The Mollusca collection of the American Museum of Natural History, New York: a brief history

Jessica A. Goodheart
Division of Invertebrate Zoology
American Museum of Natural History
New York, NY 10024-5102, USA
jgoodheart@amnh.org
https://orcid.org/0000-0003-0754-5751

Paula M. Mikkelsen
Negaunee Integrative Research Center
Field Museum of Natural History
Chicago, IL 60605, USA
https://orcid.org/0000-0002-6941-2818

ABSTRACT

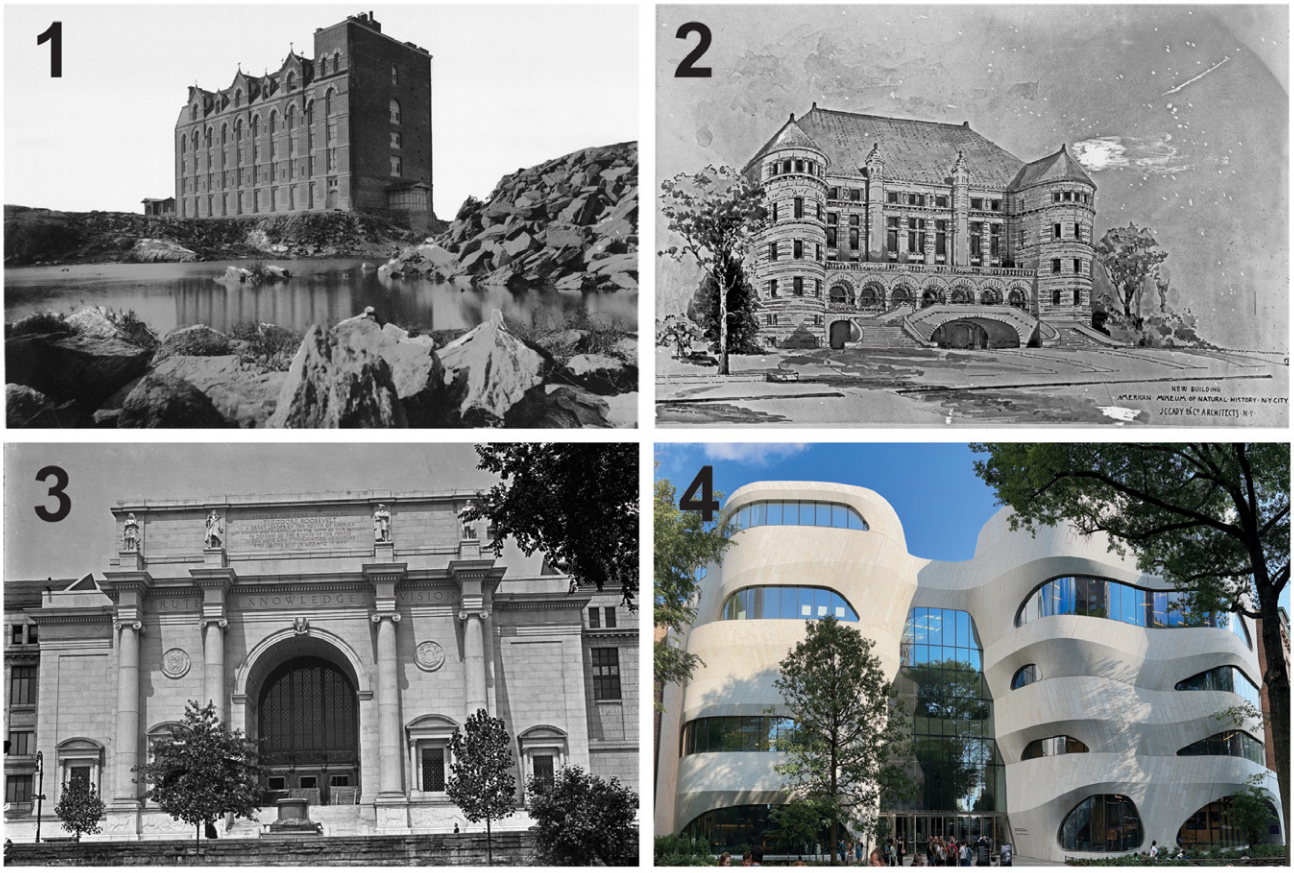
The Mollusca collection of the American Museum of Natural History (AMNH) in New York City is one of the most historically rich and taxonomically diverse malacological collections in the United States. Its formal origins date to 1874, with the acquisition of the John Clarkson Jay collection containing over 50,000 specimens representing more than 14,000 species. This collection was donated by Catherine L. Wolfe in memory of her father, John D. Wolfe, the museum's first president. Subsequent 19th- and early 20th-century acquisitions, including the Bland and Binney, Crooke, Steward, Haines, and Constable collections, significantly expanded the taxonomic and geographic scope of the holdings. Throughout the 20th century, the collection was further enriched through curatorial research and collecting, as well as major AMNH-led expeditions, such as the American Museum Congo Expedition (1909–1915), the Whitney South Sea Expedition (1929–1930), and the 1957 Puritan-AMNH Expedition to western Mexico. These efforts brought in thousands of specimens from underrepresented regions, notably the Indo-Pacific, the Gulf of California, the Caribbean, and sub-Saharan Africa. Today, the AMNH Mollusca collection comprises approximately 450,000 cataloged lots and an estimated 1.8 million specimens, with notable strengths in marine mollusks from the western Atlantic and Indo-Pacific regions. In addition to extensive dry shell holdings, the collection includes fluid-preserved specimens, histological slides, and thousands of primary and secondary type specimens. This paper provides an overview of the collection's development, curatorial history, expeditionary contributions, digitization efforts, and ongoing relevance to research and education. It draws from institutional records, published catalogs, and biographical materials to review the legacy and outline the future directions of one of North America's premier malacological resources.

