

Institute for Conservation Medicine Newsletter

Summer 2022



Research Projects

Box Turtles

The St. Louis Box Turtle Project turned 10 years old in April! We've recently added six new turtles to the study; however, we were saddened to find that Minkks, a turtle we've been following for six years, did not survive the winter brumation period. That period was especially difficult this year as we had warmer temperatures; it tempted the turtles to come up early, only for them to be faced with harsh cold weather.

Microbiome Project



After a lot of preparation, we were excited to begin fieldwork for the box turtle microbiome project. This is a collaboration with Dr. Fangqiong Ling of Washington University in St. Louis (WUSTL) and is largely funded from a Living Earth Collaborative grant. The first goal of this study is to establish baseline microbiome compositions of box turtles at both Forest Park and Tyson Research Center. The second goal is to evaluate if changes in microbiome composition correlate to changes in environmental or health parameters between the two populations. Eight radiotagged box turtles at both sites are being sampled once per month until winter brumation (three sampling periods done!) with swabs collected from each turtle from their feet, cloaca and mouth. Our ICM veterinary team, including Dr. Laura Budd, our new part-time wildlife veterinarian

(read more about Laura under "People") are leading the fieldwork along with our four summer interns, while Kathleen Apakupakul, Fangqiong, and WUSTL postdoc Dr. David Mantilla Calderon will be heading up the molecular analyses.



Box Turtle Racing

If you live in the Midwest, you've probably heard of box turtle races. They are popular not only at local festivals, but also at fundraisers and scouting events. Unfortunately, these races are not so fun for the turtles themselves. The turtles are typically removed from the wild for the race, and then returned to the nearest green patch afterwards, often nowhere near their original habitat. Our human eyes might think all parks are the same, but from a turtle's point of view, they are very different, and they do not appreciate being displaced from their home. ICM has partnered with Dr. Andrea Darracq of Murray State University to study the effects of these races on the turtles. In 2021, Drs. Sharon Deem and Maris Brenn-White traveled to Kentucky to work with Andrea and her team to sample 26 box turtles collected from a local race. Following infectious disease testing results (all negative!) and radiotag placement, these turtles were released in a nearby state park. In April 2022, Jamie Palmer and Rimsha Malik, ICM intern, headed back to Kentucky to sample these turtles a second time. Andrea's lab will follow these turtles for two years, and Kathleen Apakupakul will run infectious disease diagnostics in our molecular lab. ICM and Dr. Darracq have applied for an AZA SAFE (Association of Zoos and Aquariums Saving Animals From Extinction) grant to provide funding for this important study. Fingers crossed! Once all health data are collected and analyzed, we will conduct outreach to educate the public about the harmful effects these races have on turtle conservation.



Galapagos Tortoises

The Galapagos Tortoise Movement Ecology Programme (GTMEP) team is also busy in the field. After checking in with our tagged tortoises on Alcedo Volcano and Española Island, we learned that they are all alive and doing well. Over 100 giant tortoise samples suspected



of harboring viruses have been sequenced in Spain, and an additional 75 samples were sent to our collaborator Franz Zehetner in Austria to test for harmful pesticides. A total of 50 baby tortoises were also tested for adenovirus and herpesvirus, and preliminary results have suggested that they might be carrying adenovirus. The GTMEP work epitomizes the One Health approach to conservation of these iconic species as we identify impacts of humans living in close proximity to the wild tortoises and how changes to the environment (e.g., fencing, pesticide use, plastic pollution) can impact their health. A recent study conducted by a student in the Galapagos showed that fecal samples from tortoises living near urban areas contain plastic debris as well as other human waste such as discarded face masks. These results are helping to advise local management actions to control plastic pollution near towns.



At the end of 2021, we were able to secure funds from the Saint Louis Zoo and a generous donor to purchase a portable radiography machine. After collaborating with the Zoo's Departments of Animal Health and Herpetology to test the machine during a routine exam on the Aldabra tortoise at the Zoo, Dr. Stephen Blake took the equipment to the Galapagos where he, Dr. Ainoa Nieto Claudin, Freddy Cabrera and others used it to examine giant tortoises in the wild. Dr. Sharon Deem, Stephen, and Emily Donovan, a Ph.D. student at SIU-Carbondale, will return to the Galapagos this summer to use the equipment for tortoise reproductive fitness research.

