Biology

Rick Weiss reports from Snowbird, Utah, at the annual meeting of the Ecological Society of America

Frog finds empty bandwidth, then croaks

Like radio stations vying for crowded airwaves, some singing frogs compete for broadcast frequencies. Alejandro Purgue, a herpetologist at the University of Utah in Salt Lake City, suggests that the South American frog *Leptodactylus ocellatus* evolved an underwater mating call in response to airwave competition from another frog that uses the same frequency above water.

Scientists have suspected that a few frog species might, through some unknown mechanism, produce underwater calls. Purgue appears the first to document it thoroughly, using U.S. Navy hydrophones and computer analysis. He interprets *L. ocellatus*' underwater calls as a previously unrecognized dimension of "niche partitioning" — the means by which species living close to each other minimize competition.

The male *L. ocellatus* produces calls in the frequency range of 250 to 500 hertz, presumably to maintain territoriality and to attract mates. But the frog *Physalaemus cuvieri* calls in a similar range at many of the same ponds, and its song is about 40 decibels louder. Taking advantage of the fact that very little sound crosses the air-water interface, *L. ocellatus* apparently avoids competition by channeling its call underwater. "This underwater channel has no other species calling in a close frequency range, providing an excellent alternative way of communication," Purgue says.

Cultivating weeds for pest control

A weed that commonly sprouts between rows of corn in Mexico, lowering crop yields if left unchecked, actually enhances crop quality if allowed to survive at moderate levels, according to research performed in southeastern Mexico.

Traditional farmers in Mexico have long permitted *Bidens pilosa* to coexist with their corn, cutting the weeds back about once a month. Francisco J. Rosado-May and his colleagues at the University of California, Santa Cruz, sought a scientific rationale for this practice. They found that the weed's roots secrete compounds lethal to corn-destroying fungi and nematodes. If trimmed 15 days after crop plants emerge, and then every 30 days until harvest, the weeds control these pests without significantly stealing soil nutrients from the corn.

In the United States, the team obtained similar results with a corn-associated weed called *Brassica kaber*. "You don't have to plant the weed — it's already there. All you have to do is manage it," Rosado-May says.

Why hot plants resort to fetal position

Leave a plant too long in the blazing sun and you'll notice a typical botanical reaction: The leaves curl up. In grasses and other plants, leaf rolling is a common response to stress, but botanists have remained unsure how much protection it actually provides.

At the University of Illinois in Urbana, Scott A. Heckathorn and Evan H. DeLucia have now measured the effects of leaf rolling on leaf temperature, gas exchange and water-vapor loss in the wetlands grass *Spartinia pectinata*. Leaf rolling's major benefit, they conclude, is that it reduces the surface area exposed to sunlight, lowering leaf temperature by more than 5°C.

Other researchers experimenting with the desert resurrection plant, *Selaginella lepidophylla*, report that the curling response significantly reduces damage to the plant's photosynthetic enzyme system. Jefferson G. Lebkuecher and William G. Eickmeier of Vanderbilt University in Nashville held plants' leaves flat with a device resembling a tennis racket, then exposed the plants to indoor lighting equivalent to full sunshine. Compared with unrestrained plants under the same lights, the test plants showed marked destruction of chlorophyll and decreased activity within the electron transport system that converts sunlight into energy for the plant. "Curling reduces high-irradiance damage that would otherwise occur during dessication," they conclude.

Wormy cabbage: Blame the victim

Farmer Bill's field remains largely free of pests and is carpeted with healthy heads of cabbage. Farmer Bob's cabbage plot, just down the road, shows signs of serious chomping by the diamondback caterpillar, *Plutella xylostella* — the world's number-one pest of plants in the cabbage family. Clearly, the caterpillars deserve the blame for Bob's poor yield.

Not so, say Jamin Eisenbach and Laurel R. Fox of the University of California, Santa Cruz. They have found that *P. xylostella* has a penchant for plants *already* doing poorly — even though greenhouse studies indicate these caterpillars survive better, grow plumper and ultimately lay more eggs when raised on healthier plants. The caterpillar's seemingly poor judgment makes sense, however, given the researchers' finding that its major predator, the parasitoid wasp *Diadegma insulare*, seeks its victims primarily on healthy plants. Thus the diamondback caterpillar, in an effort to browse peacefully in enemy-free space, has developed a taste for undernourished plants, the biologists conclude.

Their experiments suggest that by raising nitrogen levels as little as 3 to 5 percent in cabbage-family crops (such as collard, broccoli and cauliflower), farmers can make their plants less attractive to the pesky larvae while increasing the number of caterpillar-killing wasps. Unfortunately, Eisenbach adds, better-nourished plants can also attract more aphids, another major crop pest. The researchers hope to identify the wasp-attracting chemicals in the well-nourished leaves so that plant breeders might develop crop strains rich in these compounds.

Sealed systems prove remarkably stable

Completely enclosed ecosystems can persist over a wider range of conditions than many scientists believed, boosting the feasibility of huge, sealed human habitats in space. So concludes Robert J. Frye, who has completed a series of experiments in plant- and microbe-filled containers ranging in volume from 5 gallons to 14,000 cubic feet (about the size of a high-ceilinged living room). Frye is a biologist at the University of Arizona in Tucson.

To his surprise, Frye discovered that small, sealed systems can remain remarkably vigorous despite their lack of the substantial air and soil reservoirs that stabilize mineral, water and gas exchanges on Earth. In a conclusion that might someday have global implications for Earth itself, he finds that closed systems do best when endowed with plenty of biological diversity.

Putting odds on a species breaking even

Two statisticians have developed a new computer model to help predict the fate of endangered species. Patricia L. Munholland of Montana State University in Bozeman and Brian Dennis of the University of Idaho in Moscow say their model takes into account the increased risk of extinctions due to random "bad years," including periods of extreme weather that can devastate already-diminished populations.

Among their predictions, given current management strategies for existing threatened or endangered species:

- Grizzly bears in Yellowstone National Park "are doomed" unless provided better protection. Their most likely year of extinction is 2070.
- Kirtland's warbler, already endangered, "is a goner."
- Whooping cranes "are in good shape."

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