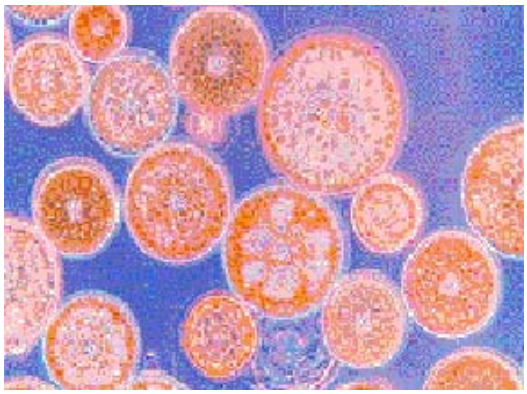
Brown Tide Devastating Long Island's Great South Bay Shellfish

Widespread outbreak of a microscopic algal bloom known as "brown tide" in Long Island's Great South Bay threatens shellfish industry. Photograph courtesy NOAA.

Earthfiles, news category.

July 2, 2000 Stony Brook, New York - Biologists in the Marine Sciences Research Center at State University of New York at Stony Brook are puzzled by the vigorous brown tide algal bloom this spring that has killed off most of the shellfish in Long Island's Great South Bay. Part of the problem, in addition to the more traditional link of algal blooms to pesticide and fertilizer runoffs from land, is global warming. Winter 2000 was warmer than normal and Spring 2000 was the warmest spring on record in the United States. But no one expected brown tide algae to persist through the winter and then flourish and spread as far as it has in the Great South Bay.

Craig Strong, Vice President of Bluepoints Co., Inc., a West Sayville hatchery specializing in hard clams and oysters, rates this brown tide as nearly the worst he has ever seen. "We have had no shellfish growth at all this entire spring in the Great South Bay. That's happened before with brown tides, but this is the longest we've had it because it went through the winter."



Phytoplankton, single celled marine algae, 1/1000 of a millimeter to 2 millimeters, live in the upper 100 meters of the oceans. Algae absorb oxygen and sunlight. If too widespread such as brown or red tides, the plants suffocate other marine life which is why shellfish have died in Long Island's Great South Bay. Photomicrograph by Rita Horner, Ph.D., NOAA.

Brown tide, like red tide, is a microscopic single celled plant called a phytoplankton. Normally, algae are a food source for marine life. But when the plants begin to cover huge areas of water, they absorb the oxygen and sunlight that other marine animals and plants need to survive. The current brown tide in Long Island's South Bay has effectively killed off all shellfish growth for this season leaving everyone to wonder what the consequences are for next year and beyond if brown tides persist.

At SUNY-Stony Brook, Professor Gordon Taylor, Ph.D. in the Marine Sciences Research Center is studying chemicals in ground water as it leaves urban areas and enters rivers and the ocean with the idea that vigorous algal blooms might be connected directly to the chemical pollution.

Interview:

Gordon Taylor, Ph.D., Professor of Marine Sciences, State University of New York at Stony Brook, Marine Sciences Research Center, Stony Brook, New York: "This brown tide is unusual because the most intense brown tides usually occur in a different bay system at the east end of Long Island between the North Fork and the South Fork of Long Island by the Hamptons. It's occurred there just about every year since 1985. Great South Bay normally doesn't get as intensive a bloom that we're seeing this year. That's what makes it so unusual.

Factors that contribute to the brown tide's growth are things like rainfall patterns, water temperature, wind. There is a weather component that sets up the physical conditions for the brown tide and we think there is also a contribution from the water that flows into the bay - it's either from the small streams and rivers or from ground water. After a rainfall, some of the rain percolates down through the soil and moves along the water table and eventually comes back up in our bays, so any chemicals that are added to our water go into the water table and end up going into the bay. That's one of the theories I'm studying right now, the chemical quality of the ground water entering the bay is what is promoting the growth of brown tides.

THE ALGAE MIGHT BE SURVIVING ON PESTICIDES AND CHEMICALS.

In a matter of speaking. Probably the fertilizers that we apply to our gardens and lands contribute, and the pesticides may have a subtle effect where it tips the balance to an environment that is particularly suitable for brown tide and not so suitable for the brown tide's competing algae, algae that normally grow in the bay.

