A first: Scientists oust a marine invader

California scientists announce they have evicted from local waters a South African worm that had been devastating area mollusks.

If confirmed, it will be "the first successful eradication of a well-established [nonnative] marine pest" anywhere, says project leader Armand M. Kuris of the University of California, Santa Barbara.

The spread of nonnative species is a large and growing problem (SN: 2/13/99, p. 103). Most go unnoticed until they are firmly established. Already widely dispersed—and lacking natural predators—they then prove all but impossible to eliminate.

The invading worm first came to light 6 years ago, when a California abalone farmer reported that his native stock was failing to grow. Shells of the sickened mollusks were no longer fairly flat, striated, and hard, but instead domed, amorphous, and crumbly. They also lacked the respiratory holes used to release materials including feces and reproductive cells.

Enter Kuris, an ecological parasitologist at the university's Marine Science Institute (MSI). Examining the shells, he discovered microscopic worms. Upon further investigation, the worms turned up in all of California's 17 other abalone farms. Carrie Culver, also of MSI, suspects that local growers unwittingly imported the pests in abalone from South Africa, where the worms had gone unnoticed.

Taxonomists Kirk Fitzhugh of the Los Angeles County Museum of Natural History and Greg Rouse of the University of Sydney in Australia now report that this abalone worm represents a new genus and species. In the fall INVERTEBRATE BIOLOGY, they christen it *Terebrasabella heterouncinata*.

"In the worst case, there can be thousands of these worms per shell," observes Culver. She's found that they induce abalone to secrete a protective tubelike shell over them. Once covered, the worms thrive even if their host dies.

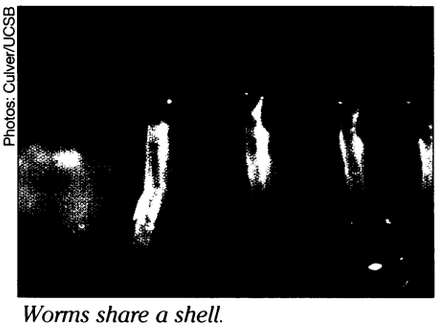
Economic losses due to the worm have already put one pioneering California abalone grower out of business, notes Culver. The epidemic, however, didn't stay confined to shellfish farms. In 1996, she and Kuris discovered the worm in coastal waters just outside an abalone farm north of Morro Bay.

The scientists immediately coaxed local public and private agencies into recruiting volunteers to cull the affected waters of aquaculture debris and some 1.5 million large snails, which the pests also infect. Their goal: to reduce local mollusks so that larval worms fail to find a host and simply die off.

"It's now been 2 years since we've seen any sign of infestation," Kuris says.

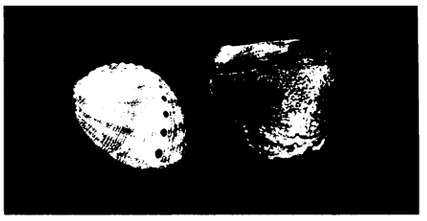
Unable to swim, the microscopic worms must crawl in search of a host. Kuris' team owes its success to identifying and quickly "exploiting this slow dispersal—the pest's Achilles' heel," says Elliott A. Norse of the Marine Conservation Biology Institute in Redmond, Wash.

"It's a marvelous example of the way we should deal with eradications," agrees Roger Mann of the College of William and Mary's Virginia Institute of Marine Science in Gloucester Point, Va. He only wishes he could find a similar vulnerability in the life cycle of another new invader—a voracious oriental whelk threatening shellfish in the Chesapeake Bay. —*J. Raloff*



Photos: Culver/UCSB

Worms share a shell.



Pore holes seen in healthy shell (left) are missing from deformed shell of infested abalone (right).

Threatened mothers have tougher offspring

Radish plants and water fleas that soup up their defenses pass the weaponry down to their offspring, even in experiments where the danger has been removed.

"This is the first time anyone has found an induced defense across generations," says Anurag A. Agrawal of the University of California, Davis. He and his colleagues report their find in the Sept. 2 NATURE.

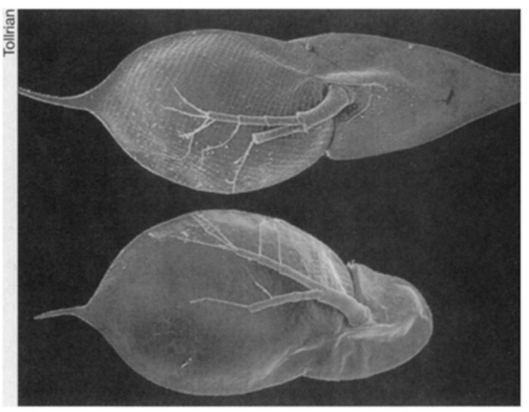
The discovery bears a spooky parallel to the discredited ideas of 19th-century biologist Jean-Baptiste Lamarck, who argued that species inherit acquired characteristics. For example, Agrawal says, "if I'm a bodybuilder, my babies will have big muscles." Lamarck didn't know about genes, but people interpret his idea as implying genetic change.

"This isn't Lamarckian; it doesn't get fixed in the genes," insists coauthor Ralph Tollrian of Ludwig-Maximilians-University in Munich. Still, genes do switch on to produce these defenses, Agrawal points out. Although he wouldn't describe the effects as Lamarckian, he says, "it's on the edge."

Induced defenses turn up in species from one-celled pond ciliates to humans with their fancy immune systems, Tollrian notes. Learning about the inheritance of such defenses might open new agricultural possibilities. He suggests that evoking defenses in a crop could yield seed needing less pest control.

To check for inherited effects, his lab raised one generation of water fleas near predatory phantom midge larvae. The water fleas grew huge helmets, halving mortality rates. When moved to safe water, they produced daughters with big helmets in all three broods that the researchers checked. Granddaughters, too, had somewhat enlarged crests.

Tollrian didn't look for paternal effects because the water fleas reproduced without sex, as they do in the wild for all but about one brood a year. He wouldn't be surprised, he says, to find some influences of dads in other species.



Tollrian

When raised near dangerous midges, the pinhead-size water fleas grow extra-large helmets (top).

Agrawal did corresponding experiments with wild radish plants. When cabbage butterfly caterpillars chewed the foliage, new leaves unfurled with 10 times the concentrations of mustard oil glycosides and 30 percent more spikes compared with unmolested plants. The defenses work: The fortified plants made 60 percent more seed.

The seedlings of the embattled radishes bristled with defenses, too. Caterpillars gained only 80 percent as much weight when attacking tough seedlings as when eating undefended controls.

What's the mechanism? "That's the million-dollar question," Agrawal sighs.

Ellen L. Simms of the University of California, Berkeley muses that passing down defenses could help explain the puzzling diversity within a plant species' characteristics. "They don't evolve in a really straightforward way," she says.

—*S. Milius*