

DATA PAPER

SNAPSHOT USA 2020: A second coordinated national camera trap survey of the United States during the COVID-19 pandemic

Roland Kays^{1,2}  | Michael V. Cove²  | Jose Diaz³ | Kimberly Todd³ |
 Claire Bresnan³ | Matt Snider¹ | Thomas E. Lee Jr⁴ | Jonathan G. Jasper⁴ |
 Brianna Douglas⁴ | Anthony P. Crupi⁵ | Katherine C. B. Weiss^{6,7} |
 Helen Rowe⁸ | Tiffany Sprague⁸ | Jan Schipper⁷ | Christopher A. Lepczyk⁹  |
 Jean E. Fantle-Lepczyk⁹ | Jon Davenport¹⁰ | Marketa Zimova¹⁰  |
 Zach Farris¹¹  | Jacque Williamson¹² | M. Caitlin Fisher-Reid¹³  |
 Drew Rezendes¹³ | Sean M. King¹³ | Petros Chrysafis¹⁴ | Alex J. Jensen¹⁵ |
 David S. Jachowski¹⁵ | Katherine C. King¹⁶ | Daniel J. Herrera¹⁷ |
 Sophie Moore¹⁷  | Marius van der Merwe¹⁸ | Jason V. Lombardi¹⁹ |
 Maksim Sergejev¹⁹ | Michael E. Tewes¹⁹ | Robert V. Horan III²⁰ |
 Michael S. Rentz²¹ | Ace Driver²¹ | La Roy S. E. Brandt²² |
 Christopher Nagy²³ | Peter Alexander²⁴ | Sean P. Maher²⁵ |
 Andrea K. Darracq²⁶ | Evan G. Barr²⁶ | George Hess³ | Stephen L. Webb²⁷  |
 Mike D. Proctor²⁷ | John P. Vanek²⁸  | Diana J. R. Lafferty²⁹ |
 Tru Hubbard²⁹ | Jaime E. Jiménez³⁰ | Craig McCain³⁰ | Jorie Favreau³¹ |
 Jack Fogarty³¹ | Jacob Hill³² | Steven Hammerich³³ | Morgan Gray³³ |
 Christine C. Rega-Brodsky³⁴  | Caleb Durbin³⁴ | Elizabeth A. Flaherty³⁵ |
 Jarred Brooke³⁵ | Stephanie S. Coster³⁶ | Richard G. Lathrop³⁷ |
 Katarina Russell³⁷ | Daniel A. Bogan³⁸ | Hila Shamon³⁹  | Brigit Rooney⁴⁰ |
 Aimee Rockhill⁴¹ | Robert C. Lonsinger⁴²  | M. Teague O'Mara⁴³  |
 Justin A. Compton⁴⁴ | Erika L. Barthelmess⁴⁵ | Katherine E. Andy⁴⁵ |
 Jerrold L. Belant⁴⁶ | Tyler Petroelje⁴⁶  | Nathaniel H. Wehr⁴⁶ |
 Dean E. Beyer Jr⁴⁷ | Daniel G. Scognamillo⁴⁸ | Chris Schalk⁴⁸ | Kara Day⁴⁹ |
 Caroline N. Ellison⁵⁰ | Chip Ruthven⁵⁰ | Blaine Nunley⁵⁰ | Sarah Fritts⁵¹ |
 Christopher A. Whittier⁵² | Sean A. Neiswenter⁵³ | Robert Pelletier⁵³ |
 Brett A. DeGregorio⁵⁴ | Erin K. Kuprewicz⁵⁵  | Miranda L. Davis⁵⁵ |
 Carolina Baruzzi⁵⁶  | Marcus A. Lashley⁵⁷  | Brandon McDonald^{16,57} |
 David Mason⁵⁷  | Derek R. Risch⁵⁸ | Maximilian L. Allen^{59,60}  |
 Laura S. Whipple⁶⁰ | Jinelle H. Sperry^{60,61} | Emmarie Alexander⁶⁰ |

