



Cover

Source: The Auk, 135(1)

Published By: American Ornithological Society

URL: <https://doi.org/10.1642/AUK-2018.135.1.cover>

BioOne Complete (complete.BioOne.org) is a full-text database of 200 subscribed and open-access titles in the biological, ecological, and environmental sciences published by nonprofit societies, associations, museums, institutions, and presses.

Your use of this PDF, the BioOne Complete website, and all posted and associated content indicates your acceptance of BioOne's Terms of Use, available at www.bioone.org/terms-of-use.

BioOne sees sustainable scholarly publishing as an inherently collaborative enterprise connecting authors, nonprofit publishers, academic institutions, research libraries, and research funders in the common goal of maximizing access to

Journal Mission and Scope

The Auk: Ornithological Advances is an international, peer-reviewed journal that publishes original research and scholarship advancing the fundamental scientific knowledge of bird species and broad biological concepts (e.g., ecology, evolution, behavior, physiology, genetics) through studies of bird species. Articles often introduce or employ innovative empirical and theoretical approaches and analyses.

Topics covered in the journal include:

- Evolutionary history and paleontology
- Systematics and nomenclature
- Behavioral ecology
- Foraging strategies and tactics
- Population biology and ecology
- Molecular ecology
- Community and landscape ecology
- Migration and orientation
- Spacing patterns and habitat use
- Genetics and genomics
- Epigenetics, and evolutionary development
- Physiology and biochemistry
- Morphology and anatomy
- Integrative and cross-disciplinary studies
- Theoretical and methodological advances
- Thematic reviews and opinion pieces

Journals of the American Ornithological Society

The American Ornithological Society publishes two peer-reviewed, international journals of ornithology. *The Auk: Ornithological Advances* focuses on basic ornithological science. *The Condor: Ornithological Applications* focuses on applied ornithological study. The redefined, separate missions of the journals in 2014 created an opportunity for them to work together to publish the best science in basic and applied ornithology and to build on their long histories as top journals in the field of avian biology.



The Auk
Ornithological Advances

Volume 135 Number 1 January 2018



Editor-in-Chief: Mark E. Hauber

The Auk: Ornithological Advances

Volume 135, Number 1, Pages 1–169

January 2018



The Auk Ornithological Advances

Published by the American Ornithological Society
www.AmericanOrnithologyPubs.org

AmericanOrnithology.org

EDITOR-IN-CHIEF Mark E. Hauber

University of Illinois at Urbana-Champaign, mhauber@illinois.edu

EDITORS

Kimberly Bostwick, ksbstwick@icloud.com

James S. Sedinger, University of Nevada Reno, jsedinger@cabnr.unr.edu

Journals Director: Kathleen E. Erickson, AOSpubs@AmericanOrnithology.org

Managing Editor: Mark C. Penrose, AOSpubs@AmericanOrnithology.org

Copyeditors: Richard Earles, Scott W. Gillihan, Thalia Sachtleben

Translators: Lucio R. Malizia, Karl S. Mokross, Hélène Senechal

ASSOCIATE EDITORS

Zachary Aidala, Bloomfield College

Laurny Benedict, University of Northern Colorado

Camille Bonneaud, University of Exeter

Melissa Bowlin, University of Michigan-Dearborn

Luke K. Butler, The College of New Jersey

Bruce Byers, University of Massachusetts Amherst

C. Daniel Cadena, Universidad de los Andes

Christopher J. Clark, University of California Riverside

James Dale, Massey University

Donald Dearborn, Bates College

Mark E. Deutschlander, Hobart and William Smith Colleges

Jack Dumbacher, California Academy of Sciences

Jeanne M. Fair, Los Alamos National Laboratory

Megan D. Gall, Vassar College

Ismael Galván, Doñana Biological Station - CSIC

Jennifer Gee, James San Jacinto Mountains Reserve

Sharon Gill, Western Michigan University

Tomáš Grim, Palacký University

D. Caldwell Hahn, USGS Patuxent Wildlife Research Center

Thomas P. Hahn, University of California Davis

Stefanie Ismar, GEOMAR Helmholtz Center for Ocean Research Kiel

Douglas H. Johnson, USGS Northern Prairie Wildlife Research Center

David Koons, Utah State University

David Lahti, Queens College, The City University of New York

Adam Z. Lendvai, Virginia Tech

Catherine Lindell, Michigan State University

Bernard Lohr, University of Maryland, Baltimore County

Kathleen S. Lynch, Hofstra University

Elizabeth A. MacDougall-Shackleton, Western University-Canada

Rafael Maia, Columbia University

Gerald Mayr, Senckenberg Research Institute Frankfurt

Bill Monahan, USDA Forest Service

Troy G. Murphy, Trinity University

Paul M. Nolan, The Citadel (Military College of South Carolina)

