

The Ichthyology Department of The Academy of Natural Sciences (ANSP)
Report for Year 2021

Overview.—The Ichthyology Department is home to one of the most important collections of preserved fishes in the world, with an estimated 1.6 million specimens representing more than 15,000 species. The collection is particularly rich in catfishes (Order Siluriformes), minnows (Cypriniformes) and eels (Anguilliformes). Geographically, its strengths include freshwater species of North and South America and marine species of the Western Atlantic and Indian Oceans. ANSP also has one of the largest collections of fish types in the world, with 2,791 primary and 17,157 secondary type specimens representing 1,852 and 2,013 species and subspecies, respectively. Specimens aside, departmental staff have assembled and curate a diverse collection of 17,195 frozen tissue samples of thousands of fish species primarily from the U.S. and South America.

Versions of the ANSP fish database are searchable online via: [FishNet2](#) (v. 2011), [SpeciesLink](#) (v. 2015) [iDigBio](#) (v. 2016), and the [collection website](#) (v. 2014).

Staff and Associates.—In 2021, The Academy supported three full-time staff in the Ichthyology Department: Drs. Mark Sabaj and Mariangeles Arce H. (both Collection Manager III) and Kyle Luckenbill (Academy Curatorial Assistant and Imaging Specialist; Academy Scientific Publications Production Editor). Mark also serves as Managing Editor of Academy Scientific Publications (2018 to present) and was Interim/Acting Director of the Center for Systematic Biology and Evolution from 18 Dec 2019 to 30 June 2021. Dr. John Lundberg has been Curator Emeritus in Ichthyology since his retirement in 2013.

Ichthyology sponsors ten ANSP Research Associates: Dr. Tiago Carvalho (Pontificia Universidad Javeriana, Bogotá), Dr. Kerin Claeson (Philadelphia College of Osteopathic Medicine), Daniel Fromm (Cherry Hill, NJ), Dr. Eileen Grogan (St. Joseph's U), Dr. Michael Hardman (Finland), Dr. Katriina Ilves (Canadian Museum of Nature, Ottawa), Dr. Scott Schaefer (American Museum of Natural History), Dr. John Sullivan (NCBI), and Dr. Jacqueline Webb (U of Rhode Island). Dr. Cecile Gama (*photo*), Collection Manager of Fishes at Instituto de Pesquisas Científicas e Tecnológicas do Estado do Amapá (IEPA), Brazil, was newly added as a Research Associate in July 2021.



Collections Growth.—A total of 38,576 specimens in 984 lots were newly cataloged into the collection in 2021. Of those, 977 specimens in 247 lots were newly collected in 2021 during fieldwork by Mark in the Philadelphia area (104 specimens, 27 lots), North Carolina (15 specimens, 8 lots), Virginia (120 specimens, 44 lots) and Amapá, Brazil (738 specimens, 168 lots). Backlog fishes cataloged into the collection in 2021 include those from 2010, 2014 & 2020 surveys of the Susquehanna River for Proctor & Gamble (36,560 specimens, 493 lots) by the Patrick Center for Environmental Research (PCER).

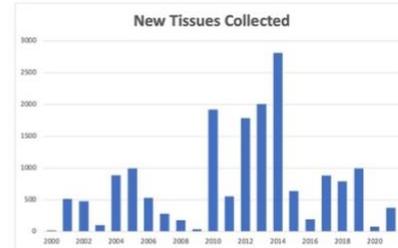
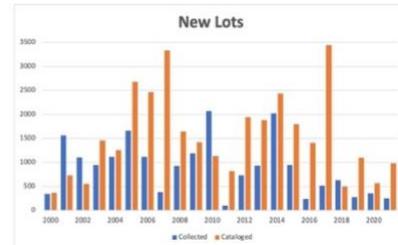
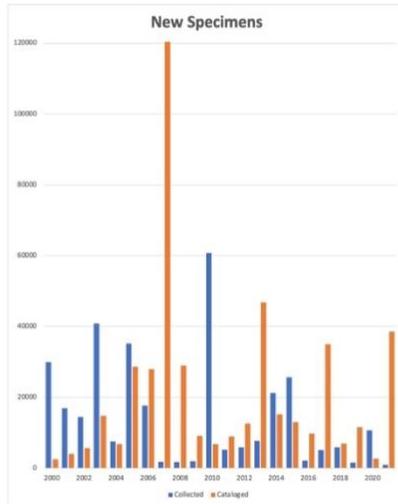
Interesting specimens received as gifts include catfishes *Chinchaysuyoia labiata* (1 alc) from Ecuador, and *Ketengus typus* (1 alc), *Batrachocephalus mino* (1 alc) and *Hemisilurus mekongensis* (1 alc, 2 sk) from Thailand. ANSP also received a variety of specimens collected during 2018 trawling surveys of the Negro and Branco rivers, Brazil, conducted by Max Bernt, currently a postdoc at the American Museum of Natural History (307 specimens, 125 lots, 162 tissues; mostly catfishes and knifefishes).

Mark collected and/or cataloged 570 new tissue samples into the collection including those from Pennsylvania (17), Virginia (14), and Brazil (350 from Amapá, 162 from Amazonas). Kyle cataloged 1,423 images into the Fish Collection database which records a total of 16,834 fish images as of 20 Feb 2022.