Patrick J. Wolff⁶¹ | **Robert H. Hagen**⁶² | **Alessio Mortelliti**⁶³  |
Amay Bolinjar⁶³ | **Andrew M. Wilson**⁶⁴ | **Scott Van Norman**⁶⁵ |
Cailey Powell⁶⁵ | **Henry Coletto**⁶⁶ | **Martha Schauss**⁶⁶ | **Helen Bontrager**⁶⁷  |
James Beasley⁶⁷  | **Susan N. Ellis-Felege**⁶⁸ | **Samuel R. Wehr**⁶⁹ |
Sean T. Giery⁷⁰  | **Charles E. Pekins**⁷¹ | **Summer H. LaRose**⁷² |
Ronald S. Revord⁷² | **Christopher P. Hansen**⁷³ | **Lonnie Hansen**⁷³ |
Joshua J. Millspaugh⁷³ | **Adam Zorn**⁷⁴ | **Brian D. Gerber**⁷⁵  |
Kylie Rezendes⁷⁵ | **Jessie Adley**⁷⁵ | **Jennifer Sevin**⁷⁶ | **Austin M. Green**⁷⁷  |
Çağan H. Şekercioglu^{77,78} | **Mary E. Pendergast**⁷⁹ | **Kayleigh Mullen**⁸⁰ |
Tori Bird⁸⁰ | **Andrew J. Edelman**⁸¹ | **Andrea Romero**⁸² | **Brian J. O'Neill**⁸³ |
Noel Schmitz⁸³ | **Rebecca A. Vandermus**⁸² | **Jesse M. Alston**⁸⁴  |
Kellie M. Kuhn⁸⁵ | **Steven C. Hasstedt**⁸⁵ | **Damon B. Lesmeister**⁸⁶  |
Cara L. Appel⁸⁷  | **Christopher Rota**⁸⁸ | **Jennifer L. Stenglein**⁸⁹ |
Christine Anhalt-Depies⁸⁹ | **Carrie L. Nelson**⁹⁰ | **Robert A. Long**⁹¹ |
Kathryn R. Remine⁹¹ | **Mark J. Jordan**⁹² | **L. Mark Elbroch**⁹³ |
Dylan Bergman⁹⁴ | **Sara Cendejas-Zarelli**⁹⁵ | **Kim Sager-Fradkin**⁹⁵ |
Mike Conner⁹⁶ | **Gail Morris**⁹⁶ | **Elizabeth Parsons**⁹⁶ |
Haydée Hernández-Yañez³ | **William J. McShea**³

¹Department of Forestry and Environmental Resources, North Carolina State University, Raleigh, North Carolina, USA

²North Carolina Museum of Natural Sciences, Raleigh, North Carolina, USA

³Smithsonian Conservation Biology Institute, Front Royal, Virginia, USA

⁴Department of Biology, Abilene Christian University, Abilene, Texas, USA

⁵Alaska Department of Fish and Game, Division of Wildlife Conservation, Douglas, Alaska, USA

⁶Arizona State University, Tempe, Arizona, USA

⁷Field Conservation Research Department, Arizona Center for Nature Conservation/Phoenix Zoo, Phoenix, Arizona, USA

⁸McDowell Sonoran Conservancy, Scottsdale, Arizona, USA

⁹School of Forestry and Wildlife Sciences, Auburn University, Auburn, Alabama, USA

¹⁰Department of Biology, Appalachian State University, Boone, North Carolina, USA

¹¹Department of Health and Exercise Science, Appalachian State University, Boone, North Carolina, USA

¹²Department of Education & Conservation, Brandywine Zoo-Delaware State Parks, Wilmington, Delaware, USA

¹³Department of Biological Sciences, Bridgewater State University, Bridgewater, Massachusetts, USA

¹⁴Predator Detection and Deterrence, Fresno, California, USA

¹⁵Department of Forestry and Environmental Conservation, Clemson University, Clemson, South Carolina, USA

¹⁶Crocodile Lake National Wildlife Refuge, Key Largo, Florida, USA

¹⁷DC Cat Count at the Humane Rescue Alliance, Washington, District of Columbia, USA

¹⁸Biological Sciences Department, Dixie State University, St. George, Utah, USA

¹⁹Caesar Kleberg Wildlife Research Institute, Texas A&M University-Kingsville, Kingsville, Texas, USA

²⁰Georgia Department of Natural Resources, Wildlife Resources Division, Brunswick, Georgia, USA

²¹Natural Resource Ecology and Management, Iowa State University, Ames, Iowa, USA

²²Cumberland Mountain Research Center, Lincoln Memorial University, Harrogate, Tennessee, USA

