

Native plants, like this agave sebastiana, are recovering on the San Benito Islands. Opposite: Biologist Shaye Wolf, who is researching reproduction and survival rates for Cassin's auklets, prepares to weigh a chick.



A close-up photograph of a woman with freckles and brown hair, wearing a blue t-shirt. She is looking down with a gentle smile at a small, dark, fluffy bird chick that she is holding carefully in her hands. The background is a plain, light-colored wall.

treasure island

A group of dedicated scientists has succeeded in reviving the health of fragile islands off the coasts of California and Mexico as well as the endangered species that rely on them—leaving little doubt that the ends justify their lethal means.

Shaye Wolf is perched atop a wind-whipped

volcanic outcrop on a remote Mexican island. Pacific waves are crashing against boulders on the shore 100 feet below her, where elephant seals are bellowing at the surf. Watching from a lower, safer rock, I hold my breath. Wolf pushes one black fleece sleeve above her elbow and stretches a slender arm through the mouth of a tiny crevice. Reaching deeper, she twists her torso this way and that, still balanced on the precipice. Suddenly she beams me a smile as she pulls a Xantus's murrelet egg out from the rocks.

The egg, which is mother-of-pearl gray and slightly smaller than a chicken's, is mottled with pastel blues and small cinnabar spots. Wolf, a seabird scientist, cradles it protectively. In her palm she holds the promise of an endangered species struggling to survive.

Several breeding seasons ago a scientist would have had a better chance of pulling a European rabbit out of this crevice than a murrelet egg. More than 500 of the nonnative mammals were overrunning this Mexican islet, the largest of the three San Benito Islands, 25 miles off the coast of Baja California. They took over murrelet nest caves, evicted other seabirds from their burrows, and decimated the island's endemic plants.

Ever since humans began sailing the seas, they have introduced species to islands unprepared for the newcomers. Cats, dogs, goats, pigs, rats, and rabbits—all have taken a harsh toll on fragile island ecosystems. Seabirds especially have suffered. Along the Mexican coast and in the Gulf of California, invasive mammals have annihilated murrelets and four other species on 14 islands. Cats alone wiped out about half the population of Laysan albatross on Guadalupe Island in 2001. Until recently they were killing more than 1,000 black-vented shearwaters a month on Natividad Island, breeding ground for 95 percent of the world's population.

While the future of these seabird species is anything but assured, a fledgling conservation group offers the best hope in decades. Since 1997 Island Conservation, based in Santa Cruz, California, and Grupo de Ecología y Conservación de Islas, its Mexican partner, have eradicated 39 invasive-mammal populations on 25 islands. The results are dramatic. Seabirds are rebounding. Endemic plants thought extinct have reappeared. Scientists hadn't realized the intruders were suppressing native lizard and salamander populations until they began to notice that these species were flourishing, too.

The Island Conservation partners' technique is as straightforward as it is unsavory: Kill the invaders. Their tools are low-tech: leg traps, poison, and sharpshooters. At a time when the planet is losing species at an unparalleled rate, their mission is to prevent extinctions by protecting and restoring biodiversity, says Bernie Tershy, the group's executive director. "No one is into killing rabbits or even rats. We think of it as making birds."

Controlling exotic species is a grim reality, says Graham Chisholm, conservation director of Audubon California. "While

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no decision to use lethal measures should be taken lightly, killing should be used as a last resort after all measures have failed; sometimes it is the only way to protect biodiversity," he says. "The risk is ending up with a world of pigeons, rats, and cockroaches."

Island Conservation's deep involvement in eradication makes it a magnet for controversy. Tershy has been accused of everything from animal cruelty to playing God. He does not take the criticism lightly but counters it by telling the tale of the albatross. The largest of all seabirds, albatross can live as long as 75 years. They begin breeding at four or five and mate for life, producing one chick a year. Along comes a cat into a Laysan albatross colony, killing birds that are completely defenseless against terrestrial predators. When the birds' mates return from the sea and find their partners dead, they are unable to support their chicks alone. More death. Before long an entire albatross colony disappears.

