95th Annual Meeting of the German Society for Mammalian Biology (Deutsche Gesellschaft für Säugetierkunde e.V.)

19 – 22th September 2022
Hamburg

Institute for Cell and Systems Biology of Animals, Universität Hamburg
and Leibniz Institute for the Analysis of Biodiversity Change,
Martin-Luther-King Platz 3, 20146 Hamburg, Germany

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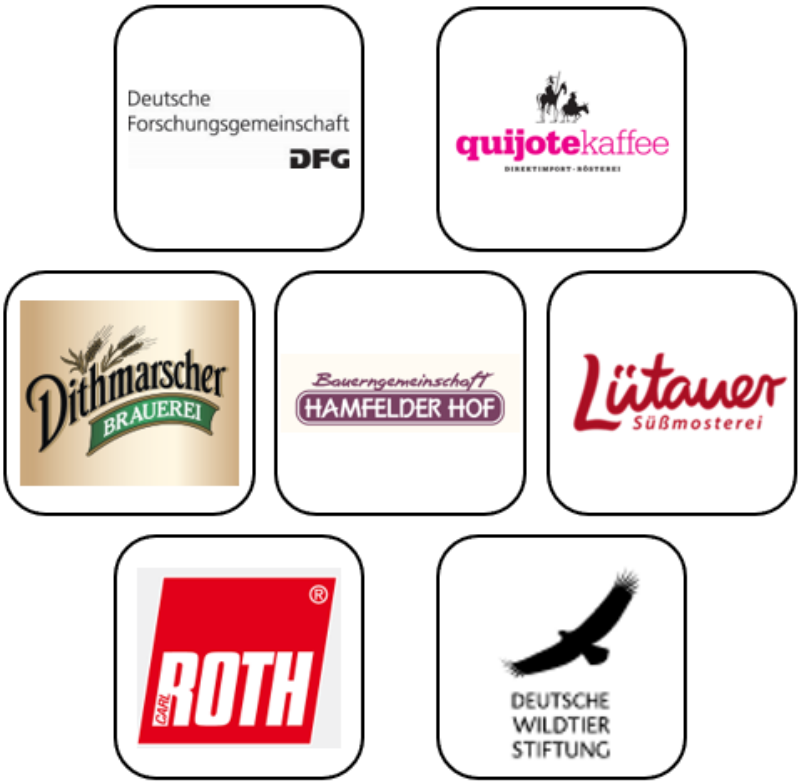

Organizing committee: Sabine Baumann, Kathrin Dausmann, Jennifer Drechsler, Jörg Ganzhorn, Julian Glos, Veit Hennig, Johanna Hollensteiner, Thomas Kaiser, Tobias Lenz, Mario Märzke, Hermann Müller, Pablo Narezo Guzman, Peter Steiner, Sabine Toussaint, Esther Verjans, Arnhild Woltmann and many helping hands.

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Program

Monday, September 19 2022

Venue: Institute for Cell and Systems Biology of Animals (IZS), Universität Hamburg and Leibniz Institute for the Analysis of Biodiversity Change (LIB), Martin-Luther King Platz 3

All talks will be given in the "Großer Hörsaal" of the IZS.
Posters are being presented throughout the meeting in the Entrance Hall in front of the lecture hall.

15h00 – 17h00	DGS Board meeting Room 456/457 (4th floor above the museum)
17h00 – 18h00	Curators' meeting Room 456/457 (4th floor above the museum)
17h00	Registration (at the entrance to the Institute, Martin-Luther-King Platz 3)
18h00	Welcome address of the CEO of IZS: **Kathrin Dausmann** - Hamburg
	Chair and Introduction: **Harald Schliemann** - Hamburg
18h15	**Evening lecture** **Vincent Nijman** - Oxford: *Wildlife trade, trafficking and Covid-19*
19h00	Ice breaker Welcome address: **Alexander Haas**- LIB Snacks and Drinks in the Schaumuseum of the Leibniz Institute for the Analysis of Biodiversity Change

Tuesday, September 20 2022, morning

8h00	Registration (IZS, Ground floor in front of the lecture hall "Großer Hörsaal")
9h00	Opening of the conference by the President of the DGS: **Frank Zachos** -Vienna
	Chair: **NN**
9h10	**Plenary** **Simone Pika** - Osnabrück *Animal cognition: from corvids and chimpanzees* Associated with an exhibit of drawings by mammals from horses to chimpanzees (collection of Rüdiger Höflechner, Graz) in the Schaumuseum of the Leibniz Institute for the Analysis of Biodiversity Change
10h00	**Kai R. Caspar**, Pavel Stopka, Daniel Issel, Kristin Katschak, Till Zöllner, Sina Zupanc, Petr Žáček, Sabine Begall – University of Duisburg-Essen *Perioral secretions enable complex social signaling in African mole-rats (genus* Fukomys*)*
10h20	**Martin Schmelz**, Friederike Schröder, Dario Wallraff - OTTER-ZENTRUM, Hankensbüttel *The Otter Spotter – how to survey and monitor an elusive species*
	Coffee Break 10h40 – 11h10
	Chair: **Thomas Kaiser**
11h10	**Marketa Kaucka Petersen** – Max Planck Institute for Evolutionary Biology, Plön *Development of the mammalian skull*
11h30	**Ana M. Balcarcel**, M. Orliac, Marcelo R. Sánchez-Villagra – University of Zurich *Brain and skull evolution in selected Artiodactyla: Form changes in microevolution and macroevolution*
11h50	**Keesha Martin Ming,** Madeleine Geiger, Georgios Georgalis, Torsten M. Scheyer, Marcelo R. Sánchez-Villagra – University of Zurich *The curious cases of insular dwarfism in horses: Comparative morphology of Greek horses from Skyros and Rhodes*
	Lunch 12h10 – 13h40 Not included in registration fees. There are plenty of "take aways" and restaurants in the immediate vicinity of the Martin-Luther-King Platz 3

Tuesday, September 20 2022, afternoon

13h40	**Thomas Breuer** – WWF *African Forest Elephants – outlook for coexistence and recovery of a critically endangered species*
14h00	**Mammal Population Monitoring for Conservation** Organized by PJ Stephenson Chair, IUCN SSC Species Monitoring Specialist Group Laboratory for Conservation Biology, University of Lausanne, Switzerland
14h00	**Plenary** **PJ Stephenson** – University of Lausanne *Population monitoring for conservation*
14h30	**Janika Wendefeuer**, Mattia Bessone, Kouame Paul N'Goran, Terence Fuh Neba – WWF *Wildlife monitoring challenges in the central African forest*
	Jenifer Hatlauf - University of Natural Resources and Life Sciences, Vienna *Monitoring golden jackals* (Canis aureus) *using bioacoustics, cameras and conservation dogs*
	Anita Gilles – University of Veterinary Medicine Hannover at Büsum *Monitoring of marine mammals*
	Andreas Wilting, T.V. Nguyen, J. Axtner, A. Ngyuen, A. Tilker - Leibniz Institute for Zoo and Wildlife Research, Berlin *Bloodsuckers for conservation: Prospects and pitfalls of environmental DNA as a survey and monitoring tool for mammals*
15h50	**Coffeebreak and Postersession** **!!! Marzipan contest !!!** **Udo Rempe**
19h00	**Conference Dinner 19.h00** Blockbräu at Landungsbrücken: overlooking the Elbe and harbor Best to get there with the S-Bahn S1 if you are in town or the U-Bahn U3 from the metro station "Schlump" in case you start at the institute

Wednesday, September 21 2022

	Chair: **Tobias Lenz**
9h00	**Plenary** **Jenny Tung** - Duke (Durham, NC) and MPI Leipzig *The social determinants of health and survival in wild primates*
9h50	**Rainer G. Ulrich**, Dennis Rubbenstroth, Calvin Mehl, Viola Haring, Claudia Wylezich, Dirk Höper, Florian Pfaff, Martin Beer - Friedrich-Loeffler-Institut, Greifswald-Insel Riems *Searching for zoonotic and animal encephalitis pathogens in small mammals*
10h10	**Ulla Lächele**, Peter Giere – Museum für Naturkunde, Berlin *Genotypic projection under scrutiny: The vomeronasal organ of semiaquatic mammals*
10h30	**Juan Olvido Perea-García** - Leiden University, Netherlands *Photoprotective adaptations of the primate eye safeguard epithelial stem cells in the corneal limbus*
	Coffee Break 10h50 – 11h20
	Chair: **NN**
11h20	**Stéphanie C. Schai-Braun**, Thomas Ruf, Erich Klansek, Walter Arnold and Klaus Hackländer - University of Natural Resources and Life Sciences, Vienna *Positive effects of set-asides on spring density, increment of growth, hunting bag and number of subadults in European hare* (Lepus europaeus) *populations*
11h40	**Emu-Felicitas Ostermann-Miyashita, H.** Bluhm, K. Dobiáš, N. Gandl, S. Hibler, F.-U. Michler, L. Weltgen, H.J. König, T. Kuemmerle, C. Kiffner - Leibniz Centre for Agricultural Landscape Research (ZALF), Müncheberg *Opportunities and challenges of citizen science for monitoring a recolonizing megaherbivore*
12h00	**Vera Rduch**, Thalia Jentke - Leibniz Institute for the Analysis of Biodiversity Change – Museum Koenig, Bonn *Detailed data allow for an evaluation of a dramatic decline in puku* (Kobus vardonii) *in Kasanka National Park, Zambia*
12h20	**Ariana N. Klappert**, Thalia Jentke, Vera Rduch - Leibniz Institute for the Analysis of Biodiversity Change – Museum Koenig, Bonn *More than numbers of population size: Data from line transect sampling reveal fascinating insights into the bovid community of selected areas of Zambia*
	Lunch 12h40 – 14h00 Not included in registration fees. There are plenty of "take aways" and restaurants in the immediate vicinity of the Martin-Luther-King Platz 3
	Chair: **Frank Zachos**
14h00	**Fritz-Frank Award Lecture 1** **Marcia Sittenthaler** - University of Natural Resources and Life Sciences, Vienna *Faecal samples as a tool to study otter* (Lutra lutra) *diet, density and marking behaviour in salmonid streams*
14h45	**Fritz-Frank Award Lecture 2** Recipient to be announced during the conference
15h30	**Coffee Break 15h30 – 16h00**
16h00	DGS General assembly

