

Males biting males: does testosterone shape both sides of the snakebite equation?

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Introduction

We examine the hypothesis that male rattlesnakes are responsible for significantly more snakebites than female rattlesnakes by correlating snakebite epidemiology recorded at a major southern California trauma center with examinations of the biting snakes and data regarding sexual differences in behavior of rattlesnakes in local populations.



Fig. 1. The Southern Pacific rattlesnake (*Crotalus helleri*) produces most of the snakebites in metropolitan southern California.

Materials and methods

Supplemental case history data were recorded and analyzed for all snakebite patients presenting to the study institution during 2003 and 2004.

- Biting snakes were identified to species and sex when possible.

This was accomplished by recovery of the animal (usually its carcass), examination of skins preserved by patients, or from photographs. In most cases, sex was determined by the presence or absence of hemipenes, detected by probing or, in the case of soft decaying carcasses, by dissection. Subcaudal scale counts were also utilized, particularly where the only remains were a removed skin, and when the count fell within the sexually dimorphic range for the species as reported by Gloyd (1940) and/or Klauber (1956). Sex of one specimen was determined from a suitable photograph by tail morphology and a traumatically everted hemipenis.

- The seasonality of snakebites was compared to the behavior of wild populations of the rattlesnake species responsible for the bites (*Crotalus scutulatus* - Cardwell, unpub. data; *C. helleri* & *C. ruber* - Dugan, unpub. data; *C. cerastes* - Secor 1992).



Fig. 2. Hemipenis everted by trauma from the carcass of a mature male Mohave rattlesnake (*Crotalus scutulatus*).

Results

Epidemiology

Seventy-eight rattlesnake bites presented to the study institution during 2003 and 2004.

- 83% (n = 65) were male patients (binomial $P < 0.001$)
- 81% (n = 63) of all bites were to the hands and/or forearms
- More males suffered hand and/or forearm bites than females but the difference was not significant (independent t -test, $P = 0.342$)

Most rattlesnake bites occurred in May (n = 17), June (n = 13), August (n = 11) and September (n = 11).

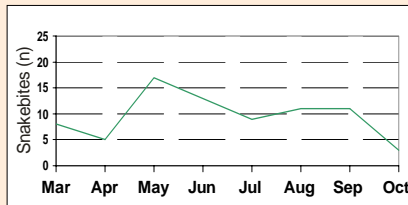


Fig. 3. Distribution of 2003 and 2004 rattlesnake bites by month.

Sex of biting rattlesnakes

Sex determination was possible for 12 of the rattlesnakes responsible for bites in the data set.

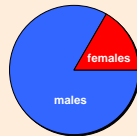


Fig. 4. 83% (n = 10) of biting rattlesnakes for which sex could be determined were male ($P = 0.039$, assuming a baseline population ratio of 50:50 males to females).

Wild rattlesnake behavior

Secor (1992) reported a bimodal mating pattern (spring and late summer/fall) for sidewinders (*Crotalus cerastes*) with males being more motile than females.

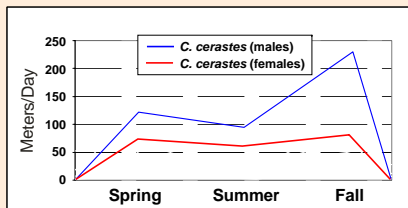


Fig. 5. Mean seasonal movement of sidewinders; males moved 62% and 201% farther than females in the spring and fall, respectively.

Wild rattlesnake behavior (continued)

A recent four-year radiotelemetry study (Cardwell unpub. data) of wild Mohave rattlesnakes (*Crotalus scutulatus*) disclosed a bimodal mating pattern with courtship activity occurring in March/April/May and August/September/October. The estimated mean home range for males (20.4 hectares, SE = 2.59) was nearly 10 times greater than for females (2.2 hectares, SE = 0.43) (independent t -test, $P = 0.001$).

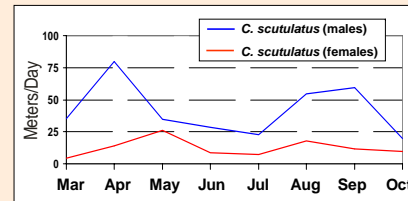


Fig. 6. Mean daily movement by month for male and female Mohave rattlesnakes (*Crotalus scutulatus*). During their bimodal mating seasons, males move more than 3 times farther (mean 47 meters/day, SE = 6.93) than females (mean 14 meters/day, SE = 2.36) (independent t -test, $P = 0.001$).

A two-year (and on-going) radiotelemetry study (Dugan unpub. data) of wild male southern Pacific and red diamond rattlesnakes (*Crotalus helleri* and *C. ruber*, respectively) discloses a bimodal mating pattern for *C. helleri* but spring-only mating by *C. ruber*.

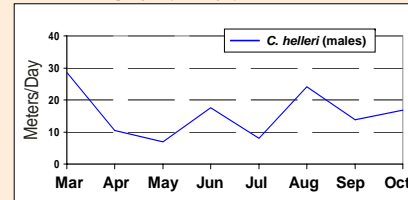


Fig. 7. Mean daily movement by month for male southern Pacific rattlesnakes (*Crotalus helleri*).

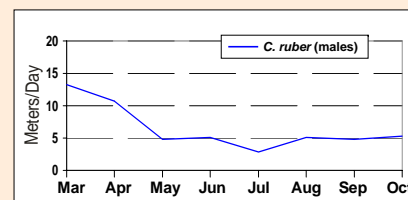


Fig. 8. Mean daily movement by month for male red diamond rattlesnakes (*Crotalus ruber*), which mate only in the spring.

Conclusions

While limited by small sample sizes in some aspects, our study suggests that:

- Male rattlesnakes are more likely than females to bite humans, at least in part because sexually mature male rattlesnakes are much more motile than females during their mating seasons and, therefore, are more likely to encounter humans (e.g., in yards and on trails and roadways).
- Male humans are more likely than females to be bitten by rattlesnakes, probably because they more often choose to interact with the snakes (consistent with previous investigators).
- The severity of a snakebite season may be predictable as the factors that stimulate sexual activity in rattlesnakes are better understood.
- Further investigation will likely identify other significant variables, particularly involving human behavior. For example, the relatively high incidence of bites in May and June may, at least in part, reflect an abrupt increase in outdoor recreational activities in spring and early summer.

Literature cited

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Acknowledgments

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For further information

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A copy of this poster is available on the Loma Linda University Medical Center Emergency Department website; look for the link at:

www.llu.edu/llumc/emergency/venom-er/