

# Armadillos

**a**RMADILLOS ARE ONE OF THE OLDEST, AND oddest, groups of mammals. Because of the tough protective carapace they all possess, early zoologists often linked them with shelled vertebrates such as turtles. Modern taxonomists put them in the order Cingulata.

The Xenarthra was the name given to one of the four basal groups of placental mammals, diverging from other mammals as long as 103 million years ago. Within the Xenarthra, armadillos split off into their own taxonomic branch about 55–75 million years ago. Recent molecular genetic studies suggest armadillos may be closely related to the ferroungulates, which include the carnivores, cetaceans, and artiodactyls.

Although they are now classified in the order Cingulata, armadillos were previously included in the order Xenarthra along with anteaters and sloths. Prior to the Xenarthra they were included in the now obsolete order Edentata, which means “without teeth.” This was always spurious, as they all possess rudimentary, peglike teeth that are undifferentiated (in other words, not divided into incisors, canines, or molars) and that serve to mash up their food. Most species have 14–18 teeth in each jaw, but the giant armadillo, with 80–100, has more than almost any other mammal. In the long-nosed species of the genus *Dasylops*, the jaws do not open very wide, so, as with the anteaters, they capture prey with their long, flexible tongues.

Though hardly lightweights, modern armadillos are puny compared with their ancestors. The largest extant species, the giant armadillo (*Priodontes maximus*), weighs 30–60kg (66–132lb), but the extinct glyptodonts were far more massive, with weights estimated at 100kg (220lb) or more. Some of these fossil forms were so large that their carapaces (up to 3m/10ft long) were used as roofs or tombs by early South American Indians.

Our knowledge of living armadillos is extremely sparse. Many species have not been studied extensively in the wild, and attempts to breed armadillos for study in captivity have been largely unsuccessful. The only well-known species currently is the nine-banded armadillo, which has been the subject of a few long-term field studies.

## Insect-eaters in Armor

### FORM AND FUNCTION

All armadillos possess a number of distinctive features, most notably a tough carapace that covers some portion of the upper surface of their bodies.



**Above** A three-banded armadillo rolling itself up into a defensive ball. When fully curled, it has the appearance of a puzzle ball, leaving no chinks for natural predators to attempt to pry it open. Yet this defense has afforded little help against predation by humans, who have exploited armadillos as a source of food for centuries.

This shell probably provides some protection from predators and minimizes damage from the thorny vegetation that armadillos frequently pass through. The carapace develops from the skin, and is composed of strong bony plates, or scutes, overlaid by horny skin. There are usually broad and rigid shields over the shoulders and hips, and a variable number of bands (from 3–13) over the middle of the back that are connected to the flexible skin beneath. The tail, the top of the head, and the outer surfaces of the limbs are also usually armored (although the tail is not covered in the genus *Cabassous*), but the undersurface is just soft, hairy skin. To protect this vulnerable area, most species are able to withdraw the limbs under the hip and shoulder shields and sit tight on the ground, while some, such as the three-banded armadillos of the genus *Tolypeutes*, can roll up into a ball. While this strategy may prove effective against most predators, it has unfortunately made these species easy prey for human hunters.

While apparently well protected, armadillos are not invulnerable to predation. Juvenile mortality can be twice that of adults, possibly due to predation by bobcats, mountain lions, some raptors,

## ARMADILLOS AND LEPROSY

In the 1960s, Eleanor Storrs made the remarkable discovery that armadillos inoculated with the leprosy bacillus can develop the disfiguring human disease, and in the 1970s the condition was found in wild populations. In wild nine-banded armadillos, its occurrence varies regionally: Floridian armadillos lack leprosy, while as many as 20 percent of the animals from populations in Texas and Louisiana may be infected.

Unlike humans, armadillos exhibit no external symptoms until the disease has progressed sufficiently to fatally damage the internal organs. It is not yet known whether people can contract leprosy from armadillos, but the risk may depend on where they are from: unlike individuals from more tropical regions, people of northern European descent are relatively immune to the malady.

FACTFILE

**ARMADILLOS**

Order: Cingulata

Family: Dasypodidae

21 species in 9 genera

**DISTRIBUTION**

Florida (except Everglades), Georgia, and South Carolina W to Kansas; E Mexico, C and S America to Straits of Magellan; Trinidad and Tobago, Grenada, Margarita.



