



Introduction: management for the survival of Sonoran pronghorn in the United States

by Paul R. Krausman, John R. Morgart,
Lisa K. Harris, Chantal S. O'Brien,
James W. Cain III, and Steven S. Rosenstock

historical population estimates of pronghorn (*Antilocapra americana*) in North America are as high as 60,000,000 (O'Connor 1939). In 2000 the population of pronghorn was estimated at 799,200 (Yoakum 2004). Currently there are 5 recognized subspecies of pronghorn based on differences in color, size, and form: American pronghorn (*A. a. americana*), Mexican pronghorn (*A. a. mexicana*), peninsular pronghorn (*A. a. peninsularis*), Oregon pronghorn (*A. a. oregona*), and Sonoran pronghorn (*A. a. sonoriensis*). However, recent genetic analyses have not revealed differences significant enough to retain these subspecies designations. Some suggest that a species decline is more legitimate than the 5 subspecies classified (Malone et al. 2002, O'Gara and Janis 2004). As genetic tools allow biologists to learn more about the genome of all species, classifications will evolve. However Sonoran pronghorn are eventually classified subspecifically, they will be protected under the Isolated Vertebrate Population Policy in the Endangered Species Act (United States Fish and Wildlife Service 1998).

Current management of Sonoran pronghorn is also controversial (Paradiso and Nowak 1971, Cockrum 1981, United States Fish and Wildlife Service 1998, Malone et al. 2002, O'Gara and Janis 2004). The United States government listed Sonoran pronghorn as endangered in 1967. Since then, recovery efforts have been limited

because much of Sonoran pronghorn habitat in the United States is inaccessible. Sonoran pronghorn historically ranged from eastern California into southeastern Arizona and south to Sonora, Mexico but are currently limited to <25% of their historical habitat in Arizona and northern Sonora, Mexico. Estimated numbers in the United States have been low since the early 1900s, ranging from approximately 100 in 1925 to <300 in 1998 (United States Fish and Wildlife Service 1998). However, during the current drought, numbers plummeted to <30 in 2002, and the subspecies was on the verge of extinction in the United States. The population of Sonoran pronghorn increased to ≤ 51 by December 2004 (J. C. deVos, Jr., Arizona Game and Fish Department, personal communication), but their survival is precarious and drastic and untested methods are ongoing to pull the subspecies from the brink of extinction. Aggressive management tactics including manipulation of forage and water availability and captive breeding have been initiated; efforts that some question.

In the past decade, dedicated and determined individuals from the Arizona Game and Fish Department and the United States Fish and Wildlife Service initiated recovery efforts that had been proposed for nearly 3 decades. Those individuals (some of whom are authors and coauthors of the following papers) generated funds, interest,

Address for Paul R. Krausman and James W. Cain III: School of Natural Resources, 325 Biological Sciences East, University of Arizona, Tucson, AZ 85721, USA; e-mail for Krausman: krausman@ag.arizona.edu. Address for John R. Morgart: New Mexico Endangered Species Office, United States Fish and Wildlife Service, 2105 Osuna NE, Albuquerque, NM 87113, USA. Address for Lisa K. Harris: Harris Environmental, 1749 East 10th Street, Tucson, AZ 85719, USA. Address for Chantal S. O'Brien and Steven S. Rosenstock: Arizona Game and Fish Department, 2221 West Greenway Road, Phoenix, AZ 85023, USA.

and national and international cooperation, and had the determination to initiate recovery efforts.

Most of the existing information on Sonoran pronghorn is not contained in peer-reviewed literature (28 articles including those in this special issue). Books ($n=26$), theses and dissertations ($n=5$), conference proceedings and symposia ($n=29$), technical reports ($n=81$), abstracts ($n=15$), and popular articles ($n=43$) constitute the body of literature related to Sonoran pronghorn (Krausman et al. 2005). Because recovery efforts are critical to the

With Sonoran pronghorn numbers so low, it is critical that biologists in the United States continue to work with biologists in Mexico to minimize effects of bottlenecks.

future of Sonoran pronghorn, biologists studying these animals needed a forum to present and discuss results of their work and actively plan for a viable population.

