About Our Cover: *Epidalea calamita*

The Natterjack Toad (*Epidalea calamita*) is a medium- to large-sized toad that is distributed throughout Europe, and is present in over 25 mainland European countries and the UK. The species was initially described within the genus *Bufo*, but were placed as the sole species within the genus *Epidalea* by Frost et al. (2006. Bull. Am. Mus. Nat. Hist. 297:1–370), who noted that additional work was needed. The species is characterized by a robust body with relatively short limbs, prominent parotoid glands, and tympana that are barely visible. The species can be easily found with the first rains of autumn and spring in temporary ponds along the countryside, where they will reproduce explosively, carpeting these ponds with their characteristic egg masses.

Our cover image was recorded by **Javier Lobon-Rovira** in Torrelodones, Madrid, Spain, during a routine autumn night walk to record amphibian activity in the area. He used a Nikon D850 with a Sigma 15mm f2.8 fisheye at F5, 1 sec, and at ISO 800. The photograph was taken using a long exposure to capture the atmosphere of the blue hour and Joby GorillaPods, and by freezing the action with two handheld flashlights on both sides of the amplectant anurans.

Javier is Ph.D. student in Cibio, Portugal, working to understand evolutionary patterns in southern African gekkonids. As a biologist, he has worked on different conservation projects and with groups around the globe, including with amphibians and reptiles at Veragua Rainforest Foundation, Costa Rica, and big mammals in Utah, USA. However, as a photographer, he has collaborated with different conservation NGOs in Africa, the Americas, and Europe and has managed to publish his photographs in journals such as National Geographic, Africa Geographic, and Nature's Best Magazine.

SSAR BUSINESS

Celebration in Honor of Bob Hansen at JMIH 2022

At JMIH 2022 in Spokane, Washington, USA, we celebrated Robert (Bob) W. Hansen's 30 years as Editor of *Herpetological Review* (1991–2021). The celebration was open to all meeting attendees and was hosted at Brick West Brewing Company. It featured a photo slideshow, poetry readings, and short speeches and roasts. Additionally, a special document was printed and given out at the celebration that is a compilation of colorful, humorous, and thankful stories and tributes to Bob, commemorating all that he has accomplished for the journal and society, but also for the greater herpetological community. A copy of the special issue is available online here: http://dx.doi.org/10.26153/tsw/42440.

Henri Siebert Awards – 2022

The 30th annual Henri Seibert Awards were presented at the 63rd Annual Meeting of SSAR held in conjunction with the Joint Meeting of Ichthyologists and Herpetologists, hosted by Gonzaga University and Eastern Washington University, 27–31 July 2022. For the first time since 2019 we returned to a fully in-person format. The SSAR Seibert wards are named in honor of Henri C. Seibert, an early and tireless supporter of SSAR who served as an officer for more than 20 years. In recognition of outstanding student presentations at the annual meeting, a single award was given in each of the following categories: *Conservation* (5 presentations), *Ecology* (4 presentations), *Evolution/Systematics* (6 presentations), and *Physiology/Morphology* (5 presentations). All awardees received a check for US $200 and a book courtesy of Taylor and Francis Publishing.

SSAR thanks this year's Seibert Committee for their service: Betsy Bancroft, Umilaela Arifin, André Luiz Carvalho, Michelle Koo, Robert Burroughs, R. Graham Reynolds, Hardin Waddle, Scott Parker, Rory Telemeco, J. Tom Giermakowski, John Rowe, and Gareth Hopkins (Chair).

The 2022 winners are:

Conservation

Winner: **Christopher Cousins** (Oregon State University), "Evaluation the efficacy of environmental DNA sampling for two cryptic species of torrent salamanders."

Honorable Mention: **Jessica Yates** (Stephen F. Austin State University), "Sneaky snakes: detection and occupancy of sympatric waternakes (Colubridae: *Nerodia*) in the Brazos River Watershed, Texas."

Ecology

Winner: **Sierra Smith** (University of Oklahoma), "Venomous snakes reveal ecological and phylogenetic factors influencing variation in gut and oral microbiomes."

Honorable Mention: **Kannon Pearson** (University of California, Berkeley), "A review of chemical defense in harlequin toads (Bufonidae: *Atelopus*)."

Evolution/Systematics

Winner: **Cynthia Carter** (University of Georgia), "Genomic data reveal patterns of hybridization in Appalachian salamanders."

Honorable Mention: **Daniel Doucet** (Sam Houston State University), "Major and minor scales: thorough investigation of integumentary characters across squamate reptiles."

Physiology/Morphology

Winner: **Analisa Shields-Estrada** (The University of Texas at Austin), "Spectral reflectance as a thermoregulatory mechanism in *Hyla* treefrogs."

Honorable Mention: **Savannah Weaver** (California Polytechnic State University), "Sweating it out in the sauna: heat and humidity increase cutaneous evaporative water loss in lizards."

Victor Hutchinson Graduate Poster Award – 2022

The SSAR graduate student poster awards honor Victor Hutchison for his extensive contributions to herpetology and the development of future herpetologists. For the first time since 2019, we returned to an in-person format. Sixteen students competed. This year we gave three total awards. The awardees received a check for US $250 and a book from CRC Press.

This year's judges were Tiffany Garcia (Oregon State University), Betsie Rothermel (Archbold Biological Station), Amy Vandergast (U.S. Geological Survey), Patrick Baker (U.S. Military Academy), Lauren Chan (Pacific University), and Rebecca Tarvin (University of California Berkeley).

The 2022 winners are:

Evolution, Genetics, Systematics, Physiology, and Morphology

Namia Stevenson (Mississippi State University), "Transferability of assisted reproductive techniques (ART) from model anurans to target species."

Conservation and Management

Desi Wilson (Purdue University), "Distribution predicts global patterns of extinction risk in toads."

Ecology, Natural History, Distribution, and Behavior

Leah Rittenburg (Kennesaw State University), "Characterizing plethodontid salamander communities across an urban gradient using eDNA."

George B. Rabb Undergraduate Poster Award – 2022

SSAR's George B. Rabb Undergraduate Poster Award is sponsored by Zoo Atlanta and honors our colleague George Rabb (1930–2017), former Director of the Brookfield Zoo in Chicago, Illinois, USA, and highly respected advocate and spokesman for wildlife conservation. 2022 marked the fourth year of this competition and the first in-person competition since 2019. Nine students competed. The winner received a check for US $250 and a book from CRC Press.

This year's judges were Anthony Barley (University of California Davis) and Alistair Dobson (California Institute of Environmental Sciences, Smithsonian Tropical Research Institution).

The 2022 winner is:

Scott Kornfeind (Moravian University), "Tadpole developmental rate, survival, and behavior when exposed to microplastics during development."

Photos Needed for New "SSAR History" Book

SSAR is currently involved in a massive effort to write a new history of the Society. This will be published as a book to be given away to registrants at our meeting at the University of Michigan in 2024. The team of writers includes several dozen present and past officers, editors, committee chairs, and other leaders from throughout the Society's entire 67-year history. The book will be a readable summary from the organization's beginnings in Ohio and through its evolution into what is now the largest international professional herpetological society. In addition, the book will be an archival document containing dozens of tables, appendices, and other compilations of historical information about every facet of the Society. It is intended to be the first place anyone would think to look who is seeking information about SSAR.

The new book will also be **a picture book** with illustrations of the many people, documents, meetings, and other SSAR activities. *But we need more pictures!* We don't just want isolated pictures of people. We prefer pictures of people doing interesting things worthy of record. Here are some examples:

1. Photos from our meetings. We especially need pictures from our non-US meetings: Brazil, Canada, Mexico, and the UK. How about a picture of the grad students throwing their professors into the pool at Auburn University in 1974?
2. Various activities, such as poster sessions, plenary speakers, symposia, herp quizzes, live auctions, silent auction set-ups, live animal and art displays, commercial exhibits, special performances, workshops, field trips, and yes, even dances. Who has photos of us learning to dance the 8-step Zydeco at Tulane University in 1990?
3. Photos of special documents, programs, banners, and the like. We already have all of the official SSAR publications and giveaway posters.

Pictures need to be labelled (activity, place, date). These should be high-resolution scans in either JPEG or TIFF. They may be sent as e-mail attachments or, if too large, in zip files or by Dropbox to **David M. Dennis** (e-mail: daviddennis@verizon.net). *Pictures need to be sent before March 2023* in order to be considered for inclusion.

MEETINGS

Meetings Calendar

Meeting announcement information should be sent directly to the Editor (editor.herpreview@gmail.com) well in advance of the event. We also welcome brief reports of meetings; please consult the Editor for details. In light of the COVID-19 pandemic, we recommend contacting meeting organizers regarding the potential for adjustments to this calendar.