Going Wild in Forest Park

Did you know Forest Park is larger than Central Park? While the latter may be more famous, if you've taken a walk through Forest Park, you've seen the diversity of wildlife in our beloved urban park. As mentioned in our 2021 summer newsletter, ICM is part of "Going Wild in Forest Park," a collaborative research project involving many species to study movement ecology, understand disease prevalence and transmission, and educate the public about the remarkable wildlife in the heart of our city.



Of course, our tagged box turtles and snapping turtles are part of this study, and to date we've also placed a telemetry tag on Astrid (a great horned owl) and conducted health assessments and placed radio collars on four raccoons. The movement data from Astrid is amazing, and the health data from the raccoons will be added to our growing database on urban wildlife health. The next species of interest for sampling and tagging are water birds such as great egrets, herons, mallards and wood ducks. We will keep you posted on our wildlife friends in our favorite park.





New World Canid Conservation Initiative



As described in the 2021 winter newsletter, the Canid Conservation Initiative is a collaborative research project focused on critical conservation issues for native Missouri canids (e.g., coyotes, red foxes, gray foxes) and other carnivores (e.g., bobcats, raccoons, opossums). This research is being led by Dr. Fernando Najera and involves studying species at both the Saint Louis Zoo WildCare Park and Tyson Research Center to answer questions about the animals' land use and health status, and to evaluate the presence of pathogens for zoonotic, viral and vector-borne diseases. So far we've captured two red foxes, two bobcats, 12 raccoons and 17 opossums. The foxes and bobcats have GPS collars, and all animals received full health assessments.



When tracking box turtles, we use radio telemetry to find their location, then manually record their coordinates where they are found. Since carnivores are highly unlikely to sit still as we move toward them, their GPS collars record the animal's location every four hours, and the data are downloaded remotely. However, we still need to get close enough to download the data, and this is easier said than done since bobcats and foxes move much faster than turtles and cover very large territories. We therefore place a radio receiver on the roof of a truck and drive around in their known range, hoping to pick up a signal. Once a signal is received, a hand antenna is used to get close enough to download the data. The bobcats (Bobby and Timmy) both range throughout Tyson and across Highway 44.

In addition to these physical assessments, we also use remote cameras at Tyson and WildCare Park to better understand the behavior and habits of these animals. The cameras are placed in areas heavily used by wildlife, which may include open trails and gaps in fencing or trees. Our camera traps have captured excellent footage of coyotes, red foxes and bobcats at both locations, and volunteers are analyzing these photos to get a better understanding of each species' land use.



Education & Outreach

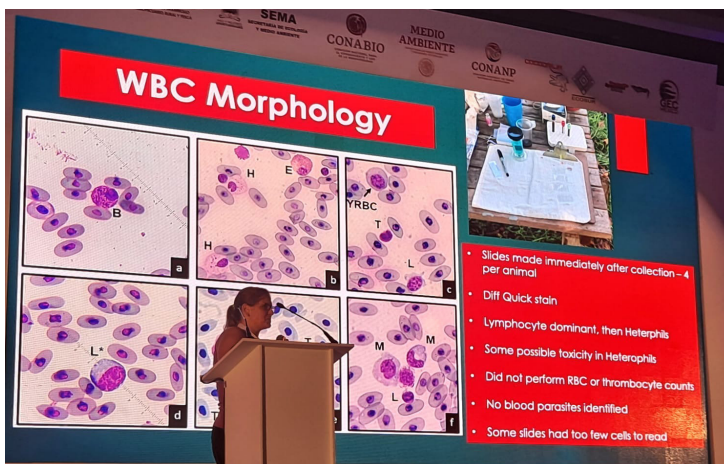
Dr. Sharon Deem and the ICM team love to spread the One Health message to students of all ages, the general public and other scientists. When COVID-19 made this difficult, we quickly adapted to virtual technology and became familiar with more hosting platforms than we even knew existed. Beginning this spring, we were thrilled to start in-person interactions again; just a few of the many events are listed below:

- A presentation to our Saint Louis Zoo WildCare Park neighbors in north St. Louis County about the Canid Conservation Initiative. Unfortunately, this was still virtual; however, we look forward to meeting new friends and neighbors in person soon.
- Dr. Fernando Najera's blog on the canid work, including a great video of Timmy the bobcat, was added to the Saint Louis Zoo website and shared on the Zoo's social media. Washington University in St. Louis also included it in their daily Record post. [stlzoo.org/about/blog/2022/04/20/canid-conservation-initiative](https://www.stlzoo.org/about/blog/2022/04/20/canid-conservation-initiative).



- The Framing Our Future video was placed online by HEC – TV and is also available on YouTube. This video is an in-depth interview with Sharon about nature-based solutions to address the challenges of climate change, the loss of biodiversity and emerging infectious diseases.
- Martin Clunes, Islands of the Pacific Episode 3 featured the Galapagos Islands and highlighted the Galapagos Tortoise Movement Ecology Programme, including Dr. Ainoa Nieto Claudin and Freddy Cabrera.
- The first education book aimed at younger children (5 to 8 years old) and based on the Galapagos Tortoise Movement Ecology Programme work is now available through the Galapagos Conservation Trust. “Tessa the Giant Tortoise” by Sarah Langford is free for all Galapagos schools and teachers. If interested, visit galapagosconservation.org.uk/get-involved/tessa-the-giant-tortoise to learn more.

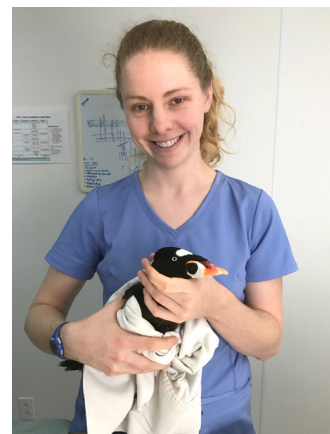
- Nate Phillips, one of our ICM summer students, is writing a weekly blog as part of his internship experience and these posts provide a fun and informative look at the life of an ICM intern. You can find his posts at blogs.cornellcollege.edu/cornell-fellows/category/2021-2022/nate-phillips-23
- Interest in our turtle safaris has significantly increased this year. After almost two years of missing out on interactive events, families are eager to sign up for this immersive nature experience with Keri Lammering, Saint Louis Zoo Conservation Education Liaison and ICM liaison. Participants get to track a box turtle with Keri and visually examine it up close. So far this year, Keri has led 16 turtle safaris and taken about 80 people (children and adults) into Forest Park. Such experiences are one of many reasons we refer to our box turtles as nature’s ambassadors.



- Together with the Galapagos Conservation Trust and Ecology Project International, we conducted education activities with local students from 12 to 18 years old. These included tortoise safaris, working in the laboratory, and learning about tortoise anatomy and movement ecology.
- Dr. Lilian Catenacci gave a talk titled “Biodiversity and One Health: All Connected” on February 24 for the Fundação Oswaldo Cruz, and it can be found on the FioCruz YouTube channel.
- Lilian also gave a talk titled: “Perspectives of Women in Science” on May 25 for the Instituto Federal do Norte de Minas Gerais. It can be found on the “30 Wi-Sci” YouTube channel.
- World Turtle Day was May 23, and the Zoo posted informative social media posts bringing awareness to issues facing turtles and tortoises around the world.

PEOPLE & PLACES

ICM said goodbye to Dr. Maris Brenn-White in December as her fellowship ended. It was invaluable having Maris on our team for three wonderful years as she worked on research related to camels in Kenya, radiated tortoises in Madagascar, vultures in South Africa, and various local chelonians and amphibian projects. Maris’ veterinarian and people skills, public health background, and attention to detail made her a joy to work with, and she was an asset to the various collaborative projects with our partners.



Dr. Laura Budd joined us on May 9 as a temporary part-time wildlife veterinarian. She hit the ground running participating in the raccoon captures in Forest Park and is working on both the box turtle project and the microbiome research. Fall possibilities are yet to be determined, and we hope to secure additional funding to allow Laura to remain with us beyond the fall.