Additional Keywords: Collections, conchology, digitization, historical curation, malacology, shell collections

INTRODUCTION

Founded in 1869 in New York, New York, USA (Osborn, 1911), the American Museum of Natural History (AMNH) is a private, non-profit organization that dedicates over a quarter of a million square feet to its collection of more than 30 million zoological, geological, and anthropological specimens and objects. Our historical collections were made by explorers, researchers and curators of the museum, in addition to specimens obtained through donations by private citizens. The Museum currently consists of 21 buildings, linked together in a complex covering approximately three city blocks. It was constructed piecemeal, with most buildings constructed at different times throughout its history. The first building was completed in 1877 (Figure 1), followed by the 77th St. facade in 1899 (Building 2; Figure 2). The main entrance of the Museum today is at Central Park West and 79th St. (Figure 3), completed in 1936, and the most recent building, the Richard Gilder Center for Science, Education, and Innovation, opened in 2023 (Figure 4).

The Museum's Mollusca holdings, formally launched with the acquisition of John Clarkson Jay's shell collection in 1874, have grown into one of the largest malacological collections in the United States. Today, the AMNH Mollusca collection supports wide-ranging research on biodiversity, ecology, and systematics. With an estimated 450,000 lots and 1.8 million specimens, the AMNH Mollusca collection is "large and general," with specimens from a vast number of localities and habitats from around the world. However, the collection is strongest in marine gastropods and bivalves, especially from the Indo-Pacific and western Atlantic (Sturm et al., 2007). Based on recent estimates, it comprises approximately 70–80% marine species, 5–10% freshwater, and 15–25% terrestrial mollusks. In this paper, we aim to describe a brief history of the AMNH Mollusca collection, including scope of the collection, historical development, major acquisitions, research and exhibitions contributions, and efforts toward digitization and access. We incorporate information from published catalogs of type specimens, expedition and departmental reports, and biographical studies. We also outline a vision for the future of the AMNH Mollusca collection.



Figures 1–4. The American Museum of Natural History buildings constructed across its history, including: **1.** Image of Building 1 at Manhattan Square, taken 1878. Photographer Unknown, AMNH Research Library Asset ID 471; **2.** Drawing of the 77th street facade (Building 2), approximately 1890, J.C. Cady and Co. Architects, AMNH Research Library Asset ID 464; **3.** Main entrance at Central Park West and 79th Street (Building 12), taken 1934, AMNH Photo Studio, AMNH Research Library Asset ID 118138; **4.** The Richard Gilder Center for Science, Education, and Innovation (Building 21), completed in 2023, Wikipedia user Zeete under license CC BY-SA 4.0.

BUILDING THE AMNH MOLLUSCA COLLECTION

The Start of the Collection

Shell collections were among the first gifts to the AMNH at the Arsenal in Central Park, which was the original location of the Museum prior to the completion of Building 1. The formal inception of the AMNH Mollusca collection occurred in 1874 when Catherine L. Wolfe purchased and donated John C. Jay's shell collection (approximately 50,000 specimens representing more than 14,000 species) in memory of her father, John D. Wolfe, the first president of the Museum (Landman and Winston, 1999; Boyko and Cordeiro, 2001; Kabat and Coan, 2019). This collection was originally named the Wolfe Memorial Collection. Jay, a key figure in 19th-century American malacology, had assembled the largest shell collection in the U.S. at the time and published multiple editions of his *Catalogue of Shells* (Jay, 1835, 1836). His collection, and publication of his *Catalogue of Shells*, formed a reference base for 19th-century taxonomy, including species described by Jay himself or other taxonomists like C. B. Adams (Kabat and Coan, 2019).

Several other significant private collections were acquired in the years following, including the Bland and Binney Collection (1882), the Crooke Collection (1890–1891), the Steward Collection (1890–1893), the William A. Haines Collection (final specimens purchased in 1895), the Witthaus Collection (1902), the Constable Collection (1929), and the Wisoff Collection (1964) (Osborn, 1911; Childs and Haas, 1944; Richards and Old, 1969). The Bland and Binney Collection of land snails, obtained in 1882 (Gratacap, 1901), comprised a significant reference series of North American terrestrial mollusks, particularly pulmonates (Binney and Bland, 1869; Binney, 1885). Other donations included the Crooke Collection, which

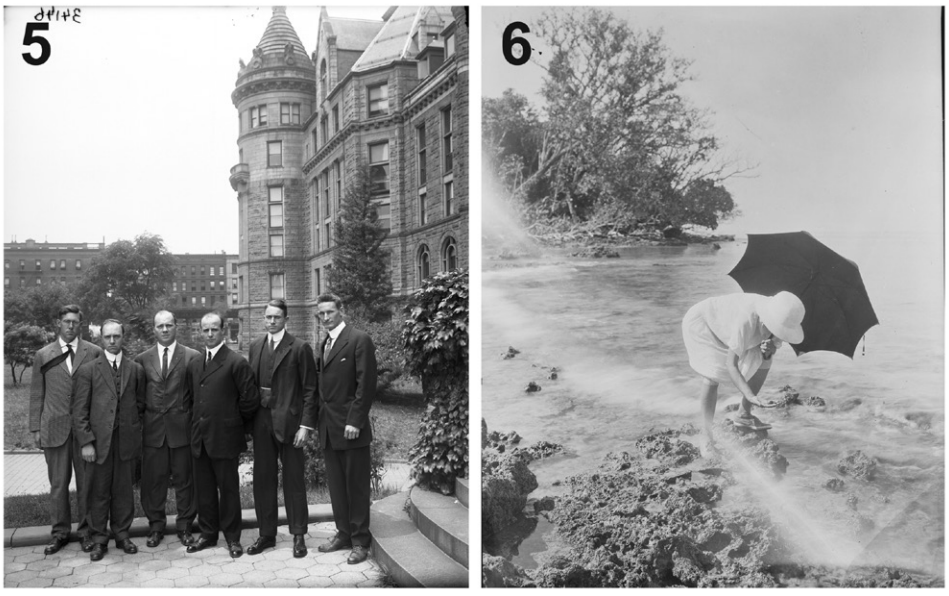
included ~3,000 specimens encompassing ~2,300 species, and the Steward Collection, which contained a large number of very rare and very well-cared for marine shells (Osborn, 1911). William A. Haines (1822–1880), one of the founders and the first Vice President of AMNH, donated part of his collection during his life, with the last specimens purchased from his son in 1895. This collection included marine, freshwater, and land snails, with a focus primarily on land snails (Richards and Old, 1969).

