THE ICHTHYOLOGY DEPARTMENT OF THE ACADEMY OF NATURAL SCIENCES (ANSP)
EXECUTIVE SUMMARY OF CALENDAR YEAR 2023

Overview.—Ichthyology hosts 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 North Atlantic and Indian Oceans. In 2022, geographical coverage was estimated (*see table*) for a paper published in Science in 2023 by Kirk Johnson, Ian Owens and a "Global Collection Group" of 153 co-authors including ANSP reps **Scott Cooper** (CEO), **Richard McCourt** (Botany Curator) and **Mark Sabaj** (Ichthyology CM).

Region	Scale	est. # specimens
North America	6	100,001-1,000,000
North Atlantic	6	100,001-1,000,000
Asia Temperate	5	10,000-100,000
Asia Tropical	5	10,000-100,000
South America	5	10,000-100,000
North Pacific	5	10,000-100,000
South Pacific	5	10,000-100,000
Indian	5	10,000-100,000
Europe	4	1,001-10,000
Africa	4	1,001-10,000
South Atlantic	4	1,001-10,000
Southern	3	101-1,000
Australasia	2	11-100
Pacific	2	11-100
Arctic Marine	1	1-10
Antarctic	0	0

ANSP also has one of the world's largest collections of fish types with 2,797 primary and 17,881 secondary type specimens representing 1,857 and 2,048 species/subspecies, respectively. In total, ANSP types represent ~3,086 species/subspecies and ~8.4% of all fish species ever named as such. Specimens aside, staff have assembled and curate ~18,000 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 2023, 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 as well as Scientific Publications Production Editor). Mark also served as Managing Editor of Academy Scientific Publications, a responsibility he took on in 2018. Dr. **John Lundberg** has been Curator Emeritus in Ichthyology since his retirement in 2013.

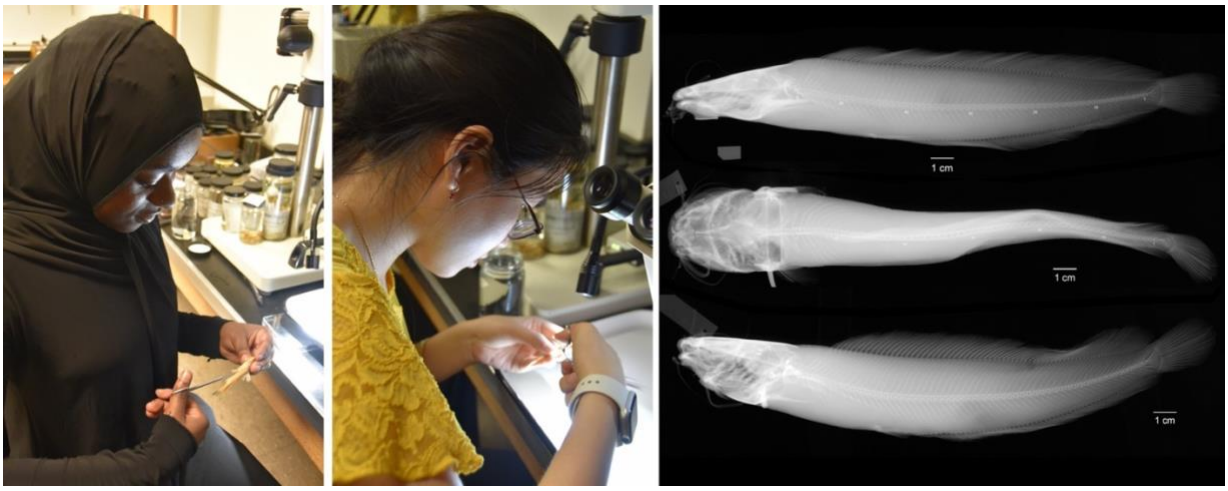
Ichthyology continued to sponsor ten ANSP Research Associates in 2023: Dr. Tiago Carvalho (Pontificia Universidad Javeriana, Bogotá), Dr. Kerin Claeson (Philadelphia College of Osteopathic Medicine), Dr. Cecile Gama, Collection Manager of Fishes at Instituto de Pesquisas Científicas e Tecnológicas do Estado do Amapá (IEPA), Brazil, 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).

Students.—Drexel undergrad **Robert Colson** completed his volunteer (unpaid) co-op position on 23 March 2023 (Fall/Winter 2022-2023 cycle). Robert worked on site in the fish collection and off site on the Catalog of Fishes of Colombia, an international collaboration led by Mariangeles and funded by GBIF in 2021. Ichthyology has hosted 12 volunteer co-ops through 20 rotations since 2013.

Former Drexel/Ichthyology co-op **Jack Ivie** applied for a Fulbright Scholarship during the Fall of 2023. He proposed to work with the Wildlands Institute and the Natural History Museum of Iceland on an "afforestation" project to determine land suitability for new forest cover in the country. Jack is a semi-finalist for the research grant as of 1 Feb 2024. Mark provided a recommendation letter for Jack, extolling his skills and virtues in no fewer than 623 words.

Caroline Putnam, a senior at the Germantown Friends School (and star point guard on their basketball team), interned with Mark for the month of January 2023. For her junior project, Caroline took data on various species of *Gelanoglanis*, a genus of miniature catfish described in 1980 by former ANSP Curator of Fishes Jim Böhlke. She was the first person to train on Ichthyology's new Microfocus Digital X-Ray System.

During the summer, Mark and Kyle participated in the 2023 EngWINS program as mentors for Philadelphia high school students **Sanai Bryant-McPharson** (Franklin Learning Center) and **Hong Phan** (Academy at Palumbo). Sanai and Hong learned how to photograph, radiograph and clear and stain specimens. They used the X-rays to count vertebrae in clariid catfishes. Their data showed that not one, nor two, but three species were represented among the *Clarias* that Mark had collected in Equatorial Guinea.



Mark and Kyle have mentored a total of 16 WINS summer interns since 2011, and the WINS Program celebrated its 41st Anniversary in June.

Dr. **Gabriel de Souza da Costa e Silva** began his one-year postdoc with Mark on April 1st with funding from the Bolsa Estágio de Pesquisa no Exterior (BEPE) program (FAPESP 2021/12979-8). Gabriel earned his master's and Ph.D. in 2012 and 2016, respectively, from the Universidade Estadual Paulista Júlio de Mesquita Filho (UNESP) under the orientation of Dr. Claudio Oliveira. For his postdoc, Gabriel is using ultraconserved elements (UCEs) to investigate relationships among the genera and families of catfishes. His work resulted in two manuscripts submitted in 2023 with Mark and others as co-authors. One proposes a new species of *Imparfinis* (Heptapteridae), and the other proposes a phylogeny of the family Pimelodidae based on UCE data.

