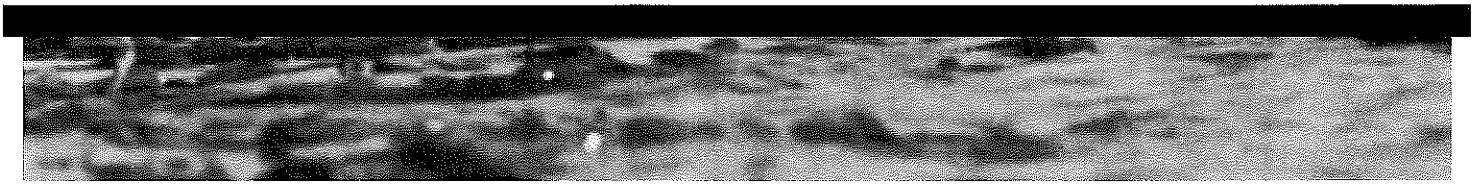

CREDIT: MIKE BAIRD

NOT EXACTLY ROCKET SCIENCE *A Blog by Ed Yong*

Sea Otters: Your Defence Against The Algal Apocalypse

POSTED MON, 08/26/2013

When humans dump nutrients into the oceans, whether it's fertilisers running off from farms or sewage pouring in from cities, the results are usually predictable. The influx of nitrogen and phosphorus quickly becomes too much of a good thing. It fuels the growth of algae that stop sunlight from reaching underwater plants, introduce toxic substances into

Sea otter, by Mike Baird.

Hughes discovered why. Sea otters grab shellfish and other prey from the sea floor and smash them open on the surface, using rocks as hammers and their own bellies as anvils. This makes it very easy for scientists to record what they're eating, and Hughes used decades of such records to show that the Eklhorn sea otters are crab-specialists. "We estimate that they can easily remove 400,000 crabs per year in an area the size of 7 football fields," he says. "That's a huge effect, which cascades down to affect the seagrass."

The crabs eat other animals including an orange sea slug and a shrimp-like isopod, both of which graze on algae. So by killing the crabs, the otters inadvertently protect the slugs and isopods, which in turn protect the seagrass by nibbling away at encroaching algae. This complicated four-part chain reaction (or "trophic cascade") is what keeps Elkhorn Slough in its current healthy state.

To see what would happen if the otters disappeared, have a look at the video below. The first clip shows the seagrass beds of Elkhorn Slough. "The seagrass is nearly devoid of any algae growing on the leaves, it's green and healthy looking, and there are large, conspicuous sea slugs consuming the algae," says Hughes.

James Estes established them as classic examples of keystone species—those that are disproportionately influential for their numbers. They protect kelp forests by eating the sea urchins that would otherwise raze them down. With otters, you get underwater jungles of wavy green kelp. Without the otters, you get bare "urchin barrens".

"The really interesting discovery here is that otters counter the detrimental impact of eutrophication," says Estes. In other words, their top-down influence is strong enough to nullify the bottom-up effects of nutrients entering the slough.

It's the bottom-up effects that scientists usually turn to when explaining the decline of seagrass beds around the world, along with the loss of other coastal habitats like salt marshes or kelp forests. But Hughes' study shows that the loss of top predators, such as sea otters, matters too. It might even matter *more*—after all, seagrass can actually do *better* under conditions that would normally lead to eutrophication, as long as there are otters around.

This has huge implications, says Hughes. Until last winter, sea otters were actually banned from southern California because people were worried that they would compete with local fisheries. That ban has since been lifted, and the otters are free to expand into their historical range, down into Baja, Mexico. As they do, the damaged seagrass beds in the southern estuaries could recover. "With the results from this study regional managers are much better informed on what to expect when sea otters start recolonizing estuaries," says Hughes.

They might also have other positive effects that we don't know about yet. "Sea otters are thought to be kelp-dwelling predators," says Brian Silliman from Duke University. "This paper shows that they fit just fine into seagrass food webs. Where else could they expand to? Marshes? It's all very exciting to think about."

Reference: Hughes, Eby, van Dyke, Tinker, Marks, Johnson & Wasson. 2013. Recovery of a top predator mediates negative eutrophic effects on seagrass. PNAS http://dx.doi.org/10.1073/pnas.1302805110

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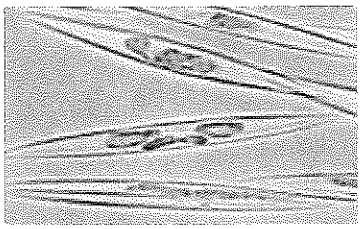
WHAT'S KILLING CALIFORNIA SEA OTTERS?

