schools throughout the state.

Three-quarters of the sample reported no thoughts of or attempts at suicide. About 11 percent cited serious suicidal thoughts, more than 6 percent acknowledged making a specific plan to kill themselves, and 7.5 percent reported making a suicide attempt.

Most suicide attempters reported formulating a plan to kill themselves rather than acting impulsively, the researchers say.

Cigarette smoking and use of alcohol and illicit drugs increased among those reporting suicide thoughts or attempts, the team reports. But teens who cited the most aggressive behavior stood the greatest chance of thinking about, planning for, or attempting suicide. This link remained after statistically controlling for alcohol and illicit drug use, race, and gender.

Aggressive teenagers may prove more likely to act on suicidal thoughts and plans when depressed, frustrated, or scared, Garrison's team suggests. However, they lack data on symptoms of depression among the students.

The South Carolina findings suggest that suicide prevention efforts should concentrate not only on depressed teens, but on highly aggressive and alcohol-abusing adolescents, Shaffer argues.

—B. Bower

Detecting an electromagnetic vacuum force

The electromagnetic force, which binds electrons to atomic nuclei, can have such distinctive effects in different situations that physicists have often given these effects special labels. Manifestations of the electromagnetic force range from the van der Waals forces of attraction between molecules and atoms to the postulated Casimir-Polder interaction between a neutral atom and an electrically conducting plate.

Now, researchers have for the first time obtained experimental evidence clearly demonstrating the existence of the elusive Casimir-Polder force. Edward A. Hinds and his co-workers at Yale University report their findings in the Feb. 1 PHYSICAL REVIEW LETTERS.

The Casimir-Polder interaction arises out of a quantum effect associated with fluctuations of electromagnetic fields in a vacuum. In 1948, H.B. Casimir and D. Polder proposed that such vacuum fluctuations would cause an observable attraction between an isolated, neutral atom and a flat, conductive plate.

Though extremely small, this attractive force would be the dominant influence when plate and atom are separated by distances much greater than an atomic diameter. At such distances, the time it takes for an electromagnetic field (or photon) to travel back and forth between atom and plate becomes significant. Known as retardation, this phenomenon affects how atom and plate interact with each other.

To detect the Casimir-Polder force, Hinds and his colleagues studied the deflection of sodium atoms traveling down the gap between two nearly parallel plates coated with gold. In the absence of other interactions, the sodium atoms would experience a Casimir-Polder force that pushes them sideways toward the plates as they move along the gap.

To detect such a minuscule effect, the researchers had to be particularly careful to avoid contamination of the gold film, which could give rise to stray electrical fields. Such fields would cause effects obscuring any attraction that could be attributed to the Casimir-Polder force.

The experiment "was a lot harder to do than it looks," says graduate student Charles I. Sukenik, a member of the Yale team.

The measurements reveal the presence of an atom-plate interaction that clearly fits a Casimir-Polder force much better than it does a van der Waals force. "Our results confirm the magnitude of the [Casimir-Polder] force and the distance dependence predicted by quantum electrodynamics," the researchers conclude.

"It's a really elegant experiment, beautifully carried out," comments Stephen R. Lundeen of the University of Notre Dame (Ind.).

Lundeen and his co-workers have attempted to detect the Casimir-Polder interaction in a different type of experiment. They studied transitions from one energy level to another in a helium atom in which one electron has been excited so that it tends to remain much farther from the helium nucleus than it would in its ground state. "We wanted to do a high-precision test on a microscopic scale," Lundeen says.

These experiments yielded the most precise measurements yet of energy levels to which the Casimir-Polder force makes a discernible contribution. However, the researchers found a minute but significant and puzzling discrepancy between their experimental results and theoretical calculations—based on quantum electrodynamics — of what those energy levels should be.

"We're seeing a vast difference from the energy levels that would exist in the helium atom if there were no retardation," Lundeen says. "But we have a clean experimental result that is in rather dramatic disagreement with the best available calculations."

Whether the Casimir-Polder force plays any role in this discrepancy remains unsettled. "It'll be interesting to see how this matter gets resolved," Lundeen says.

—I. Peterson

Valdez spill leaves lasting oil impacts

On March 24, 1989, the *Exxon Valdez* supertanker ran aground in Alaska's Prince William Sound. Ruptured holds released a fifth of the vessel's oil — some 10.8 million gallons of Prudhoe Bay crude. Over three years, Exxon, the state, and the federal government coordinated a $2.5 billion cleanup—sometimes involving 10,000 workers.

