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A GREAT YEAR FOR MAMMALOGY

Greetings from the Burke Museum's Mammalogy Collection! We are excited to provide you with the first installment of our annual newsletter, which highlights some of our major achievements in 2015. We had a busy and productive year, as we continued to fulfill the collection's mission to archive mammal diversity, support scientific inquiry, and contribute to science teaching and public outreach within Washington State and beyond.

2015 Activity Summary	
Specimens catalogued	697
Research visits	387
Research projects at the Burke	27
Specimens examined at the Burke	2,419
Specimens loaned	426
Scientific publications	18
Students served	420
Visitors engaged in public outreach	1,600+

The collection continued its steady growth in 2015, thanks to fieldwork efforts by Mammalogy staff, institutional partnerships, and chance events, as detailed in several sections within this newsletter. The collection continued to receive specimens from large scale research initiatives in Washington State, including the Elwha River Dam Removal and the Mt. St. Helens Biodiversity Monitoring Project.

Mammalogy specimens were used in a wide variety of research projects, spanning the fields of biology, engineering, archeology, paleontology and art. Previous research at Burke Mammalogy yielded 18 scientific publications in 2015 (full list on page 6). Eleven classes, serving 420 students at the University of Washington, the Northwest School, Alderleaf Wilderness College, and Seattle Public Schools used specimens from the collection to provide hands-on learning experiences.

Last November, over 1,000 visitors came through the Burke's door for the 10th annual Meet the Mammals family day. With the help of dozens of volunteers, we showcased mammal specimens, UW student research, objects from the Archaeology and Ethnology collections, the UW Department of Anthropology and School of Music, and the Whale Museum. Visitors were also able to engage in activities provided by the Seattle Aquarium, The Whale Trail and the NW Guild of Scientific Illustrators, pet a live llama, and get their photo taken with Dubs, the UW mascot.



Volunteers teach visitors about mammal diversity at Meet the Mammals 2015; guest appearance by Dubs, the UW mascot

With the New Burke on the horizon, Mammalogy has also been increasingly involved in planning for our new building. We recently finalized the design of research labs, specimen preparation and storage spaces, and are currently working on the design and content of public exhibits. At the same time, we are starting to plan and prepare for the upcoming move of the entire Mammal Collection to the new building. Construction for the New Burke will start this spring, and opening is projected for fall 2019 (more information [here](#)).

NOTABLE ACCESSIONS

Baird's beaked whale

Last May, a 38-foot female Baird's beaked whale (*Berardius bairdii*) stranded and died south of Grays Harbor on the Washington coast. Baird's beaked whales, sometimes called giant bottlenose whales, are the largest members of the cetacean family Ziphiidae. Ziphiids are deep divers and their bodies are rarely encountered; this was only the fourth Baird's beaked whale reported in Washington State. Initial assessment indicates that this female whale died soon after childbirth due to an infection.



Baird's beaked whale, as found at Grays Harbor (left); Jeff Bradley and volunteers flensing the whale carcass (center); the whale carcass is moved with the help of an excavator (right); the skeleton before being buried (below)

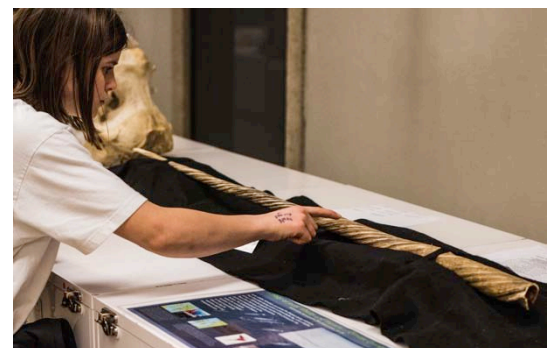


Due to this animal's rarity and excellent condition, we decided to salvage its entire skeleton. It took a team of 32 people and heavy equipment to flense the whale and bury its skeleton. The latter will allow for natural processes to clean the remaining soft tissues from the bones. To avoid loss of small bones (flipper and pelvic bones, mandibles, teeth), these were brought to the Burke for cleaning by our dermestid beetle colony. Over the next year (or more), we will regularly monitor the decomposition process of the whale carcass by checking the buried skeleton—it is important to exhume the entire skeleton before bones start to decay. We will keep you updated on the status of the skeleton in future newsletters. If all goes according to plan, we hope to articulate and display this beautiful specimen in the New Burke.

We would like to thank Burke students and volunteers, the Westport Aquarium, the Cascadia Research Collective, the Marine Science and Technology Center and Washington State Parks for their invaluable assistance in the preparation of this rare specimen.

