Common Garter Snake

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The **common garter snake** (*Thamnophis sirtalis*) is a species of natricine snake, which is indigenous to North American and found widely across the continent. Most common garter snakes have a pattern of yellow stripes on a brown or green background, and their average total length (including tail) is about 55 cm (22 in), with a maximum total length of about 137 cm (54 in).[1][2] The average body mass is 150 g (5.3 oz).[3]

Contents

Subspecies

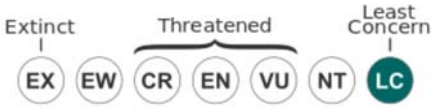
Current scientific classification recognizes thirteen subspecies (ordered by date):[4]

- *T. s. sirtalis* (Linnaeus, 1758) – eastern garter snake
- *T. s. parietalis* (Say, 1823) – red-sided garter snake (has also been introduced to northern Halland in Sweden)
- *T. s. infernalis* (Blainville, 1835) – California red-sided garter snake
- *T. s. concinnus* (Hallowell, 1852) – red-spotted garter snake
- *T. s. dorsalis* (Baird & Girard, 1853) – New Mexico garter snake
- *T. s. pickeringii* (Baird & Girard, 1853) – Puget Sound garter snake
- *T. s. tetrataenia* (Cope, 1875) – San Francisco garter snake (endangered)
- *T. s. semifasciatus* (Cope, 1892) – Chicago garter snake

Common garter snake

Thamnophis sirtalis sirtalis

Conservation status



Least Concern (IUCN 3.1)

Scientific classification

Kingdom:	Animalia
Phylum:	Chordata
Subphylum:	Vertebrata
Class:	Reptilia
Order:	Squamata
Suborder:	Serpentes
Family:	Colubridae
Subfamily:	Natricinae
Genus:	*Thamnophis*
Species:	***T. sirtalis***

Binomial name

Thamnophis sirtalis

(Linnaeus, 1758)

Subspecies

13 sspp., see text

Synonyms

- *T. s. pallidulus* Allen, 1899 – Maritime garter snake
- *T. s. annectens* B.C. Brown, 1950 – Texas garter snake
- *T. s. fitchi* Fox, 1951 – valley garter snake
- *T. s. similis* Rossman, 1965 – blue-striped garter snake
- *T. s. lowei* W. Tanner, 1988

Nota bene: A trinomial authority in parentheses indicates that the subspecies was originally described in a genus other than *Thamnophis.*

- *Coluber sirtalis* Linnaeus, 1758
- *Tropidonotus sirtalis* — Holbrook, 1842
- *Tropidonotus ordinatus* Holbrook, 1842
- *Eutainia sirtalis* — Baird & Girard, 1853
- *Eutœnia sirtalis* — Cope, 1875
- *Thamnophis sirtalis* — Garman, 1892

Description

Common garter snakes are thin snakes. None grows over about 4 ft (1.2 m) long, and most stay smaller. Most have longitudinal stripes in many different colors. Common garter snakes come in a wide range of colors including: green, blue, yellow, gold, red, orange, brown, and black

Life history

The common garter snake is a diurnal snake. In summer, it is most active in the morning and late afternoon; in cooler seasons or climates, it restricts its activity to the warm afternoons.

In warmer southern areas, the snake is active year-round; otherwise, it sleeps in common dens, sometimes in great numbers. On warm winter afternoons, some snakes have been observed emerging from their hibernacula to bask in the sun.

Toxicity

The saliva of a common garter snake may be toxic to amphibians and other small animals. For humans, a bite is not dangerous, though it may cause slight itching, burning, and/or swelling. Most common garter snakes also secrete a foul-smelling fluid from postanal glands when handled or harmed.

Common garter snakes are resistant to most naturally found poisons such as that of the American Toad and Rough-Skinned Newt, the latter of which can kill a human if ingested. Common garter snakes have the ability to absorb the toxin from the newts into their body making them poisonous, which can deter potential predators.[5]

Toxicity, a very common characteristic in many animals, is used for offense as well as defense. The common garter snake is one of these animals. The snake's venom can be toxic to some of its smaller prey such as mice and other rodents.[6] On the defensive side, *Thamnophis sirtalis* (common garter snake) uses its resistance to toxicity as an important anti-predator response[7] A study was done on the evolutionary development of resistance of Tetrodotoxin in *T. sirtalis*, which tested between two populations of *Thamnophis* and then tested inside a population of *T. sirtalis*. It was found that those who were exposed to and lived in the same environment as the newts (*Taricha granulosa*) that produce the Tetrodotoxin when eaten, were more immune to the toxin.[8] This is seen in Figure 1 from the experiment:[9]

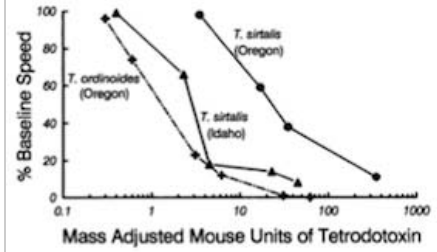


FIG. 1. Mean resistance (in % baseline speed) as a function of mass-adjusted mouse units of TTX (shown on a $\log_{10}$ scale) for each of three garter snake (*Thamnophis* sp.) populations.