Although the number of specimens newly collected and cataloged in 2021 (982) was only about 11% of the annual average over the past 10 years (8,670), the number of specimens newly cataloged (38,576) was the third highest since 2000, exceeded only by 2007 and 2013 (see below).

year ["pre-" records excluded]	ANSP specimens newly collected	ANSP specimens newly cataloged	ANSP lots newly collected	ANSP lots newly cataloged	~ANSP tissues newly collected
2000	29928	2481	346	368	15
2001	16904	4008	1560	729	518
2002	14457	5606	1102	558	480
2003	40809	14795	945	1457	99
2004	7489	6796	1114	1257	891
2005	35169	28594	1660	2679	998
2006	17616	27945	1118	2462	532
2007	1812	166951	380	3329	283
2008	1752	28938	926	1644	181
2009	1963	9105	1188	1422	38
2010	60735	6721	2070	1133	1921
2011	5134	8938	96	812	552
2012	5855	12657	730	1944	1786
2013	7643	46868	933	1881	2009
2014	21246	15131	2021	2428	2816
2015	25671	13026	943	1793	639
2016	2131	9754	241	1408	194
2017	5080	34995	519	3444	884
2018	5861	6948	630	501	793
2019	1564	11606	279	1099	995
2020	10670	2634	356	569	76
2021	982	38576	250	984	375
10 yr total	86703	192195	6902	16051	10567
10 yr avg	8670	19220	690	1605	1057

Note: "collected" based on date of collection; "cataloged" based on create_date of record (adjusted for Orphan Collection import in

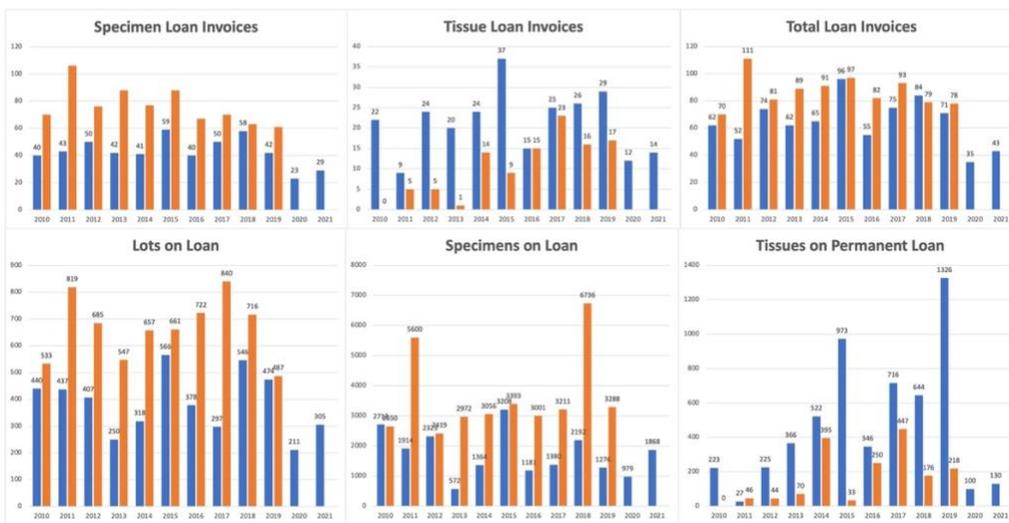


Service.—Service is broadly separated into two categories, Extra-departmental and Extracurricular. Extra-departmental service is tracked via the Fish Collection database (for specimen loans) and CM Notebook (database in use since Aug 2000). CM Notebook generally tracks staff responses to internal and external requests for collections-related data and/or staff expertise and participation (e.g., outreach activities). Extracurricular service includes volunteer participation on committees (ANSP and external) as well as other services to the professional community (e.g., reviews for scientific journals).

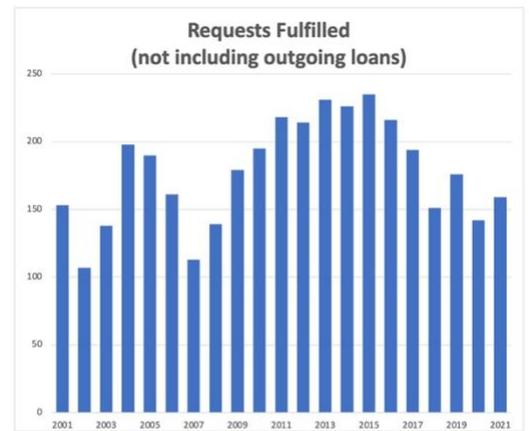
Service (Extra-departmental).—Ichthyology fulfilled 29 specimen and 14 tissue loan requests in 2021. Both numbers are slightly up from 2020 (23 specimen plus 12 tissue loans) but remain below the annual average over the past 10 years (43 specimen plus 23 tissue loans). From 2010 to 2019, the ANSP Fish Collection fulfilled ~80% of the loan activity (specimen plus tissue loans) of the Smithsonian’s Fish Collection (largest in the world) with <25% of the staff (2.5 at ANSP vs. ~11 at USNM). This rises to 90% if one includes 2020–21 since the Smithsonian shut down loan activities in those years. As an aside, USNM opened to 30% staff in Feb 2022 (up from zero) but remains closed to visitors due to the pandemic. About 344 specimens listed on 15 invoices were returned to ANSP in 2021. Mariangeles handled nearly all outgoing loans and incoming returns. In 2021, she conducted a major recall of outgoing loans that are overdue for return to ANSP.

Comparison of 2010–2021 Loan Activity between The Academy of Natural Sciences (blue) and US National Museum (orange)

Note: In 2019, ANSP staff was ~2.5 (2 x CMs + part-time Museum Specialist), USNM staff is ~11 (3 Curators, Collection Mgr., 7 Museum Specialists, 1 intermittent part-time Museum Aide for fishes/herps)



Apart from outgoing loans and incoming returns, Ichthyology staff responded to a total of 159 other extra-departmental requests (all recorded in CM Notebook). This is slightly up from 2020 (142) but below the annual average since 2010 (196). About 14% of all requests come from ANSP/Drexel vs. 86% from external sources. Compared to 2019, 2021 saw a drop in the percentage of internal requests and a bump in the percentage of external requests for data, photos, X-rays, identifications, etc. The drop in internal requests is due in part to Mark’s service as CSBE Interim/Acting Director for the first half of 2021 (i.e., such requests were not recorded in CM Notebook).



Note: includes extra-departmental requests fulfilled for photographs, radiographs, identifications, counts/measures, catalog numbers, record searches/releases, incoming/outgoing gifts, returns/transfers of loans to ANSP, library research, general expertise, outreach (tours, lectures, public programs, interviews, etc.) and institutional advancement.