During the late 19th and early 20th centuries, mollusks at AMNH were initially curated within the Department of Geology, Mineralogy, and Conchology. J. B. Holder (Curator from 1881–1888) and Robert P. Whitfield (Curator from 1887–1901) were among the earliest curators overseeing shell materials, despite their research focusing on vertebrates and invertebrate fossils, respectively (Richards and Old, 1969; Landman and Winston, 1999). Louis P. Gratacap (Curator from 1901–1917) followed and was instrumental in the reorganization and documentation of collections, including the Binney and Bland and Jay collections (Annual Report of the Trustees 1890). By the early 20th century, conchology shifted administratively into a growing Department of Invertebrate Zoology (Anonymous, 1953). As the 20th century progressed, collection oversight remained with rotating staff and invertebrate curators more broadly, rather than with a dedicated malacologist. Although mollusks were recognized as a key research group within AMNH, it was not until the mid-20th century that a specialized curatorial position in Malacology was formally established with the appointment of William K. Emerson in 1955.

Mollusks at the AMNH: Collections Growth

The AMNH expeditions and curatorial research profoundly shaped the breadth of the Mollusca collection. Beginning with the American Museum Congo Expedition (1909–1915) led by Herbert Lang, James Chapin, and Joseph Bequaert, thousands of terrestrial and freshwater mollusks were collected across the Belgian Congo and later described by Pilsbry and Bequaert (Pilsbry, 1919; Pilsbry and Bequaert, 1927). With the inclusion of some freshwater aquatic taxa, these specimens established the core of the Museum's African land mollusk holdings (Richards and Old, 1969). These collections were largely obtained from two regions: (1) the lower Congo, from Kinshasa (formerly Léopoldville) and Mbanza-Ngungu (formerly Thysville) to Banana, and (2) in the Aruwimi-Ituri Valley (Pilsbry, 1919). The extensive collection contained more than 15,000 specimens representing 68 species, subspecies, and "mutations" (Pilsbry and Bequaert, 1927).

Additional, smaller, contributions to the Mollusca collection were obtained through further expeditions in the early to mid-1900s. The Crocker Land Expedition (June 1913–August 1917) was a trip to the Arctic Circle sponsored by the AMNH, the University of Illinois, and the American Geographical Society (Figure 5). The primary aim was to find Crocker Land Island, but the expedition



Figures 5–6. Images of people involved in AMNH expeditions that resulted in additions to the Mollusca collection. **5.** Staff of the Crocker Land Expedition, standing outside American Museum of Natural History, 1913–1917. Photographer Unknown, AMNH Research Library Asset ID 34146. **6.** Ida May Beck holding a parasol and picking up shells on the reef in the Solomon Islands on the Whitney South Sea Expedition, 1920–1941. Photos: Beck, Rollo Howard (1870–1950), AMNH Research Library Asset ID 115473.

also collected various samples, including several hundred mollusk specimens that were added to the collection (Baker, 1919). The Whitney South Sea Expedition (1929–1930), under Ernst Mayr and Walter Eyerdam, collected extensive shell material from numerous Pacific islands (Figure 6), substantially enriching the Indo-Pacific gastropod collection (Clench, 1941; Richards and Old, 1969). In early 1941, Robert Cushman Murphy's Askoy Expedition surveyed marine habitats from Panama through Colombia to Ecuador, collecting mollusks at sixteen separate stations out of the 113 visited (Richards and Old, 1969).

The 1957 Puritan-AMNH Expedition to western Mexico, covering Baja California, the Gulf of California, and the Tres Marías Islands, was also a significant source of material for the collection. During the expedition, researchers gathered intertidal and dredged mollusks at 183 stations, which included a suite of East Pacific shells that now underpin the Museum's representation of that region (Emerson, 1958; Richards and Old, 1969). The aims of this expedition were to "study the effects of insular isolation on populations of mammals, reptiles, and amphibians and to compare the present and past distributions of the littoral marine invertebrate faunas, particularly the mollusks, stony corals, and bryozoans" (Emerson, 1958). This cruise made use of the PURITAN, a schooner owned by Harry J. Bauer, who invited the AMNH on the expedition. Both marine and terrestrial mollusks were collected. Morris K. Jacobsen, William K. Emerson, and William E. Old, Jr. published multiple papers outlining species collected on this expedition, including the terrestrial mollusks (Jacobson, 1958), and the marine gastropod groups Conidae (Emerson and Old, 1962), Cypraeoidea (Emerson and Old, 1963), Stromboidea and Tonnoidea (Emerson et al., 1963), and Harpidae, Vasidae, and Volutidae (Emerson, 1964).

In addition to formal expeditions and major donations, significant growth of the AMNH Mollusca collection was driven by the work of dedicated staff and curators (Table 1). William K. Emerson, appointed curator in 1955, oversaw a dramatic expansion of the collection (from 74,000 to 275,000 cataloged lots) through targeted fieldwork, institutional exchanges, and systematic reorganization (Mikkelsen and Landman, 2017). He played a pivotal role in elevating the scientific stature of the collection, curating extensive material from the Atlantic coast, Caribbean, and Indo-Pacific. Paula Mikkelsen, Curator of Malacology (1997–2006) continued this legacy by integrating modern digitization practices and broadening research accessibility. Long-serving "Scientific Assistants" (serving as collection managers) William Old Jr. (1960–1982) and Walter E. Sage III (1983–1995) were instrumental in processing new acquisitions, maintaining catalog integrity, and facilitating specimen-based research. Importantly, many members of the New York Shell Club, which was based out of AMNH from 1949 to 2011, also provided well-documented specimens from their collections and local expeditions. They often assisted with curation of the collection and played a crucial role in creating a valuable reference source for the study of taxonomic and zoogeographic malacology (Emerson, 1971).