²³Mianus River Gorge, Bedford, New York, USA

²⁴Craighead Beringia South, Kelly, Wyoming, USA

- ²⁵Department of Biology, Missouri State University, Springfield, Missouri, USA
- ²⁶Department of Biology, Murray State University, Murray, Kentucky, USA
- ²⁷Noble Research Institute, Ardmore, Oklahoma, USA
- ²⁸Department of Biological Sciences, Northern Illinois University, DeKalb, Illinois, USA
- ²⁹Wildlife Ecology and Conservation Science Lab, Department of Biology, Northern Michigan University, Marquette, Michigan, USA
- ³⁰Department of Biological Sciences and the Advanced Environmental Research Institute, University of North Texas, Denton, Texas, USA
- ³¹Paul Smith's College, Paul Smiths, New York, USA
- ³²Department Biology, North Carolina State University, Raleigh, North Carolina, USA
- ³³Pepperwood Foundation, Santa Rosa, California, USA
- ³⁴Biology Department, Pittsburg State University, Pittsburg, Kansas, USA
- ³⁵Department of Forestry and Natural Resources, Purdue University, West Lafayette, Indiana, USA
- ³⁶Biology Department, Randolph-Macon College, Ashland, Virginia, USA
- ³⁷Department of Ecology, Evolution, and Natural Resources, Rutgers University, New Brunswick, New Jersey, USA
- ³⁸Department of Environmental Studies and Sciences, Siena College, Loudonville, New York, USA
- ³⁹Silvio O Conte National Fish and Wildlife Refuge, Brunswick, Vermont, USA
- ⁴⁰Independent Researcher, Whitefish, Montana, USA
- ⁴¹Department of Geosciences and Natural Resources, Western Carolina University, Cullowhee, North Carolina, USA
- ⁴²U.S. Geological Survey, Oklahoma Cooperative Fish and Wildlife Research Unit, Oklahoma State University, Stillwater, Oklahoma, USA
- ⁴³Department of Biological Sciences, Southeastern Louisiana University, Hammond, Louisiana, USA
- ⁴⁴Biology and Chemistry Department, Springfield College, Springfield, Massachusetts, USA
- ⁴⁵Biology Department and Nature Up North Program, St. Lawrence University, Canton, New York, USA
- ⁴⁶Global Wildlife Conservation Center, State University of New York College of Environmental Science and Forestry, Syracuse, New York, USA
- ⁴⁷Wildlife Division, Michigan Department of Natural Resources, Lansing, Michigan, USA
- ⁴⁸Arthur Temple College of Forestry and Agriculture – Stephen F. Austin State University, Nacogdoches, Texas, USA
- ⁴⁹Georgia Department of Natural Resources, Social Circle, Georgia, USA
- ⁵⁰Texas Parks and Wildlife Department, Paducah, Texas, USA
- ⁵¹Department of Biology, Texas State University, San Marcos, Texas, USA
- ⁵²Tufts Center for Conservation Medicine, Cummings School of Veterinary Medicine at Tufts University, North Grafton, Massachusetts, USA
- ⁵³School of Life Sciences, University of Nevada, Las Vegas, Las Vegas, Nevada, USA
- ⁵⁴U.S. Geological Survey Fish and Wildlife Cooperative Research Unit, University of Arkansas, Fayetteville, Arkansas, USA
- ⁵⁵Department of Ecology and Evolutionary Biology, University of Connecticut, Storrs, Connecticut, USA
- ⁵⁶School of Forest, Fisheries, & Geomatics Sciences, University of Florida, Gainesville, Florida, USA
- ⁵⁷Department of Wildlife Ecology and Conservation, University of Florida, Gainesville, Florida, USA
- ⁵⁸Department of Natural Resources and Environmental Management, University of Hawaii at Mānoa, Honolulu, Hawaii, USA
- ⁵⁹Illinois Natural History Survey, University of Illinois, Champaign, Illinois, USA
- ⁶⁰Department of Natural Resources and Environmental Sciences, University of Illinois Urbana-Champaign, Urbana, Illinois, USA
- ⁶¹Engineer Research and Development Center, Champaign, Illinois, USA
- ⁶²Environmental Studies Program, University of Kansas, Lawrence, Kansas, USA
- ⁶³Department of Wildlife, Fisheries, and Conservation Biology, University of Maine, Orono, Maine, USA
- ⁶⁴Environmental Studies, Gettysburg College, Gettysburg, Pennsylvania, USA
- ⁶⁵Cow Creek Band of Umpqua Tribe of Indians, Roseburg, Oregon, USA
- ⁶⁶Friends of Cañada de los Osos Ecological Reserve, Gilroy, California, USA
- ⁶⁷Savannah River Ecology Laboratory, D. B. Warnell School of Forestry and Natural Resources, University of Georgia, Aiken, South Carolina, USA
- ⁶⁸Biology Department, University of North Dakota, Grand Forks, North Dakota, USA
- ⁶⁹Department of Biology, Oberlin College, Oberlin, Ohio, USA