Thursday, September 22 2022

	Chair: **NN**
9h00	**Plenary** **Dietmar Zinner** – Göttingen *Hybridization in Primates*
9h50	**Yvonne E.-M. B. Bohr**, Azhari Purbatrapsila, Dyah Perwitasari-Farajallah, Jörg U. Ganzhorn, Stefan Merker - Universität Frankfurt and State Museum of Natural History Stuttgart *Intermediate songs and asymmetric character displacement in a tarsier hybrid zone*
10h10	**Laura Hagemann,** Nanda Grow, Yvonne E.-M. B. Bohr, Dyah Perwitasari-Farajallah, Yulius Duma, Sharon L. Gursky and Stefan Merker - State Museum of Natural History Stuttgart *Lonely at the top – the Sulawesi mountain tarsier represents an ancient lineage*
	Coffee Break 10h30 – 10h50
	Chair: **NN**
10h50	**Ana Patricia Calderon**, Patricia Landaverde-Gonzalez, Claudia Wultsch, Rebecca Foster, Volker Grimm, Stephanie Kramer-Schadt, Katherine Zeller - Leibniz Institute for Zoo and Wildlife Research, Berlin *Multiscale modelling of gene flow and functional connectivity of large carnivores in fragmented landscapes: The Central American jaguar as a model*
11h10	**Nimisha Srivastava**, John D. C. Linnell, Claudia Sattler, Barbara Schröter, Ramesh Krishnamurthy, Christine Fürst, Hannes J. König - Leibniz Centre for Agricultural Landscape Research (ZALF), Müncheberg *Finding a balance between carnivore conservation and human-carnivore interactions*
11h30	**Benjamin Gillich**, Frank-Uwe Michler, Caroline Stolter and Siegfried Rieger – University for Sustainable Development, Eberswalde *Neighbor's grass is always greener - possible interactions between livestock and local wildlife*
11h50	**William J Foley,** Philippa Beale, Ben Moore, Kara Youngentob, Karen J. Marsh – Australian National University, Canberra *Rising temperatures & herbivore nutrition: Overlooked effects of global warming*
12h10	**Closing of the conference**

Poster

In order of the numbers on the pinboard and for the Marzipan contest

1	**Stéphanie C. Schai-Braun**, Annika Posautz, Paulo C Alves and Klaus Hackländer - University of Natural Resources and Life Sciences, Vienna *Gastrointestinal parasite infestation in the Alpine mountain hare* (Lepus timidus varronis): *Are abiotic environmental factors affecting prevalence of parasite species?*
2	**Eleanor Stalenberg**, Jörg U. Ganzhorn, Andrew Krockenberger, Michael Hutchinson, William J. Foley – Australian National University, Canberra *Mechanistic models reveal the impacts of climate change on lemurs*
3	**Lea Gerstenberger**, Nicola S. Heckeberg, Albrecht Manegold - Staatliches Museum für Naturkunde Karlsruhe, Karlsruhe and Museum für Naturkunde Berlin *Identification of tiger subspecies based on craniometrics, morphological characters and geometric morphometrics*
4	**Sina Remmers,** Marie Schoroth, Stepahnie Reher, Kathrin Dausmann - Universität Hamburg *Thermoregulatory plasticity in the Malagasy bat species* Triaenops menamena
5	**Jacques S. Rakotondranary**, Maël Jaonasy, Chris Birkinshaw, Timothy M. Eppley, Tiana Filamatra Ralambomanantsoa, Mialitiana Erica Ramahatanarivo, Fanomezantsoa Laurette Ravololoniaina, Jörg U. Ganzhorn – Universität Hamburg and Université d'Antananarivo, Madagascar *Lemur communities and the distribution and abundance of the White-footed Sportive Lemur* (Lepilemur leucopus) *in southern Madagascar*
6	**Yedidya R. Ratovonamana**, Antonia Walzer, Rahery Andriatsimietry, Jana Jeglinski, Matthias Marquard, Emilienne Razafimahatratra, Simone Sommer, Jörg U. Ganzhorn - Universität Hamburg, and Association Analasoa, Tulear, Madagascar *Notes on the natural history of* Galidictis grandidieri *Wozenkraft, 1986 (Eupleridae) in the spiny forest of Madagascar*
7	**Ngawo Namukonde**, Britta Bösing, Ute Schmiedel – Copperbelt University, Zambia and Universität Hamburg *Effect of habitat and land use on small mammal communities in arid and wet regions of southern Africa*
8	**Maël F. Jaonasy**, Behevitra Laurent, Chris Birkinshaw - Missouri Botanical Garden and Université d'Antananarivo, Madagascar *Lemur inventories at the Vohidava-Betsimilaho New Protected Area*
9	**Malte Götz**, Moritz Mercker - Deutsche Wildtier Stiftung and Bionum *Sandy landscapes, tanks and wildcats – habitat patterns of* Felis silvestris *at its northern range*
10	**Sebastian Brackhane**, Bernd Ihle, Hartmuth Mohr, Bettina Saier, Jochen Paleit, Albert Reif, Markus Dietz, Anna-Lena Hendel - Deutsche Wildtier Stiftung *Can low intensity grazing and traditional land use promote the activity and diversity of bat species in the nature conservation site Taubergießen, Baden-Württemberg?*
11	**Christine Miller**, Andreas Kinser - Deutsche Wildtier Stiftung *Hard facts or just folklore? What trophy shows tell us about chamois and humans*
12	**Klaus Hackländer**, Simon Schwienbacher, Steve Smith - University of Natural Resources and Life Sciences, Vienna *Interspecific competition within the genus* Lepus *in the Alps: Altitudinal ranges and introgression*
13	**Sarah Thivierge**, Robin Sandfort, Holger Meinig, Livia Schäffler, Johannes Lang - University of Bonn *Garden dormouse conservation: passive acoustic monitoring, sound recorders and machine learning as new useful tools*

14	**Frank P. Cuozzo**, John K. Dalton, Michelle L. Sauther, Adrian S.W. Tordiffe, Ilana van Wyk - University of Pretoria, South Africa *The dental ecology and oral biology of a population of wild* Otolemur crassicaudatus *from the Lajuma Research Centre, South Africa*
15	**Michelle L. Sauther**, James B. Millette, Frank P. Cuozzo, Channen Long, Vümboni Harry Msimango - Department of Anthropology, University of Colorado, USA *Body size effects on the behavioral ecology of two sympatric bushbabies in an Afromontane habitat*
16	**Anastasia Fadeeva**, Peggy Giertz, Emma Baltes, Tim Stoever, Yedidya R. Ratovonamana - Universität Hamburg and Association Analasoa, Madagscar *Limiting structural elements for* Microcebus griseorufus *in different habitats*
17	**Yedidya R. Ratovonamana**, Celina Apel, Herindrainy D. Hajanantenaina, Daniel Kübler, Stella Nevermann, Kim E. Steffens, William J. Foley, Jörg U. Ganzhorn - Universität Hamburg, and Association Analasoa, Tulear, Madagascar *Vegetation characteristics limiting the distribution of a folivorous lemur under changing ambient conditions*
18	**Berit A. Michler**, Mechthild Roth, Siegfried Rieger, Frank-Uwe Michler - Johann Heinrich von Thünen Institute, Braunschweig *Mammalogical field research on the population biology of the raccoon in the Müritz National Park, Germany*
19	**Marcelo Magioli**, Svenja Arlt, Wedika Hanoeman, Neda Lotfiomran, Rewie Mattai, Ariane Ooms, Thomas Püttker, Anne-Maria Schweizer, Miriam Scriba, Michael Köhl, Jörg U. Ganzhorn - Centro Nacional de Pesquisa e Conservação de Mamíferos Carnívoros (CENAP), Instituto Chico Mendes de Conservação da Biodiversidade (ICMBio), Atibaia, São Paulo, Brazil *Certified timber extraction has no effect on mammalian diversity in Suriname*
20	**Jeremias J. Schoreisz**, Paulina Meller, Ngawo Namukonde, Manfred Finckh - Free University of Berlin *The influence of mole-rats on geoxyle-grassland in central Angola*

21	**Clara Stefen**, Thalia Jentke, Heiko Stuckas, Anke Müller, Jens Jakobitz, Henrietta Atzig, Carsten Morekel, Tobias Gerlach, Jonas Thielen, Andrea Kaus-Thiel, Jan Decher, Sönke Twietmeyer - Senckenberg Naturhistorische Sammlungen Dresden *Searching the elusive – do non-invasive methods enable large-area monitoring of Mediterranean water shrews* (Neomys anomalus)*?*
22	**Sean W. Hixon**, Mikhaela Neelin, Stephanie Chan, Dominic Mayo, Caitlynn Filla, Zach J. Farris, Susan deFrance, John Krigbaum, Kim Valenta - Max Planck Institute for Geoanthropology, Jena *Dogs occupying grassy habitat near protected areas in eastern Madagascar rely on foods from forests*
23	**Jan Moritz Schnieders**, Lara-Marie Schoop, Flavia Koch, Erik Patel - Universität Hamburg *Food choice of* Propithecus candidus *(A. Grandidier, 1871) and* Propithecus verreauxi *(A. Grandidier, 1871) in relation to chemical plant components*

Abstracts of oral presentations and posters in alphabetical order

Oral presentation

Brain and skull evolution in selected Artiodactyla: form changes in microevolution and macroevolution

Ana M. Balcarcel*[1], M. Orliac[2], M.R. Sánchez-Villagra[1]

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Fossil endocrania have shown that mammalian brain evolution has been characterized by generalized increases in brain size and neocortical folding throughout geological time. Artiodactylan taxa possess some of the most gyrified brains, after primates. For camelids, Eocene to Miocene endocasts reportedly point to unique patterns of neocortical evolution that may have driven their modern brain complexity. We describe the first known camelid endocasts from the Pleistocene: of *Palaeolama* sp. and *Camelops hesternus*, plus neocortical topologies of extant camelids including wild and domestic forms, to test the hypothesis of unique brain evolution for this group. We find brain complexity increased significantly from Miocene to Pleistocene Epochs. *C. hesternus* (~44-11Kya) possessed features previously known only to extant taxa, suggesting a great capacity for information processing. A rare example of brain size reduction is that which is reported for domesticated taxa. Among domestic artiodactyls, reduction is variable (~7-41%) and we report revised estimates for 17 taxa based on new brain size estimation models, and the first analysis on domestic cattle, whose brains are ~26% smaller than the wild aurochs. We find that brain reduction also varies across cattle breeds, correlating with differences in husbandry practices which align with different degrees of human engagement and selection for docility. Using geometric morphometrics, we also describe covariation of the skull and brain in camelids and goats—groups displaying unique directions of skull shape change associated with domestication, and discuss this in the contexts of phylogeny, breeding, and environmental factors.