HIGHLIGHTS FROM THE AMNH MOLLUSCA COLLECTION

The AMNH Mollusca collection features many notable specimens that have interesting and sometimes unusual histories, including those that have been in the public eye, those that have significantly contributed to scientific research in Malacology, or those that have been used for exhibitions and education at the Museum. For example, one valuable specimen, both financially and scientifically, of the species *Sphaerocypraea* (formerly *Chimaeria*) *incomparabilis* (Briano, 1993) was stolen from the AMNH in 1996 by a shell dealer while he was appraising a donated collection, which he then sold for $12,000 (Nolin, 1997; Associated Press, 1997). The group of snails to which *S. incomparabilis* belongs was thought to have become extinct 40 million years ago, and specimens are difficult to find due to their distribution in 100 meters of water or deeper. Thanks to the efforts and cooperation of several conchologists, the specimen was ultimately returned to the Museum. Another highlight of the collection is *Argonauta argo* Linnaeus, 1758, represented by a specimen complete with a reconstruction of the cephalopod that produced the shell-like egg case. This specimen offers a unique perspective on the life of this pelagic cephalopod and its delicate egg case, often mistaken for a true nautilus shell. The museum also houses a 7.6-meter-long Giant Squid *Architeuthis dux* Steenstrup, 1856 specimen (Figure 7), acquired in 1998 after being caught off the coast of New Zealand. Preserved in a large steel tank, this specimen was one of the few giant squids on display in North America, although it has not been on display for quite some time.

Research Activities

In the late 19th and early 20th centuries, foundational taxonomic and biodiversity research drew heavily on AMNH's Mollusca holdings. The Binney and Bland land snail collections, built on W. G. Binney's efforts to amass specimens "from every locality of every species," became a cornerstone for authoritative manuals and subsequent taxonomic monographs (Gratacap, 1901). Additional work on terrestrial snails saw Henry E. Crampton's studies of Pacific-island *Partula* Férussac, 1821 diversity, which used museum lots to describe new species and illuminate patterns of endemism and morphological variation (Crampton, 1932; Crampton and Cooke, 1953; Crampton, 1956; Landman and Winston, 1999). Building on this legacy, Eugene V. Coan revised eastern Pacific *Petricola* Lamarck, 1801 species, and relied on AMNH material to redefine species boundaries and distributions (Coan, 1997). Major collecting expeditions further expanded the museum's research impact. H. A. Pilsbry and J. Bequaert's descriptions of dozens of new species from the Belgian Congo series (1909–1915) mapped previously undocumented Congo

Table 1. List of the primary curators and staff responsible for the Mollusca collection over its history.

Contributor	Focus/Contribution	Reference
Robert P. Whitfield (Curator, 1887–1901)	Responsible for the original invertebrate collections, despite his interests being primarily vertebrates.	(Richards and Old, 1969)
Louis P. Gratacap (Curator, 1876–1917)	Mineralogy and conchology, but was mostly a paleontologist and geologist.	(Richards and Old, 1969; Landman and Winston, 1999)
Henry E. Crampton (Curator, 1909–1921)	Concurrently a professor at Barnard College, studied land snails from the Pacific region, particularly species of the genus *Partula*.	(Landman and Winston, 1999)
Roy W. Miner (Curator, 1921–1943)	Invertebrate zoology curator, but primarily interested in exhibitions.	(Landman and Winston, 1999)
Harold E. Vokes (Curator, 1937–1943)	Specialized in Eocene and Pliocene mollusks, but worked on some Recent mollusks on the eastern and western coasts of the United States.	(Landman and Winston, 1999)
William K. Emerson (Curator, 1955–1995)	Expanded collection with fieldwork and exchanges; led major reorganization and taxonomic updates. Focused on molluscan taxonomy and biogeography (mainly on neogastropods and scaphopods), especially of the Indo-Pacific.	(Mikkelsen and Landman, 2017)
William E. Old Jr. (Scientific Assistant, 1960–1982)	Managed and documented thousands of lots; collaborated on field-based research and cataloging. Focused on marine gastropods, especially Conidae.	(Raeihle and Emerson, 1983)
Walter E. Sage III (Scientific Assistant, 1983–1995)	Streamlined processing and maintenance during major collection growth. Focused on popular conchology and the interface of amateur and professional malacology.	(Boyko, 1996; Scheu, 1996)
Paula M. Mikkelsen (Curator, 1997–2006)	Modernized curation, digitization, and research integration. Focused on marine molluscan biodiversity in the southeastern U.S. and the Caribbean; systematics, life histories, anatomy, and phylogeny of marine bivalve mollusks (Bivalvia) and shelled opisthobranch snails.	This paper
Mark Siddall (Mollusca Curator, 2006–2020)	Curator responsible for the mollusk collection, but with research interests focused on blood parasites and leeches.	This paper
Estefanía Rodríguez (Mollusca Curator, 2020–2022)	Curator responsible for the mollusk collection, but with research interests primarily centered on anemone systematics.	This paper
Jessica A. Goodheart (Curator, 2022–present)	Currently working toward digitization efficiency and accessibility of collections data; developed collections plan for Malacology; building new connections with collections management programs. Focus on the evolution of complex phenotypes, particularly stolen defenses, in marine heterobranch gastropods.	This paper

malacofauna (Pilsbry, 1919; Pilsbry and Bequaert, 1927). Mid-20th-century Gulf of California and Galápagos surveys under William K. Emerson yielded new *Cymatium* Röding, 1798 species from the Gulf of California (Emerson et al., 1963) and new *Murexsul* Iredale, 1915 and *Strombina* Mörch, 1852 species (Emerson and D'Attilio, 1968a, b), underscoring the collection's ongoing role in the description of global molluscan diversity. Functional morphology investigations also benefited, including one on *Trisidos* Röding, 1798 and other arcoid bivalves that identified three morphological strategies for burrowing that highlighted a trade-off between burrowing efficiency and minimal resistance to ventilating currents (Tevesz and Carter, 1979).