We are proud to tell you that Dr. Lilian Catenacci, our adjunct colleague in Brazil, was selected as a 2021 laureate for Women in Science from L’Oréal Brazil in partnership with the United Nations



Educational, Scientific and Cultural Organization in Brazil and The Brazilian Academy of Sciences. Lilian leads surveillance activities on arboviruses and antimicrobial resistance in wildlife and domestic animals in Brazil. She also just completed a three-month sabbatical in Belgium working with colleagues at the Antwerp Zoo and Federal University of Piauí State.



In student news:

Rimsha Malik completed her eight-month Princeton-funded internship with ICM in May. It was great to have her for the extended period, and we wish her well as she starts Cornell Veterinary College this fall.

- Josie Alexander, our summer 2021 intern who continued working with Kathleen Apakupakul one afternoon each week in the molecular lab, left ICM in May after graduating from Washington University in St. Louis.
- We are lucky to have four new summer interns – Brianna Hawkins, Carly Etter, Erin Sedlacek and Nate Phillips – to help us with our local conservation research, including the microbiome project; turtle tracking at the Saint Louis Zoo WildCare Park, Forest Park and Tyson Research Center; and the canid conservation work.



Publications

Everyone knows the phrase “when life gives you lemons, make lemonade.” Well if COVID-19 has been two years of lemons, then an astounding number of published articles would be ICM’s lemonade. While the ICM researchers were frustrated to postpone or cancel planned fieldwork and conservation-related travel, we used that time to analyze data, write articles, respond to editors and see their work published in numerous journals.

Two new articles on findings from the Galapagos Tortoise Movement Ecology Programme:

Blake S, Deem S, Nieto-Claudin A, Cabrera F. The Galapagos Tortoise Movement Ecology Programme: what have we learned about tortoise movement and what does it mean for conservation? *Testudo* Vol. 9 No. 3.

Pike, K.N., Blake, S., Gordon, I.J., Cabrera, F., Nieto-Claudin, A., Deem, S.L., Guezou, A., Schwarzkopf, L. Sharing land with giants: Habitat preferences of Galapagos tortoises on farms. *Global Ecology and Conservation* 37.

The consequences of common parasitic infections in wild animals on terrestrial ecosystems:

Koltz, A.M., Civitello, D.J., Becker, D.J., Deem, S.L., Classen, A.T., Barton, B., Brenn-White, M., Johnson, Z.E., Kutz, S., Malishev, M., Preston, D.L., Vannatta, T., Penczykowski, R.M., and Ezenwa, V.O. 2022. Sublethal effects of parasitism on ruminants have cascading consequences for ecosystems. *Proceedings of the National Academy of Sciences*.

Description of new herpesvirus found in tortoises in Texas and California and box turtles in Missouri:

Winter, J.M., Wellehan, J.F.X., Apakupakul, K., Palmer, J., Brenn-White, M., Standorf, K., Berry, K.H., Childress, A.L., Koplos, P., Garner, M.M., and Deem, S.L. A novel herpesvirus detected in 3 different species of chelonians. *Journal of Veterinary Diagnostic Investigation*.

A comparison between box turtles in Forest Park to those at Tyson Research Center:

Lamczyk, B.A., Palmer, J.L., Kozłowski, C.P., Blake, S., and Deem, S.L. No difference in corticosterone concentrations between Missouri three-toed box turtles living in an urban and a rural site. *Human Wildlife Interactions*.

Important information about the health and conservation of threatened radiated tortoises:

Brenn-White, M, Raphael B.L, Rakotoarisoa, N.Y.T, Deem, S.L. 2022. Hematology and biochemistry of critically endangered radiated tortoises (*Astrochelys radiata*): reference intervals in previously confiscated subadults, baseline values in free-living tortoises, and variability based on common techniques. *PLoS One*.



