



feature

Nests and Nest-building Animals

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Spring is generally considered to be a time of birth and renewal in the natural world. For many people, springtime is also synonymous with nest building and baby birds. Birds, however, are not the only animals that build nests. Many spider and insect species are nest builders, as are a variety of species of fish, amphibians, mammals, turtles, lizards, snakes, and crocodiles. Among extinct animals, dinosaurs are probably the most famous (or infamous) nest builders. Given this diversity of both invertebrate and vertebrate nest builders, it may come as a surprise that there are common themes to all nesting species. Driven by a strong “nesting instinct,” animals build nests to protect their offspring from harsh and/or unpredictable climatic conditions, to minimize the threat of predation, and, in the case of nests with multiple eggs, to gain “safety in numbers.”

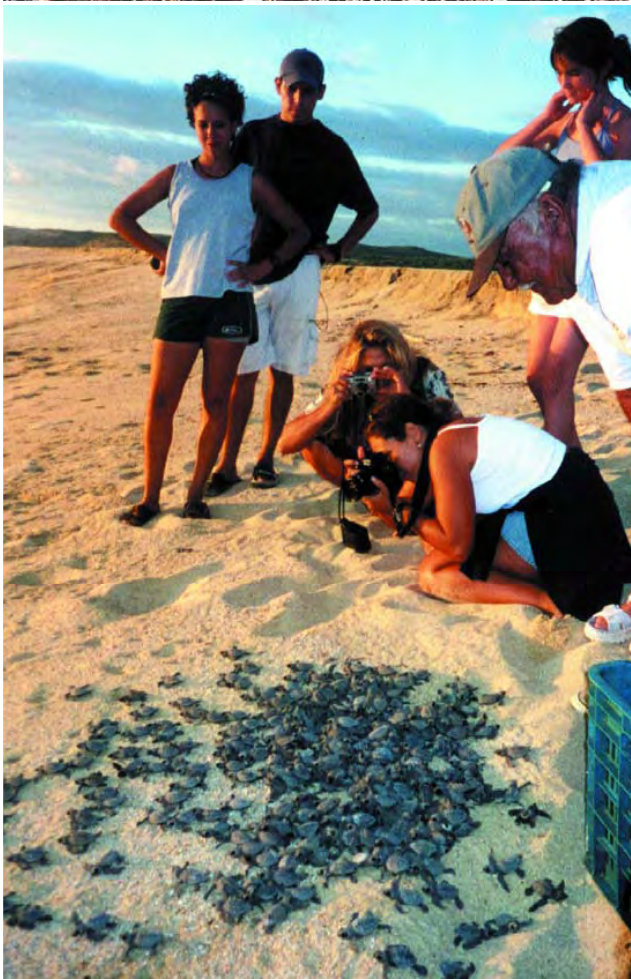
The egg-laying animals that build nests also vary in the degree of parental care they give to their offspring as they develop from an embryo to an adult. Some of the simplest nests are designed to hide eggs from predators and the sun or to protect them from being scattered by currents of air and water. Our stream-dwelling frogs lay large numbers of eggs in gelatinous masses attached to underwater vegetation. The jellylike material serves as a nest to prevent the eggs from being washed downstream. Sea turtles in the Gulf of California build simple nests on beaches. They emerge at night to excavate a pit in the sand above the tide line. Once they lay their eggs, they cover the hole to protect the eggs from the heat of the sun and opportunistic predators. In both examples, parental care ends after the eggs are laid.

In a broad sense, the complexity of nests increases as parental care increases. Perhaps this is also tied to the level of development a hatchling has reached when it emerges from the egg. A suitable nest is needed to continue the rearing of a newborn until it is mature enough to fend for itself. Vespine wasps build complex nests of papery material where they hatch their eggs in individual cells and feed their larvae chewed-up pieces of insects. The nest can vary in architecture depending on the species. Paper Wasps build a single tier of cells, while Yellowjackets eventually construct a multi-tiered condominium that reaches over a foot in diameter. The nest is used as both a hatchery and a day-care center.

The American Alligator is noted for its good parenting skills. Alligators build a large nest made of decaying plant material and mud. The nest is situated above the waterline on either a bank or vegetation mat. In the center, the female digs a hole and deposits up to 50 eggs. Once finished, she covers the hole with her forelimbs and jaws. As time passes the mud hardens



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to encase the eggs inside. Within the nest, the eggs incubate in the warmth of the decomposing vegetation for a little over two months. Outside, the mother stands guard and fiercely defends the nest should a scavenger try to unearth the eggs. As the eggs hatch, she breaks the nest open and carries the chirping babies to the water where she protects them for a year or more. The limited dexterity of alligators likely prevents them from weaving an intricate nest, yet they take great care in selecting a nest site and constructing the mound. If conditions are not right, the female abandons the site.

