

DATA PAPER

SNAPSHOT USA 2021: A third coordinated national camera trap survey of the United States

Hila Shamon¹  | Roi Maor^{1,2}  | Michael V. Cove³  | Roland Kays^{3,4}  |
 Jessie Adley⁵ | Peter D. Alexander⁶ | David N. Allen⁷  |
 Maximilian L. Allen^{8,9}  | Cara L. Appel^{10,11}  | Evan Barr¹² |
 Erika L. Barthelmess¹³ | Carolina Baruzzi¹⁴  | Kelli Bashaw¹⁵ |
 Guillaume Bastille-Rousseau^{16,17}  | Madison E. Baugh¹⁸ | Jerrold Belant¹⁹ |
 John F. Benson²⁰  | Bethany A. Bespoyasny²¹ | Tori Bird²² |
 Daniel A. Bogan²³ | LaRoy S. E. Brandt^{24,25} | Claire E. Bresnan^{1,26} |
 Jarred M. Brooke²⁷ | Frances E. Buderman²⁸  | Suzannah G. Buzzell²⁹ |
 Amanda E. Cheeseman²¹  | M. Colter Chitwood³⁰  | Petros Chrysafis³¹ |
 Merri K. Collins³² | D. Parks Collins³³ | Justin A. Compton³⁴ |
 L. Mike Conner³⁵ | Olivia G. Cosby¹ | Stephanie S. Coster³⁶ |
 Benjamin Crawford⁹ | Anthony P. Crupi³⁷ | Andrea K. Darracq^{12,38} |
 Miranda L. Davis³⁹ | Brett A. DeGregorio⁴⁰ | Kimberly L. Denningmann⁴¹ |
 Kyle D. Dougherty²⁰ | Ace Driver⁴² | Andrew J. Edelman⁴³ |
 E. Hance Ellington⁴⁴  | Susan N. Ellis-Felege⁴⁵ | Caroline N. Ellison¹⁵ |
 Jean E. Fantle-Lepczyk⁴⁶ | Zach J. Farris⁴⁷  | Jorie Favreau⁴⁸ |
 Pilar Fernandez⁴⁹ | M. Caitlin Fisher-Reid⁵⁰  | Matthew C. Fitzpatrick⁵¹  |
 Elizabeth A. Flaherty²⁷ | Tavis D. Forrester⁵² | Sarah R. Fritts⁵³ |
 Travis Gallo³²  | Brian D. Gerber⁵  | Sean T. Giery⁵⁴  |
 Jessica L. Glasscock⁵⁵ | Alex D. Gonatas⁵⁰ | Anna C. Grady⁵⁶  |
 Austin M. Green⁵⁷  | Tremaine Gregory¹ | Noel Griffin^{3,4} |
 Robert H. Hagen⁵⁸ | Christopher P. Hansen⁵⁹ | Lonnie P. Hansen⁵⁹ |
 Steven C. Hasstedt⁶⁰ | Haydée Hernández-Yañez¹ | Daniel J. Herrera³² |
 Robert V. Horan III⁶¹ | Victoria L. Jackson¹⁸ | Luanne Johnson⁶² |
 Mark J. Jordan⁶³ | Willaine Kahano⁶⁴ | Joseph Kiser³³ |
 Travis W. Knowles⁶⁵ | Molly M. Koeck³⁰ | Caroline Koroly³³ |
 Kellie M. Kuhn⁶⁰ | Erin K. Kuprewicz^{39,66}  | Diana J. R. Lafferty⁶⁷ |
 Scott D. LaPoint^{68,69}  | Marcus Lashley⁷⁰  | Richard G. Lathrop⁷¹ |
 Thomas E. Lee Jr.⁷² | Christopher A. Lepczyk⁴⁶  | Damon B. Lesmeister^{10,11}  |
 Jason V. Lombardi⁷³ | Robert A. Long⁷⁴ | Robert C. Lonsinger^{30,75}  |