Oral presentation

Intermediate songs and asymmetric character displacement in a tarsier hybrid zone

Yvonne E.-M. B. Bohr[1,2,3], Azhari Purbatrapsila[4,5], Dyah Perwitasari-Farajallah[6,4], Jörg U. Ganzhorn[3], Stefan Merker[1,2]

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Natural hybridization acts like a window into evolution and can bring to light driving and inhibiting factors of ongoing speciation. Sulawesi tarsiers *Tarsius dentatus* and *T. lariang* hybridize within a narrow zone, indicating selection against hybrids. One key for choosing the "right" mate in areas of contact might be their conspicuous, species- and sex-specific duet songs: They might serve as a premating barrier, and might disfavour hybrid individuals if these inherit mixed song traits. To shed light on the hybrid zone's songscape and its evolutionary significance, we analysed temporal and frequency-related parameters of 57 duet songs from within and outside the contact area. Songs of both sexes differed significantly between species. Female hybrid songs were intermediate in most parameters; a clear interpretation of male hybrid songs was not possible. Songs of purebred *T. lariang* males from the hybrid zone showed character displacement. In view of assortative mating, intermediate song traits might reduce the chances of hybrids to find mates and thus lower their fitness. Character displacement in male songs is consistent with female mate choice, as females should opt for unmistakable signals to avoid costly hybridization. The asymmetry here suggests that females of *T. lariang* have higher costs through mismatches than females of *T. dentatus*, and that hybridization between both species in general is asymmetric. Our findings corroborate the assumption that duets songs of *T. lariang* and *T. dentatus* play a key role in shaping this hybrid zone.

Marzipan contest Poster N° 10

Can low intensity grazing and traditional land use promote the activity and diversity of bat species in the nature conservation site Taubergießen, Baden-Württemberg?

Sebastian Brackhane[1,2,*], Bernd Ihle[3], Hartmuth Mohr[3], Bettina Saier[4], Jochen Paleit[5], Albert Reif[6], Markus Dietz[7], Anna-Lena Hendel[6]

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Traditional land use systems formed the cultural landscape of Central Europe. This has led to landscapes with a high structural diversity and high biodiversity patterns. However, in the past decades, the intensification of agriculture and forestry has led to a decline in habitat and populations of wildlife in Central Europe. It is assumed that this has also affected the populations of many European bat species, with many of them nowadays being red-listed as vulnerable, threatened or (critically) endangered. In this study, we investigated how traditional land use systems, including low intensity grazing, influence the diversity and activity of bat species in the nature conservation site Taubergießen, located in the Upper Rhine Valley of Baden-Württemberg, Germany. In 2021, we conducted acoustic bat surveys on 54 plots using Batcorder 3.1 and compared three different land use types: a) traditional land use systems including low intensity grazing, b) conventionally used forests and meadows, and c) strictly protected forests. The results can provide valuable insights for conservationists that aim to implement land use systems that protect and promote threatened bat species in Central Europe.

Oral presentation

African Forest Elephants – outlook for coexistence and recovery of a critically endangered species

Thomas Breuer

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African Forest Elephants (*Loxodonta cyclotis*) are now a separate species. They have undergone a dramatic decline of more than 86% over two generations lengths due to poaching for ivory, habitat loss, fragmentation, human-elephant conflict, and climate change and are therefore now considered critically endangered. There are many differences on the national and local level in the degree that forest elephants have undergone decline, and ranger-based law enforcement methods have largely failed to protect forest elephants including a still lively trade in ivory. Protected areas are largely too small to host viable forest elephant populations, making connectivity and transborder collaboration a more than ever need. Despite their decline, forest elephants are in increasing conflict with people which is exuberated by a diversity of factors including habitat loss and fragmentation, long-term effects or poaching and more increasingly (but less studied) via climate. There is an urgent need to move from counting dead elephants to protecting key forest elephant sites and corridors and provide livelihood benefits in the conservation sector . The participation and inclusion of local and indigenous communities and volorizing their wisdom is strongly encouraged for better protection of forest elephants and their high conservation value areas. Giving their key role as ecosystem engineer and carbon storage enhancers, a long-term strategy with adequate financing mechanism for forest elephant conservation is needed. Initiatives such as carbon credits, wildlife credits and other funding for biodiversity and ecosystem services should be tested and implemented if successful.

Oral presentation

Multiscale modelling of gene flow and functional connectivity of large carnivores in fragmented landscapes: The Central American jaguar as a model

Ana Patricia Calderon[1,2,3,*], Patricia Landaverde-Gonzalez[4], Claudia Wultsch[5,6], Rebecca Foster[7], Volker Grimm[2,3], Stephanie Kramer-Schadt[8], Katherine Zeller[9]

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Safeguarding connectivity is a conservation priority to secure jaguar populations' long-term viability in Central America. Here, 67% of the species' former range is lost and local populations show early signs of genetic isolation. We modelled habitat use and functional connectivity of jaguars across the region, and produced spatially-explicit maps for management of key-areas of habitat suitability and gene flow. Using an occupancy model of 13-year-camera-trap occurrence data, we show that human influence has the strongest impact on jaguar habitat use, followed by primary productivity and distance from rivers. Our model also supports specific conservation actions, targeting priorities for preventing habitat loss, mitigating human pressure, and fostering connectivity. To further assess functional connectivity of jaguar populations in the region, we developed and optimized multiscale, multivariate resistance surfaces of gene flow using microsatellite data and generalized linear mixed-effects models. Our results show that the main drivers of jaguar's gene flow in the region are builtup, non-vegetation, tree cover and distance from lakes. We are currently mapping population connectivity using resistance kernels in the study region, however our results so far highlight that the long-term persistence of jaguars in the region will depend on strong international cooperation that secures jaguar populations, habitats and low human footprints across Central American borders.

Oral presentation

Perioral secretions enable complex social signaling in African mole-rats (genus *Fukomys*)

Kai R. Caspar[1, 2*], Pavel Stopka[3], Daniel Issel[1], Kristin Katschak[1], Till Zöllner[1], Sina Zupanc[1], Petr Žáček[3], Sabine Begall[1]

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Subterranean common mole-rats of the genus *Fukomys* (family Bathyergidae) live in large cooperatively-breeding families. Odor cues have been hypothesized to importantly mediate social behaviors in the underground ecotope, but only little is known about the role of olfactory signaling in burrowing mammals. Here we characterize the so far neglected perioral glands of *Fukomys* and other African mole-rats as an important source of olfactory social information. Histology demonstrates these structures to be derived sebaceous glands that are developed regardless of sex and reproductive status. However, gland activity is higher in *Fukomys* males, leading to sexually dimorphic patterns of stain and clotting of the facial pelage. Behavioral assays revealed that conspecifics prefer male but not female perioral swabs over scent samples from the back fur and that male sebum causes similar attraction as anogenital scent, a known source of social information in *Fukomys*. Finally, we assessed volatile compounds in the perioral sebum of the giant mole-rat (*Fukomys mechowii*) via GCxGC-MS-based metabolomic profiling. Volatiles displayed pronounced sex-specific signatures but also allowed to differentiate between intrasexual reproductive status groups. These different lines of evidence suggest that mole-rat perioral glands provide complex odor signals that play a crucial role in social communication. Since perioral glands are present but severely understudied in a great variety of rodents, these findings might have important implications beyond the African mole-rat family.

Marzipan contest Poster N° 14

The dental ecology and oral biology of a population of wild *Otolemur crassicaudatus* from the Lajuma Research Centre, South Africa

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Here we present dental ecology and oral biology data from 10 capture sessions between 2013-2021 from a population of *Otolemur crassicaudatus* from the Lajuma Research Centre in northern South Africa. In this population (n = 82 adults, 36 females, 46 males), there is a high frequency (> 90%) of maxillary canine damage: fractures, decay and/or apical abscesses, often concurrently occurring in single individuals. This pattern shows no sex difference ($X^2 = 0.08$, $p = 0.77$) suggesting an ecological, i.e., feeding cause, rather than male bias in maxillary canine damage due to intra-sexual competition as seen among complex social group living non-human primates (e.g., African cercopithecines or Madagascar's ring-tailed lemurs). We suggest that the population-wide pattern of maxillary canine damage is more likely a result of resource acquisition, specifically gouging bark and hard gum from *Valchellia* sp. (formally *Acacia*) trees, especially during the cold winter season in this Afromontane habitat (>1200 meters). Salivary pH does not vary by sex (n = 26 females, n = 26 males; $X^2 = 2.40$, $p = 0.12$), with a slightly acidic mean of ≈ 6.3, suggesting a long-term diet of less acidic foods in this species, in contrast to several Malagasy lemur species that show more alkaline salivary pH, a potential buffer against more acidic diets. As *Valchellia* gums are acidic and accessing this food is connected to high canine damage, this suggests that gum as a major food source may be a more recent addition to the *Otolemur* diet.

Marzipan contest Poster N° 16

Limiting structural elements for *Microcebus griseorufus* in different habitats

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Climate change poses a global threat to biota, which is why adaptation to changing living conditions is vital for animals and plants. The biodiversity hotspot Madagascar contains unique biodiversity that is threatened by climatic and anthropogenic influences and therefore faces a particular challenge. Studies on mouse lemurs indicate that they show a moderate to even great tolerance to these conditions, which is partly explained by their flexibility in resource use. In search of factors limiting the distribution of species, the substrate use of the mouse lemur species *M. griseorufus* was studied in two different habitats of the Madagascan national park Tsimanampetsotse. The limestone plateau was studied here as a representative example of habitats under the climatic and anthropogenic influences due to its degraded state compared to more mesic vegetation. The studies took place between March 2007 and March 2009 and the data on the activity patterns was collected using the focal animal sampling method. The analyses showed that *M. griseorufus* used trees significantly more often than shrubs as a substrate, regardless of the habitat. For the activities, such as resting, feeding, traveling, roaming trees were also used significantly more often as a substrate. The results indicate that *M. griseorufus* is able to use shrubs as substrate, but still shows a persistence in substrate use with a preference for large trees. These findings illustrate the limits of even supposedly degradation tolerant lemur species towards habitat degradation.

Oral presentation

Rising temperatures & herbivore nutrition: Overlooked effects of global warming

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Most studies of climate change on mammal populations focus on either the availability and quality of food or model the effects of future temperatures on current climate envelopes. Elevated ambient temperature is a large yet overlooked effect that can lead to rapid local extinction of mammal populations through indirect effects on animal nutrient acquisition and metabolism. I will describe two key impacts of rising ambient temperature on the ability of mammals to obtain sufficient nutrients. Firstly, as ambient temperature rises, mammals eat less. This has been demonstrated in many studies with domestic species but is largely overlooked in wildlife. Second, diets that contain plant secondary metabolites can be more toxic when consumed at higher ambient temperatures and this further reduces the amount of food consumed or reduces diet breadth. Multiple other subtle effects of temperature can occur including a preference against protein-rich diets. Integrating these effects with models of thermal physiology are urgently needed.