Narwhal tusk

In October, we were excited to accession another rare and beautiful whale specimen. Although our collection focuses on specimens with scientific value, we occasionally accession specimens for aesthetic reasons. This was the case of a spectacular, 5+ feet-long, perfectly preserved narwhal tusk. The tusk had been in private hands since the mid-1900s, and was generously donated to the Burke by Bob Roblee. Being the only complete narwhal tusk in the collection, it received a special spot for display at last fall's Meet the Mammals.



FIELDWORK AROUND THE WORLD

In summer 2015, Mammalogy curator Sharlene Santana and her students conducted fieldwork on three continents. These efforts were part of various research projects on the ecology, evolution and diversity of bats. In June, Sharlene travelled to the Philippines as part of a research team funded by the National Geographic Foundation. The team collected Old World fruit bat specimens for analyses of skull development, along with data on their bite force and feeding behavior.

In July, Sharlene went to Costa Rica to continue her research on the coevolution between fruit bats and plants. Funded by the National Science Foundation, her team has been collecting chemical samples from bat-dispersed plants, and bat guano and tissue samples for dietary and genetic analyses. Members of the Santana Lab returned to Costa Rica in the fall to continue data collection for this project.

Ph.D. students Rochelle Kelly and Leith Miller worked across Washington State's San Juan archipelago performing acoustic recordings, collecting samples and measurements from over 300 bats across 15 islands. As part of her Dissertation, Rochelle will apply modern genetic tools to elucidate how diet affects the distribution of bat species across the San Juan Islands.



Sharlene Santana and David Villalobos (U Costa Rica MSc. student), 5 Km into the rainforest.

Before the end of summer, Leith and Sharlene went to Grenada for a new collaboration with virologists at St. George's University. They collected representative bats across all of Grenada's parishes, which are being used to identify viruses carried by tropical bats. This work generated the first Grenadian mammal specimens and samples for the Burke.



Site spotlight: Palo Verde National Park

Wind, lots of wind. It is hot, dry and dusty. This is not what most people imagine when they think of Costa Rica. Water is scarce in Palo Verde, with the exception of crocodile-riddled wetlands that are fed by the Rio Tempisque. The patchy water sources in this habitat make it ideal for catching a high diversity of bat species as they visit ponds and puddles for a drink.



Palo Verde wetlands; a wrinkle-faced bat; PhD student Leith Miller holding a bat.

From January through March of the last two years, Leith Miller has traveled to the dry forest of Palo Verde for her Dissertation research. She has been collecting data on the feeding behavior and echolocation of insectivorous bats, voucher specimens for Mammalogy, and tissue samples for the Burke's Genetic Resource Collection. Most specimens belong to the family Phyllostomidae (Neotropical leaf-nosed bats), which are some of the most common and diverse bats in the New World tropics. This year, the catch includes a very rare species: the wrinkle-faced bat, *Centurio senex* (left), which owes its odd anatomy to its habits of feeding on the very hard seeds of the Tempisque tree. In addition to phyllostomids, Leith has collected a variety of species from the insectivorous families Mormoopidae (mustached bats), Emballonuridae (sac-winged bats) and Natalidae (funnel-eared bats). These valuable specimens will increase the diversity of projects that the Mammalogy Collection will be able to support in the future. Leith's work has been possible thanks to a fellowship through Mammalogy's William & Janice Street Fund.

More details, photos and anecdotes about our fieldwork can be found in the [Santana Lab Blog](#), and the [Burke Blog](#).

FEATURED STUDENT RESEARCH

Geographic variability in Pallid Bats

The Pallid Bat (*Antrozous pallidus*), a native to Western North America, is one of the most ecologically unique bat species in Washington State. Whereas all bats in Washington are insectivorous, Pallid Bats have a much more varied palate. They exhibit wide diversity in their diet, and have been documented to eat scorpions, millipedes, small vertebrates (lizards and rodents), and even nectar from cardon cacti in the southern part of their range. The Burke Museum's Mammalogy Collection holds a diverse and geographically widespread sample of Pallid Bat specimens. Biology Ph.D. student Rochelle Kelly took advantage of this resource to investigate the patterns of skull size and shape variation across the Pallid Bat's geographic range, and test what ecological factors may explain such trends. She took hundreds of photographs of Pallid Bat skulls and mandibles and applied geometric morphometric techniques, which allows her to analyze variation in shape and size independently. Rochelle has found that Pallid Bats are larger in more northern latitudes and in areas with higher vegetation cover, and that larger bats also exhibit skull shapes that may increase their ability to consume larger and harder prey. The results from Rochelle's research are being submitted for publication to the *Journal of Mammalogy*, and will have important implications for understanding the relationship between morphology and foraging ecology in bats.