It gets worse. Nonnative species put entire ecosystems at risk, not just seabirds. The disappearance of one species triggers other disappearances in what conservation biologists call trophic cascades, a series of secondary effects. Like salmon, seabirds are a link between oceanic and terrestrial ecosystems, carrying nutrients from the sea. During their nesting months on islands, the birds fertilize terrestrial plants in the course of their normal activities. Insects and beetles feed on the plants before they become food themselves for lizards and spiders. When predators wipe out seabirds, these connections are destroyed. Eventually island ecosystems become biologically sterile.

Islands harbor an exceptional treasury of

plant and animal life that includes marine mammals, bizarre reptiles, and a dizzying array of insects. It is this abundance that so amazed Charles Darwin and Alfred Russel Wallace, contributing to their theories of the origins and adaptations of all species. As mankind extends its dominance around the planet, islands are disproportionately affected, especially by introduced species. Humans may have deposited the first nonnatives accidentally—every shipwreck releases rats. But by the 1770s, when Captain James Cook was sailing the Pacific seas, he and others were deliberately putting ashore goats and pigs, cattle and sheep as hedges against supply shortages on future voyages. Fishermen and other island residents brought in cats as pets and to control mice. Rabbits came for sport hunting.

The results have been horrific. The vast majority of all recorded animal extinctions have been species endemic to islands. Island birds represent a staggering 95 percent of all birds snuffed out. More than half of these extinctions globally are the result of introduced species. On San Benito and other Mexican islands, invasive predators have caused 19 of 21 animal extinctions.

Tershy conceived Island Conservation with Don Croll in 1992 in the Mexican city of La Paz, where Croll was teaching and Tershy was doing seabird research. Jose Angel Sanchez, another cofounder, was then working for the Mexican National Protected Areas in Baja California. The three men recognized the destruction introduced species were wreaking on Mexican islands. They knew, too, that removing nonnative mammals had restored ecosystems in the Pacific and New Zealand. That inspired them to combine their academic expertise with activism focused on islands. Besides Mexico, Island Conservation is working with partners in Alaska, Hawaii, and Canada.

On this day Tershy, 44, an adjunct professor, and Croll, 49, a

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Opposite, clockwise from top left: The Cassin's auklet uses its powerful legs to dig deep nest burrows in the ground; biologist Shaye Wolf measures the egg of a Xantus's murrelet; so far 9 of 14 Xantus's murrelet colonies in the San Benito Islands have been cleared of a number of invasive mammals, such as rabbits and goats; a view from the water of East San Benito Island at sunset, when seabirds visit their nests.



professor of ecology and evolutionary biology, are reviewing this doleful history from Croll's second-floor office in the Center for Ocean Health at the University of California, Santa Cruz. Pictures of penguins, whales, and albatross share the walls with books and a surfboard, leaning in one corner near a window looking toward Monterey Bay. A whalebone rests on a cabinet. Wearing flip-flops and faded jeans, the men have the look of dedicated conservation biologists who have yet to outgrow decades as committed surfers.

Most islands are remote and inaccessible, which frees them of the development pressures that conflict with conservation efforts elsewhere. Because their ecosystems are relatively intact, they offer the chance to preserve not just species but the evolutionary processes that have been occurring on islands for millions of years.

Wolf, 33, a Santa Cruz doctoral candidate, is part of the Island Conservation cadre. Strong and slender, she moves over the San Benito rocks with the grace of the hula dancer she was in high school in Fort Lauderdale, Florida. Before descending from the precipice, she measures, records, and carefully returns the murrelet egg to its exact position in the crevice. The adults, which have not started sitting on this egg, have a limited sense of smell and will not notice the brief disturbance when they return from the sea to lay another egg, she says. When their chicks are two days old and still unable to fly, they will lure them down from their cliff nests to the sea. The chicks will not return to land until they are adults and ready to lay their own eggs.