A One Health publication co-authored with colleagues from Kenya in a high impact journal:

Worsley-Tonks, K., Bender, J.B., Deem, S.L., Ferguson, A.W., Fèvre, E.M., Martins, D.J., Muloj, D.M., Mutinda, M., Murray, S., Ogada, D., Omondi, G.P., Prasad, S., Wild, H., Zimmerman, D.M., and Hassell, J. Strengthening global health security by improving disease surveillance in remote rural areas of low- and middle-income countries. *The Lancet Global Health*.

A manual to guide researchers working in the field with small Neotropical primates:

Catenacci, L., Raboy, B.E., Oliveira, L., Guidorizzi, C.E., Neves, L.G., Suscke, P, Deem, S.L., and De Vleeschouwer, K. 2022. Golden-headed lion tamarins, *Leontopithecus chrysomelas* (Kühl, 1820): 27 years of experience in methods for their capture and collection of biological materials. *Primate Conservation* 37.

Perceived COVID-related challenges to conservation work at the Saint Louis Zoo

Fine, L., Barnes, C., Niedbalski, A., and Deem, S. L. 2022. Staff perceptions of COVID-19 impacts on wildlife conservation at a zoological institution. *Zoo Biology*, 1–10.

A review of scientific literature to determine the major reported causes of disease and death in free-living vultures worldwide:

Ives, A.M., Brenn-White, M., Buckley, J.Y., Kendall, C.J., Wilton, S., and Deem, S.L. 2022. A Global Review of Causes of Morbidity and Mortality in Free-Living Vultures. *EcoHealth*.

The first description of certain parasites in free-living golden-headed lion tamarins:

Catenacci, L., Oliveira, J.B.S., de Vleeschouwer, K.M. de Carvalho Oliverira, L. Deem, S.L., de Sousa Júnior, S.C., and dos Santos, K.R. 2022. Gastrointestinal parasites of *Leontopithecus chrysomelas* in the Atlantic Forest, Brazil. *Brazilian Journal of Veterinary Parasitology*.

A description of the novel viral sequence found in five species of Galapagos tortoises:

Nieto-Claudin, A., Esperón, F. Apakupakul, K., Peña, I., and Deem, S.L. 2021. Health assessments uncover novel viral sequences in five species of Galapagos tortoises. *Transboundary and Emerging Diseases*.

A large scale, long term surveillance of the emerging zoonotic hepatitis E in the Iberian lynx:

Caballero-Gómez, J., Rivero-Juarez, A., Zorrilla, I., López, G., Nájera, F., Ulrich, R.G., Ruiz-Rubio, C., Salcedo, J., Rivero, A., Paniagua, J. and García-Bocanegra, I., 2022. Hepatitis E virus in the endangered Iberian lynx (*Lynx pardinus*). *Transboundary and Emerging Diseases*.

Book chapters:

Najera, F. 2022. Chapter 13 “Trapping Carnivores: The Role of Physiological Parameters as Capture Stress Response Biomarkers” in *Mammal Trapping -Wildlife Management, Animal Welfare & International Standards*. Published by Alpha Wildlife Publications.

Najera, F. and Hearn, A.J. 2022. Chapter 16 “Assessing Welfare while Capturing Free-ranging Sunda Clouded Leopards (*Neofelis diardi*) by Cage-traps: Effects of Physical Restraint on Serum Biochemistry” in *Mammal Trapping - Wildlife Management, Animal Welfare & International Standards*. Published by Alpha Wildlife Publications.

Najera, F., del Rey-Wamba, T and Lopez, G. 2022. Chapter 16 “Trapping within The Context of Conservation and Reintroduction Programs: The Iberian Lynx (*Lynx pardinus*) as A Case Example” in *Mammal Trapping - Wildlife Management, Animal Welfare & International Standards*. Published by Alpha Wildlife Publications.

All of these publications, except the book chapters, may be found on the ICM page on the Saint Louis Zoo website under the tab “Publications.” If you would like a copy of any of these articles, please feel free to contact any of the ICM staff.

To learn how you can contribute to the work of the ICM, contact Director Dr. Sharon Deem at (314) 646-4708 or deem@stlzoo.org.

For more information on the Institute for Conservation Medicine, visit stlzoo.org/icm.



Saint Louis Zoo

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