- ⁷⁰Eberly College of Science, Department of Biology, The Pennsylvania State University, University Park, Pennsylvania, USA
- ⁷¹Fort Hood Natural Resources Management Branch, USA Army Garrison, Fort Hood, Texas, USA
- ⁷²Center for Agroforestry, University of Missouri, Columbia, Missouri, USA
- ⁷³Wildlife Biology Program, W.A. Franke College of Forestry and Conservation, University of Montana, Missoula, Montana, USA
- ⁷⁴Huston-Brumbaugh Nature Center, University of Mount Union, Alliance, Ohio, USA
- ⁷⁵Department of Natural Resources Science, University of Rhode Island, Kingston, Rhode Island, USA
- ⁷⁶Department of Biology, University of Richmond, Richmond, Virginia, USA
- ⁷⁷School of Biological Sciences, University of Utah, Salt Lake City, Utah, USA
- ⁷⁸College of Sciences, Koç University, Rumelifeneri, İstanbul, Turkey
- ⁷⁹Sageland Collaborative, Salt Lake City, Utah, USA
- ⁸⁰Utah's Hogle Zoo, Salt Lake City, Utah, USA
- ⁸¹Department of Biology, University of West Georgia, Carrollton, Georgia, USA
- ⁸²Department of Biological Sciences; Department of Geography, Geology, and Environmental Science, University of Wisconsin-Whitewater, Whitewater, Wisconsin, USA
- ⁸³Department of Biological Sciences, University of Wisconsin-Whitewater, Whitewater, Wisconsin, USA
- ⁸⁴Program in Ecology, Department of Zoology and Physiology, University of Wyoming, Laramie, Wyoming, USA
- ⁸⁵Department of Biology, US Air Force Academy, USAFA, Colorado Springs, Colorado, USA
- ⁸⁶USDA Forest Service, Pacific Northwest Research Station, Portland, Oregon, USA
- ⁸⁷Department of Fisheries, Wildlife, and Conservation Sciences, Oregon State University, Corvallis, Oregon, USA
- ⁸⁸Division of Forestry and Natural Resources, West Virginia University, Morgantown, West Virginia, USA
- ⁸⁹Office of Applied Science, Wisconsin Department of Natural Resources, Madison, Wisconsin, USA
- ⁹⁰U.S. Forest Service, Chequamegon-Nicolet National Forest, Great Divide Ranger District, Hayward, Wisconsin, USA
- ⁹¹Woodland Park Zoo, Seattle, Washington, USA
- ⁹²Department of Biology, Seattle University, Seattle, Washington, USA
- ⁹³Panthera, New York, New York, USA
- ⁹⁴Point No Point Treaty Council, Poulsbo, Washington, USA
- ⁹⁵Natural Resources, Lower Elwha Tribe, Port Angeles, Washington, USA
- ⁹⁶The Jones Center at Ichauway, Newton, Georgia, USA

Correspondence

Roland Kays

Email: rwkays@ncsu.edu

Funding information

American Society for the Prevention of Cruelty to Animals, The Humane Society of the United States, Winn Feline Foundation, Maddie's Fund; Aurora Country Club; Iowa; Isabel Lepczyk, Kreher Preserve, and Nature Center; AK; Maine Department of Inland Fisheries; Mcnair's Scholars Program; Murray State University; National Science Foundation; Ordway-Swisher Biological Station; Pepperwood Foundation; Scout Island Educational Center; Smithsonian Institution; The Delaware Zoological Society, Parks, DE State, Brandywine Zoo; U.S. Department of Agriculture; U.S. Department of Energy, Grant/Award Number: DE-EM0004391; University of Kansas Field Station, KU Environmental

