encourage Galápagos farmers to grow more produce, which should both cut down on imports of produce that can bring in aliens and also keep invasive weeds from spreading beyond little-used fields. One sign of success, Snell says, is that last month villagers cooperated when the invasives team eliminated every rock dove they found in one town on Santa Cruz, except for a few owned by one holdout family.

Victory?

Even with local support, the challenges are enormous. Poverty is a constant pressure. And perhaps no country has attempted anything this comprehensive before, says Bensted-Smith, with a program that not only seeks to wipe out major invasive species populations but halt human immigration as well. But then, no developing country, anyway, has had so much money before either. "The added funding should make a huge difference in what Galápagos can manage to do," says Lloyd Loope, an invasive-plant expert with the U.S. Geological Survey in Hawaii. And to make sure these actions don't die out in a few years for lack of funds, the plan calls for setting up a $15 million endowment for the station's conservation efforts from the GEF grant and other sources.

And what will happen to the Galápagos ecosystems if the project succeeds? Some should spring back, says Bensted-Smith. Once the cats are gone on Baltra, for instance, snakes, land iguanas, and native doves should flourish. And vegetation on northern Isabela should come back right after the goats are gone. However, on other islands that have both goats and invasive plants, the weeds could take over after goats are removed if land managers don't intervene, perhaps by planting native species. And on Pinta Island, the "solution" has created a new problem. After the goats were removed, vegetation returned—with a vengeance. The island historically was grazed by giant tortoises—but only one is left, Lonesome George. So the biologists are debating whether to put captive-bred tortoises of a different subspecies on the island so it will have enough herbivores.

Even if the plan is a resounding success, Charles Darwin Station scientists say they don't expect to claim victory. For one, their plan targets only "a small percentage of the invasive species that occur on the Galápagos," says station biologist Brand Phillips, albeit the most destructive ones. And unlike an oil spill, he says, keeping invasive species in check "is a permanent situation."

—JOCELYN KAISER

MEETING NORTH AMERICAN PALEONTOLOGICAL CONVENTION

Fossils With Lessons for Conservation Biology

BERKELEY, CALIFORNIA—This quadrennial meeting regularly runs the gamut of life history, but this year's convention, from 26 June to 1 July, featured an emphasis on research with relevance to problems of today, such as invasive species and the decline of coral reefs.

Big Clams Make Good Invaders

When exotic species invade new territory, trouble may ensue—or it may not. In the sea, some creatures that humans intentionally or unwittingly moved to new homes have turned conqueror, wreaking ecological devastation on marine habitats. Others, however, fail to thrive. Why the difference? Studies haven't found a hallmark of modern marine invaders that can predict their success. At the meeting, however, a trio of paleontologists showed that—for ancient clams, at least—a warning sign of a potentially successful invader may be its size.

By analyzing millions of years' worth of invasions recorded in the marine fossil record, David Jablonski of the University of Chicago and his colleagues—Kaustuv Roy of the University of California (UC), San Diego, and Jim Valentine of UC Berkeley—found that bulkier clams were more likely than small clams to have expanded their geographic range. That held true both during the ice ages of the Pleistocene and after the Cretaceous-Tertiary mass extinction 65 million years ago. "This suggests we're picking up a general pattern, and that range dynamics of fossil species can provide insights and perhaps predictions for human-mediated biotic interchanges as well," Jablonski says.

Jablonski, Roy, and Valentine started by compiling a database of sites where 216 species of marine clams along the California coast were known to have lived during the middle and late Pleistocene. Since then, 26% of the species have changed their range by at least 1 degree of latitude, as the team will describe in an upcoming issue of *Ecology Letters*. Then the paleontologists looked for ways in which successful invaders differed from other species in their native habitat that didn't spread out.

Muscling in. Large bivalves, such as *Mytilus edulis*, appear to have an edge in invading new habitat.

What made the invaders unique, it turned out, was not life habits—for example, whether they lived on the sea floor or embedded in the sediment—or even reproductive traits such as spawning free-floating larvae. But on average, the invasive taxa were larger than species that didn't expand their turf. "It seems that size really does matter when it comes to geographic range shifts in the Pleistocene," Jablonski says.

The same pattern held when the group examined biological invasions that took place in the Gulf Coast after the Cretaceous-Tertiary mass extinction, 65 million years ago. It was also true when they compared the median size of 25 successful recent marine bivalve invaders, compiled by Jim Carlton of Williams College in Williamstown, Massachusetts, to 914 marine bivalve species native to the northeast Pacific shelf. All together, Jablonski says, the three data sets imply that large bivalves are better than small ones at exploiting good habitat as it opens up. A possible reason for their success is that larger bivalves tend to produce more eggs and gametes—and consequently more larvae that can colonize new habitat.

"This is really a first for the marine realm," says Ted Grosholz, a marine and invasion biologist at UC Davis. Most studies of modern marine invaders, Grosholz says, have compared the size of invaders to that of other taxa in their new habitats—not the ones they left. That's misleading, because exotic marine species of all sorts tend to get bigger after invading a new ecosystem. And that, in turn, makes it hard to say whether size gave them an advantage to start with.