The AMNH Mollusca holdings have also long underpinned our knowledge of the local and regional western Atlantic and U.S. East Coast faunas. Twentieth-century works such as Miner's *Field Book of Seashore Life* (Miner, 1950), Jacobson and Emerson's *Shells of the New York City Area* (Jacobson and Emerson, 1961) and *The American Museum of Natural History Guide to Shells: Land, Fresh-water, and Marine from Nova Scotia to Florida* (Emerson and Jacobson, 1976) drew extensively on regional lots at the Museum and benefitted many researchers and hobbyists alike. For example, *Shells of the New York City Area* was reviewed enthusiastically in the *New York Shell Club Notes* (Stark, 1976), where it was praised as a comprehensive handbook for the metro-area's

Figure 7. *Architeuthis dux* specimen under preparation for fixation in the American Museum of Natural History in 1998. Photo: Paula Mikkelsen.

land, freshwater, and marine mollusks. The *AMNH Guide to Shells* also quickly became the standard field reference along the U.S. Atlantic coast with its diagnostic keys and distributional data informing ecological and pollution-impact studies such as one investigating intertidal community responses to organic pollution in Raritan Bay, New York (Stainken, 1984) and serving as the taxonomic backbone for baseline port surveys of introduced mollusks in U.S. harbors (Power et al., 2006).

In addition to large field guides, AMNH Mollusca specimens have proven useful for other research activities. For example, Curator Harold E. Vokes, although he primarily worked on fossils, also contributed to the knowledge of the northeastern U.S. fauna with his work on migration in the slipper snail *Crepidula convexa* Say, 1822 (Vokes, 1935). Additionally, paratypic material from John Brooks Henderson's Eolis cruises (1910–1916) furnished the type series for multiple scaphopod species in *Dentalium* Linnaeus, 1758 and *Cadulus* Philippi, 1844 collected off Florida and the Bahamas (Richards and Old, 1969; Boyko and Sage, 1996). In recent decades, Paula Mikkelsen, Curator of Malacology (1997–2006), often in collaboration with Rüdiger Bieler (Field Museum), worked on multiple revisions of western Atlantic heterobranch systematics (including the genera *Cylindrobulla* Fischer, 1857 and *Ascobulla* Marcus, 1972) (Mikkelsen, 1998), a redescription the pearl oyster *Pinctada longisquamosa* (Dunker, 1852) (Mikkelsen et al., 2004), and a revision of the file clam genera *Lima* Bruguière, 1797 and *Ctenoides* Mörch, 1853 (Mikkelsen and Bieler, 2003). Much of her work culminated in the comprehensive *Seashells of Southern Florida: Bivalves* (Mikkelsen and Bieler, 2007). Museum specimens also enabled the first recognition of the Indo-Pacific oyster *Hyotissa hyotis* (Linnaeus, 1758) in the Florida Keys, extending its known biogeographic range (Bieler et al., 2004).

Public Exhibitions

The AMNH has long leveraged its extensive Mollusca collections to create engaging exhibits that illuminate the biological, ecological, and cultural significance of mollusks. These exhibits have played a pivotal role in enhancing public understanding of mollusks and their role in human history.

One of the earliest dedicated spaces at the AMNH was the Shell Hall (otherwise known as the Hall of Shells or Hall of Conchology; Figure 8), which was established in approximately 1901 (Anonymous, 1902). This exhibition showcased mollusks, some of which were arranged according to Lamarckian classification (Anonymous, 1904) and contained approximately 100,000 specimens representing nearly 15,000 species (Lucas, 1918). It featured significant donations, including the Jay-Wolfe, Crooke, and Constable collections (Anonymous, 1904; Lucas, 1935). Exhibits included land shells, bivalves, gastropods, special displays illustrating molluscan anatomy and their distributions, and featured a massive 262 kg shell of the Giant Clam, *Tridacna gigas* (Linnaeus, 1758), at the entrance to the exhibition (Lucas, 1918). The Shell Hall remained a prominent feature until its closure around 1924–1925, when many of the shell collections on exhibit were transferred to the Irma and Paul Milstein Family Hall of Ocean Life (Anonymous, 1925). The giant clam shell currently resides in the Theodore Roosevelt Hall of Biodiversity. Although the species is known to reach larger sizes (Knop, 1996), this *Tridacna gigas* specimen is considered to be the largest giant clam in a museum collection.

In the 1970s, AMNH continued to emphasize mollusks through specialized exhibits. The Mollusks of New York State exhibit (Figures 9–10) opened in Fall 1972 and was curated by William K. Emerson, William E. Old, and Harold S. Feinberg (Anonymous, 1972; Mikkelsen and Landman 2017). Located in a well-traveled hallway on Floor 1, Section WC, this permanent exhibition showcases common mollusks of the region, providing insights into local biodiversity. Building on this history, the Hall of Mollusks and Mankind (later "Mollusks and Our World"; Figure 11–12) opened

Figure 8. Shell and Coral Hall, looking west, 1904–1925, AMNH Photo Studio, AMNH Research Library Asset ID 494.

in December 1975 (Anonymous, 1975; Landman and Winston, 1999). This exhibition, which was intended to be permanent, explored the role of mollusks in human culture and economy (Anonymous, 1972). Curated by Emerson, Old, Feinberg, and Roger L. Batten, the hall featured cases on "The World of Mollusks," "Life and Light," "Shell Growth," and "Shells in Architecture," among others. Notably, the hall included a sculpture by Henry Moore, inspired by molluscan forms, emphasizing the intersection of natural history and art. This hall closed for renovations in ca. 1996, but was not permanently closed to the public until March, 2001.

