NEST BUILDING IN BIRDS: MUCH MORE THAN INSTINCT

BY MARIELLA BODEMEIER LOAYZA CAREAGA

With its vast landscapes and sparse population, Montana can feel like a land of silence at times—a quietness that often takes over the night and lingers into the early hours of the morning. But as night turns to day, we are pleasantly surprised by one of the few sounds brave enough to break the quietude: the music of birds.

In western Montana, bird songs and calls abound, as these parts are home for a wide range of bird species. As we leave the cold, dark days of winter behind, though, it is not the music that birds make that comes to my mind as I think about spring, its warm temperatures, lush greeneries, and long days. It's their nests. Or, more specifically, how they build them.

NEST: DEPOSITPHOTOS.COM

Nest building is an evolutionary feat spread across the animal kingdom. Birds do it; so do mammals and reptiles. By creating nests, these animals protect their eggs and younglings from the elements (wind, rain, intense sunlight) and predators, while providing a space that ensures optimal temperature for their offspring.

The reproductive success of birds depends on their abilities to build nests. Without them, there is no adequate place to keep the eggs and raise the chicks, which, in turn, compromises the development of the next bird generation.

For many years, it was assumed that the ability to build nests was innate to birds. After all, many, if not most of them, do it, so it made sense to think that there must be some biological instruction in their genes. Even though researchers have studied bird behavior for over a century, it was only in the 1960s that bird experts started to look more closely at nest building and discovered that many aspects of it were learned—even though the role of learning was thought to be small at that time.

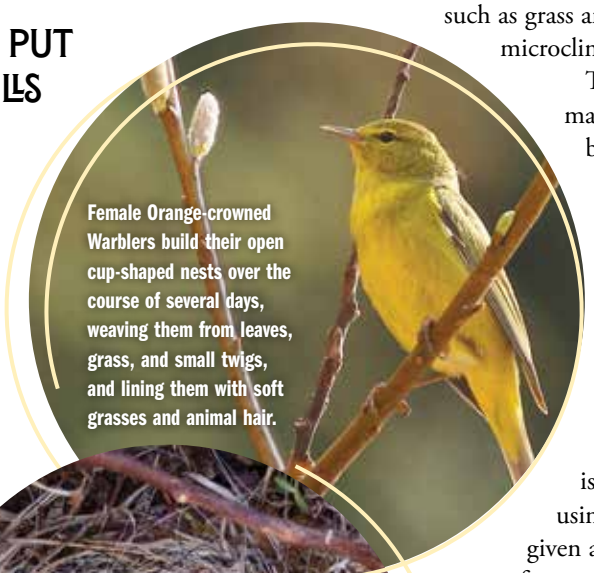
In the 2000s, with the rekindled interest in avian cognition, more researchers started to explore the cognitive aspects of nesting behavior in more detail.

When not threatened by chipmunks and other predators, Ovenbirds build their nests on the ground, clearing a spot in the leaf litter and then crafting a domed nest, complete with oval side entrance, that looks like an outdoor bread oven—giving the Ovenbird its name.

NEST BUILDING: LET'S PUT THOSE COGNITIVE SKILLS TO WORK!

In birds, nest building is a multiple-step process, all of which seem to require a level of cognitive ability.

The first decision a bird has to make is where to build a nest. Site selection is key to nest building, as the location of a nest may minimize the risk of predation. Two songbirds that are no strangers to Montanans are good examples of the amazing cognitive flexibility birds have when choosing nest sites. Orange-crowned Warblers *(Leiothlypis celata)* breed in parts of Montana during the summer. When Orange-crowned Warblers are exposed to recorded vocalizations of the predatory Scrub Jay, female warblers build their nests on the ground instead of in shrubs or tree canopies. Similarly, the loud-singing Ovenbird *(Seiurus aurocapilla)*, a warbler that breeds in the Rockies, moves its nest off the ground to unusual places when sneaky chipmunks threaten its eggs and chicks.



Female Orange-crowned Warblers build their open cup-shaped nests over the course of several days, weaving them from leaves, grass, and small twigs, and lining them with soft grasses and animal hair.

After selecting a nesting site, birds start to choose and gather the appropriate materials to build their nests. Depending on the environment, birds may have access to a wide range of materials, which can be classified as either structural or for lining. Structural materials, such as twigs, provide the nest with structural support and give it its general shape. In contrast, lining materials, such as grass and animal fur, are used to create the ideal microclimate to raise the younglings.

To study how birds might "know" which materials to use, scientists have looked at nest building in the Australian native Zebra Finch *(Taeniopygia guttata castanotis)*. These cheerful and social songbirds have long been used as a model species to study cognition and behavior, so it came as no surprise that scientists also turned to Zebra Finches to study nest-building behavior.

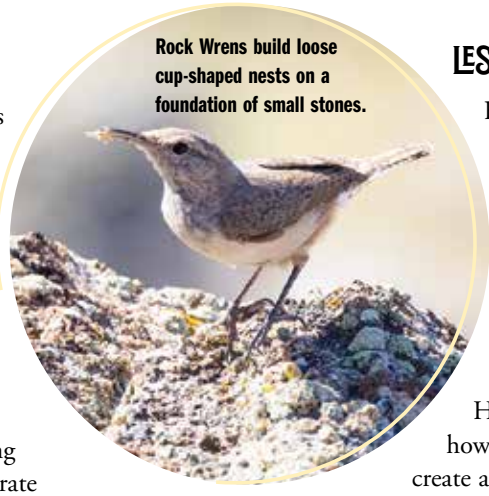
Researchers have found, for instance, that Zebra Finches' nest material preference is shaped by experience. Males that built nests using flexible strings prefer stiff strings when given a choice between the two string types. This preference might be explained by how effective the material is: when using stiff strings, Zebra Finches use fewer pieces to build their domed nests.