Abstract

Managing wildlife populations in the face of global change requires regular data on the abundance and distribution of wild animals, but acquiring these over appropriate spatial scales in a sustainable way has proven challenging. Here we present the data from Snapshot USA 2020, a second annual national mammal survey of the USA. This project involved 152 scientists setting camera traps in a standardized protocol at 1485 locations across 103 arrays in 43 states for a total of 52,710 trap-nights of survey effort. Most (58) of these arrays were also sampled during the same months (September and October) in 2019, providing a direct comparison of animal populations in 2 years that includes data from both during and before the COVID-19 pandemic. All data were managed by the eMammal system, with all species identifications checked by at least two reviewers. In total, we recorded 117,415 detections of 78 species of wild mammals, 9236 detections of at least 43 species of birds, 15,851 detections of six domestic animals and 23,825 detections of humans or their vehicles. Spatial differences across arrays explained more variation in

Studies Program; Wildlife, Cooperative Forestry Research Unit; MD

Handling Editor: William K. Michener

the relative abundance than temporal variation across years for all 38 species modeled, although there are examples of significant site-level differences among years for many species. Temporal results show how species allocate their time and can be used to study species interactions, including between humans and wildlife. These data provide a snapshot of the mammal community of the USA for 2020 and will be useful for exploring the drivers of spatial and temporal changes in relative abundance and distribution, and the impacts of species interactions on daily activity patterns. There are no copyright restrictions, and please cite this paper when using these data, or a subset of these data, for publication.

KEYWORDS

biodiversity, biogeography, camera traps, Carnivora, Cetartiodactyla, Didelphimorphia, Lagomorpha, mammals, occupancy modeling, species distribution modeling

CONFLICT OF INTEREST


The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

The complete data set is available as Supporting Information (Data S1). Associated data are also available at the Smithsonian's eMammal data repository <https://emammal.si.edu/analysis/data-download> by choosing North America in the map and then selecting the project: Snapshot USA – 2020.

ORCID

Roland Kays  <https://orcid.org/0000-0002-2947-6665>
 Michael V. Cove  <https://orcid.org/0000-0001-5691-0634>
 Christopher A. Lepczyk  <https://orcid.org/0000-0002-5316-3159>
 Marketa Zimova  <https://orcid.org/0000-0002-8264-9879>
 Zach Farris  <https://orcid.org/0000-0003-0600-9682>
 M. Caitlin Fisher-Reid  <https://orcid.org/0000-0003-1587-7086>
 Sophie Moore  <https://orcid.org/0000-0001-7359-7109>
 Stephen L. Webb  <https://orcid.org/0000-0001-6034-5164>
 John P. Vanek  <https://orcid.org/0000-0002-8684-9632>
 Christine C. Rega-Brodsky  <https://orcid.org/0000-0002-3483-1465>
 Hila Shamon  <https://orcid.org/0000-0001-5252-7013>
 Robert C. Lonsinger  <https://orcid.org/0000-0002-1040-7299>
 M. Teague O'Mara  <https://orcid.org/0000-0002-6951-1648>
 Tyler Petroelje  <https://orcid.org/0000-0003-4957-6732>
 Erin K. Kuprewicz  <https://orcid.org/0000-0002-6658-9052>

Carolina Baruzzi  <https://orcid.org/0000-0003-1796-9355>

Marcus A. Lashley  <https://orcid.org/0000-0002-1086-7754>

David Mason  <https://orcid.org/0000-0001-8456-5700>

Maximilian L. Allen  <https://orcid.org/0000-0001-8976-889X>

Alessio Mortelliti  <https://orcid.org/0000-0003-0480-6100>

Helen Bontrager  <https://orcid.org/0000-0002-9457-2119>

James Beasley  <https://orcid.org/0000-0001-9707-3713>

Sean T. Giery  <https://orcid.org/0000-0003-3774-5295>

Brian D. Gerber  <https://orcid.org/0000-0001-9285-9784>

Austin M. Green  <https://orcid.org/0000-0002-7443-3015>

Jesse M. Alston  <https://orcid.org/0000-0001-5309-7625>

Damon B. Lesmeister  <https://orcid.org/0000-0003-1102-0122>

Cara L. Appel  <https://orcid.org/0000-0002-4761-606X>

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

How to cite this article: Kays, Roland, Michael V. Cove, Jose Diaz, Kimberly Todd, Claire Bresnan, Matt Snider, Thomas E. Lee Jr, et al. 2022. "SNAPSHOT USA 2020: A Second Coordinated National Camera Trap Survey of the United States during the COVID-19 Pandemic." *Ecology* 103(10): e3775. <https://doi.org/10.1002/ecy.3775>