Raul Ortiz-Pulido, Universidad Autónoma del Estado de Hidalgo

Sara Oyler-McCance, USGS Fort Collins Science Center

Juan L. Parra, Universidad de Antioquia

Stephen Pruett-Jones, University of Chicago

Wendy L. Reed, North Dakota State University

Christina Riehl, Harvard University

James W. Rivers, Oregon State University

Kristen C. Ruegg, University of California Santa Cruz

Rebecca J. Safran, University of Colorado Boulder

Terry Shaffer, USGS Northern Prairie Wildlife Research Center

Frederick H. Sheldon, Louisiana State University

Dave Shutler, Acadia University

Jill Soha, Duke University

Garth M. Spellman, Denver Museum of Nature & Science

Benjamin N. Taft, University of Wisconsin-Parkside

Sabrina S. Taylor, Louisiana State University

Daniel B. Thomas, Massey University

Andrea K. Townsend, Hamilton College

Rachel Vallender, Canadian Wildlife Service

Eric Walters, Old Dominion University

Michael P. Ward, University of Illinois at Urbana-Champaign

Karen L. Wiebe, University of Saskatchewan

L. LaReesa Wolfenbarger, University of Nebraska at Omaha

Timothy F. Wright, New Mexico State University

Book Review Editor: Jay Mager, Ohio Northern University, j-mager@onu.edu

In Memoriam Editor: Ted Anderson, McKendree University, ted020@centurytel.net

On the Cover: Male Gambel's Quail (*Callipepla gambelii*) photographed at Joshua Tree National Park, California, April 8, 2010. Photographer: Bruce Lyon

Journal Information: *The Auk: Ornithological Advances* publishes original research and scholarship advancing the fundamental scientific knowledge of bird species and broad biological concepts (e.g., ecology, evolution, behavior, physiology, genetics) through studies of bird species. Appropriate topics include documentation, analysis, and interpretation of laboratory and field studies; theoretical or methodological developments; and reviews of information or ideas. Authors are encouraged to write papers from the perspective of general concepts and theories and to consider the relevance of their findings to taxa in addition to birds. Contributions are welcomed from around the world but must be written in English. *The Auk* was published from 1884 to 2016 by the American Ornithologists' Union (AOU), and as of 2016 is published by the American Ornithological Society (a merger of the AOU and the Cooper Ornithological Society). *The Auk* became *The Auk: Ornithological Advances* in 2014. *The articles in this journal reflect the research and opinions of the individual authors. As such, the articles do not necessarily reflect the opinions of the editors or any official policy of the American Ornithological Society.*

Submit manuscripts online at www.editorialmanager.com/auk. **Author instructions** are at <http://americanornithologypubs.org/page/instructions>.

Copying and permissions notice: To obtain rights and permission to reprint papers, figures, tables, etc., or parts thereof, previously published in *The Auk* and *The Auk: Ornithological Advances*, contact the Publications Office at AOSpubs@AmericanOrnithology.org.

Abstracting and indexing: Articles appearing in *The Auk: Ornithological Advances* are abstracted and indexed in the databases listed online at www.AmericanOrnithologyPubs.org.

The Auk: Ornithological Advances is published weekly online (ISSN 1938-4254) by the American Ornithological Society, 1400 S Lake Shore Drive, Chicago, IL 60605. Print copies (ISSN 0004-8030) are available from Sheridan Press at <http://aos.sheridan.com>



AMERICAN ORNITHOLOGICAL SOCIETY

THE COUNCIL FOR 2017–2018

OFFICERS AND EDITORS

President: Steven R. Beissinger, *Division of Ecosystem Science, University of California-Berkeley*, 130 Mulford Hall, #3114, Berkeley, CA 94720, beis@berkeley.edu

President-Elect: Kathy L. Martin, *Department of Forest and Conservation Sciences, University of British Columbia*, 2424 Main Mall, Vancouver, BC, V6T 1Z4 Canada, kathy.martin@ubc.ca

Secretary: Andrew W. Jones, *Department of Ornithology, Cleveland Museum of Natural History*, 1 Wade Oval Drive, University Circle, Cleveland, OH 44106, ajones@cmnh.org