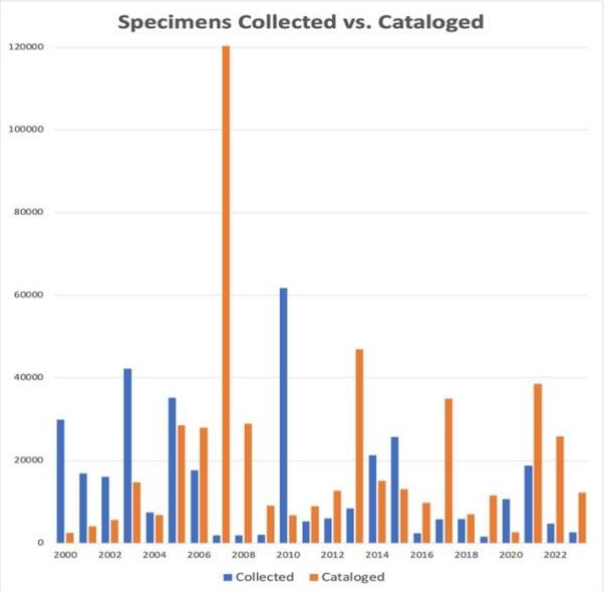
Dr. **Lais Reia** also began studying in the department in April. She earned her master's and doctoral degrees in 2018 and 2023, respectively, from the same institution as Gabriel and under the orientation of Ricardo Benine. On August 1st, she was awarded funding from Fixação de Jovens Doutores (FAPESP 2023/01497-8), a cooperative agreement between CNPq and FAPESP. The title of her project is: Phylogenetic relationships of Stevardiinae with emphasis on the tribe Diapomini (Characiformes: Characidae) using ultra-conserved elements (UCEs). During her studies in the collection, Lais has identified a number of smaller projects that she will work on with Mark and tetra specialists including Flávio C.T. Lima.

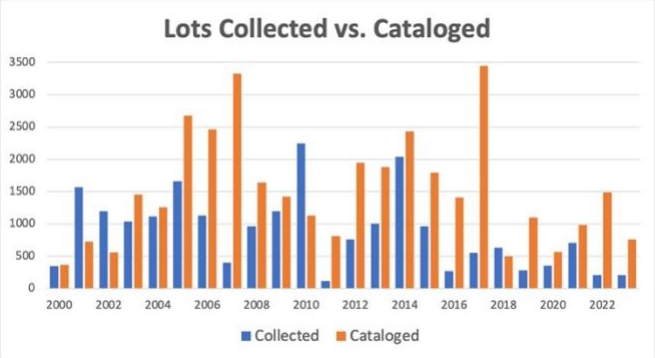
Lais and Gabriel were married in Brazil in 2022 and have been living with Mark and Sofia (and various guests) during their year-long stay in the US.

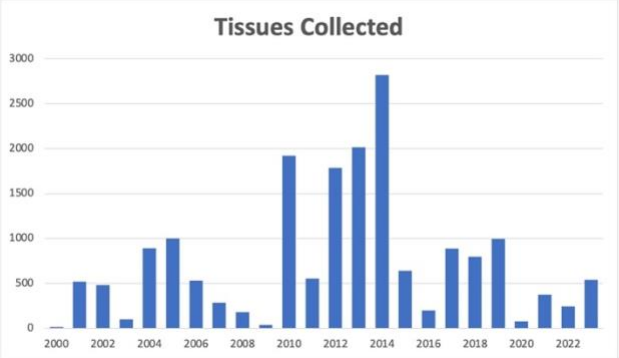
Collections Growth (General).—A total of 12,248 specimens in 757* lots plus 541 tissue samples were cataloged into the collection in 2023 (*includes 16 new lots split from previously cataloged specimens). Of those, 2,633 specimens (21%) in 210 lots (28%) were collected in 2023 (*see section on Fieldwork*). The remainder were cataloged from backlog or specimens received in 2023. With respect to new specimens/lots/tissues, annual growth was modest overall; 2023 exceeded 2022 in terms of tissues, matched 2022 in terms of lots collected, and was below 2022 for other categories (*table below*).

Significant accessions included 1,581 specimen (96 lots) representing 32 species (mostly Sciaenidae) collected in the Gulf of Nicoya, Costa Rica, from 1979–1981 by H.M. Brundage III, University of Delaware Masters student who worked for Ichthyological Associates, Inc. Received in 2010, this collection added 19 species to the general collection. Donald J. Stewart dropped off 55 catfish specimens (12 lots), the bulk of which were of a new species of channel-dwelling, miniature pimelodid discovered during the 1990's Calhamazon surveys and loaned to DJS for study (the fish remains undescribed). The fish collection also accessioned 3,476 specimens (64 lots) received from fisheries biologist Daniel Morrill and preserved during 2022 Patrick Center creek surveys in the Delaware River Basin, PA.

year	specimens collected	specimens cataloged	lots collected	lots cataloged	~ tissues collected
2000	29930	2481	348	368	15
2001	16911	4008	1566	729	518
2002	16083	5606	1198	558	480
2003	42177	14795	1037	1457	99
2004	7486	6796	1115	1257	891
2005	35171	28594	1664	2679	1000
2006	17664	27945	1132	2462	532
2007	1880	166951	400	3329	284
2008	1908	28938	965	1644	181
2009	2019	9105	1195	1422	38
2010	61704	6721	2248	1133	1921
2011	5233	8938	115	812	553
2012	5982	12657	757	1944	1786
2013	8437	46868	1007	1881	2013
2014	21310	15131	2039	2428	2819
2015	25732	13026	963	1793	640
2016	2412	9754	269	1408	199
2017	5775	34995	555	3444	888
2018	5862	6948	631	501	797
2019	1573	11606	283	1099	995
2020	10671	2634	357	569	76
2021	18794	38576	707	984	375
2022	4702	25845	210	1492	244
2023	**2633**	**12248**	**210**	**757**	**541**
10 yr avg	**9946**	**17076**	**622**	**1448**	**757**
24 yr avg	**14669**	**22549**	**874**	**1506**	**745**







Collections Growth (Types).—Descriptions of four new species in 2023 added one holotype and 69 paratypes to the ANSP Fish Collection: *Prodontocharax aquilaepinnae* Bertaco, Chuctaya, Jerep & Malabarba (paratypes ANSP 116450, 20; 166928, 10), *Sturisoma defranciscoi* Londoño-Burbano & Britto (paratype ANSP 120648, 1), *Sternopygus sarae* Torgersen, Galindo-Cuervo, Reis & Albert (holotype ANSP 209718; paratypes 160357, 27; 163043, 7), and *Scobinancistrus raonii* Chaves, Oliveira, Gonçalves, Sousa & Py-Daniel (paratypes ANSP 193045, 1 of 1 gifted to Auburn University; 194819, 1; 194989, 1; 200828, 1).

Research on historical specimens and uncataloged backlog added a total of 486 type specimens not previously recognized. Among those may be the missing holotype of *Tetragonopterus ortonii*, a species described by American ichthyologist Theodore Nicholas Gill (1837–1914) in 1870. Gill (1870) described ten species of freshwater fishes based on specimens collected by James Orton (1830–1877) during his 1867 expedition which began in Guayaquil, on the Pacific Coast of Ecuador, and ended in Pebas, Peru. Subsequent authors generally considered Gill's species to be based on Orton specimens from the upper Amazon. Vari et al. (2005:227-228),

however, provided convincing evidence that Gill (1870) based his *Cetopsis ventralis* on a specimen from the Andes' Pacific versant. Therefore, Orton returned with specimens from Pacific coastal drainages as well as the upper Amazon. Eight of Gill's ten holotypes are preserved at USNM; the types of *Centromochlus steindachneri* and *Tetragonopterus ortonii* were generally regarded as missing.