18–21 October 2022: XXII Congreso Argentino de Herpetología. Santa Fé, Argentina. Information: http://aha.org.ar/evento/xxii-congreso-argentino-de-herpetologia/

16–19 January 2023: 15th Herpetological Association of Africa Conference, Hoedspruit, South Africa. Information: https://africanherpetology.org/conferences-events/

24–29 April 2023: Joint Annual Meeting: Northwest Partners in Amphibian and Reptile Conservation (NWPARC), Washington Chapter of The Wildlife Society, and the Society for Northwestern Vertebrate Biology, Grand Mound, Washington, USA. Information: https://watws.org/annual-meeting

12–16 July 2023: Joint Meeting of Ichthyologists and Herpetologists, Norfolk, Virginia, USA. Information: TBA

OBITUARIES

Herpetological Review, 2022, 53(3), 550–554.

Of Salamanders, Cats, and Opera: Robert G. Jaeger Über Alles

Dr. Robert "Bob" Jaeger (Figs. 1–4) passed away this summer from a very aggressive cancer. During his esteemed career, mostly at the University of Louisiana at Lafayette, he graduated 28 M.S. students (many of those continued as his doctoral students) and 23 Ph.D. students. Bob's research focused primarily on the lungless plethodontid species, *Plethodon cinereus*, his cherished Eastern Red-backed Salamander. Bob made it his mission to filly understand the behavior of *P. cinereus*, and he often joked that they might be as smart as cats. Bob's outstanding contributions to our knowledge of salamander behavior and ecology include 240 papers published from 1970–2021, including perhaps his best-known publication "Dear enemy recognition and the cost of aggression between salamanders" (Jaeger 1981), and his book synthesizing 50 years of research on *P. cinereus* (Jaeger et al. 2016). Bob was very active in The Herpetologists' League, and was editor of *Herpetologica* for 20 years. Bob's life and academic contributions can be found in Gabor and Anthony (2020). Several of his students and associates have provided remembrances of the beloved scientist, friend, and mentor that was Bob.

Fig. 1. Bob Jaeger dressed to attend the opera. This photograph was given to SEW's daughter, who carried it in her violin case as an inspiration. After his death, she moved his picture to her box of special memories because she gets sad seeing his picture every day.

Bob was my Ph.D. advisor and particularly enjoyed mentoring and giving advice to student researchers. Since his death, it has come to my attention that a misunderstanding has persisted concerning a very unfortunate incident that occurred almost 15 years ago. Since the HL board was involved, at least indirectly, I want to set the record straight. Bob was accused of sexual misconduct involving a child by a woman he had been involved with. To avoid a he-said/she-said trial, he pleaded no contest, but maintained to his friends and colleagues (including me) that he was innocent. The woman eventually recanted and admitted that she made the whole thing up. The judge voided the prosecution, signing the "order to set aside conviction and dismiss prosecution and expunge records" in 2009. During that time, Bob was

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Fig. 2. Bob Jaeger celebrating an infamous "Golden Spermatophore" party. Here he is holding a gift from Bryant Buchanan and smoking his pipe.

apparently asked by the then HL president to resign his position as VP/president-elect of HL. In addition, the HL student award which had been named in his honor had his name removed from the award. I was on the board at this time, and we were told simply that these actions had been taken at Bob's request. Bob decided that he just wanted to get on with his post-retirement life and did not, to my knowledge, make any substantial effort to let people know that he had been vindicated concerning this false charge, which is the reason the rumors and misconceptions have persisted.

Bob was happy in his retirement, spending much of his time traveling to visit friends and former students, including attendance at numerous performances of operas (his passion) in the USA and Europe. In addition, he collaborated with several of his former students on a book describing the behavior and ecology of *Plethodon cinereus* (Jaeger et al. 2016), which I highly recommend.

It is my hope that news of his death will stimulate discussions of fond remembrances of him as well as acknowledgements of his contributions to the field that he loved. Personally, Bob taught me so much about salamanders, science, and writing (I'll always remember those long lists of annotated comments on my papers!). He was a good scientist and an encouraging presence to many over the years. He will be missed.

—Alicia Mathis, Ph.D. (1983–1989)

Yet another great loss of a friend and mentor. Bob Jaeger passed away this morning. He was my major professor for both my M.S. and Ph.D. degrees. I've known him since 1983 and he had a huge influence on me, transforming me from a blathering idiot into a scientist who could actually articulate hypotheses. I will miss him greatly. RIP, Bob.

—Susan Walls, M.S., Ph.D. (1983–1991)

I remember Bob fondly in two ways, professionally and personally. Bob treated his graduate students extremely well. He never took advantage of us; in fact, he did much to make sure we got off to an excellent start. He did several things that I think speak to his excellence as a graduate advisor. First, he would always get his new students involved in a research project from start to finish that may or may not be the final direction they would take in their graduate studies. He would provide guidance in how effectively to design experiments, collect data, analyze data, and write a paper. Most of his students published with him early in their careers and learned much about the process of science. Second, he had an open-door policy for all graduate students: they could talk to him about anything at any time. He would provide guidance, funding, and editorial review as needed, and he did not expect to be an author on the paper unless he was involved in writing or data analysis. This allowed many of his students to develop their independence. Third, he wanted his students to be broadly trained and required most of his students to take graduate classes in philosophy (especially philosophy of science). This broad training has served me well over the last 30 years. Finally, Bob was always very supportive (and honest) of our abilities as graduate students. He was a mentor through-and-through and was able to find that sweet spot of being able to praise us when we did something well, and letting us know where we needed improvement.

On a personal level, Bob was my friend and family for many years beginning in graduate school and ending when I left his home just days before he passed away. He introduced me to classical music, opera, and martinis. Bob invited me to experience the Houston Grand Opera every year as a graduate student, and after I graduated, he took me, and my family, to various operas across the country. Bob and I talked on the phone weekly (I was not a good letter-writer). My own father and my spouse's father died long before we had children, and Bob has treated my children as if they were his grandchildren. He would always ask about how they were doing (especially their music education), and recently he began sending my oldest daughter advertisements about colleges with good music programs. He regularly visited us each summer for wonderful discussions about science, music, politics, and human behavior; and he spent time talking and teaching my daughters about music; they just adored Bob. Bob was generous, kind, and compassionate, and my family and I will miss him dearly.

—Sharon Wise, M.S., Ph.D. (1989–1995)

Bob was a very supportive advisor, always putting his students first and creating a welcoming laboratory atmosphere that fostered collaboration among lab members. I will be forever grateful for Bob's patience with me. Very intelligent people like Bob are not always great listeners (I mean, whatever they have to say is probably more interesting!). Bob was an exception. He was a fabulous listener! And the topic of discussion did not have to be the Eastern Red-backed Salamander for Bob to be engaged. He loved discussing all manner of topics. As an advisor, Bob worked to keep me on track to complete proposals and he tirelessly (and heavily) edited my writing efforts. Only now, as I advise my own graduate students, do I fully understand how much he really worked for us. Science has lost a great thinker, but I like to think that his ideas, process, and love of salamanders live on in his academic descendants. I often reflect on the ways that Bob has influenced me as a scientist. He made me a much more critical thinker and he taught me the value of following my own research interests. Bob also had a very powerful influence on my teaching. His discussion-based and literature-heavy approach to course design is something that I use to this day, and I am forever grateful!

—Carl Anthony, Ph.D. (1990–1995)

Bob was a special person. He was conscious of all of his vernacular (e.g., he didn't say "you guys" because of the origin of the name Guy), thought about every academic move he made, and cultivated an eccentric personality. Bob refused to use computers; he was a true Luddite.

Bob had no biological family remaining when he died; his family was his academic family and some stayed at his side all the way to the end. Once I met Bob's physician and he said that Bob talked to him about kin recognition and fitness. Bob told the doctor that because he had no children or living relatives, he had no fitness. The doctor had known Bob for a long time and said, "of course you have fitness - you have all the students that you advised". This was so true.

Bob could make friends with anyone. Bob loved to sit and contemplate and talk while smoking his pipe. He loved his stray cats and dog. He loved opera and music. Bob was my staunchest supporter. Bob helped mold me. He said I was a diamond in the rough. He removed the rough.

As soon as I started graduate school Bob handed me a pile of all of his papers and said read them, so I took them home and I just started reading them all. It was during that time that I decided to work as hard as I could. I put my head down and worked hard. Bob didn't want to know about my social side or my family life. So mostly I lived to "make Bob happy" in my mind during graduate school. One of my favorite things was going to talk to him in his office about research. He was so supportive, and he would always see the positive in every discussion we had. I would come out feeling excited about more ideas and more research. I didn't realize that Bob was special that way so when I encountered other faculty who were quite negative, I couldn't figure out why they were that way. Even in my faculty position I would share some papers with Bob as I was writing them, and he would always come back to the most basic of elements making sure I was saying what I meant to say but was also very positive.

