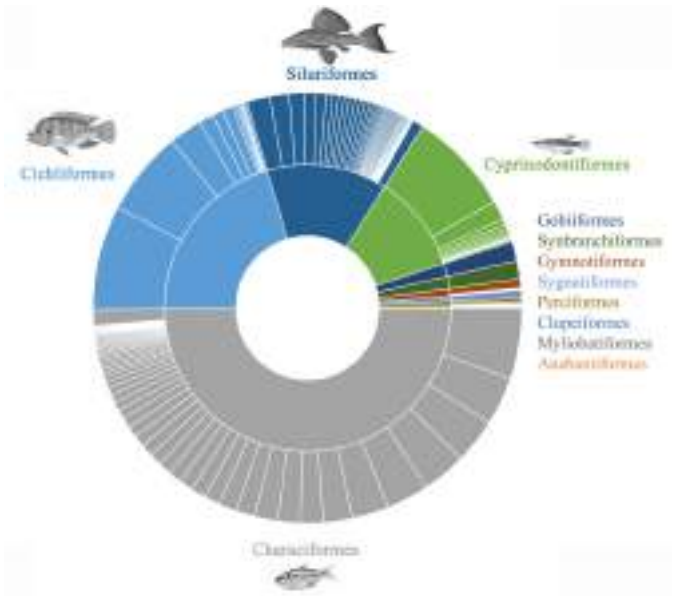

Figura 3. Porcentagem de lotes de peixes de água doce na CIUFRN de acordo com ordem (círculo interno) e família por ordem (círculo externo), segundo Eschmeyer & Fong (2018). Ordens à direita do gráfico com menos representantes na CIUFRN.

foram realizadas expedições para coleta de peixes em diversas bacias hidrográficas dos nove estados do nordeste, havendo uma ampliação na riqueza de

Figura 4. Expedições realizadas por integrantes do Laboratório de Ictiologia Sistemática e Evolutiva (LISE).

espécies da coleção (Figura 4). Essas expedições ocorreram em consequência dos auxílios financeiros de alguns projetos de pesquisa: "Efetividade das Unidades de Conservação para a ictiofauna e carcinofauna das bacias hidrográficas do Nordeste Médio-Oriental e avaliação de possíveis efeitos deletérios da transposição do rio São Francisco para a biota aquática", "Diversidade e conservação dos peixes de água doce das bacias hidrográficas do litoral oriental do Estado do Rio Grande do Norte", "Diversidade e conservação da ictiofauna do Parque Nacional das Nascentes do Rio Parnaíba: transição de biomas e divisor de águas inexplorado", "Evolução, história natural e conservação de peixes rivulídeos não-anuais do gênero *Kryptolebias* (Actinopterygii: Cyprinodontiformes: Rivulidae)". Estes foram financiados por órgãos de fomento, tais como o Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq), Fundação de Apoio à Pesquisa do Rio Grande do Norte (FAPERN) e, mais recentemente, pela National Geographic Society (NGS).

Devido a abrangência de regiões amostradas, a CIUFRN pode ser considerada uma instituição depositária de referência de peixes teleósteos das drenagens sob influência da Caatinga, bioma que está inserido parcialmente nas ecorregiões do Nordeste Médio-Oriental, São Francisco, Maranhão-Piauí, e Mata Atlântica Nordeste (Lima *et al*., 2017), além de outros biomas, como da Mata Atlântica e Cerrado. Há também uma variedade de amostras de tecido e/ou exemplares marinhos coletados nas províncias Atlântico Sudoeste Tropical e Sudoeste Atlântico Temperado Quente, dentro das quais estão as ecorregiões Ilhas São Pedro e São Paulo, Fernando de Noronha e Atol das Rocas, Nordeste do Brasil, Leste do Brasil, Ilhas Trindade e Martin Vaz (Spalding *et al.*, 2007) (Tabela 1).

As espécies depositadas em coleções científicas são registros temporais de faunas e/ou flora de uma determinada área geográfica, servindo como um material testemunho (Zaher & Young, 2003).

Figura 5. Algumas Unidades de Conservação em que foram feitas coletas e os exemplares estão depositados na CIUFRN: A. Parque Nacional Marinho de Fernando de Noronha; B. Parque Nacional das Nascentes do Rio Parnaíba; C. ESEC Jureia-Itatins; D. Estação Ecológica de Aiuaba.

Tabela 1. Porcentagem de lotes da Coleção Ictiológica da UFRN por ecorregiões de água doce (*sensu* Abell *et al.*, 2008) e marinhas (*sensu* Spalding *et al.*, 2007).

Ecorregião	% de lotes
Alto Paraná[D]	0.05%
Madeira[D]	0.07%
Ilhas de São Pedro e São Paulo[M]	0.11%
Leste do Brasil[M]	0.14%
Paraíba do Sul[D]	0.16%
Ribeira de Iguape[D]	0.20%
Ilhas de Trindade e Martin Vaz[M]	0.25%
Mata Atlântica Nordeste[D]	0.61%
Fluminense[D]	0.64%
Mata Atlântica Sudeste[D]	0.75%
Fernando de Noronha e Atol das Rocas[M]	0.84%
Nordeste do Brasil[M]	2.13%
Tocantins-Araguaia[D]	2.95%
São Francisco[D]	7.72%
Piauí-Maranhão[D]	14.50%
Nordeste Médio-Oriental[D]	68.88%
Total	100%

[D]Ecorregião para ambiente de água doce.
[M]Ecorregião para ambiente marinho.

