

Editorial Comment. – This section has been established as a forum for the exchange of ideas, opinions, position statements, policy recommendations, and other reviews regarding turtle-related matters. Commentaries and points of view represent the personal opinions of the authors, and are peer-reviewed only to the extent necessary to help authors avoid clear errors or obvious misrepresentations or to improve the clarity of their submission, while allowing them the freedom to express opinions or conclusions that may be at significant variance with those of other authorities. We hope that controversial opinions expressed in this section will be counterbalanced by responsible replies from other specialists, and we encourage a productive dialogue in print between the interested parties. Shorter position statements, policy recommendations, book reviews, obituaries, and other reports are reviewed only by the editorial staff. The editors reserve the right to reject any submissions that do not meet clear standards of scientific professionalism.

Chelonian Conservation and Biology, 2006, 5(2): 326–330
© 2006 Chelonian Research Foundation

Workshop on the Ecology, Status, and Management of the Gopher Tortoise (*Gopherus polyphemus*), Joseph W. Jones Ecological Research Center, 16–17 January 2003: Final Results and Recommendations

LORA L. SMITH¹, TRACEY D. TUBERVILLE², AND RICHARD A. SEIGEL³

¹*Joseph W. Jones Ecological Research Center, Route 2, Box 2324, Newton, Georgia 39870-9651 USA [lora.smith@jonesctr.org];*

²*University of Georgia, Savannah River Ecology Lab, Drawer E, Aiken, South Carolina 29802 USA [tuberville@srel.edu];*

³*Department of Biological Sciences, Towson University, 8000 York Road, Towson, Maryland 21252 USA [rseigel@towson.edu]*

From 16 to 17 January 2003, 30 invitees from 6 states gathered at the Joseph W. Jones Ecological Research Center in Georgia for a workshop to discuss the status, ecology, and conservation of the gopher tortoise (*Gopherus polyphemus*). The impetus for this workshop was continuing reports of declining tortoise populations despite federal and state legal protection throughout the range. The gopher tortoise is federally listed as threatened in Louisiana, Mississippi, and west of the Tombigbee and Mobile Rivers in Alabama, and receives varying degrees of state protection in eastern Alabama, Florida, Georgia, and South Carolina.

In addition to the exchange of data on tortoise biology and status, the workshop was designed to identify research needs that may lead to more effective conservation of gopher tortoise populations rangewide. This objective was accomplished by a survey of participants' perception of the status, threats, and research needs for tortoise populations, and by an assessment of the state of knowledge of tortoise populations in protected areas. The 30 attendees as well as numerous state and regional biologists provided the data. We summarize the major findings and recommendations that emerged from the workshop.

Methods. — Prior to the workshop, we asked representatives from each state to provide an overview of the legal and biological status of the gopher tortoise in their state. This information included state-level protection

and management policies pertaining to the gopher tortoise, an evaluation of population trends, and major threats to the species in each state. We also asked representatives to summarize information about tortoise populations in protected areas. We chose to restrict our efforts to protected areas (state lands, federal lands, private reserves) because we felt these sites would have the most current and readily available data. We specifically requested information on population size (and the source of the data and methods by which the estimate was derived), percent juveniles, habitat management practices, and threats to populations. We also requested Geographic Information Systems (GIS) maps of locations of the protected areas. During the workshop, all attendees were asked to respond to a questionnaire on the status and threats to gopher tortoises rangewide. The workshop agenda also included a discussion of critical research needs.

Results. — Although only 21 attendees returned questionnaires, we considered the results noteworthy because these individuals were a cross section of experts from the entire range of the species and because they represented academia, state and federal agencies, and nongovernmental organizations. The key results of the questionnaire are presented here.

An overwhelming majority of respondents (85.7%, $n = 18$) felt that gopher tortoises were declining; 4.7% said that populations were stable; and 4.7% said that populations were increasing. Reflecting this assessment, 76.2% of respondents ($n = 16$) said that tortoise populations would decline to the point that additional legal protection would be warranted in the next 50 years. Furthermore, 43.3% of 18 respondents felt that local or regional extinction was likely within a 50-year period.