WHAT DO YOU THINK HAPPENED IN 1985 THAT THIS HAS BECOME SUCH A DEVASTATING PROBLEM IN THE LAST 10 TO 15 YEARS?

That's an excellent question. That's the one I've asked before I heard about this problem and moved to Long Island. What is different about the bay systems here since 1985 as opposed to the previous century when it was never observed. My hypothesis is that the land use patterns have changed around surrounding the Great South Bay and the Peconic's Bay and that change in land use has influenced the chemical quality of the ground water that leaves the land and enters the land.

JUST LIKE THE PFIESTERIA PROBLEM FURTHER SOUTH, LARGELY IN NORTH CAROLINA, THERE ARE ALGAE THAT SEEM TO THRIVE ON PESTICIDES AND FERTILIZERS.

That's correct. All plants need fertilizers, whether we're growing tomatoes in our garden or phytoplankton in our bays and harbors. They all need the nitrogen and phosphorous that we apply to our lawns. All plant life needs this for growth. The interesting thing with brown tide is that it's a species that's not that fast growing. There are other algae out there that should compete just as well and they don't. And that's what really is the puzzling aspect of this whole problem.

I should say this brown tide, unlike Pfiesteria (which can harm people) does not present a health threat to human populations, but it does seem to be a very poor quality food source for organisms for animals that eat algae. And most of the things that live in our bay and harbor, their life depends on having a good nutritional source of algae.

Aggressive algal blooms in both Pfiesteria and brown tide turn waters brown. Fish and other marine animals die when oxygen is depleted. Pfiesteria, a dinoflagellate that has an animal amoeba stage in addition to its plant life cycles, can literally eat the flesh of fish and whatever tissue is in the water, including humans. Pfiesteria also releases aerosols into the air which affect the central nervous system and cause disorientation and memory loss. Photograph courtesy NOAA.

YOU'VE GOT A PROBLEM WHERE NOTHING WANTS TO EAT IT AND IT KEEPS SPREADING AND USING THE OXYGEN.

Exactly. And the light. Because these brown tides get so dense, they shade the light. They absorb all the light and use it for their own growth and very little light is left over to reach bottom vegetation which our bays and harbors normally have, at least along the inshore areas, the shallow areas.

I UNDERSTAND IT IS SO SERIOUS NOW THAT YOU ARE FACING A SUMMER IN WHICH THERE MAY NOT BE ANY SHELL FISH PRODUCTION AT ALL ALONG THE LONG ISLAND'S GREAT SOUTH BAY.

That's what some workers have told us. Yes, that's correct.

NO SHELL FISH.

There was a nice illustration I saw the other day of a commercial shell fish grower down in Great South Bay in Blue Points where they have tanks where they raise the larvae and the small juvenile oysters. And in one set of tanks, they had water where they had removed the brown tide and you saw nice growth. Oysters were developing normally. And those where they just let the bay water come in that had the brown tide were 1/10th the size. So they will not reach maturity. They will not make it to market. And that's probably what is occurring universally across most of Great South Bay right now.

HOW SERIOUS CAN THIS BE IF YOU LOSE ONE ENTIRE SEASON OF ANY SHELL FISH PRODUCTION - DOES THAT MEAN THERE

WILL BE LESS AND LESS AND LESS OVER THE FORESEEABLE FUTURE?

We've experienced this in the Peconic Bay system for the last 15 years, a brown tide there, every year except two that I can think of and the effect it's had in that basin - it's completely decimated the bay scallop industry. They've had very few years where they have had a commercial crop of scallops. Great South Bay is more intermittent. It's never as widespread as we see it this year. We have no more reason to believe it's going to be this bad next year. This may just be a fluke.

BUT WHAT IF IT ISN'T?

Then the shell fish industry is definitely in trouble. If the brown tide isn't here next year, they will bring in seed stock to the hatchery from other locations where the shell fish are healthy. They'll grow them up in their hatcheries and put them out in the bay bottom. And if there's not a brown tide, we'll be fine.

BUT IF THERE IS A BROWN TIDE AGAIN?

Again, that industry is going to vanish, because there will be no healthy waters to raise their product.