Marzipan contest Poster N° 3

Identification of tiger subspecies based on craniometrics, morphological characters and geometric morphometrics

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Currently, six living subspecies of *Panthera tigris* are recognised, the Bengal tiger (*P. t. tigris*), Amur tiger (*P. t. altaica*), South China tiger (*P. t. amoyensis*), Sumatran tiger (*P. t. sumatrae*), Indochinese tiger (*P. t. corbetti*), and the Malayan tiger (*P. t. jacksoni*). All of them are critically endangered facing decreasing population numbers due to habitat destruction, deforestation and poaching. The Bali tiger (*P. t. balica*), Caspian tiger (*P. t. virgata*), and Javan tiger (*P. t. sondaica*) became extinct in the 20th century.
The number of subspecies has been much debated over the past decades, since there is little variation and large overlap of phenotypic traits and low genotypic diversity. Subspecies delimitation, however, is crucial for conservation, particularly in threatened species.
Here, we test the discrimination of tiger subspecies based on 39 craniodental and mandibular distances, 10 craniodental characters and 3 sets of 2D geometric morphometric landmarks on the skulls and mandibles of 100 specimens housed in several collections. Statistical (e.g., PCA), clustering, and phylogenetic methods showed that at least some subspecies can be distinguished. However, the most striking differences were found between the larger mainland subspecies and the smaller island subspecies. Further, we were able to confirm the identification of five skulls of *P. t. sondaica* in the collections of the Staatliche Museum für Naturkunde Karlsruhe.
However, incomplete or missing information on the specimens and sexual dimorphism represent the challenges running these analyses and distinguishing subspecies.

Oral presentation

Monitoring of marine mammals

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Marine mammals are considered indicators of marine ecosystem health. Their monitoring, however, is challenging, not only because of their diving behaviour influencing detectability, but also because of the large, sometimes inaccessible study areas. For highly mobile and wide-ranging populations of cetaceans, but also for pinnipeds, a trans-boundary approach is a prerequisite to allow for a proper assessment of population status based on best available science. In order to determine population size and distribution of cetaceans, large-scale visual surveys (such as SCANS - Small Cetaceans in European Atlantic waters and the North Sea) using line-transect distance sampling methodology will be introduced. In addition to these design-based abundance estimates a modelling framework can inform key parameters such as abundance and distribution, and changes thereof over key high-density areas; and predict these parameters over unsurveyed areas given that high-quality data is available to inform these models. This talk will introduce different methods (e.g. visual surveys, acoustics monitoring, strandings monitoring) and discuss their pros and cons. The key policy drivers for conservation of marine mammals in Europe will be set into context with respect to data needs for conservation and management.

Oral presentation

Neighbor's grass is always greener - possible interactions between livestock and local wildlife

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Most of Germany's former military training areas consist of a semi-open landscape, that provides habitats for rare plants and animal species.
Without military use, succession usually begins slowly, and these semi-open areas become forested. However, these landscapes are often meant to be preserved to ensure environmental conservation. Low intensity use of grazing animals is now considered common practice to prevent succession by browsing. Once traditional management techniques, such as mechanical mowing or intentional burning, are not possible in these areas due to the existence of duds in the ground. The potential effects of grazing animals on local wildlife, like red deer (*Cervus elaphus*), were unclear. Grazing animals, like cows (*Bos taurus*) and horses (*Equus ferus caballus*) need appropriate fencing and daily control by a keeper. For this study, camera traps were installed to study possible barrier effects from the fencing on red deer throughout the year. Additionally, faecal pellet counts were conducted to investigate the general use of the fenced pasture by red deer. Furthermore, free ranging red deer (n=11), cows (n=5) and horses (n=5) were collared with GSM-GPS-collars to examine the space-time behavior and to conduct interaction analyses between deer and grazers.
The study detected both fence crossing and general use of the pasture by the red deer. The interaction analyses between red deer and grazers revealed a neutral behavior within the pasture. Therefore, low intensity use of cattle and horses can be supported as a possible management tool to maintain a semi-open landscape.

Marzipan contest Poster N° 9

Sandy landscapes, tanks and wildcats - Habitat patterns of *Felis silvestris* at its northern range

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Starting in some low mountain regions the protected European wildcat (*Felis silvestris*) is recolonising areas also in the lowlands of northern Germany again. In telemetry studies we figure out habitat preferences and movement patterns to support the dispersal of the species at its northern range. The study area „Colbitz-Letzlinger-Heide“ (Saxony-Anhalt) is the largest unfragmented heathland of Central Europe. The protected area (SPA, FFH) is surrounded by forest. Open lands are managed and used for military training. In 2020 we collared six wildcats (4 females / 2 males) at this study site.
GPS data of 5 resident wildcats tracked over 10-13 months showed that the sizes of individual home ranges (LoCoH-95%) presumably dependent on the proportion of deciduous forest, age and the reproductive status. Senile females used home ranges of 300-800 hectares mainly in deciduous forests, which corresponded to those found in studies in forested low mountain ranges. Younger, reproductive wildcats frequently used open land beside forest habitats and had extremely large home ranges (males 2.700-9.000 hectares / female 1.500 hectares). One non-resident female dismigrated and left the mother‘s home range at the age of 10 month. It covered long distances also in the open agricultural landscape outside the study area and could only be observed over 5 months.
To test habitat preferences integrated step selection analyses (iSSA) were used on the level of individuals and multi-individuals. All four habitats studied were found to be avoided compared to deciduous forest, which is known to be the preferred habitat type. In the case of settlements, heathland and coniferous forest, this avoidance is significant. In the case of dry grassland, the question of avoidance versus preference seems to be very individual-specific. Additional wildcats collared in 2021 and 2022 will provide further data also on dispersal.

Marzipan contest Poster N° 12

Interspecific competition within the genus *Lepus* in the Alps: altitudinal ranges and introgression

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As an ice age relict, the Alpine mountain hare (*Lepus timidus varronis*) is particularly affected by ongoing climatic changes. In parallel, the European hare (*Lepus europaeus*) is expanding its range towards higher altitudes. Competition for scarce resources and hybridization between the closely related species are the consequences in areas, where both leporids live in sympatry. We hypothesized that mountain hares can be found at higher altitudes, especially when European hares share the habitat with them. Furthermore, we assumed that introgression rate was higher in areas of sympatry. To test our hypotheses we studied the distribution and introgression of both hare species in four study sites in the province of South Tyrol using non-invasive faecal pellet sampling and genetic analysis. Introgression could only be detected in areas where both species were present, with a proportion of introgression ranging between 5 % and 14 %. The distribution of hare species across the altitudinal range did not show a clear picture. In fact, in one area mountain hares were found at lower altitudes (forests) than European hares (above the tree line). The latter species was found on alpine meadows up to 2,430 m a.s.l., even in winter.

Oral presentation

Lonely at the top – the Sulawesi mountain tarsier represents an ancient lineage

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Sulawesi is a unique biodiversity hotspot located in the collision zone of major tectonic plates. Twelve species of tarsiers, tiny nocturnal primates, are known to occur exclusively there or on the surrounding islands. Their evolutionary history is closely linked to the complex geological past of the region. Phylogeographic reconstructions suggest that tarsiers arrived to southern Sulawesi in the early Miocene and split into two major lineages in the early Pleistocene, about 20 MY later. Both lineages then diversified further in connection with northward movements in consecutive waves. The role of the pygmy or mountain tarsier (*Tarsius pumilus)* was, however, very much unclear to date. *T. pumilus* is peculiar in many ways, most striking is its extremely reduced body size and the exclusive occurrence in cloud forests above 1800 m asl. For the longest time, *T. pumilus was only* known from two museum specimens. Here we present the first genetic data on this enigmatic species. Our results suggest that the *T. pumilus* lineage split from the ancestor of the other species about 10 MYA, about 7 MY before these diversified further. Thus, the mountain tarsier is the sister taxon to all other Sulawesi tarsiers. Paleogeographic maps suggest that the timing of the split coincides with the rise of the sea level between the western and eastern parts of proto-Sulawesi. This process predates the presence of permanent mountains on the western part, the tentative range of the *T. pumilus* ancestor. Displacement into the mountains is thus unlikely to be the underlying mechanism for speciation.

Marzipan contest Poster N° 22

Dogs occupying grassy habitat near protected areas in eastern Madagascar rely on foods from forests

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Introduced predators on islands can help control invasive species yet can also contribute to the extirpation and extinction of endemic taxa. The spread of dogs on Madagascar by ~1000 years ago coincided with the introduction of livestock and spread of grazer-adapted grasslands, and we help evaluate the extent to which modern dogs are part of novel grassland food webs.
To infer dog diet, we identified food remains, where possible, and conducted stable isotope ratio analysis for n=100 modern dog feces collected in derived grassland at varying distances from protected forest edges around Analamazoatra and Andasibe-Mantadia National Park in eastern Madagascar.
Animal remains in feces and the observed range of fecal $\delta^{15}N$ values are consistent with dog meals at multiple trophic levels. However, the observed distribution of fecal $\delta^{13}C$ values suggest that few dogs in the study area consumed food derived from open C_4 grasslands. Existing data suggest that dogs rely primarily on C_3 consumers inhabiting forest biomes (forest-dwelling animals) for their prey, which may include endemics such as tenrecs, Malagasy rodents, and lemurs and introduced rodents such as rats. These findings indicate that dogs are not confined to the anthropogenic niche defined by grazer-adapted grasslands, but rather use and impact animal food resources associated with protected forests. Higher resolution study of dog diet and mobility can further clarify the potential for dogs to exploit endemic prey, compete with endemic predators, and spread disease across ecotones.

Marzipan contest Poster N° 8

Lemur inventories at the Vohidava-Betsimilaho New Protected Area

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In the context of the "Durban Vision" of 2013, Madagascar has added a series of "New Protected Areas" to its protected areas system. Vohidava-Betsimalaho (V.-B.) is one of these sites located in the remote spiny thicket vegetation in the upper Mandrare River valley. It was designated as a 18,169 ha New Protected Area (NPA) in 2015. The process to designate the site was led by Missouri Botanical Garden (MBG) and this NGO now supports a site-based team that implements a conservation program here in collaboration with the local community. MBG invested in this site primarily because of its diverse flora that includes a number of threatened and locally endemic species. The fauna of this area was poorly known. We installed permanent transects for standardized long-term monitoring of the flora and fauna of the reserve in 2021. Lemur inventories revealed the presence of four lemur species. The population densities of *Lemur catta*, *Propithecus* verreauxi, *Lepilemur leucopus* and *Microcebus griseorufus* were estimated respectively as 4.6 groups per km², 79.1 individuals per km², 112.0 individuals per km², and 90.0 individuals per km². It is remarkable that *L. catta* was recorded from all but one of the ten transects established at V-B. This is unusual since most studies show that this species has a very patchy distribution in spiny forest. The first three species are classified as Endangered or Critically Endangered by the IUCN Red List. Their densities in V.-B. is higher than recorded in most parts of their range. Effective protection of the site is being attempted by maximizing the engagement of the local communities in all aspects of site management.

Marzipan contest Poster N° 11

Hard facts or just folklore? What trophy shows tell us about chamois and humans

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In some federal states of Germany there is an obligation to issue hunting trophies once a year in trophy exhibitions. The trophy exhibitions in Bavaria contain a valuable source of data: both sexes of the chamois carry a trophy, which can be used to determine the exact age and sex of the hunted individual. By determin age and sex, conclusions can be drawn about the structure of the harvested population and, in the medium term, also about the surviving population and trends in population development. They also offer the possibility of monitoring and evaluating the favorable conservation status, to which Germany has committed itself by listing chamois in Appendix V of the EU Habitats Directive.