Tetrodotoxin Effects in Garter Snakes

While resistance to tetrodotoxin is beneficial in acquiring newt prey, there are also costs associated with it as well. Reduced speed and sometimes no movement for extended periods of time, along with thermoregulation problems, are the result of TTX interactions. [10] This anti-predator display that this species uses demonstrates the idea of an "arms race" between different species and their anti-predator displays [11] Along the entire geographical interaction of *T. granulosa* and *T. sirtalis*, there are patches that correspond to strong coevolution taking place as well as weak coevolution, if any at all. Populations of *T. sirtalis* allopatric to those of *T. granulosa* contain the lowest amount of tetrodotoxin resistance, while those sympatric contain the highest levels of tetrodotoxin resistance. In populations where TTX is absent in *T. granulosa*, TTX resistance in *T. sirtalis* is selected against due to the mutation causing lower average population fitness. This helps with maintenance of polymorphism within garter snake populations. [12]

Reproduction

In the early part of spring, when snakes are coming out of hibernation the males generally emerge first to be ready when the females wake up. Some males will assume the role of a female and lead other males away from the burrow, luring them with a fake female pheromone. After such a male has led rivals away, he "turns" back into a male and races back to the den, just as the females emerge. He is then the first to mate with all the females he can catch. There are generally far more males than females and that is why, during mating season, they form "mating balls," where one or two females will be completely swamped by ten or more males. Sometimes a male snake will mate with a female before hibernation and the female will store the sperm internally until spring, when she will allow her eggs to be fertilized. If she mates again in the spring, the fall sperm will degenerate, and the spring sperm will fertilize her eggs. The females may give birth ovoviviparously to 12 to 40 young from July through October.

Habitat

The habitat of the common garter snake ranges from forests, fields, and prairies to streams, wetlands, meadows, marshes, and ponds, and it is often found near water. It is found at altitudes from sea level to mountain locations. Their diet consists mainly of amphibians and earthworms, but also fish, small birds, and rodents. Common garter snakes are effective at catching fast-moving creatures like fish and tadpoles. Animals that eat the common garter snake include large fish (such as bass and catfish), bullfrogs, snapping turtles, larger snakes, hawks, raccoons, foxes, wild turkeys and domestic cats and dogs.

Conservation

Water contamination, urban expansion, and residential and industrial development are all threats to the common garter snake. The San Francisco garter snake (*T. s. tetrataenia*), which is extremely scarce and occurs only in the vicinity of ponds and reservoirs in San Mateo County, California, has been listed as an endangered species by the U.S. Fish and Wildlife Service since 1967.

Anti-predatory displays

Garter snakes exhibit many different anti-predatory behaviors, or behaviors that ward off predators. Morphology refers to the shape that the snake's body makes in response to the environment, predatory defense, mating, etc. The term body geometry may also be used to describe the shape a snake's body makes. Garter snakes exhibit a higher variation of morphology when compared to other snakes. Predation has been such an intense selection pressure throughout evolution; these snakes have developed body geometries that are highly variable and heritable.[13] These morphologies have been concluded to be highly variable even within a single population.[14] Different geometries indicate whether the snake is preparing to flee, fight, or protect itself. Since the traits are heritable, there must be some evolutionary benefit such as warding off

predators. Additional research also shows that different biological factors such as body temperature and sex influence whether the snake will exhibit certain anti-predatory behaviors.[15]

Studies show that the warmer the temperature of a garter snake, the more likely the snake is to flee a predator. While a snake with a cooler body temperature remains stationary or attacks. Male garter snakes are also more likely to flee.[16][17] Garter snakes that exhibit more aggressive anti-predatory displays tend to also be fast and have high stamina. However the cause for correlation is unknown.[18]

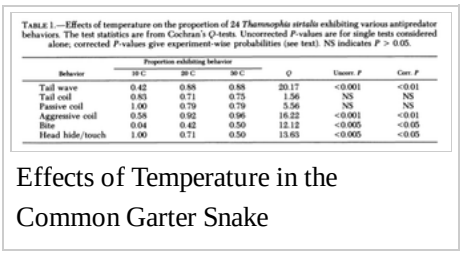


TABLE 1.—Effects of temperature on the proportion of 24 *Thamnophis sirtalis* exhibiting various antipredator behaviors. The test statistics are from Cochran's *Q*-tests. Uncorrected *P*-values are for single tests considered alone; corrected *P*-values give experiment-wise probabilities (see text). NS indicates $P > 0.05$.

