Biology

Red-cockaded woodpeckers stash bone

Female birds need calcium to produce thick, protective eggshells, but they have trouble getting enough of it from a diet restricted to seeds and insects. So during the breeding and egg-laying season, they seek out calcium supplements, foraging for bits of bone, seashells and other items rich in the mineral.

Zoologists now report that female red-cockaded woodpeckers stash away bone fragments during the egg-laying season. This very preliminary observation, they say, marks the first known instance of a bird hoarding a substance for its mineral, rather than caloric, content.

Richard R. Repasky and his colleagues at North Carolina State University in Raleigh discovered the unusual behavior during a study of the endangered red-cockaded woodpecker (*Picoides borealis*) in the Sandhills, a very old pine forest in North Carolina. They report their findings in the latest issue of THE CONDOR (Vol.93, No.2).

The team tracked three female woodpeckers during egg-laying season and found that two of them gathered and hid bone fragments. They noted the behavior on only a couple of days before and during egg-laying. The females would spy a bone on the ground, land nearby, and consume flakes of it on the spot. The birds then carried larger fragments to a nearby tree and wedged them into the bark, retrieving the hidden fragments on several occasions during the egg-laying period, says Repasky.

While many birds cache food to help them through the lean season, these woodpeckers stored their calcium-rich finds despite a relative abundance of bone fragments and raptor pellets, hair-and-bone balls regurgitated by birds of prey. The habit may hark back to a primitive instinct, Repasky speculates: Egg-laying woodpeckers can avoid a risky trip to the forest floor by hiding their calcium supplements in trees. Birds pecking away at the ground make an easy target for hawks, owls and other predators, he notes.

Development makes songbirds easy prey

Loss of North American forests may explain, at least in part, the "alarming" decline in migrating songbirds, researchers report in the fall ECOLOGY AND CONSERVATION OF NEOTROPICAL MIGRANT LANDBIRDS.

By some estimates, songbirds that summer in North America and winter in the tropics have experienced population declines of 3 percent each year since the late 1970s. To get to the root of the problem, Richard T. Holmes of Dartmouth College in Hanover, N.H., and Thomas W. Sherry of Tulane University in New Orleans studied a population of American redstarts (*Setophaga ruticilla*) that summer in New Hampshire's White Mountains and winter in Jamaica.

The 10-year study revealed a strong statistical correlation between fledgling survival in summer and population changes the following year. Rather than dying in Jamaica or during the long migrations, the young warblers appeared to face their greatest risk in North America. While many factors affect fledgling survival, this study indicates that North American predators pose the greatest threat, the investigators say.

Although some researchers have blamed deforestation in Central America and the Caribbean for the birds' population bust, the redstart findings provide the strongest evidence yet that North American land-use patterns contribute to this decline, Holmes contends. As trees fall under the developer's ax, predators venture farther into the forest interior, thereby putting more fledglings at risk, he explains. Even in New Hampshire, where forests remain relatively intact, says Holmes, predation appears to be the key factor in redstart population size. Thus, he suggests, its effect may be even more pronounced in heavily deforested regions of North America.

Physical Science

Data transfer via noisy neurons

One of the central puzzles of neurophysiology concerns how the dense web of neurons in the brain encodes sensory information carried from eyes and ears to the brain's central processing regions. Researchers have monitored this neural traffic by measuring the rate at which neurons generate voltage pulses, or spikes, but have so far failed to determine precisely how these spikes convey information.

Now a group of physicists has identified a simple physical mechanism that appears to reproduce key features of the timing of neural pulses. Their model suggests that noise — random fluctuations superimposed on signals carried from sensory organs to the brain's processing centers — plays a crucial role in the transmission of sensory information. André Longtin of the Los Alamos (N.M.) National Laboratory and his co-workers describe their mechanism in the July 29 PHYSICAL REVIEW LETTERS.

To monitor the response of a single neuron to a smoothly varying, periodic signal, neurophysiologists typically measure the time intervals between successive spikes. When plotted in the form of a histogram showing how often different time intervals come up, the data typically display a characteristic pattern, with the largest number of recorded time intervals corresponding to the period of the incoming signal.

Longtin and his collaborators investigated — both experimentally (in the form of an electronic circuit) and theoretically — the behavior of a system that switches back and forth between two states in response to a noisy, periodic signal. With only noise present, the system randomly switches from one state to the other. However, as the intensity of the smooth, periodic component increases, the switching times start following the signal's oscillations, even though the signal by itself isn't strong enough to force the system to switch from one state to the other. This phenomenon is known as stochastic resonance (SN: 2/23/91, p.127). Simply by adjusting either the noise level or the stimulus intensity — and by measuring and plotting the time intervals corresponding to shifts from one state to the other and back again — the researchers could produce histograms resembling the data obtained from experiments on real neurons.

"Supposing, as seems reasonable, that the brain interprets [these characteristic patterns] to obtain information on the frequency and intensity of the stimulus, one comes to the inescapable conclusion that noise plays an essential role in this process," they say.

Spinning to a prismatic beat

A cylinder mounted so that it stands upright on a turntable has no tendency to spin when air rushes by — but a similarly mounted flat plate or three-sided prism not only spins but also generates lift in such an airstream. This aerodynamic effect, known as autorotation, plays an important role in determining the paths followed by freely falling, geometrically complicated objects, ranging from tree fruits to parts ejected from spacecraft or airplanes.

Recent experiments by mechanical engineer B.W. Skews of the University of the Witwatersrand in Johannesburg, South Africa, reveal that only prisms with fewer than eight sides rotate in an airstream, and that prisms of a triangular cross section spin fastest. In each case, the spinning prisms generate more lift than they would if driven at the same rotation rate by a motor of some kind. Reporting in the Aug. 8 NATURE, Skews suggests that his findings could influence the design of wind-power devices, such as wind-driven rotors used to propel ships. The findings may also shed light on the behavior of wind-buffeted, many-stranded ropes and cables, which sometimes have cross sections resembling those of multifaceted prisms.