Com esses registros podem-se avaliar regiões que já foram ou serão impactadas ambientalmente. Esse é o caso do material coletado nas drenagens envolvidas no projeto de integração do rio São Francisco (PISF), que poderá causar graves impactos ambientais, com possível homogeneização de faunas entre as bacias receptoras e a doadora (Silva *et al.*, 2017). Dessa forma, a CIUFRN contém uma considerável representação da ictiofauna dessas drenagens antes da conexão artificial.

A coleção também detém significativa amostragem de espécies da fronteira agrícola do MATOPIBA (Maranhão, Tocantins, Piauí e Bahia), região que apresenta um cenário crescente de degradação ambiental, principalmente pela agropecuária em áreas de Cerrado. Em ambos os casos (PISF e MATOPIBA) também foram amostradas unidades de conservação (UCs), a maioria sem planos de manejo elaborados, permitindo uma avaliação da representatividade da ictiofauna protegida (Silva *et al.*, 2017). Nesse sentido, o acervo da CIUFRN também abriga lotes dos corpos d'água no interior e

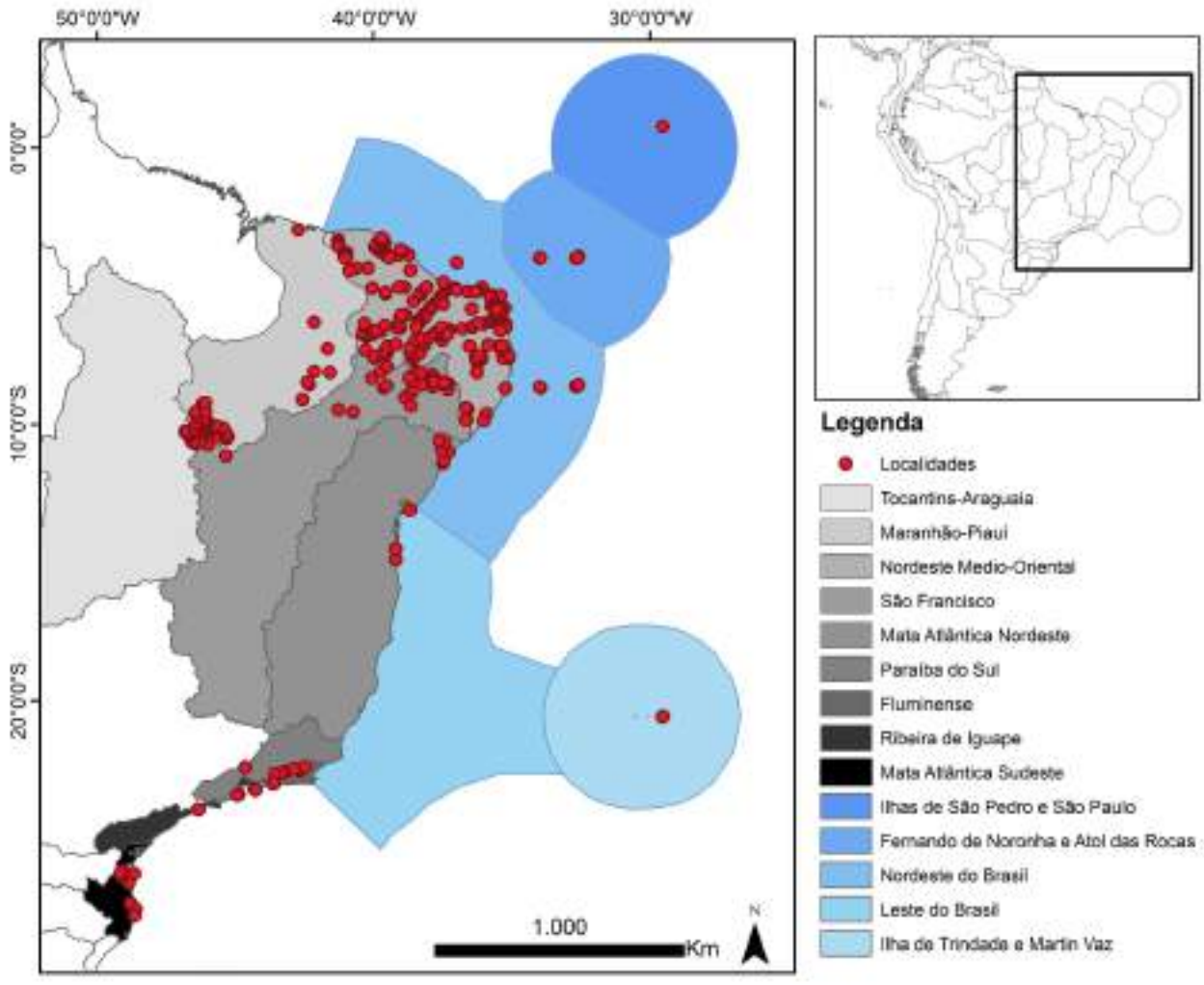

Figura 6. Mapa com todas as localidades georreferenciadas dos lotes de exemplares depositados na CIUFRN.