Eventually while I tried to work as hard as I could, I was able to find a balance between life and work. But it still took me many years to share that side of me with Bob. Then as Bob neared retirement he seemed to soften. He would remember birthdays and call; he even sent cards for Christmas. And he finally went and traveled. Bob also visited us for Thanksgiving for almost the last 17 years. He would bring mulberries (he counted each one) for my turtle and satsumas for us. And in turn, I invited my students over to meet him. He would spend most of a day with them, taking them to get pastries and probing their minds. I have tried to continue Bob's legacy with students, but I don't have his ability to be so positive. But I try.

—Caitlin R. Gabor, M.S., Ph.D. (1991–1997)

RIP Bob Jaeger. Ph.D. advisor, mentor, manuscript editor, instructor, biggest supporter, and dear friend. I was so fortunate to have such a wonderful advisor who knew exactly when to provide guidance and when to let me fly. I will forever try to live up to his example. Peace and love, Bob.

—Megan Gibbons, M.S., Ph.D. (1996–2001)

On my initial visit to interview with Bob as I searched for a graduate school, I arrived at the ULL campus. Inside Billeaud Hall, I headed towards Bob's office. I was nervous. Would he like me? What if I didn't like him? Could I make a good impression? What if I said something really, really stupid? But…that awful smell! Was it burning plastic? The smell only got stronger as I neared his office. I knocked; he opened his door, shook my hand enthusiastically and welcomed me. After some variation of "lovely to meet you!", my next words were a puzzled, "what on earth is that horrible smell? Is something burning?" He threw back his head, laughed hard, and said "Oh, that's just my pipe smoke!" I reckoned I'd just set a new record for time-to-rejection by a potential advisor. But, in typical Bob fashion, he found my accidental insult hilarious, and soon put me at ease. By the end of my visit, I knew I'd found my advisor.

Trying to describe the impact he had on me during graduate school, and beyond, inevitably will miss the mark. He taught me to see, to think, to do, and to write—all things that I naïvely thought I could do before I met him. He opened the doors for me to a scientific, intellectual rigor that I vaguely knew existed but had so far failed to grasp. He was infamous for working long hours, including weekends, and expected his students to work harder. After all, he was fond of telling us, he had a tenured position, and we didn't. He pushed us, but his support was endless. He would drop anything he was doing if we walked into his office needing his time. Megan and I would occasionally walk into his office and announce to him that he was taking us to lunch (Megan says this was generally my idea, not hers). Bob would laugh, and we'd head out, often to our favorite Pimon Thai. We had lively discussions about experimental design, or Popperian philosophy, or what inferences we could reasonably draw from our latest results, or any other thing currently tickling his fancy. I always knew that no matter what, he would be there for me, helping me aim for the finish line, and teaching me along the way to be the best scientist I could be.

Fig. 3. Bob Jaeger holding court, while smoking a pipe at a conference. This was his favorite part of attending conferences.

In my first semester, I took his Behavioral Ecology course. We had a writing assignment. I remember only that it included a Literature Cited section. He told us, before we turned the assignment in, how important it was to get the formatting correct. I didn't need to be told this (so I thought) because of course I would get it right. I got my comeuppance when my assignment came back covered with red ink. I'd never had an assignment covered in so much red ink. Did my typo of "(Jones, 1987)" in the text versus "(Jones, 1978)" in the Literature Cited really matter? Turns out it did. I vowed I would never turn in another sloppy assignment, and his positive impact on my writing skills was cemented.

His annual Golden Spermatophore parties were legendary. I'll never forget him singing his version of "I am a modern major general", pipe or martini glass in one hand, lyrics in the other. He carefully wrote out "awards" to each of his students, and read these to the assembled partygoers. Witty, clever, insightful, and hilarious—I wish I still had mine.

I had the privilege of visiting him at the end of May this year. Although the cancer was getting to him, he was still sharp. We had three special days, and I finally had to take my leave of him for the last time. My final memory is of him sitting on his beloved screen porch, pipe in one hand, martini in the other, still doing things on his terms. I couldn't have asked for a better advisor, mentor, and friend.

—Jennifer Gillette, M.S., Ph.D. (1996–2002)

Bob was one of the most supportive mentors that I had. He covered some of the costs of my field work at Mountain Lake Biological Station with his personal funds when I was short on funding as a graduate student. He truly appreciated intellectual prowess and potential in his students. The wisdom and knowledge that I gained from Bob benefit me to this day. Not only have I learned much from him about survivorship in academia, Bob's knowledge on history and trivia was also impressive. I enjoyed listening to him talking about the Chickamauga Battle or the story behind the name for the Hungry Mother State Park on our way to the salamander collection field trips in the Southern

PHOTO BY CANDICE FALK

Fig. 4. Bob Jaeger (second from left) with a gaggle of his prior students over the decades at the 2016 Plethodontid Biology Conference. Front row (L to R): Alicia Mathis, Bob Jaeger, Nancy Kohn (holding the Jaeger et al. [2016] book soon after it was published), Sharon Wise, Jennifer Gillette, and Megan Gibbons; back row (L to R): Chris Beachy, Caitlin Gabor, Carl Anthony, and Ethan Prosen.

Appalachian Mountains. Things like his remark about evolutionary fitness have been adapted for my own lectures now. Nowadays, I strive to make an impression on my students the way that Bob did on his.

—George Wang, Ph.D. (2001–2007)

I met Bob Jaeger at my first Animal Behavior Society meeting in 2002, at Indiana University. Bob stopped me in the hallway to comment on my wearing a fleece jacket when it was 90°F outside (the conference rooms were cold). Our initial conversation led to many other conversations throughout the meeting, and on the last night of the conference Bob invited me to visit his laboratory in Louisiana. He had enjoyed our discussions that ranged from science to art and opera. Bob also learned that I was about to defend my M.S. thesis.

About a week after the conference, I received a handwritten letter from Bob which included many words of encouragement, his best wishes on my thesis defense, another invitation to visit his laboratory, and his contact information. Three days after I defended my M.S. thesis, I called Bob. That conversation led to my first visit to Mountain Lake Biological Station in order to help collect salamanders. Bob had agreed to reimburse me for my travels.

Later, I took Bob up on his invitation to visit Louisiana and his laboratory. Little did I know that when I joined the Jaeger laboratory in August of 2003 that I would become Bob's last graduate student. Two years into my Ph.D., Bob retired, and I spent the next three years running my own salamander laboratory.

Once Bob retired, our friendship grew. We had dinner together once or twice a week where we would discuss my latest art project, cats, salamanders, experimental design, research, word choice, manuscripts, or my dissertation. On days off from running experiments, Bob and I would explore the natural and historical sites of southern Louisiana. When I moved to France for my first post-doc, Bob was my biggest supporter. He would write at least once a week, call on Saturdays, and visit once a year (French pastries were a good bribe). He even volunteered to come take care of me after I spent a week in a French hospital. Near the end, I took care of Bob for two weeks.

Bob and I continued our correspondence throughout the years. While at Cottey College, he visited me twice. Both times he gave guest lectures in one of my courses. Bob was in his element. After those lectures, there was always a student who would comment about how much they enjoyed watching Bob and me interact. Without meeting Bob, I would never have learned to love salamanders, nor would I be starting my introductory biology classes with Philosophy of Science.

One of Bob's valued treasures was a salamander t-shirt that I designed and gave him. By a way of passing on the torch, I have sent that t-shirt to one of my former students who plans to earn a B.S. in Environmental Science.

—Nancy Kohn, Ph.D. (Bob's last Ph.D. student, 2003–2008)

I was not one of Bob's "salamander" students. Nor was I even one of his "official" students. I was a doctoral student in another research laboratory working on marine shrimp. Bob taught me everything, and I mean everything, I know about evolutionary biology and animal behavior, given I was not otherwise exposed to these topics as an undergraduate student. Bob took me under his very vast, full wings and taught me experimental design and nonparametric statistics. Every experiment, every manuscript: Bob was a huge part of my graduate experience because of the guidance and advice that he invested in my work and in my personal growth.

