

The Submerged Subway Reef

Despite environmental concerns, artificial reefs made from subway cars may soon provide a habitat for reef fish along the Mid-Atlantic Coast

By Harald Franzen

For the past half year, New York City's Metropolitan Transit Authority (MTA) has been shopping around an unusual proposal: the agency wants to find locations nearby to sink 1,300 aging subway cars into the ocean. The cars, they hope, will serve as artificial reefs and attract marine fauna to the barren, sandy, submarine slopes off the Mid-Atlantic coast. Several environmental groups have voiced concerns over the effectiveness and possible dangers of the project, but preparations are nonetheless under way to begin submerging the first cars in mid- to late August.

In fact, the idea is not entirely new. People have

built artificial reefs off the Atlantic coast since the 1830s, according to Jeff Tinsman, the reef program manager for the Delaware Department of Natural Resources and Environmental Control. "I guess they recognized that natural or accidental shipwrecks made good fishing grounds, so that was the first attempt to make and submerge wooden structures, which would attract and support reef fish," he says. Mussels, mollusks and other crustaceans attach to the large structures and spur the growth of underwater grasses, worms and other organisms. The structures also offer shelter to small fish and other marine life.

Over the years, people have experimented with a variety of reef materials, ranging from rubble and concrete to old ships, tanks, refrigerators, cars, tires and so-called reef balls—hollow concrete spheres containing many holes. This kind of starter reef is especially important off the mid-Atlantic shoreline. "New England has its rocky coast; tropical Florida and the Gulf have some coral reef. We have nothing like that," Tinsman says.

Scientists, fishermen and environmentalists all refer to the sandy slopes off the mid-Atlantic as a submarine desert. Most agree that creating artificial reefs is a good idea, but they are divided on how to do it. The Gulf States Marine Fisheries Commission defines four criteria for artificial reef material: function, compatibility, stability and durability. "If money weren't an object, probably granite stone [would be the perfect reef-building material] because it's natural," Bill Muir, regional oceanographer at the Environmental Protection Agency's Philadelphia office, says. But money is an object—and New York City's old subway cars are free.



Image: HARALD FRANZEN/ScientificAmerican.com

STRIPPED OF SEATS, light fixtures, ad banners and lead paint, the submerged subway cars will be difficult to recognize. Windows and doors will also be removed, to prevent divers from getting trapped inside.

ocean floor. In the process, the transit authority would save an estimated \$11 million to \$13 million in disposal cost, Zacchea says. "Clearly the number of cars raised some eyebrows, particularly because New York was going to save so much money by dumping them into the ocean," says Cindy Zipf, executive director of Clean Ocean Action, an environmental advocacy group based in New Jersey. "That sort of sends up a red flag that there's a little bit of a disposal factor here."

Still, several states were immediately interested. "If somebody comes to you and says, 'Do you want 1,300 subway cars and we'll put them on the site—free,' that's tough to turn down," says Dery Bennett, executive director of the American Littoral Society, a coastal conservation group. Artificial reef building is largely privately funded, and the New York subway cars offered an opportunity to increase the current artificial reefs considerably. These reefs attract recreational fishing and diving and consequently bring business, boosting the local economies.

The MTA initially proposed the plan last September, and the New Jersey Department of Fish and Wildlife offered to take 650 cars. When it became public that the cars contained asbestos, however, New Jersey eventually backed out. In April, the state's acting governor, Donald DiFrancesco, said, "While I strongly support the artificial reef program, I believe we must err on the side of safety and the environment." Maryland volunteered to take the cars intended for New Jersey but then turned them down as well. In June, Delaware decided to take 400 of the cars, and according to Zacchea, plans are under way to begin sinking them there in mid- to late August.

"We learned about the asbestos-containing materials that were in the cars and began raising concerns," Zipf says. "We felt that in light of the lack of real assessment and in light of the fact that there have been studies that raise concerns about asbestos in aquatic life, the project should be withheld until we establish a good standard."