By far the largest request fulfilled in 2021 was the digital inventory of 2,009 reports prepared by the Patrick Center for Environmental Research (PCER) and its predecessors from 1949 to 2011. Those reports were organized into 52 boxes that were deposited in ANSP Archives in October. The inventory was prepared by Drexel Spring/Summer Volunteer Co-ops Jack Ivie and Lauren Tuffy under Mark’s supervision. The PCER reports had previously occupied 82 boxes occupying storage space for exhibits. Jennifer Sontchi, Senior Director of Exhibits and Public Spaces, was happy to regain that space for her team.

Categories	2019		2021	
	Requests	% of Total Requests	Requests	% of Total Requests
Internal (ANSP/Drexel)	50	20%	29	14%
PCER	4	2%	2	1%
Education, Exhibits, Public Programs	13	5%	10	5%
BEEES	8	3%	2	1%
Communications, IA, Marketing	20	8%	11	5%
other	5	2%	4	2%
External	197	80%	173	86%
Specimen loans	42	17%	29	21%
Tissue samples	29	12%	14	7%
Data, photos, X-rays, identifications, etc.	89	36%	105	52%
Specimen loan returns and transfers	26	11%	11	5%
Accessions/Deaccessions	9	4%	10	5%
other	2	1%	4	2%
TOTAL REQUESTS	247		202	

In 2021, a total of 461 digital images were prepared and/or provided in response to 66 requests from internal and external users. Included in that total were images of at least 265 specimens. A total of 16,834 digital images (including X-rays) are cataloged into the Fish Database with the original and edited image files organized by ANSP catalog number on the Academy server Unity IV.

If you add up all of the outgoing loan and other extra-departmental requests since 2010, Ichthyology staff are called upon an average of 261 times per year for specimens, data and expertise (261 also equals the number of work days in 2021).

Service (Extracurricular).—On 1 Jan 2021, Mark became the 18th Secretary of the American Society of Ichthyologists and Herpetologists (ASIH), a professional society with 1,307 student and professional members worldwide (as of Dec 2021). Henry W. Fowler, ANSP Curator of Fishes from 1902 to 1965, co-founded the ASIH in 1915. Mark is expected to volunteer his service as ASIH Secretary until 31 Dec 2025.

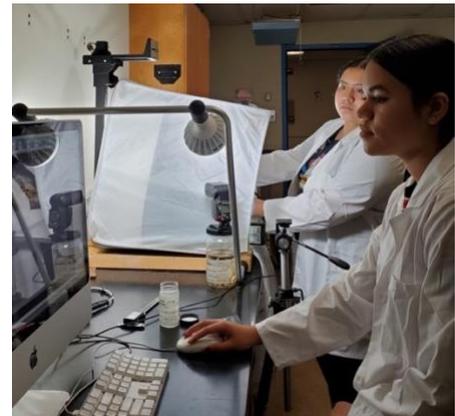
In Dec 2021, Mariangeles completed her volunteer service as Co-Chair of the ASIH Committee on Diversity, Equity, Inclusion and Belonging (DEIB). Mariangeles began as DEIB co-Chair in 2019 and helped develop and oversee multiple initiatives that have benefitted ichthyologists and herpetologists (particularly students) from minoritized and marginalized backgrounds. Those accomplishments include: 1) expansion of the ASIH Executive Committee to include one member of the DEIB Committee, 2) two membership surveys (2019 and 2020) to (in part) improve efforts to recruit, sustain and support a more diverse ASIH, 3) financial awards to support travel to annual meetings for students from minoritized/marginalized groups, 4) “Spotlight” articles in the society’s journal with biographies and interviews featuring ichthyologists and herpetologists from minoritized/marginalized groups (see below), and [changing the name of the society’s journal](#) to *Ichthyology & Herpetology* (the journal’s original name honored a racist and misogynist).

Mark (along with Ornithologist Dan Thomas) served as the CSBE Representative for the New Website Design Task Force. One of Mark's duties in that role was to compile, edit (and write from scratch for a few reticent staff) 100- to 300-word bios for 28 staff members in CSBE and Library & Archives (a task that stretched for nearly two months). Mark also peer-reviewed one book chapter plus four articles submitted to the journals *Acta Amazonica*, *BioScience*, *Molecular Phylogenetics and Evolution* and *Neotropical Ichthyology*, respectively.

As a side note, Mark volunteered to serve as the Interim Director of CSBE in Dec 2019, replacing Mariangeles who was chosen by President Scott Cooper to serve in that role for the three months prior. Mark asked to step down in Dec 2020 but agreed to stay on for another six months after Scott offered him a temporary 10% administrative bump in his salary retroactive to Dec 2019. During the first half of 2021, Mark oversaw and/or participated in a variety of activities including: completion of the FY21 and FY22 budgets for CSBE; compilation, writing and editing of quarterly reports to the Board; external review of Academy Science by Fairmount Ventures, Inc.; and the formal promotions of Jordan Teisher and Mariangeles Arce H. from Collection Manager II to III. During and beyond his tenure as Interim/Acting Director, Mark also compiled and tracked data (so-called "Sabaj logs") on CSBE (staff, collections, funded projects, international work) and ANSP Science (presentations/outreach, publications, students). ANSP Marketing and Communications routinely call upon Mark for summaries and bullet points related to such data. He looks forward to transferring such time-consuming duties to the new full-time CSBE Director expected for hire in 2022.

Students.—Ichthyology hosted three Drexel Co-ops in 2021. Jack Ivie and Lauren Tuffy accepted volunteer (unpaid) positions for the Spring/Summer 2020-2021 cycle (29 Mar to 17 Sep 2021) and worked on site in the fish library, lab and collection. Jacob Bornyas was a self-directed co-op during the same time period and worked remotely under the supervision of Mariangeles. Lauren Tuffy became a paid student employee (funded by Roland Wall) in Sep 2021 and will continue working as such until the end of March 2022. Lauren continues to inventory PCER reports and helped situate into the department some 900 jars housing the personal aquatic collections of Dr. Richard Horwitz (retired from PCER fisheries/Drexel BEES). She has completed an inventory of those jars and is working with Mark to catalog the fishes into the collection.