Figura 7. Espécies da CIUFRN que estão presentes na Lista Nacional Oficial de Espécies da Fauna Ameaçada de Extinção (Brasil, 2014). A. *Malacoctenus brunoi*, foto: Françoise Lima, B. *Kryptolebias brasiliensis*, foto: Sergio Lima. C. *Anablepsoides cearensis*, foto: Sergio Lima; D. *Parotocinclus spilurus*, foto: Sergio Lima.

no entorno de UCs da Caatinga, tais como o Parque Nacional de Ubajara (CE), PARNA do Catimbau (PE), PARNA da Furna Feia (RN), PARNA das Nascentes do Rio Parnaíba (PI), Estação Ecológica de Aiuaba (CE) e EE do Seridó (RN) do Cerrado.

Lotes de outras UCs também estão presentes: PARNA da Serra dos Órgãos (RJ), PARNA da Serra da Bocaina (SP), Parque Estadual da Pedra Branca (RJ), PE da Serra do Mar Picinguaba (SP), PE dos Três Picos (RJ), ESEC Jureia-Itatins (SP), Área de Proteção Ambiental da Bacia do Rio São João (RJ), APA de Petrópolis (RJ). Assim como representantes de UCs marinhas: APA Fernando de Noronha, Rocas, São Pedro e São Paulo, APA do Arquipélago de Trindade e Martim Vaz, APA do Arquipélago de São Pedro e São Paulo, PARNAMAR de Abrolhos, PARNAMAR de Fernando de Noronha, Reserva Biológica do Atol das Rocas (Figura 5). Além disso, a CIUFRN atinge maior abrangência ao conservar lotes com espécies de outras regiões do país, como as bacias costeiras da Serra do Mar (Rio de Janeiro a Santa Catarina) (Figura 6).

Vale ressaltar que, a coleção possui lotes de algumas espécies incluídas na Lista Nacional Oficial de Espécies da Fauna Ameaçada de Extinção (Brasil, 2014): *Apareiodon davisi* Fowler 1941 (em perigo, EN), *Megalops atlanticus* Valenciennes 1847 (vulnerável, VU), *Parotocinclus spilurus* (Fowler 1941) (EN), *Rhamdiopsis krugi* Bockmann & Castro 2011 (VU), *Taunayia bifasciata* (Eigenmann & Norris, 1900) (VU), *Anablepsoides cearensis* (Costa & Vono, 2009) (criticamente em perigo, CR), *Kryptolebias brasiliensis* (Valenciennes 1821) (CR), *K. gracilis* (Costa 2007) (CR), *Malacoctenus brunoi* Guimarães, Nunan & Gasparini 2010 (VU), *Hippocampus reidi* Ginsburg 1933 (VU) e *Mycteroperca bonaci* (Poey 1860) (VU) (Figura 7), assim como amostras de tecidos coletados em feiras livres dos tubarões *Sphyrna zygaena* (Linnaeus 1758) (CR) e *Ginglymostoma cirratum* (Bonnaterre 1788) (VU). Estes dados são importantes para se conhecer a distribuição, morfologia e ecologia das espécies antes de ações antrópicas que possam causar seu desaparecimento do ambiente natural.

A CIUFRN conserva material para estudos taxonômicos (morfológicos e moleculares), inclusive utilizado em descrições de novas espécies, resultando na manutenção de 23 lotes de espécimes-tipo (todos parátipos) de sete espécies recém descritas: *Acyrtus pauciradiatus* Sampaio, de Anchieta, Nunes &

Figura 8. Parátipos depositados na CIUFRN. A. *Acyrtus pauciradiatus*; B. *Ituglanis agreste*; C. *Hypostomus sertanejo*; D. *Bathygobius brasiliensis*; E. *Parotocinclus seridoensis*; F. *P. cabessadecuia*; G. *Phenacorhamdia cabocla*. Fotos retiradas dos artigos de descrição das espécies, com exceção de *A. pauciradiatus* (foto: R. Macieira) e *H. sertanejo* (foto: S. Lima).

Mendes (2004), *Bathygobius brasiliensis* Carvalho-Filho & de Araújo (2017), *Hypostomus sertanejo* Zawadzki, Ramos & Sabaj (2017), *Ituglanis agreste* Lima, Neves & Campos-Paiva (2013), *Parotocinclus seridoensis* Ramos, Barros-Neto, Britski & Lima (2013), *P. cabessadecuia* Ramos, Lima & Ramos (2017) e *Phenacorhamdia cabocla* Rocha, Ramos & Ramos (2018) (Fig. 8).