This special section resulted from a workshop held at the University of Arizona in May 2004. The articles in this section are a subset of workshop papers on Sonoran pronghorn and related issues.

The special section begins with 3 papers related to home-range and habitat use. In the first paper Hervert et al. discuss home-range size (range=43–2,873 km²) and describe habitats that will be important to understand as forage resources are enhanced, water developments installed, and captive breeding begins. The second paper examines how military activity has altered habitats. O'Brien et al., in the third paper, identify >12,000 km² of potential habitat for future translocation sites and present recommendations for site-specific habitat evaluation.

The next 2 papers examine survival of Sonoran pronghorn. DeVos and Miller examine survival (> 0.92) for Sonoran pronghorn during 1983–1991, years with above average rainfall. In contrast, Bright and Hervert report adult mortality of 11–83%/year during drought years, 1995–2002.

For several decades Sonoran pronghorn were considered to be independent of freestanding water. As a result, establishment of human-provided water sources has only recently been implemented for Sonoran pronghorn. Morgart et al. address that misconception and renewed efforts to include water sources in habitat modifications.

The final 2 papers are a "From the Field" and an "In My Opinion" piece. Cancino et al. discuss capturing, hand-raising, and managing captive peninsular pronghorn in Mexico. As we attempt recovery in the United States, biologists will look to and seek advice from our Mexican

colleagues. Bleich concludes the special section with concerns biologists face when wilderness designation and land-use policy conflict with attempts to recover and manage wildlife, especially when common sense is not used.

Is this the end? Hardly. These papers bring us up to date on some of the current research. Genetic studies are in press elsewhere that will benefit the management of long-term viability of this endangered species. With Sonoran pronghorn numbers so low, it is critical that

biologists in the United States continue to work with biologists in Mexico to minimize effects of bottlenecks. Additionally, recommendations to enhance habitat in the United States are included in some papers. However, those efforts are underway and untested, as is the captive breeding

program. The captive breeding enclosure contains 1 adult male and 2 adult females captured in Mexico in 2004 and 4 pregnant females captured in the United States in December 2004. Captures to enhance the captive breeding population will continue. Success in these actions will influence the recovery of the species on current range and potentially yield animals that can be translocated. Will forage enhancement, captive breeding, and translocations into potential habitats be successful? The data are being carefully monitored, and biologists are approaching recovery in a positive manner. We cannot unequivocally state that these efforts will be successful. However, these drastic and sometimes controversial measures may allow managers to assist the population during harsh droughts. Without such efforts, the indigenous Sonoran pronghorn population in the United States could become a memory.

Acknowledgments. We acknowledge and thank everyone who presented papers and moderated sessions at the Sonoran Pronghorn Workshop in Tucson, Arizona, and those who produced the papers for this special section. We also thank all referees for their insightful comments that enhanced the quality of the special section. W. B. Ballard, Editor, and J. Wallace, Editorial Assistant, were instrumental in the production of this special section. Funding for the workshop and publication of the special section on Sonoran pronghorn was provided by the United States Marine Corps.

Literature cited

- COCKRUM, E. L. 1981. Taxonomy of the Sonoran pronghorn. Pages 2–10 *in* Anonymous. The Sonoran pronghorn. Arizona Game and Fish Department, Game Branch. Special Report 10. Federal Aid in