During the summer, Mark and Kyle participated in the 2021 EngWINS program, first as recipients of mentor/diversity training and then as mentors for Philadelphia high school students Carmen Andrade and Diana Escobar (*photo*). The EngWINS program is developing the capabilities of working engineers and faculty (among others) to serve as mentors in a new initiative to develop interest, self-efficacy and persistence in engineering careers among urban high school women in grades 9–12 (100% low income; 85% minoritized youth). The program is funded by a \$1.2 million NSF grant awarded to PI Jacqueline Genovesi (VP of Academy's Center for STEAM Equity) and Co-PIs Sharon Walker (Dean of Drexel's College of Engineering), Nancy Peter (Director of the McKinney Center for STEM Education) and Ayana Allen-Handy (Associate Professor, Drexel School of Education). Mark and Kyle have mentored a total of 12 WINS interns since 2011.



Research Visitors.—Ichthyology hosted 73 visitors for a total of 114 days in 2021 including 11 research visits (10 researchers, 53 days). Among those were Pablo Argüello, student at Universidad Central del Ecuador and undergraduate researcher at Escuela Politécnica Nacional (MEPN), who visited from 15 Nov to 20 Dec to work on loricariids (*Pseudohemiodon*) and cichlids (*Crenicichla*). His travel and lodging were supported by the Böhlke Memorial Fund and Pablo spent part of his stay in Mark's home. Max Bernt and Bruno Melo, postdocs at the American Museum of Natural History, also visited to study clariids and alestiids/curimatids, respectively. They too stayed in Mark's home and Böhlke Funds covered their return train tickets to NYC. Though technically not a visitor, Ichthyology welcomed retired PCER fisheries biologist Richard Horwitz to share office space with John Lundberg in Rm 107.

Fieldwork.—In 2021, Mark took the three co-ops (Jack, Jacob, Lauren; *photo*) into the field on five separate trips to seine fishes in local streams (Cobbs, Mill, Poquessing, Skippack and Wissahickon). Their efforts added 104 specimens (27 lots) to the Fish Collection including young-of-year specimens of the American shad (*Alosa sapidissima*) useful for an ongoing PCER Fisheries project. The fieldwork was funded in part by the Böhlke Memorial Endowment.



From 29 April to 3 May, Mark joined the 51st annual “Roanoke Round-Up” organized by Eric Hilton and Sarah Huber of the Virginia Institute of Marine Sciences (VIMS). Started in 1970, the VIMS Round-Up takes students into the field to collect and learn about the freshwater fishes of Virginia. Due to the pandemic, the 2021 Round-Up was limited to ichthyologists Mark, Eric, Sarah and Kate Bemis (Smithsonian Institution) plus Eric and Sarah’s daughters Clare and Emma and Mark’s daughter Sofia. The trip added 135 specimens (52 lots) plus 15 tissues to the fish collection including the first ANSP specimens of the rare orangefin madtom *Noturus gilberti* (ANSP 207038, n=2; *photo*), a protected species endemic to the Upper Roanoke and James rivers, VA. Mark’s participation on the trip was funded out of his pocket.



Mark also traveled twice to Amapá State, Brazil, to collect fishes in collaboration with Dr. Cecile Gama, Collection Manager of Fishes at Instituto de Pesquisas Científicas e Tecnológicas do Estado do Amapá (IEPA). The first trip (January) yielded 444 specimens (63 lots) plus 135 tissue samples and the second trip (September) yielded 294 specimens (105 lots) plus 215 tissues for the ANSP Fish Collection. IEPA also gifted to ANSP 14 specimens (9 lots) representing various rare (including new) species of loricariid catfishes. Based on this and previous fieldwork in 2019, ANSP has the largest collection of Amapá freshwater fishes outside of Brazil. The trip will be featured in the Academy’s Annual Report in prep by Brigette Brown. Non-labor costs of the 2021 trips to Brazil were funded out of Mark’s pocket and by grant-money to Dr. Gama.

The September Brazil trip included a pilot expedition to [Parque Nacional Montanhas do Tumucumaque](#) (world’s largest tropical forest national park) facilitated by Park Chief Christoph Jaster. Photos from the trip were posted to Facebook in two separate albums ([one](#) and [two](#)). Additional Facebook posts highlighted sampling closer to Macapá in [headwaters](#) and a [tidal creek](#). Mark plans to return to Tumucumaque in September 2022 and has discussed with Kim Reynolds (Executive Director, Institutional Advancement) the possibility of inviting a few Academy benefactors on that trip.



Expedition Crew. Front row L to R: Girlan Gias (ICMBio guide), Wellington Montaeiro (IEPA entomologist), Antonino and Valdeci (boat pilots), me, Cecile Gama (IEPA ichthyologist), Christoph Jaster (Park Chief), Gigi (co-pilot). Back row L to R: Flavio Lima (ichthyologist, Univ. Est. Campinas), Allan Kardec Ribeiro Gallardo (IEPA Research Dir.) and his daughters Beatriz and Alicia, Paula Gama Jaster, Andrea Santarosa Freire (oceanographer, Univ. Federal de Santa Catarina), Gabriella Gama Jaster, Julie Nedelec Andrade (photo-journalist) and Linda and Nara (cookers).

Research.—Mariangeles Arce H., Mark Sabaj and Emeritus Curator John Lundberg co-authored eight peer-reviewed papers, three popular articles and one book chapter in 2021.