A skeleton found in the collection (ANSP 16834) was accompanied by a crude sketch of a (seemingly) entire specimen and original label in E.D. Cope's handwriting "*Tetragonopterus Ortonii*, Pebas (Coast)". The "coast" reference is consistent with Orton's 1867 expedition vs. his 1873 and 1876 expeditions focused on the Amazon interior. A contemporary of Gill, Cope (1870, 1872) also published on fishes from the Amazon Basin (including "Pebas, Equador") collected by John Hauxwell (among others). Cope was certainly aware of Gill's *T. ortonii* as he mentioned the species and author by name (Cope 1870:566) in reference to "Other Characinidae contained in the collection..." However, the "collection" in this case seems to refer to Hauxwell's specimens (not Orton's). Furthermore, Gill (1870) based his brief description not on a skeleton, but on an entire specimen with "D. 11. A. 34." The dorsal fin of ANSP 16834 is detached from the axial skeleton and has a count of ii,8 if the last two elements are counted as one (otherwise ii,9); the anal fin has a count of iv,33 (first two simple rays small and closely adhered to third, which would have made them inconspicuous in entire specimen). Features of the skeleton consistent with Gill's description are its concave profile in parietal region, transversely convex interorbital region, and relatively tall dorsal fin. If ANSP 16834 is not the true holotype of *Tetragonopterus ortonii*, it certainly represents Cope's interpretation of Gill's species.

Additional types were discovered by matching ANSP specimens to parental type lots at the Smithsonian (USNM) and California Academy of Sciences (CAS). Theodore Gill also described freshwater fishes from North America, including *Enneacanthus margarotis* Gill & Jordan 1877, now a synonym of *Enneacanthus gloriosus* (Holbrook 1855), the Blue-spotted sunfish. *Enneacanthus margarotis* was based on specimens from multiple sites including many collected by C.C. Abbott from the vicinity of Trenton in 1875 and sent to the Smithsonian. ANSP 22596 (1) was tied to one of the syntype lots (USNM 20494) with locality Watsons (not Matsons) Creek. Abbot returned to this site on multiple occasions with Henry Fowler to collect fishes. Watsons Creek is now part of the Rowan Lake marshes which drain into Crosswicks Creek near the latter's confluence with the Delaware River. Built in 1708, the Isaac Watson House, now headquarters of the NJ chapter of the National Society of the Daughters of the American Revolution, sits on a bluff (40°11'25"N 74°43'39"W) overlooking Watson's Creek. Whether *Enneacanthus* persists in this area is unknown.

Another Smithsonian connection involves the sucker *Moxostoma rupiscartes* described by Jordan & Jenkins (1889) from the Catawba River, NC. The species was based in part on types cataloged as USNM 40424, some of which were noted as missing by Gilbert (1998:199). ANSP 68539 (1) was removed from USNM 40424 during a 1937 exchange with the Smithsonian arranged by Henry Fowler; therefore ANSP 68539 is a paralectotype of *M. rupiscartes*.

Finally, from the backlog, 483 paratypes were found among specimens formerly associated with naturalist, educator, and eugenicist David Starr Jordan (1851–1931). Henry Fowler was a special student of Jordan at Stanford for two years beginning in 1901 (Smith-Vaniz & Peck, 1991:174). He returned to the Academy with a large number of Stanford specimens apparently on exchange. Many of those specimens (including types) were cataloged years ago into the collection. But a few remained unidentified on the backlog shelves, including a variety of specimens from central Mexico collected mostly by J.O. Snyder. Jordan & Snyder (1899) described 20 new species from this trip to Mexico with specimens deposited at Stanford (now CAS) and sent to the British Museum (now NHMUK), museum in Vienna (NWM), and the US Fish Commission and US National Museum (USNM). The ANSP specimens in question bear original labels confirming their split from Stanford lots and some of those labels reveal their intended status as type specimens. The new ANSP paratypes represent cichilds *Cichlasoma steindachneri* (ANSP 210902, 1), *Heros istlanus* (ANSP 27137, 10), and *Neetroplus carpintis* (ANSP 26950, 18), poeciliids *Poecilia limantouri* (ANSP 27051, 10; 85373, 89) and *Xiphophorus montezumae* (ANSP 27159, 51; 210904, 288), and the silverside *Eslopsarum arge* (ANSP 26895, 16). Information on the original Stanford labels also helped clarify locality data for all the Jordan & Snyder (1899) material at now at ANSP (1,149 specimens in 26 lots).

It is worth noting that these modern discoveries of old types were made possible by the ANSP Fish Database and online databases for specimens (iDigBio) and publications (Biodiversity Heritage Library). Previous treatments of ANSP types (e.g., Böhlke, 1985; Eschmeyer, 1998; Gilbert, 1998), though carefully done, lacked such valuable resources for linking physical specimens to historical records. All newly found types are reported to Richard van der Laan for incorporation into the largest online type catalog ever assembled, Eschmeyer's Catalog of Fishes hosted by CAS.

Based on a Jan 2024 inventory, ANSP has 2,797 primary type specimens representing 1,857 fish names. Although one holotype was added in 2023, the total number of ANSP holotypes remained at 1,480 due to one recategorized as missing: ANSP 70157, holotype of *Cheirodon troemneri* Fowler 1942. Weitzman & Palmer (1997:233–234) ruled out the specimen previously cataloged as ANSP 70157 as the holotype of *C. troemneri* and that imposter is now cataloged as *Hemigrammus stictus*, ANSP 210697.

ANSP	lots	specimens	species	Counts include	Counts do not include
Primary types					
Holotypes	1480	1480	1480	3 lots/specimens as questionable holotypes; 1 lot/specimen that is also neotype of another species	17 holotypes cataloged as missing/discarded; 2 holotypes transferred to other museums; 13 MS holotypes
Lectotypes	116	116	116	—	1 lectotype cataloged as missing
Neotypes	11	11	12	2 species represented by the same lot/specimen	1 lot/specimen that is also the holotype of another species
Syntypes	297	1190	249	Questionable syntypes; 3 species represented by the same 2 syntypes	16 syntype lots cataloged as missing; 12 species represented only by missing syntypes
TOTALS	**1904**	**2797**	**1857**	holotype/neotype specimen counted as 1	missing/transferred specimens; MS types; 12 species represented only by missing syntypes
Secondary types					
Paratypes	3874	17881	2048	6 of 8 specimens in ANSP 120449; 15 lots (64 specimens) cataloged as questionable paratypes; 21 of 23 paratypes representing two different species counted as 23 specimens in two lots (ANSP 69417 & 69420)	83 lots cataloged as missing/transferred; 149 lots (~1023 specimens) of MS types
TOTALS	**5753**	**20088**	**3075**	see above	see above

Finally, in December 2023, **Mark Sabaj** became the top collector/contributor of fish lots cataloged into the ANSP collection, surpassing former Curator of Fishes **James E. Böhlke** (1930–1982). That said, Böhlke still exceeds Sabaj in the number of cataloged specimens. The top collector in terms of cataloged specimens is former Patrick Center Fisheries Biologist **Paul Overbeck** who retired in 2022. From 1983 to 2022, Paul helped collect a staggering 259,498 specimens now cataloged into the collection. This is more than twice the number of specimens of the second highest collector, fisheries biologist **David Keller**, who is still actively electro-shocking fishes in the field.