Kristen Milligan, a staff scientist at Clean Ocean Action, agrees. "If we inhale or ingest asbestos fibers, they can get lodged in our tissue, and that forms lesions and then can lead to [cancer](#) or emphysema or corrosion of our membranes," she says. "The same things can happen to marine life."

Muir does not see a risk from the subway cars. "Since it's not airborne, is it as much of an issue? The answer is no," he says. "When they did studies on [water](#) impacts from asbestos, it took hundreds and hundreds of millions of fibers per liter to see lesions in fish. We've had that happen, by the way, in an asbestos mining operation in the Midwest. We found some lesions in fish. But we're talking about thousands of times higher concentrations than our regulatory limit." That limit—seven million fibers per liter—is the drinking water standard. When Muir investigated a sunken ship that contained asbestos, he found a concentration of 100 fibers per liter. "That's roughly a million times below what it would need to be for actual aquatic impact," he says.

But environmentalists like Zipf believe that ships and tanks, which corrode much more slowly than the subway cars, are not a valid point of reference. "It's just apples and oranges," she says, "to compare that exposure to marine life to quickly-corroding subway cars where the actual asbestos-containing material becomes the structure on which the [animals](#) are growing." According to Muir, the asbestos-containing material is unlikely to dissolve or enter the food chain. "Normally you think of asbestos in terms of these flaky ceiling tiles or powdery white substance," he says. "In the case of the subway cars, think in terms of black asphalt material. It's not friable unless it were ground up and a torch was put to it. There is no mechanism really for it to be released."

Reef builders experimented with objects such as automobiles and refrigerators in the past but found that they lasted for only three to four years, which hardly made them worth the effort. Tanks and ships are expected to last for centuries, whereas subway cars fall somewhere in between. Based on a study of five Philadelphia subway cars placed offshore in 1990, researchers predict the steel structures will last about 20 years before collapsing entirely.



BLUE MUSSELS and other mollusks are key players in artificial reef ecosystems.

Environmentalists say that's too short. "Are we trying to restore a breach in a tropical coral reef, which we might expect to live for thousands of years, by placing limestone in the breach? No, we're not," Tinsman says. "We're trying to support a blue mussel community. These are very, very short-lived organisms. Every year this community is renewed by settling of new, juvenile mussels. It's not something where we're waiting for decades for coral heads to grow on this material. This is a different kind of community, and we consider the subway cars to be perfectly adequate for a reef material, despite the criticism we've gotten."

Environmentalists believe that putting subway cars in the ocean despite their comparatively short life expectancy could eventually blur the line between reef building and the mere disposal of metal junk in the ocean. "We support biologically defensible artificial reef materials that mimic natural ecosystems and provide a long-term biological community of substance," Zipf says.

One question that was largely overlooked in the entire controversy was whether artificial reefs should be created at all. Many fishing groups supported the reef-building efforts, arguing that more reefs and therefore more habitat would lead to more reef fish, but that may not be the case. "It's obviously beneficial to the person who has a boat that makes money renting space on the boat to catch fish. And it's of benefit to the person that has a private boat and wants to catch fish," Bennett says. "The question is whether it's good for the fish, and I don't think we know the answer."



THE TAUTOG, a reef fish found commonly along the Mid-Atlantic coast, is very popular with recreational fishermen.

To really enhance the population would require far greater effort. "You'd have to come up with better nursery habitats, cut down dredging, probably put up more different types of reefs and wetlands protection in the small estuaries all along the Mid-Atlantic and cut down on the commercial fishing," Muir says. "Those are two hard sells."

"There's a difference between what we call FADs—fish-attracting devices—and pure artificial reefs, where you build a population of organisms on the reef," Muir explains. Small, insular reefs tend to function as FADs, making it easier for fishermen to find and catch the fish. Although more reefs probably won't add more fish, Muir says they may still help to protect the [animals](#) from overfishing to some extent. "I don't believe the artificial reefs are going to dramatically increase the adult population. What it's going to do is spread it out a little bit," he says. "It will just be harder to catch them all. You're not increasing the population of fish because it's not targeting the juvenile or the nursery habitat."



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1,300 "REDBIRD" SUBWAY CARS may soon find a new home on the ocean floor.