

## EVOLUTION

# Native Mussel Quickly Evolves Fear of Invasive Crab

When an invasive species arrives, many ecologists fear the worst: a new creature running amok through an ecosystem and driving native species extinct. “People have the idea that it’s a bloodbath,” says Geoffrey Trussell, an evolutionary ecologist at Northeastern University in Boston, Massachusetts. “The assumption has been that prey just passively submit to their fate on the dinner plate.”

Some species refuse to roll over, however, and even improve their defenses. On page 831, Aaren Freeman, a Ph.D. student in zoology at the University of New Hampshire, Durham, and his adviser James Byers describe how a native mussel of New England has rapidly evolved the ability to shield itself from an invasive crab. “It doesn’t mean that we ought to ignore the threats of these introductions, but it does show that native species are not helpless,” says George Cox, a retired biologist in Santa Fe, New Mexico, and author of *Alien Species and Evolution*.

The invader in this case is the Asian shore crab (*Hemigrapsus sanguineus*), which turned up on the New Jersey coast in 1988. Since then, it has bred prolifically and spread to North Carolina and midway up the coast of Maine. The 4-centimeter-wide marine crab, which has a broad diet, has acquired a taste for the blue mussel (*Mytilus edulis*), which people eat as well. These mussels already have to deal with another invader, the green crab (*Carcinus maenas*), which arrived from Europe in the 1800s and has established itself along the East Coast.

Mussels, of course, can’t flee predators. So when young blue mussels sense that the green crabs are near their particular patch—no one knows the telltale signal, but it’s likely a hormone or other chemical—they begin to thicken their shells. After several months, the shell is 5% to 10% thicker than it would otherwise have been. This seems to help, as crabs need 50% more time to open mussels with thicker shells. “Crabs often will give up if they can’t open a mussel and move on to easier prey,” Freeman says. If crabs don’t happen to be around, the mussels don’t bother making thicker shells, perhaps

because it diverts energy from other activities, such as reproducing.

Freeman and Byers wanted to know whether the mussels were also able to detect the recently arrived Asian shore crab. For their experiment, they collected blue mussels from several locations along the northern coast of Maine—still beyond the range of Asian shore crabs—and others deep within their southern territory. In 2002, they exposed various



**Tough nut.** Mussels that grow a thicker shell have a better chance of surviving an attack by the invasive Asian shore crab.

groups to predator signals in the lab from either green or Asian crabs, or no crabs at all.

Three months later, both the southern and the northern mussels had thickened their shells in response to the green crab, as expected. But only the southern mussels responded to the Asian shore crab. (Freeman and Byers got the same results when they repeated the experiment in the wild, with the mussels and crabs in cages off a dock in Woods Hole, Massachusetts.) This means that the southern mussels have evolved the ability to detect Asian shore crabs in perhaps as little as 15 years after first encountering them. “It’s blinking fast,” says Trussell, who is on Freeman’s dissertation committee.

Given the many invasions under way, evolution of defenses could be quite common, says marine ecologist James Carlton of Williams College and Mystic Seaport in Mystic, Connecticut. What’s novel about Freeman and Byers’s research, he says, is that they happened to catch the mussels in the act. Although it’s too soon to say what other evolutionary or ecological effects the Asian shore crabs might have, the finding is good news for fans of blue mussels—including those who want them on their own dinner plates. —ERIK STOKSTAD

## Now Available: H5N1 Sequences

Indonesia last week reversed itself and announced that it would put all sequence data from human H5N1 influenza patients into the public domain. Scientists say the move will help them understand how the disease is spreading.

Indonesia’s samples had been sequenced by World Health Organization collaborating labs at the University of Hong Kong and the U.S. Centers for Disease Control and Prevention in Atlanta, Georgia, and placed in a password-protected influenza database at Los Alamos National Laboratory in New Mexico with limited access. Indonesia was one of several countries that resisted wider circulation of the data, a position that angered influenza researchers (*Science*, 3 March, p. 1224).

Last week, the Indonesian government reversed its position and had the password protection removed, reportedly after pressure from the Indonesian Academy of Sciences. “I’m very happy,” says Ilaria Capua, an Italian bird flu researcher campaigning for broader access. “I hope this will stimulate other countries to move in the same direction.”

—MARTIN ENSERINK

## Taiwan Pours It On

Taiwan’s National Science Council (NSC) has approved a \$2.6 billion science budget for 2007 that puts the country on a trajectory to match global leaders in its level of research spending. “Being a small island without natural resources, Taiwan is in great need of R&D [for] the knowledge-based economy,” says NSC’s Chien-Jen Chen, an epidemiologist at Academia Sinica, the nation’s top research institution. Chen has called for a 10.8% increase next year, which is expected to be adopted this fall by national legislators.

Recent research spending increases have outpaced overall governmental spending and economic growth for the past 6 years, propelling Taiwan’s research investment to 3% of the country’s gross domestic product by 2008. “We all feel very highly supported,” says Cheng-Ting Chien, deputy director of Academia Sinica’s Institute of Molecular Biology.

The new budget benefits all sectors, with special attention to mission-oriented programs in regenerative energy, earth sciences and astronomy, industrial-academic collaborations, avian and pandemic flu, and stem cells. Chen says all projects will be subject to peer review.

—DENNIS NORMILE