This evaluation of named collectors required a fair amount of database editing. The collector's field often included only the lead collector, "et al." with additional names often in the locality remarks. Top collectors named in the locality remarks field were moved to the collector's field for proper attribution. Other times, collector names are abbreviated; surnames are now spelled out in the database for top collectors (e.g., PFO is now P.F. Overbeck). Other edits were needed to facilitate searches on specific names (e.g., "H.R.& H.Roberts" expanded to "H.R. Roberts & H. Roberts"). Unfortunately, generalized attributions remain in the collector's field such as "PCER Staff," "ANSP Dept. Limnology," and "R/V Anton Bruun." Other collectors are semi-generalized. For example, most (if not all) of the Brazilian Amazon trawling surveys of the 1990s include "Calhamazon" in the locality field and "J.G. Lundberg" in the collector's field, plus the name of the person identified by the field number (e.g., J.P. Sullivan for JPS-93-001); but other personnel names on those surveys

are left out. Such cases require more sleuthing for precise attribution. Also, with respect to specimens, Jim Böhlke (and probably others) often eye-balled counts (e.g., 50, 100, 200) which (when checked) are generally underestimates of the true numbers.

Nevertheless, the table compiled for the top 25 collectors named in the ANSP fish database is more or less a fair summary for *cataloged* specimens. One wonders if there is a special place in the afterlife for ichthyologists who deposit (with proper data) the specimens they sacrifice into an active natural history collection.

	Collector(s)	Title at ANSP	Lots	Specimens	[Specimen Ranking]	Date Range
1	**Mark Sabaj**	Collection Manager (2000–)	11157	92838	[6]	1992–
2	**James Böhlke**	Curator (1954–1982)	11156	111606	[5]	1945–1977
3	**James Tyler**	Curator (1962–1972)	9824	65350	[9]	1959–1994
4	**Charles C.G. & Gordon Chaplin**		6493	38124	[11]	1940–2012
5	**William Saul**	Collection Manager (1972–1999)	6298	87028	[7]	1967–1997
6	**Neil Foster**	Patrick Center Fisheries Biologist	4836	118701	[3]	1952–1975
7	**Paul Overbeck**	Patrick Center Fisheries Biologist	4735	259498	[1]	1983–2022
8	**John Lundberg**	Curator (1999–2013)	4720	30472	[13]	1972–2014
9	**Richard Horwitz**	Patrick Center Fisheries Biologist	4328	112806	[4]	1973–2019
10	**William Smith-Vaniz**	Curator (1976–1991)	3857	21443	[17]	1954–2000
11	**Jules Loos**	Patrick Center Fisheries Biologist	3820	75561	[8]	1964–1982
12	**Henry Fowler & family**	Curator (1902–1965)	3522	25076	[15]	1896–1949
13	**Nathan Lujan**		3397	21133	[18]	2003–2016
14	**Edward Drinker Cope Collection**		3248	12256	[24]	1830–1898
15	**H.R. Roberts**		2984	19482	[19]	1951–1973
16	**Daniel & Patricia Fromm**	Research Associate (Daniel)	2793	24590	[16]	1979–
17	**Leandro Sousa**		2639	17990	[20]	2002-2019
18	**Alany Gonçalves**		2546	17795	[21]	2013–2019
19	**Daniel Fitzgerald**		2482	17431	[22]	2013–2014
20	**Barry Chernoff**	Curator (1983–1987)	2405	34589	[12]	1982–1998
21	**Mariangeles Arce**	Collection Manager (2015–)	2375	11371	[25]	2004–2018
22	**David Keller**	Patrick Center Fisheries Biologist	2220	122691	[2]	2004–
23	**Edward Jankowski**	Patrick Center Fisheries Biologist	2169	42963	[10]	1968–1988
24	**David Werneke**		2112	12682	[23]	2002–2016
25	**Scott Schaefer**	Curator (1988-1996)	1572	27202	[14]	1989–1995

Collections Databases.—Academy staff continued its long search for a digital savior to unify data across all collections (Botany, Diatoms, Entomology, Herpetology, Ichthyology, Mammalogy, Ornithology and Invertebrate and Vertebrate Paleo). Over the summer, Larry Gall of the Yale Peabody Museum was called in to evaluate, collection by collection, the Academy's databases and needs. He ardently pitched Axiell's EMu as the best solution, and everyone more or less agreed. Mark expressed a willingness to *export* fish data to any new Academy-wide platform (should one become available), but has no interest in managing fish data from within a new system. This is because the current fish database (in FileMaker) has been in use without interruption since 2008, and self-improved over time to support all of the collection's needs. Larry assured him that EMu *will* improve the department's ability to manage the fish collection.

The is no question that EMu is a powerful and well-supported Collections Management System. The question is whether the Academy can afford and maintain it. To help answer that question (among others), **Pedro Raposo**, Director of Academy Library & Archives, established (in September) a "Biodiversity Data Group" composed of IT and collections staff (including Mark and Mariangeles). This group supersedes the "Database Working Group" (ca. 2018–2020) which had a similar mission but failed to produce a viable savior.

Mark has been working with the new (and highly competent) Database Programmer **Robby Noonan** to re-establish IPT links between the fish database and external aggregators (e.g., GBIF, iDigBio). Such aggregators offer effective ways to unify (and serve) collections data not only across an institution, but across the Global Collection of Natural History (Johnson et al., 2023).

Fieldwork.—Trips to the Dominican Republic, Amapá, Brazil, and especially Equatorial Guinea accounted for most of the specimens collected and preserved in 2023.

The Equatorial Guinea Expedition was made possible by a generous gift from **Daniel and Patricia Fromm** in February 2022. In fact, to obtain approvals from the Academy and Drexel (and Paul Callomon), Mark had to promise not to use any institutional funds on the trip because of a budget-related embargo on staff travel.

The Academy team was composed of Mark Sabaj, Cecile Gama, **Anwar Abdul-Qawi**, and **Daouda Njie**. They were received on the island of Bioko by **David Montgomery** who (at the time) was Director of Drexel's Bioko Biodiversity Protection Program. The BBPP was founded in 1998 by Gail Hearn as an academic partnership between Arcadia University, where she was a Biology professor, and the National University of Equatorial Guinea. Gail and the BBPP moved to Drexel University in 2007. After Gail's retirement, Drexel Associate Professor Katy Gonder became director of the BBPP from 2014–2021, during which time the program struggled to maintain and attract funding. During the Fall, the Academy and Drexel divested itself of BBPP's staff and in-country network to other institutions such as CIBIO, Centro de Investigação em Biodiversidade e Recursos Genéticos in Porto, Portugal. On November 2, David Montgomery left the Academy and Drexel to become CIBIO's Director of the Equatorial Guinea Biodiversity Program.