**HABITAT** Savanna, pampas, arid desert, thorn scrub, and deciduous, cloud, and rain forest.



**SIZE** Head-body length ranges from 12.5–15cm (5–6in) in the Lesser fairy armadillo to 75–100cm (30–39in) in the Giant armadillo; tail length ranges from 2.5–3cm (1–1.2in) to 45–50cm (18–20in) and weight from 80–100g (2.8–3.5oz) to 30–60kg (66–132lb), both in the same two species.

**COAT** Broad shield of pale pink or yellowish dark brown armor (scute plates) over shoulders and pelvis, with varying numbers of flexible half-rings over middle of back; some species have white to dark brown hairs between the scute plates.

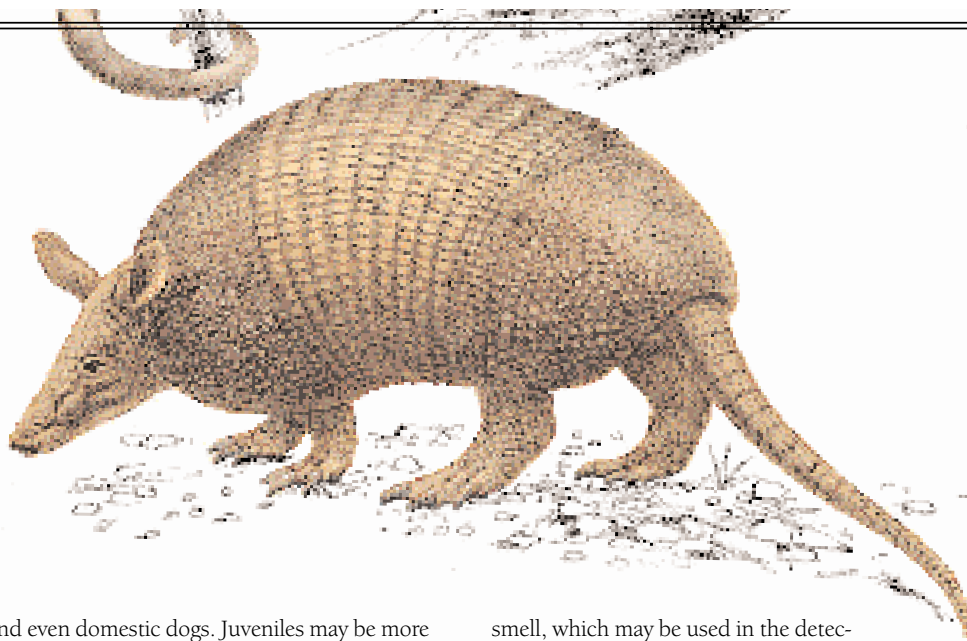
**DIET** Soil invertebrates, especially ants and termites. Will also feed on some plant matter, and are occasionally observed preying on small vertebrates (live or dead).

**BREEDING** Both sexes are sexually mature at about 1 year. Breeding can occur year-round, but is most frequent during summer. Gestation varies from 60–65 days (in the Yellow and hairy armadillos) to 120 days (prolonged by delayed implantation) in the Nine-banded armadillo. Litter size usually 1–4, but reaching 8–12 in some species.

**LONGEVITY** Unknown in the wild, but may be about 8–12 years (up to 20 in captivity).

**CONSERVATION STATUS** At present, 4 species are considered Vulnerable by the IUCN, and 6 more are listed as Lower Risk, Near Threatened. Two species are classed as Data Deficient.

See genera box ▷



and even domestic dogs. Juveniles may be more vulnerable to predators because of their small size and softer carapace, but adult carcasses have also been found in the guts of large predators, such as jaguars, alligators, and black bears.

Most armadillos find prey by digging in the soil. In addition, many species excavate burrows that are used as refuges, resting places, and nest sites for rearing young. Consequently, most armadillos have muscular fore- and hindlimbs, ending in large, sharp claws that facilitate digging. While the hindlimbs always bear five-clawed digits, the forelimbs may have from three to five digits with curved claws, depending on the species. In some species such as the naked-tailed armadillos and the giant armadillo the front claws are greatly enlarged, perhaps to facilitate opening ant and termite mounds for foraging. As a result, however, these species are unable to run quickly when danger appears.

