

To make islands safe for rare native species, biologists are mounting increasingly complex campaigns to shoot, trap, or poison exotics

## Winning the War Against Island Invaders

**SANTA CRUZ ISLAND, CALIFORNIA**—It is the coldest, blackest hour before dawn, and Norm MacDonald's professional killers are getting ready. In the doorway of a map-filled war room, Ace is cleaning the sight on his .223-caliber rifle and working the bolt. Steve, sipping tea, straps on a pouch of hollow-point ammo good for blowing baseball-size holes in flesh. Then they step outside to the helicopter that will take them to the enemy: 5000 feral pigs roaming this 250-square-kilometer landmass. "The boys," as MacDonald calls his team in his soft-as-rain New Zealand accent, "are not just hunting. This is eradication."

Every day around the world, terminators are pursuing human-introduced creatures accused of threatening island biota, and, increasingly, wiping out every last invader. It's just a dream on the mainland, where exotic invaders such as nutria or zebra mussels can only be controlled, because once a patch of woodland or water is cleared there are always more in the next. But on islands, humans have proven good at finishing the job because space is limited and the exits sealed: Consider the dodo.

Scientists have focused their attention on islands because they are among the richest and most vulnerable of the world's ecosystems.

They cover 3% of Earth but house 45% of bird, plant, and reptile species. Introduced species are endangering many of the natives, because many island creatures are endemic. They have not evolved defenses against the mainland predators and grazers that humans bring—rats, cats, sheep, goats, and pigs. Islanders often get outcompeted or eaten; biologist Bernie Tershy, director of Island Conservation, a California-based nonprofit that specializes in eradications, says that since 1600, islands have accounted for up to 90% of bird and reptile extinctions worldwide, and half those of plants and mammals. Rats, now on 80% of islands, attack plants, insects, birds, and small animals; they are implicated in about half of recorded bird and reptile extinctions. Goats eat whole trees and gnaw plants to bare rock. On Hawaii's remote Laysan, rabbits eliminated 26 plant species within 20 years after arriving in the 1900s. On the Indian Ocean's subantarctic Kerguelen Archipelago, one cat and her three kittens arrived in the 1950s, and by the 1980s, they had reproduced into 3500 felines killing 1.2 million seabirds a year.

Ecologists once thought it impossible to wipe out invaders, even on islands. Into the 1980s, "hardly anyone thought eradication could be done," says Daniel Simberloff, an ecologist at the University of Tennessee, Knoxville, who was an early advocate.

But efforts on hundreds of islands worldwide have proven that mammals, at least, can be taken out, although campaigns against plants, insects, and reptiles are much tougher. Now exter-

minations in the name of conservation are taking place on ever-bigger islands, with ever more military-style planning and hardware.

The key, say experts, is to attack fast and get every last indi-

vidual before they can reproduce, adapt, or escape, because even a few strays can quickly rebound.

New studies show that some threatened species recover spectacularly. "The problems are obvious, and the solutions are obvious," says Tershy. However, this "nasty necessity," as Tershy calls it, is not always simple. Subtracting one invader from an ecosystem can make other components run amok, and the slaughter cannot always bring back rare native species to environments that have been severely altered. Then there is human ecology, as animal-rights protesters increasingly try to thwart extermination efforts. Together, these complications can weave a plot as tangled as a history of the Hundred Years' War. Santa Cruz is Exhibit A.

### Extermination island

About 100 kilometers northwest of Los Angeles, Santa Cruz is the largest of the 12 Channel Islands of California and Mexico. Their precipitous canyons, woodlands, and prairies hold some 2000 species and subspecies. Approximately 140 are endemic to one or a few islands, including the gigantic island scrub jay; the island spotted skunk (said to smell nicer than mainland cousins); dozens of flowering plants; and six subspecies of cat-size foxes, each peculiar to its own island. Some 10,000 years ago, Chumash people arrived with imports such as oaks; after 1800, Europeans brought smallpox, pigs, sheep, garden plants, and honeybees. The Chumash disappeared, alien grasses spread to 75% of Santa Cruz, and by the early 1900s, creatures such as the island sparrow and the Santa Cruz monkey flower were extinct.

Attempts at control came as early as 1904 after livestock escaped and started denuding the land. Hunters shot tens of thousands of sheep and pigs. But they never got them all. As soil eroded and nearly a dozen plants approached extinction in the

**Coming back.** Without rats, Xantus's murrelet chicks are rebounding on Anacapa Island.