Journal Articles – peer reviewed

Gales, S.M., J.S. Ready, **M.H. Sabaj**, M.J. Bernt, D.J.F. Silva, C. Oliveira, G. Oliveira & J.B.L. Sales. 2021. Molecular diversity and historical phylogeography of the widespread genus *Mastiglanis* (Siluriformes: Heptapteridae) based on palaeogeographical events in South America. *Biological Journal of the Linnean Society* 135(2): 322–335. <https://doi.org/10.1093/biolinnean/blab150>

Hilton, E.J., A.M. Bauer, K.E. Bemis, **M.H. Sabaj**, D.G. Smith and G.J. Watkins-Colwell. 2021. A common love of science: the one-hundredth meeting of the American Society of Ichthyologists and Herpetologists. *Ichthyology & Herpetology* 109(3): 916–924. <https://doi.org/10.1643/t2021071>

Littmann, M.W., **J.G. Lundberg** and M.S. Rocha. 2021. Revision of the South American catfish genus *Hypophthalmus* (Siluriformes, Pimelodidae) with descriptions of two new species from the Amazon and Orinoco Basins. *Proceedings of the Academy of Natural Sciences of Philadelphia* 167(1): 171–223. <https://doi.org/10.1635/053.167.0112>

Magalhães, K.X., R.D.F. da Silva, A.O. Sawakuchi, A.P. Gonçalves, G.F.E. Gomes, J. Muriel-Cunha, **M.H. Sabaj** and L.M. Sousa. 2021. Phylogeography of *Baryancistrus xanthellus* (Siluriformes: Loricariidae), a rheophilic catfish endemic to the Xingu River basin in eastern Amazonia. *PLoS ONE* 16(8): [1–21]. <https://doi.org/10.1371/journal.pone.0256677>

Sabaj, M.H., & M. Arce H. 2021. Towards a complete classification of the Neotropical thorny catfishes (Siluriformes: Doradidae). *Neotropical Ichthyology* 19(4): e210064. <https://doi.org/10.1590/1982-0224-2021-0064>

Silva-Oliveira, C., R.P. Ota, **M.H. Sabaj** & L.H. Rapp Py-Daniel. 2021. A new species of *Bryconops* (Characiformes: Iguanodectidae) from Atlantic coastal drainages of Suriname and French Guiana. *Neotropical Ichthyology* 19(4): e210113. <https://doi.org/10.1590/1982-0224-2021-0113>

Silva, G.S.C., B.F. Melo, F.F. Roxo, L.E. Ochoa, O.A. Shibatta, **M.H. Sabaj** and C. Oliveira. 2021. Phylogenomics of the bumblebee catfishes (Siluriformes: Pseudopimelodidae) using ultraconserved elements. *Journal of Zoological Systematics and Evolutionary Research*. DOI: 10.1111/jzs.12513. <https://doi.org/10.1111/jzs.12513>

Silva, G.S.C., F.F. Roxo, B.F. Melo, L.E. Ochoa, F.A. Bockmann, **M.H. Sabaj**, F.C. Jerrep, F. Foresti, R.C. Benine & C. Oliveira. 2021. Evolutionary history of Heptapteridae catfishes using ultraconserved elements (Teleostei, Siluriformes). *Zoologica Scripta*. <https://doi.org/10.1111/zsc.12493>

Popular Articles

Arce H., M., R. Bell, M. Franklin, A. Roa-Varon and B.A. Wehrle. 2021. Scientist Spotlights: Rosa Smith Eigenmann. *Ichthyology & Herpetology* 109(1): 323. <https://doi.org/10.1643/t2021004>

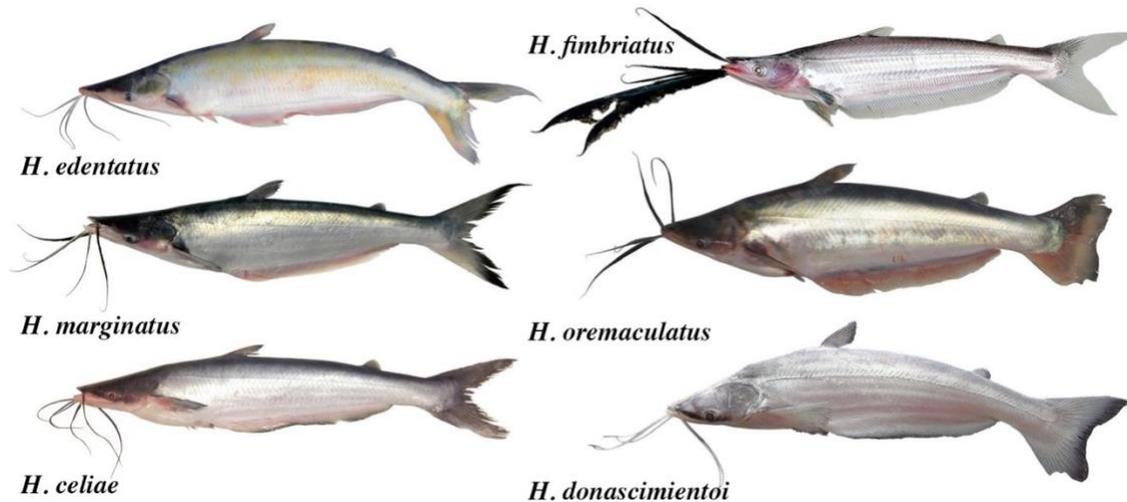
Bell, R., **M. Arce H.,** M. Franklin, A. Roa-Varon and B.A. Wehrle. 2021. Scientist Spotlights: Helen Thompson Gaige. *Ichthyology & Herpetology* 109(1): 322. <https://doi.org/10.1643/t2021003>

Urbano-Bonilla, A., A. Roa-Varon & **M. Arce H.** 2021. Scientist Spotlights: Dr. Javier Alejandro Maldonado-Ocampo. *Ichthyology & Herpetology* 109(4): 1073–1074. <https://doi.org/10.1643/t2021115>