Rochelle Kelly examining pallid bat specimens at Burke Mammalogy

A BOOK OF NATURE STORIES BY JIM KENAGY



Jim Kenagy holds an alligator lizard in the field

Emeritus Curator of Mammals Jim Kenagy has taken the time, which he hastens to point out is abundantly available in his retirement, to write down and collect a series of stories about his personal experiences in nature. His stories span a range from his years as an undergraduate and graduate student through the recent past. The accounts are all about the beauty and simplicity of the kinds of places we fall in love with when we get out into the field to explore what animals do all day and all night, whether above the ground or below. Having taken more time in the last year to work on this project, Jim is expecting to complete his book later this year.

Many of Jim's earlier adventures take place in the desert, and the first of these involve his long-time fondness for kangaroo rats. Jim's goal is to tell the sorts of stories that one never gets a chance to report when we produce typical scientific journal publications. For example, what does it really feel like to spend time out in the desert, whether on a scorching day in summer

or a quiet, moonlit night in winter? And, what is it like to find and capture animals, particularly small mammals? What are some of the surprises of discovery that happen when we spend time watching the animals, trying to figure out puzzles that present themselves only once we get out into the desert, the forest, or wherever we may head out into nature?

Several of the stories are inevitably about the behavior and ecology of kangaroo rats, but the range of creatures appearing in Jim's adventures includes lizards, ants, beetles, ground squirrels, beavers and pandas. The process of discovering what nature can reveal is part of each story. *We need to get out there. We need to pay attention.* And it's all a pleasure, one that we don't usually get to describe—unless we take the time to write down a series of stories like the ones Jim has selected for this special collection. It's also a story of Jim and what he believes there is to find in nature. Stay tuned to this newsletter for an announcement of publication of the book.

ETNIER, TEAM OF UW ALUMS, FINALIZES FOUR-YEAR ANALYSIS



Dr. Etnier finalizes the inventory for ~40,000 bone fragments housed in 36 boxes. The Tse-Whit-zen archaeological collection is held in trust at the Burke for Washington DOT on behalf of the Lower Elwha Klallam Tribe (Photo by Laura Phillips, Burke Archaeology).

Dr. Mike Etnier, Affiliate Curator of Mammalogy and Affiliate Research Associate at Portland State University, has been working with a team of UW alums for the past four years to understand what life was like for the ancestors of the Lower Elwha Klallam Tribe (LEKT), who have lived along the shores of what is now Port Angeles harbor for the past ~2500 years.

The team is analyzing midden samples—the pieces of bone and shell discarded after long-past meals—from the Tse-Whit-zen (pronounced cha-WEET-zen) village site. This site was excavated in 2004 as part of a Washington Department of Transportation construction project. Each of the different team members has their own specialty and research focus. Dr. Sarah Sterling is a geoarchaeologist who helped excavate and document the archaeological site; all of the other team members are zooarchaeologists with different specialties: Dr. Virginia Butler, fish bones; Dr. Kris Bovy, bird bones; and Dr. Sarah Campbell, shells. For his part, Etnier has focused his analysis on a sample of nearly 40,000 mammal bones recovered from the site.

The research team has two main goals. The first is to characterize, in a general way, the subsistence economy of the LEKT who lived at Tse-Whit-zen. This is the first site of its kind to be carefully excavated along this section of coastline. The excavations yielded an enormous volume of midden, which provides an indirect measure of the near-shore ecology of the Strait of Juan de Fuca. The second goal is to determine how resilient the LEKT and the local ecosystem were in the face of local and regional disasters. Dr. Sterling's excavations identified at least one, and possibly two or three instances of the entire village being inundated by a tsunami.

The team has already accomplished the first goal. The inhabitants of Tse-Whit-zen harvested a wide variety of terrestrial and marine (both near-shore and off-shore) resources, with a heavy emphasis on oil-rich sea mammals and herring, as well as ducks, murrets (relatives of puffins) and butter clams. The team has not yet determined if any major shifts occurred following the tsunami/s that were identified in the stratigraphic layers of the site. This will have to wait until all the identification and radiocarbon dating information can be analyzed in a GIS database. For now, all the identification work has been completed, and the collections have been returned to the Burke, for eventual return to the LEKT in Port Angeles.

This project was funded by the National Science Foundation (Award# 1219468), with additional contributions from the Burke Museum and Washington DOT to help cover the costs of curation.

Team members pose on the banks of the Elwha River, near Port Angeles, WA. From left to right: Kris Bovy, Virginia Butler, Mike Etnier, Sarah Sterling and Sarah Campbell (Photo by Joey Sparaga, Western Washington University).



