

Herpetological Review

The Herpetology Collection at the North Carolina State Museum of Natural Sciences

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With at least 92 amphibian and 72 reptile species, North Carolina has long attracted the attention of herpetologists, including such pioneers in early North American herpetology as John Edwards Holbrook, Edward Drinker Cope, and Emmett Reid Dunn (Martof et al. 1980; Beane et al. 2010). The herpetological richness of the state is attributed to its great diversity in topography, climate, and vegetation (Martof et al. 1980; Beane et al. 2010), and the herpetofauna consists of an admixture of temperate northeastern U.S. and subtropical southeastern U.S. taxa. The significance of North Carolina's herpetofauna is reflected in the amphibian and reptile collection at the North Carolina State Museum of Natural Sciences (NCSM), one of the largest and most complete regional collections in the United States.

The collection was started in the late 1800s by North Carolina naturalists and brothers Clement Samuel (C. S.) Brimley and Herbert Hutchinson (H. H.) Brimley. H. H. became the museum's first full-time curator in 1895 and its first official director in 1928 (Cooper 1979; Martin 2001). While C. S. was never officially employed by the museum, he collected or otherwise acquired many of the specimens that would later form the beginning of its amphibian and reptile collection. The oldest specimen known to be in the holdings, NCSM 431, is not a North Carolina specimen, but rather a Gulf Coast Toad (*Bufo valliceps*) collected in Waco, McLennan County, Texas, on 30 March 1895 and received by C. S. from an unstated collector (probably John K. Strecker, Jr., from whom he acquired several other specimens from that locality). Most of the specimens have been accumulated since the 1960s, when William M. Palmer (Fig. 1) began caring for the fish, amphibian, and reptile collections. Palmer began working part-time for the museum in 1951, and was hired full-time as Curator of Zoology in 1963. Prior to then, the amphibian and reptile collection consisted of an assortment of uncatalogued specimens identified by museum accession numbers or associated data labels. In 1962, Palmer acquired archival catalog ledgers, fluid-resistant specimen tags, and adequate storage containers, and on 15 December 1962 he designated NCSM 1 to a *Necturus lewisi* (the first 20 specimens catalogued were of this species, a North Carolina endemic described by C. S.), thus initiating the cataloging system still used today.

Alvin L. Braswell (Fig. 1) joined the staff in 1968, first as an intern, then as a part-time assistant. He became permanent staff



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FIG. 1. William M. Palmer (right) and Alvin L. Braswell (left) herping in 1969 in the Croatan National Forest, North Carolina. The van was a North Carolina State Museum vehicle. Palmer's baseball cap stands for "Players' Retreat," a bar and restaurant in Raleigh that was founded in 1951 and remains popular today.

in 1974 as Collection Manager of Lower Vertebrates, and then as Curator of Lower Vertebrates. Palmer and Braswell held joint positions as curators until Palmer retired in 1995. Palmer continues to work in the collection today in the supporting role of Emeritus Curator of Herpetology. Jeffrey C. Beane (Fig. 2) was hired in 1985 as a Research Technician and has held the position of Collection Manager of Herpetology since 1995. Most recently, Bryan L. Stuart joined the museum in September 2008 as Curator of Herpetology when Braswell moved into an administrative position as the museum's Deputy Director. At the time of writing,

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all four generations of herpetologists, representing at least 114 person-years at the museum, are actively serving the institution (Fig. 3). Palmer, Braswell, and Beane have dedicated their careers to documenting the natural history, distribution, and conservation status of the amphibians and reptiles of North Carolina and adjacent states, and these three individuals have together built most of the collection. Stuart has added an interest in molecular systematics and species delimitation, as well as an international perspective (Southeast Asia and Central Africa), to herpetological research at the museum.

Despite the name similarity, the museum is not officially part of North Carolina State University, although the museum and university maintain a close association and many of the museum's curators have adjunct faculty appointments at the university. The institutional acronym of NCSM, used in cataloging specimens, is based on the earlier name of "North Carolina State Museum" (Leviton et al. 1985). The official name of the institution is now North Carolina State Museum of Natural Sciences, although the word "State" is often omitted from the institutional title for marketing purposes, such as on the museum's website.

As of June 2011, NCSM's amphibian and reptile collection contains over 78,300 cataloged records consisting of approximately 200,000 specimens. Approximately 80% of the collection consists of North Carolina material, although at least 45 states, 24 countries and 650 species are represented. Other states with substantial representation include California, Delaware, Georgia, Florida, Louisiana, New Jersey, New York, South Carolina, Tennessee, and Virginia. Other countries with substantial representation include Gabon, Laos, and Vietnam. The collection contains paratypes of seven amphibian taxa (*Eurycea chamberlaini*, *E. junaluska*, *Leptotalax aereus*, *L. bidoupensis*, *Leptobranchium leucops*, *Rana palustris mansuetii*, and *Rhacophorus vampyrus*) and two reptile taxa (*Ophisaurus mimicus* and *Nerodia sipedon williamengelsi*), and the holotype of one amphibian (*Leptobr. leucops*). From the 1960s to the late 1980s, then-curator Palmer transferred additional types (including holotypes) to the Smithsonian Institution National Museum of Natural History and the American Museum of Natural History when the long-term persistence of the collection appeared uncertain.