Book Chapter

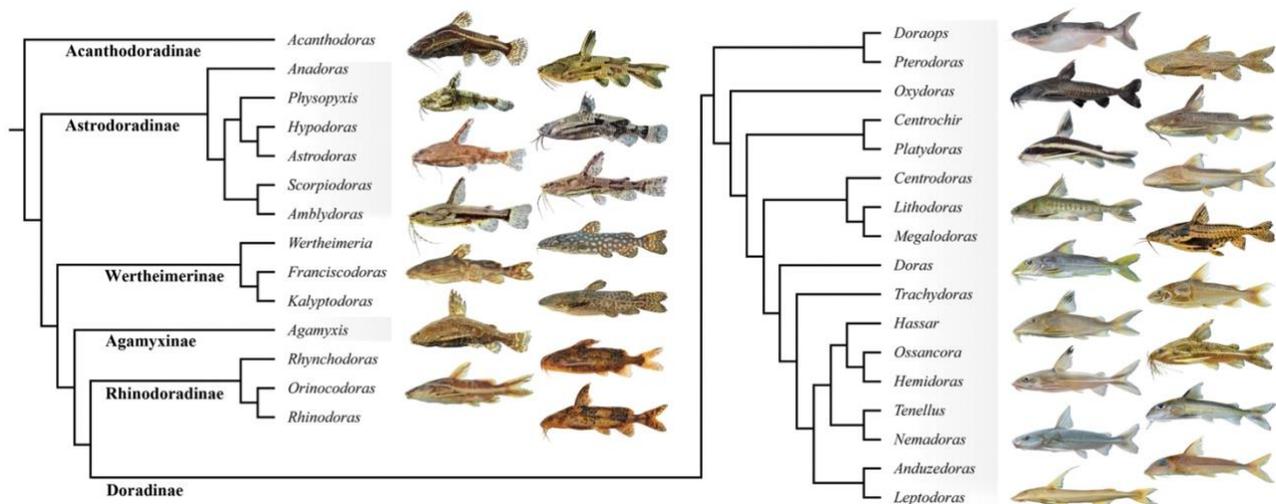
Cantuária, P.C., C.S. Gama, **M.H. Sabaj**, L.M.S. González, F.J. Nge, T.D.S. Medeiros and A.K.R. Galardo. 2021. Uma introdução para a importância das coleções científicas [An introduction to the importance of scientific collections], p. 13–22 *In*: Gama, C.S., L.F.S.C. Leite & P.C. Cantuária (org.), *Coleções Científicas do IEPA, Passado, Presente e Futuro*. Instituto de Pesquisas Científicas e Tecnológicas do Estado do Amapá, Macapá, AP, Brazil.

New Taxa.—Michael Littmann, John Lundberg and Marcelo Rocha (2021) described two new species in the pimelodid catfish genus *Hypophthalmus*, *H. celiae* and *H. donacimientoi*, both occurring in the Amazonas and Orinoco basins. *Hypophthalmus celiae* honors Ms. Celia Bueno of the Museum d'Histoire Naturelle de Neuchâtel, Switzerland. *Hypophthalmus donacimientoi* honors good friend and collaborator Dr. Carlos Luis DoNascimento Montoya, now at Universidad de Antioquia, Colombia.



Cárlison Silva-Oliveira, Rafaela Ota, Mark Sabaj & Lúcia Rapp Py-Daniel (2021) described a new species of iguanodontid tetra, *Bryconops florenceae*, from Suriname and French Guiana. The type series was collected during the 2007 expedition to the upper Maroni Basin led by John Lundberg and Mark Sabaj and funded by the All Catfish Species Inventory (NSF DEB-0315963). The species honors Florence de Rapleye Foerderer (1926–1999) whose will granted \$7 million each to The Academy of Natural Sciences of Philadelphia, The Philadelphia Zoo and Gallaudet University, a liberal arts college for deaf and hard-of-hearing students. Florence held a great love for animals and her generous bequest continued the Foerderer family’s long history of civic involvement and philanthropy in the Philadelphia area (Schmidt, 2001).

Mark Sabaj & Mariangeles Arce H. (2021) proposed three new subfamilies in the catfish family Doradidae (Acanthodoradinae, Agamyxinae and Rhinodoradinae) diagnosed by caudal-fin characteristics and supported by molecular phylogenetic analyses of one nuclear (*rag1*) and two mitochondrial (*co1*, *16s*) genes. The molecular dataset comprises 174 doradid specimens representing all 31 valid genera, 83 of the 96 valid extant species and 17 species-level taxa that remain undescribed or nominally unassigned.

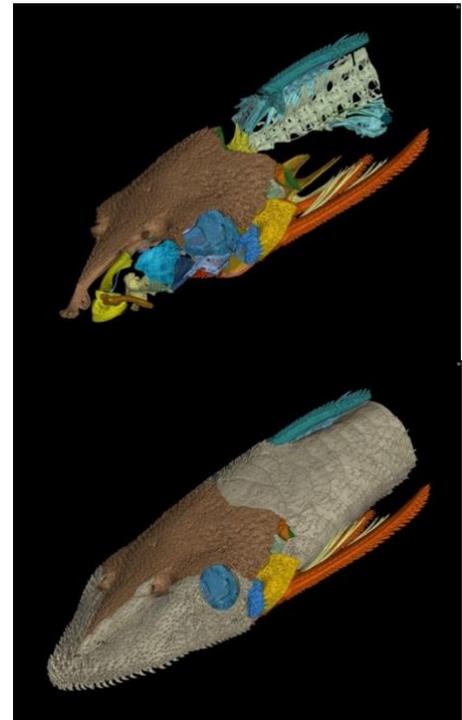


Funding & Proposals.—Mariangeles co-led a team of Colombian ichthyologists that received a grant from the Global Biodiversity Information Facility (GBIF) under the Biodiversity Information for Development program. This project assembles over 50 neotropical ichthyologists from seven countries to create a national checklist and species pages for all of Colombia’s estimated 3,800 fish species. The grant to the Universidad Nacional de Colombia will build on existing relationships between biodiversity data-holding institutions and decision-makers to respond to conservation and policy needs.