The Academy team spent 5 days sampling 6 sites around the island before travelling to the mainland to sample another 10 sites in the río Benito Basin. Naturalist Juan (Cary) Cruz Ondo helped the team navigate the mainland. The trip netted a total of 1,341 specimens (97 lots) of ~63 species of fresh and brackish water fishes now cataloged into the ANSP collection. Also added were 234 tissue samples representing nearly all of the species collected. Over 100 photos of fishes from the expedition were shared via Facebook.

In April, Research Associate **Daniel Fromm** and Mark returned to the Dominican Republic to reprise their successful 2022 trip. They sampled 11 sites and returned with 659 specimens (37 lots) of ~17 species and 107 tissue samples. The two fishes below were collected at a particularly rich site in the río Quisibaní, a tributary to the Yuma, near Villa Cerro of Higüey (18°38'59.8"N, 68°42'35.5"W).

And for their honeymoon, Mark and Cecile made a collection of fishes in the rio Aporema, a tributary to the Araguari (01°13'47.4"N, 50°53'20.3"W). Mark returned with another collection of Brazil/Amapá fishes: 130 specimens (39 lots) and 81 tissue samples plus dozens of fish photos including the Fall-themed one below.

Service.—Service is broadly separated into two categories, Departmental (job-related) and Extracurricular (volunteer). All Departmental service is tracked via the Fish Collection database (specimen loans) and CM Notebook (database in use since Aug 2000). CM Notebook generally tracks responses to internal and external requests for collections-related data and/or staff expertise and participation (e.g., outreach activities including lectures and tours). Extracurricular service, on the other hand, is usually on a volunteer basis and not specifically related to departmental duties (i.e., not tracked via CM Notebook). This includes service to scientific societies and reviews for scientific journals. Other volunteer service that may fall into the extracurricular category is participation on ANSP/Drexel committees.

Service (Departmental).—Ichthyology fulfilled 39 specimen-related and 11 tissue-related loan requests in 2023. Specimen loans were up from 2022 but under the average numbers of requests fulfilled over the past 10 (41 loans) and 23 (45 loans) years. Tissue loans were slightly down from 2022, and also less than the average number of requests fulfilled over the past 10 (21 loans) and 23 (16 loans) years (*see table below*).

In recent years, the largest borrower by far has been Dr. Kory Evans-Jackson (and his students) at Rice University in Houston, Texas. Since 2021, they have borrowed a total of 243 specimens/lots (via 16 invoices) for CT scanning. In January 2023, Kory won a National Science Foundation CAREER Award to study shape changes in the skulls of spiny ray-fin fishes (Acanthomorpha) across their evolutionary history. He was awarded $1,125,190 (NSF DEB 2237278) for five years, and will likely keep the department busy through 2028 (if not longer).

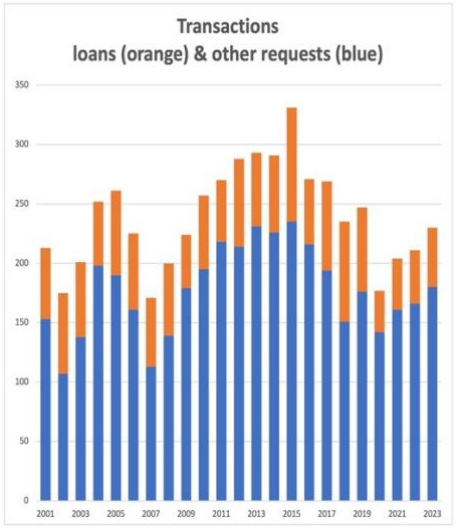
ANSP remains a go to spot for stone suckers (*Petromyzon marinus*) among southern hemisphere ichthyologists. Mariangeles sent 10 adults to Francisco "Kiko" Langeani at UNESP Instituto de Biociências, Letras e Ciências Exatas, São José do Rio Preto, and Mark hand carried 12 adults to São Paulo for Ricardo Benine at UNESP Instituto de Biociências, Botucatu. Back in 2019, Mark began corresponding with Andrea Jaeger Miehls of the Hammond Bay Biological Station, Michigan, who kindly supplies (upon request) fresh-dead lampreys (on ice) that were removed from the wild during the annual trapping season.

Apart from fulfilling loan requests, Mariangeles handles returns of specimens that were loaned (or transferred) to ANSP staff. In 2023, she returned 102 specimens on loan to John Lundberg from Instituto nacional de Pesquisas da Amazônia (INPA) via invoices dating back to 1990. That return closed invoices 05/2005, 09/2006, 09/2010 and 06/2014 (INPA invoices 22/1990, 23/1990, 07/1992, 01/2006, 34/2015 remain open).

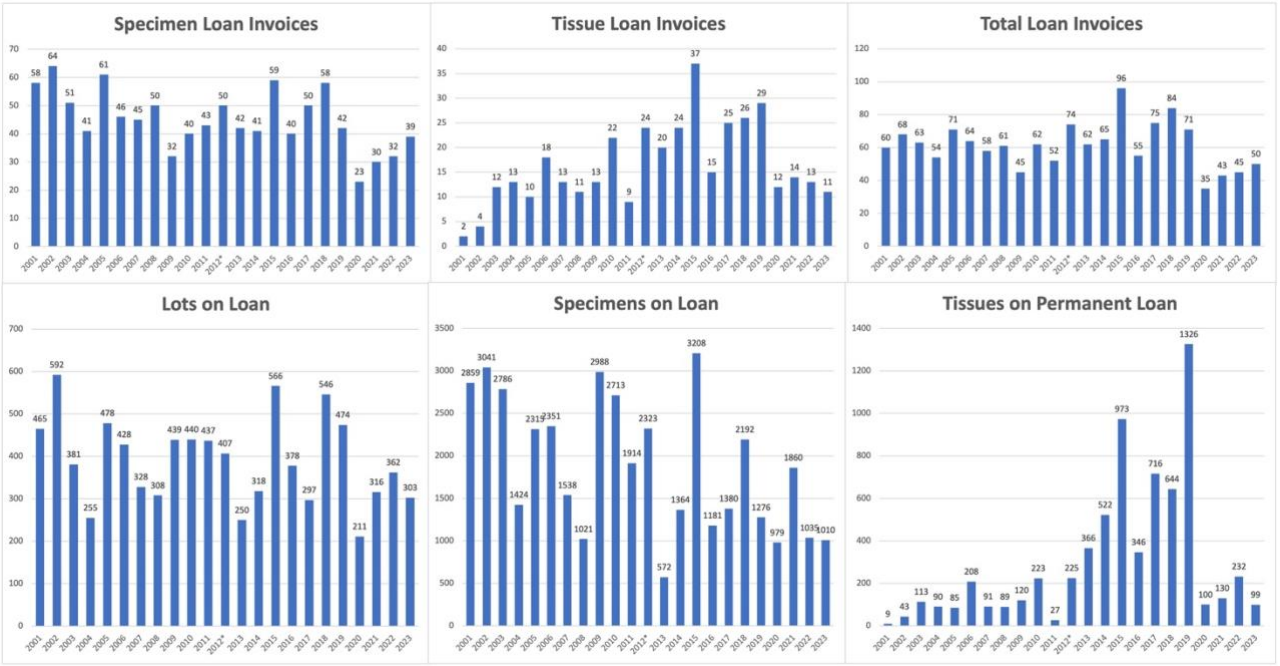
Apart from loans, Ichthyology staff responded to a total of 180 other departmental requests (all recorded in CM Notebook). This is up from 2022 (166 requests), slightly below the 10-year average (185 requests), and slightly above the 23-year average (178 requests). About 16% of all 2023 requests (including loans) came from ANSP/Drexel (down from 23% in 2022) vs. 83% from external sources. Nearly half of all 2023 requests (48%) involved providing data on specimens, taking photos and X-rays, and/or specimen- and library-related research. In 2023, the department provided images and radiographs of 96 and 84 specimens, respectively, in response to 51 requests from internal and external users. Kyle Luckenbill skillfully stickhandles most requests for specimen images and radiographs.