CONFERENCES, MEETINGS AND TALKS

In 2015, Sharlene Santana and graduate students Rochelle Kelly, Leith Miller and Katie Stanchak attended and gave research presentations at the Society for Integrative and Comparative Biology (SICB) annual meeting in West Palm Beach, FL, and the North American Symposium of Bat Research, Monterey, CA. In January 2016, Santana, Stanchak and Biology undergraduate Kristin Campbell presented their work at the SICB annual meeting in Portland, OR.

Collection manager Jeff Bradley was invited to give a Keynote Address at the annual conference of the American Association of Zoo Veterinarians in Portland. The talk was entitled "Zoo Animals as Museum Specimens—Continuing Contributions to Research and Education". The talk was well received by over 400 vets who attended from all over North America.

PUBLICATIONS USING MAMMALOGY SPECIMENS (2015)

- Briones-Salas, M., et al. (2015). Diversidad y distribución geográfica de los mamíferos terrestres del estado de Oaxaca, México. *Revista Mexicana de Biodiversidad* 86(3): 685-710.
- Chen, M. and G. P. Wilson (2015). A multivariate approach to infer locomotor modes in Mesozoic mammals. *Paleobiology* 41(02): 280-312.
- Churchill, M. and M. T. Clementz (2015). Functional implications of variation in tooth spacing and crown size in Pinnipedimorpha (Mammalia: Carnivora). *The Anatomical Record* 298(5): 878-902.
- Churchill, M. and M. T. Clementz (2016). The evolution of aquatic feeding in seals: insights from Enaliarctos (Carnivora: Pinnipedimorpha), the oldest known seal. *Journal of Evolutionary Biology* 29(2): 319-334.
- Churchill, M., et al. (2015). Cope's rule and the evolution of body size in Pinnipedimorpha (Mammalia: Carnivora). *Evolution* 69(1): 201-215.
- D'Elía, G., et al. (2015). Description of a new soft-haired mouse, genus *Abrothrix* (Sigmodontinae), from the temperate Valdivian rainforest. *Journal of Mammalogy* 96(4): 839-853.
- Gustafson, E. P. (2015). An early Pliocene North American deer: *Bretzia pseudalces*, its osteology, biology, and place in cervid history. *Bulletin of the Museum of Natural and Cultural History, University of Oregon* (25).
- Jenkins, K. J., et al. (2015). Occupancy patterns of mammals and lentic amphibians in the Elwha River riparian zone before dam removal. *River Research and Applications* 31(2): 193-206.
- Kerhoulas, N. J., et al. (2015). Complex history of isolation and gene flow in hoary, Olympic, and endangered Vancouver Island marmots. *Journal of Mammalogy*.
- Korth, W. W. and J. X. Samuels (2015). New rodent material from the John Day Formation (Arikareean, Middle Oligocene to Early Miocene) of Oregon. *Annals of Carnegie Museum* 83(1): 19-84.
- Piras, P., et al. (2015). Digging adaptation in insectivorous subterranean eutherians. The enigma of *Mesoscalops montanensis* unveiled by geometric morphometrics and finite element analysis. *Journal of Morphology* 276(10): 1157-1171.
- Pisano, J., et al. (2015). Out of Himalaya: The impact of past Asian environmental changes on the evolutionary and biogeographical history of Dipodoidea (Rodentia). *Journal of Biogeography* 42(5): 856-870.
- Rivals, F., et al. (2015). A tool for determining duration of mortality events in archaeological assemblages using extant ungulate microwear. *Scientific Reports* 5.
- Santana, S. E. (2015). Quantifying the effect of gape and morphology on bite force: biomechanical modelling and in vivo measurements in bats. *Functional Ecology*.
- Self, C. J. (2015). Cricetid rodents: Is molar root morphology an indicator of diet? *Zoomorphology* 134(2): 309-316.
- Shores, C., et al. (2015). Comparison of DNA and hair-based approaches to dietary analysis of free-ranging wolves (*Canis lupus*). *Conservation Genetics Resources* 7(4): 871-878.
- Timm-Davis, L. L., et al. (2015). Divergent skull morphology supports two trophic specializations in otters (Lutrinae). *PLoS ONE* 10(12): e0143236.
- Volkman, L. A., et al. (2015). Genetic distinctiveness of red foxes in the Intermountain West as revealed through expanded mitochondrial sequencing. *Journal of Mammalogy* 96(2): 297-307.

Funded in 1899 and with more than 55,000 specimens, the Burke Mammal Collection is among the oldest and largest in the Pacific Northwest. The collection ranks as the 10th largest university collection in North America and the 18th largest collection in the Western Hemisphere. The Burke Mammalogy Collection supports research, education and outreach related to mammals. It maintains and continues to expand a large archival collection of mammal specimens, which are made available to local educators and the global research community. The collection also provides a source of information about mammals to the public.

For more information visit our website: burkemuseum.org/research-and-collections/mammalogy

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