Mark, Mariangeles and Kyle contributed to the preparation of a broadly collaborative proposal submitted to the National Science Foundation’s Major Research Instrumentation Program (MRI; NSF 18-513) in Jan 2022. The proposal is for \$1,228,025 to acquire a state-of-the-art high-resolution X-ray computed tomography (XCT) system to replace a Drexel instrument which has been critical to many research projects since 2006. The lead PI is Antonios Kontsos (Drexel College of Engineering). Co-PIs are Antonios Zavaliangos (CoE), Craig Johnson (Drexel Director of Operations), Kara Spiller (Drexel School of Biomedical Engineering Science and Health Systems) and Jocelyn Sessa (ANSP/College of Arts and Sciences). Mark, Mariangeles and Richard McCourt (Botany) are among Senior Personnel and Kyle is an Internal Collaborator. External Academic Collaborators include faculty at Navajo Technical University, New Mexico State University, Rowan University, Rutgers, Stevens Institute of Technology, Swarthmore, Temple, Thomas Jefferson University, University of Nebraska-Lincoln, UPENN and Villanova. Industry Collaborators include Exponent (Engineering and Scientific Consulting), Merck, Pulse Technologies, Sigma Labs and Simmetrix, Inc. This is a resubmission of an unfunded proposal submitted in Jan 2021.

In Jan 2022, Mark submitted to NSF the final reports on ANSP’s collaboration in the oVert Project. oVert is a Digitization Thematic Collections Network (TCN) led by the U of Florida (PI David Blackburn) with separate grants to 14 museum collections and scanning centers at institutions across the US: ANSP (PI Mark Sabaj), California Academy of Sciences (PI Luiz Rocha), Cornell (PI Casey Dillman), Field Museum of Natural History (PI John Bates), Harvard (PI James Hanken), Louisiana State U (PI Christopher Austin), Texas A&M (PI Kevin Conway), U of California–San Diego, Scripps Institute of Oceanography (PI Philip Hastings), U of California–Berkeley (PI Carol Spencer), U of Kansas (PI Luke Welton), U of Michigan (PI Daniel Rabosky), U of Texas at Austin (PI David Cannatella), U of Washington (PI Luke Tornabene), Virginia Institute of Marine Science (PI Sarah Huber) and Yale (PI Gregory Watkins-Colwell).

The NSF grant to ANSP ([DBI 1701943](#): \$73,248) was awarded in 2017 and completed on-time in 2021. The oVert project aimed to CT scan over 80% of the approximately 10,500 genera of vertebrate animals alive today. ANSP was a small but vital part of that network due to its experienced staff and important collections of vertebrates, especially fishes. Mariangeles and other ANSP personnel loaned over 800 vertebrate specimens to nine CT-scanning facilities over the course of the project. Based on those specimens, 661 media files have been added to [MorphoSource](#) with more to come as scanning and uploading continues. ANSP project personnel also helped develop best practices for shipping specimens both safely and in a way that minimizes work for the scanning facility. During the project, Mark developed and published a [system of codes](#) (3,845 total) for authors and electronic databases to tie natural history specimens to their home institutions and collections.



ANSP project personnel trained a variety of students (high school, undergraduate, graduate) and postdoctoral researchers from the US and abroad on how to process and study 3-D specimen models using high-end imaging software such as Dragonfly and VG Studio Max. Four of those students completed summer internships in the Women in Natural Sciences (WINS) program sponsored by ANSP’s Center for STEAM Equity. The four

WINS interns received in-person lessons on the identification and anatomical study of fishes using a variety of techniques (dissections, clearing and staining, manipulation of 3-D scans) on both ANSP specimens and media generated by the oVert project. Furthermore, Mark and Kyle participated in a mentor-training program sponsored by a separately funded NSF project (EngWINS; [DRL 1849735](#)).

Finally, ANSP project personnel incorporated CT technology and 3-D media into a variety of classroom exercises, public programs and exhibits sponsored by the museum and Drexel University. A highlight of those activities involved two 3-D sculpture courses taught in Drexel University's Westphal College of Media Arts and Design during the Fall Quarter of 2020–21. Drexel students visited the ANSP Fish Collection to work with Kyle on CT scans and renderings of skeletal structures to create unique sculptures with a focus on climate change (*figure*). Kyle's work was part of an internal Museum Innovation Fund (MIF) awarded to Lewis Colburn and Mark Stockton (Westphal) in 2021. Kyle will continue to work with Stockton's iPad drawing classes in 2022, providing access to the Ichthyology collection, labs and specimens.



In 2022, Mariangeles and Mark will collaborate with Ornithologists Nate Rice and Jason Weckstein on a proposal to NSF to establish a liquid-nitrogen storage facility at ANSP for frozen tissues of birds and fishes.

Finally, though technically belonging to next year's activities, the Ichthyology Department received a generous gift of \$20,000 from Daniel and Patricia Fromm on 4 Feb 2022. Dan and Pat have enjoyed a long and fruitful relationship with the Ichthyology Department since the 1970s. Dan has been an Academy Research Associate for many years and has recently enjoyed working on fishes in the department with help from Kyle, Mariangeles and Mark. Dan and Pat are thankful to Dr. Jim Böhlke (Curator from 1954–1982), John E. Cadle (Curator of Herpetology in the 1980s and 90s), and especially Bill Saul (Collection Manager from 1972–1999) for welcoming and encouraging their early interests in fishes and other organisms, and for direction, guidance, and support in conducting their fieldwork. Dan and Pat take great pleasure in contributing to Academy Ichthyology in return for enriching their lives. The donation will support research and fieldwork led by Academy-employed ichthyologists.

As an aside, Dan has one fish named for him: [Cynodonichthys frommi](#) (Berkenkamp & Etzel 1993). According to the [ETYFish Project](#), the species name honors aquarist Daniel W. Fromm (Cherry Hill, New Jersey, USA), for active field work and fish collections in Costa Rica and Panama during various trips, and for breeding the fish he collected and publishing the results. ANSP hold two specimens collected by Dan (ANSP 147654 and 151285).



Photo by F. Vermeulen

Pat also has a fish named for her. *Austrolebias patriciae* (Huber 1995) honors aquarist Patricia Fromm who along with her husband Dan collected the type series in Paraguay with local aquarists who already knew of the fish but had referred it to *Cynolebias alexandri*.