- Wildlife Restoration Act. Project W-53-R. Work Plan 1, Job 1.
- KRAUSMAN, P. R., J. R. MORGART, L. K. HARRIS, C. S. O'BRIEN, J. W. CAIN III, AND S. S. ROSENSTOCK. 2005. Sonoran pronghorn literature: an annotated bibliography. United States Geological Survey, Tucson, Arizona. Technical Bulletin; in press.
- MALONE, C. L., J. C. DEVOS, JR., J. R. HEFFELFINGER, AND O. E. RHODES, JR. 2002. Genetic distinction of the Sonoran pronghorn antelope. *Antelope Workshop Proceedings* 20: 15 (abstract).
- O'CONNOR, J. 1959. *Game in the desert*. Derrydale Press, New York, New York, USA.
- O'GARA, B. W., AND C. M. JANIS. 2004. Scientific classification. Pages 3–25 in O'Gara, B. W., and J. D. Yoakum, editors. *Pronghorn: ecology and management*, University Press of Colorado, Boulder, USA.
- PARADISO, J. L., AND R. M. NOWAK. 1971. Taxonomic status of the Sonoran pronghorn. *Journal of Mammalogy* 52: 855–858.
- UNITED STATES FISH AND WILDLIFE SERVICE. 1998. Final revised Sonoran pronghorn recovery plan. United States Fish and Wildlife Service, Albuquerque, New Mexico, USA.
- YOAKUM, J. D. 2004. Distribution and abundance. Pages 75–105 in O'Gara, B. W., and J. D. Yoakum, editors. *Pronghorn: ecology and management*. University Press of Colorado, Boulder, USA.

Paul R. Krausman is professor of wildlife sciences and associate director of Arizona's Agricultural Experiment Station, University of Arizona, Tucson. He received a B.S. in zoology from Ohio State University, an M.S. in wildlife science from New Mexico State University, and a Ph.D. in wildlife ecology from the University of Idaho. Paul, a Certified Wildlife Biologist, has studied desert ungulates since 1972 and has assisted state and federal agencies with the recovery of Sonoran pronghorn. He is currently co-advisor of the University of Arizona Student Chapter, Southwest Representative of TWS, associate editor of the *Wildlife Society Bulletin*, and editor of *Wildlife Monographs*. His teaching and research concentrate on large mammals in arid environments. **John R. Morgart** was the United States Fish and Wildlife Service recovery coordinator for Sonoran

pronghorn and biologist on the Cabeza Prieta National Wildlife Refuge, Arizona from 199–2004. He is currently the recovery coordinator for the Mexican wolf (*Canis lupus*) and lives in Albuquerque, New Mexico. He was the supervisory wildlife biologist on the Yukon Delta National Wildlife Refuge, Alaska, and has worked with the United States Bureau of Land Management and United States Bureau of Reclamation. John received his B.S. in wildlife biology (1974) and M.S. in zoology (1978) from Arizona State University, and his Ph.D. in wildlife ecology (1990) from the University of Arizona. John has been a member of The Wildlife Society since 1974 and a Certified Wildlife Biologist since 1982. He was an associate editor for *The Journal of Wildlife Management*. As his job responsibilities shift within the United States Fish and Wildlife Service, his interests will shift from prey to predator. **Lisa K. Harris** is founder and president of Harris Environmental Group, Inc., a natural and cultural resources consulting firm. She obtained a B.A. in economics, from the University of Chicago, an M.B.A. in marketing from the University of Chicago Graduate School of Business, and a Ph.D. in renewable natural resources from the University of Arizona. She is also an adjunct research scientist in the School of Natural Resources at the University of Arizona, and currently is the primary investigator for a long-term study of saguaro transplant success. **Chantal (Chasa) O'Brien** has been a research biologist with the Arizona Game and Fish Department since 2002. She received her M.S. in wildlife ecology from the University of Arizona and B.S. in wildlife and fish conservation biology from the University of California, Davis. Her current projects focus on desert ungulates in southern Arizona. **James W. Cain III** is a Ph.D. candidate in wildlife ecology at the University of Arizona, Tucson. He received his B.S. degree in biology from Colorado State University in 1997 and an M.S. degree in biological conservation from California State University, Sacramento, in 2001. He is studying the responses of desert bighorn sheep to the removal of man-made water sources in Cabeza Prieta National Wildlife Refuge, Arizona. James is a board member of the Arizona Chapter of The Wildlife Society and is a technical editor for *Wildlife Monographs*. **Steven (Steve) Rosenstock** has been a research biologist with the Arizona Game and Fish Department since 1992 and also serves as adjunct professor in the School of Forestry, Northern Arizona University. His current research efforts focus on wildlife ecology and management in the Sonoran Desert of southwestern Arizona.

