

Social Lives of

Because the snakes bask, breed, and hibernate together, recognizing their relatives is a key advantage, especially for females.



Rattlesnakes

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Photographs by John Cancalosi



Timber rattlesnakes (*Crotalus horridus*) cluster near a communal den in the Pennsylvania woods. Group congregation sites such as this one are becoming rare, as are the snakes themselves, in part because they are often prime targets for hunters.



So, what good are they anyway?"

I sigh as I hear this question, yet again, about the animals I study: rattlesnakes. I suppose anyone who spends taxpayer dollars studying animal behavior has to deal with that kind of skepticism at some point along the

way. Answering such a question gets even trickier if what you study is small and seemingly insignificant, like a cricket. And getting a sympathetic ear for such a feared, hated, misunderstood, and potentially dangerous species as a rattlesnake is nearly impossible.

On this occasion, a retired truck driver has queried me over breakfast at the counter of a rural Pennsylvania diner. As it happens—though he doesn't know it—we are just a few miles from one of the largest concentrations of timber rattlesnake dens in the country. Rattlers, usually thought of as solitary tailshakers, actually breed in groups, making them an easy, albeit elusive, target for hunters—not to mention the people who take part in the dreadful "rattlesnake roundups," in the mistaken belief that killing snakes improves the woods. The group behavior of rattlesnakes is the focus of my research. Yet it is becoming increasingly difficult to study large groups of the snakes, because their numbers are dwindling. Pennsylvania continues to be one of the few places in the United States where timber rattlesnakes (*Crotalus horridus*) are still common.

Immediately I'm on the defensive—cautious about revealing too much about where I'm going to study the snakes, yet eager to respond. Being flip, I nearly say, "Well, what good are *you*?" Instead, I settle on an easy, utilitarian answer: they help control rodents.

But the timber rattlesnake is more than a simple rodent-eater. As top-level predators, rattlesnakes are an integral part of the ecosystem, contributing to the overall health of the forests. The snakes influence prey populations and perform vital ecosystem functions through their natural effect on the dynamics of the food web, helping to maintain balances between herbivore populations, plants, and predators. The loss of any one species from a community may not be catastrophic, but the ongoing decline of many populations in an ecosystem erodes the balances that make natural systems persist.

I was in Pennsylvania to observe the spring emergence of the timber rattlesnakes. Several years ago an expert on local rattler populations, Curt E. Brennan, who works for the Pennsylvania Department of Conservation and Natural Resources, first showed the populous rattler den to me. My return trek in

the spring took me to the secluded site up along a steep, forested bluff. At the summit of the bluff is a small clearing with exposed slate bedrock, fractured by cracks and crevices. Such exposed openings are few and far between in northeastern forests; whenever possible, the snakes use them as dens. Timber rattlesnakes are ectothermic, or cold-blooded, animals; come winter, they take refuge in the cracks beneath the frost line. By early May, though, temperatures become warm enough for the rattlers to move safely out into the woods. They don't return to their dens for hibernation until mid-October, just before the nighttime frosts begin.

I had arrived in the middle of May, the peak of the spring emergence period. The day was cool and slightly overcast—perfect for viewing snakes. They would be out in the open, trying to soak up what little warmth penetrated the haze. It took a moment of scanning to see them. A dozen or so large, thick-bodied, velvety timber rattlesnakes lay loosely piled and wrapped around each other just under the edge of a large stone slab. They basked contentedly in the sun, gently shifting their muscular coils every so often. If they were aware of my presence, they seemed unconcerned about it. I felt I was looking through a small window onto an alien world.

Everyone I have ever taken into the field—my mother, a businessman, a local redneck, a college student, a six-year-old child—has been equally moved by the sight of timber rattlesnakes in the wild. After such an experience, no one seems to have any further doubts about the value of these animals. Perhaps the overhyped fear and loathing whipped up about animals such as rattlesnakes arises from surprise encounters that people have with snakes, in which the snakes are perceived as intruders. Yet a visit to the same animal in its natural environment can have the opposite effect, fostering a sense of value and appreciation.