After graduation, Bob and I corresponded for 20 years by writing handwritten letters, full of research projects, hypotheses, statistical dilemmas, and personal struggles and accomplishments. Bob always let me know how proud he was of me and my route in academia, something that I think is so important to show and express to others. Bob visited me several times in Florida and helped lay the academic groundwork with my son, by talking with my son at a very young age. My son loves history and Bob talked with him about the many career paths in history. When my son graduated with his undergraduate degree in history, I remember telling Bob that this was another one of Bob's accomplishments and students, even a second generation of his students. My life would have been much lonelier without Bob when I was in graduate school. It would have taken me much longer to find my way. After graduate school, my life would still have been so much lonelier without those robust, personal letters back and forth, often being a substitute in my life for family that I did not have. I owe Bob more than a paragraph, more than the visit I had with him in the last few weeks, and more than all the future manuscripts. My goal is to help be a "Bob" for some future animal behavior researcher, and in this, I hope to help his treatment of others and selfless nature be seen. I know, big shoes, big pipe, and big martini glass to try to fill.

—Jen Wortham (Dr. Raymond Bauer's Ph.D. student,1995–2001)

I first met Bob in 1989, at the 1st World Congress of Herpetology in Canterbury. Bob, who was always interested in discussing their work with graduate students, talked to me during some reception. This chat led to a regular correspondence that lasted for more than 30 years. In our letters, we shared not only news about our research, but also about our private lives. It was wonderful for me to have a friend who was interested in my successes and mishaps. Whenever I found a letter from Bob in my mailbox, it was a red-letter day indeed. Better still was meeting with Bob in person, of course. His love of music brought him to Vienna, my hometown, on several occasions. He stayed either with my husband and me or at the "Hotel Sacher", which had the double advantage of being close to the Vienna State Opera and of serving excellent coffee and the famous Sacher cake for breakfast. During those visits we arranged various excursions for him. Bob loved to relate his mountain climbing experience on the Schneeberg, where he ended up

in a restaurant a few hundred meters from the top station of the cog railway called "Salamander" and was plied with coffee and schnapps by a kind waitress. In the evenings, he loved to discuss Austrian history and politics with my husband. My husband and I also visited Bob at his home in Louisiana, where we got to know his cats—twelve formerly homeless animals he had adopted. I felt honored when Bob invited us to join him in a research project at Mountain Lake Biological Station, which turned out to be the best "working holiday" I ever had, and even more so when he suggested I should co-author the book on Plethodon cinereus. Bob's death leaves a huge gap in my life.

—Birgit Gollmann (friend and co-author)

I met Bob in 1994 when I was hired as the administrative assistant in the biology department at ULL. Bob always supported me, was so kind, very respectful, and always had great advice for me. When I interviewed for another position on campus, he was first and foremost to offer to write a reference letter for me. I have no doubt it came with high recommendations. Once he retired, we remained friends. When I contemplated retiring in 2019, he was very encouraging and helped me make my decision.

I thoroughly enjoyed having lunch with him, dinners with him and our friends, and those wonderful martinis. Many times, I was a chauffeur for Bob, taking him shopping for sandals, grocery shopping, doctor visits, etc. We looked forward to going to our favorite yearly activities …sweet dough pie festival, the conge' (end of the year local school function), craft shows…oh, not to look at the crafts but to eat the pastries and whatever food the vendors were preparing. I was always amazed at Bob being able to eat so much…he enjoyed everything he ate. I remember one year for the sweet dough pie festival, he gave me the date to put on my calendar and remind him. That Saturday, we arrived at the location and were confused as to why no one was there… were we that early? Bob happened to have in his car the newspaper article with the information. Looking at it we discovered we were very early indeed—a whole month early! He had given me the wrong month! We had a good laugh, but nothing wasted. We made the best of it and walked around in the very old cemetery in that area. And yes, we made it back on the correct date!

I once gave him a bright yellow 'Hawaiian' shirt which he wore often when we would go out for dinner. Although this was definitely not his typical style, he was so proud to wear it. What I miss the most are the afternoons we spent sitting on my back patio or his back porch just talking, reminiscing about the ULL days, listening to his stories. My Dad said Bob was a very curious man, always wanting to know everything about everything.

He was always so proud to talk about his former grad students. He even invited me to travel with him to attend the Plethodontid conference. What a wonderful time I had being with him and some of his former grad students. I was fortunate to spend time with Bob every day during his last days. One afternoon while Bob was resting, I was telling him how happy I was to have him as my friend and how much I enjoyed our time together. He opened one eye, looked up at me and said, "I'm not dead yet". Thanks for making me laugh, Bob.

And now, as I sit in his 'magic chair' at his house, I relive wonderful memories of him. I looked up to Bob and admired him…he was a true friend… and I'm honored to have been called his friend. I miss you, Bob.

—Jenny Thibodeaux (Administrative assistant, ULL)

Literature Cited

Gabor, C. R., and C. D. Anthony. 2020. Historical perspectives: Robert Gordon Jaeger. Copeia 108:184–187.

Jaeger, R. G. 1981. Dear enemy recognition and the costs of aggression between salamanders. Am. Nat. 117:962-974.

———, B. Gollmann, C. Anthony, C. Gabor, and N. Kohn. 2016. Behavioral Ecology of the Eastern Red-backed Salamander: 50 Years of Research. Oxford University Press, New York, New York. 248 pp.

Herpetological Review, 2022, 53(3), 554–557.

Jonathan Leakey (1940–2021): Kenyan Herpetologist and Entrepreneur

Jonathan Leakey, Kenyan entrepreneur and herpetologist, died on 12 July 2021, in Nairobi. He was the last survivor of a group of influential herpetologists associated with the National Museum in Nairobi (then the Condon Museum), the founding of Nairobi Snake Park in the 1960s and early 1970s, and was responsible for nurturing the interest of a number of young naturalists.

Jonathan Harry Erskine Leakey was born in Nairobi on 4 November 1940, the eldest of the three sons of Mary and Louis Leakey. His parents were eminent paleoanthropologists; they made ground-breaking hominin discoveries in east Africa. His mother once wrote of Jonathan, 'I quite liked having a baby…but I had no intention of allowing motherhood to disrupt my work as an archaeologist' (Morell 1995). At the time the Leakeys were based in Nairobi but were frequently in the field in Kenya and Tanzania, on their lifelong hunt for early humanity in eastern Africa. At the time, their fame had not yet spread, funds were tight, and the Leakeys' expeditions were often on shoestring budgets. Jonathan, and later his two brothers, Richard and Philip, were taken into the field with their parents. Their lives consisted of schooling in Nairobi, coupled with life under canvas in hot, wild places: an existence in which the boys thrived.

PHOTO BY MARGARET COOPER

Fig. 1. Jonathan Leakey at Baringo in 1970 with team members, John Cooper (treating a python, center) and Peter Nares (director of Nairobi Snake Park, right).

Jonathan proved an adept fossil hunter, making several important discoveries, including the jawbone of a giant extinct baboon

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Fig. 2. Jackson Iha, curator at Nairobi Snake Park, trained by Jonathan, with boomslangs.

(named at the time *Simopithecus jonathani*) and the type specimen of *Homo habilis*, nicknamed 'Johnny's Child'. His father's hopes that Jonathan would study palaeontology at degree level and return to the field were not fulfilled, however. As a boy in the wild country of eastern Africa, Jonathan developed a keen interest in snakes, and began keeping them at home; he built a snake pit at the family home in Langata, Nairobi. He was frequently called out to capture problem snakes. On one occasion, when he was away, a neighbour reported a Puff Adder was in her garden. Jonathan's brother Richard (who did become both a palaeontologist and a prominent conservationist) went instead; but he was bitten by the snake as he was handling it, and nearly died from anaphylaxis after being given antivenom.

Catching and keeping snakes was a common hobby among young white Kenyans; few persisted with it, but Jonathan did. He left school at 18 and began collecting snakes commercially and selling them and their venom. His father made another attempt to get Jonathan back into the scientific world and persuaded him to run the newly opened Nairobi Snake Park in 1961. Jonathan stayed two years but then went back to commerce. He once told me he had seen the academic life that his parents carried out, the grinding field work, the battle to raise funds, the struggle to get published, and wanted no part of it. 'The family had enough palaeontologists', he told me, 'all I was really interested in was business, and using my expertise to make a profitable living'.