Respondents were asked to rank the major threats to gopher tortoises on a scale of 1 to 6, where 1 was the greatest threat. The following is a summary of the rankings of all 21 respondents, in order of perceived importance:

1. Habitat destruction (mean rank = 1.66, range = 1–3)
2. Lack of habitat management (e.g., fire suppression; mean rank = 1.73, range = 1–3)
3. Invasive species (mean rank = 3.76, range = 1–5)
4. Upper respiratory tract disease (mean rank = 3.88, range = 2–5)

5. Collecting/poaching (mean rank = 4.13, range = 3–5)
6. Other (road impacts, habitat fragmentation, rattle-snake roundups, small population sizes)

Respondents were asked to divide the research needs for gopher tortoises into 3 groups: 1) aspects that are known well enough to make generalizations (“Things we know”); 2) aspects known reasonably well, but where more data are needed (“Things we think we know”); and 3) poorly known aspects, where more data are needed badly (“Things we don’t know”). After considerable discussion, the group reached a consensus, as summarized in Table 1. The group did not rank topics within groups, but there was strong consensus that the topics in the last category (i.e., “Things we don’t know”) urgently need more study and warrant special consideration for funding by federal and state agencies and private conservation groups.

According to Natural Heritage Program rank designations (Stein et al. 2000), which are biological rather than legal designations, the gopher tortoise is Vulnerable throughout its range (Global Rank = G3; Table 2). The degree of imperilment varies among states: the gopher tortoise is Vulnerable (State Rank = S3) in Alabama, Georgia, and Florida; Imperiled (S2) in Mississippi; and Critically Imperiled (S1) in Louisiana and South Carolina. In addition, state representatives considered gopher tortoise populations to be declining in at least 3 states (Florida, Louisiana, South Carolina). Population trends are unknown for Alabama.

Although the gopher tortoise is federally listed in only the western portion of its range, each state in the species’ range legally recognizes the gopher tortoise as a Species of Concern, State-Threatened, or State-Endangered. However, in practice, the level of protection that these legal designations actually confer to the species varies dramatically among states and, in some cases, from the intended goal. For example, several states lack protection measures against incidental take (Table 2). In addition, some current state management policies (i.e., relocation practices in Florida) are ranked as one of the primary threats to the species in that state.

State representatives provided data for 280 tortoise populations on protected areas in Florida, 54 in Georgia, 11 in Alabama, 8 in Mississippi, 3 in South Carolina, and 3 in Louisiana. A range of methods was used to derive population estimates, including counts based on burrow camera surveys, burrow counts with or without application of a correction factor, GIS-based population estimates, and detailed long-term studies of individual populations. In addition, state representatives considered gopher tortoise populations to be declining, or presumed declining, in each of the 6 states within the range of the tortoise.

The populations were categorized by size and mapped to demonstrate the distribution of populations on protected areas rangewide (Fig. 1). Florida had the most comprehensive data for state and federal lands, as a result of a recent population viability analysis performed by the

Florida Fish and Wildlife Conservation Commission (P.S. Miller, unpubl. data, 2001); however, the data used for the analysis were nearly 10 years old. The largest populations (> 10,000 tortoises) on protected areas were Apalachicola National Forest, Withlacoochee State Forest, Ocala National Forest, and Merritt Island National Wildlife Refuge. Mississippi also had fairly detailed data for populations on Camp Shelby Training Site and Desoto National Forest, which fall within the federally listed portion of the range. These sites harbor the largest populations of tortoises (> 1000 individuals) in the state. Although tortoises are widely distributed in southern Georgia, there are few protected areas with tortoise populations, and little is known of their status on existing protected areas. Only 3 protected areas in Georgia have populations greater than 1000 individuals. Although Alabama comprises ca. 14% of the species’ range, only 11 protected areas have tortoise populations, and only Conecuh National Forest and Fort Rucker have large populations (> 1000 tortoises). Of the 3 protected areas with tortoise populations in South Carolina (Tillman Sand Ridge Heritage Preserve, Aiken Gopher Tortoise Heritage Preserve, and a reintroduced population at the Savannah River Site), Tillman Sand Ridge Heritage Preserve supports the largest population (< 500 tortoises). Only 1 naturally occurring population exists in Louisiana (Ben’s Creek Wildlife Management Area; < 250 tortoises).

Across all states, only limited data were available on the percent of juveniles in individual populations (a possible indication of recruitment). Recent studies at Camp Shelby training site in Mississippi have indicated that, on an annual basis, recruitment in tortoise populations can be quite low (Epperson and Heise 2003). Although adult survivorship is probably the most critical demographic variable for gopher tortoises, the lack of information on juvenile survivorship across the range may be cause for concern.

The major threat to protected populations identified by state representatives was fire suppression or lack of growing season fires. Other threats included impacts of timber management (e.g., site preparation and high basal area), predation (by non-native and native subsidized predators), road mortality, disease, release of waif tortoises, and habitat degradation due to invasive plants. In addition, many populations (41%, $n=145$) on protected areas were considered too small (< 100 individuals) to be viable over the long term.