A CIUFRN também tem registros das principais espécies introduzidas no nordeste do Brasil, como *Oreochromis niloticus* (Linnaeus, 1758), *Poecilia reticulata* Peters (1859), *Xiphophorus hellerii* Heckel, 1848, *Plagioscion squamosissimus* (Heckel, 1840), *Astronotus ocellatus* (Agassiz, 1831), *Cichla* spp. Bloch & Schneider 1801, *Parachromis managuensis* (Günther 1867) e *Trichopodus trichopterus* (Pallas, 1770). Esses registros podem contribuir na avaliação da expansão geográfica destas espécies, que podem se beneficiar de aquedutos e canais artificiais, como os da transposição do rio São Francisco.

A Coleção Ictiológica da Universidade Federal do Rio Grande do Norte é recente e de pequeno porte quando comparada às demais coleções brasileiras de peixes. No entanto, apresenta uma significativa amostragem da ictiofauna do nordeste brasileiro, principalmente da Caatinga, que é um bioma pouco documentado e único do Brasil (Lima *et al*., 2017), com destaque para os registros em unidades de conservação e das bacias envolvidas no PISF. Mas também abriga um acervo significativo da ictiofauna de água doce da área de expansão agrícola do MATOPIBA, que inclui o divisor de três ecorregiões e atualmente em discussão sobre uma nova transposição a partir da bacia do rio Tocantins. Também apresenta registros de peixes estuarinos e marinhos da costa e ilhas oceânicas brasileiras. Dessa forma, essa coleção é altamente relevante, visto que dados regionais podem ser usados não só para se conhecer a fauna local mas, principalmente, auxiliar a tomada de decisões conservacionistas.

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Name and acronym	Coleção Ictiológica da Universidade Federal do Rio Grande do Norte (CIUFRN)
Institution	Universidade Federal do Rio Grande do Norte
Address	Departamento de Botânica e Zoologia, Centro de Biociências, Universidade Federal do Rio Grande do Norte, Campus Universitário, Avenida Senador Salgado Filho 3000, Lagoa Nova, 59078-900, Natal, RN, Brasil.
Curator(s) and contact(s)	Sergio Maia Queiroz Lima (Email: smaialima@gmail.com, Telefone: 084 999092813).
Website	https://sites.google.com/view/liseufrn
Year of foundation	2011
Facilities and area of the collection	A coleção ictiológica encontra-se no Museu de Ciências Morfológicas Professor Hiram Diogo Fernandes, da Universidade Federal do Rio Grande do Norte
Number of visitors per year (average considering 2015, 2016, 2017)	2 por ano
Number of loaned lots per year (average number considering 2015, 2016, 2017)	4 por ano
Specimens habitat	3,47% (Marinhas) e 96,53% (Dulcícolas)
Specimens origin	Espécies oriundas do Brasil. A maioria são das bacias da região Nordeste (Nordeste Médio Oriental, Maranhão-Piauí, São Francisco).
Total number of lots and number of lots from Neotropical region	4.707 lotes
Total number of species and number of specimens from Neotropical region	322 espécies
Total number of holotypes and number of holotypes from Neotropical region	0
Total number of paratypes and number of paratypes from Neotropical region	24 lotes
Number of tissue samples from Neotropical fishes	4.369 lotes
Number of C&S specimens	28 lotes
Number of dry skeleton specimens	0

FISH COLLECTION

UFRGS
Fish collection of the Universidade Federal do Rio Grande do Sul

Juliana M. Wingert, Juliano Ferrer, André L. Netto Ferreira & Luiz R. Malabarba

The fish collection of the Universidade Federal do Rio Grande do Sul (UFRGS) traces its origin within the extinct Instituto de Ciências Naturais (ICN), by that time a department attached to the university. For this early period, little information about its operation can be recovered, but the first fish specimens cataloged in the present collection indeed came from the general zoological collection of that institute. In 1978, the few fish holdings of that collection were transferred to the Department of Zoology under the care of Leda F. A. Jardim and her undergraduate student Paulo A. Buckup, who acted as responsible for the collection up to 1982. One year later (1979), the undergraduate student Luiz R. Malabarba joined the group working in the fish collection, being officially hired in 1983 as Professor and curator, a position that maintains until today.

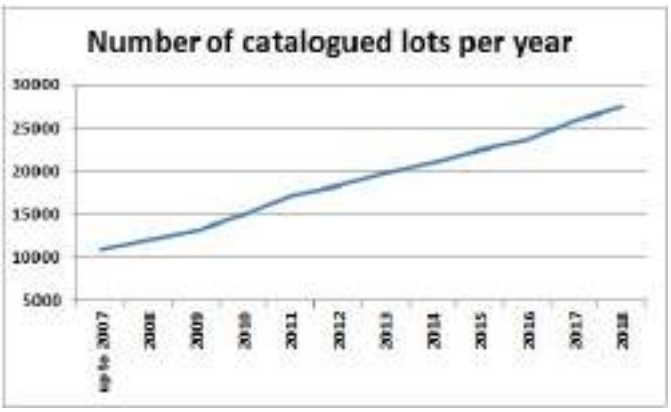
The collection participated in the NEODAT I and NEODAT II projects of creation of an Inter-Institutional Database of Fish Biodiversity in the Neotropics, being fully computerized in 1994 with the Muse software. Later, the Specify platform was implemented and is still being used to date. The list of collection holdings can be consulted via SpeciesLink (splink.cria.org.br/) since 2012 and

Figure 1. Top, collection room; middle, tissue collection; bottom, ARCHGEN facilities for extraction of ancient DNA.