Since 2016 and with the exception of the years 2020 and 2021, almost 13,000 trophies of at least one-year-old chamois have been examined at the Bavarian trophy exhibitions. In the hunting grounds of the Bavarian State Forest Enterprise (BaySF), which manages around 80 % of the chamois population in Bavaria, the sex ratio was male-biased (1.6 :1). In the remaining hunting grounds the ratio was 1.4 :1. Young and middle-aged individuals predominate in the hunting bag, especially in the BaySF hunting grounds. A particularly striking example of this is the Ruhpolding forest enterprise: In 2019, the average age of shot chamois >12 months was 2.5 years. In contrast, in the communal or private hunting grounds the average age of chamois shot in 2019 was 5 years. The number of middle-aged and old individuals continues to decrease, while the structure of the hunting bag shows increasing use of young and youngest age groups.

From the results of the trophy exhibition analysis it can be assumed that the chamois stocks in Bavaria have hardly any socially mature animals and are therefore destabilized. The youth classes are heavily overused. A solution to this could be wildlife resting areas or non-hunting areas, in which the species could at least locally develop natural age and social structures as well as behavior

Oral presentation

More than numbers of population size: Data from line transect sampling reveal fascinating insights into the bovid community of selected areas of Zambia

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Bovids play a vital role in many ecosystems, influencing both lower and higher trophic levels. Consequently, conserving bovids is of immense importance. Zambia encompasses one of the world's most important ecosystems, Miombo-woodlands. However, more research is needed to adequately understand and protect these areas. Our study looked at interactions between population characteristics, behavioral patterns, and habitat use with respect to interspecific and intraspecific differences in the bovid communities of selected areas of Zambia (Kasanka and Kafue National Park). We identified diverse interspecific differences in the behavior of bovid species in both regions. Intraspecific analyses were done on two focus species, the puku (*Kobus vardonii*) and impala (*Aepyceros melampus*). Particularly puku presented behavioral and ecological variation, for example, regarding habitat use in different areas by different groups, or activity patterns in different areas, revealing the plasticity of its ecological niche. Impala, in contrast, did not show plasticity. Temporal differences in behavior and ecology were detected. We highlight here the increase of flightiness in puku in Kasanka National Park, comparing data from 2009/2010 to 2019. Intraspecific data was analyzed for different sexes and group compositions, thus providing data-based facts that replace anecdotal knowledge (flightiness in territorial males and sunbathing in puku). Moreover, they provide an important baseline of comparison for future surveys to understand possible future changes in the populations better. Still, more research is needed to gain a more in-depth insight into the bovid communities of Zambia.

Oral presentation

Genotypic projection under scrutiny: the vomeronasal organ of semiaquatic mammals

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The vomeronasal system (VNS) is a sensory system involved in pheromone detection, based on its sensory part, the vomeronasal organ (VNO), which is located in the anterior nose. Most mammals possess a functional VNS with secondary reduction in some taxa. Manatees and whales lack a functional VNS and it was previously reported that *Trpc2*, which is a marker gene for VNS functionality, is not only inactivated in the taxa for which the absence of the VNO is documented, but also in the semiaquatic phocids (*Phoca vitulina*) and otters (*Lutra lutra*). DiceCT was used to determine the morphology of the VNO of these taxa and two additional semiaquatic mammals, the coypu (*Myocastor coypus*) and the muskrat (*Ondatra zibethicus*), were scanned to enhance comparability. The VNO of the rodent species appears to be well developed, whereas it is absent in the seal and comparatively small in the otter. In reversing the genotypic basis for seal and otter, we confirm that an inactivation of *Trpc2* anatomically is reflected in a completely or partly reduced VNO.

Marzipan contest Poster N° 19

Certified timber extraction has no effect on mammalian diversity in Suriname

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Certified timber extraction can provide incentives for maintaining tropical forests by combining economic benefits for people, linked to biodiversity conservation. Here, we provide an example where extraction of a maximum of 25 m^3 of wood per hectare with a rotation interval of 25 years from a tropical lowland forest of Suriname did not lead to any measurable change in community composition, encounter rates or activity patterns of terrestrial mammals. We set a total 20 camera traps in logged and 18 cameras in unlogged parts of the Greenheart operations in central Suriname. The areas are certified by FSC for sustainable management. Each trap was operated between 44 and 123 days (mean: 89 days) between 2015 and 2017. During the total number of 3379 trap-days we recorded at least 29 mammal species. We did not find any significant difference in species composition of mammal communities, species number or activity patterns between logged and unlogged parts of the concession. The logging concession that we sampled housed similar species assemblages as a nearby nature reserve, including top predators such as jaguars and pumas. The results indicate that sustainable economic practices can be in line with mammal conservation in lowland forests of the Amazon. Yet, the records of jaguars per 1000 trap nights was much lower than at other South American lowland forest sites while the records of possible prey was within the upper range of other lowland forests. This discrepancy of low top predator but high prey records hints remains unresolved.

Marzipan contest Poster N° 18

Mammalogical field research on the population biology of the raccoon in the Müritz National Park, Germany

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The North American raccoon *Procyon lotor* is a generalist mesopredator from the order Carnivora and belongs to the American predator family of small bears (Procyonidae).
The Müritz National Park (Mecklenburg-Western Pomerania) has been colonized by raccoons since the late 1970s and is an ideal habitat for raccoons due to its abundance of water and old deciduous trees. A substantive research focus of the National Park was the complex of questions concerning the monitoring of this neozoonal species and the potential impacts on the biotic communities that exist in the park. Within the framework of an integrated research study lasting from 2006 until 2017, extensive studies on the population biology of the raccoon within its eastern German range were carried out for the first time. The overarching goal of this wildlife biology study was to collect valid population biology data in order to provide a basic ecological characterization of the raccoon from a conservation and species protection perspective. Based on superordinate topics (including among others spatial and social behaviour, reproduction, population structure and dynamics, epidemiology, feeding ecology & parasitology) and 16 subprojects, unique insights into the population biology of raccoons in Europe could be obtained. This will allow adapted management and a better understanding of the biology of this allochthonous species.

Oral presentation

The curious cases of insular dwarfism in horses: comparative morphology of Greek horses from Skyros and Rhodes

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The horse varieties from Skyros and Rhodes islands are extremely small, reaching shoulder heights of only about one meter. We aim at investigating the evolutionary morphology of these horses of great cultural significance in Greece, as examples of the phenomenon of island evolution. We integrate cranial data from historical literature with data from six newly gathered specimens and analyse a dataset featuring various domestic and wild horse breeds and varieties. Our specimens do not deviate from proportions of other 'dwarfed' horses, such as Falabellas and Shetland Ponies (e.g. maxillary diastema & palate length). Both Greek forms have narrower snouts than Shetlands. Tooth row size is proportionally larger in relation to skull size in dwarfed horses than in standard-sized horses, as reported for some other small domestic mammals. We used non-invasive imaging to study 3D models of the bony inner ear. Rhodes horses show a pointed and overall less round posterior semi-circular canal and a thicker crus commune compared to Skyrians, but these characters are not pronounced enough to be discriminant. Globally, there are at least 30 distinct horse populations on islands, offering the chance to study processes of convergence in morphological divergence and evaluate the effect of drift and the environment. Changes in life history could be associated with island-living; our histological study of long bones of Greek horses provide a first assessment of the kind of information this approach can provide, although natural history data from breeders and locals will be needed to assess this matter.

Marzipan contest Poster N° 7

Effect of habitat and land use on small mammal communities in arid and wet regions of southern Africa

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We investigated the effect of different habitat types and land use on small mammal communities in two regions of southern Africa. Knersvlakte in South Africa represented a biodiversity hotspot in an arid region, whilst Kafue National Park in Zambia a biodiversity hotspot in a wet region. We hypothesized that habitats and land use affected their community composition. Habitats of the wet region included grassland, termitaria and miombo woodland, whilst those of the arid region included loamy and quartz gravel-covered soils. Our description of land use in the arid region was based on the grazing intensity, i.e. high and moderate grazing for small livestock, whilst in the wet region on the land management utilization options, i.e. intensive utilization by tourism, wild and wilderness zones. Thus, using standard trapping methods for small mammals, we laid a combination of Sherman traps in 17 sampling sites in the wet region, each consisting of 3 plots (100 m x 40 m). In the arid region, Sherman traps were laid in 22 plots (135 m x 150 m). Our findings suggest that the community composition of small mammals in the wet and arid regions is mainly influenced by habitats. Further, land use does not have a significant effect on the community composition of small mammals, but mainly leads to concentration or avoidance by some of the species. Our findings are particularly important for conservation as they provide empirical evidence for the protection of species and ecological processes in biodiversity hotspots.

Plenary

Wildlife trade, trafficking and Covid-19

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Three out of four newly emerging infectious diseases come from animals. Covid-19 more than anything else has put a spotlight on emerging infectious diseases and how this is linked to the trade in wild animals and to wet markets. One aspect of this trade gets more than its fair share of attention: the illegal wildlife trade. The illegal trade in tigers, ivory, rhino horn, pangolins and primates is indeed something to worry about but wildlife trade affects one in three species globally, and animals and plants are traded for a wide variety of reasons. Based on twenty years of research in the animal markets of Asia I give an overview of the trade in wildlife, both legal, illegal and everything in between. I also present data on how wildlife traders and consumers responded to the outbreak of Covid-19 and give suggestions how best to regulate the trade in wildlife to ensure that it does not impact already imperilled species and how to reduce the risk of spreading infectious diseases.

Oral presentation

Opportunities and challenges of citizen science for monitoring a recolonizing megaherbivore

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Wildlife monitoring is a prerequisite for evidence-based management. For species occurring at low densities, conventional monitoring approaches are often inefficient. However, wildlife are occasionally observed by members of the public. This kind of information can be leveraged in Citizen Science (CS) projects. While involving the public in scientific research activities is gaining momentum, few studies investigated the quantity and quality of CS data for monitoring mammalian megafauna and how CS reporting systems could be designed to facilitate effective participation.
Due to effective conservation efforts, moose (*Alces alces*) populations have recovered and are occasionally sighted in Germany. Here, we compare three different CS approaches for monitoring moose in Brandenburg State: a mail/email report system, a smartphone application, and a homepage. Based on the most data-rich method, we further analysed demographic, and temporal aspects of these sightings. To identify the preferred technical properties and time requirements for CS reporting system, we analysed responses of a structured survey among potential CS participants.
Among the available CS monitoring approaches, the smartphone app did not yield any sightings, the home page generated several sightings but both were operational for a limited time. Sightings of the mail/email system increased over time, and peaked during late summer. In most cases, the reported moose were identified as single, adult, male individuals.
The interview data revealed a high willingness to report moose sightings. Respondents preferred a homepage reporting system over mail/email or smartphone applications. In addition, responses indicated that the reporting process should not exceed three minutes.

