Mapping out endangered species' hot spots

A mere 7 percent of the land area of the United States is home to fully 50 percent of U.S. plant and animal species at risk of extinction. Protecting that imperiled group, therefore, requires managing a fairly small amount of land, says Andrew P. Dobson of Princeton University.

Speaking at the Ecology Society of America's annual meeting in Providence, R.I., this week, Dobson explained how he and his coworkers mapped so-called hot spots—regions containing dense populations of species protected under the federal Endangered Species Act. To create the maps, they used a 1995 Environmental Protection Agency list of the county-by-county locations of more than 900 at-risk species. Many species of endangered plants and arthropods live in single counties.

The Hawaiian Islands, Florida, southern Appalachia, and Southern California have the highest overall densities of endangered species. These hot spots lie not in protected havens such as national parks, but mostly in urban or agricultural areas.

Protecting at-risk species by targeting their hot spots may not require a lot of land, but it may prove difficult because these species live in areas important to people, notes team member David S. Wilcove of the Environmental Defense Fund in Washington, D.C.

Dobson's team also mapped the hot spots of specific endangered groups: mammals, birds, reptiles and amphibians, fish, crustaceans, clams, snails, insects, arachnids, and plants. Areas that total only 0.8 to 3.3 percent of the contiguous United States provide habitats for more than 50 percent of the species in each group, the study reveals. At-risk reptiles and amphibians live on only 0.68 percent of U.S. land. Endangered fish take up the most room: Their habitat covers 3.33 percent.

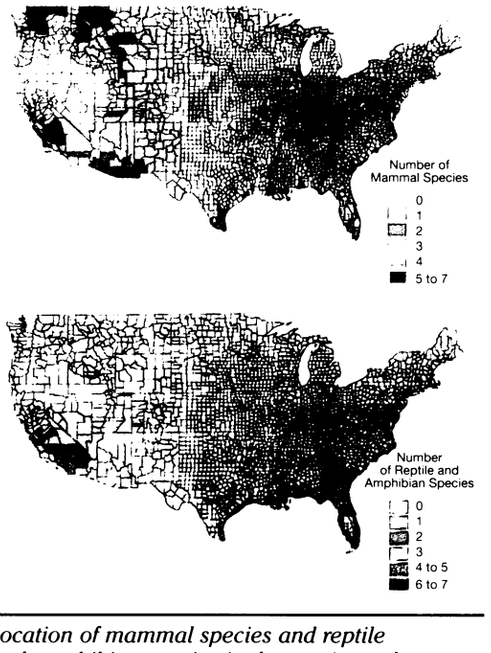
Two California locations are hot spots for several groups: San Diego County for endangered fish, mammals, and plants and Santa Cruz County for arthropods, reptiles and amphibians, and plants.

Nine counties are hot spots for two groups. Four counties in Hawaii have especially high densities of imperiled birds and plants. Los Angeles County has many of the arthropods and birds, while San Francisco County features arthropods and plants. Three counties in Florida and Georgia are hot spots for two groups each, Dobson and his colleagues explain in an unpublished report.

The presence of high numbers of at-risk arthropods—and, to a lesser extent, plants—appears to indicate that a county has many other endangered species, Dobson says. Researchers identified these indicator groups by calculating the number of imperiled plant and animal species in the counties that harbor endangered arthropods, for example, then dividing that figure by the number of species found in a similar group of counties selected at random.

In making their maps, however, the researchers faced a serious lack of information on the status of arthropods and plants, Dobson complains. Moreover, warns Larry Turner, project manager of EPA's Endangered Species Protection Program, many threatened species go unrecognized. — *T. Adler*

Dobson *et al.*



Location of mammal species and reptile and amphibian species in the continental United States protected under the Endangered Species Act.

Shrimp make intricate seabed labyrinth

Scuba diving off the Italian island of Giglio in 1991, Wiebke Ziebis floated over a miniature underwater moonscape. The seabed was pimpled with volcanolike cones, each just a few centimeters high (upper photo).

When the local people confessed their ignorance of this oddity, Ziebis began to dig into it. Now, the doctoral student at the Max Planck Institute for Marine Microbiology in Bremen, Germany, reports with her colleagues in the Aug. 15 NATURE that the conical mounds are made by the tiny mud shrimp Callianassa truncata *(inset), whose tunnels provide a chemical connection between sea and sediment. Such tunnel fields are widespread off the coasts of Greece and Italy, Ziebis says.*

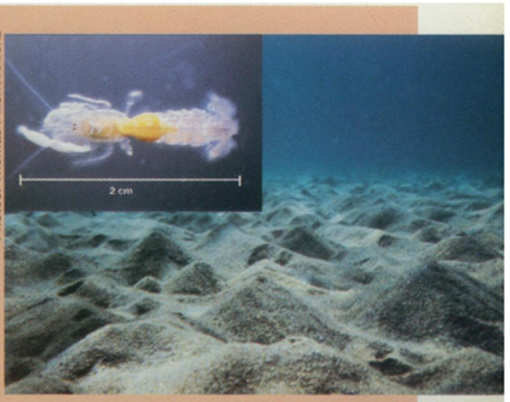
Adjacent to each cone is a shallow depression in the seabed that funnels water into the system. Without the shrimp and its tunnels, Ziebis says, oxygen would penetrate only about 4 millimeters into the ocean floor. With them, oxygen travels more than half a meter down, allowing even tinier oxygen-breathing animals to populate the holes.

Ziebis found that the cones are tunnel outlets. Ammonium from decaying organic matter buried in the sediment flows through the system to the water above, helping to nourish phytoplankton—and thus the entire oceanic food chain. The team injected polyester resin into several tunnels, where it hardened, preserving the burrows' intricate structure for excavation later.

Robert C. Aller, a marine geochemist at the State University of New York at Stony Brook, said he was struck by Ziebis' innovative use of an acrylic-walled observation room sunk deep into the sediment (lower photo), enabling divers for the first time to directly measure the activities of animals burrowing beneath the sea. Tubes through the walls of the cubicle enabled Ziebis and her coworkers to sample the oxygen and ammonium concentrations in the tunnels at various depths as well as to gauge the rate of water exchange.

Ziebis expressed wonder that "these relatively small animals can build such complex burrow structures and complex architecture." — E. Skindrud

Photos: Thomas Pillen /NATURE



Boris Unger