Figure 2. South America and adjoining areas showing the collecting localities of the freshwater catalogued lots at UFRGS fish collection.

the actual database was made available at specify.ufrgs.br (username: convidadopeixes; password: convidado) as of early 2018/late 2017 where a folder ("attachments"), has just been implemented with photos of collection sites and catalogued specimens available.

In 2001, the fish collection was transferred from the Campus Central near downtown to the Campus do Vale, along with the Department of Zoology, with a properly designed room to hold the Zoological collections. Later, with the increase of the amount of tissue samples collected for molecular studies, a second room was designed to house five freezers with the tissue collection, along with three additional freezers for processing samples prior to incorporation to the collection and/or storing loaned tissue samples. Following its growth in size and relevance, in the recent years, the collection hired Juliana M. Wingert, as its fellow collection manager (2016 on), and in 2018 André L. Netto-Ferreira was hired as Professor and curator, acting along with L. Malabarba. The laboratory has also debuted in 2017 a research line focusing on ancient and degraded DNA, focusing both on unveiling the identity of problematic fish taxa (Silva *et al*., 2017), but also in employing such techniques to recognize the host of parasitic trichomycterids from DNA samples obtained directly from the parasites' digestive tract (Bonato *et al*., 2018). That research line also stimulated the preparation of a room dedicated to such activities and isolated from potential sources of contaminations, named ArchGen, the first Brazilian ancient DNA station so far. Among the future



perspectives the collection is expected to move to a new facility, currently under construction.

Current holding belonging to 1.488 species, 581 genera, 137 families, and 41 orders from all Brazilian States as well as other 20 countries being represented in the collection. The most represented orders are characiforms, but the collection includes samples from 78 orders of fish. The collection of tissue samples for DNA extraction is associated to their respective vouchers, mostly of Neotropical freshwater fishes and some marine specimens, mainly from the Brazilian coast.

The type material includes 21 holotypes and 3,483 paratypes, all from the Neotropical region and mainly described from southern Brazil. Part of the lots is borrowed to researchers from several Brazilian institutions and other countries as well as loans of tissue samples are provided and usual.

Departamento de Zoologia, Universidade Federal do Rio Grande do Sul, Av. Bento Gonçalves 9500, Agronomia, 91501-970 Porto Alegre, RS, Brazil.

Name	Fish Collection, Departamento de Zoologia
Acronym	UFRGS
Institution	Universidade Federal do Rio Grande do Sul
Address	Av. Bento Gonçalves, 9500 CEP 91501-970 Porto Alegre, RS, Brazil
Curator(s) and contact(s)	Luiz R. Malabarba (malabarb@ufrgs.br) André L. Netto-Ferreira (alnferreira@gmail.com)
Website (include also websites that hold information on the collection specimens)	www.ufrgs.br/ictio Available at Species Link: http://splink.cria.org.br Actual database at: specify.ufrgs.br (username: convidadopeixes; password: convidado)
Year of foundation	1978
Facilities and area of the collection	Current collection room 85 m^2 (new facility under construction 200 m^2). Tissue collection room 29 m^2
Number of visitors per year (average considering 2015, 2016, 2017)	15
Number of loaned lots per year (average number considering 2015, 2016, 2017)	2015 (415 lots); 2016 (183 lots); 2017 (140 lots)
Specimens habitat	94.2 % Freshwater
Specimens origin	93% Brazil
Current cataloging method	Specify 7.0
Total number of lots and number of lots from Neotropical region	25,770 lots 20,280 from Neotropical region
Total number of specimens and number of specimens from Neotropical region	260,867 specimens 99% from Neotropical region
Total number of holotypes and number of holotypes from Neotropical region	21, all from Neotropical region
Total number of paratypes and number of paratypes from Neotropical region	3483, all from Neotropical region
Number of tissue samples from Neotropical fishes	75,100
Number of C&S specimens	797
Number of dry skeleton specimens	344

FISH COLLECTION

UFRO
A Coleção Ictiológica da Universidade Federal de Rondônia e seu papel à documentação da diversidade da ictiofauna da maior bacia amazônica: a bacia do rio Madeira

Carolina R. C. Doria[1], Lucia Rapp Py-Daniel[2], Jansen Zuanon[2], Luiz Jardim de Queiroz[3], Willian Ohara[4], Fabiola Gomes Vieira[1], Bruno Stephany Feitosa Barros[1], João Alves de Lima Filho[1], Débora Cristina de Castro[1], Anny Caroline Portella[1], Ariana Cella-Ribeiro[1] & Gislene Torrente Vilara[5]