For affiliations refer to page 3

Paula MacKay⁷⁴ | Sean P. Maher⁷⁶ | David S. Mason⁷⁰  |
 Joshua J. Millspaugh⁵⁹ | Remington J. Moll²⁹ | Jessica B. Moon^{12,38} |
 Alessio Mortelliti^{77,78}  | Alexis M. Mychajliw^{7,79} | Christopher M. Nagy⁸⁰ |
 Sean A. Neiswenter⁶⁴ | Dana L. Nelson^{1,81} | Claire E. Nemes⁵¹ |
 Clayton K. Nielsen^{16,82} | Elizabeth Olson⁶² | M. Teague O'Mara⁸³  |
 Brian J. O'Neill⁸⁴ | Blake R. Page⁵⁰ | Elizabeth Parsons^{35,85} |
 Brent S. Pease⁸²  | Mary E. Pendergast⁸⁶ | Mike Proctor⁸⁷ |
 Heather Quick³³ | Christine C. Rega-Brodsky⁸⁸  | Michael S. Rentz⁴² |
 Kylie Rezendes⁵ | Daric Rich⁸⁹ | Derek R. Risch⁹⁰ | Andrea Romero⁹¹ |
 Brigit R. Rooney⁹² | Christopher T. Rota⁹³ | Corey A. Samples⁸⁹ |
 Christopher M. Schalk⁵⁵ | Çagan H. Sekercioglu^{57,94} | Maksim Sergeyev⁷⁷  |
 Austin B. Smith⁹⁵  | Daniel S. Smith⁸⁹ | Jinelle H. Sperry⁹⁶ |
 Jennifer L. Stenglein⁹⁷ | Michael K. Stokes⁹⁸ | Johnathon S. Stutzman¹ |
 Kimberly R. Todd¹ | John P. Vanek^{99,100}  | Wren Varga¹⁰¹ |
 Zachary M. Wardle^{77,102}  | Stephen L. Webb^{102,103}  | Nathaniel H. Wehr¹⁹  |
 Laura S. Whipple⁶⁷ | Christopher A. Whittier¹⁰⁴  | Jane S. Widness¹⁰⁵ |
 Jacque Williamson¹⁰⁶  | Andrew M. Wilson¹⁰⁷ | Alexander J. Wolf⁸⁹ |
 Marketa Zimova¹⁰⁸  | Adam S. Zorn¹⁰⁹ | William J. McShea¹

Correspondence

Hila Shamon

Email: shamon@si.edu

Present address

Roi Maor, Royal Botanic Gardens,
Kew Richmond, UK.

Funding information

McIntire-Stennis Project, Grant/Award Number: WVA00818; USDA National Institute of Food and Agriculture, Hatch Project, Grant/Award Numbers: 1019737, 1024904, 1026189, 1024128; NSF Division of Undergraduate Education, Grant/Award Number: 1564969

Handling Editor: Simona Picardi

Abstract

SNAPSHOT USA is a multicontributor, long-term camera trap survey designed to survey mammals across the United States. Participants are recruited through community networks and directly through a website application (<https://www.snapshot-usa.org/>). The growing Snapshot dataset is useful, for example, for tracking wildlife population responses to land use, land cover, and climate changes across spatial and temporal scales. Here we present the SNAPSHOT USA 2021 dataset, the third national camera trap survey across the US. Data were collected across 109 camera trap arrays and included 1711 camera sites. The total effort equaled 71,519 camera trap nights and resulted in 172,507 sequences of animal observations. Sampling effort varied among camera trap arrays, with a minimum of 126 camera trap nights, a maximum of 3355 nights, a median 546 nights, and a mean 656 ± 431 nights. This third dataset comprises 51 camera trap arrays that were surveyed during 2019, 2020, and 2021, along with 71 camera trap arrays that were surveyed in 2020 and 2021. All raw data and accompanying metadata are stored on Wildlife Insights (<https://www.wildlifeinsights.org/>), and are publicly available upon acceptance of the data papers. SNAPSHOT USA aims to sample multiple ecoregions in the United States with adequate representation of each ecoregion according to its relative size. Currently, the relative density of camera trap arrays varies by an order of magnitude for the various ecoregions (0.22–5.9 arrays per 100,000 km²), emphasizing the need to increase sampling effort by further recruiting and retaining contributors. There are no copyright restrictions on these data. We

request that authors cite this paper when using these data, or a subset of these data, for publication. Any use of trade, firm, or product names is for descriptive purposes only and does not imply endorsement by the US Government.

KEYWORDS

biodiversity, biogeography, camera traps, Carnivora, Cetartiodactyla, Cingulata, Didelphimorphia, Lagomorpha, mammals, Rodentia

AUTHOR CONTRIBUTIONS

Aside from the primary SNAPSHOT USA team based at the Smithsonian Conservation Biology Institute and NC Museum of Natural Sciences, all authors contributing data were listed in alphabetical order.