In recent years, the AMNH has continued to showcase mollusks and collections in its exhibitions. One notable exhibition was "Pearls: A Natural History", a temporary exhibit that ran from October 13, 2001, to April 14, 2002 and was curated by Paula Mikkelsen and paleontologist Neil Landman in collaboration with colleagues from the Field Museum in Chicago, including Rüdiger Bieler and anthropologist Bennet Bronson (Anonymous, 2003). This exhibition delved into the science and allure of pearls, showcasing over 800 specimens and artifacts and nearly 500,000 individual pearls, including fossil pearls, pearls formed around pea crabs, and pearl-encrusted objects such as a chalice from the Basilica of San Marco. The exhibition also highlighted the biological processes of pearl formation and their cultural significance across civilizations (Landman, 2001). After 2002, the "Pearls" exhibit traveled to more than a dozen exhibition spaces in other museums.

Mollusks are also common in other permanent halls at the AMNH. The Hall of Ocean Life features a dramatic diorama depicting a life-sized encounter between a Sperm Whale and a Giant Squid, highlighting the ecological interactions of deep-sea mollusks. The Hall of Biodiversity also includes displays of mollusk shells and models mounted on the walls as well as a Giant Squid model mounted on the ceiling. The museum's commitment to educating the public on the value of mollusks is further exemplified in the Richard Gilder Center for Science, Education, and Innovation (opened in 2023) with the Collections Core, where shells from various venomous snails from the collection are featured in a panel curated by Research Associate Dr. Mandë Holford, Professor of Organismic and Evolutionary Biology and Curator of Malacology in the Museum of Comparative Zoology at Harvard University and former Professor at Hunter College, City University of New York.

THE AMNH MOLLUSCA COLLECTION TODAY

Administratively, the AMNH Mollusca Collection resides within the Division of Invertebrate Zoology and is partially supported by the Procter Malacology Fund. The Collection holds nearly 450,000 cataloged lots, including dry shells, fluid-preserved specimens, and microscope slides, representing an estimated 1.8 million individual specimens. The collection is focused primarily on marine gastropods, bivalves, scaphopods, and chitons from the Indo-Pacific and western Atlantic. Today's backlog of

Figures 9–10. Images of the Mollusks of New York State Exhibit, taken 2017, Photos: Shanley, Matthew, AMNH Research Library Asset IDs: **9.** MS_170808_7532; **10.** MS_170808_7537.

uncataloged and undigitized material is steadily being addressed through ongoing digitization efforts and student projects.

Physically, the mollusk specimens in the collection are stored in 530 locked metal cabinets (Figures 13–14; 490 dry, 39 wet, and 1 for slides) across four museum buildings (3, 5, 9, and 20). Sections 3, 5, and 9 house the dry collection in temperature-controlled hallways where each cabinet is lined with archival trays, paper labels, and wooden drawers (Figure 13). Section 20 contains the climate-controlled space for the fluid-preserved lots and type specimens, which are stored in sealed metal cabinets with metal drawers and continuous environmental monitoring (Figure 14). A histology laboratory (Section 9) and imaging equipment such as Keyence digital microscope and GIGAmacro imaging system support research and curation in Mollusca and the rest of Invertebrate Zoology. Together, these resources make the AMNH Mollusca Collection a leading repository for taxonomic research, conservation assessments, and public exhibitions.

Scope of the Collection

The AMNH Mollusca collection spans all major classes of mollusks and is especially strong in marine gastropods and bivalves, including families such as Cypraeidae, Muricidae, Volutidae, and Conidae among gastropods, and Veneridae, Pectinidae, Unionidae, Cardiidae and Tellinidae among bivalves (see Figures 15–19 for example drawers). These reflect not only broad-scale geographic sampling but also the collecting interests of key curators and donors. Terrestrial pulmonates, particularly Planorbidae, are well represented, stemming from

Figures 11–12. Images of the Mollusks and Mankind Exhibit: **11.** Entrance to the exhibit, AMNH Research Library Asset ID 336490; **12.** one of the exhibit cases, AMNH Research Library Asset ID 336494. Photos: Coxe, James and Menchick, I. Taken 1975.

Figures 13–14. Examples of the cabinets used in the current Mollusca collection for both the **13.** dry and **14.** fluid-preserved collections. Photos: Jessica Goodheart.

foundational collections such as Binney and Bland and work by 19th-century American malacologists. The fluid-preserved collection at AMNH comprises more than 6,200 cataloged lots, with the majority representing Gastropoda (more than 4,500 lots) and Bivalvia (approximately 1,040 lots) alongside smaller holdings of Scaphopoda, Cephalopoda, Polyplacophora, and a few Monoplacophora and Aplacophora. As of 2005, the collection represented 64 of the 105 recognized bivalve families in the *Southern Synthesis* (Beesley et al. 1998) and 188 of the 377 gastropod families listed by Vaught (Vaught, 1989), reflecting 61% and 50% family-level coverage, respectively. Cataloging efforts that year revealed that 65% of the gastropod families and 27% of the bivalve families in the collection had only recently been added to the museum's records, underscoring the collection's rapid growth and improved resolution in the late 20th and early 21st centuries. These statistics highlight the diversity and depth of AMNH's Mollusca holdings and make clear the importance of the ongoing efforts to document and curate them comprehensively.