Because they are usually active at night, most armadillos have poor eyesight. They seem, however, to have well-developed senses of hearing and

smell, which may be used in the detection of both predators and prey. Olfaction may also be employed to determine the identity (and, during the breeding season, the reproductive condition) of other armadillos. The yellow armadillo and species in the genus *Chaetophractus* have 3–4 gland pits located on the back carapace. The long-nosed armadillos of the genus *Dasypus* have glands on the ears, eyelids, and soles of the feet, as well as a bean-shaped pair of anal glands that produce a yellowish secretion. These glands may be important in chemical communication, as armadillos are frequently observed sniffing this area when they encounter one another; they may also rub the glands on the ground in spots along the periphery of their home range. Although their hearing seems fairly acute, most armadillos are silent. What sounds they do produce are usually just low grunts or squeals, so most communication is probably chemical.

While there are reports of modest differences in body size between the sexes, the males being larger than the females, most armadillos exhibit no obvious sexual dimorphism. One interesting anatomical feature is the male penis, one of the longest among mammals, extending two-thirds of the body length in some species. Armadillos were at one time thought to be the only mammals other than humans to copulate face to face, though this is now no longer believed to be the case; it seems instead that the males mount females from behind, as in most other mammals. If so, then the long penis may be necessary to permit intromission, given the necessity to extend beyond the

▲ **Above** The nine-banded armadillo, unlike the other species, is able to traverse water by inflating its stomach and intestine with air for buoyancy. Since it can hold its breath for several minutes, it can cross smaller streams underwater.

▼ **Below** The configuration of the armored shell varies markedly between species of armadillo: 1 the southern three-banded armadillo (*Tolypeutes matacus*); 2 the pichi (*Zaedyus pichiy*); 3 the lesser fairy armadillo (*Chlamyphorus truncatus*).



armored carapace to reach the vaginal opening. The musculature of the penis consists of a series of longitudinal and circumferential supporting fibers, an arrangement that is thought to be common to all mammals.

## New World Burrowers

### DISTRIBUTION PATTERNS

Armadillos are strictly New World species; the majority of fossil forms come from South America, suggesting that this was where the group originally evolved. They subsequently colonized North America, where glyptodont fossils are found as far north as Nebraska, during periods when a land bridge connected the two continents. These fossil forms eventually went extinct, leaving no armadillos in North America until recent times, when, from the late 1800s onward, the nine-banded armadillo (*Dasyurus novemcinctus*) rapidly expanded its range from northern Mexico to include much of the southern USA, with current sightings as far north as southern Illinois, Nebraska, Missouri, and southwestern Tennessee. In Florida, several armadillos escaped from zoos or private owners in the 1920s, and these also established wild populations, which have slowly spread northward and westward. Florida-derived and Texas-derived populations of armadillos have probably made contact by now, possibly in Alabama or Mississippi.

Although normally associated with moist, tropical habitats, armadillos can be found almost anywhere in the New World. For example, the pichi is found in the Patagonian region of Argentina all the way south to the Straits of Magellan; the hairy long-nosed armadillo is known only from high-altitude regions of Peru from 2,400–3,200m (7,900–10,500ft); while the greater long-nosed armadillo occurs only in the rain forests of the Orinoco and Amazon basins.

Species of armadillo vary dramatically in their abundance. The nine-banded armadillo, also aptly known as the common long-nosed armadillo, can reach population densities of 50 per sq km (130 per sq mi) in the coastal prairies of Texas and elsewhere. However, the maximum density estimated for the southern naked-tailed armadillo in the Venezuelan llanos is only 1.2 per sq km (3.1 per sq mi), and the giant armadillo, even in optimum lowland forest habitat in Surinam, was only found to reach half that figure. Yellow armadillos have been found in Brazilian savanna and forest at densities of up to 2.9 animals per sq km (7.5 per sq mi), while southern three-banded armadillos in southern Brazil may reach densities of 7 animals per sq km (18 per sq mi).