AFFILIATIONS

¹Smithsonian's National Zoo and Conservation Biology Institute, Front Royal, Virginia, USA

²Institute of Zoology, The Zoological Society of London, London, UK

³North Carolina Museum of Natural Sciences, Raleigh, North Carolina, USA

⁴Department of Forestry and Environmental Resources, North Carolina State University, Raleigh, North Carolina, USA

⁵Department of Natural Resources Science, University of Rhode Island, Kingston, Rhode Island, USA

⁶Craighead Beringia South, Kelly, Wyoming, USA

⁷Department of Biology, Middlebury College, Middlebury, Vermont, USA

⁸Illinois Natural History Survey, Champaign, Illinois, USA

⁹Department of Natural Resources and Environmental Sciences, University of Illinois Urbana-Champaign, Urbana, Illinois, USA

¹⁰USDA Forest Service, Pacific Northwest Research Station, Portland, Oregon, USA

¹¹Department of Fisheries and Wildlife, Oregon State University, Corvallis, Oregon, USA

¹²Department of Biology, Murray State University, Murray, Kentucky, USA

¹³Biology Department and Nature Up North Program, St. Lawrence University, Canton, New York, USA

¹⁴Department of Wildlife Ecology, University of Florida, Gainesville, Florida, USA

¹⁵Texas Parks and Wildlife Department, Paducah, Texas, USA

¹⁶Cooperative Wildlife Research Laboratory, Southern Illinois University, Carbondale, Illinois, USA

¹⁷School of Biological Sciences, Southern Illinois University, Carbondale, Illinois, USA

¹⁸Department of Biology, University of Central Oklahoma, Edmond, Oklahoma, USA

¹⁹Department of Fisheries and Wildlife, Michigan State University, East Lansing, Michigan, USA

²⁰School of Natural Resources, University of Nebraska, Lincoln, Nebraska, USA

²¹Department of Natural Resource Management, South Dakota State University, Brookings, South Dakota, USA

²²Hogle Zoo, Salt Lake City, Utah, USA

²³Department of Environmental Studies and Sciences, Siena College, Loudonville, New York, USA

²⁴Department of Biology, Lincoln Memorial University, Harrogate, Tennessee, USA

²⁵Cumberland Mountain Research Center, Harrogate, Tennessee, USA

²⁶Department of Ecology, Montana State University, Bozeman, Montana, USA

²⁷Department of Forestry and Natural Resources, Purdue University, West Lafayette, Indiana, USA

²⁸Department of Ecosystem Science and Management, Pennsylvania State University, University Park, Pennsylvania, USA

²⁹Department of Natural Resources and the Environment, University of New Hampshire, Durham, New Hampshire, USA

³⁰Department of Natural Resource Ecology and Management, Oklahoma State University, Stillwater, Oklahoma, USA

³¹Predator Detection and Deterrence, Fresno, California, USA

³²Department of Environmental Science and Policy, George Mason University, Fairfax, Virginia, USA

³³Department of Biology, Mitchell Community College, Statesville, North Carolina, USA

³⁴Biology and Chemistry Department, Springfield College, Springfield, Massachusetts, USA

³⁵The Jones Center at Ichauway, Newton, Georgia, USA

³⁶Biology Department, Randolph-Macon College, Ashland, Virginia, USA

³⁷Alaska Department of Fish and Game, Division of Wildlife Conservation, Douglas, Alaska, USA

³⁸Watershed Studies Institute, Murray State University, Murray, Kentucky, USA

³⁹Department of Ecology and Evolutionary Biology, University of Connecticut, Storrs, Connecticut, USA