Recommendations. — The group considered the pros and cons of petitioning for federal status for the gopher tortoise rangewide, but had concerns about whether this action is biologically defensible and if it might have negative repercussions. In addition, many in the group felt that federal listing has not conferred adequate protection for western populations already listed. Thus, the group did not support a motion to list the remaining populations as Threatened at this time. The group did, however, support a motion to pursue a Candidate Conservation Agreement

Table 1. Legal status, population trends, and threats to gopher tortoise populations rangewide.

State	S-rank	Federal legal status	State legal status	State protection policies	Population trend	Major threats
AL	S3	Threatened = (15% of range)	State protected	“Take” prohibited in federally listed portion of range; “state protection” very weak (not addressing incidental take) in 20 of 23 counties in which tortoises occur	Presumed declining	Habitat loss, fragmentation, alteration; lack of prescribed fire; exotic cogon grass; predation by fire ants
FL	S3	None	Threatened	Tortoises cannot be possessed or taken without a permit	Declining	Habitat loss, alteration; fire suppression; increasing human population; current relocation practices
GA	S3	None	Threatened	Protection from direct take; protection from incidental take applies only to public land	Declining	Habitat loss, alteration, fire suppression, inadequacy of current protection laws
LA	S1	Threatened	Threatened	No state policies relevant to management of tortoises	Presumed declining	Habitat destruction
MS	S2	Threatened	Endangered	“Take” prohibited on private and public lands	Declining	Habitat loss, alteration, fragmentation; lack of growing-season burns; predation by fire ants; apparently low recruitment rates
SC	S1	None	Endangered	State Endangered Species Act has never been tested with regard to incidental take	Declining	Populations very small, extremely isolated; lasting impacts from previous habitat alteration and lack of management

with Assurances (CCAA) within the nonlisted portion of the range (US Fish and Wildlife Service 2003). CCAs are formal agreements between the US Fish and Wildlife Service and private entities that address the conservation needs of proposed or candidate species, or species likely to become candidate species in the near future. Under a CCAA, federal funds may be available for research and monitoring activities that contribute to the elimination of the need to list the target species.

The intended use of the data on population status in protected areas generated for the workshop was to aid in identifying areas most likely to have stable, viable populations of gopher tortoises and to determine whether enough populations are protected to ensure the long-term survival of the species. It is clear that, at this time, we lack the demographic data to answer these questions. No comprehensive rangewide surveys have been conducted since Auffenberg and Franz in 1982 (but see Hermann et al. 2002). We also lack data on the amount of suitable tortoise habitat on protected areas, and all workshop participants shared the concern that fire suppression and lack of growing season fires may be causing a decline in tortoise populations on these lands. While tortoise populations still exist on most protected areas in Florida, we have no current data on population trends. Additionally, large gaps exist in the distribution of protected areas with tortoise populations in Georgia, Alabama, and Mississippi. Emerging technology such as GIS may aid

in large-scale assessments, but survey data are still needed to calibrate the models (McCoy et al. 2002).

Given the uncertain status and gaps in the distribution of tortoise populations in protected areas, the group recognized that there is an urgent need for better surveys of tortoise populations on private lands. These populations are likely very important to conservation of the species (Hermann et al. 2002), and obtaining conservation easements on these lands is a priority. Further, a major effort is needed to identify key private lands for acquisition and management, as well as key partners for acquiring and managing these lands.

The group adopted a motion to establish a long-term monitoring/research network patterned after the Long Term Ecological Research (LTER) network model. The LTER network is a collaborative effort involving scientists and students investigating ecological processes over long temporal and broad spatial scales. We propose to establish a network of sites across the gopher tortoise’s range to monitor populations over the long term, using standard methods that will build upon and complement work already in progress. The research priorities identified in the survey (Table 1) should be used to establish priorities for funding and for future research projects. The mechanism to establish this network is currently being investigated.

Acknowledgments. — The workshop was sponsored by the Joseph W. Jones Ecological Research Center and the

Table 1. Extended.