Even if no live animals are observed, a good sign of the presence of armadillos in a habitat is a burrow. Armadillos dig between 1 and 20 burrows, each 1.5–3m (5–10ft) long, in their home ranges, occupying a given burrow for anything from 1–29 consecutive days. Because armadillos use multiple burrows, counting burrows in a hab-



**▲ Above** The southern naked-tailed armadillo has five curved claws on each forefoot, the middle one of which is especially powerful. Its gait is unusual – it walks on the soles of its hindfeet (plantigrade), but on the tips of the claws on its forefeet (digitigrade).

itat may not provide a reliable estimate of actual population density. Burrows are generally not very long and tend to run horizontally under the surface rather than to extend vertically down into the ground. Most burrows usually have just one or two entrances.

## Snuffling through the Leaf Litter

### DIET

Perhaps because of their armor, armadillos are often fairly conspicuous, making a considerable racket as they snuffle along searching for food in dry vegetation. For armadillos, foraging consists of moving slowly along with the nose in the soil and leaf litter, then digging up material with the foreclaws. The animals may also use their claws to rip open rotting logs.

With their large front claws, giant and naked-tailed armadillos seem specialized for ripping open ant and termite mounds. Other species have a more catholic diet; analyses of gut contents have revealed a mix of invertebrates, mostly beetles and ants. The nine-banded armadillo is one of the few species to have been observed bravely feeding on fire ants (*Solenopsis invicta*), enduring their painful stings to dig open the nest and eat the larvae within. In addition to invertebrates, armadillos are also known to feed on some vegetable matter, including persimmons and other fruits, and, rarely, on certain vertebrates, such as snakes and small lizards; they may also scavenge carrion and the eggs of ground-nesting birds.

## NATURE'S CLONES

Armadillos in the genus *Dasyurus* are the only vertebrates known to exhibit obligate polyembryony, in which a female produces one fertilized egg that divides into multiple embryos. Because of this, all the offspring produced are genetically identical to one another. Genetic uniformity of siblings in the nine-banded armadillo (BELOW) has been confirmed using modern molecular techniques.

One proposed reason for such a strange system may be to encourage offspring to help each other out. Altruistic behavior reaps more evolutionary dividends when directed towards relatives, as they share a higher proportion of genes. Because of polyembryony, armadillo littermates are clones, and thus might be predicted to be particularly helpful to each other. As it turns out, however, armadillos get very little opportunity to mix with their siblings as adults, and it seems more likely that polyembryony represents an ingenious way of countering a physical restriction on reproduction, helping to overcome a constraint in the female's reproductive system that leaves space for only one egg prior to implantation.



## Armadillo Genera

### Long-nosed armadillos

Genus *Dasypus*

S USA, Mexico, C America, Colombia, Venezuela, Guiana, Surinam, Brazil, Paraguay, Argentina, Ecuador, Peru; also Grenada and Trinidad and Tobago. 7 species: the **Nine-banded** or **Common long-nosed** (*D. novemcinctus*), **Seven-banded** or **Brazilian lesser** (*D. septemcinctus*), **Greater** (*D. kappleri*), **Southern lesser** (*D. hybridus*), **Hairy** (*D. pilosus*), and **Northern** (*D. sabanicola*) **long-nosed armadillos**; and **Yepes's mulita**, *D. yepesi* (from northeastern Argentina). The Southern lesser long-nosed armadillo is classed as Near Threatened, the Hairy long-nosed armadillo is Vulnerable.

### Naked-tailed armadillos

Genus *Cabassous*

C and S America E of the Andes from S Mexico and Colombia to Paraguay, Uruguay, and N Argentina. 4 species: the **Southern** (*C. unicinctus*), **Northern** (*C. centralis*), **Chacoan** (*C. chacoensis*), and **Greater** (*C. tatouay*) **naked-tailed armadillos**. The Chacoan naked-tailed armadillo is classed as Lower Risk, Near Threatened.

### Yellow armadillo

Genus *Euphractus*

**Yellow** or **Six-banded armadillo**. S Surinam and adjacent areas of Brazil; also E Brazil to Bolivia, Paraguay, N Argentina, Uruguay.