The AMNH Mollusca type collection includes more than 2,000 lots representing hundreds of taxa, including primary types from prominent malacologists such as Clench, Petuch, Jay, Lea, Binney, F. C. Baker, and G. B. Sowerby I. Notable strengths include types from the Belgian Congo Expedition (1909–1915), described by Pilsbry and Bequaert, and extensive type material from donated or purchased collections. The two most important pre-1900 type collections are those of John C. Jay and William A. Haines. Both collections included type material received from Isaac Lea and others. Other type specimens in the AMNH Mollusca collection include new species described by Luitfried von Salvini-Plawen, Victor Scarabino, and Ernst and Eveline Marcus, as well as from the Gordon Nowell-Usticke Collection (Faber, 1988; Boyko and Sage, 1996). During Emerson's tenure, a catalog of Recent molluscan type specimens in the Museum was compiled by Margaret C. Richards and William E. Old (Richards and Old, 1969). Post-Emerson, two catalogs of Recent type specimens were published by Christopher B. Boyko, Walter E. Sage III, and James R. Cordeiro (Boyko and Sage, 1996; Boyko and Cordeiro, 2001).

Collections Care and Digitization

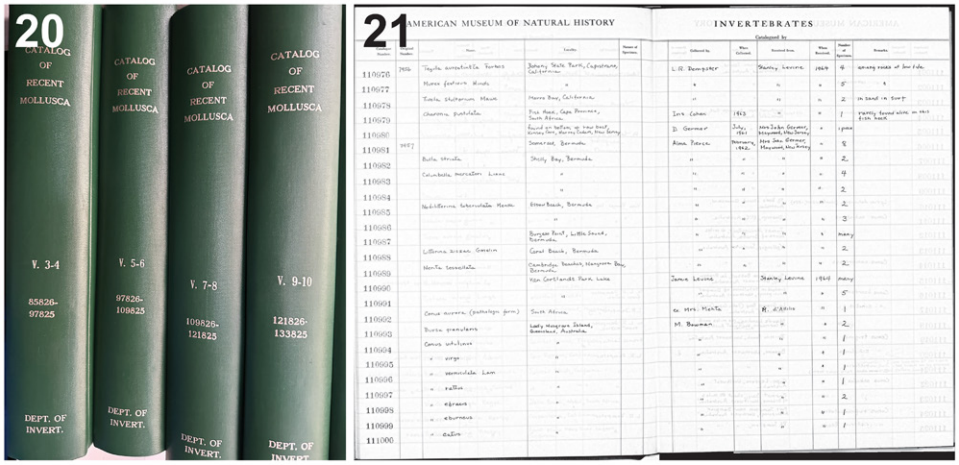
Curatorial leadership in the second half of the 20th and early 21st centuries was instrumental in modernizing and eventually digitizing the Mollusca collection at AMNH. William E. Old Jr., Scientific Assistant (who served as Collection Manager) from 1960 to 1982, played a key role in cataloging new accessions and standardizing storage and documentation procedures for both dry and fluid-preserved collections. Walter E. Sage III continued this work from 1983 to 1995, helping to manage an increasingly large and complex specimen base, and facilitating research use through careful maintenance and reorganization of holdings. These collections improvements were all started under the direction of Curator William K. Emerson, who began computerizing the collection in the early 1990s. Emerson also established multiple departmental funds in support of Malacology, including the Beatrice S. Procter Malacology Fund, the Halpern Malacology Fund, and the memorial William E. Old/Veronica P. Johnson/Walter E. Sage III Malacology Fund (Mikkelsen and Landman, 2017). Only the Procter Fund exists today.

Paula Mikkelsen, Curator of Malacology (1997–2006), focused on updating nomenclature, integrating digitization workflows, and increasing accessibility of the collection for systematic research and biodiversity initiatives through her digitization efforts. During Mikkelsen's time at the Museum, the Mollusca collections staff, including Jay Cordeiro, Marla Coppolino, Julia Sigwart, and various volunteers, computerized (i.e., databased) 91,100 lots, including ~7,200 fluid-preserved lots and 2,708 types.

Figures 15–19. Images of various drawers of Eastern Seaboard (ESB) mollusks in the AMNH collection, including members of the class Bivalvia, such as: **15.** Cardiidae: *Dallocardia muricata* (Linnaeus, 1758); **16.** Mytilidae: *Geukensia demissa* (Dillwyn, 1817); and members of the class Gastropoda, such as: **17.** Muricidae: *Chicoreus florifer* (Reeve, 1846); **18.** Calyptraeidae: *Crepidula fornicata* (Linnaeus, 1758); **19.** Conidae: *Conus spurius* Gmelin, 1791. Photos: Jessica Goodheart.

The Mollusca collection also grew nearly 15% during Mikkelsen's time at the Museum. At that point, the AMNH Mollusca type collection was housed in new Montel cabinetry in a recently built, state-of-the-art structure called the Starr Natural Science Building. The entire collection also underwent re-curation, and in 2005 all the primary types were photographed using a Microptics system of digital photography. Imaging of secondary types also began during this time, as were the original catalog cards from the Belgian Congo Expedition types. Also in 2005, volunteer Mary Conway performed a full survey of the wet collections, in which she identified 6,263 cataloged lots (4,580 Gastropoda, 1,041 Bivalvia, 315 Polyplacophora, 234 Cephalopoda, 103 Scaphopoda, 2 Monoplacophora, and 1 Aplacophora). Together, these efforts contributed substantially to the development, stabilization, and modernization of the collection's infrastructure. The Mollusca collection card catalog (catalog numbers, Mollusca 1–74000) and handwritten ledgers (catalog numbers, Mollusca 75000–213825) were also scanned by the AMNH library in 2007 (Figures 20–21).