Other threats	Comments	No. sites for which data were available	Sites with juvenile data and range of estimates
Rattlesnake roundups, road mortality, human predation, unauthorized relocation; URTD?	Widespread in southern Alabama; status poorly known, even on public land	11	9% (5%–10%)
Exotic plants, road mortality, illegal harvest, disease	Tortoises are widely distributed in the state, but populations are becoming increasingly fragmented due to rampant development	280	?
Rattlesnake roundups, road mortality, subsidized predators, human predation, unauthorized relocation	Availability and reliability of population estimates varies widely across the state; recreation demands on protected lands not always compatible with tortoises; probably more tortoises on private lands than conservation lands but viability on private lands is unknown; some significant private lands	54	16% (1%–5%)
		3	0
Invasive exotic plant species (cogon grass), predation by domestic dogs, URTD	US Forest Service and the Mississippi Forestry Commission have adopted a policy of no timber harvests during tortoise mating season	9	75% (5%–20%)
Previous collection pressure; level of predation by fire ants unknown; predation and/or disturbance by domestic dogs	Current distribution of tortoises primarily in areas where dominant land use is agricultural or rural residential	3	33% (0%–60%)

Gopher Tortoise Council. Funding for RAS was provided by NASA, Dynamac Corporation, and Towson University. Funding for TDT was provided by the Environmental Remediation Sciences Division of the Office of Biological and Environmental Research, US Department of Energy, through Financial Assistance Award No. DE-FC09–96-SR18546 to the University of Georgia Research Foundation. We especially thank all workshop participants and others who provided data on tortoise populations. The following individuals provided assistance

at the workshop: David Pike, Jean Brock (Jones Center), and Chris Borg (Jones Center). We thank J. Whitfield Gibbons for his thoughtful comments on the manuscript. Opinions expressed in this manuscript and any errors or omissions are the sole responsibility of the 3 compilers, and the views expressed here should not be taken as the official position of any state or federal agencies.

List of Participants. — Individuals noted with an * did not attend the meeting, but provided information for this summary.

Table 2. Summary of how the attendees at the Gopher Tortoise Status Workshop divided research needs for gopher tortoises into 3 distinct categories. Within categories, research topics are listed in unranked alphabetical order. See text for details of categories.

Things we know well enough to generalize	Things we think we know (but need to know better)	Things we don't know (Critical Research Needs)
Adult sex ratio	Burrow use patterns (e.g. changes over time)	Adult survival and longevity
Fecundity (clutch size, frequency, egg size)	Burrow counts and population size	Age structure (variation among sites)
Home-range size	Egg viability (lab and field)	Impact of upper respiratory tract disease
Seasonal activity periods	Foraging ecology and diet	Juvenile and subadult survival rates
	Growth rates (variation among sites)	Long-term population viability
	Hormonal cycles	Multiple mating and paternity patterns
	Impacts of forest management schemes	Population genetics
	Predators	
	Nest and hatchling mortality rates	
	Nest site location	
	Relocation success	
	Thermal ecology	
	Sexual dimorphism (variation within and among sites)	
	Size and age at sexual maturity (variation among sites)	
	Use of growth annuli to estimate age	