Near a cove where three dolphins cavort in the waves, Wolf crosses a colony of Cassin's auklet nests, hopscotching to avoid collapsing the burrows dug into the sandy soil. Before her first visit to San Benito, rabbits had taken over these seabirds' spots, forcing them to build new burrows. The rabbits' predecessors—goats and donkeys—overran the island when they were brought here in the 1930s.

The effects were devastating to the trio of islets, which combined measure 3.7 square miles. Historically the islands supported one of the largest and most diverse populations of breeding seabirds in North America outside of Alaska—more than 2 million birds from 13 different species and subspecies. Three of the local plants, including the San Benito live-forever, were unique globally. By the time Wolf arrived in 2000, live-forevers were nowhere to be seen—the rabbits had gobbled them all up. The flat, open patches of sandy soil below the cliffs were hard-packed by decades of goat and donkey hooves pounding in the auklets' burrows. Rabbits occupied rock caves and burrows alike.

Today Wolf can tally about 35,000 Cassin's auklet nests and more than 300 for Xantus's murrelets, listed as endangered in Mexico and threatened in California. The island also supports healthy populations of black-vented shearwaters and three species of storm-petrels. Even the plant life is reviving. On a hike across the island, Wolf spots a live-forever, a small, delicate succulent sporting a pale yellow blossom. Long lost to the rabbits, it has come back from seeds lying dormant in the ground.

Wolf credits the San Benitos' recovery to Bill Wood, Island Conservation's first employee. Wood, a hunter and trapper who spent most of his life in the eastern Sierra Nevada near Bishop,

California, devoted many months over four years to San Benito. His mission was to wipe out the rabbits. He and Freckles, his Jack Russell terrier, would go to work at dawn. Freckles roused the rabbits; Wood shot them. By 2001 the rabbits were gone from all three islands. The killing bothers Wood, but after decades of hunting bobcats for their pelts, he says he has a debt to repay. "I saw the damage the rabbits were doing and the benefits to the islands after we were through. I felt I had taken from the resources. This was a way to pay back with something good."

The effects show not just on West San Benito, where Wolf is gathering most of her dissertation data, but also on East San Benito. On a gray afternoon we ride a 20-foot boat through rolling swells to survey seabirds on this foreboding islet, where the Mexican government has banned humans. We float over a deep-green kelp forest and past a colony of California sea lions hauled out on the rocks. Around a bend in a quiet cove, dozens of Guadalupe fur seals lounge on the shore, the only breeding population in the world other than on nearby Guadalupe Island. A yellow-crowned night heron watches us watch the seals.

Wolf starts her census on a steep slope mottled yellow with San Benito tarweed and green with Pacific mallow. While she is counting—46 Brandt's cormorant nests and 195 brown pelican nests—endangered pelicans are feeding around our boat in spectacular plunge dives. Sociable at mealtime, they are sensitive nesters. All it takes, Wolf says, is flushing one brown pelican and that nest is often finished for the year.

The information she is collecting is among the most comprehensive ornithological data gathered for San Benito, but it is only one part of her work. Wolf is also a conservation ambassador. She spends hours each day and many of her evenings with the fishing families who live in a hodgepodge of multicolored cabins during the seven months a year they spend diving for abalone and tending lobster pots around San Benito. She takes children to the auklet burrows, showing them the delicate porcelain eggs, even the fluffy gray-and-white chicks.

The villagers grew up taking local species for granted, throwing rocks at the elephant seals and snatching murrelet eggs for dinner. Since Wolf and other scientists arrived on San Benito, the people have realized how rare these species are. Today their speech is peppered with words like *endangered* and *endemic*.

"Scientists like Shaye have brought environmental education to our community," says Ramon Castro Amador, past secretary of the abalone cooperative responsible for protecting the island's wildlife in exchange for fishing rights.

On nearby Natividad Island, 25 miles south

of the San Benitos, Brad Keitt, then a Santa Cruz graduate student and now a program director with Island Conservation, was studying black-vented shearwaters in the midst of thousands of feral cats, imported to control mice. He made such a strong connection between the shearwaters and the island's health that Natividad's only school incorporated the long-winged seabird into its logo. By the time Island Conservation brought in Wood and other sharpshooters to eradicate the cats, Keitt had used an infrared videocamera to show the schoolkids the shearwaters in their burrows. The kids had become their guardians.