THERE IS NOTHING THAT SCIENCE AND TECHNOLOGY CAN DO ABOUT THE BROWN TIDE TODAY?

Not today given the state of our knowledge. I'm optimistic that in the future, not too distant future, we'll understand all the conditions that allow this organism to proliferate and we'll be able to do something about t it. The solution might be very expensive. It might be politically sensitive. It may be uncomfortable for a lot of people. But I'm confident there will be a solution.

WHAT IF IT'S TIED TO THE INCREASING PESTICIDE, FERTILIZER AND RUNOFF AND THE FACT THAT GLOBAL WARMING SEEMS TO BE SETTING IN REGARDLESS OF ARGUMENTS ABOUT ITS SOURCE AND THAT EACH SUMMER SEEMS TO BE GETTING WARMER AND WARMER. ISN'T THAT CONTRIBUTING TO THESE VIGOROUS ALGAE BLOOMS?

That's well put. That's a definite possibility. We find throughout the U. S. problems with agriculture lands being over-fertilized. But there are new generations of fertilizers being introduced that are less mobile. They don't migrate through the soils as rapidly. And through education and public awareness,, if we change the mode in which we apply pesticides and fertilizers and the products themselves improve and become less mobile and stay on site rather than moving to bays and harbors, that there is a chance that there can be some correction. We can't do anything about the global warming issue. But other things are under our control.

NEXT SUMMER THEN THE LIKELIHOOD IS THAT IF THE TREND WE'VE SEEN FOR AN ENTIRE DECADE OF INCREASINGLY WARMER SUMMERS KEEPS GOING, THE LIKELIHOOD IS THAT THE SUMMER OF 2001 WILL FIND THE BROWN TIDE EQUALLY AS BAD. WHAT HAPPENS IF THERE IS NO SHELL FISH NOT ONLY IN LONG ISLAND'S GREAT SOUTH BAY, BUT THAT I MIGHT BEGIN TO AFFECT ALL THE SHELL FISH INDUSTRY IN THE NORTHEAST?

We haven't seen massive outbreaks of brown tide anywhere other than in our area of Long Island Sound Bay. I should point out on this temperature issue that brown tide doesn't do well when the water reaches summer temperatures. That's when the brown tide starts to die off because it doesn't like really warm water. There is an optimum temperature range in which it thrives. It just so happens this year, Great South Bay reached that optimum earlier in the year than it normally does. That's why it hit early and hard, we believe, combined with rainfall patterns.

THIS IS THE WARMEST SPRING ON RECORD IN THE UNITED STATES AS WELL.

Yes, and we had a very wet May in this region. April was rather dry. We got our April showers in May. And the brown tide was reported around May 15th.

THE PROBLEM IS THAT WE MAY START SEEING WARMING SPRINGS AND THIS PROBLEM OF THE ALGAE BLOOMING BEFORE HOTTER SUMMER TEMPERATURES KICK IN AND KILL IT OFF THAT THIS IS EXACTLY THE SPRING TIME WHEN THE SHELL FISH NEED TO GROW AND THAT'S WHEN THE ALGAE COULD BE CAUSING THE GREATEST PROBLEM?

Excellent. Yes, that's a very good point. The thing to consider is that most of the fisheries and resources that we're talking about, they reproduce in early spring. They produce their larvae which are most sensitive to environmental conditions and so if something is not right with the environment, these larvae are not going to survive. They are not going to make it to mature animals. So, as you say, if it does occur this way, brown tide is dominant in the spring when everything is reproducing that does not bode well for survival in those particular environments.

IF THIS BECAME A REPETITIVE PATTERN IN THE SPRING AS THIS YEAR, HOW EXTENSIVE COULD THIS DAMAGE OF THE SHELL FISH INDUSTRY BECOME?

That's an interesting question. I think that the effects will be seen from here southward, but the waters are still cool enough northward in New England that it would be a very long time before we would see that pattern migrating northward. But we would certainly see it more commonly to the south of us.

SO GLOBAL WARMING MIGHT MAKE SHELL FISH AS RARE AS GOOD CAVIAR?

(laughs) That is possible yes."

Websites:

http://www.nwfsc.noaa.gov/hab/blooms.htm#what

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