Timber rattlers are striking in such large aggregations. They come in two colors: some are almost solid black, whereas others are bright yellow, marked with splotches of brown. These two "color morphs" can even occur in the same litter. As I watched the jumble of snakes in May, I noticed one large, yellowish-brown male start to make his way slowly but steadily up the slope and into the woods. He was probably beginning his yearly migration through the forests in search of food. Males, juveniles, and non-

Timber rattlesnakes are unfazed by the stray garter snake (left foreground in the photograph at right) that is sharing their basking area amidst rocky crevices and boulders. Within a few weeks of emerging from winter hibernation, male snakes, like the one pictured at the top of this page, and non-pregnant females slip into the woods in search of prey.

pregnant females all leave the denning areas over the course of a few weeks. After a winter without food, the animals need to seek out the small mammals that constitute their diet.

Rattlesnakes are not fast animals, and they certainly lack endurance. Instead, they rely on patience, camouflage, keen senses, and a lightning-quick strike to capture their prey by ambush. After several months of such hunting and feeding, males become restless and start dispersing more widely through the woods—fifteen to twenty times farther than normal—to pick up the scent of receptive females.

Adult females become receptive to male advances only in years when they have stored enough body fat to bear a litter. The storage process usually takes

no less than three years following a season of pregnancy and sometimes as long as six, depending on hunting conditions—leaving only a fraction of the female population available for breeding each year. Mating season is in late summer. Females hold sperm in their reproductive tract during winter hibernation and fertilize their eggs at the beginning of the following spring. During pregnancy, females forgo foraging. Incredibly, even after a winter without food, the expectant mothers spend almost the entire summer without hunting. Instead, they stay at exposed, south-facing basking areas near their winter den, allowing their hard-earned fat reserves alone to support the growth and development of their embryos [see photograph on pages 36 and 37].

In a good year, the females give birth to live young in late August. But the mothers, typically emaciated



by this point, still aren't quite ready to abandon their newborns. Even though a baby rattlesnake is venomous from birth, it is a somewhat helpless creature, susceptible to attack from a wide range of predators that have no problem dispatching tiny reptiles. The babies need to spend the first week of life basking in

leads to a slow rate of population growth and—if a population endures a crash—to a slow recovery.

Perhaps the most impressive aspect of the reproductive cycle, however, is its communal nature. Like the denning areas, a good basking area is a prize find. In spring and summer, piles of gravid females can be found lounging in the sun together, black and yellow coils piled up in intricate mounds. These females give birth together at sites that biologists have termed “birthing rookeries.” The rudimentary protective crèche they form with their entwined bodies probably makes a basking area the safest place for newborn snakes.

Are such groupings merely chance meetings at an ideal locale, or do they constitute gatherings of more subtle and sophisticated social groups? Vertebrate biologists have long taken it almost for granted that snakes in general are asocial animals, leading simplistic lives of solitude filled only with basic instinctual drives toward food and sex. My research, in which, among other techniques, I radio-tag individual snakes and follow them around in the field, has led me to think otherwise.

Timber rattlesnakes live as long as thirty years in the wild, and they seem to live as stable, cooperative community mem-

bers. They appear to form lasting relationships with other individuals, follow similar paths through the woods, bask together before shedding their skins under the same fallen log, and sometimes follow each other from one den to another. Young timber snakes have demonstrated a tendency to trail older ones. A recent genetic study has demonstrated that snakes sharing a den are closely related. Other research on a similar species, the prairie rattlesnake (*Crotalus viridis*), has shown that the species can mobilize a

Biologists have long taken it almost for granted that snakes lead simplistic lives of solitude; in fact, they are highly social animals.



Male timber rattlesnakes search the forest for food in the summer months, but they travel even greater distances in early autumn when looking for mates.

the open until they shed their natal skin and can disperse into the relative safety of the woods. During that natal basking period, the mothers stay near their young, defending them from potential predators.