Harmful Algal Blooms



What are harmful algal blooms?
Algae – microscopic, single-celled plants – that live in the ocean sometimes "bloom" or multiply so quickly that they appear in dense patches on the sea's surface. Although most are harmless, some species produce toxins that move up through the food web and can kill shellfish, fish, birds, marine mammals and even humans.

Why is domoic acid such a concern?
Occasionally along the California coast the diatom *Pseudonitzschia*blooms and produces a neurotoxin called domoic acid. No one knows what sets off the glass-shelled algae to bloom or produce so much domoic acid. This toxin can cause seizures and even death in otters who eat contaminated shellfish. Many otters develop inflammation of heart muscle and heart failure after being exposed to domoic acid. Heart disease is responsible for 13% of sea otter deaths.

Is domoic acid dangerous to people?
Humans who eat shellfish or fish tainted with domoic acid can start twitching and feel nauseous. The toxin can permanently destroy a part of the brain that controls short-term memory and, in severe cases, causes death.

CDPH Issues Warning about Dungeness and Rock Crabs Caught in Waters Along the Central and Northern California Coast

Date: 11/3/2015

Number: 15-082

Contact: Anita Gore, Orville Thomas - (916) 440-7259

SACRAMENTO

The California Department of Public Health (CDPH) today advised consumers not to eat Dungeness and Rock crabs caught in waters between the Oregon border and the southern Santa Barbara County line, due to the detection of dangerous levels of domoic acid, a naturally occurring toxin.

Recent test results have shown persistently high levels of domoic acid in Dungeness crab and Rock crab, which have been caught along the California coastline. The levels have exceeded the State's action level for the crabs' body meat as well as the viscera, commonly referred to as crab butter, and therefore pose a significant risk to the public if they are consumed.

CDPH staff collects viscera from cooked crabs during sample test preparation. Credit: CDPH. For media use.

CDPH in conjunction with other state agencies will continue its sampling efforts to monitor domoic acid levels in Dungeness and Rock crabs until the levels subside and no longer exceed the State's action level of 30 ppm in the viscera and 20 ppm in the meat. Domoic acid accumulation in seafood is a natural occurrence that is related to a "bloom" of a particular single-celled plant called Pseudo-nitzschia. The conditions that support the growth of this plant are impossible to predict, and it is unknown when the levels found in crab will subside. The health advisory will be lifted once the levels are no longer above acceptable levels.

Symptoms of domoic acid poisoning can occur within 30 minutes to 24 hours after eating toxic seafood. In mild cases, symptoms may include vomiting, diarrhea, abdominal cramps, headache and dizziness. These symptoms disappear within several days. In severe cases, the victim may experience trouble breathing, confusion, disorientation, cardiovascular instability, seizures, excessive bronchial secretions, permanent loss of short-term memory (a condition known as Amnesic Shellfish Poisoning), coma or death. There have been no reported illnesses associated with this event.

To receive updated information about shellfish poisoning and quarantines, call CDPH's toll-free Shellfish Information Line at (800) 553-4133. For additional information visit CDPH's Natural Marine Toxins: PSP and Domoic Acid Web page.

For additional photos of CDPH staff testing crabs visit our Facebook account.

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The New York Times | http://nyti.ms/1kbAiaF

SCIENCE

Toxin Taints Crabs and Kills Sea Mammals, Scientists Warn

By JONAH BROMWICH NOV. 4, 2015

The authorities in California are advising people to avoid consumption of crabs contaminated by a natural toxin that has spread throughout the marine ecosystem off the West Coast, killing sea mammals and poisoning various other species.

Kathi A. Lefebvre, the lead research biologist at the Wildlife Algal Toxin Research and Response Network, said on Wednesday that her organization had examined about 250 animals stranded on the West Coast and had found domoic acid, a toxic chemical produced by a species of algae, in 36 animals of several species.

"We're seeing much higher contamination in the marine food web this year in this huge geographic expanse than in the past," Ms. Lefebvre said.

She said that the toxin had never before been found in animals stranded in Washington or Oregon, and that there were most likely greater numbers of contaminated marine mammals not being found by humans.

The California Department of Public Health recently advised people to avoid consumption of certain species of crabs because of potential toxicity. Razor clam fisheries in Washington have been closed throughout the summer for the same reason.

If acid secretion is meant to deter predators, it is clear that it is a failing strategy on the part of the algae. Ms. Lefebvre expressed concern that the acid poisoning of sea life would continue to spread.

"My concern is that we're going to see an increase in the number and geographic range of marine mammals being affected," she said.

A version of this article appears in print on November 5, 2015, on page B11 of the New York edition with the headline: Spreading Toxin Taints U.S. Seafood and Kills Sea Mammals, Scientists Say.

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