

SOME POSSIBLE ECOLOGICAL EFFECTS OF "RATTLESNAKE ROUNDUPS" IN THE SOUTHEASTERN COASTAL PLAIN¹

by

Dan W. Speake
Alabama Cooperative Wildlife
Research Unit
Auburn University

and

Robert H. Mount
Department of Zoology-Entomology
Agricultural Experiment Station
Auburn University

ABSTRACT

For several years, ecologists, naturalists, and others have been concerned over the possible ecological effects of wide-spread gassing of gopher tortoise burrows by snake hunters in the southeastern Coastal Plain. Research was conducted on some of the effects of tortoise burrow gassing at several localities in Alabama, Georgia, and Florida in 1969, 1970 and 1971.

Forty-one tortoises were gassed in their burrows with amounts of gasoline ranging from 0.25 ounce to 6 ounces. They were recovered by excavation following exposure periods of from 6 hours to 42 days. None of the tortoises died or showed any ill-effects of having been gassed.

Of fourteen eastern diamondback rattlesnakes gassed, 3 died and 2 nearly died, apparently from the effects of the gasoline. Tests were made on 3 indigo and 2 Florida pine snakes to determine their reaction to gassing and the effects of gassing upon them. All 5 snakes were confined overnight in separate tortoise burrows with screened entrances and each one was gassed with 2 ounces of gasoline which was put into the bottom of the burrow the following morning. They all came to the mouth of the burrow within 3 to 35 minutes of the time the gas was introduced. Two of the 3 gassed indigo snakes died within 12 to 14 days after the gas treatment. The 2 pine snakes were dead within 24 days.

A test was made in the summer of 1971 to determine the time required for snakes to become overcome by gasoline fumes. Snakes were confined from 5 minutes to one hour in the bottoms of tortoise burrows in bags made of plastic screen. It was found that a period ranging from 15 to 40 minutes of exposure to 2 ounces of gasoline applied through a hose was enough to render the snakes unconscious and unable to leave the burrow.

Recommendations are made concerning protection of desirable species endangered by gassing.

INTRODUCTION

For several years ecologists, naturalists, and others have been concerned that widespread "gassing" of burrows of the gopher tortoise, *Gopherus polyphemus*, in the southeastern Coastal Plain may be producing detrimental ecological

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effects. Much, if not most of this "gassing", is prompted by the publicity accorded the annual "Rattlesnake Roundups" that are held in Opp, Alabama; Whigham, Georgia; and some other localities. Concern has been expressed for the gopher tortoise as well as for several other animals that use the tortoise burrows as homes or retreats. From 1969 to 1971 we conducted field experiments to study several aspects of this problem.

BACKGROUND

The burrows of the gopher tortoise are important to the ecology of certain southeastern Coastal Plain communities, especially the sandhill or longleaf pine turkey oak type. Laessle (1942) has described the geological and vegetative characteristics of this community type. It is a fire-subclimax and is widely distributed throughout much of Florida north of Lake Okeechobee and in the Coastal Plain portion of Georgia, Alabama, Mississippi, and South Carolina. The supporting soils are sandy and excessively well drained. Ground cover is often sparse and comprised of relatively few species.

Because the sandhill habitat is a rather harsh environment, many of its animal residents rely either on burrowing or on using burrows constructed by other animals to provide a home or shelter. The gopher tortoise (Fig. 1) is particularly well adapted to the sandhill habitat, where it digs long, slanting burrows and feeds on wiregrass and other herbaceous material. Its range extends from Louisiana to South Carolina and southward to extreme southern Florida. It seems to be declining in number, however, and in some areas that once supported tortoise populations, the species no longer exists (Harper 1943; personal observations). Other burrowing vertebrates in the sandhill habitat include the rodents *Geomys pinetis* and *Peromyscus polionotus*. It has been suggested that burrowing vertebrate animals contribute substantially to the carrying capacity of the habitat (Mount 1963).

Young and Goff (1939) listed 32 species of invertebrates, some of them obligate inquilines, from gopher tortoise burrows. Carr (1952) and numerous others, including the authors, have noted the importance of tortoise burrows as dens and temporary retreats for such animals as skunks, foxes, opossums, small rodents, eastern diamondback rattlesnakes, indigo snakes, pine snakes, gopher frogs, and other vertebrates.



Figure 1. Gopher tortoise entering its burrow.



Figure 2. Indigo snakes, often sold for pets, are becoming rare.