I first met Jonathan in 1961. At the time I was seven, we were living in Meru, Kenya, where my father taught at Meru Secondary School. I had become interested in animals and kept frogs and chameleons. In 1961, I saw an article in the East African Standard newspaper, about the founding of the Nairobi Snake Park, and how the new curator, Jonathan Leakey, was interested to receive any specimens the public could send him. I had collected some chameleons, so I wrote to Jonathan, and said that I had found 'some ordinary chameleons' and asked if he would like them? I received a few days later a kindly hand-written letter, saying that no chameleons were ordinary, and he would be delighted to have the animals and that they were important to science. He included full instructions as to how to send them. Subsequently, when I was in Nairobi with my father, we went to the museum, and we were directed to Louis Leakey's office; Jonathan came along, chatted with both of us, and showed us around the snake collection, both the live and the spirit specimens. He knew exactly what to say to a young enthusiast. He explained the importance of a reference collection and encouraged me to collect specimens for the museum; he made me feel that my contribution was important. His

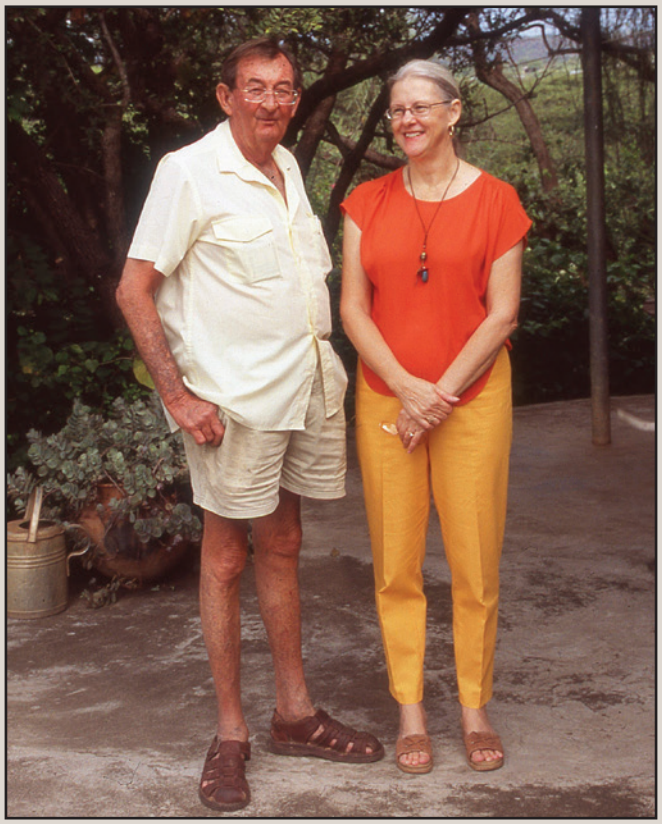

Fig. 3. Jonathan Leakey and Dena at Baringo, 2013.

enthusiasm essentially started me into herpetology: an interest that has remained with me all my life. In 1966, after we had moved to Nairobi, I began collecting snakes seriously, and regularly visited the Nairobi Snake Park, which was then being curated by a dynamic herpetologist and showman, James Ashe. At the time, Jonathan regularly came to the snake park in connection with his snake business. He always had time to chat. In the late 1960s and early 1970s, a remarkable herpetological team associated with the snake park and the museum, including the veteran herpetologist C. J. P. Ionides, inspired many of us to pursue the field of herpetology. Being at the snake park with these experts was akin to being part of an endless masterclass of herpetological expertise; all were welcome if they had enthusiasm.

In the 1960s, the reptile business that Jonathan set up at Lake Baringo in Kenya's Rift Valley prospered. His income came from three main lines: selling clawed frogs (*Xenopus*) for pregnancy testing and research, producing venom (particularly from mambas) for antivenom production, and supplying desirable animals (chameleons, tree frogs, sand boas, spectacular vipers) to the pet trade. In order to obtain the venomous snakes needed for the supply of venom, Jonathan trained a team of Kenyan collectors, based in four areas of Kenya: 1) at Gede on the northern coast; 2) in and around Kitui in Ukambani, the dry country of eastern Kenya; 3) in the Kerio Valley, just west of Baringo; and 4) near Kakamega, in western Kenya where the great central African forest reaches its easternmost extension. He didn't simply hire anyone. His approach was to visit the areas, contact local experts who already knew something of snakes (often "medicine men", or local healers, known in those days as "waganga" or "witch doctors") and persuade them to lead a team. He offered the rigorous training necessary to safely find, catch, handle, bag, and transport large num-

bers of deadly snakes. He once said to me, "I wasn't interested in having anyone bitten. This was business, not an adventure." The teams were supplied with grab sticks, surgical tongs, heavy duty cloth bags and compartmented wooden boxes, and taught how to catch a snake, get it under control, bag it (using the famous reverse bag technique pioneered by Ionides; see Spawls 2018), box it, and transport it without incident. As a measure of his thoroughness, Jonathan also talked to the local bus companies, explained that his men would be travelling on the buses with boxes of snakes, and persuaded them that there would be no danger to the public. At Baringo, the snakes were housed in large fine-mesh wire enclosures, called bomas, essentially made by setting up a metal cage over a tree or clump of bushes, and then sewing the wire mesh over the frame. Every day, a number of snakes were removed from the bomas and their venom extracted. Jonathan also hosted a number of prominent herpetologists at Baringo. The expert snakebite doctor Alistair Read came with some colleagues and took back to the United Kingdom a number of Northeast African Carpet Vipers (*Echis pyramidum*) for venom research, Alice 'Bunty' Grandison of the Natural History Museum in London visited several times, as did Arne Schiotz, the Danish frog expert, and Barry Hughes, West African herpetologist. With Alex MacKay, the herpetologist at the National Museum, Jonathan organised an expedition to Moille Hill in northern Kenya to obtain carpet vipers for their venom. Over 4000 snakes were collected, had their venom extracted, and were then released.

In the early 1970s, things began to go wrong at Baringo. The demand for the Clawed Frogs dropped, as simpler pregnancy testing kits were developed, and educational institutions that used the frogs for other research found they were easy to breed. At the farm, a bacterial disease spread in the snake bomas and pits and affected much of the stock. Pet traders became wary of buying animals from Leakey, as they often arrived diseased and died not long after arrival. Companies manufacturing antivenom had stockpiled dried venom; Jonathan's enquiry in early 1972 to one pharmaceutical firm as to how much mamba venom they would need that year was met with the response that they had enough stocks to last them five years. Cooperation with the prominent Kenya-based British veterinary surgeon John Cooper (Fig. 1) achieved some success at curbing the bacterial disease, but it kept stubbornly returning, despite such dramatic action as setting fire to entire bomas. A documented vaccine (Cooper and Leakey 1976), possibly the first ever produced for snakes, showed promise but failed to control the problem. Eventually, Jonathan switched to other projects, including setting up a tourist tented camp at Baringo, harvesting the bark of the *Prunus africana* tree (an extract of which is used to treat prostate cancer), collecting *Centella asiatica*, a low growing perennial used in traditional medicine for treating burns, growing melons and *Aloe vera*, and keeping and breeding lungfish and tilapia for the pet food trade. As his snake business faded, he persuaded the National Museum to employ or give collecting contracts to his team leaders. One of them, Jackson Iha, (Fig. 2), who came from a talented coastal family long involved with snakes and snake handling, became the curator at Nairobi Snake Park, before leaving to set up several successful snake parks on the coast. Mutui Mutisya, another team leader, supplied specimens to the Snake Park for many years, and his son still collects for the National Museum. I worked with some of these men; their handling skills were astonishing. As anyone who has worked with venomous snakes knows, there are certain liberties you can take with dangerous species without risk, and some that you cannot, just as there are changes in behaviour between wild and captive snakes. Jonathan's men knew these things. As far as I am aware, none of his team leaders were ever bitten, although some were catching 20–30 (or more) mambas a month, as well as other very dangerous species. On one occasion at Nairobi Snake Park, we were working with Black Mambas and one sprang from the cage, Jackson Iha had a grab stick on it before I could turn around.

Jonathan formally published almost nothing on herpetology. The lack of publications was to some extent a reaction to the relentless output by his parents, and later his brother, Richard, who as academic researchers kept up a steady stream of publications.

However, Jonathan knew a vast amount; he carried in his head an overview of the East African herpetofauna, and where it lived. He was always willing to share his expertise with anyone interested. In the early 1970s, he contributed a great amount of information on snake distribution, morphology, and behaviour to Charles Pitman, who was working on his monumental 1974 revision of *A Guide to the Snakes of Uganda* (Pitman 1974). When unusual animals were brought in by his collectors, Jonathan recognised them and sent them to either the National Museum in Nairobi (or the Natural History Museum in London, for although Jonathan supported the National Museum, there was a wariness in the early days of Kenyan independence about the future of the museum and the curation of its collections). Jonathan was instrumental in preserving the first beautiful sand snake, *Psammophis pulcher*, and the first *Polemon christyi* recorded in Kenya. He recognised that the carpet vipers of Baringo differed from others further east in Kenya, leading Oscar Stemmler and Erich Sochurek to name the Baringo form as the subspecies *Echis pyramidum leakeyi* (Stemmler and Sochurek 1969). Years later, in 2008, when I was at Baringo, Jonny and I were discussing the distribution both of Forest Cobras and Side-striped Chameleons. Jonny's expert knowledge of where those animals occurred in western Kenya enabled me to make sense of what seemed a confused distribution pattern. When we were working on our revision of our field guide to East African reptiles (Spawls et al. 2018), he kindly sent us the field notebooks of C. J. P. Ionides, which provided a great deal of data.