Although this form of parental care is common among rattlesnakes and other vipers, herpetologists have been slow to appreciate the sacrifices it entails. Imagine what it would be like to carry eggs around in your body all year and forgo your own chance to eat until your young have fed off your fat and can survive on their own! Small wonder that female timber rattlesnakes in northern climates can afford such an ordeal only once every three to six years. Such a slow reproductive rate, combined with a maturation period as long as ten years for the young snakes,

Baby rattlesnake finds safety in its mother's coils (next page). Females stick together during their pregnancies and in the first few weeks after giving birth. The communal gathering provides a safe environment for newborn rattlers.



group defense, mediated, in part, by alarm pheromones. Add to those findings the clear concern of mother snakes for their young [see *photograph on preceding page*], and you have to wonder whether the social lives of rattlesnakes are really so simplistic after all.

Those and similar observations sent me to the laboratory, to see whether snakes raised in captivity could recognize their relatives. Kin recognition serves as the foundation of advanced social systems in a wide variety of other animal societies. No one, though, had ever demonstrated that ability

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among snakes. Yet if snakes did work collectively, they could enjoy several important benefits in the wild. A group of snakes could retain their combined heat longer than an individual could, making thermoregulation more efficient. And a group of snakes could make a far more convincing display against predators, and mount a much fiercer defense, than could a lone snake on its own.

Because relatives share genetic material, the benefits of group membership would be enhanced if the group were made up of kin—from an evolutionary perspective, raising offspring is just one way of passing your genes on to the next generation. The same genes could be passed on if they helped non-descendant kin, such as siblings, survive and reproduce. Working in the laboratory, I raised litters of timber rattlesnake siblings in isolation from one another, and then placed the snakes one by one at random in an enclosure with a nonsibling snake. The snakes—at least the females—associated more closely with littermates than with unrelated females. In other words, the female snakes seemed to recognize their sisters.

That intriguing result has led me to investigations that are still ongoing: with genetic techniques I am testing the kin relationships among females in the wild that spend time basking together at communal rookeries. Perhaps it will turn out that timber rattlesnakes organize themselves matrilineally—in other words, that social groups form along the maternal line, with extensive contact among related individuals across generations. Such a finding could go a long way toward changing people's negative perceptions about snakes. The stereotype—that

they are emotionless predators leading solitary and uninteresting lives devoid of social contact—is certainly untrue.

To collect tissue samples for the genetic project, I return to the Pennsylvania woods in late summer with John Cancalosi, a nature photographer who has decided that snakes are, photogenically, “the new birds.” As we approach the boulder-strewn clearing, dozens of females and their babies are lying in huge piles at the base of a large rock. As many as thirty females have given birth here. Each litter includes, on average, seven or eight young, putting the number of babies in the hundreds. The sight is awesome. How many people realize that one can view hundreds of venomous snakes in their natural habitat without seeming to create much of a disturbance? Even the busy whirring of Cancalosi's

camera makes no notable impression on the snakes.

In the middle of a pile, we notice a garter snake [see *photograph on page 39*]. The garter has apparently decided that even in the presence of its venomous, mammal-eating cousins, the slab isn't such a bad place to get a little sun of its own. Since natural breaks in the woods are so important for ectotherms, it is not uncommon to find several different snake species sharing basking and denning sites.

The annual aggregation of rattlesnakes is a natural spectacle that remains underappreciated by naturalists and the public alike, and it underscores the importance of these vital habitat sites to the local reptile population. The once-abundant timber rattlesnake is quickly succumbing to the twin pressures of habitat loss and overhunting. Its plight is worsened by its public-relations problem: lots of people don't care if the species is actively protected or not. The problem is not insurmountable, though. In my experience, people in general have an innate fascination with snakes. That fascination can be the hook that fosters an appreciation for unusual and interesting wildlife of all kinds.

The next time you see a snake in the woods, you will be startled and probably a little frightened. But think of the myths and fables that once portrayed the woods as a magic, mysterious place—a place where the senses quickened to catch any whiff of danger that might be lurking beyond the next tree. Would a domesticated forest, without that spice of risk, the unpredictable wild, really be a better place? The loss of the rattlesnake—a very real possibility—would change our forests irrevocably, making them a kind of stage set, rather than a portal to nature. □