Indigo snakes (*Drymarchon corais couperi*) (Fig. 2), Florida pine snakes (*Pituophis melanoleucus mugitis*) (Fig. 3), black pine snakes (*P. m. lodingi*) and gopher frogs (*Rana areolata aesopus*, *R. a. capito*, and *R. a. sevosa*) (Fig. 4) are becoming increasingly scarce. All are confined to the southeastern Coastal Plain. Indigo snakes, Florida pine snakes, and the gopher frog, *R. a. sevosa*, are all considered rare or endangered by the Alabama State Department of Conservation and Natural Resources (Anon. 1972). The indigo snake, whose range extended until relatively recently from Alabama to Florida and into Georgia and South Carolina, may be extinct in Alabama; it was last reported by Neill (1954) in Covington County. In recognition of the plight of this large, spectacular snake, Florida has added it to its list of protected animal species.

The black pine snake is found only within a limited area in southwestern Alabama and southeastern Mississippi. The Florida pine snake occurs locally in the Coastal Plain from North Carolina to Baldwin County, Alabama, where it intergrades with the black pine snake. The gopher frogs that inhabit gopher tortoise burrows occur from Louisiana through southern Mississippi, Alabama, Georgia to South Carolina and most of Florida.

For at least 15 years rattlesnake "roundups" have been held annually in one or more places in the Southeast. The events are usually sponsored by local civic organizations and involve cash awards to the leading snake hunters, displays of live snakes, "side-show" performances, dances, and other such attractions. The central features are live eastern diamondback rattlesnakes (*Crotalus adamanteus*) the great majority of which are captured as they crawl from the mouths of gopher tortoise burrows that have been "gassed" by the hunters. The roundups are held during the winter months, usually in February, at which time the snakes and other reptiles are overwintering and often in a more or less torpid state. Following a lengthy period of up to several weeks during which the snakes are displayed, they are sold, skinned and eaten, or otherwise disposed of.

The experienced, skillful rattlesnake hunter is usually able by listening through a hose to determine whether a snake (though not necessarily a rattlesnake) is in a burrow. Upon making a positive determination, he will pour an ounce or two of gasoline into a hose leading to the bottom of the burrow and blow on the end (Fig. 5). He then withdraws and waits quietly for up to an hour for the snake to crawl from the burrow. Based on our own experience and on conversations with experienced collectors, we estimate that snakes will attempt to escape the fumes by crawling out of the burrow, and thus be captured, in less than 50 percent of such episodes (Fig. 6). If the snake does not appear, the hunter may repeat the performance. Inexperienced snake hunters often gas burrows indiscriminately, using up to 6 ounces of gasoline per burrow. They often lack the stealth and patience of those with experience and are generally less successful in obtaining specimens. When nonpoisonous species are captured, they are usually brought in with the rattlers and sold to reptile dealers, or kept as "pets" or trophies.



Figure 3. Florida pine snakes, which often inhabit gopher tortoise burrows, may be endangered by gassing.



Figure 4. Gopher frogs spend most of their lives in or near gopher tortoise burrows.



Figure 5. Snake hunter introducing gasoline into gopher tortoise burrow.



Figure 6. A large specimen of the eastern diamondback rattlesnake shortly after being secured from a gopher tortoise burrow.

EXPERIMENTS

The objective of the following experiments was to determine whether gassing, on a "one-time" basis, has any detectable detrimental effect on the gopher tortoise or on some of the other vertebrate inhabitants of the tortoise burrows. No attempt was made to study the effects of repeated gassing. Varying amounts of unleaded gasoline were introduced through a hose into burrows known to be inhabited by animals, and the effects of the treatments were observed. Some test animals were overwintering in the burrows prior to gassing. Some of the snakes crawled out of the gassed burrows, while others did not and required excavation (Fig. 7). We excavated a total of 74 tortoise burrows from which we obtained 41 tortoises that were gassed and 8 that were used as controls. We captured 14 eastern diamondback rattlesnakes that were gassed in their burrows and 9 control diamondbacks that were not gassed.



Figure 7. Excavating a gopher tortoise burrow is hard work — some of them are 6 to 8 feet deep and over 30 feet long.

Experiment 1. Effects of gassing on gopher tortoises.

Forty-one tortoises were gassed in their burrows with amounts of gasoline ranging from 0.25 to 6 fluid ounces. They were recovered by excavation following exposure periods of from 6 hours to 42 days. All were gassed during the overwintering period, and most were excavated before the beginning of the period of warm-weather activity (Table 1).

None of the tortoises died or showed any ill-effects of having been gassed, even after months in captivity.