From the fossil record, it is known that many, if not all, dinosaurs laid eggs and that at least some were nest builders as well. Dinosaur eggs were first discovered in Mongolia in the 1920s, but have since been found at a variety of sites around the world. The richest finds have come from China, Mongolia, Patagonia, and the High Plains of North America. Not all discoveries of dinosaur eggs can automatically be assumed to represent nests, and careful study is required to confirm the presence of features consistent with nest building. Such features include clustering of eggs in a regular pattern, the co-occurrence of whole eggs and broken ("hatched") eggs, the co-occurrence of eggshell fragments and embryos or neonates, and the occurrence of physical structures such as excavated pits.

Some of the best insights into the behavior of dinosaur parents and offspring come from a Cretaceous nesting sight in Montana called Egg Mountain. The location contains dozens of nests, each with twenty or more eggs. The nests belong to the hadrosaur *Maiasaura* (meaning "good mother lizard"). Based on the analysis of adult, juvenile, and embryonic fossils, it is believed that the name is befitting. Scientists are confident that a large amount of parental care was given to the young *maiasaurs* since the teeth of the juveniles show signs of wear, yet their legs are not developed enough for the youngsters to have foraged on their own. The nests are located in depressions in the ground, but the eggs were not likely brooded by the parents because of their large size (over 25 feet in length). Instead, the nests were likely covered with vegetation and sand for incubation, and clustered into colonies for better protection. Imagine the commotion at an active *Maiasaura* rookery!

In other dinosaur nesting sites, evidence of brooding parents has been found. In one well-documented case from the Cretaceous of Mongolia, fossilized remains of an adult *Oviraptor* were found in a brooding posture on top of a clutch of eggs. The notion of a brooding dinosaur is not too surprising given their close relationship to birds (their living descendants), who are the most successful and varied brooders alive today. And the notion of good parenting skills among dinosaurs and birds is not entirely unexpected either. Their shared ancestry with alligators and crocodiles makes this archosaurian group (crocodiles + dinosaurs + birds) an evolutionary radiation with nest building and parenting as its basis.

With the predisposition of nesting and parental oversight seen in non-avian dinosaurs, the stage was set for birds and the further evolution of brooding. And radiate they



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did! Birds are the most practiced and skillful nest builders of all. Nests vary with material, construction, size, shape, location, and, in some instances, by what may be best described as artistic expression.

"So it is with the nests of birds, which vary partly in dependence on the situations chosen, and on the nature and temperature of the country inhabited, but often from causes wholly unknown to us."

—Darwin, 1859, *On the Origin of Species*

Over the past five years, bird nesting has received renewed attention, as part of the Museum's San Diego County Bird Atlas project. Though each species has its characteristic style of nest, most exercise flexibility in selecting a site suitable for that style. Birds' understanding of a site's ability to protect a nest, and their selecting the most protective site in their territory, are impressive. Not only the Cactus Wren but the House Finch, Roadrunner, and Mockingbird, among others, recognize that cacti deter predators and select cacti for nest sites when possible. Even if no cacti are available, many species select the thorniest plant around as a site. Some species, like the Bushtit and Bullock's Oriole, often suspend their nests from the tips of branches, from twigs too slender for many predators to negotiate.

Still other species seek the concealment of cavities in trees or, failing these, birdhouses or crevices in buildings. Around San Diego, where trees are naturally scarce, cavity-nesting birds often must compete for suitable sites. The planting of trees and provision of birdhouses in cities, though, has enabled some cavity-nesting birds, like the Western Bluebird, House Wren, and Nuttall's Woodpecker,

to expand their ranges. New features of our urbanizing environment may provide a species with new opportunities. The Western Flycatcher, for example, typically seeks knotholes and broken-off snags to support its nest. But around San Diego, this species has found that the space behind sloughing slabs of eucalyptus bark is equally suitable, allowing it to expand into a nonnative habitat shunned by many other native animals.

From a worldwide view, the variety of bird nests is taken to more exuberant extremes. In the New World tropics, the oropendolas, giant relatives of our orioles, build hanging pouches that may reach a length of six feet. In southeast Asia, the tailorbirds, members of the Old World warbler family, carefully stitch together leaves, creating a pocket in which the nest is hidden. Africa is famed for the weaver family, some species of which weave elaborate spouts providing entrance to their globular nests, others building huge arboreal houses of straw in which each pair has its own apartment. The megapodes of the Australasian region have reverted back to incubating their eggs in a mound of decomposing vegetation as their archosaurian ancestors did. One species of this family, *Macrocephalon maleo* of the Indonesian island of Sulawesi, uses the geothermal heat of volcanic sand as its source of energy for incubation.

Clearly, complex nest-building behavior was a key adaptation making birds as a class so successful, just as viviparity (bearing live young) and nourishing the young with milk was a key adaptation making mammals so successful.

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