- ⁴⁰US Geological Survey Fish and Wildlife Cooperative Research Unit, University of Arkansas, Fayetteville, Arkansas, USA
- ⁴¹Participant volunteer, Laramie, Wyoming, USA
- ⁴²Natural Resource Ecology and Management, Iowa State University, Ames, Iowa, USA
- ⁴³Department of Natural Sciences, University of West Georgia, Carrollton, Georgia, USA
- ⁴⁴Range Cattle Research and Education Center, University of Florida, Ona, Florida, USA
- ⁴⁵Biology Department, University of North Dakota, Grand Forks, North Dakota, USA
- ⁴⁶College of Forestry, Wildlife and Environment, Auburn University, Auburn, Alabama, USA
- ⁴⁷Department of Public Health & Exercise Science, Appalachian State University, Boone, North Carolina, USA
- ⁴⁸Paul Smith's College, Paul Smiths, New York, USA
- ⁴⁹Paul G. Allen School for Global Animal Health, Washington State University, Pullman, Washington, USA
- ⁵⁰Department of Biological Sciences, Bridgewater State University, Bridgewater, Massachusetts, USA
- ⁵¹Appalachian Laboratory, University of Maryland Center for Environmental Science, Frostburg, Maryland, USA
- ⁵²USDA Forest Service, Rocky Mountain Research Station, Missoula, Montana, USA
- ⁵³Department of Biology, Texas State University, San Marcos, Texas, USA
- ⁵⁴Eberly College of Science, Department of Biology, The Pennsylvania State University, University Park, Pennsylvania, USA
- ⁵⁵Stephen F Austin State University, Nacogdoches, Texas, USA
- ⁵⁶Paul G. Allen School for Global Health, Washington State University, Pullman, Washington, USA
- ⁵⁷School of Biological Sciences, University of Utah, Salt Lake City, Utah, USA
- ⁵⁸Environmental Studies Program, University of Kansas, Lawrence, Kansas, USA
- ⁵⁹Wildlife Biology Program, W.A. Franke College of Forestry and Conservation, University of Montana, Missoula, Montana, USA
- ⁶⁰Department of Biology, United States Air Force Academy, Air Force Academy, Colorado, USA
- ⁶¹Georgia Department of Natural Resources, Wildlife Resources Division, Brunswick, Georgia, USA
- ⁶²BiodiversityWorks, Vineyard Haven, Massachusetts, USA
- ⁶³Department of Biology, Seattle University, Seattle, Washington, USA
- ⁶⁴School of Life Sciences, University of Nevada, Las Vegas, Nevada, USA
- ⁶⁵Department of Biology, Francis Marion University, Florence, South Carolina, USA
- ⁶⁶Connecticut State Museum of Natural History, Storrs, Connecticut, USA
- ⁶⁷Wildlife Ecology and Conservation Science Lab, Department of Biology, Northern Michigan University, Marquette, Michigan, USA
- ⁶⁸Black Rock Forest, Cornwall, New York, USA
- ⁶⁹Lamont-Doherty Earth Observatory, Palisades, New York, USA
- ⁷⁰Department of Wildlife Ecology and Conservation, University of Florida, Gainesville, Florida, USA
- ⁷¹Department of Ecology, Evolution, and Natural Resources, Rutgers University, New Brunswick, New Jersey, USA
- ⁷²Department of Biology, Abilene Christian University, Abilene, Texas, USA
- ⁷³Caesar Kleberg Wildlife Research Institute, Texas A&M University-Kingsville, Kingsville, Texas, USA
- ⁷⁴Woodland Park Zoo, Seattle, Washington, USA
- ⁷⁵US Geological Survey, Oklahoma Cooperative Fish and Wildlife Research Unit, Stillwater, Oklahoma, USA
- ⁷⁶Department of Biology, Missouri State University, Springfield, Missouri, USA
- ⁷⁷Department of Wildlife, Fisheries, and Conservation Biology, University of Maine, Orono, Maine, USA
- ⁷⁸Department of Life Sciences, University of Trieste, Trieste, Italy
- ⁷⁹Environmental Studies Program, Middlebury College, Middlebury, Vermont, USA
- ⁸⁰Mianus River Gorge, Bedford, New York, USA
- ⁸¹Department of Forestry and Environmental Conservation, Clemson University, Clemson, South Carolina, USA
- ⁸²Forestry Program, Southern Illinois University, Carbondale, Illinois, USA
- ⁸³Department of Biological Sciences, Southeastern Louisiana University, Hammond, Louisiana, USA
- ⁸⁴Department of Biological Sciences, University of Wisconsin-Whitewater, Whitewater, Wisconsin, USA
- ⁸⁵Warnell School of Forestry and Natural Resources, University of Georgia, Athens, Georgia, USA
- ⁸⁶Sageland Collaborative, Salt Lake City, Utah, USA
- ⁸⁷Noble Research Institute, LLC, Ardmore, Oklahoma, USA
- ⁸⁸Biology Department, Pittsburg State University, Pittsburg, Kansas, USA
- ⁸⁹Scenic Hudson, Poughkeepsie, New York, USA
- ⁹⁰Department of Natural Resources and Environmental Management, University of Hawaii at Mānoa, Honolulu, Hawaii, USA
- ⁹¹Department of Biological Sciences; Department of Geography, Geology, and Environmental Studies,

University of Wisconsin-Whitewater, Whitewater, Wisconsin, USA

⁹²Landowner, Whitefish, Montana, USA

⁹³Division of Forestry and Natural Resources, West Virginia University, Morgantown, West Virginia, USA

⁹⁴College of Sciences, Koç University, Istanbul, Turkey

⁹⁵Haub School of Environment and Natural Resources, University of Wyoming, Laramie, Wyoming, USA

⁹⁶U.S. Army Construction Engineering Research Laboratory, Champaign, Illinois, USA