Oral presentation

Photoprotective adaptations of the primate eye safeguard epithelial stem cells in the corneal limbus

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Pigmentation patterns of primate eyes have been investigated for the past two decades under the assumption that communicative functions drove extant diversity. Ecological functions represent an underexplored alternative to communicative functions. The specific proposal that the amount and wavelength of light in a species' typical range drive the evolution of external eye appearance has recently gained support. I add to this growing body of evidence by detailing primate and human specific ocular traits strongly suggesting a main role of ocular pigmentation in the preservation of limbal epithelial stem cells. Because healthy populations of epithelial stem cells are needed throughout the life of the organism to keep the cornea transparent, these adaptations are likely to result from primates' greater reliance on vision compared to other mammalian taxa.

Oral presentation

Development of the mammalian skull

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The mammalian head is a composite structure integrating the central and peripheral nervous system, sensory organs, muscles, joints and other specialized tissues with the skull. The skull development during embryogenesis is largely dependent on a cartilage template - the chondrocranium – and is synchronized with the development of the nervous system. Numerous human congenital syndromes manifest by both craniofacial and neurodevelopmental abnormalities, which supports the hypothesis of the brain-skull developmental dependence. However, how this complex morphogenetic process is initiated and interactions between various tissues are coordinated remains enigmatic.
To understand the interplay between the nervous system and chondrocranium morphogenesis, we employed the Sonic Hedgehog paradigm. This conserved morphogen shows a dynamic expression pattern throughout embryogenesis and is known to have an essential function in head formation. Genetic manipulations and lineage tracing enabled us to identify the sources of Sonic Hedgehog that control the induction of individual parts of chondrocranium.
Once the chondrocranium emerges, its immense growth and shape tuning requires tight coordination with the nervous system development. We have investigated the underlying cellular dynamics and showed that chondrocranium growth relies on three uncoupled mechanisms. We found the cellular dynamics of facial cartilage growth to be substantially different from those operating in the long bones. Surprisingly, similar cell dynamics underlie salamander limbs' skeletogenesis and likely represent an evolutionarily ancient program that maintains higher regeneration capacity.

Plenary

Animal cognition: from corvids and chimpanzees

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The evolutionary origins of human cognition have been described as one of the 125 most pressing scientific questions of our time. However, how similar and different cognitive skills of nonhuman animals are is still under much investigation.

Here, I will provide a brief overview of this fascinating research domain by focusing specifically on cognitive skills of one of our closest living relatives, the chimpanzees (*Pan troglodytes*) and a member of the corvid family, ravens (*Corus corax*). I will present recent observations and behavioural experiments on tool-use and proto-tool use, cognitive performance and insect medication and discuss them in relation to existing findings and future research.

Marzipan contest Poster N° 5

Lemur communities and the distribution and abundance of the White-footed Sportive Lemur *Lepilemur leucopus* in southern Madagascar

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Over the last decade, lemurs (primates of Madagascar) have undergone substantial taxonomic revision and their habitat has suffered from excessive forest clearing. As a consequence, neither the extent of occurrence nor the area of occupancy are precisely defined for most species. This is particularly the case in remote areas with difficult access, such as in the spiny forest of southern Madagascar. We surveyed the region east of the rainforest of Andohahela towards the west until the spiny forest became discontinuous for the occurrence of lemurs during the days and days shelters of *Lepilemur leucopus*. Night surveys were impossible due to security issues. Surveys were completed at 13 sites. Objectives were: (1) determine the extent of occurrence of *Lepilemur leucopus,* considering also *Lemur catta* and *Propithecus verreauxi;* (2) assess the abundance of *L. leucopus* in different vegetation types; (3) relate the distribution and abundance of *L. leucopus* (and other lemurs) to vegetation characteristics that can be used for estimating the area of occupancy and total population size of *L. leucopus*; (4) use village surveys to identify threats for the forest and lemur species. All species were still widely distributed but forest clearing has been found to be excessive in many areas. Most important, the last connection in the southern half of Madagascar between the evergreen rainforest in the east and the dry and spiny forest of western Madagascar is being cleared for charcoal production. This eliminates a prime example where speciation and specialization of lemurs could have been studied in evolutionary terms.

Marzipan contest Poster N° 6

Notes on the natural history of *Galidictis grandidieri* Wozenkraft, 1986 (Eupleridae) in the spiny forest of Madagascar

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Galidictis grandidieri is an endemic "carnivore" from southeastern Madagascar, feeding mostly on cockroaches and other invertebrates. Body mass ranges between 1.5 and 2.4 kg. It used to be known only from the National Park of Tsimanampetsotse and thus has one of the smallest extents of occurrence of any carnivore worldwide and an estimated population size of about 3000 individuals. Recent inventories extended the range to the north and south, but the species seems to be restricted to the area between the rivers Onilahy in the north and Linta in the south (about 150 km). Within this area, the species occupies only a very narrow strip of dry forest where there is access to open water, reducing the actual area of occupancy to less than 150 x 1 km². As long as water is available, the species seems rather tolerant of disturbances and occurs also close to villages, if not killed by dogs. Ongoing mark-recapture studies since 2006 revealed a stable population but very low recruitment into the population, with 0 – 2 juveniles caught per year in the study area (size: 3 km²) as compared to 6 to 17 adult individuals. Females are caught repeatedly within a smaller area than males. The longest time interval between recaptures was 11 years for a male.

Marzipan contest Poster N° 17

Vegetation characteristics limiting the distribution of a folivorous lemur under changing ambient conditions

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Species distribution patterns are likely to change due to climate change and are impacted by anthropogenic habitat degradation. In order to identify possibly limiting constraints, we documented vegetation changes along an environmental gradient at the distributional limit of *Lepilemur petteri*, a folivorous lemur in the dry southeastern Madagascar. The gradient covered areas inhabited by *L. petteri* and sites where the species is absent. The region is characterized by erratic and localized rainfall varying in space and time between years, resulting in fairly unpredictable plant production. Under these conditions, *L. petteri* first requires a certain density of trees. Once this density threshold is exceeded, the animals adapt their home range to maximize the number of tree species within their home range, rather than favoring specific structural components or the occurrence of high-quality food species. We interpret this pattern as a consequence of the need to live in areas with diversified food production. This might increase the chances that different tree species produce edible items under different rainfall regimes and thus provide food in this unpredictable environment.

Oral presentation

Detailed data allow for an evaluation of a dramatic decline in puku (*Kobus vardonii*) in Kasanka National Park, Zambia

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Monitoring animal populations is the baseline for good conservation. Undeniably, data about how many individuals are as important as data about who is concerned and where. We used distance sampling along line transects to perform a re-survey of the bovid species in Kasanka National Park, Zambia. Data collection and subsequent analyses were of the same design as in a previous survey in 2009–2010. This allowed for the direct comparison between survey periods, especially for the data collected in November 2010 and 2019. The focus was on the on the puku (*Kobus vardonii*). The estimated puku population size decreased dramatically by 84% from 5,038 (range 3,268–7,238) animals in 2009–2010 to 819 (range 250–2,708) animals in 2019. So far the plain numbers. The closer look revealed: Smaller group sizes were observed. Changes in population structure were detected like a decline in male abundance. The decline was more pronounced along the park boundaries. Puku became more vigilant and demonstrated significantly longer flight distances in 2019 in comparison with 2010. This indicates towards increased poaching activities in Kasanka National Park. Further, a decrease in body condition indicates that also other factors like a shift in rainfalls contributed to the decline. The puku acts as an indicator for the bovid community as also other species have declined in numbers or even disappeared from Kasanka National Park. This alarming result call for immediate action and an agenda for long-term conservation of Kasanka National Park and its unique ecosystem.

Marzipan contest Poster N° 4

Thermoregulatory plasticity in the Malagasy bat species *Triaenops menamena*

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Most animals are restricted to specific environmental characteristics, which determine the distribution, abundance and behavior of every species. However, widespread species, in particular, are often facing a variety of environmental conditions across their distribution range and thus, might exhibit a broad physiological variation. Hence, intraspecific thermoregulatory plasticity can be important for coping with varying conditions and for maintaining a positive energy balance. Daily torpor, a temporally controlled reduction of the metabolic rate, is one form of heterothermy and recent studies revealed that this physiological strategy is used by many tropical and subtropical species. Bats are particularly well suited for investigating intraspecific physiological plasticity since most species are widespread, but their local roosting sites differ vastly. Yet, little is known about torpor in bats and their intraspecific thermoregulatory flexibility. Therefore, three populations of the Malagasy bat species *Triaenops menamena* were investigated, to examine their thermoregulatory plasticity. This study exposed significant physiological differences among these populations, inhabiting different roosting sites along a gradient of fluctuation in environmental conditions. The greater the fluctuations in ambient temperature and humidity, the higher was the general resting metabolic rate and the rate of its reduction, but the lower was the torpid metabolic rate (TMR). Additionally, *T. menamena* expressed diverse patterns of torpor, e.g. hyperthermic daily torpor patterns with surprisingly high T_{skin} (35.2°C) that even exceeded ambient temperature, while the MR was exceptionally low (0.06 ml O_2 h^{-1} g^{-}). This species shows a highly adaptive flexibility in their physiology and are able to cope with unfavorable environmental conditions by using different strategies of thermoregulation and hypometabolism, which is beneficial regarding ongoing climatic changes.

Poster

How to get around? Cross-generational information transfer in maternity colonies of greater mouse-eared bats

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Every fall, temperate bats aggregate in great numbers near natural caves or man-made underground structures. At these locations, they swarm and mate before they later on go into hibernation. Such sites, which are crucial for reproductive success and for survival during winter, are often located at distances of tens of kilometers or more from maternity colonies where the very same bats are born or give birth to their own young in following years. So far, it remains unclear, if and how information on the whereabouts of important locations like swarming sites (i.e. potential mating sites) and hibernacula is shared among colony members and passed on to the next generation. In this ongoing project, we combine long-term monitoring data from three maternity colonies of banded mouse-eared bats with high-resolution social network data from proximity sensors to evaluate the role of maternity colonies in passing on information that guides bats on their seasonal movements. We expect that young and naïve individuals follow adult females while commuting to important locations. Proximity sensors allow tracking contacts among young and adult colony members both inside the day roost and outside during foraging and commuting, thus revealing potential flow of information among individual bats. Audio- und video observations will help to describe social interactions among departing individuals in maternity roosts. In case social information is shared at maternity colonies, then social networks from banding data from hibernating bats should show similarities to social networks collected form tagged bats inside maternity colonies.

Marzipan contest Poster N° 1

Gastrointestinal parasite infestation in the Alpine mountain hare (*Lepus timidus varronis*): are abiotic environmental factors affecting prevalence of parasite species?

