term (*Science*, 25 July 1997, p. 491). Stepping forward, Gregor Hodgson, a marine ecologist at the University of California, Los Angeles (UCLA), and his colleagues established Reef Check (*Science*, 6 June 1997, p. 1494). About 200 people helped with the first survey, in Kauai, Hawaii. By the year's end, the organizers had data on about 300 reefs in 31 countries. That success prompted the establishment of yearly Reef Checks.

Drying up. A count of coral reef organisms such as the Nassau grouper (*top*) and a cowry snail called the flamingo tongue (*right*) revealed human-inflicted losses.

Some researchers have questioned the value of data gathered by volunteers. But according to UCLA's Jennifer Liebeler, a co-author of the report, straightforward protocols and data review by scientists make the results sound. At each site, volunteers and their scientist-supervisors estimate the ratio of live coral to dead coral. Some species they count, such as parrotfish, are indicative of reef quality. Others, such as spiny lobsters, help reveal the extent of overfishing. And a few, such as the giant clam, show how curio and aquarium-trade collectors are affecting reefs. As far as Gittings is concerned, with just a few species to keep an eye on, "the volunteer counts are not going to be that far off."

Clive Wilkinson of the Australian Institute of Marine Science in Townsville, Queensland, says that the surveys have given him new information, even though he is a longtime veteran of coral biology. For example, the extent of overfishing was news to him. Sea cucumbers are missing from half the reefs, and in Guam their numbers dropped from 17 per 100 square meters in 1997 to about three in 2001. The Nassau grouper has virtually disappeared: Among 162 reefs, 142 reefs had none, 12 more had just one. But the good news is that marine sanctuaries, where fishing is limited, appear to be working. The surveys found higher numbers of certain key species there compared to other areas, which "is valuable to note," says Wilkinson.

Those arguing for new measures to protect reefs may soon get more ammunition. A NOAA report coming out next month highlighting reefs in the United States and U.S. Territories will include data from volunteer surveys, long-term research projects, and remote sensing. And by November, Wilkinson expects to finish a catalog of damage done to reefs, including an assessment of reefs' prospects. Both reports are expected to show widespread damage to reef communities. Gittings hopes the efforts will "continue the momentum" and draw attention to the plight of this marine resource. **–ELIZABETH PENNISI**

CREDITS: (TOP TO BOTTOM) JACK RANDALL; CLAUDINE BARTELS; SOURCE: NOAA

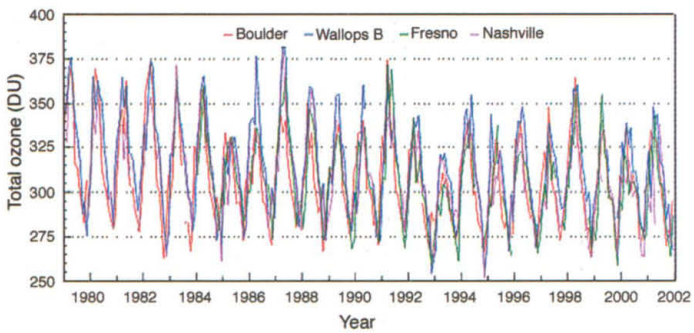
OZONE DEPLETION

A Brighter Outlook For Good Ozone

Things are looking up in the stratosphere. The latest quadrennial assessment of the state of the protective stratospheric ozone layer is just out, and the international report* from about 250 scientists finds that restraints on production of ozone-destroying chemicals such as chlorofluorocarbons are having the intended effect. The concentration of the prime offender, chlorine, is at or near a peak in the stratosphere. And an improved scientific understanding of stratospheric ozone is reassuring scientists that the world has probably seen the worst of ozone loss. Global ozone should soon begin increasing, fast enough that within the decade the infamous Antarctic ozone hole should start to shrink. All this assumes, of course, that signatories to the 1987 Montreal Protocol limiting emissions of ozone-damaging chemicals continue to meet their obligations and that the major remaining scientific uncertainty in ozone's future—climate change—doesn't spring a big surprise.