At an oil-spill symposium in Anchorage, Alaska, last week, scientists reported that both the pollution and its cleanup took a heavy toll on south central Alaska's marine ecosystems. And though many plants and animals are recovering, notable exceptions exist. The meeting marked the first general release of government-funded research on effects of the *Valdez* spill, observes Bruce A. Wright of the National Marine Fisheries Service in Auke Bay, Alaska, a coordinator of spill-damage assessment research.

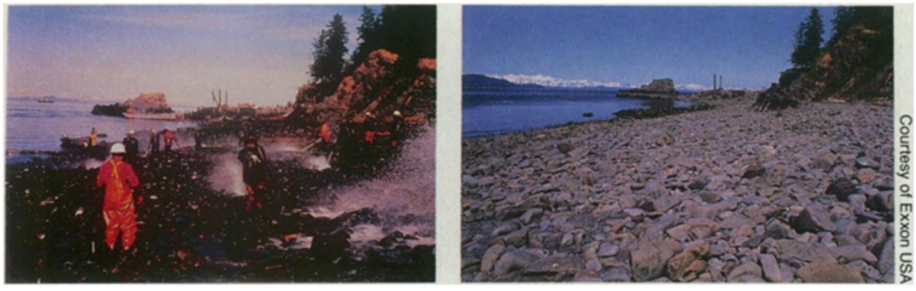
Federal law requires that state and federal agencies name "trustees" to establish public claims against firms that damage natural resources. Trustees managing the case against Exxon prohibited their researchers from discussing spill effects prior to court approval, on Oct. 1, 1991, of a $900 million settlement from the Irving, Texas-based Exxon Co. USA. Planning for this meeting began just after that, Wright says.

No one knows exactly how much *Exxon Valdez* oil ended where. The National Oceanic and Atmospheric Administration (NOAA) is attempting to "reconstruct" the oil's trajectory and estimate its removal by plugging both weather data and observations from spill sites into sophisticated computer models.

Preliminary analyses indicate that 20 percent of the oil evaporated — 8 percent on day one alone, according to Douglas A. Wolfe, chief scientist of NOAA's ocean assessments division in Rockville, Md. He says another 50 percent probably degraded on beaches, in the water, and within tidal sediments; an estimated 12 percent now lies in deep (nonbeach) sediments, and some 3 percent remains on intertidal shores, usually as tarry deposits.

Mechanical water skimmers removed some 8 percent of the oil. Wolfe estimates that cleanup crews recovered 6 percent more from sand and sediment or dispersed this oil into the water, where less than 1 percent remains.

"Skimming was operation heartbreak . . . [because] not a lot of oil was picked up," recalls Coast Guard Vice Admiral Clyde E. Robbins, who served as the cleanup's initial, federal on-scene coordinator. Cleaning heavily oiled shorelines proved a more visible success, he says. Hot-water washing and treat-



Smith Island beach oiled by the Exxon Valdez *spill. The first photo was shot May 2, 1989, while cleanup was under way; the second, June 6, 1992.*

ment scoured blackened rocks bright again. Displaying before-and-after shots of one Smith Island beach he visited (see photos), Robbins said, "I swear, I never expected it to come clean like that."

The frequently used high-pressure, hot-water washing also "annihilates a lot of marine life that otherwise survive the spill," observes Alan J. Mearns of NOAA's ecological recovery monitoring program in Seattle. Rockweed, a brown alga, proved its most prominent victim. Formerly constituting up to 90 percent of the intertidal plant mass in some areas of Prince William Sound, it virtually disappeared in many areas subjected to hot water, scientists reported. And especially in higher tidal zones, rockweed's recovery remains slow.

But it was oil that devastated the bird population. Oil killed perhaps half a million – more than 10 times as many as in any other U.S. spill, says D. Michael Fry of the University of California, Davis. Notable casualties included perhaps 11 percent of the 8,000 bald eagles in Prince William Sound. However, say scientists with the U.S. Fish and Wildlife Service, that population may already have recovered.