Finally, a call for TikToks inspired Mark, Drexel Co-op Robert Colson, Drexel grad Daouda Njie and Academy Educator Anwar Abdul-Qawi to record one of the museums first offerings in this arena of social media – a salute to William G. Saul who managed the fish collection from 1972 to 1999 (and places 5th on the ANSP list of collectors by lots).

year	specimen loan invoices	**A:** tissue loan invoices	total loan invoices	lots sent on loan	specimens sent on loan*	tissues sent on loan	**B:** cm notebook invoices [total]	cm notebook invoices **[B – A]**
2001	58	2	60	465	2859	9	155	153
2002	64	4	68	592	3041	43	111	107
2003	51	12	63	381	2786	113	150	138
2004	41	13	54	255	1424	90	211	198
2005	61	10	71	478	2315	85	200	190
2006	46	18	64	428	2351	208	179	161
2007	45	13	58	328	1538	91	126	113
2008	50	11	61	308	1021	89	150	139
2009	32	13	45	439	2988	120	192	179
2010	40	22	62	440	2713	223	217	195
2011	43	9	52	437	1914	27	227	218
2012*	50	24	74	407	2323	225	238	214
2013	42	20	62	250	572	366	251	231
2014	41	24	65	318	1364	522	250	226
2015	59	37	96	566	3208	973	272	235
2016	40	15	55	378	1181	346	231	216
2017	50	25	75	297	1380	716	219	194
2018	58	26	84	546	2192	644	177	151
2019	42	29	71	474	1276	1326	205	176
2020	23	12	35	211	979	100	154	142
2021	30	14	43	316	1860	130	175	161
2022	32	13	45	362	1035	232	179	166
2023	39	11	50	303	1010	99	191	180
10 yr avg	**41**	**21**	**62**	**377**	**1549**	**509**	**205**	**185**
23 yr avg	**45**	**16**	**61**	**390**	**1884**	**295**	**194**	**178**



Other requests include 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/marketing.



Categories	2019		2021		2022		2023	
	Requests	% Total Requests	Requests	% Total Requests	Requests	% Total Requests	Requests	% Total Requests
Internal (ANSP/Drexel)	**50**	**20%**	**29**	**14%**	**48**	**23%**	**36**	**16%**
PCER (incl. Accessions)	4	2%	2	1%	4	2%	5	2%
Education, Exhibits, Public Prog. (incl. WINS)	13	5%	10	5%	12	6%	11	5%
BEES (incl. lectures)	8	3%	2	1%	4	2%	4	2%
Communications, IA, Marketing	20	8%	11	5%	20	9%	10	4%
other (incl. CSBE, Westphal)	5	2%	4	2%	8	4%	6	3%
External	**197**	**80%**	**174**	**86%**	**163**	**77%**	**192**	**83%**
Specimen loans	42	17%	30	21%	32	15%	39	17%
Tissue loans	29	12%	14	7%	13	6%	11	5%
Data, photos, X-rays, identifications, etc.	89	36%	105	52%	99	47%	110	48%
Specimen loan returns and transfers	26	11%	11	5%	7	3%	3	1%
Accessions/Deaccessions	9	4%	10	5%	7	3%	15	7%
other (incl. Sci. Pubs. Related)	2	1%	4	2%	5	2%	16	7%
TOTAL REQUESTS	**247**		**203**		**211**		**230**	

Service (Extracurricular).—As for last year (2022), Mariangeles organized and presided over the Academy's Research Day held in the Academy auditorium on 14 December 2023. A total of 15 staff members gave 12 presentations on a variety of topics ranging from the saving the Ironcolor Shiner (David Keller, Fisheries) to stormwater-related gentrification and displacement in Philadelphia (Winn Costantini, Environmental Planning and Policy). Ichthyology was well represented by visiting postdoc Lais Reia who presented on cryptic species in redeye tetra group (*Moenkhausia sanctaefilomenae* and allies). The Keynote speaker was Aleister Saunders, Drexel's Executive Vice Provost for Research & Innovation, and Dave Griffith (ANS Board Chair) gave the closing remarks.

Mark continued his service as the 18th Secretary of the American Society of Ichthyologists and Herpetologists (ASIH) and attended their annual meeting in Norfolk, Virginia, from July 12–16. 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 (and that day cannot come too soon).

Mark also completed peer reviews of seven manuscripts submitted to the Journal of Fish Biology (1), Miscellaneous Pubs. Museum of Zool. Univ. Michigan (1), Molecular Phylogenetics and Evolution (1), Neotropical Ichthyology (2) and a book on catfishes edited by Gloria Arratia and Roberto Reis (2 chapters). Among those was a 7-page review of a 441-page manuscript checklist of the order Characiformes.