Um breve histórico da pressão ambiental na bacia do rio Madeira. A bacia do rio Madeira vem sendo duramente descaracterizada ao longo das últimas décadas, especialmente na sua porção brasileira, no estado de Rondônia. A longa história de desmatamento para ceder lugar ao desenvolvimento agropecuário do estado levou sua inclusão à região categorizada como "o arco do desmatamento" (Fearnside, 2005) com mais de 85% de sua área natural desmatada (Hanada, 2004). As porções média e alta do rio Madeira em território brasileiro sofreram forte impacto ao longo das duas últimas décadas, advindos principalmente de intensas atividades de garimpo (Balzino *et al*. 2015) como principal fonte de metais pesados nas suas águas (Bastos *et al*. 2015) e pela construção de hidrelétricas (Cella-Ribeiro *et al*. 2015). Concluída em 1989 e situada no Rio Jamari, a usina hidrelétrica (UHE) de Samuel foi a primeira de grande porte construída na bacia causando importantes impactos na ictiofauna (Santos, 1995), mas deixando material biológico depositado na coleção do INPA. Mais recentemente, o estabelecimento de duas UHEs (UHE Jirau e UHE Santo Antônio) no leito principal do rio Madeira, afogando as raras (ou únicas) cachoeiras de águas brancas da Amazônia, ampliou os projetos de infraestrutura, uma ameaça à conservação. No sudoeste da bacia, o histórico da construção de dezenas de Pequenas Centrais Hidrelétricas (PCH's) não deixou testemunhos em coleções, com um quadro de perda irremediável da ictiofauna. São onze PCH's em operação e mais onze em processo de planejamento para o sudoeste da Bacia do Madeira no Estado de Rondônia (Fernandes & Guimarães, 2002; Silva & Maniesi, 2005). Situação semelhante tem sido observada para a UHE Tabajara, que, se for construída, afogará a cachoeira homônima com pouco ou nenhum registro depositado em coleção da ictiofauna local.

Figura 1. Prédio das Coleções Zoológicas da Universidade Federal de Rondônia (UNIR). Foto: Acervo LIP.

Figura 2. Coleção Ictiológica da Universidade Federal de Rondônia (UFRO-ICT). Foto: Débora de Castro, 2018.

Um breve histórico da Coleção de Peixes da Universidade Federal de Rondônia. A bacia do rio Madeira em território brasileiro abrange uma área de alta singularidade ambiental transcrita na sua incrível diversidade com expressivos valores de riqueza de espécies (Queiroz *et al*., 2013). A coleção de peixes da Universidade Federal de Rondônia (UFRO-I) é fruto de uma parceria técnico-científica entre o Laboratório de Ictiologia e Pesca (LIP/UNIR) e a Coleção do Instituto Nacional de Pesquisas da Amazônia (INPA) para que os exemplares coletados da ictiofauna permanecesse na bacia da Madeira, contribuindo para o desenvolvimento local e regional. Assim, UFRO-ICT foi construída com recursos financeiros da Santo Antônio Energia para abrigar testemunhos da ictiofauna da bacia do rio Madeira (Figura 1). Atualmente a UFRO-ICT reúne 1.067 espécies distribuídas em 13 ordens e 48 famílias com mais de 285.000 espécimes catalogados ao longo dos projetos desenvolvidos pelo LIP/UNIR (Figura 2). Embora em menor intensidade, locais de difícil acesso e mais distantes do principal trecho inventariado na calha principal do rio Madeira, como áreas da bacia dos rios Tapajós e Purus (com certa de 2.100 indivíduos catalogados e tombados no Specify), também foram inventariadas, ampliando a área de cobertura e de amostragem das drenagens da bacia (Figura 3a). Os exemplares tombados são provenientes de diferentes habitats, como praias, corredeiras, remansos, calha do rio principal amostradas por diversos apetrechos, sempre adaptados aos ambientes, entre eles: rede de espera, rede de cerco, arrasto bentônico (*bottom trawl net*), puçá, peneira, tarrafa e espinhel (Figura 3b).

Com o propósito de garantir a identificação do material tombado, a UFRO-I recebeu a visita de dezenas de taxonomistas do Brasil e do exterior, entre os anos de 2011 e 2013, o que resultou em uma coleção, cujo material foi intensamente revisado e atualizado (Figura 4). Os grupos que tiveram espécies submetidas à revisão por especialista foram: I) Chondrichthyes: Potamotrygonidae; II) Clupeomorpha: Engraulididae e Pristigasteridae; III) Ostariophysii: Characiformes (Acestrorhynchidae, Anostomidae, Characidae, Crenuchidae, Curimatidae, Erythrinidae, Hemiodontidae, Lebiasinidae, Parodontidae e Serrasalmidae), Siluriformes (Auchenipteridae, Callichthyidae, Cetopsidae, Doradidae, Heptapteridae, Hypoptopomatinae, Hypostominae e Loricariinae, Pimelodidae, Pseudopimelodidae, Scoloplacidae e Trichomycteridae) e Gymnotiformes (Apteronotidae, Gymnotidae, Hypopomidae, Rhamphichtyidae e Sternopygidae); III) Acanthopterygii: Achiriidae, Belonidae, Cichlidae, Eleotridae e Rivulidae.