Table 1. Treatment levels and exposure times on 41 gopher tortoises gassed without apparent effects in field tests.¹

<u>No. tortoises in experiment</u>	<u>Treatment in fluid ounces</u>	<u>Exposure time</u>
4	0.25	4 days
2	0.5	8.5 hrs. (1), 2 days (1)
11	1	.5 hr. (1), 6 hrs. (1), 1 day (5), 2 days (1), 42 days (3)
3	2	6 hrs. (1), 2 days (2)
5	3	42 days
13	5	7 hrs. (1), 1 day (4), 4 days (8)
3	6	42 days

¹All were gassed by introducing gasoline or gasoline fumes with a hose extending to the end of the burrow during the overwintering period. Most were excavated before the beginning of the period of warm-weather activity. In most cases burrow mouths were screened so that the tortoises could not leave.

Experiment 2. Effect of gassing on eastern diamondback rattlesnakes.

Fourteen diamondback rattlers were located in tortoise burrows and gassed with amounts of gasoline ranging from 0.25 to 5 ounces. All were given the opportunity to leave the burrows, but only two actually did so. The others were dug out from 5 to 60 hours later (Table 2).

Three of the snakes died, and two were so affected by the gas that they appeared to be dead but finally revived after exposure to fresh air. Two snakes that were recovered from burrows gassed with 0.25 ounce of gasoline and three from burrows gassed with 0.5 ounce were all apparently unaffected when dug out several hours later. These small amounts of gasoline may not be effective for snake hunting since none of the snakes receiving such small amounts attempted to leave the burrows. Three snakes were gassed with 1.0 ounce of gasoline. One of these was dead and 2 were apparently unaffected when removed from the burrow. Two ounces of gasoline killed 2 snakes, rendered 1 unconscious and caused 1 to leave the burrow after 4 minutes. One snake survived 4 ounces, but would not leave the burrow and was close to death when it was dug out an hour after gassing. One snake, which survived gassing with 5 ounces, had crawled to the mouth of a burrow which had a screened entrance. Surviving gassed rattlesnakes were confined with un-gassed rattlesnakes for several months during which time any effects of gassing were undetectable.

Table 2. Effects of gassing on 14 eastern diamondback rattlesnakes, *Crotalus adamanteus*, in gopher tortoise burrows.¹

No. snakes in experiment	Treatment in fluid ounces	Exposure time	Condition of snakes when removed ²
2	0.25	24 hrs.	3' & 4' snakes normally active
3	0.50	8.5 hrs.	Juvenile, 3.5' & 4.5' snakes normally active
3	1	5 hrs.	3.5' snake normal
		6 hrs.	4.5' snake normal
		60 hrs.	4' snake dead
4	2	4 mins.	4' snake left hole in 4 min. very active*
		6 hrs.	4' snake almost dead but did recover
		48 hrs.	6' snake dead
		51 hrs.	4' snake dead
1	4	1.25 hrs.	5.5' snake almost dead but did recover
1	5	7 hrs.	3.5' snake at screened burrow mouth active*

¹All were gassed by introducing gasoline or gasoline fumes with a hose extending to the end of the burrow during the overwintering period. In most cases burrow mouths were screened so that snakes could not leave.

²Snakes indicated by asterisks emerged from burrows. All others were recovered by excavation after time interval indicated.

Experiment 3. Effects of gassing on indigo and pine snakes.

In March, 1971, 3 apparently healthy indigo snakes and 2 Florida pine snakes were confined overnight in separate gopher tortoise burrows with screened entrances. One of the pine snakes had been held in captivity for 2 years prior to this test and was feeding well, and the other had been freshly captured. The following morning the screens were removed and 2 ounces of gasoline was introduced into the bottom of each burrow. Within 3 minutes 1 snake had arrived at the burrow mouth, and all had either emerged or arrived at the burrow mouth within 35 minutes. The snakes were recaptured and confined with 2 ungasped indigo snakes for further observation. One of the gassed indigo snakes died on the twelfth day of confinement, another on the fourteenth day, and one survived to be released with the ungasped snakes a month later. Both pine snakes were dead, apparently from the effects of gassing, within 24 days.

Experiment 4. Determination of time required to inactivate colubrid snakes by gassing.

A test was made in the summer of 1971 to obtain an estimate of the length of time required for adult colubrid snakes to be overcome by gasoline fumes. Gray rat snakes (*Elaphe obsoleta spilodes*), eastern king snakes (*Lampropeltis getulus getulus*), and one corn snake (*Elaphe guttata guttata*) were used in this test. The snakes were confined in net bags at the bottoms of separate tortoise burrows and subjected to gassing with 2 ounces of gasoline. They were withdrawn from the

burrows following exposure periods ranging from 5 minutes to 60 minutes (Table 3).

Some snakes were rendered insensitive and immobile after as little as 15 minutes exposure to the fumes, while some others could make feeble movements following a 30-minute exposure. The snakes withdrawn after 40 minutes or more appeared lifeless and would probably have died had they not been withdrawn. None of the snakes were killed outright by the fumes, however, and all had recovered the ability to crawl in a reasonably normal fashion within 45 minutes following withdrawal. They were released immediately following their apparent recovery.