The same has not proved true of harlequin ducks. Fry said half of those living in the oiled regions were killed outright, and most that survived have failed to breed. Dennis Heinemann of Walcott and Associates in Alexandria, Va., reported that up to one-third of the area's adult common murres – diving seabirds that resemble mini-penguins – died directly from the spill. Even more troubling, he noted, breeding in colonies affected by the oil has virtually ceased.

Other researchers described signs of "functional sterility" in pink salmon and herring from heavily oiled areas. While these fish continue to spawn, certain age classes have produced dramatically increased numbers of dead eggs or severely malformed hatchlings – such as live young with curved spines or no jaws.

A pilot study by Evelyn D. Biggs of Alaska's Department of Fish and Game in Cordova, for example, suggests that year-old herring who lived in oiled near-shore waters in 1989 produced just half the viable young last year of similar herring from unoiled waters. So dramatic an effect this long after a spill "has never been documented before," she says and might indicate damage to cells producing sperm and eggs. If true, says Biggs, these fish would be "reproductively impaired for the rest of their lives."

Organizers of last week's meeting had invited Exxon to present research – and to share in planning the symposium. The company chose instead to unveil its data in April at an American Society for Testing and Materials (ASTM) meeting in Atlanta. ASTM offers a more "independent" forum, says Dennis Stanczuk of Exxon in Anchorage. Moreover, he contends, the Anchorage meeting's "stated purpose was to help make decisions on how [damage] settlement funds will be allocated." As Exxon is not part of that process, he says, "it would be inappropriate to take part."

L.J. Evans of Alaska's Department of Environmental Conservation in Anchorage disagrees. An organizer of last week's meeting, she says the symposium was never intended to affect spending of the $900 million settlement.

Exxon has invited trustee-funded researchers to report at ASTM, however, "and we will," Wright says. *– J. Raloff*

Plants relay signals much as animals do

Scientists first noticed ethylene's effects on plants at the turn of the century, when they realized that this gas, leaking from street lamps, caused trees to drop their leaves. They later discovered that ethylene is a plant hormone that can dramatically alter the shape of seedlings grown in the dark. By studying these odd seedlings, molecular geneticists have now uncovered hard-to-obtain details about how plant hormones work.

Ethylene sets off a chemical cascade inside plant cells that alters genetic activity, says Joseph J. Kieber of the University of Pennsylvania in Philadelphia.

He and his colleagues describe one chemical in this cascade – a protein kinase enzyme – in the Feb. 12 CELL. Remarkably, the enzyme's gene resembles genes for similar enzymes in animals.

"It's a real breakthrough," comments Elliot M. Meyerowitz, a molecular geneticist at the California Institute of Technology in Pasadena. "It's the first molecular identification of an intermediate [chemical] in a plant hormone signal transduction pathway."

Scientists seek to understand ethylene because it helps plants alter their growth and development in response to the environment. Emerging seedlings make ethylene so they can break through hard soil. Later in the plant's life, the rapid production of this substance may protect a torn leaf from infection. Finally, ethylene affects the rate at which fruit ripens or petals fade.

Since many companies seek to control fruit ripening or floral blooming, this report "is tremendously interesting from a practical and basic perspective," says Harry Klee, a plant molecular biologist at Monsanto Co. in St. Louis. Also, clues about ethylene may help clarify how nitric oxide, a simple gas and important messenger in animals (SN: 7/4/92, p.10), works, he adds.

Short, curved seedling (middle) grows as if exposed to ethylene.

To learn about ethylene, the Pennsylvania group screened more than a million *Arabidopsis* seedlings, culling out short ones with curled-up tips. These had grown as if they had been exposed to too much ethylene. The researchers added ethylene inhibitors to the short seedlings and discarded the ones that then began to grow normally: They represented plants that simply overproduced ethylene. The remaining seedlings represented plants with mutations in the signal pathway.

One mutation turns out to be in a gene that codes for a protein kinase, an enzyme that adds a phosphate to a protein, which then becomes the next signal in this chemical cascade. Without this protein-phosphate complex, cells act as if they were constantly being stimulated by ethylene, so the plant becomes stunted, says Joseph R. Ecker of the University of Pennsylvania.

"[This gene] turns out to be semi-familiar," says Meyerowitz. Yeast, worms, and fruit flies, as well as people, use similar protein kinases to relay chemical messages within cells. "It implies a commonality between plants and animals," he adds. *– E. Pennisi*