Major acquisitions into NCSM's amphibian and reptile collection include the collections of Duke University (the late Joseph R. Bailey et al.), Virginia Commonwealth University (Charles R. Blem et al.), State University of New York at Binghamton (Ted D. Murphy et al.), the University of North Carolina's Institute of Marine Sciences (Frank J. Schwartz et al.), and the personal collections of the late Elmer E. Brown, Richard C. Bruce, Rufus W. Gaul, Jr., the late Julian R. Harrison III, and David L. Stephan. Numerous other individuals have made substantial contributions

to the collection, often over many years; these include Stanley L. Alford, Rudolf G. Arndt, Michael E. Dorcas and students (Davidson College), Richard R. Montanucci, L. Todd Pusser, Thomas J. Thorp, the late George Tregembo and family, and numerous members of the North Carolina Herpetological Society, an NCSM affiliate group.

NCSM's amphibian and reptile collection formed the basis for three significant books on the state's herpetofauna. *Amphibians and Reptiles of the Carolinas and Virginia*, first published by Martof et al. (1980) and recently revised by Beane et al. (2010), is a guide to all the amphibian and reptile species of the state (and South Carolina and Virginia), including color images and maps of species. *Reptiles of North Carolina*, published by Palmer and Braswell (1995), is a comprehensive volume on all aspects of the biology of the state's reptiles. Other popular publications based heavily on the collection include a booklet on North Carolina's venomous snakes (Palmer 1974; revised by Braswell et al. 2003), a book highlighting NCSM and its collections (Martin 2001), and a book and CD guide to North Carolina anurans and their calls (Dorcas et al. 2007). Innumerable scientific publications have extensively utilized the NCSM amphibian and reptile collection, among them many student theses, such as those by Davis (1968), Fedak (1971), Braswell (1977), Reynolds (1980), Williams (1983), Gaul (1996), and Mebert (2003).

Since 1998, the amphibian and reptile collection has been housed at the museum's Research Laboratory (Fig. 4), a 20,296 square foot facility that was specifically designed for housing the museum's "wet" collections (invertebrates, fishes, amphibians and reptiles, and some fluid-preserved birds and mammals). The "dry" collections (most birds and mammals, paleontology, and geology) are housed approximately six miles away, in the main museum building in downtown Raleigh, where exhibits and events open to the public are also located. The amphibian and reptile specimen range is a 4,709 square foot room maintained at a constant 20°C (68°F) and 45 ± 2% relative humidity, without windows and with ultraviolet light filters on overhead fixtures. A Honeywell MDA Scientific Midas alcohol gas sensor system in the range trips an alarm if alcohol is detected from a spill. The collection maintains fluid-preserved specimens, skeletons, skins, dry taxidermy mounts, stomach contents, photographic vouchers, and other materials, as well as supporting documentation such as field notes, data sheets, and correspondences. Most amphibian eggs, amphibian larvae, and reptile hemipenes are stored in buffered 8-10% formalin; most other wet specimens are originally fixed in formalin and subsequently switched to 70% ethanol for permanent storage. Most wet specimens are stored on open metal shelves in glass jars, vials, or crocks; some larger specimens (such as crocodylians, turtles, and snakes) are in stainless steel tanks on wheels or in plastic buckets or barrels. Dry materials, such as skeletons, skins, and taxidermy mounts, are housed in glass containers or archival-quality storage boxes with lids. Taxa are arranged phylogenetically by order and family, and then alphabetically within family by genus, species, subspecies, and county. Type specimens, catalog ledgers, and some original field notes and other records are stored in fireproof cabinets. Adjacent to the range is a herpetology "wet lab" with a fume hood, microscopes, computers, and other equipment and supplies needed for processing, curating, examining, and loaning specimens. Offices for herpetology personnel are in close proximity to the wet lab and collection range. Tours of the facility are frequently conducted for interested individuals and groups such as university classes.



FIG. 2. Jeffrey C. Beane in 1987 with preserved Pine Snakes (*Pituophis melanoleucus*) in the amphibian and reptile collection at the North Carolina State Museum.



FIG. 3. William M. Palmer, Alvin L. Braswell, Jeffrey C. Beane, and Bryan L. Stuart (left to right), 22 June 2011, in the amphibian and reptile collection at the North Carolina State Museum of Natural Sciences.



FIG. 4. A view down the central aisle of the amphibian and reptile collection at the Research Laboratory, North Carolina State Museum of Natural Sciences, 22 June 2011.

Two major initiatives are underway in the collection. The first is to develop genetic resources in the amphibian and reptile collection to make tissues and DNA extractions available to users for molecular genetic analyses. The vouchered tissue collection has rapidly grown from a handful of tissues in 2008 to over 1,300 tissues in June 2011, and tissues now account for a large percentage of loan requests from the scientific community. A National Science Foundation-funded project, inception in April 2011, provides for storing these tissues in labeled and barcoded cryogenic vials in an ultra-cold (-80°C) freezer to minimize thermal degradation.

The second major initiative is to database and georeference the catalog ledgers to allow rapid and remote access of the collection's holdings by researchers, resource managers, the public, and other user groups. The development and success of the museum's database structure was extensively treated by Hogue and Raine (2006). At the time of writing, the amphibian and reptile collection database is online (<http://collections.naturalsciences.org>), but only a portion of the collection is in the database. Users should be aware that this digitization effort is a work-in-progress, and curatorial staff should be contacted for a complete list of holdings. The museum is a participant in HerpNet (<http://herpnet.org>), and plans are to have the digitized portion of the collection on the HerpNet portal by 2012. Readers are encouraged to consider utilizing the NCSM herpetological collection for their future research needs.

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