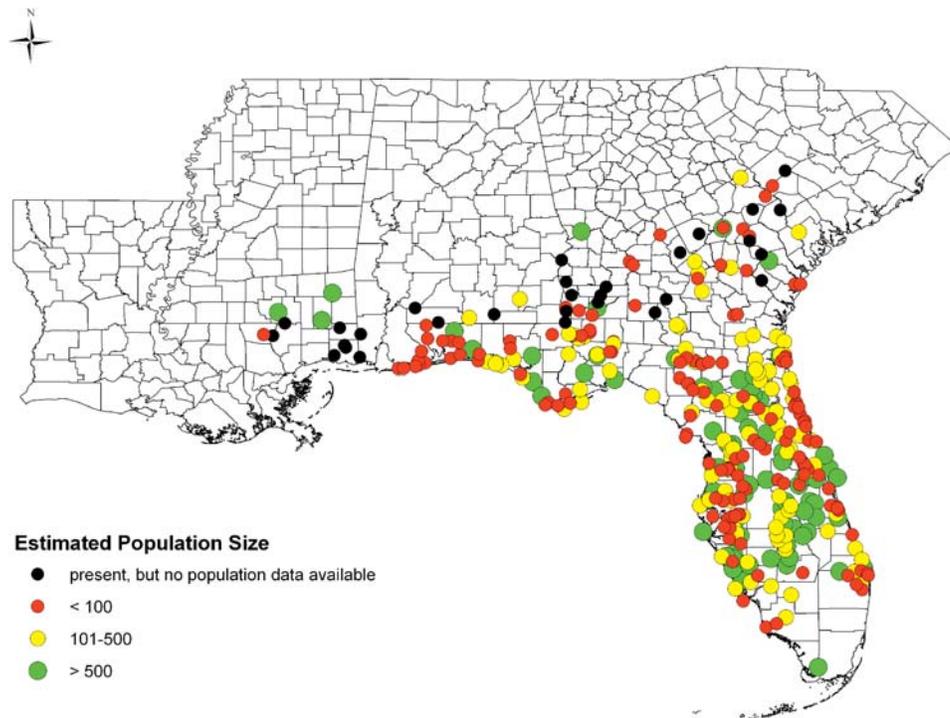


Figure 1. Geographic distribution of protected areas with gopher tortoise (*Gopherus polyphemus*) populations. Populations have been categorized by size, where data were available.

MATT ARESO (Florida State University), RAY ASHTON (Gopher Tortoise Conservation Initiative), MARK BAILEY (Southeastern Conservation Services; Alabama state Gopher Tortoise Council [GTC] Representative), JOAN BERISH (Florida Fish and Wildlife Conservation Commission; Florida state GTC Representative), BOYD BLIHVDE (Florida Department of Environmental Protection), MARY BROWN (University of Florida College of Veterinary Medicine), KURT BUHLMANN (Conservation International, Center for Applied Biodiversity Science), MATT DINKINS (Environmental Services, Inc), C. KENNETH DODD, JR. (US Geological Survey), DEBORAH EPPERSON (Camp Shelby), CRAIG GUYER (Auburn University), GEORGE HEINRICH* (Heinrich Ecological Services), COLLEEN HEISE (The Nature Conservancy), SHARON HERMANN (Auburn University), ELLIOTT JACOBSEN (University of Florida College of Veterinary Medicine), DAWN JENNINGS (US Fish and Wildlife Service, Ecological Services), JOHN JENSEN (Georgia Department of Natural Resources; Georgia state GTC Representative), APRIL JOHNSON (University of Florida College of Veterinary Medicine), PATTY KELLY (US Fish and Wildlife Service), THOMAS M. MANN (Mississippi Museum of Natural Science; Mississippi state GTC Representative), CANDACE MARTINO* (US Fish and Wildlife Service), INÉS MAXIT* (Louisiana Natural Heritage Program; Louisiana state GTC Representative), EARL MCCOY (University of South Florida), WILL MCDEARMAN (US Fish and Wildlife Service), PAUL MOLER (Florida Fish and Wildlife Conservation Commission), HENRY MUSHINSKY (University of South Florida), DAVID PIKE (Towson University), DAVE ROSTAL* (Georgia Southern University), RICHARD A. SEIGEL (Towson

University), LORA L. SMITH (Jones Ecological Research Center), REBECCA B. SMITH (Dynamac Corporation), TRACEY D. TUBERVILLE (Savannah River Ecology Lab; South Carolina state GTC Representative), TINA WALTHER (Towson University), LORI WENDLAND (University of Florida College of Veterinary Medicine), ED WESTER (Southeast Ecosystems Research)

LITERATURE CITED

- AUFFENBERG, W. AND FRANZ, R. 1982. The status and distribution of the gopher tortoise (*Gopherus polyphemus*). In: Bury, R.R. (Ed.) North American tortoises: Conservation and Ecology. US Fish and Wildlife Service, Wildlife Research Report 12. Washington, DC: US Fish and Wildlife Service, pp. 95–126.
- EPPERSON, D.M. AND HEISE, C.D. 2003. Nesting and hatchling ecology of gopher tortoises (*Gopherus polyphemus*) in southern Mississippi. *Journal of Herpetology* 37:315–324.
- HERMANN, S.M., GUYER, C., WADDLE, J.H., AND NELMS, M.G. 2002. Sampling on private property to evaluate population status and effects of land use practices on the gopher tortoise, *Gopherus polyphemus*. *Biological Conservation* 108:289–298.
- MCCOY, E.D., STYS, B., AND MUSHINSKY, H.R. 2002. A comparison of GIS and survey estimates of gopher tortoise habitat and numbers of individuals in Florida. *Chelonian Conservation and Biology* 4:472–478.
- STEIN, B.A., KUTNER, L.S., AND ADAMS, J.S. (Eds.). 2000. Precious Heritage: The Status of Biodiversity in the United States. New York: Oxford University Press.
- US FISH AND WILDLIFE SERVICE. 2003. Safe harbor agreements and candidate conservation agreements with assurances; revisions to the regulations. *Federal Register* 68:53320–53327.

Received: 29 December 2003

Revised and Accepted: 13 April 2005