⁹⁷Office of Applied Science, Wisconsin Department of Natural Resources, Madison, Wisconsin, USA

⁹⁸Department of Biology, Western Kentucky University, Bowling Green, Kentucky, USA

⁹⁹Hobart and William Smith Colleges, Geneva, New York, USA

¹⁰⁰SUNY College of Environmental Science and Forestry, Syracuse, New York, USA

¹⁰¹School of Life Sciences, Arizona State University, Tempe, Arizona, USA

¹⁰²Natural Resources Institute, Texas A&M University, College Station, Texas, USA

¹⁰³Department of Rangeland, Wildlife and Fisheries Management, Texas A&M University, College Station, Texas, USA

¹⁰⁴Tufts Center for Conservation Medicine, Cummings School of Veterinary Medicine at Tufts University, North Grafton, Massachusetts, USA

¹⁰⁵Department of Anthropology, Yale University, New Haven, Connecticut, USA

¹⁰⁶Wildlife Habitat Council, Bethesda, Silver Spring, Maryland, USA

¹⁰⁷Environmental Studies, Gettysburg College, Gettysburg, Pennsylvania, USA

¹⁰⁸Department of Biology, Appalachian State University, Boone, North Carolina, USA

¹⁰⁹Huston-Brumbaugh Nature Center, University of Mount Union, Alliance, Ohio, USA

CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

Summaries of the camera trap image metadata are available as Supporting Information in Data S1. These data and the original images used to compile the database are available from Wildlife Insights at <http://n2t.net/ark:/63614/w12003286>.

ORCID

Hila Shamon  <https://orcid.org/0000-0001-5252-7013>

Roi Maor  <https://orcid.org/0000-0002-8876-2290>


Michael V. Cove  <https://orcid.org/0000-0001-5691-0634>

Roland Kays  <https://orcid.org/0000-0002-2947-6665>

David N. Allen  <https://orcid.org/0000-0002-0712-9603>

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

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

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

Guillaume Bastille-Rousseau  <https://orcid.org/0000-0001-6799-639X>

John F. Benson  <https://orcid.org/0000-0002-3993-4340>

Frances E. Buderman  <https://orcid.org/0000-0001-9778-9906>

Amanda E. Cheeseman  <https://orcid.org/0000-0002-3744-0945>

M. Colter Chitwood  <https://orcid.org/0000-0001-7240-7430>

E. Hance Ellington  <https://orcid.org/0000-0001-7899-2781>

Zach J. Farris  <https://orcid.org/0000-0003-0600-9682>

M. Caitlin Fisher-Reid  <https://orcid.org/0000-0003-1587-7086>

Matthew C. Fitzpatrick  <https://orcid.org/0000-0003-1911-8407>

Travis Gallo  <https://orcid.org/0000-0003-2877-9848>

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

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

Anna C. Grady  <https://orcid.org/0000-0002-8085-5687>

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

Erin K. Kuprewicz  <https://orcid.org/0000-0002-6658-9052>

Scott D. LaPoint  <https://orcid.org/0000-0002-5499-6777>

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


Christopher A. Lepczyk  <https://orcid.org/0000-0002-5316-3159>

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

Robert C. Lonsinger  <https://orcid.org/0000-0002-1040-7299>

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

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

M. Teague O'Mara  <https://orcid.org/0000-0002-6951-1648>

Brent S. Pease  <https://orcid.org/0000-0003-1528-6075>

Christine C. Rega-Brodsky  <https://orcid.org/0000-0002-3483-1465>

Maksim Sergeev  <https://orcid.org/0000-0001-9975-0423>

Austin B. Smith  <https://orcid.org/0000-0002-2095-5299>


John P. Vanek  <https://orcid.org/0000-0002-8684-9632>

Zachary M. Wardle  <https://orcid.org/0000-0003-0765-7585>

Stephen L. Webb  <https://orcid.org/0000-0001-6034-5164>

Nathaniel H. Wehr  <https://orcid.org/0000-0002-3722-8821>

Christopher A. Whittier  <https://orcid.org/0000-0001-9626-6513>

Jacque Williamson  <https://orcid.org/0000-0002-5626-8706>

Marketa Zimova  <https://orcid.org/0000-0002-8264-9879>

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: Shamon, Hila, Roi Maor, Michael V. Cove, Roland Kays, Jessie Adley, Peter D. Alexander, David N. Allen, et al. 2024. "SNAPSHOT USA 2021: A Third Coordinated National Camera Trap Survey of the United States." *Ecology* e4318. <https://doi.org/10.1002/ecy.4318>