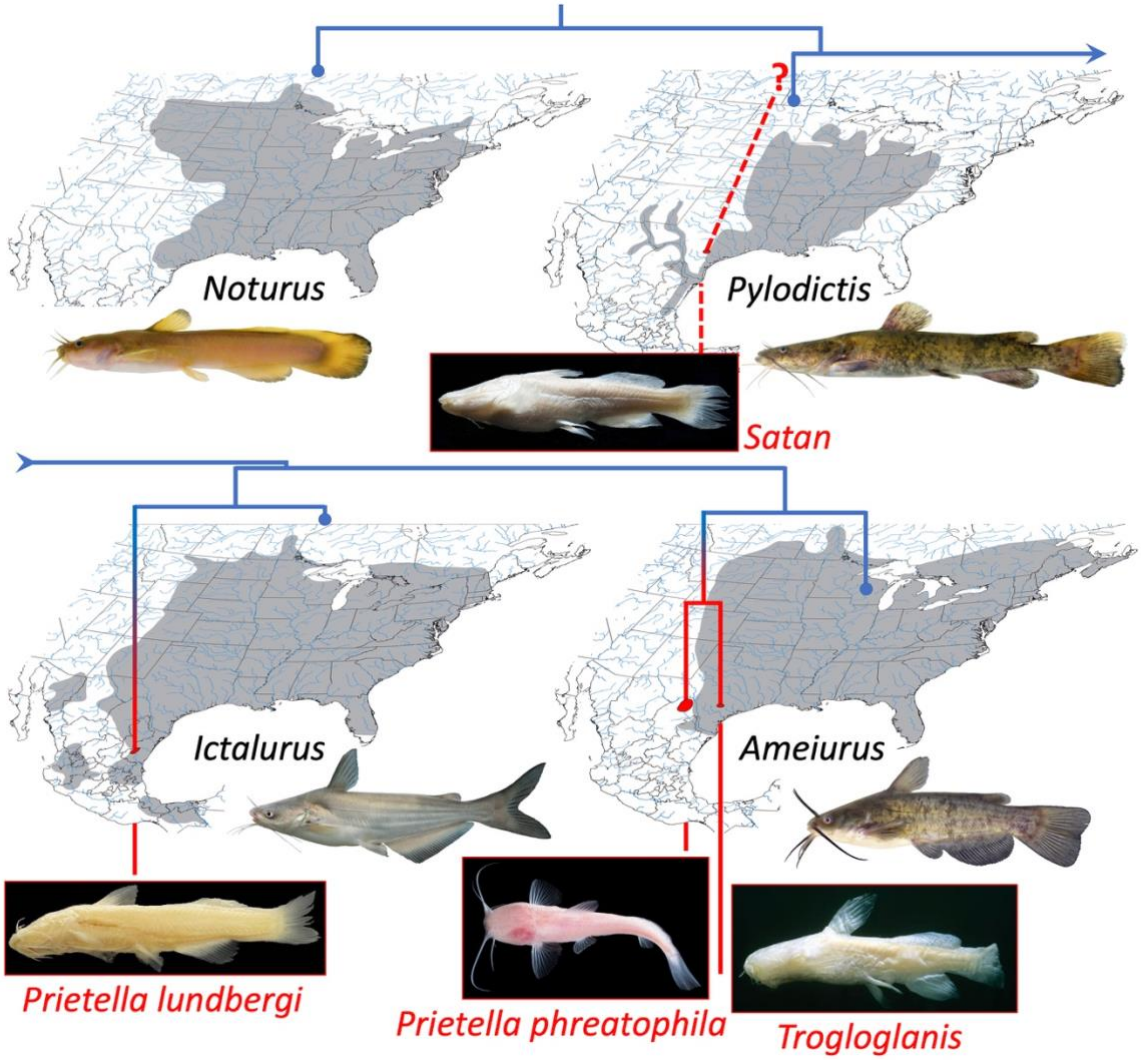
Research.—Mark Sabaj authored one technical report and co-authored two peer-reviewed papers in 2023.

Janzen, F.H., R. Pérez-Rodríguez, O. Domínguez-Domínguez, D.A. Hendrickson, **M.H. Sabaj** and G. Blouin-Demers. 2023. Phylogenetic relationships of the North American catfishes (Ictaluridae, Siluriformes): Investigating the origins and parallel evolution of the troglobitic species. Molecular Phylogenetics and Evolution 182: 107746. https://doi.org/10.1016/j.ympev.2023.107746

Johnson, K.R., I.F.P. Owens and the Global Collection Group [153 co-authors including S. Cooper, R. McCourt and **M. Sabaj**]. 2023. [Policy Forum:] A global approach for natural history museum collections. Science 379(6638): 1192–1194. DOI: 10.1126/science.adf6434

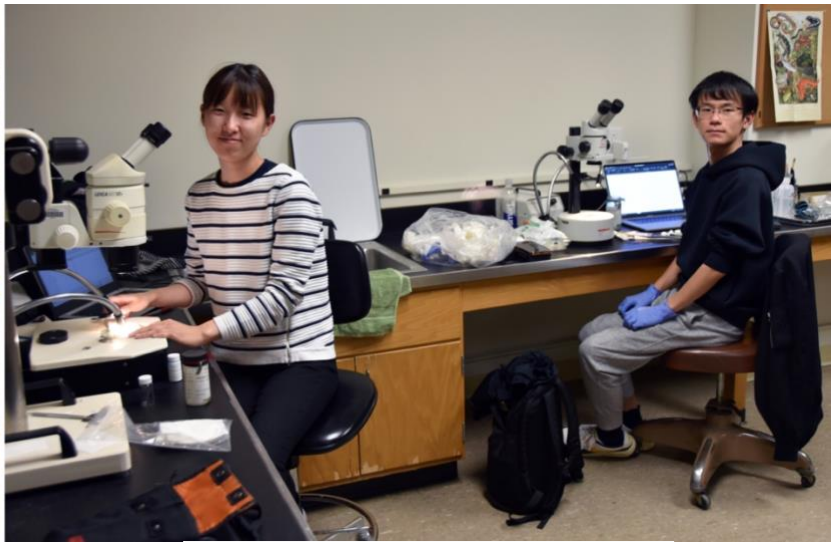
Sabaj, M.H. 2023. Summary of the Meetings [101st annual meeting of the American Society of Ichthyologists and Herpetologists, 27–31 July 2022]. Ichthyology & Herpetology 111(1): [1–9]. https://doi.org/10.1643/t2023013

As noted by lead author Frankie Janzen, doctoral student at the University of Ottawa, the phylogeny of ictalurid catfishes was based on "the largest molecular dataset on the group to date." That record was previously held by Mariangeles Arce H. and co-authors John Lundberg and Maureen O'Leary (Arce H. et al., 2016).



Visitors.—Ichthyology hosted >200 visitors in 2023 including 16 researchers on short-term visits (i.e., counts do not include student interns and visiting scholars). From the US, visiting researchers included Bruno Melo (AMNH), Maddie Byrne (George Washington University), and Kerin Claeson (Philadelphia College of Osteopathic Medicine) and colleague Alfi Ramon. From abroad, research visitors included Jonas Andrade (Univ. Federal da Paraíba, Brazil), Arthur de Lima Oliveira e Silva and Vinicius Carvalho Cardoso (Univ. São Paulo/MZUSP, Brazil), Lin Bai-An (Xiamen University, China), Harutaka Hata (JSPS Overseas Research Fellow, Japan), Franz Uiblein (Institute of Marine Research, Norway), Norhafiz Hanafi (National Sun Yat-sen University, Taiwan), and a contingent from The Kagoshima University Museum, Japan: Hiroyuki Motomura and his students Yuna Dewa, Ryusei Furuhashi, Tatsuya Matsumoto, and Daijiro Yuki.