When the previous scientific assessment came out in 1998, prospects for stratospheric ozone were muddled. The great eruption of Mount Pinatubo in 1991 had spewed megatons of debris into the stratosphere, where it interacted with pollutant chlorine to accelerate ozone loss. As a result, global ozone plunged to a new low, complicating extrapolations of the rapid ozone losses seen in the 1980s. Most predictions called for ozone losses to worsen in the 1990s, particularly in the midlatitudes, where most people live. The Antarctic ozone hole had been deepening and widening at a frightening rate. And the first model to simulate how accumulating greenhouse gases affect ozone showed future Arctic losses ballooning, even as real Arctic ozone suffered a series of unprecedentedly bad years.

After four more years of observations and research, stratospheric ozone's future is looking clearer and brighter. The Antarctic hole is obviously hitting bottom over the South Pole each October. During the austral spring, as sunlight returns to the stratosphere, icy polar stratospheric clouds (PSCs) combine with chlorine to catalyze ozone destruction in the layer between 12 and 20 kilometers where PSCs can form. For the past decade, there's been no ozone left to destroy



Down but not out. Northern midlatitude ozone declined in the 1980s and took a hit from the 1991 Mount Pinatubo eruption but held its own in the 1990s.

*Executive Summary, UNEP/WMO Scientific Assessment of Ozone Depletion: 2002, available at www.unep.ch/ozone/pdf/execsumm-sap2002.pdf

in that layer. But because the thickness of the layer has not increased during that time, the hole's depth hasn't, either. And its breadth—the width of the hole—has increased only slightly since the mid-1990s. "That's positive news," says atmospheric physicist and assessment chapter co-author Paul Newman of NASA's Goddard Space Flight Center in Greenbelt, Maryland. With ozone-destroying halocarbons expected to be on the decline, Newman says, "by 2010, we could see 5 to 6 years when the hole looks consistently smaller than during the past 5 years."

Encouraging news is coming from the Arctic, as well. That scary string of low-ozone years in the mid-1990s (researchers never rated them "holes") ended with 1997. Four of the 5 years since have seen minimal springtime ozone losses. The Arctic, it turns out, was not plunging into a full-blown, Antarctic-like ozone hole. New modeling reported in the assessment suggests that it might never do so. An early model study had suggested that the greenhouse gases that cool the stratosphere would encourage PSC formation and cause a massive ozone loss (*Science*, 10 April 1998, p. 202). "It's really looking like the more detailed models don't give that [low-ozone] result," says atmospheric chemist Susan Solomon of the National Oceanic and Atmospheric Administration in Boulder, Colorado.

Outside the polar regions, ozone has fared better than feared too. In the 1990s, rather than worsening over the northern midlatitudes, ozone depletion all but ground to a halt. Researchers aren't sure what caused the slowdown. Plateauing halocarbons certainly played a major role, but some researchers have suggested that changes in atmospheric circulation have been a key factor as well (*Science*, 22 June 2001, p. 2241). If natural variations, global warming, or even ozone depletion itself increased the amount of air moving into midlatitudes from the ozone-rich tropics, for example, midlatitude ozone would be bolstered.

There is increased evidence that atmospheric dynamics has in fact contributed to the leveling off of midlatitude ozone depletion, says dynamical meteorologist and chapter co-author William Randel of the National Center for Atmospheric Research in Boulder: "Some fraction of ozone changes—probably less than 50%—may be associated with changes in the dynamics of the stratosphere." No one can say what proportion of dynamically induced ozone change might be natural and how much is human induced.