A maioria dos lotes catalogados disponíveis

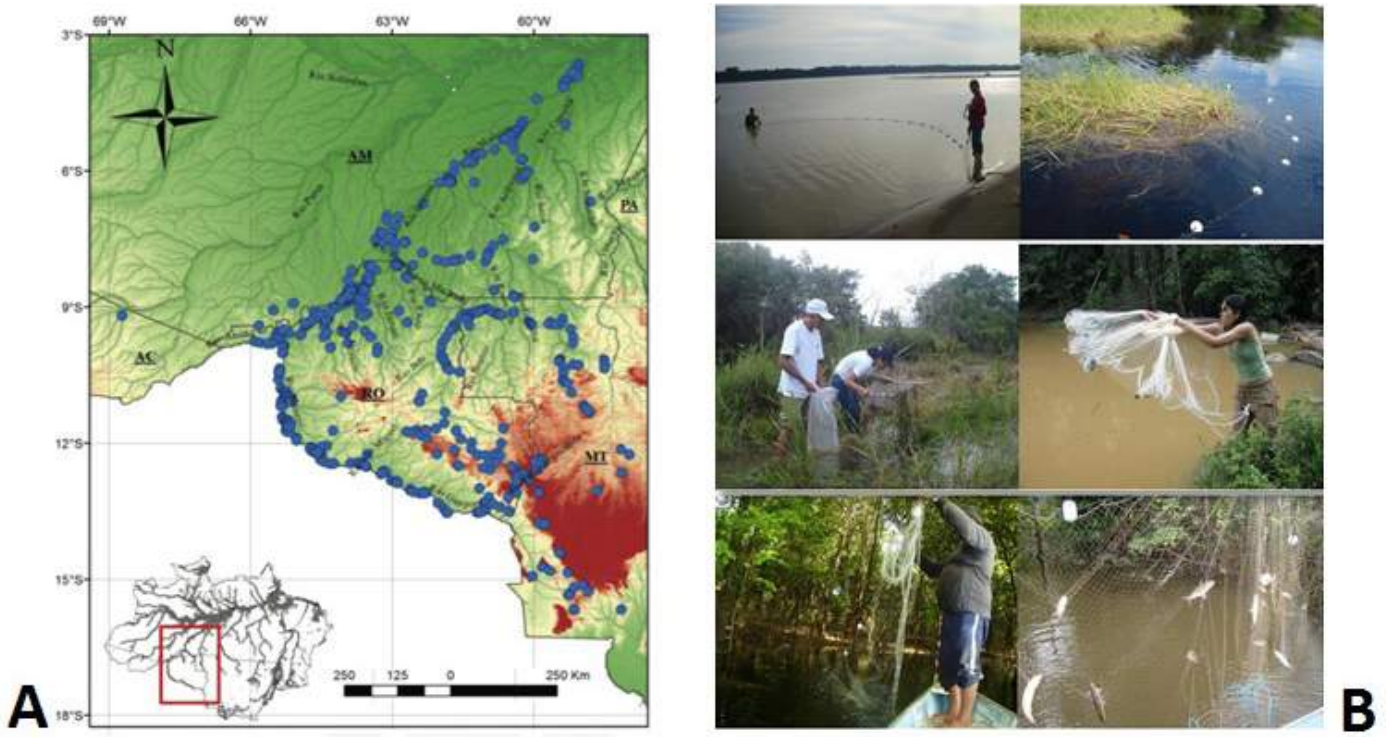


Figura 3. a) Principais locais das coletas dos peixes que estão no acervo da Coleção de Peixes da UNIR. Fonte: (Ohara *et al*. 2015) b) Métodos de captura de peixes. Fotos: Acervo LIP.

na coleção de peixes é formada por Characiformes (12.456 lotes e 106.276 indivíduos) e Siluriformes (6.838 lotes e 25.633 indivíduos), mas uma importante participação também provém dos Gymnotiformes (1.817 lotes e 14.897 indivíduos), Perciformes (2.562 lotes e 12.242 indivíduos) e Clupeiformes (286 lotes e 2.150 indivíduos). Dentre as famílias mais representativas, temos Characidae (7.217 lotes e 87.297 indivíduos), Loricariidae (2.370 lotes e 8.915 indivíduos), Cichlidae (2.308 lotes e 10.802 indivíduos), Doradidae (875 lotes e 4.475 indivíduos) e Pimelodidae (1.115 lotes e 2.917 indivíduos). [Dados obtidos até 23 de abril de 2018].

Diversos trabalhos retratando a fauna de peixes bacia do rio Madeira foram publicados utilizando material depositado na coleção UFRO-ICT, entre eles, livros (e.g. Queiroz *et al*., 2013a; Vieira *et al* 2016; Doria & Lima, 2015; Cella Ribeiro *et al*., 2016) e diversos artigos (e.g. Sousa & Birindelli 2011; Ohara 2012, Marinho & Ohara 2013; Queiroz *et al*., 2013; Ota *et al*. 2015; Petrolli & Benine 2015; Zanata & Ohara, 2015; Benine *et al*., 2015; Cramer & Rapp Py-Daniel 2015; Ohara & Lima 2015a-b; Ohara & Marinho, 2016; Crampton *et al*., 2016; Ohara & Neuhaus, 2016;Pastana & Ohara, 2016; Ohara & Loeb, 2016; Ohara *et al*., 2016a-b; Tencatt & Ohara 2016a-b; Ohara *et al*., 2017a-b).

