

Rising temperatures throw nature a curve

Species in Narragansett Bay are in midst of a wide change



Erin Collings of the University of Rhode Island sorted her catch last month. Some fish species are in sharp decline. Erin Collings weighed a bucket of crabs. She catalogs all the types of fish species she catches and also assesses water quality. (Eric Jacobs/Globe Staff)

By Beth Daley
Globe Staff / November 13, 2007

OFF WICKFORD, R.I. - Once, natural events in Narragansett Bay occurred with the predictability of the tides: Thick ice clung to the shore in February. Giant phytoplankton blooms tinted the water green by March. Striped bass began to move to warmer waters by mid-October.

No longer. Winter surfers off Narragansett Town Beach rarely have to slosh through frozen chunks anymore. Those blooms, which rained nutrients down to bottom-dwelling creatures, have all but disappeared. Fishermen regularly brag about catching striped bass in mid-November.

Narragansett Bay's natural timing is out of sync.

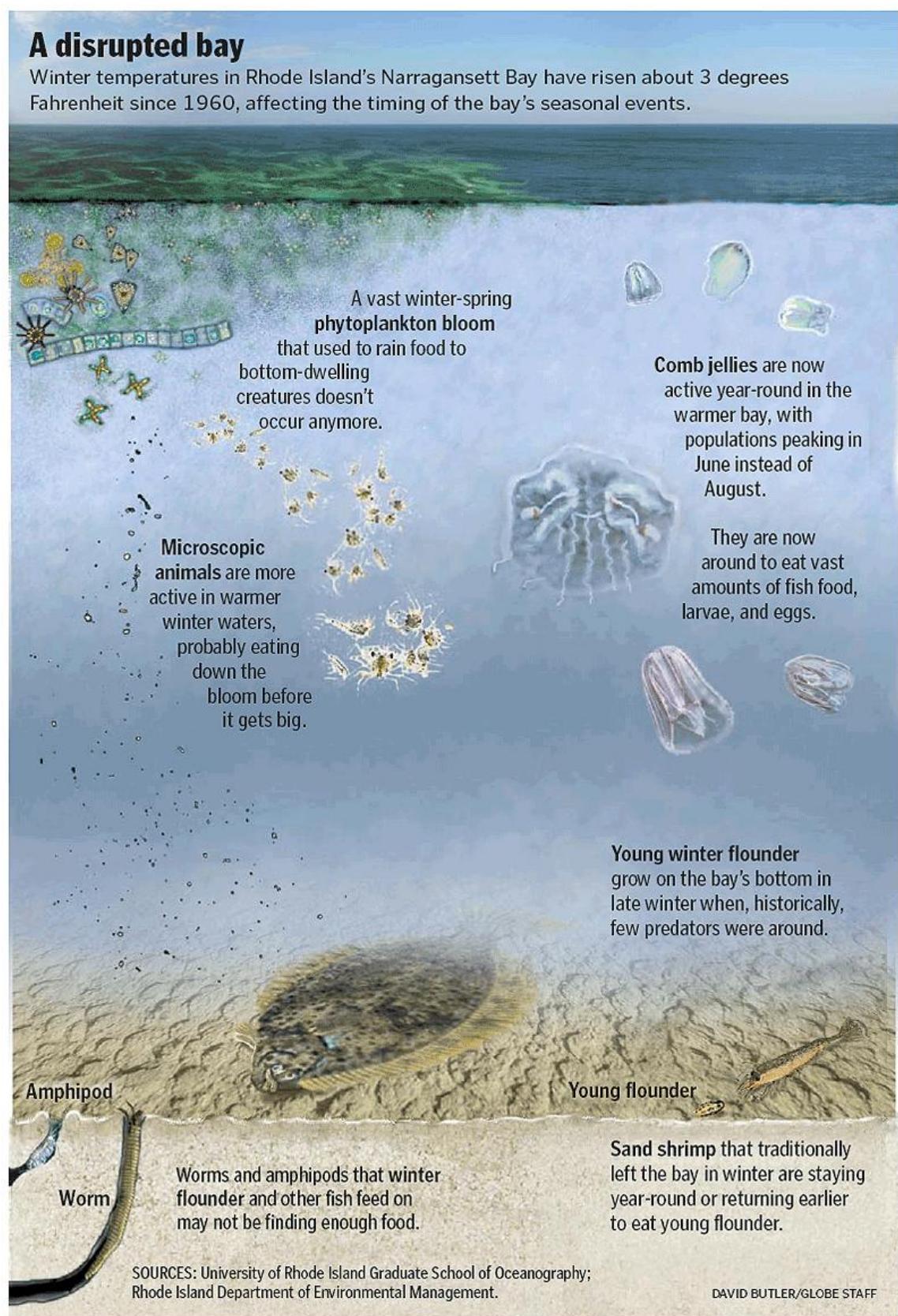
The bay's average annual water temperature has increased about 2 degrees Fahrenheit since 1960, and in winters it has warmed about 3 degrees. There is growing evidence that the temperature changes are breaking down carefully evolved relationships among species and disrupting the vast food web the bay depends upon.