Keitt and Wolf are critical conservation links between science and communities. Most species would fare better without any human contact, but the world has evolved *Continued on page 93*

ISLAND BIRDS REPRESENT A STAGGERING 95 PERCENT OF ALL SPECIES SNUFFED OUT. MORE THAN HALF OF THESE EXTINCTIONS GLOBALLY ARE THE RESULT OF INTRODUCED SPECIES.

Opposite, clockwise from top left: Black and least storm-petrels in flight. More than a million storm-petrels nest in the San Benitos; structures threaten nocturnal seabirds, which sometimes collide with lighted buildings; black-vented shearwaters are also benefiting from the removal of exotic species from their breeding grounds; the islands are one of the last refuges for the northern elephant seal, which was almost wiped out by hunting.

beyond that. Today species' survival depends on the education and responsibility of local communities, says Alfonso Aguirre, director of Island Conservation's Mexican partner, based in Ensenada, Baja Mexico. Once an island is rid of its nonnative invaders, local residents must keep it predator free. "Today there is no nature without people," he says. "The conservation of natural resources is very much connected to the well-being of the community."

Island Conservation's most controversial eradication project was in southern California's Channel Islands National Park, where black rats were overrunning the three islets that comprise Anacapa Island, one of only two regular nesting areas in the United States for Xantus's murrelets. The rats' taste for murrelet eggs had reduced the population to as few as 31 breeding pairs from one that numbered in the hundreds, maybe the thousands. In 2001 and 2002 the Park Service used helicopters to drop poison on Anacapa, including its inaccessible cliffs. Island Conservation organized and conducted the eradication, which National Audubon supported.

The project drew furious opposition from animal-rights activists, who sued to stall the poisoning and waged a publicity campaign citing the "slow, cruel deaths" inflicted on the rats. They challenged the scientific basis for the program, and still remain livid. "It is hubris in the extreme to wipe out one species in favor of another one," says Scarlet Newton of the Channel Islands Animal Protection Association.

For Kate Faulkner, chief of natural resources for Channel Islands National Park, the survival of a species easily justifies the loss of individuals in a species found worldwide. Conserving biological diversity is the Park Service's mission, she says. "I'm not willing to lose the Xantus's murrelet. If Congress wants these islands for a rat sanctuary, they should not be part of a national park."

The poison project was an enormous success for the Anacapa ecosystem. The next breeding season Faulkner found Xantus's murrelets nesting in places where they had never before bred successfully, and some in places where they had not been seen since the 1920s. Nest predation has decreased from nearly 100 percent to less than 20 percent today, and the number of active nests has increased by 80 percent. Faulkner has also found a Cassin's auklet nest, the first ever documented on Anacapa. Native deer mice have rebounded beyond scientists' expectations and are beginning to colonize areas where none were found before the project. The survival rate of juvenile side-blotched lizards has increased; scientists hadn't even realized the rats were suppressing them.

These successes have helped convince the Mexican government to protect seabird habitat. All 20 islands off the Baja coast were recently proposed as a biosphere reserve, which would protect them from development, support small-scale sustainable fishing, and halt habitat destruction.

On a moonless night on San Benito Island, Wolf is collecting more data. Cassin's auklets are flying in from a day at sea, their craws filled with krill to feed mates or chicks waiting in burrows below ground. The soft pulse of their wings is all but drowned out by the hoarse cries of black-vented shearwaters, raucous squawks that belie the birds' sleek-bodied beauty. Louder still is the screech of a lone barn owl from the crags above us.

As I wander toward the beach past a jumble of black rocks, I catch a murrelet in my headlamp beam. It freezes against the rocks. I turn off my light, waiting. A cheeping comes from behind me—three short peeps. Then three higher-pitched peeps, followed by the first voice. Somewhere in the dark on San Benito Island, a two-day-old Xantus's murrelet is about to begin a life at sea. ■