### Giant armadillo

Genus *Priodontes*

S America E of the Andes, from N Venezuela and the Guianas to Paraguay and N Argentina. Vulnerable.

### Hairy armadillos

Genus *Chaetophractus*

Bolivia, Paraguay, Argentina, Chile. 3 species: the **Andean** (*C. nationi*), **Screaming** (*C. vellerosus*), and **Larger** (*C. villosus*) **hairy armadillos**. The Andean hairy armadillo is classed as Vulnerable.

### Three-banded armadillos

Genus *Tolypeutes*

Brazil and E Bolivia S through the Gran Chaco of Paraguay to Buenos Aires (Argentina). 2 species: the **Southern**

(*T. matacus*) and **Brazilian** (*T. tricinctus*) **three-banded armadillos**. The Brazilian three-banded armadillo is classed as Vulnerable, while the Southern three-banded armadillo is Lower Risk, Near Threatened.

### Fairy armadillos

Argentina, Paraguay, Bolivia. 2 species in 2 genera: the **Greater** or **Chacoan** (*Calyptopractus retusus*), and the **Lesser** or **Pink fairy armadillo** (*Chlamyphorus truncatus*). The Lesser fairy armadillo is classed as Endangered, while the Greater fairy armadillo is Vulnerable.

### Pichi

Genus *Zaedyus*  
*Zaedyus pichiy*  
C and S Argentina, and E Chile S to the Straits of Magellan. LR, Near Threatened.

## Life beneath the Carapace

### SOCIAL BEHAVIOR

Most armadillos are relatively solitary, and with a few exceptions most species are active at night, although this can vary with age – juveniles are often active in the late morning or early afternoon – and with the time of year: there is more diurnal activity when the weather is colder.

Among adults, most social interactions usually occur during breeding. For most species, breeding is seasonal, with matings occurring primarily during the summer months, although captive animals may breed year-round. Prior to mating, males and females may engage in extended bouts of courtship in which the males avidly follow the females. After mating, most species initiate embryonic development right away, but in northern populations of the nine-banded armadillo (*Dasyopus novemcinctus*), possibly as an adaptation to the different timing of the seasons, implantation of the fertilized egg may be delayed by 3–4 months or more; one captive female of this species reportedly gave birth at least three years after the last date at which she could possibly have been inseminated. *D. novemcinctus* may be polygynous, with males mating with 2–3 females per breeding season, while females typically mate with just a single male. Yet not all individuals are reproductively

successful: as many as one third of the females in a population may not reproduce in a given year, and, in a 4-year study, only about a third of all adults were identified as parents of at least one litter. Litter sizes are usually small, varying from 1–4 young per litter for most species, with a maximum of 8–12 reported for captive *D. hybridus*. The majority of species only reproduce once per year.

In *D. novemcinctus*, males occasionally chase, kick, and scratch each other with their claws either in defence of their home ranges or when competing for access to females. Although female home ranges may overlap quite extensively, pregnant or lactating adult females can also be quite aggressive, primarily targeting other females and younger individuals of both sexes.

*D. novemcinctus* home ranges vary from about 1.5ha (4 acres) for a population in Oklahoma to over 10ha (25 acres) for a population in Florida. Home range sizes for other species are largely unknown, but the low population densities of most species suggest they may range widely.

## Conserving the Hoover Hog

### CONSERVATION AND ENVIRONMENT

For centuries, armadillos have been exploited by humans for their meat, and they continue to be a favored food item in many areas of Latin America. In North America people partake of armadillo meat less frequently; however, during the Great Depression of the 1930s, destitute southern sharecroppers came to rely on armadillos for food, and the animals were nicknamed “Hoover hogs,” a wry allusion to US President Herbert Hoover.

Habitat loss from deforestation, agriculture, and other sources is another significant cause of declining populations, as is the eradication of digging armadillos from both agricultural areas and the well-manicured lawns of suburban communities. On the bright side, the Brazilian three-banded armadillo, which was formerly classed as extinct in the wild, has been rediscovered recently in several areas of Brazil.

CMM/WJL

**Right** The larger hairy armadillo has been known to burrow under animal carcasses in order to feed on the maggots and other insects that accumulate there. This species relies on insects, rodents, and lizards in summer, but half of its winter diet is vegetation.