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Information regarding factors regulating Alpine mountain hare (*Lepus timidus varronis*) populations such as host-parasite interactions is lacking as only a few parasitological surveys exist of this subspecies. Parasites are not only dependent on their host but also on appropriate environmental conditions for infestation. Abiotic environmental factors have a crucial regulating role on parasites in mammals. It is anticipated that the elevation range of parasites is likely to alter in response to different host movement and variations in climate. Here we evaluate the parasitic infestation in the Alpine mountain hare by analysing the parasites in faeces and comparing the parasite infestation at different elevation ranges and at varied weather conditions for two years in the Austrian Alps. Nearly half of the faecal samples were free of parasites (46.2%, n=52). Most common was the infection by Coccidia (46.2%), whereas stomach intestine strongylids, *Trichuris* spp, and Cestoda were only found in 9.6% of all faeces. Hence, only Coccidia may be widespread enough to regulate Alpine mountain hare populations in the Austrian Alps. Elevation had a significant positive effect on the infection of animals by *Trichuris* spp, whereas temperature had a significant negative effect on the infection by any parasite traceable in faeces and, when looking at the parasite groups separately, on Coccidia.

Oral presentation

Positive effects of set-asides on spring density, increment of growth, hunting bag and number of subadults in European hare (*Lepus europaeus*) populations

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Farmland biodiversity in Europe has declined since agricultural intensification began in the early 1900s. Non-farmed features are of great importance for the promotion of plant and animal species including the European hare (*Lepus europaeus*). A reduction in reproductive success has been proposed as an immediate cause of the decline in European hare abundances. Female fertility is not reduced and leveret survival is inherently low in this lagomorph species. However, hunting bags imply that leveret mortality has increased in recent decades. We studied the effect of set-asides on population trends of hunted European hares by analysing data of spotlight counts and of hunting bags in arable landscapes in Lower Austria during six years. We found no interannual and interareal differences in reproductive output of adult females. Consequently, female reproductive output had no effect on population growth of the hares. Leveret mortality rate was lower in the study sites with a high proportion of set-asides (9 and 13%) than in the sites with a lower proportion of set-asides (3 and 5%). We recorded a positive effect of leveret survival rate on population growth and next year's spring density. Furthermore, the proportion of set-asides positively affected spring density, population growth, hunting bag, leveret survival rate and number of subadults in autumn. Hence, set-asides promote the survival of leverets and, equally, population growth and spring density. Therefore, set-asides are a very important habitat measure and an evidence-based conservation tool for the promotion of this species in arable landscapes.

Marzipan contest Poster N° 15

Body size effects on the behavioral ecology of two sympatric bushbabies in an Afromontane habitat.

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Body size broadly affects biological, life history and behavioral traits. Although few, temperate-living primates are dominated by large-bodied haplorrhine genera and there are few temperate strepsirrhine primates. We compared two non-heterothermic nocturnal sympatric Afromontane galago species, *Otolemur crassicaudatus* and *Galago moholi*, living within a temperate seasonal habitat (Lajuma Research Centre, South Africa). These species differ dramatically in body size (*O. crassicaudatus* 1090g; *G. moholi* 150 g). Using professional grade thermal imaging cameras (Model T600, Flir® Systems) we determined how encounters by species (84 encounter walks across 11 months, total encounters: *Otolemur* = 208, *Galago* = 206) varied relative to ambient temperature, humidity, moon phase and luminosity, night length, season, and time. *Otolemur* encounters were reduced at the hottest temperatures [(X^2 (1, 85) = 4.69, $p < 0.034$)] indicating negative larger body size effects. *Otolemurs* were more often encountered before midnight. Galagos had higher encounters after midnight, with a dramatic reduction from 11pm - 12 am and an equally dramatic increase from 1 – am indicating different body size effects on resting and feeding. *Galagos* are lunarphilic, with higher encounters during periods of greater moon illumination [(X^2 (1, 413) = 8.07, $p < 0.045$)], and during the waning gibbous moon [X^2 (1, 46) = 5.29, $p < 0.038$]. Humidity and night length showed no effect. Results add to our knowledge of temperate primate ecology and expand our understanding of how body size mediates behavior in nocturnal primates, which is key to assessing their resilience to climate change.

Oral presentation

The Otter Spotter – how to survey and monitor an elusive species

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After near extinction, Eurasian otter (*Lutra lutra*) populations are recovering across Germany. However, a large otter-free zone through Central Europe, including western Germany, remains. Otters are notoriously hard to monitor due to their nocturnality, large territories, and general avoidance of humans. In order to track their recovery status and migratory routes, indirect methods are necessary. For two current studies in the southwest and the south of Lower Saxony, otter tracks and spraint samples were recorded and collected based on the IUCN “Standard Method” with the specially developed “otter spotter” mobile app. The southwestern study area is of special interest as it lies between the genetically separated otter populations in eastern Germany / Lower Saxony and in the Netherlands. Spraint samples were genetically analyzed to identify sexes and individuals and compare their DNA to the two populations. First results show a mixing of the formerly separate populations in the study area – seven individuals could be matched to the Dutch population while three individuals were of eastern German descent. Another focus of our studies was to identify impediments to the further expansion of Eurasian otter populations and to map safe travel corridors. When bridges are not suitably built, otters will leave the water and cross roads, risking to be hit by cars – their number one known cause of death. In the current studies, bridges were assessed with regards to their otter-safety in the mobile app and necessary measures were proposed.

Marzipan contest Poster N° 23

Food choice of *Propithecus candidus* (A. Grandidier, 1871) and *Propithecus verreauxi* (A. Grandidier, 1871) in relation to chemical plant components

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Impacts of food chemistry on the diet of primates are still poorly known. Here we compare correlations between feeding time and chemical plant components (energy, nitrogen, total nonstructural carbohydrates (TNC) and condensed tannins) in Silky (*Propithecus candidus* or *Propithecus diadema candidus*, A. Grandidier 1871) and Verreaux's Sifaka (*Propithecus verreauxi*, A. Grandidier, 1871) in relation to sex, seasonality or different plant parts. Between March 2012 and April 2013, 18 individuals of Verreaux's Sifakas were monitored in the dry deciduous Kirindy Forest in western Madagascar. Seven Silky Sifakas were observed between July 2009 and July 2010 in an intact and undisturbed rainforest in Marojejy National Park in northeastern Madagascar. Feeding times were measured to the nearest second, plant parts sifakas fed on were collected and analysed for their chemical composition. *Propithecus candidus* females and males spent more time feeding on plant parts with high energy levels and low concentrations of condensed tannins. Correlations did not differ between dry and wet seasons. Only condensed tannins were found to be avoided by *P. verreauxi* males in general and by both sexes in the choice of leaves. Feeding times increased during the dry season. The intact and undisturbed rainforest in Marojejy National Park offers a richer average food quality year-round than the dry deciduous Kirindy Forest. Thus, Silky Sifakas may have more options for food choice than Verraux's Sifakas. In contrast, Verraux's Sifakas from the dry forest with an extensive dry season maximize food intake over choice according to specific chemicals, except for avoiding tannins.

Marzipan contest Poster N° 20

The influence of mole-rats on geoxyle-grassland in central Angola

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During the rainy season of the years 2019 and 2020, mole-rats living in the Angolan Central Plateau (ACP) were investigated and their pedoturbation, tunnel architecture and effect on vegetation structure examined. The ACP is part of the miombo ecoregion which straddles across 11 countries in South-central Africa, and is rich in savannas and grasslands. These are characterized by tall C4 grasses and dwarf growth forms of woody plants with massive woody underground structures - so called geoxyles. Given the subterranean, tooth digging and herbivorous behavior of mole-rats, we hypothesized that their underground activity causes immediate disturbance on geoxyle habitats which may have significant effects on plant diversity. Thus, we randomly trapped mole-rats throughout the study sites by exposing tunnel entrances. Tunnels were excavated to expose nests, latrines, storage and food chambers, whilst drone photography and CAD Vector Works was used to map tunnels. Pedoturbation was determined by weighing mounds and calculating their volumes as ellipsoids. Additionally, drone photography was used to assess new mounds per time span. Standard vegetation surveys were employed to determine the vegetation structure.
Only *Fukomys mechowii* was encountered. One of its systems extended over an area of 1,930 m² with a combined tunnel length of 166 m. In addition to the nest & chambers already described in literature, we encountered bolt holes, that have not yet been described for *Fukomys*. Contrary to the study's hypothesis, presence/absence of mole-rat mounds had no significant effect on the species richness (Kruskal-Wallis $\chi^2 = 0.809$, df = 2, p-value = 0.667) or the cumulated cover values (Kruskal-Wallis $\chi^2 = 5.269$, df = 2, p-value = 0.072) of geoxyles. Subterranean herbivory may not be a "disturbance" in the sense of the intermediate disturbance theory in geoxyles. Instead, *F. mechowii* is a part of the ecosystem and vegetation has evolutionarily adapted to it. However, absence/presence of mole-rats significantly changed the species composition (ANOSIM statistic R = 0.016, p-value = 0.026) of the whole vegetation (geoxyles and non-geoxyles). Pedoturbation and feeding by mole-rats presumably changes fine-scale heterogeneity of vegetation patterns. From our findings, mole-rats move a remarkable amount of soil material (2.1 t ha^{-1} y^{-1}) through their pedoturbation activities.

Oral presentation: Fritz-Frank Award Winner

Faecal samples as a tool to study otter (*Lutra lutra*) diet, density and marking behaviour in salmonid streams

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Unbiased data on population demography and feeding ecology is fundamental for targeted measures and efficient monitoring in wildlife management, specifically when species of conservation concern and species with potential for human-wildlife conflicts are in focus of interest, as it is the case for Eurasian otter (*Lutra lutra*). In many parts of Europe, after decades of otter absence due to habitat loss and direct persecution, the ongoing re-expansion of the fish-eating species has led to a revival of human-wildlife conflicts between the feeding needs of otters, fisheries, and nature conservation proponents. Recently, this conflict is getting even more severe in riverine habitats, especially in the upper regions of salmonid streams, where multiple stressors affect fish populations. For otters as elusive and protected species indirect field census and sampling methods have become the method of choice to obtain ecological and demographical data. As their faeces are an evident and easy recognizable field sign, they were used to study otter diet composition and foraging strategies. Further their suitability for population monitoring and non-invasive genetic techniques was evaluated and optimized. As the human-wildlife conflict has intensified in salmonid streams and knowledge on otters as top predators in these ecosystems is scarce, the study focused on otters in upper reaches of streams in temperate Europe. This study underlines the potential and added value of scats for studying otter ecology and demography, but also discusses methodological considerations and gives recommendations to increase cost-efficiency of monitoring programmes using (molecular) scatology. The provided information on otter-prey interactions, predator densities and efficiency of methods builds on an evidence base for revised management strategies and legal frameworks aiming a coexistence of fisheries and piscivores free of conflicts.