A certain amount of optimism runs through the assessment, but so does a note of caution. The effect of climate change remains uncertain, not just on the Arctic but the whole stratosphere. The assessment also notes that although damaging ultraviolet radiation has increased on the order of 10% in some regions, ozone depletion has not been the only cause. Difficult-to-predict changes in cloud cover and pollutant hazes have altered and will continue to alter the amount of ultraviolet reaching the ground, it says. And then there's the human element. Further reductions in the production of ozone-destroying halocarbons are required in the next few years under the Montreal Protocol, especially by developing countries. Without continued reductions, the assessment concludes, ozone recovery could be delayed decades or even indefinitely. **–RICHARD A. KERR**

CREDITS (TOP TO BOTTOM): ELAINE THOMPSON/AP; THIERRY CENNEN/CGIAR

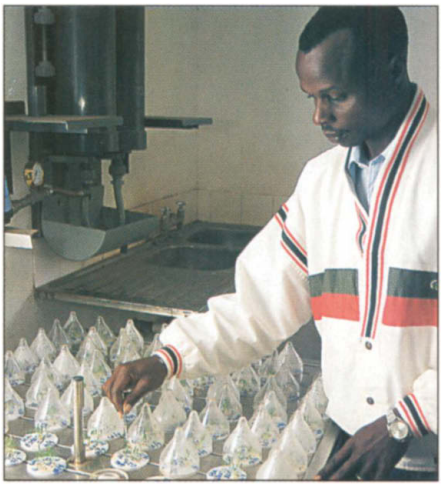
PLANT SCIENCES

Rescue Planned for Seed Banks

Plant germ plasm is a political hot potato. The issue of access to—and payments for—samples stored in gene banks was a sticking point for a treaty signed last fall by 116 nations (*Science*, 26 October 2001, p. 772). Now it could haunt a new proposal, announced last week, aimed at preserving a deteriorating global network of gene banks.

On 29 August, a new organization called the Global Conservation Trust used the United Nations (U.N.) World Summit on Sustainable Development in Johannesburg, South Africa, to announce a drive to raise a $260 million endowment to rejuvenate these seed banks. A report also released at the summit shows that shrinking budgets and smaller staffs are hindering repositories' ability to keep seeds available to breeders for improving strains or fighting diseases.

Crop gene banks around the world hold perhaps 2 million varieties of plants. Some of these, such as wheat, can be stored for years as seed. Others must be maintained in tissue culture. But even seeds need occasional replanting to ensure a viable supply, a laborious



Undernourished. Many gene banks lack resources to care for rare crop varieties.

ScienceScope

Anthropologists Win on Kennewick A federal judge has ruled that the U.S. government must allow scientists to study the bones of Kennewick Man, an ancient skeleton unearthed on the banks of the Columbia River near Kennewick, Washington. The 30 August decision marks a clear victory for a team of eight anthropologists who have fought to gain access to the 9300-year-old skeleton, arguing that it could offer new clues to how people first arrived in America. But the ruling might not end the 6-year legal tussle, as the Justice Department can still appeal the decision.

Kennewick Man, known as "the ancient One" to Native Americans, was discovered in 1996. The 380 bones and bone fragments compose one of the most nearly complete sets of ancient remains ever found in North America. Government researchers completed an initial analysis of the skeleton in 1998. But it was placed out of scientific bounds 2 years ago, when then–Secretary of the Interior Bruce Babbitt ruled that a 1990 law called the Native American Graves Protection and Repatriation Act required the skeleton to be given to the five modern Native American tribes that claimed him as an ancestor and sought to have him reburied (*Science*, 29 September 2000, p. 2257).

In his 73-page ruling, U.S. Magistrate John Jelderks of Portland, Oregon, called Babbitt's decision "arbitrary and capricious." After reviewing some 22,000 pages of documents, Jelderks ruled that there was insufficient evidence to link the skeleton to any modern tribe. "Allowing study is fully consistent with applicable statutes and regulations, which are clearly intended to make archaeological information available to the public through scientific research," Jelderks wrote. Plaintiff attorney Alan Schneider calls the decision a "landmark" because it sets an important precedent that should give researchers access to future discoveries of ancient remains.

"We are delighted with the decision," says Robson Bonnichsen, who heads the Center for the Study of the First Americans at Texas A&M University in College Station and was a plaintiff in the case. He says researchers hope to carry out a wide variety of tests on the skeleton, including skull measurements and possibly DNA tests, to pinpoint the origin of the bones. The ruling gives the researchers 45 days to submit a study proposal to the Department of the Interior and another 45 days for the government to respond.