Behavior	Proportion exhibiting behavior			Q	Uncorr. P	Corr. P
	10 C	20 C	30 C			
Tail wave	0.42	0.88	0.88	20.17	<0.001	<0.01
Tail coil	0.83	0.71	0.75	1.56	NS	NS
Passive coil	1.00	0.79	0.79	5.56	NS	NS
Aggressive coil	0.58	0.92	0.96	16.22	<0.001	<0.01
Bite	0.04	0.42	0.50	12.12	<0.005	<0.05
Head hide/touch	1.00	0.71	0.50	13.63	<0.005	<0.05

Effects of Temperature in the Common Garter Snake

As said, temperature can play a part in the anti-predator behavior of the common garter snake.[19] Temperature can also be the factor that determines whether the snakes stay passive or attacks when provoked by a predator. For example, one study found that snakes are less likely to escalate in response to an attack when the temperature is lower. There was a study done that tested the activity of the snake in response to different temperatures while being provoked by touching or by almost touching. By recording the popular responses as passive or aggressive, they were able to conclude that as temperature goes down, so does the anti-predator response and general activity of the snake.[20] Thus, temperature is important in determining the snake's anti-predatory responses. Table 1 from the experiment gives a good visual of the data involved in determining their conclusion:[21]

In the same study on temperature, they included the idea that the first response of the snake is actually a bluff. When the snake was teased with their finger, the snake reacted aggressively, however, once touched, they became passive and did not react with any more violence. [22] This was seen multiple times throughout the course of the experiment. They did not specifically test for this hypothesis, however, it was an important observation that should be tested in the future.

Aposematism, or warning coloration, is another factor that influences anti-predator behavior. For example, the coral snake exhibits aposematic coloration that can be mimicked.[23] While garter snakes do not exhibit mimicry or aposematic coloration, it has been found that garter snakes with striped patterns are more likely to slowly, successively slither away, while spotted and not striped snakes were more likely to deceptively flee from predators.[24]

The decision of a juvenile garter snake to attack a predator can be affected by whether the snake has just eaten or not.[25] Snakes that have just eaten are more likely to strike a predator or stimuli than snakes that do not have a full stomach. Snakes are more likely to flee a threatening situation if their stomachs are empty.[26] Snakes that have just eaten a large animal are less mobile. Feeding positively affects endurance as opposed to speed.[27]

Another factor that controls the anti-predatory response of the garter snake is where, on its body, the snake is attacked. Many birds and mammals prefer to attack the head of the snake.[28] In a research study, it was found that garter snakes are more likely to hide their head and move their tail back and forth when being attacked close to the head.[29] The same study concluded that snakes that were attacked in the middle of their body were more likely to flee or exhibit open-mouthed warning reactions.[30]

Time may be another factor that contributes to anti-predatory responses. Garter snakes are affected by maturation time.[31] As snakes mature, the length of time at which garter snakes can display physical activity at 25 °C increases. Juvenile snakes can only be physically active for three to five minutes. Adult snakes can be physically active for up to 25 minutes.[32] This is mostly due to aerobic energy production; pulmonary aeration increases up to three times in adult garter snakes when compared to juveniles.[33] The quick fatigue of the juveniles most certainly limits the habitats they can live in as well as their food source.[34] It absolutely affects the anti-predator response of both juvenile and adult garter snakes; without sufficient energy production the snake cannot exhibit any anti-predatory response.

Female garter snakes produce a specific pheromone. Studies show that some males of various species of garter snake exhibit female behavior as well as morphology.[35] This type of mimicry is primarily found in the red-sided garter snake. A portion of the males that exhibit female mimicry also secrete the sex-specific hormone to attract other males.[36] In a study these "she-males" mated with females significantly more often than males that did not exhibit this mimicry.[37] A male pretending to be a female around other males increases his chances of reproduction as well as protects against stronger, more aggressive males.

T. s. sirtalis (Ontario specimen)

T. s. sirtalis (Florida specimen)

T. s. pallidulus

See also

- Narcisse Snake Pits
- Inger, R.F. (1946). Restriction of the type locality of *Thamnophis sirtalis*. *Copeia* 1946:254.

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External links

- Eastern Garter Snake (http://www.ontarionature.org/protect/species/reptiles_and_amphibians/eastern_gartersnake.php) at Ontario Nature
- Red-sided Garter Snake (http://www.ontarionature.org/protect/species/reptiles_and_amphibians/red-sided_gartersnake.php) at Ontario Nature

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