Male Zebra Finches also choose materials of appropriate length to build their nests. When researchers provided these birds with nest boxes with either small or large entrances and nest materials that were long and short, Zebra Finches chose the type of material that fit their nest boxes' entrances best. Interestingly, as they got more experienced, Zebra Finches learned how to handle both materials, becoming less "picky" and using all building supplies they had available.

Like humans who might never be pleased with the wall paint they chose for their living rooms, birds can also keep changing their nests, even when there are eggs or an incubating parent inside. And the risk of predation is one of the factors weighing on this decision.

WARBLER EGGS PHOTO: MARK PECK, FLICKR.COM; WARBLER PHOTO: ROB ALEXANDER, FLICKR.COM; OVENBIRD PHOTO: ANDY REGAO & CHRISSY MACCLARREN, FLICKR.COM; OVENBIRD NEST PHOTO: CHARLES DE MILLE-ISLES, FLICKR.COM

The small Rock Wren *(Salpinctes obsoletus)*, a fellow Montana resident, uses cavities within or between rocks as a nesting site. Unlike most birds, Rock Wrens take their engineering skills up a notch by building walkways of small, flat stones that lead to the nests' cavities. Depending on their placement, the stones on these walkways can reduce the nest cavity opening, making it harder for predators to infiltrate the nest. Some researchers also hypothesize that these stones might work as an anti-predator alarm system, amplifying the sounds made by predators and alerting the incubating female Rock Wren of their approach.



Rock Wrens build loose cup-shaped nests on a foundation of small stones.

LESSONS FROM THE NEST

Bird nests are as diverse as the birds that build them. Some are cup-shaped, some have roofs, some are built in tree cavities or between rocks—and that's only the beginning.

At first glance a bird's nest might seem easy to put together. After all, how could a bunch of sticks, grass, and fur compare to the intricate constructions humans make? Yet, as I stand next to a tree and look at one more closely, I start to recognize the ingenuity behind it. How the twigs are intertwined to give the nest its shape; how the grass, fur, or soft bark is carefully lined inside it to create a cozy little space for the eggs to hatch and the chicks to develop.

The more I observe, the more I see that nest building is a fascinating and very complex behavior. It not only reveals how skillful birds are, but it also gives us a glimpse of what their brains can do. Birds, like many other animals, are just like us: they give something a try, they learn from their mistakes and from others, and they adapt when they have to.

—Mariella Bodemeier Loayza Careaga is a freelance science writer. She loves learning and writing about the cool and weird aspects of nature. She has words published in The Scientist magazine, Drug Discovery News, *and others.*

LEARNING FROM OTHERS

While a bird's own experience can teach it a great deal about how to build a nest, our avian fellows can also learn about different features of the process by watching others—what we have come to know as social learning.

In birds, social learning is particularly important for the decisions of first-time nest builders. In experiments with Zebra Finches, researchers showed that novice builders, after watching another Zebra Finch build a nest, switch the color of their nest building materials to match the ones used by the experienced builder. But they don't make the switch all the time: the observer Zebra Finch only copies the material choice when it watches a familiar, but not an unfamiliar, fellow finch.

Besides learning about which materials to use on a nest, some birds also pick up information about nesting sites from others. This is the case with Piping Plovers *(Charadrius melodus)*, sand-gray-looking shorebirds that people might see breeding in northeast Montana. When evaluating a nesting site, Piping Plovers keep an eye on their neighbors to assess the quality of the location. If a pair of Piping Plovers had neighbors that were unable to raise chicks, they would build their next nest far away from that place.

Piping Plovers typically choose their sandy nest sites near clumps of grass above the high tide line.

WHO'S GONNA BUILD THE NEST?

Building a nest is a task that can be shared by a pair of birds—or not.

Females take the lead among Orange-crowned Warblers and Ovenbirds. In both species, the female is responsible for choosing the location and constructing the nest. While Orange-crowned Warblers build open cup nests, female Ovenbirds are experts at weaving domed nests.

Rock Wrens prefer to share the load of nest building. Both males and females search for a good location and build the nest together. While male Rock Wrens are typically tasked with gathering the materials, the females are responsible for arranging them properly.

Among Piping Plovers, males spearhead the nesting site selection. These birds do not build elaborate nests; they simply scrape away sand, gravel, and shells with their feet to make small depressions on loose sand. Even though this initial step may take only a day, a Piping Plover pair can take more than a week to decide which scrape to call home.

Bonus species:
Black-billed Magpies *(Pica hudsonia)* are true Montana residents. These social birds are team players when it comes to building nests. Both males and females look for a nesting site together and share the actual build work. Males are primarily tasked with gathering sticks for the nest's exterior, while females take care of the nest's interior, building a mud cup that is lined with grass.

PLOVER EGGS PHOTO: USFWS/JACKIE JACOBSON; PIPING PLOVER PHOTO: USFWS STEVEN TUCKER LOSTWOOD WETLAND MANAGEMENT DISTRICT; ROCK WREN PHOTO: YNP, FLICKR.COM