RUTGERS in the NEWS

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Dye lets scientists track water's progress

By KIRK MOORE
STAFF WRITER

From the Monmouth County highlands over Sandy Hook Bay, the Hudson River appears to join seamlessly with the Atlantic Ocean, one blue swath from the beach northward to Manhattan's towers.

But the stream's momentum is out there. Pulses of fresh water from the Hudson, pouring out at 20,000 cubic feet per second and more, form a ghost river that continues on south, the lighter fresh water gliding into, and mixing with, the heavier salt.

If you could somehow color the river, you might track its progress — which is exactly what scientist Robert Chant and a research team from Rutgers University did this week.

"As it comes down here, it mixes with the ocean water," Chant said a few days before he went to sea, as he traced a line on a chart past the mouth of lower New York Harbor. "As the top half of the water column is coming out, it's mixing with salt water on the bottom.

"We'll tag it, but with some dye, and as it goes down the (continental) shelf, track it for five days."

Already the experiment has helped scientists come up with a possible explanation for persistent low-oxygen conditions that are frequently seen in the ocean off northern Monmouth County. This week's tracking revealed a "recirculation eddy" that contained most of the dye in waters between the base of Sandy Hook south of the Shrewsbury Rocks off Monmouth Beach, Rutgers oceanographer Scott Glenn said.

It's an important finding, because the Hudson River plume carries nutrients that feed microscopic plants called phytoplankton, Glenn explained. When phytoplankton bloom and then die, the decomposition process uses up dissolved oxygen in the water, creating stressful conditions for fish and shellfish.

"The dye just sat there for a long, long time," said Glenn, who is monitoring operations from the Coastal Ocean Observatory Laboratory room at the Rutgers Institute for Marine and Coastal Studies in New Brunswick. Meanwhile, Chant and other researchers are offshore on the research vessels Cape Hatteras and Oceanus.

Boaters are familiar with swift currents around the tip of Sandy Hook, but the dye tracking shows that phtyoplankton blooms can stay for days in calm waters just a few miles south, Glenn said.

"The phytoplankton sit there long enough to go through their life cycle. When they die, they start using up the oxygen," he said. "I think we have a good hypothesis."

Chant's team is not staining the ocean. The red dye they released Sunday was visible to the naked eye only near the Hatteras, but it can be detected at very high dilution for days after using sensitive instruments called fluorometers.

"The dye will tell us exactly how much mixing is going on," Chant said.

Satellites, ships, moored and drifting buoys, and a robotic underwater autonomous vehicle are all part of the two-week project, which will continue this weekend with one ship cruising up the Hudson to its salt-water boundary, and a second dye release in the ocean on Sunday.

Rutgers officials have dubbed the experimental series LaTTE, which stands for Lagrangian Transport and Transformation Experiment. Lagrangian refers to a technique of mathematical modeling, pioneered by 18th-century Italian mathematician Joseph Louis Lagrange, that is used to describe the path of particles in an atmosphere or liquid.

Data from this two-week experiment could answer other questions about the coastal ecosystem, from fish movements to the effects of discharging treated wastewater into the sea, Chant says. The river carries traces, too, of its pollution burden, and suspended organic material that can fuel microscopic plant growth as it disperses at sea.

On satellite imagery, the plume billows out of the harbor past Sandy Hook, then appears to make a sharp turn toward the New Jersey beaches. That motion is driven by the Coriolis force, a deflection caused by the Earth's rotation, Glenn said.

Each surge of fresh water tends to slowly sink, with the next surge arriving on top of it "and skating around in the wind" as the freshet floats atop denser, saltier water, Glenn said.