Aproximadamente 40 novos táxons estão em processo de descrição, incluindo espécies de pequenos bagres (*Cetopsorhamdia, Gladioglanis, Horiomyzon* e *Nemuroglanis;* Heptapteridae), cascudos (*Ancistrus, Hypostomus, Pseudohemiodon, Rineloricaria, Farlowella,* Loricariidae), bagres-banjo (*Amaralia*; Aspredinidae), mandis (*Propimelodus;* Pimelodidae), charutinhos (*Characidium* e *Microcharacidium;* Crenuchidae), piabas (*Moenkhausia, Hemigrammus, Hyphessobrycon, Knodus, Thayeria;* Characidae), candirus (*Paracanthopoma* e *Tridens;* Trichomycteridae), peixes-elétricos (Hypopomidae), além de pelo menos quatro gêneros novos das famílias Aspredinidae, Trichomycteridae, Pimelodidae e Sternopygidae.

O acervo ictiológico da UFRO-ICT também abriga espécies naturalmente raras e pouco abundantes, e até séries incomuns em coleções ictiológicas. Por exemplo, o espécime do mandi *Iheringichthys* sp. (UFRO-ICT 6385) capturado no rio Guaporé foi o primeiro registro para bacia amazônica. Outros casos de importância significativa são os cascudos dos gêneros *Panaque* (UFRO-ICT 13026) e *Acanthicus* (UFRO-ICT 689) (Loricariidae), o candiru *Apomatocerus alleni* (UFRO-ICT 023358) e o candiru-miniatura *Miuroglanis platycephalus* (UFRO-ICT 20017) (Trichomycteridae), o sarapó *Orthosternarchus tamandua* (UFRO-ICT 655) (Apteronotidae), o linguado *Apionichthys rosai* (UFRO-ICT 442) (Achiridae), os bagres subterrâneos *Phreatobius* spp., (*Incertae sedis*), os bagre-banjos *Xyliphius melanopterus* (UFRO-ICT

Figura 4. Algumas espécies do acervo ictiológico depositado na Coleção de Peixes da UNIR. Foto: Bruno Barros e Tiago Pires, 2011.

8925), *Ernstichthys* cf. *anduzei* (UFRO-ICT 16081) e *Dupouyichthys* cf. *sapito* (UFRO-ICT 016218) (Aspredinidae), o peixe pulmonado *Lepidosiren paradoxa* (UFRO-ICT 009012) (Lepidosirenidae), e as piabas *Clupeacharax anchoveoides* (UFRO-ICT 014177), *Engraulisoma taeniatum* (UFRO-ICT 12942), *Parecbasis cyclolepis* (UFRO-ICT 15056), *Oxybrycon parvulus* (UFRO-ICT 15527) e *Triportheus culter* (UFRO-ICT 13021) (Characidae). Paralelamente à coleção científica de peixes, um banco de tecidos tem sido mantido. A coleção de tecidos conta atualmente com cerca de 12.400 amostras distribuídas entre aproximadamente 374 espécies representadas na UFRO-ICT).

O rico acervo da UFRO-ICT tem sido utilizado por acadêmicos e cientistas de diferentes instituições no Brasil e no exterior. Apesar de seu inquestionável valor para a Amazônia, a UFRO-ICT se mantém com limites inferiores aos recursos básicos necessários para sua manutenção básica, seja do ponto de vista de pessoal por não contar com nenhum sistemata ou recurso para insumos básicos. Nesse sentido, a UFRO-ICT revela a necessidade urgente do poder público estabelecer acordos legais de comprometimento, atenção e incentivo para com os acervos biológicos e seu papel fundamental para a sociedade.

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Curator(s) and contact(s)	Drª Carolina Rodrigues da Costa Doria carolinarcdoria@unir.br +55 69 98114-9374
Website	http://www.gpbiodiversidade.ro.unir.br//pagina/exibir/3703
Year of foundation	2009
Facilities and área ot the collection	230 m² with 175 shelves of steel
Number of visits per year	411 peoples for year
Number of loaned lots per year	68 lots per year
Specimens habitat	100% freshwater fish
Specimens origin	Brazil, Madeira River Basin
Current cataloging method	Specify 6.4.13
Total number of lots and number of lots from Neotropical region	35,000 lots – 25,000 registered lots
Total number of specimens and number of specimens from Neotropical region	285,000 specimens and 158,390 specimens cataloged
Total number of holotypes and number of holotypes from Neotropical region	4 holotypes, all from Neotropical region
Total number of paratypes and number from Neotropical region	11 paratypes, all from Neotropical region
Number of tissue samples from Neotropical fishes	12,903 samples of tissues

MEETINGS

VI Simposio Argentino de Ictiología (SAI6)

24-28 novembro 2019, San Carlos de Bariloch, Argentina

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28-31 maio 2020, Brasília, Brazil

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