



## ECOLOGY

## The Starfish Assassin

A poison-carrying robot homes in on starfish that are destroying the world's most famous coral reef

**The Great Barrier Reef** will have a robotic protector beginning this winter. The underwater autonomous vehicle is programmed to patrol the massive living structure in search of destructive crown-of-thorns starfish (COTS), which it then kills by lethal injection. These starfish prey on coral polyps, and although they are native to the reef, their population has exploded in the past few years, possibly because of overfishing of their natural predators. The latest report from Australia's Great Barrier Reef Marine Park Authority places the venomous invertebrates alongside climate change and human activity as a significant threat to the reef, which lost half its coral cover between 1985 and 2012.

COTSbot, developed by robotics researchers at Queensland University of Technology in Australia, could help slow the starfish's invasion. Artificially intelligent, it correctly identified its target 99.4 percent of the time in laboratory tests. "It's now so good it even ignores our 3-D-printed decoys and targets only live starfish," Queensland's Matthew Dunbabin says. A fleet of COTSbots could supplement the efforts of human divers who currently remove or poison the sea stars by hand and could operate during bad weather or high currents. They could also be useful at night when starfish are more active but swimming is prohibited. —John R. Platt

### HOW IT WORKS

1. The COTSbot follows a preprogrammed path, moving up and down the Great Barrier Reef with the help of five thrusters. It stays close to the reef—and avoids bumping into the delicate structure—with the aid of sonar and multiple cameras.
2. The cameras scan for starfish, distinguished by their purplish colors, arm and thorn shapes, and creeping motion. Starfish often wrap around and hide under coral outcroppings, but the robot's software has been programmed to recognize those positions.
3. When the robot spots a crown-of-thorns starfish, its needle-capped pneumatic arm lowers and injects 10 milliliters of poisonous bile salts into the echinoderm. The compounds effectively digest the animal from the inside.
4. A poisoned starfish will die within 24 hours, leaving no opportunity for separation and regeneration—a survival tactic that is a boon for the starfish population but maddening to those trying to reduce its numbers.
5. The vehicle's tanks carry enough poison to kill more than 200 starfish in one four- to eight-hour mission. The rapid pace is key because even one starfish can spawn millions of young.