Critical seasonal cues are misfiring, delivering new food sources to some species and new predators to others. A shrimp that traditionally migrated to warmer waters in winter is now staying year-round or returning earlier to eat young cold-water flounder. Luminescent jellies are also staying through the winter, meaning that their populations peak in spring rather than summer, exactly when fish larvae and eggs are plentiful. Scientists fear that the voracious jellies could be reducing fish populations and competing with them for food.

"The temperature change may not seem very big, but it gets amplified in the food web," said Jeremy Collie, professor of oceanography at the University of Rhode Island.

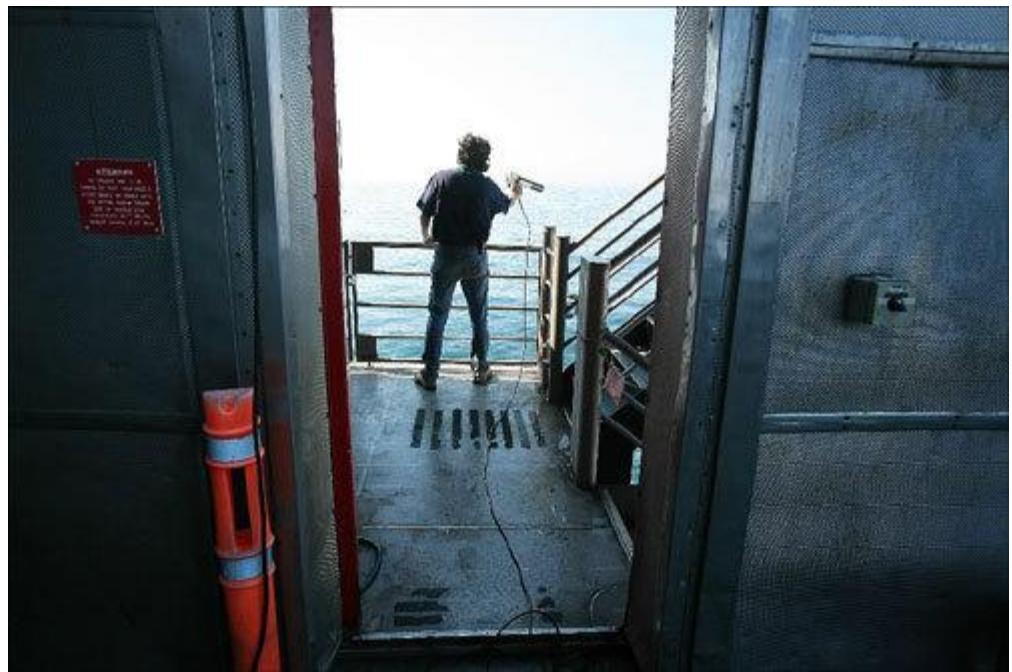
The multitude of changes taking place in Narragansett Bay illustrates a critical lesson as the world warms: Large ecological change may come from the smallest break in the food chain.

The bay's winter warming roughly parallels a 4.4-degree rise in New England's average winter air temperature since 1970, a trend scientists ascribe, at least in part, to the release of heat-trapping carbon dioxide from power plants, vehicles,



and factories. Scientists deduce that the warming of Narragansett Bay is tied to this trend because they know that estuaries and bays are heavily influenced by air temperatures. Other partially enclosed coastal waters, such as Woods Hole and Long Island Sound, have also warmed during the same period, giving researchers confidence the warming in Narragansett Bay is not an anomaly.

The bay is also one of the places where researchers would expect to see the effects of warming first, because it is on the dividing line between southern and northern waters. In the summer, the bay is flooded with migratory species attracted to its warm water, some near the northern edge of their range. In winter, the waters are dominated by resident bottom-dwelling fish, some near the southern edge of their range. As a result, many of the species are vulnerable to temperature changes.