Photo by Dan Fromm

Academy Scientific Publications

Overview.—The Ichthyology Department has been responsible for publishing the Academy’s academic journal, *Proceedings of the Academy of Natural Sciences of Philadelphia* (PANSP), since 2007. In 2020, that responsibility was expanded to include Academy Special Publications. Established in 1841, PANSP is the longest running serial on natural history and the environment published in the Americas.

Staff.—In 2021, Mark Sabaj served as Managing Editor and Kyle Luckenbill served as Production Editor, a post he has held since 2007. About 25% of Kyle’s time is spent on work related to Scientific Publications. In 2021, Paul Callomon volunteered his copyediting services to a catalog of marine snails (Fascioliariidae) that will be printed as Academy Special Publication No. 25 in 2022.

Activities.—The highlight of 2021 was seeing from submission (Feb) to print (Dec) ANSP Special Publication No. 24: *Diatoms of Montana and Western North America: Catalog and Atlas of Species in the Montana Diatom Collection. Volume 1*. Forty-eight boxes of 576 copies of the book were received on the Academy loading dock on 4 Jan 2022 (*figure*).



The work is authored by Dr. Loren Bahls who has been studying diatoms for over 50 years (and attended Charlie Reimer’s lectures at the Iowa Lakeside Lab in the 1970s). The volume includes 840 taxa in 81 genera among the centrics, araphids, monoraphids and a couple select groups. Marina Potapova reviewed the MS and prepared the Foreword. Kyle did the layout for the 508-page volume, ensuring that all 204 full-page plates printed to perfection. Mark handled copyediting with help from Drexel Co-op Lauren Tuffy on the 17-page taxonomic index. Loren personally covered the printing costs of Volume 1 (\$9577.69 including sales tax & shipping to ANSP) and is currently working on Volume 2 (biraphid pennates).

In 2021, Sci Pubs also published four manuscripts (71 pages) in Volume 167 of the *Proceedings*:

1. *Oecetis inconspicua* (Walker) (Trichoptera: Leptoceridae) added to the caddisfly fauna of Monroe County, Florida (doi.org/10.1635/053.167.0110) by Lawrence J. Hribar & Andrew K. Rasmussen
2. *Gobio battalgilae* Naseka, Erk’akan & Küçük, 2006 is a junior synonym of *Gobio microlepidotus* Battalgil, 1942 (Actinopterygii: Gobionidae) (doi.org/10.1635/053.167.0111) by Erdoğan Çiçek, Soheil Eagderi & Sevil Sungur.
3. Revision of the South American catfish genus *Hypophthalmus* (Siluriformes, Pimelodidae) with descriptions of two new species from the Amazon and Orinoco Basins (doi.org/10.1635/053.167.0112) by Michael W. Littmann, John G. Lundberg & Marcelo Salles Rocha.
4. Testing the “young-species” hypothesis for *Alburnus heckeli* Battalgil 1944 (Teleostei: Leuciscidae) inhabiting Lake Hazar, Turkey (doi.org/10.1635/053.167.0113) by Erdoğan Çiçek, Soheil Eagderi, Sevil Sungur & Burak Secer.

The total number of MSS received in 2021 was seven, slightly up from 2020 (5) and matching numbers for 2016 and 2018. The total number of MSS published was five, slightly down from 2020 (6) but exceeding numbers for 2016 (4) and 2018 (4). Due to the Diatom Catalog, the total number of pages published in 2021 (579) far exceeded all previous years on record since 2010.

In 2021, the [Impact Factor](#) of the *Proceedings* jumped to a respectable 1.67, its highest value on record. The Academy received a total of \$22,839 in revenue from BioOne and JSTOR in 2021, setting another annual record (see below).

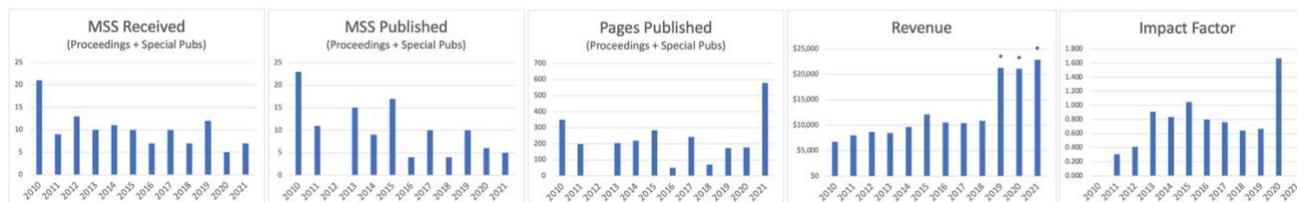
—Mark Sabaj
25 Feb 2022

The Proceedings of The Academy of Natural Sciences of Philadelphia (est. 1841)

~250 active exchanges (~200 international, ~50 domestic) in 2021

Mark Sabaj (Senior Editor since 2018, Junior Editor 2007–18) & Kyle Luckenbill (Production Editor since 2007)

Yearly Totals	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020		2021		Yearly Avg [2010-19]	
											Proc.	Spec. Pubs	Proc.	Spec. Pubs		
Manuscripts Received	21	9	13	10	11	10	7	10	7	12		5		7		10.2
Manuscripts Published	23	11	0	15	9	17	4	10	4	10		6		5		9.5
Pages Published	349	198	0	205	219	283	51	241	69	173		176		579		211.9
Revenue (YR received)	\$6,757	\$7,990	\$8,696	\$8,475	\$9,660	\$12,130	\$10,526	\$10,376	\$10,884	\$21,264		\$21,039		\$22,839		\$10,676
Impact Factor™ <small>(cites/doc-2 yrs)</small>	0.000	0.304	0.412	0.909	0.833	1.048	0.800	0.762	0.643	0.667		1.667				0.6378



*Includes revenue from BioONE & JSTOR
(JSTOR revenue unknown for previous years)

<https://www.scimagisr.com/journalscanh.php?i=18721&op=aid>