Things became tough at Baringo in Jonathan's final years. He struggled with mobility. His beloved family home was quite close to the lake shore. In 2010, the lake began a relentless and inexplicable rise, and although the house was on stilts on a high point, the rising lake eventually engulfed it. This was a matter of great sadness to Jonathan, as it was a beautiful building and imaginatively designed; a huge fish tank was set in the wall between two of the main rooms. It was also home not only to him, his partner Dena Crain, and his four children, but to their many pets and animals over the years, including a couple of cheetahs and five orphaned baby hippos that Jonathan raised after being abandoned by their mothers during times of severe drought. Jonathan regularly sent me pictures of the approaching water, with droll comments about the crocodile basking on his erstwhile driveway, but eventually Jonathan and Dena (Fig. 3) had to move to Nairobi. In a curious coincidence, one the snake handlers he had trained, William Ewoi, passed away on the 30 June 2021, 12 days before his own death. Jonathan is survived by Dena, his first wife Mollie, and his children Julia, Nigel, Tanya, and Mary (Mouse). His enthusiasm lives on among those he trained and inspired (myself included). Safari njema, Jonny!

Acknowledgments.—My thanks are due to Thomas Madsen, Margaret and John Cooper, and Julia Leakey, all of whom read an initial draft and kindly contributed their memories and information; I thank also Margaret Cooper and Thomas Madsen for photographs.

Literature Cited

Cooper, J. E., and J. H. E. Leakey. 1976. A septicaemic disease of east African snakes associated with Enterobacteriaceae. Trans. R. Soc. Trop. 70:80–84.

Morell, V. 1995. Ancestral Passions. Simon and Schuster, New York, New York. 639 pp.

Pitman, C. R. S. 1974. A Guide to the Snakes of Uganda. Wheldon & Wesley, Codicote, UK. 290 pp.

Stemmler, O., and E. Sochurek. 1969. Die Sandrasselotter von Kenya: *Echis carinatus leakeyi* subsp. nov. Aqua-terra 6:89–94.

Spawls, S. 2018. C. J. P. Ionides: a commemoration. Herpetol. Rev. 49:480–484.

———, K. Howell, H. Hinkel, and M. Menegon. 2018. A Field Guide to East African Reptiles. Bloomsbury, London, UK. 624 pp.

CURRENT RESEARCH

The purpose of Current Research is to present brief summaries and citations for selected papers from journals other than those published by the American Society of Ichthyologists and Herpetologists, The Herpetologists' League, and the Society for the Study of Amphibians and Reptiles. Limited space prohibits comprehensive coverage of the literature, but an effort will be made to cover a variety of taxa and topics. To ensure that the coverage is as broad and current as possible, authors are invited to send reprints to the Current Research section editors, Ben Lowe (lowe0160@umn.edu) or Chava Weitzman (chava.weitzman@cdu.edu.au).

Can't Handle the Cold: Reduced Chytrid Resistance in Warm-Loving Salamander Morph

One theory in disease ecology particularly relevant to ectotherms is the thermal mismatch hypothesis, suggesting that the gap in performance between a host and parasite at a given temperature should determine disease outcomes. For example, hosts adapted to warmer temperatures may be more susceptible to infection during colder times. Though this theory has gained traction, its support is expectedly not universal. In this study, the authors tested the thermal mismatch hypothesis in the context of *Bd* infection (*Batrachochytrium dendrobatidis*) in two morphs of Eastern Red-Backed Salamanders (*Plethodon cinereus*) with differing habitat and thermal preferences. Striped morphs prefer cooler habitats and unstriped morphs prefer warmer habitats, with an assumption that these preferences align with physiological performance and tolerances. In this fully factorial 2 × 2 × 2 experiment, wild-caught adult striped and unstriped morphs were exposed to *Bd* zoospores or control treatment in warm or cool temperatures, which resulted in a continuum of temperatures experienced by salamanders in the experiment. In the resultant infection, unstriped salamanders had an average of 6.5x higher *Bd* abundance than the striped morphs. Though unstriped salamanders with a preference for warmer environments had greater *Bd* loads across the temperature range studied, the probability of infection decreased from over 50% below 18°C to less than 10% above 24°C. Similarly, unstriped salamanders held at lower temperatures had twice the *Bd* loads as unstriped morphs held at warmer temperatures. In contrast, striped morphs' probability of infection hovered around 20% across temperatures, but also with reduced *Bd* loads at higher temperatures. Though immune measures were not included in this study, these results suggest that warm-tolerant unstriped morphs have suppressed immune responses to *Bd* in cold environments, while cold-tolerant striped morphs maintain pathogen resistance in the cold. Because both morphs had resistance at higher temperatures, the thermal mismatch hypothesis was only supported at lower temperatures included in this experiment. It could be that though the morphs have differing thermal preferences, their physiological performances do not differ at the warmer temperatures included here. *Bd* also has poor growth at warmer temperatures, and a lower thermal range in the experiment may have exposed stronger support for this hypothesis.

Venesky, M. D., J. DeMarchi, C. Hickerson, C. D. Anthony. 2022. Does the thermal mismatch hypothesis predict disease outcomes in different morphs of a terrestrial salamander? Journal of Experimental Zoology–A 337:467–476.

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Invasive Turtles Differently Affect Tadpoles at Different Developmental Stages

Red-Eared Sliders (*Trachemys scripta elegans*) are invasive on most continents, owing the pet trade for their international spread from the USA. Consequently, these sliders can have damaging impacts on diverse species worldwide. Previous studies found that sliders can impact the behavior and growth of Common Frog (*Rana temporaria*) tadpole prey in Europe. When predators and prey have dramatically different movement abilities, it is important to explore the long-term effects of relatively short-lived interactions. Here, Vodrážková and colleagues delved further into the effects of sliders on frog tadpole growth, asking how these predators affect tadpole growth when present early (first half of tadpole development) or late (second half) into development. They predicted to find slowed growth rates in the presence of the turtle predator regardless of developmental stage, but more pronounced reduction in growth rates for tadpoles exposed to sliders early in development. At smaller sizes, tadpoles exposed to predators often reduce movement and consequently food acquisition, stunting their growth, while larger older tadpoles are better able to escape predation. Indeed, the presence of Red-Eared Slider chemical cues early in tadpole development dramatically reduced growth. Although the tadpoles ramped up their growth after the turtle was removed, and had extended time to metamorphosis, they were unable to make up the growth lost in those early weeks of development. The tadpoles exposed

to turtle cues for the second half of development, alternatively, did not experience any detrimental effects to their development time or metamorph size. Smaller metamorph sizes and longer development time of Common Frogs when raised in the presence of Red-Eared Sliders contrasts some amphibians' responses to predators during development. These results highlight the changes in tadpole vulnerability over development.

Vodrážková, M., I. Šetlíková, J. Navrátil, and M. Berec. 2022. Different time patterns of the presence of red-eared slider influence the ontogeny dynamics of common frog tadpoles. Scientific Reports 12:7876.

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We May Thank Feral Pigs for the Comeback of Saltwater Crocs

Large carnivores are instrumental to community maintenance, though populations across diverse taxa of large carnivores have dramatically declined worldwide, with various sources of anthropogenic impacts. Saltwater Crocodiles (*Crocodylus porosus*) in Australia had a brush with extinction in the 1970s from over-exploitation, stimulating conservation efforts that have led to the species' recovery. However, their recovery was not equally successful across Australia, which the authors of this study hypothesize may be impacted by prey availability, in addition to the clear range of habitat variability around coastal Australia. In the Northern Territory where crocodiles quickly recovered, these authors used stable isotopes to detect shifts in the dietary niche of crocodiles between the time when their numbers were low (museum specimens collected 1968–1986) and present day (2012–2016). Stable isotope analysis detected increases in ^{13}C and ^{15}N with greater crocodile body length in both groups, but overall lower ^{13}C and ^{15}N in contemporary samples. Interestingly, stable isotope values from both historical and contemporary samples overlap with feral terrestrial herbivores available. Though the authors predicted that the high numbers of crocodiles in the region today would require diverse alternative prey options, the crocodiles instead seem to have reduced prey diversity. This timeframe overlaps with a reduction in feral buffalo and anecdotal evidence of an increase in feral pig populations in the region. Consequently, the dramatic increase in crocodile biomass in the Northern Territory may be supported in large part by feral pigs, which can be consumed by smaller crocodiles as opposed to the large size required to take down a buffalo. Conversely, lower availability of large terrestrial herbivores elsewhere in the crocodile distribution may limit population growth in comparison to their dramatic success in parts of the Northern Territory.