Norhafiz Hanafi (front) & Lin Bai-An



Yuna Dewa & Daijiro Yuki

Hiroyuki's students overnighted in Mark's home (2 x 2) and were treated to a night of watching Phillies playoff baseball at local pubs. Hiroyuki also brought with him a large (and heavy) gift of various books he has co-authored. **Briana Giasullo**, Cataloging and Digital Resources Librarian, kindly cataloged six of those into the Academy Main Stacks.

Published	Title	Call No.
2017	Commercial and bycatch market fishes of Panay Island, Republic of the Philippines	QL634.P6 M68 2017
2017	Kagoshimawan no gyorui = Field guide to fishes of Kagoshima Bay southern Kyushu, Japan.	QL634.J3 I93 2017
2019	Identification guide to fishes of the Amami Islands in the Ryukyu Archipelago, Japan	QL634.J3 M68 2019
2020	Fishes from markets in Osumi Peninsula, Kagoshima, Japan	QL634.J3 K64 2020
2021	Reef and shore fishes of Bidong Island: off east coast of Malay Peninsula	QL634.M2 M68 2021
2022	Satsuma hanto engan no gyorui = Field guide to fishes of the East China Sea side of Satsuma Peninsula in Kagoshima, southern Kyushu, Japan.	QL634.J3 I93 2022

Proposals.—Over the spring and summer, Mark worked with Patrick Center Biochemist **Timothy Maguire** on a proposal to look at the bioaccumulation of microplastics in the Delaware River, 1900 to present. The work involved combing through the fish database to identify fishes from the Delaware Basin, improve their locality data, tie records to dates (or at least decades), update taxonomic identifications, and assign records to regional groups: upper vs. lower Delaware Basin, channel vs. trib, and PA vs. other states (NY, NJ, DE). The groups were then tied to Delaware River Water Quality Management zones (see Fig. 1 in Kauffman 2018).

The search identified ~180,000 preserved specimens cataloged from throughout the Delaware River basin. More than two-thirds of those specimens were collected from Pennsylvania waters from the 1890s to present. Most specimens are from the 1950s, 1960s, and 1970s with fair representation for the 1890s, 1900s, and 1910s. There were large gaps for the 1920s, 1930s, 1940s, and 2010s. Based on spatiotemporal coverage and ecological characteristics, seven taxa were proposed for the examination of microplastics: *Hybognathus regius*,

Catostomus commersonii, *Anguilla rostrata*, *Fundulus*, *Lepomis*, *Morone* and clupeids (*Brevoortia*, *Dorosoma*, *Alosa*).

The proposal was submitted to the Pennsylvania Sea Grant program in June with Tim as PI and Mark and David Keller as Co-PIs. The proposal requested $167,550 over two years (2024–2026) with $101,185 of matching support. The proposal received two positive reviews, but the third reviewer did not consider microplastics a priority and this was enough to reject the proposal for funding. Tim and Mark have discussed plans to resubmit the proposal in 2025 and/or expand it for a pitch to NSF or another funding agency.

Ichthyology Budget.—The cost of running the department in FY2023 was down a little ($217) from FY2022. This was despite an expensive year for shipping specimens: $3,449 (43% of FY2023 budget). Shipping costs will rise in calendar year 2024 due to substantial rate hikes by UPS and Fedex.

The department saved an impressive 95% on copier costs in FY2023, but these gains were slashed in half by an increase in telecommunications costs.

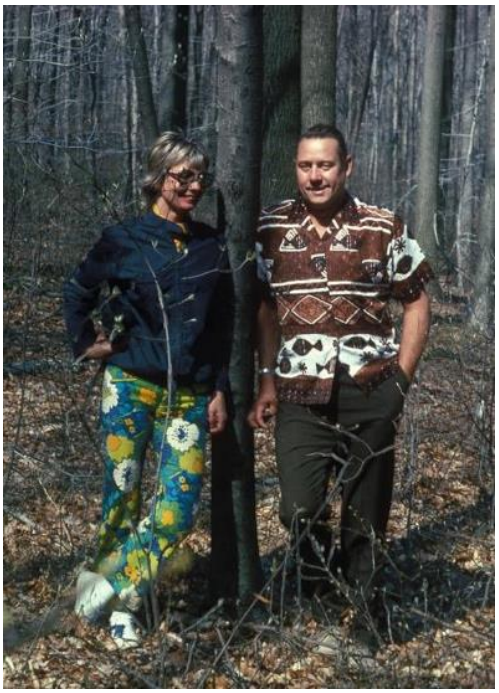
Ichthyology Operations (9556-111001) and Salaries FY2019-2023.

FISCAL YEAR	2019	2020	2021	2022	2023
Books/Articles	20	0	0	0	88
Computer/Software	180	90	180	2,392	1,849
Copier	22	11	1	2.19	0.12
Equipment Related	0	266	130	0	0
HR	0	83	0	34	34
Licenses/Memberships	183	60	213	75	0
Miscellaneous	2,015	-773	1,277	747	0
Shipping/Postage	2,213	1,806	3,054	2,883	3,449
Office/Lab Supplies	2,925	3,858	402	1,347	2,121
Telecommunications	338	339	337	338	339
Travel - Domestic	258	351	226	153	84
Travel - International	1,980	989	0	160	0
Funds Transfer	0	0	0	50	0
TOTALS - ICH Operations	10,134	7,080	5,820	8,181	7,964
TOTALS - ICH Salaries	100,389	102,738	118,085	207,387	160,047
Net Assets Released from Restricted Endowments	-75,182	-71,066	-82,060	-82,631	-85,447
BOTTOM LINE	**$35,341**	**$38,752**	**$41,845**	**$132,937**	**$81,823**

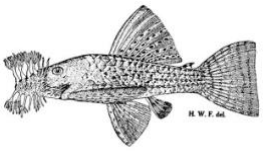
Böhlke Memorial Fund.—A total of $1,720 was awarded in FY2023 primarily for student travel from ANSP to other museums (AMNH, USNM), lodging in Philadelphia, and participation in local fieldwork. Recipients of FY2023 Böhlke Funds included visiting students and postdocs Malu Araujo Almeida (U São Paulo, Ribeirão Preto), Arthur de Lima Oliveira e Silva and Vinicius Carvalho Cardoso (U São Paulo/MZUSP), and Gabriel de Souza da Costa e Silva and Lais Reia (Estadual Paulista Júlio de Mesquita Filho). All of the aforementioned lodged at Mark's home in Mt. Airy, Philadelphia.

In August 2023, $4657 was newly allocated to available Böhlke funding for FY2024 (vs. $4547 in FY2023). The annual draw will gradually decrease from 7% to 5% in FY2027, reducing the annual allocation to an estimated $3,300. As of 4 February 2024, the Böhlke Memorial Fund has a total of $11,311 available for spending without touching the principal.

The Böhlke Memorial Fund was established in 1991 and has since granted ~$75,000 to >100 researchers (mostly students) primarily for travel to Philadelphia to conduct research on ANSP fishes. Anyone interested in applying (or donating) to the Böhlke Memorial Fund is welcome to contact Mark Sabaj at mhs58@drexel.edu.



Genie & Jim Böhlke ca. 1976



—Mark Sabaj, 9 Feb 2024