In 2018, the Division of Invertebrate Zoology migrated 600,000 specimen catalog records, 56,605 taxonomy records, 45,835 locality records, 19,450 person records,



Figures 20–21. Bound, handwritten ledgers detail many of the AMNH Mollusca holdings: **20.** Shows the outside of a subset of ledgers (Volumes 3–10); **21.** Example image of one of the scanned ledger pages. Photo: Jessica Goodheart.

and 21,151 specimen or habitat images from 46 individual databases on various platforms (including Microsoft Access and FileMaker Pro) and spreadsheets, as well all loan, accession and visitor records, into a single unified database (Axiell/EMu). These records included both mollusks and non-mollusks in the IZ collections, including arthropods, cnidarians, annelids, and echinoderms, among others. These data are now publicly available via internet access through the AMNH website (https://emu-prod.amnh.org/imulive/iz/iz.html), but only the crustacean records have been shared with iDigBio via the GBIF Integrated Publishing Toolkit (IPT) (https://portal.idigbio.org/portal/recordsets/e4708cae-22d3-45c0-904d-aca6cb1c0f29). This mass migration allowed for more specimen data research use and better organization and management of AMNH collections. Globally Unique Identifiers (GUID) have also been and continue to be generated for each specimen and locality record.

Unfortunately, the AMNH Mollusca collection has been minimally digitized since 2006. It is currently estimated to be approximately 18–20% databased, but it was previously estimated at 19.5% in 1999 and 21% in June 2001 by Paula Mikkelsen, and at 29% by Sierwald and collaborators using an estimated total number of lots (Sierwald et al., 2018). Large-scale collaborative digitization efforts around the U.S. started in earnest in 2011 with the National Science Foundation's Advancing Digitization in Biological Collections (ADBC) program and the associated Integrated Digitized Biocollections (iDigBio) project. However, the last Mollusca-specific staff members (curator and collections assistants) at AMNH left in 2006, prior to the most intensive nationwide push toward large-scale digitization efforts. Although the curators and staff assigned to Malacology did their best to support the collection in the interim, little digitization was accomplished during this time. As such, rapidly moving forward on digitization efforts is a priority for the collection.

The American Museum of Natural History Malacology collection is one of the seven largest Mollusca collections in the United States and the only "large"-designated U.S. collection besides the Pacific-focused Bishop Museum (see Sierwald et al., 2018) that has yet to join the "Mobilizing Millions of Mollusks of the Eastern Seaboard" (ESB) Thematic Collections Network (TCN) project sponsored by the National Science Foundation. As of the writing of this manuscript, a Partners to Existing Networks (PEN) grant proposal is under review to allow for the AMNH Mollusca collections to contribute to this project. Our marine collection is large and taxonomically broad, similar to the collections of the Academy of Natural Sciences of Drexel University, the Museum of Comparative Zoology, and the Florida Museum of Natural History, and therefore will likely increase overall sampling density along most of the coastline of the Eastern Seaboard. As previously mentioned, our collection holds an estimated 450,000 lots. Of these, an estimated 91,000 are databased to some degree; an estimated 8,000 of these (approximately 9.4%) were determined to be part of the Eastern Seaboard of the United States. This suggests that approximately 9.4% of our 450,000 lots (an estimated 42,300 lots) are likely part of the ESB. If we remove the 8,000 that are already databased from our calculation, we estimate that ~ 34,300 ESB lots still require databasing (Table 2), with an estimated 137,200 specimens of mollusks from the Atlantic and Gulf coasts. As part of this project, we aim to database both collection label and ledger data for each lot, georeference additional ESB localities, image primary type lots, and make specimen records publicly available through aggregators like iDigBio and GBIF.

In addition to specific efforts to join the large ESB Mollusca digitization project, current Curator Jessica A. Goodheart and Museum Specialist Laura Rincón Rodríguez are currently making use of part-time invertebrate zoology staff, interns, and volunteers to catalog, organize,

Table 2. Number of estimated non-type ESB lots to be databased in this project per molluscan class. Calculations are based on the distribution of 34,269 fully databased lots from the wet and dry mollusk collection at AMNH. The number of databased lots were counted for each class (Col. 1), and the percentage of lots from each class was calculated (Col. 2). This proportion was then multiplied by 42,300 to estimate the number of lots left to be databased for each mollusk class.

Class	Estimated % of databased collection	Estimated # of ESB lots
Aplacophora	0.12%	**41**
Bivalvia	16.82%	**5,769**
Cephalopoda	0.51%	**175**
Gastropoda	81.11%	**27,821**
Monoplacophora	0.01%	**3**
Polyplacophora	1.13%	**388**
Scaphopoda	0.30%	**103**
TOTAL	–	**34,300**

and database the AMNH Mollusca collection. As of now, nearly all fluid-preserved collection material has been databased with the exception of material that still requires sorting and cataloging. A fullness survey is also underway that will aid in the planning of a re-organization of the collection, which we aim to begin within the next two years. As of mid-June 2025, we have databased an additional 1,153 specimen lots (including new and existing) and imaged 1,240 since the end of 2022. We have also generated pipelines and spreadsheets that will allow for bulk data uploads to EMu to speed up our databasing efforts and maximize efficiency. Our current aim is to have the Mollusca collection fully databased within the next five to ten years.

VISION FOR THE FUTURE

The American Museum of Natural History mission seeks to "discover, interpret and disseminate – through scientific research and education – knowledge about human cultures, the natural world, and the universe". Reflecting upon this mission, the AMNH Malacology Collection is dedicated to the preservation, study, and dissemination of our research and collections to make them more accessible and inclusive. Through intensive, ongoing digitization efforts, we aim to make our collection metadata available online within the next five to ten years to support this goal. We see biological collections as dynamic and active hubs with the goal to serve the needs of their audiences and the Museum's mission, and these steps are necessary for increasing engagement and activity within the collection. The Malacology Collection also has an interdisciplinary team, and our diversity in expertise, cultural backgrounds, languages, and personal experiences are integral aspects of our approach to caring for the Malacology collection. As such, we eagerly seek collaborations with outside institutions and anticipate continued collaboration with scientific and natural history collections communities, academia at large, and members of the general public to ensure that the collections remain available and preserved for generations to come.

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