Campbell, M. A., V. Udyawer, T. D. Jardine, Y. Fukuda, R. K. Kopf, S. E. Bunn, and H. A. Campbell. 2022. Dietary shifts may underpin the recovery of a large carnivore population. Biology Letters 18:20210676.

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Watching Frog Declines in Real Time: a Yellowstone Story

When amphibian declines worldwide became apparent, an effort emerged to collate available historical population data and recreate surveys for direct comparisons to provide estimates of the extent of declines. Some of these efforts became long-term surveys in themselves. In a 28-ha study area in Yellowstone National Park, Frederick Turner assessed the population structure and dynamics of Columbia Spotted Frogs (*Rana luteiventris*) in the 1950s, and his experiments were recreated in the 1990s by Patla and Peterson, who then continued regular surveys in the vicinity through 2020. Since the 1950s, this study site and its inhabitants experienced dramatic habitat changes, including building of a roads, tourist facilities, and other infrastructure, alongside changes due to the changing climate. Consequently, many wet zones in the area contracted since the 1950s, and there was a 78% reduction of Columbia Spotted Frogs in the main study area in the subsequent 40 years. From Turner's data, the authors estimate an average of 1561 frogs per year in the study area from 1953–1955, compared to 336 on average from 1993–1995. Importantly, the authors report the complete halt of egg masses laid in the study area (in the remaining pools) after 2007, reduced from 62 egg masses in three breeding pools in 1955 to under 20 egg masses per year in the early 1990s in two remaining pools. With mark-recapture and telemetry (1990s) data, frogs in the study area were recorded using three spatial use patterns in the 1950s, each with distinct breeding, foraging, and overwintering sites, which decreased to the last remaining vestiges of one of those patterns revolving one breeding pool by 1995. A nearby lagoon with some connectivity to the main study area contained variable numbers of frogs and egg masses over the years. Unfortunately, this lagoon breeding site has been hit by multiple disease outbreaks related to trematode, Ranavirus, and chytrid fungal infections, some of which have caused severe die-offs. Columbia Spotted Frogs are still one of the most common frogs in Yellowstone. Regardless, we can all imagine assuming that the wildlife we see (or don't see) in a wilderness location may be representative of the past and future at that site, unable to envision the incremental changes to populations over time. Studies like the one presented here, incorporating 70 years of population data, provide an important look at how species interact with, and react to, changing environments.

Patla, D. A., and C. R. Peterson. 2022. The slow decline of a Columbia spotted frog population in Yellowstone National Park: a cautionary tale from a developed zone within a large protected area. Ecological Indicators 136:108606.

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Riparian Populations of Southern Appalachian Salamander Species Show Resilience to Fire Disturbance

While anthropogenic disturbance generally has a negative effect on populations of native species, many communities have evolved to tolerate—and even benefit from—natural disturbance. Understanding how species respond to natural disturbance is

critical for conservation. The authors of this paper studied the response of three plethodontid salamander species following fire in riparian forest. In the southern Appalachians of western North Carolina, USA, riparian habitats are often acidic cove forest, a moist habitat often spared from fire. However, a record drought in 2016 appears to have fueled an autumn fire in the Nantahala National Forest that brought fire into cove forests, sometimes severely. The authors surveyed for salamanders at ten sites (five burned, five unburned) between 2017 and 2019. They performed visual encounter surveys at each site three times in 2017 and 2019, and twice in 2018, gathering data for one terrestrial species (*Plethodon shermani*) and two species with aquatic larvae (*Desmognathus ocoee* and *Eurycea wilderae*). These surveys showed interesting demographic and distributional distinctions between the two treatments. In the last two survey years, adult proportion of the *P. shermani* population was greater in burned sites, while the adult proportion was lower for *E. wilderae* across the first two survey years. For all species, distance from stream was greater in burned sites. Relative to unburned sites, *E. wilderae* was less abundant at burned sites. Interestingly, *D. ocoee* in burned sites were at steady abundance across the survey years while abundance increased at unburned sites. The authors call out the need for studies of plethodontid response to fire over longer periods of time, and highlight the importance of studying wildlife's response to naturally occurring wildfire.

Gould, P. R., M. R. Gade, A. J. Wilk, and W. E. Peterman. 2022. Short-term responses of riparian salamander populations to wildfire in the southern Appalachians. The Journal of Wildlife Management 86:e22282.

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Tadpole Study Reveals Effects of Population Density on eDNA Concentration Estimates

More and more studies are using environmental DNA (eDNA) techniques to survey for species. To better understand this methodology, more controlled experiments are needed. The authors of this paper performed a controlled study to investigate the connection between eDNA concentration estimates and actual abundance of individuals. Tadpoles of Northern Leopard Frogs (*Lithobates pipiens*) or Wood Frogs (*Lithobates sylvaticus*) were raised in densities of 0, 1, 4, 16, or 64 per 80 L container. The authors maintained these mesocosms throughout development and periodically collected water samples (10 times for *L. sylvaticus* and 14 times for *L. pipiens*). Using qPCR technology, the authors evaluated the samples for presence and amount of eDNA. Presence of eDNA was detected in more than 97% of the samples from populated mesocosms. Surprisingly, eDNA amounts for *L. pipiens* were double those for *L. sylvaticus* at a given biomass. Despite this, the two species were comparable in their rate of eDNA increase across development. Both species ceased to be detectable five days after having been removed from the mesocosm (this did not vary with tadpole density). These findings add to a growing number of studies that have found that eDNA may reliably provide insights into population density if proper species-specific calibrations are performed.

Breton, B.-A. A., L. Beaty, A. M. Bennett, C. J. Kyle, D. Lesbarrères, S. Torres Vilaça, M. J. H. Wikston, C. W. Wilson, and D. L. Murray. Testing the effectiveness of environmental DNA (eDNA) to quantify larval amphibian abundance. Environmental DNA (*in press*). https://doi.org/10.1002/edn3.332.

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The following Current Research summaries were submitted by undergraduate students (as noted) enrolled in Herpetology at Ohio Wesleyan University, under the supervision of Dr. Eric Gangloff. They have been edited for content, formatting, and sentence structure.

Specialist versus Generalist Morphology in *Mediodactylus kotschyi*

(*contributed by McKenna M. Roush*)

This study sought to identify whether conspecifics occupying different niches demonstrate specialist or generalist morphology. In Greece, Kotschy's Geckos (*Mediodactylus kotschyi*) occupy a variety of environments, from mainland forests to small rocky islands off the coast, that vary in structural habitat. A total of 211 individuals were collected from seven populations. At the time of capture, researchers documented which substrate they were located on (rock or tree), and measured each individual's body structure and limb morphology. Then, they conducted experiments to determine substrate preference and clinging ability to different substrates (rock and tree bark). Substrate preference was measured by placing geckos in terraria containing both substrate types, then measuring how much time individuals spent on each surface. Clinging ability was measured using a spring scale, corrections being made for individual mass and sex. All geckos, regardless of capture location, demonstrated a preference for trees. Hence, substrate preference was not correlated with the gecko's occupied microenvironment. This may suggest that *M. kotschyi* is opportunistic in how they utilize their environment. Analysis of morphology found that tree-dwelling geckos possessed longer second manual digits and rear limbs. The authors theorize that arboreal lizards with long hind limbs can increase their sprawl, giving them a low center of gravity. However, these differences did not increase arboreal geckos' clinging performance in comparison to terrestrial individuals, suggesting that this trait may be an evolutionary response to another environmental factor. Regardless of morphology, all individuals were found to cling equally well to trees, while individuals that clung better to rocks possessed longer fourth manual and pedal digits. More research is necessary to determine why this is. These findings demonstrate that conspecifics may possess different traits that enhance certain abilities, making it difficult to categorize the entire species as specialist or generalist. The authors of this study call for the use of a specialist–generalist gradient, rather than a dichotomy, to be applied with respect to specific traits. The data collected here suggest that most of the morphological differences between individuals were not functionally oriented towards enhancing clinging ability, so further study could shed light on the purpose of this differential morphology, as well as how Kotschy's Geckos utilize their environment.

Schwarz, R., G. Stark, A. Antonopolous, Y. Itescu, P. Pafilis, D. G. Chapple, and S. Meiri. 2021. Specialist versus generalist at the intraspecific level: functional morphology and substrate preference of *Mediodactylus kotschyi* geckos. Integrative and Comparative Biology 61:62–75.

