

## Tail Loss in Garter Snakes

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Tail autotomy is part of the defensive strategy of the common garter snake (*Thamnophis sirtalis*), with the greatest frequency in adult females because their mass facilitates breakage. If garter snakes are held by the tail, they rotate the body with a whirling motion that quickly gains momentum and snaps off the tail (Fitch 1965, 1999). In the present report I explore further the topic of tail breakage in garter snakes, comparing the incidence of breaks in the sexes, and in adults vs. young (Tables 1–4).

**Methods and Materials.**—The records used in this study were gathered during the course of ecological studies on the Fitch Natural History Reservation (FNHR). Only records obtained during the decade of the 1990's (1828 in all) were used. The ratio of those with tail breaks vs. those with intact tails is noted. Two sets of figures were used and compared. In the larger set every capture was included, with the result that some individuals, those recaptured several times, were overrepresented. In the second sample each individual was tallied only once—at its first capture. However, this data set excluded many records of older snakes that were most likely to have broken tails. On a few occasions I accidentally broke a tail in handling a snake, but the vast majority of breaks are believed to have resulted from the attacks of natural predators such as the coyote (*Canis latrans*), striped skunk (*Mephitis mephitis*), raccoon (*Procyon lotor*), opossum (*Didelphis virginiana*), red-tailed hawk (*Buteo jamaicensis*), and great blue heron (*Ardea herodias*). In the tables, males of 400 mm or more SVL were listed as mature, as were females of 500 mm or more.

**Results and Discussion.**—When a tail breaks, the broken end is very active, performing a series of lateral contractions which may be so rapid that it is seen as a blur, causing it to skip and hop about on the surface of the ground. The lively movements of the detached tail may distract the attention of a predator momentarily, permitting the snake to escape, and the large number of snakes having part of the tail missing suggests the success of the strategy. By sacrificing part of the tail, garter snakes sometimes save their own lives, but it seems that some handicapping may result. Garter snakes with stub tails are noticeably slower in swimming or crawling, and the greater the length of lost tail the more serious the disadvantage. Cooper and Alfieri (1993) described tail autotomy in *T. s. sirtalis* of Seabrook Island, South Carolina and emphasized the greater activity of adults in twisting off the tail; the only small juvenile which they observed did not attempt to autotomize when handled. However, when picked up by the tail, juveniles as well as adults may perform the whirling movements that can result in autotomy. The response tends to be weaker in juveniles than in adults, and is much less effective because of their smaller mass. Unlike lizards, snakes do not regenerate broken tails.

Tail breaks may often result from attempted predation, unsuccessful in all recorded cases, since the snake had survived. Some parts of the tail seem to be more fragile, or else they are more liable to be targeted by predators. In my sample there were no tail

TABLE 1. Tail breakage compared in adult and juvenile red-sided garter snakes, first captures only.

	Intact Tails	Broken Tails	Totals
Adults	764	122	886
Juveniles	441	11	452
Totals	1205	133	1338

chi-square = 42.95, P = 0.001

TABLE 2. Tail breakage compared in adult male and female red-sided garter snakes, first captures only.

	Intact Tails	Broken Tails	Totals
Males	358	41	399
Females	406	81	487
Totals	764	122	886

chi-square = 7.40, P = 0.005

TABLE 3. Tail breakage compared in adult and juvenile red-sided garter snakes, including all recaptures.

	Intact Tails	Broken Tails	Totals
Adults	982	257	1239
Juveniles	551	38	589
Totals	1533	295	1828

chi-square = 10.63, P = 0.0001

TABLE 4. Tail breakage compared in adult male and female red-sided garter snakes, including all recaptures.

	Intact Tails	Broken Tails	Totals
Males	521	107	628
Females	461	150	611
Totals	982	257	1239

chi-square = 60.24, P = 0.0001

breaks from the end of the body to about the seventeenth percentile. The remainder of the tail break lengths were not randomly distributed. In female snakes there was a concentration of breaks at about one-fourth of the distance to the tip, with 17.2% of the sample between the 20th and 29th percentile. Ninety snakes (27.95%) were missing their tail tips, and this was the most frequent type of tail injury. In males, breaks across the tail base would damage the hemipenes. Males average smaller than females but have relatively longer tails. In courtship the male's tail serves a tactile function, helping to bring the vents of male and female together (Fitch 1999), and presumably loss of any of the tail would interfere with male courtship. The increased survival gained by tail autotomy presumably outweighs these handicaps (Fitch 1999). The number of damaged tails in a population obviously depends on the kinds and numbers of snake-predators that are present, as well as the amount, quality, and distribution of escape cover. There-

fore, the incidence of breakage could be expected to differ at each locality, and to change over time.

In the data set that included recaptures, snakes probably averaged older and therefore had a higher ratio of broken tails, but the trends for the two data sets are similar. In both samples, females had higher frequencies of broken tails than males, and adults had higher frequencies of broken tails than juveniles (Tables 1–4). Tail breaks are not common in first-year snakes, and it seems that immatures seldom rely on autotomy for defense. Of first-year young (less than 350 mm SVL) only 2.42% of 452 had broken tails, but for 886 larger snakes the ratio was 13.7%. As adult size is attained the incidence of tail breaks rises sharply, especially in females. The incidence of breakage was 10.3% in 399 males and 16.7% in 487 females. It is not known how much tail loss affects survivorship.

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