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One of the few studies that did look at preinvasion size seems to contradict Jablonski's results. In an unpublished dissertation, the Smithsonian Environmental Research Center's Whitman Miller, then at UC Los Angeles, examined 41 types of East Coast bivalves that had probably been transported across the United States with commercial oysters in the 19th and 20th centuries. Size, he concluded, did not predict success.

Some paleontologists are also skeptical about the bigger-is-better scenario. "If I look at patterns of taxa I know to have spread, nothing jumps out at me as being size-related," says Geerat Vermeij, who studies fossil mollusks of the Pacific. "I'd be surprised if there was a pattern."

Yet the chance that the pattern may hold is enough to excite conservation biologists. A simple trait to predict the tendency to take over a new ecosystem would be very useful to those attempting to prevent such disasters, Grosholz says.

Humans to Blame for Coral Loss

The most important species of coral in the Caribbean have been dying since the 1970s at tremendous rates, and the once-majestic reefs now are overgrown with algae. Among the stresses are warmer ocean temperatures and what appears to be disease, but the suspects also include human activities. Pollution can damage the coral, and overfishing removes an important control on algae.

Now, a paleontologist has bolstered the evidence that humans bear much of the blame, by showing that Caribbean reefs consisted of nearly the same mix of coral species for much of the past 220,000 years. This long-term baseline shows that the recent devastation is "a profound change that's unprecedented in recent geologic history," says John Ogden, a marine ecologist at the University of South Florida in St. Petersburg. "It's difficult to lay that at the feet of any cause other than humans."

To identify past trends in coral reef ecology, John Pandolfi of the Smithsonian Institution's National Museum of Natural History in Washington, D.C., examined ancient reefs in the Caribbean that were left high and dry when sea level dropped during ice ages and the islands rose. He made numerous 40-meter-long surveys of fossil reefs on San Andres, Curaçao, and Barbados, counting every coral species. The surveys covered the reefs' leeward crest, a shallow environment that is relatively easy to identify in fossil reefs.

On Barbados, Pandolfi found, the communities had the same composition of coral species at four time intervals: 220,000, 190,000, 125,000, and 104,000 years ago. About 80% was Elkhorn coral

Almost gone. Elkhorn coral used to be very common but is now rare in the Caribbean.

(*Acropora palmata*), a species that has become exceedingly rare in the Caribbean since the early 1970s. Another 15% of the coral community consisted of five other species—always the same ones—in every survey. The community structure was so stable that the 25 rare species that made up the remaining 5% showed up every time, too. "I almost fell off my chair when that came out," Pandolfi says.

Reefs have come and gone in the Caribbean during the past 220,000 years, but they have reappeared with the same community structure each time. That demolishes the argument that reef ecology may change all the time, Pandolfi says: "People can't say we don't know what's normal." And several researchers note that the fact that community structure survived the vicissitudes of climate change in the past—such as swings in sea level, temperature, and carbon dioxide levels—suggests that the current problems really are unnatural.

The new data extend the persistence of stable community structure from a 3000-year-long record from Belize, published last May in *Nature* by Richard Aronson, a marine biologist and paleobiologist at the Dauphin Island Sea Lab in Alabama. Whereas that study focused on the reef lagoon, a slightly different environment, it found essentially the same trend of stability—until the massive die-offs of the last few decades. "This tells you that what we're seeing today is not some random fluctuation," Aronson notes. "That's very powerful ammunition," he adds, for trying to muster the political will to fix some of the problems that people have caused.

—ERIK STOKSTAD

GENETICS

Can SNPs Deliver on Susceptibility Genes?

Minor differences in people's DNA ought to predict their risk of certain diseases. Is research on so-called SNPs living up to its promise?

When genetic markers called SNPs burst on the scene several years ago, scientists hailed them as a salvation for weary gene hunters. For decades researchers had been trying to track the genes involved in major killers such as heart disease and cancer. These complex diseases are not caused by a defect in a single gene, as is cystic fibrosis; rather, they arise from the interaction of multiple genes and environmental factors. But these so-called susceptibility genes emit such weak signals that chasing them has frustrated even the most seasoned geneticist.

As DNA sequencing capabilities soared in the late 1990s, researchers hit upon a new strategy: tracking down risk genes by using single-nucleotide polymorphisms (SNPs), fondly known as "snips." SNPs are simply locations along the chromosomes where a single base varies among different people. Where some have a guanine in a given string of nucleotides, for instance, others might have a cytosine.

Optimist. David Altshuler expects that new techniques will speed up SNP studies and make them cheaper.

The premise of SNP mapping is simple: Common diseases such as cancer must be caused in part by common mutations. And the most common mutations in the genome are SNPs, which occur about every 1000 bases. All scientists have to do, the reasoning goes, is find enough SNPs on the human genome map and see whether distinct SNPs occur more often in people with a given disease. If so,

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