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Insight into Thermal Behaviors in Sand-dwelling Lizards

(*contributed by Alan Cohn*)

Without the ability to attain correct body temperature, ectotherms such as reptiles wouldn't be able to move, hunt, or grow properly. This can be especially difficult in thermally challenging environments, such as deserts. These researchers examined the thermoregulation of a sand-dwelling species of lizard, the Shoulder Tree Iguana (*Liolaemus scapularis*), in the deserts of Salta province, Argentina, to gain knowledge of factors affecting their behavioral thermoregulation. The researchers tested two hypotheses in this experiment: 1) *L. scapularis* is an active thermoregulator that uses different microenvironments with different amounts of sun exposure, and 2) thermal biologies will vary depending on sex, body morphology, and seasonal changes. To test their ideas, the researchers captured lizards in their natural habitat, measuring body mass, snout-vent length, body temperature, air temperature, substrate temperature, and amount of sun exposure at capture sites (classified as total exposure, partial exposure, and shade). In the lab, they then measured the lizards' preferred body temperature and the range of set body temperatures. The data supported their first hypothesis but not their second. *L. scapularis* is an active thermoregulator species, meaning these lizards moved back and forth from areas with different amounts of sun exposure to adjust their body temperature. This was supported by the positive correlation between the lizards' body temperature and the different environmental temperatures (air and substrate) collected from the capture sites. However, sex, body morphology, and seasonal changes did not cause differences in the body temperature among the subjects. In conclusion, these researchers determined that *L. scapularis* is a species that regulates its own body temperature by moving to different locations with differences in air and substrate temperatures to maintain a set temperature in their body while living in extreme desert conditions. These results are important because they show that a reptile's daily routine can be affected by their surrounding environment, giving us an insight on the daily behaviors of these reptiles as well as their environmental needs to adequately thermoregulate.

Salva, A. G., C. I. Robles, and M. J. Tulli. 2021. Thermal biology of *Liolaemus scapularis* (Iguania: Liolaemidae) from Argentinian northwest. Journal of Thermal Biology 98:102924.

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Monitor Lizard Cognition and Predation Style Impacted by Invasive Toad Species

(*contributed by Katherine E. Walter*)

Invasive species are known to impact both native predators and prey species. In the case of a poisonous or toxic invasive species, native species must learn to avoid this invader, potentially developing higher cognitive functioning in order to do so. Cane Toads (*Rhinella marina*), a poisonous invasive species in Australia, may exert such selective pressures on native apex predators, such as Lace Monitor Lizards (*Varanus varius*). Researchers suspected that higher cognitive functioning of the monitor lizards would be associated with 1) living in a population that had been invaded by cane toads, and 2) living in a population that had been invaded for a longer period of time. In order to test the cognitive functioning of the monitor lizards, the researchers designed several puzzles containing food and placed them in 17 different sites along the Eastern coast of Australia, 11 of which had been invaded by cane toads for varying amounts of time. Remote cameras were set up in order to record when a lizard approached the puzzle, whether the lizard completed the puzzle, how long the lizard took to complete the puzzle, and the approximate snout-vent length of the lizard. Surprisingly, solving the puzzle was negatively associated with how long cane toads had been present in the population. Time taken to solve the puzzle, meanwhile, was positively correlated with how long cane toads were present. The researchers suggest that this unexpected result may be less about the cognitive ability of the lizards, and more about their unique predation tendencies. The lizards that have lived with invasive Cane Toads the longest may need to be more cautious in order to obtain food. This would explain why fewer of them solved the puzzle, and those that did took longer to do so. Predators learning to avoid an invasive species may need to be more cautious in novel situations in order to survive.

Pettit, L., G. Ward-Fear, and R. Shine. 2021. Invasion of cane toads (*Rhinella marina*) affects the problem-solving performance of vulnerable predators (monitor lizards, *Varanus varius*). Behavioral Ecology and Sociobiology 75:39.

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Tooth Variation in *Boa constrictor* Plays a Role in Striking Behavior

(*contributed by Sam Villasenor*)

Although the snake bite has been widely researched regarding fangs and venom, the functions of other teeth have been overlooked in all snake species. Previous research on fish has shown that distinguishing between homodonts (individuals that have teeth of similar form) and heterodonts (individuals that have multiple tooth morphologies) may not be as simple as it seems; the similar teeth of homodonts may have more of a function in feeding than previously thought. In this study, the researchers tested the functionality of teeth in homodonts within the species *Boa constrictor*. They hypothesized that the morphology of teeth would vary based on position within the mouth and would therefore determine the strike mechanics of the snake. The research-

ers collected data from both live animals and museum specimens and assessed many morphological characteristics such as lower jaw length, the length and width of the head, and eye diameter. They also performed a tooth shape analysis and examined different aspects of feeding strikes such as the maximum gape angle, region of first contact with the prey item, and velocity of the strike. They determined that there was great variation in tooth shape between and within different regions of the mouth, particularly between the maxilla and mandible. They also found that the lower jaw made first contact with the prey in the majority of the strikes, while in the remainder of the observed strikes both the lower and upper jaw made contact simultaneously. For both types of strikes, they found that the region that made this contact was restricted to a few teeth. By examining the tooth shape and the kinematics of the predatory strike, the researchers concluded that there was a relationship between tooth morphology and feeding behavior in *B. constrictor*. These results support the hypothesis that teeth in homodonts serve different purposes and therefore have an effect on prey capture performance.

Ryerson, W. G. and T. Van Valkenburg. 2021. Linking tooth shape to strike mechanics in the *Boa constrictor*. Integrative and Comparative Biology 61:759–771.

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Liolaemus leopardinus Lizard Prey and Parental Behaviors Examined

(*contributed by Abby Doza*)

This study focused on *Liolaemus leopardinus*, a social and group-living lizard species found in a variety of habitats throughout central Chile. *Liolaemus leopardinus* are medium-to-large sized, temperate climate lizards with a long life span (over ten years). The researchers hypothesized that avian predation risk would be higher for smaller lizards and lizards out in the open. The experiment used clay model lizards of three different sizes (small, medium, and large) to measure predation based on lizard size and in different habitats (bush, rock, and ground). They set up the model lizards in the habitats and recorded the number of predatory bird attacks that occurred for each sized model lizard. The results showed significantly more attacks on the small model lizard than the medium and large model. The model lizards on rock or ground were attacked significantly more than model lizards in bushes. The researchers also investigated parental care by attaching radio transmitters on pregnant females to measure their location. They found that although adults typically occupied exposed positions on rocks, gravid females sought out and gave birth beneath flat rocks among vegetation. The authors used a borescope to watch the activity inside the natal chamber. They found that *L. leopardinus* exhibit parental care for their neonates. For example, the females were agitated and bit the borescope, indicating they were protecting their neonates. The females stayed with the neonates for at least 24 h after they were born and aided them in coming out of their embryonic sac. Once the mother left the natal chambers, she would cover the opening in soil which protected the neonates from predators. The mothers stayed close to the natal chamber for 3–5 d. The experimental design can be adopted and used to study predation and parental care within different *L. leopardinus* populations or other species.

Santoyo-Brito, E., S. Perea-Fox, H. Nunez, and S. Fox. 2021. Maternal care and secretive behaviour of neonates in the highly social lizard *Liolaemus leopardinus* from the central Chilean Andes may relate to size-specific bird predation. Behavior 158:195–223.

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Social Cues in *Gopherus polyphemus* with Respect to Mental Gland Secretions

(*contributed by Nebraska White*)

In many species, multiple sensory modalities (visual, olfactory, auditory, etc.) are important to social behaviors. However, the role of input from multiple senses is understudied in most reptilian taxa. In this study, researchers investigated Gopher Tortoises (*Gopherus polyphemus*) and their ability to use both visual input and chemical signals to garner information about the species, sex, and individual qualities of other animals. For Gopher Tortoises, one such possible source of chemical cues could be secretions from seasonally enlarged mental glands. Researchers evaluated both sexes in a paired choice presentation of mental gland secretions as compared to distilled water on resin tortoise models to evaluate the response to a tortoise model with tortoise-specific secretions. They quantified behaviors of animals in each treatment to investigate if mental gland secretions present recognizable olfactory information. The study showed that both sexes spent more total time and exhibited a greater number of behaviors towards the mental gland secretion treated model in comparison to the distilled water treated model. This suggests that olfactory mental gland secretions are required along with the visual presence of a tortoise in order to engage in social behaviors. Their results are part of the first few for this species that suggest that pheromone use may be a main factor contributing to the drive of social interactions. This study is the first to show that Gopher Tortoises of both sexes engage in social behaviors in response to mental gland secretions, suggesting that visual and olfactory cues work in conjunction to stimulate social behavior in this species.

Kelley, M. D. and M. T. Mendonça. 2021. Mental gland secretions as a social cue in gopher tortoises (*Gopherus polyphemus*): tortoise presence stimulates and maintains social behaviour with chemical cues. Acta Ethologica 24:1–8.

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