Because URI's Graduate School of Oceanography is located on its shores, the bay has some of the best long-term scientific records of temperature, fish abundance, and algal blooms in the Northeast, allowing scientists to document changes over time. Already, they have seen a sharp decline in commercially valuable northern fish species such as winter flounder and a rise in traditionally less-prized southern fish such as scup, and those changes cannot be explained by overfishing alone.

Disappearing food supply

Standing firm against 2-foot seas rocking a research boat a mile off Wickford, URI graduate student Jason Graff threw a red bucket overboard. Tugging on a heavy rope attached to the bucket, he hauled up a water sample and knelt to pour the water carefully into bottles that would later be measured for phytoplankton, or microscopic plants, and other barometers of the bay's health.

Almost 40 years of such weekly samples gave researchers one of their first hints that the bay was changing. A late-winter phytoplankton bloom long formed the foundation of the bay's food web. As days got longer and sunlight increased, the bloom would grow to cover almost the entire 25-mile-long bay. By early spring, the bloom would die naturally, and organic debris would settle to the bay's bottom, where creatures such as worms would feed on it and in turn become meals for fish such as winter flounder.

In the 1980s, the winter bloom stopped growing as large, and by the late 1990s it was all but gone. In temperature-controlled tanks at URI, marine biologists figured out why: It is being eaten.

Tiny marine animals called zooplankton are normally sluggish eaters in the winter. But researchers found that even a 1.4-degree increase in water temperature caused them to be more active in the tanks and to eat more, curbing the size of the bloom. Today, a longstanding summer phytoplankton bloom has become a more important food source, but it mostly feeds migratory, warm-water fish species, such as scup and bay anchovies. Without a significant winter bloom, the cold-water fish may be missing their meal.

URI oceanographers hope to identify other changes from the bucketfuls of water students scoop out of the bay every Monday morning from the deck of the 53-foot Cap'n Bert. Among the questions: Are new types of microscopic marine plants or animals moving in that could further change the timing of the bay's food supply? "The winter bloom is as important to the bay as grass and leaves are" on land, said David Borkman, a URI marine research associate. "It's the beginning of the productive part of the year, it gets the ball rolling ... and it doesn't happen anymore."

Predator stays in winter

Times are not good for Narragansett Bay's winter flounder, once a prized catch of Rhode Island fishermen.

New England populations of the tasty flat fish plummeted in the 1980s, partly from too much fishing. While the stocks have recovered in some places, they have not in the bay: Winter flounder populations there are now only about 10 percent of what they were before the crash.

A one-two climate punch is probably why. The flounder may not be getting enough food because of disappearance of the winter phytoplankton bloom. And now, the warming bay has fostered a new predator. The flounder has long had a winning strategy for survival: the cold. Young flounder grew in the cold waters on the bay's bottom when few predators were around. By the time hungry predators showed up when waters warmed, the fish were big and fast enough to escape.

Now, an aggressive sand shrimp called crangon is waiting for those juvenile flounder, no bigger than a pinkie nail. The shrimp has traditionally moved to warmer waters when the bay's temperature dipped. But in recent years the water has been warm enough for them to stay year-round or to return earlier to the bay and feed on whatever they find.

If the warming continues, scientists say, it is unlikely that winter flounder, already near the southern edge of its range, will bounce back in Narragansett Bay.

Uncertainty for fishermen

At the start of this decade, Rhode Island fishery biologists realized that other bottom-dwelling fish were disappearing from Narragansett Bay, too, including species no fishermen wanted: hogchokers, oyster toadfish, and grubbies. That meant that overfishing could not be the only reason, and persuaded researchers that the bay's temperature rise was probably driving the decline. In addition, scientists noticed an increase in species that like warm water, such as summer flounder, black sea bass, scup, and squid. There aren't fewer fish in Narragansett Bay overall, but the players have changed.



And some fishermen say the rules about catching them need to change too. "Global warming is changing habits in the bay, and fishing quotas have to be adjusted to deal with it," said Richard Fuka, president of the Rhode Island Fishermen's Alliance. Fuka said state officials need to relax limits for species that are becoming more abundant.

State officials said quotas were adjusted upward in 2005 to account for the increasing number of scup, black sea bass, and summer flounder. They said they are being cautious about further quota increases to make sure that overfishing does not begin anew.

If Narragansett Bay continues warming at the same pace, water temperatures could climb nearly another 4 degrees by the end of the century. While scientists say the bay is not going to die, its ecology will continue to evolve.

For fishermen, that means uncertainty, and that can translate to lost income. "A fisherman's logbook is like a set calendar, things always happen within a week of when it happened before," Fuka said.

That is what fishermen base their livelihood on, he said. "But now, it's like having a misguided calendar."

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