Oral presentation

Finding a balance between carnivore conservation and human-carnivore interactions

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Increasing evidence from around the world points to the need for landscape-level governance for large carnivore conservation. However, competing and segregated objectives across different stakeholder groups challenge effective governance of large carnivores in multi-use landscapes. In order to create holistic and effective governance solutions it has been suggested that conservation institutions collaborate with other governance institutions from other sectors such as, agriculture, rural development. Although such cross-sectoral collaboration has a huge potential, the dynamics of each institutional system and their interactions, coupled with the complexity of scales and hierarchies, pose formidable challenges. In our study, we identify challenges in governance of carnivore conservation by interviewing experts and review of legislative documents from inter-connected institutions in India and Germany. The focused species are tiger (*Panthera tigris*), and grey wolves (*Canis lupus lupus*) in the two countries, respectively. Coupled with the existing literature on effective governance of complex socio-ecological systems, we develop a framework that aims to effectively map existing networks of governance institutions and informal actors (such as stakeholders), in different scales and levels of functionality of inter-connected institutions. This framework provides essential information on how to measure power dynamics and functionality of collaborations, and identify possible leverage points to generate more sustainable measures for effectively managing large carnivores in human-dominated landscapes.

Marzipan contest Poster N° 2

Mechanistic models reveal the impacts of climate change on lemurs

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Understanding the impacts of environmental change on wildlife will require an integrated approach that draws together different disciplines and exploits new technologies and innovations. Biophysical mechanistic models have emerged as key tools for trait-based species conservation management and risk assessment. Mechanistic models apply fundamental principles to predict animals' energetic requirements and provide insights into underlying drivers of distribution change and species vulnerability to future climate change. Madagascar supports 23% of the world's primate diversity, however all species are at risk from a range of threats, including anthropogenic climate change. Biophysical models may provide important insights into the ecology of lemurs and other primates and assist in conservation. We developed and validated a biophysical mechanistic model for the threatened lemur genus *Lepilemur* from our empirical case study of the energetics, morphology and behaviour of *L. petteri* at Berenty, southern Madagascar. We used the model to calculate constraints on water and energy balance in varying conditions and thus determine limits to survival. We developed a spatial proxy for habitat suitability from predicted metabolic rate, which we mapped using current and historical GIS data and climate change simulations. The model suggests that high temperatures in the summer wet season in the south of Madagascar are particularly stressful for *Lepilemur* and shows that climate changes that have occurred across Madagascar over the 20th Century have already reduced the suitability of the habitat for *L. petteri* within their current geographic range. The simulations also show that small changes in biology, behaviour and environment can lead to population-wide consequences and higher risks of extinction for *Lepilemur*. Insights from the model can be used to inform targeted conservation management of the genus, such as to identify habitat resources that are critical for survival and highlight places of conservation priority.

Marzipan contest Poster N° 21

Searching the elusive – do non-invasive methods enable large-area monitoring of Mediterranean water shrews (*Neomys anomalus)*?

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The water shrews, *Neomys fodiens*, the Eurasian water shrew, and *N. anomalus*, the Medieterranean water shrew, have similar ecologies and are sympatric in many regions of Europe. *N. fodiens* has a larger range and is better known than *N. anomalus* which is elusive, appears rare and is the least known shrew in Europe. In Germany *N. anomalus* is listed as "strongly endangered" in the Red List and Germany has a high responsibility for its conservation. Monitoring of small mammals using live traps is time consuming in particular for shrews as traps have to be checked very frequently to reduce mortality**.** And as *Neomys* species are hardly found in owl pellets other methods are needed to document their distribution. The study was initiated to test whether a combination of non-invasive collection of fecal pellets using baited tubes and a high throughput molecular method (barcoding using COI marker) will enable to screen large areas for the presence of *Neomys* anomalus and would allow monitoring of other elusive small mammal species.
So far 373 fecel pellets are analyzed and for 189 (50.7 %) a sequence could be generated and the mammal species identified. The following species were identified: *Sorex minutus S. araneus, Apodemus flavicollis, A. sylvaticus, A. agrarius, Clethrionomys glareolus*, *Mus musculus* and *Microtus oeconomus*. This indicates, that the method has the potential to find elusive species like *M. oeconomus*. The analysis of the remaining samples might also yield the target species *N. anomalus* and subsequently different approaches in the field might be tested to be able to get samples of more rare species and document small mammal communities of a site.

Plenary

Mammal Population Monitoring for Conservation: An Overview of Challenges and Opportunities

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Evidence-based decision-making in mammal conservation is often constrained by lack of robust monitoring data. Technology offers opportunities for enhanced data collection through a range of satellite-based and Earth-based sensors and techniques. This paper provides an overview of the types of data needed for mammal conservation management, and the main challenges and opportunities for monitoring. It provides a review of lessons learned from the application of traditional observer-based methods such as transect counts, as well as the use of key technological monitoring solutions (such as satellite-based remote sensing, cameras, acoustic recording devices and environmental DNA) to identify factors affecting their relevance and applicability. Most tools, if relevant to local user needs and integrated into goal-based monitoring schemes, can contribute to creating the enabling conditions necessary for effective mammal monitoring, improving data availability and quality for various taxa when compared with traditional observer-based methods. The paper concludes by discussing how different methods can be used to complement each other,a s well as highlighting the situations in which traditional observer-based methods are still most relevant, especially in biodiversity-rich and resource-poor countries.

Marzipan contest Poster N° 13

Garden dormouse conservation: passive acoustic monitoring, sound recorders and machine learning as new useful tools

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Conservation of garden dormice (*Eliomys quercinus*), a small nocturnal hibernator in steep decline in Germany, is especially challenging due to the difficulty of visual detection. Passive acoustic monitoring is a recent, non-invasive method that has proved its use for the identification of a wide variety of vocalizing species in the field such as birds, bats and cetaceans. For time and cost-efficient analysis of the large amount of data produced by bioacoustic methods, an automatized process of animal vocalization identification is needed. A total of 10 audiomoths and 10 BAR-LT recorders were used in pairs at 10 sites of known garden dormouse occurrence throughout Germany. During the recording period from June to September 2021, a total of 3.54 TB of data was produced. Manual identification of garden dormouse vocalizations was performed on a subset of the acoustic data using personal and volunteers' observations. A TensorFlow model was trained and tested using both target and ambient sound samples. Cheap, open source audiomoths selection over more expensive equipment such as BAR-LT recorders came at the cost of quality, but still proved useful in the passive acoustic monitoring and machine learning context. Future analysis of temporal activity patterns of garden dormice will help to achieve a more effective sampling design in future bioacoustic studies of this elusive species.

Oral presentation

Searching for zoonotic and animal encephalitis pathogens in small mammals

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Rodents and shrews represent important reservoirs for animal and zoonotic pathogens, including e.g. those causing encephalitis: Borna disease virus 1 (BoDV-1), rustrela virus (RusV) and lymphocytic choriomeningitis mammarenavirus (LCMV).
BoDV-1 has long been known as the causative agent of Borna disease in horses, alpacas and other domestic mammals. More recently, BoDV-1 was found to cause encephalitis also in humans, with almost always lethal course. The currently accepted reservoir of BoDV-1 is the bicolored white-toothed shrew (*Crocidura leucodon*). Recently, a novel encephalitis pathogen, RusV, was discovered in diseased zoo animals in northeastern Germany. The zoonotic potential of RusV is, so far, unknown. The yellow-necked field mouse (*Apodemus flavicollis*) was identified as a reservoir of RusV. The reservoir of LCMV, another long-studied zoonotic pathogen, is the house mouse (*Mus musculus*). Little is currently known about the presence of LCMV in Germany. Here we report on the screening for and occurrence of these pathogens in small mammal reservoirs as well as the identification of further potential reservoirs.

Oral presentation

Wildlife monitoring challenges in the central African forest

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Monitoring mammal populations in the central African forest is challenging. Surveys must be carried out on the ground, where thick understory hinders direct observation and reliable counting of individuals. Sampling of indirect signs, such as nests for great apes or dung for elephants, has been introduced as an alternative. However, assessing species population size based on the conversion of sign estimates remains difficult. Additionally, the technique does not apply for species with less conspicuous signs. A more effective technique to capture elusive species has been found in camera traps. And while the use of cameras is not new, the estimate of densities with them is still a challenge, given that most species cannot be identified by individual traits as required by capture-recapture approaches. Distance sampling for camera traps has been introduced as an alternative technique. We show-case two mammal surveys in the Congo Basin that applied both, line transect and camera trap distance sampling. We illustrate how, in the line transect technique, inaccurate conversion factors and human observer bias in sympatric areas of gorilla and chimpanzee could lead to misestimates for both species. On the other hand, immense amount of footage makes the camera trap approach tedious. Furthermore, violation of methodological assumption hinders the accuracy and precision of resulting estimates. Nevertheless, a first estimate for e.g. giant pangolin densities show that remote cameras have a great advantage over traditional line transects. This information is of great importance for conservation practitioners planning long-term wildlife monitoring in dense rainforest ecosystems.

Oral presentation

Bloodsuckers for conservation: prospects and pitfalls of environmental DNA as a survey and monitoring tool for mammals

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Globally, mammalian biodiversity is declining at an alarming rate and the conservation of vulnerable species is of crucial importance. To implement evidence-driven conservation, it is important to monitor threatened mammal populations. However, monitoring also presents challenges, particularly in tropical rainforests where species of interest are often rare, secretive, and occur in remote areas. In recent years environmental DNA (eDNA) and its subdiscipline invertebrate-derived DNA (iDNA), in combination with high throughput sequencing, has been proposed as a cost efficient and powerful tool to survey mammal species. Despite this potential, there have been few studies that have used e/iDNA for systematic landscape surveys, and so far most field studies have only presented a proof of concept that mammal DNA can be derived from environmental sources or blood-sucking invertebrates. I will present an overview of the opportunities and challenges for using e/iDNA for systematic surveys of threatened mammal species. I will mainly use results from concurrent camera-trap and terrestrial leech surveys in Malaysian Borneo and the Annamite landscape in Vietnam and Laos to test and discuss the utility of e/iDNA as an alternative survey and monitoring tool for mammals.

Plenary

Hybridization in Primates

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Sixteen years ago, Arnold & Meyer (Zoology 109: 261-276) reviewed the role and importance of natural hybridization in the evolutionary histories of primates. Until that time, it was largely assumed that hybridization has only a limited evolutionary impact on the evolution of primates and other animals. However, in the following years, due to the rapid advancement of molecular and bioinformatic methods, it became obvious that hybridization and subsequent genetic introgression are common features of the histories of many primate taxa, including our own. With my contribution, I will provide an updated overview of our knowledge about hybridization in primates and its impacts on taxonomy, phylogeny and biogeography of this mammalian order.

Participants

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