Scientists study harmful algal blooms in Puget Sound

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Under a microscope, Heterosigma akashiwo looks like a potato or a cornflake. To the naked eye, sea lettuce is a big, green sheet of seaweed. In most cases, these different algae are food for the ocean's vegetarians.

But every few years during summer and early fall they multiply in massive numbers until they harm the marine ecosystem, kill fish or die off themselves and wash onto Puget Sound beaches, where they reek like rotting seafood.

Two scientists -- Suzanne Strom and Kathy Van Alstyne -- at Western Washington University's Shannon Point Marine Center in Anacortes are studying these harmful algal blooms.

Their projects have been awarded nearly $1.9 million in federal grants from the National Atmospheric and Oceanic Administration and the National Science Foundation. The research is being done with the help of WWU students and scientists at the University of Rhode Island and Seattle Pacific University.

Their focus:

• Determine what factors spark these dense blooms in the Puget Sound. Scientists say it's difficult to predict when they're going to show up.

• Find out what makes the blooms poisonous and what affects their levels of toxicity.

• Study how the blooms affect marine life, including the food web.

• Provide a baseline for ongoing study, as Heterosigma and sea lettuce have not been studied as widely as the toxic algae that cause paralytic shellfish poisoning.

The algae being studied by Strom and Van Alstyne are not known to be dangerous to people.

"Even if you're swimming in a whole bloom of this stuff, it wouldn't hurt you because we have skin," Strom said of Heterosigma.

Heterosigma akashiwo are single-celled, microscopic algae smaller than the width of a human hair. They and other algae are abundant in the Puget Sound, making up most of the plant life in the ocean here and elsewhere and giving the region's water its rich green color.

The algae exist in two forms: A resting stage known as the cyst form, in which they sink and hang out in the sediment, Strom said, and as "vegetative" cells, in which they swim around in the water and cause the blooms that sometimes kill fish.

"It has caused fish kills in places all over the world, especially around the Pacific Rim," Strom said, adding that farmed fish are particularly vulnerable because they can't swim away from the blooms.

Widespread in coastal and brackish waters, Heterosigma have killed salmonids in the U.S. and Canada, yellowtail in Japan, milkfish in Taiwan and unidentified wild fish in South Carolina and South Africa, according to Strom.

Locally, blooms have been noted going back to the 1970s.

Why Heterosigma multiples and multiplies until it forms blooms isn't fully understood.

"In response to some sort of cue(s) involving temperature and perhaps salinity and light, the cysts 'hatch out' or excyst and turn back into the swimming vegetative cells," said Strom, senior marine scientist for Shannon Point Marine Center.

Then conditions have to be right for those vegetative cells to multiply, she added.

"We are very interested in how and where 'cyst beds' form and the role they play in seeding the water column and initiating blooms," Strom said.

The last major blooms occurred in 2006 and 2007 in northern Puget Sound.

The 2006 bloom, the larger of the two, caused $2 million in losses to farmed salmon. An aerial photo taken that year shows a brownish tongue off Shannon Point Beach near the ferry dock in Anacortes. There were patches in Bellingham Bay, north of Lummi Island and extending west from Sandy Point, Cherry Point and Birch Bay, according to a report compiled by Jack Rensel, an area scientist who studies Heterosigma blooms.

As for what makes the blooms toxic, that seems to be related to their production of reactive oxygen, which damage cells. Japanese researchers determined that fish are killed when the reactive oxygen damages their gills.

"Once the gill tissue is damaged, the fish suffocate," Strom said.

But not all organisms are harmed by consuming Heterosigma in its toxic

form. And whether its levels of toxicity are caused by natural factors or human activity is still to be determined.

Van Alstyne is studying four species of sea lettuce, a natural part of the marine ecosystem that in recent years seem to be showing up in larger blooms.

"What we're seeing looks like excessive growth," she said.

The study also looks at why sea lettuce blooms grow where they do.

Sea lettuce are big green seaweeds that look like flat sheets. They usually become more abundant around April or May, peak in summer, then start dying off later in September. "Usually the fall storms take them out," Van Alstyne said.

These large blooms of sea lettuce, known as green tides, are found in many bays in the Puget Sound and Northwest Straits. They form mats in shallow waters, especially during hot, sunny conditions.

When they die and begin to decompose, they suck oxygen out of the water -- killing surrounding marine life, including themselves, said Tim Nelson, a biology professor at Seattle Pacific University who is conducting the study with Van Alstyne.

They also produce toxins that could damage oyster and crab larvae, Nelson said, adding that sea lettuce blooms can negatively affect eelgrass by shading it out.

Eelgrass meadows provide critical habitat for species, including juvenile salmon and herring as well as molting Dungeness crab, so they're protected by the state of Washington.

Sea lettuce's impact to the marine environment is seen in another way. One of the species under study produces large quantities of dopamine, which imparts a bitter taste that deters critters from eating it. When this sea lettuce dies and releases enough dopamine into the water, it causes a red tinge -- not to be confused with deadly "red tide" -- that could be toxic to marine life.

Like Strom, Van Alstyne is trying to pinpoint factors causing the blooms and whether those are man-made or natural. The last bad bloom occurred in 2006 and affected the San Juan Islands, the Strait of Juan de Fuca and Puget Sound proper.

That was when piles of sea lettuce washed ashore and caused some concern about health hazards as decaying seaweed let off hydrogen sulfide and dimethyl sulfide.

"They smell really bad," Van Alstyne said.

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