Treasurer: Rebecca T. Kimball, *Department of Biology, University of Florida*, 528 Bartram Hall, Gainesville, FL 32611, rkimball@ufl.edu

Editor-in-Chief of *The Auk: Ornithological Advances*: Mark E. Hauber, *Department of Animal Biology, School of Integrative Biology, University of Illinois at Urbana-Champaign*, 515 Morrill Hall, 505 S. Goodwin Avenue, Urbana, IL 61801, mhauber@illinois.edu

Editor-in-Chief of *The Condor: Ornithological Applications*: Philip C Stouffer, *School of Renewable Natural Resources, Louisiana State University*, Baton Rouge, LA 70803, pstouffer@lsu.edu

Editor-in-Chief of *Studies in Avian Biology*: Kathryn P. Huyvaert, *Warner College of Natural Resources, Colorado State University*, 400 University Avenue, Fort Collins, CO 80523, kate.huyvaert@colostate.edu

Executive Director: Melinda Pruett-Jones, 1400 S. Lake Shore Drive, Chicago, IL 60605, mpruettjones@americanornithology.org

2018: Elizabeth P. Derryberry, Katie M. Dugger, Kevin E. Omland, Viviana Ruiz-Gutierrez
2019: Melissa S. Bowlin, Renee A. Duckworth, Scott V. Edwards, Nathaniel T. Wheelwright
2020: Anna D. Chalfoun, Abby N. Powell, Andrea K. Townsend, Michael S. Webster

American Ornithologists' Union: Scott Lanyon (2014–2016), Susan M. Haig (2012–2014), John Faaborg (2010–2012), Erica H. Dunn (2006–2008), James A. Kushlan (2004–2006), Fred Cooke (2002–2004), John W. Fitzpatrick (2000–2002), Frank B. Gill (1998–2000), Richard C. Banks (1994–1996), Frances C. James (1984–1986)

Cooper Ornithological Society: Martin Raphael (2015–2016), Frank R. Moore (2013–2015), Kimberly A. Sullivan (2011–2013), Mercedes S. Foster (2009–2011), Thomas E. Martin (2007–2009), John T. Rotenberry (2005–2007), Bonnie S. Bowen (2003–2005), Terry Rich (2001–2003), Glenn Walsberg (1999–2001), J. Michael Scott (1997–1999), Sheila Mahoney (1995–1997), Lloyd Kiff (1993–1995), Martin L. Morton (1991–1993), Jared Verner (1989–1991), Russell P. Balda (1987–1989), C. John Ralph (1985–1987), Dennis Power (1978–1981), Stephen M. Russell (1976–1978)

Any person interested in avian biology may become a member of the American Ornithological Society. Regular membership costs **\$90** per year; Early Professional membership is **\$55**; Emeritus/retired and student memberships are **\$32**. Membership is **\$32** for persons in all countries except the United States, Canada, Israel, Japan, Australia, New Zealand, and the following Western European countries: Iceland, Norway, Sweden, Finland, Denmark, Germany, The Netherlands, Belgium, Luxembourg, France, the United Kingdom, Ireland, Switzerland, Austria, Italy, Spain, and Portugal. All members receive access to the online version of *The Auk: Ornithological Advances* and *The Condor: Ornithological Applications* and the bimonthly *Ornithological Newsletter*. A life membership is \$2880, paid in one sum or four annual installments of \$720. Individuals may join, renew memberships, and report changes of address through the Ornithological Societies of North America (OSNA): the OSNA Member Portal; **osnamembers@gmail.com**; **(312) 883-4670**.

AOS is grateful to receive contributions of any amount. Donations help support AOS's programs to advance ornithology as a profession and promote ornithologists at every career stage. Contributions may be sent to: AOS, 1400 S. Lake Shore Drive, Chicago, IL, 60605; or, can be made online through AOS's website, AmericanOrnithology.org. Gifts to the AOS are tax-deductible to the full extent permitted by law.

INSTITUTIONAL SUBSCRIPTIONS

Institutional subscriptions are handled by the American Ornithological Society, 1400 South Lake Shore Drive, Chicago, IL 60605, 312-665-7571, 312-883-4114 FAX, cruiz@americanornithology.org. \$400 for an annual online subscription to *The Auk: Ornithological Advances*, \$700 for both *The Auk: Ornithological Advances* and *The Condor: Ornithological Applications*.

PRINT ISSUES

To order 2018 print single issues or print annual subscriptions, go to: <http://aos.sheridan.com>. To order print issues for journals issued prior to 2018, email a request to OSNAmembers@gmail.com, providing the journal name and issue requested.