Table 3. Responses of colubrid snakes to varied periods of exposure to gasoline fumes.¹

Snake, No. and kind	Exposure time	Condition of snakes upon removal and time required for recovery
One 3' king snake, <i>Lampropeltis getulus</i>	5 minutes	Slightly intoxicated and very irritated but could move with fair coordination
One 3' king snake	15 minutes	Very intoxicated with slow reaction and poor coordination
Two 4.5' gray rat snakes <i>Elaphe obsoleta</i>	30 minutes	Very intoxicated, could not crawl. Appeared normal after 45 min. in fresh air
One 4' gray rat snake	40 minutes	Very intoxicated, could not have left burrow. Recovered in about 1 hour
One 3' corn snake, <i>Elaphe guttata</i>	1 hour	Appeared dead but recovered in 1 hour

¹Snakes were confined in gopher tortoise burrows in net bags and gassed with 2 ounces of gasoline introduced by hose.

Experiment 5. Effects of gassing on gopher frogs.

On a warm day in March, two active adult gopher frogs (*Rana areolata sevosia*) were allowed to enter gopher tortoise burrows and retreat to the bottom. One-half ounce of gasoline was then introduced into one hole and 2 ounces into the other. The frogs hopped out quickly, were recaptured, and kept under observation for 1 week. No ill effects were observed.

Experiment 6. Effect of gassing on Opossums.

Opossums were the only mammals tested. Two opossums in gopher tortoise burrows were gassed with 2 ounces of gasoline; another, with one ounce. Two of the three were dead when dug from their burrows between 1 and 2 hours later. One (gassed with 2 ounces) survived. This one had crawled almost to the burrow entrance and remained until recovered.

On several occasions skunks were inhabiting burrows at the time they were gassed. They, like the last opossum, reacted by retreating from the end of the burrow and stopping short of its mouth.

SUMMARY AND CONCLUSIONS

The snake-procuring technique employed by most participants in southeastern rattlesnake rodeos, involving the introduction of gasoline or gasoline fumes into the burrows of gopher tortoises, has no noticeable adverse effects on the tortoises. The present study did not, however, consider the effects of repeated gassing, nor did it explore the possibility that gassing may adversely affect reproductive functions or some of the other more subtle aspects of the animals' physiology or behavior.

Among snakes, individual and interspecific variation in response to gassing was marked. Indigo snakes and pine snakes were severely affected. All five of the gassed individuals were driven from the burrows, and 4 of the 5 died within 24 days. It is questionable whether any member of either of these species, both of whose populations seem to be declining already, ever survives to continue as a functional member of its population after its den is gassed by a snake hunter.

Some rattlesnakes were killed, while others appeared unaffected. Dosage levels of 2 ounces and over, which drove 2 of 6 snakes from the tortoise burrows, killed or inactivated 4 others. Factors other than dosage levels that may be important in determining effects, but which were not evaluated, include physiological condition of the snake, ambient temperature, and soil characteristics.

Gopher frogs, on the decline in many parts of their range, may be driven from the burrows when gasoline is introduced, provided the ambient temperature is within the frogs' activity range. Although not apparently harmed by brief exposure to gasoline itself, a gopher frog driven into the open during the day is highly susceptible to predation and, in many instances, desiccation.

The opossum, the only mammal tested, was found to be highly susceptible to being overcome and killed by gasoline introduced into the burrows in which it hides.

No studies were made on the effects of gasoline or of gasoline fumes on invertebrate inhabitants of the gopher burrow microhabitat. Based on our previous general observations of the effects of gasoline on numerous invertebrates, however, we conclude that most, if not all, would be affected adversely.

Despite the apparent lack of immediate harm to some species, our observations indicate that the rattlesnake roundups, as they are now conducted, pose an ecological threat that warrants concern. In addition to adding one more menace to the indigo snake over substantial portions of its range, they result in the destruction, directly or indirectly, of other forms of animal life that rely heavily or solely on gopher burrows for overwintering quarters in sandhill communities.

To help protect the beneficial snakes, as well as to provide refugia for other harmless inquilines of gopher burrows, it is recommended that (1) the practice of introducing gasoline into the burrows of animals, especially gopher burrows, be banned in National Forests, State Parks, and on other public lands; (2) that some of the protected areas which formerly supported populations of gopher tortoises, indigo snakes, and pine snakes be restocked; and (3) that the affected states not now affording legal protection to indigo snakes, Florida pine snakes, and black pine snakes be apprised of the plight of these animals and encouraged to add them to their list of protected animals.

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