Snails dine at desert dust depot

Winds from the Arabian and Sinai peninsulas sweep across the limestone rocks of Negev Desert Highlands in Israel, depositing dust in their wake. Long considered a major source of soil formation in the Negev, these winds apparently are not the only significant contributors. Researchers are finding that in the sands below, two species of snails may be equally responsible for soil formation.

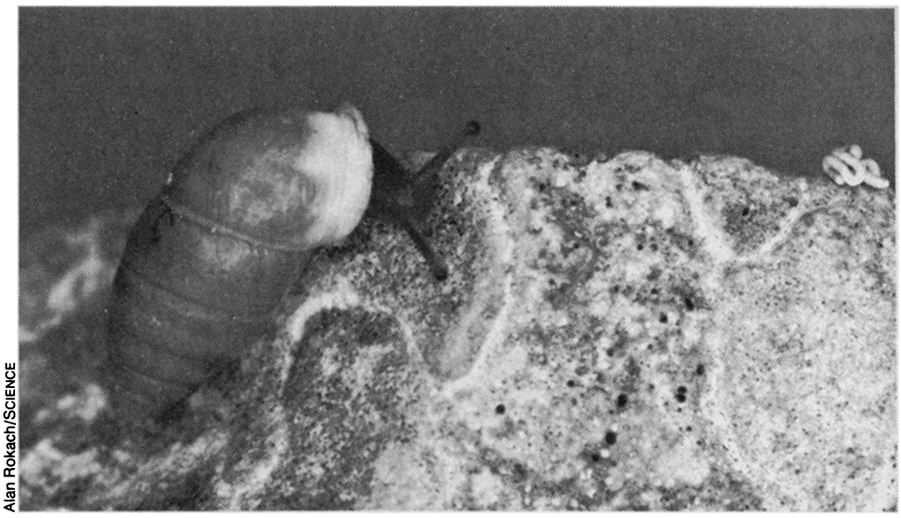
Although plant-eating animals have been known to affect their ecosystems through overconsumption of a resource, such as overgrazing, these snails have a significant regulatory impact despite the small amount they consume, according to a report in the May 29 SCIENCE by Clive G. Jones of the Institute of Ecosystem Studies in Millbrook, N.Y., and Moshe Shachak and Yigal Granot of the Mitrani Center for Desert Ecology in Israel.

The two species, *Euchondrus albulus* Mousson and *Euchondrus desertorum* Roch, are found throughout the desert at a rate of 21 snails per square meter and feed seven months out of a year during seasonal dew formation. The lichens they feed on, known for their toughness and low digestibility, grow under the rock surface at depths between 1 to 7 millimeters. Called endolithic lichens, they are cryptogams that don't bear seeds or flowers, and are dominant in limestone in extreme environments. The arid desert terrain these hardy lichens and snails call home is a hilly region some 5,000 square miles large and covered mostly by rock.

Videotapes of lab experiments showed the snails foraging in short side-to-side motions for about 20 minutes, leaving behind a white trail in the process. Depths of the trails varied, say the researchers, possibly because the snails might rebrowse trails for the lichen that grew there within 48 hours of when they made their first feeding pass. "We don't know how often they rebrowsed a trail," says Jones. "We expect it's fairly frequently." The scientists also observed small piles of limestone-colored feces that showed a calcium content similar to that of the upper layers of rock and lichen, supporting the theory that the snails were not only disturbing the rock for food, but also ingesting and redepositing it as waste.

Based on observations of foraging behavior of 10 snails per stone in the lab, researchers estimated that the snails removed about 7 percent of the surface area of the rock to a depth of 1 mm per year. Field observations produced somewhat lower results: removal of 4 percent of the surface area of the rock to the same depth per year. On the basis of these estimates the researchers conclude that the foraging snails "weather" the desert at a rate of about 0.7 to 1.1 tons per hectare per year.

To find the impact of soil formation caused by wind deposition, the group measured dust levels from 10 stones each month during the dry season in an area of the highlands with low snail density. Through this method, they estimated about 0.4 ton or more per hectare per year. But dust deposition is difficult to measure, and other estimates place this figure much higher. Either way, the dust deposition caused by snails is at least as great as that produced by wind, according to the study. *– K. Hartley*



Alan Rokach/SCIENCE

White lines on rock show foraging behavior of Euchondrus desertorum, *one of two species of snails found to contribute heavily to soil formation in the Negev Desert Highlands.*

Natural selection: Bird seeds of change

A legacy of the 1983 El Niño is granting evolutionary biologists the rare opportunity to test the central tenet of their field: the theory of natural selection. As part of a long-term study that began in 1973, these scientists are monitoring how El Niños and other climate shifts forced changes within a population of finches on the Galápagos islands.

Two researchers report in the June 11 NATURE that the eight months of extraordinarily heavy rainfall during that El Niño led to the differential survival of smaller birds for the two subsequent years. Earlier, parts of this study had demonstrated that periods of drought promoted the survival of larger birds with big bills. These swings in the population not only prove that environmental forces can shape the population of a species, but also show that the direction of evolution can change or reverse, often quite rapidly, says Peter R. Grant of Princeton (N.J.) University.

Grant and H. Lisle Gibbs of the University of Michigan in Ann Arbor have been observing the species *Geospiza fortis* on the island of Daphne Major, which measures roughly 3/4 mile by 1/2 mile in area. Daphne Major and the other Galápagos islands are particularly well-suited to studies of natural selection because they provide isolated populations of birds that live in a variable climate, says Grant. The birds, commonly known as Darwin's finches, also possess physical traits that are highly inheritable, such as weight and bill size.

D. Schluter/SCIENCE

Large ground finch with big bill.

For most of the year, the finches subsist on seeds of varying size and hardness. During lean years of little rainfall, the birds deplete the supply of small, soft seeds that require more rainfall, and then must turn to the harder, larger seeds that remain. Because large birds with bigger bills are the only ones able to crack open the hard seeds, a greater number of large birds survived through the dry years of 1977, 1980 and 1982.

The 1983 El Niño allowed Grant and Gibbs to observe the reverse of this process. Rains from this climatic upheaval pounded the tropics of the eastern Pacific and dropped 1,359 millimeters of rain on the Galápagos from December 1982 through July 1983. Normal yearly rainfall ranges between 50 and 100 mm.

As is natural with the onset of the