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Fish Out of Water

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Forget what you've heard about farm-raised fish. Today, healthy, fresh fish are coming inside, and someday your grandkids may find the idea of eating fish from the outdoors as quaint as buffalo hunts. Meet the farmers who are building a better fishbowl.

Photo by Travis Rathbone. Click for larger image.



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DARA MOSKOWITZ GRUMDAHL, MAY 2013

In a brown single-story warehouse just northeast of St. Paul, Minnesota, thousands of fish swim around in tanks the size of VW buses. Most of the fish are tilapia, but they're hard to see, as their "fishbowls" are opaque and covered. "If you want to see the trout, we can make them jump," says Dave Roeser, climbing a small half-staircase next to the pond, a rectangular tank that would be at home on the back of a 16-wheeler. He scatters a handful of fish food into the water, and its black surface roils with foot-long rainbow trout jumping over each other to get a snack.

Roeser's company is Garden Fresh Farms, and the fish tank for the rainbow trout is supplied with the cold water that comes out of a Minnesota water system in the winter. Trout need cold water, which holds more oxygen; when the water warms, it gets piped over to the tilapia, tropical fish that need warmer water. Waste in the water is then converted by beneficial bacteria into nutrient-rich water, which is then streamed through hundreds of specially directed PVC pipes to feed tens of thousands of heads of lettuce and herbs. The plants clean the water and it is returned to the fish to renew the process again. The produce is all destined for local Minnesota cafeterias, restaurants and food-service establishments. Roeser has a customer for each head of lettuce in this nondescript warehouse, which he bought 10 years ago for his previous business: a candy-making company.

Every now and then, Roeser and his son, a biologist who makes all the organisms work in harmony, put on their less-than-best clothes and gut a pile of fish for their customers. "We're looking into other labor options," Roeser says, wryly. He is currently taking out a lease on other sites for their urban farm concept, with one in St. Paul and another adjacent to downtown Minneapolis. There are similar operations currently raising thousands of fish in or near the downtowns of Chicago, Milwaukee, Cleveland, Sacramento and other cities not known for their fish and seafood.

It might seem strange, but there's a lot of strange in the world of fish and seafood right now. We've either reached or are coming close to reaching the hinge-point in human relations to fish: For millennia, people caught fish in oceans, rivers and streams—in nets and with hooks. By some accounts, we now get more fish from fish farms than from the wild. And the reason no one knows whether this history-making hinge happened last year or this year or whether it will happen next year is because China keeps revising its numbers, and it's now the top fish-farming country in the world. But whatever the precise date, the trend is unmistakable: Fish used to be a wild food, and now it's a farmed one.

Fish farms take on many shapes, but most of them are net pens of various sizes in coastal bodies of water. In Canada, for instance, vast salmon net pens now dominate the Bay of Fundy; in 2009, the latest year for which information is available, Canada sold about \$800 million in farm-raised fish. It's about 26th in the world. The

Fisheries and Agricultural Organization of the United Nations estimates that world aquaculture production in 2008 was 52.5 million tons, with a worldwide market value just shy of \$100 billion. If you grew up with a vision of fish as coming from guys in yellow rainslickers standing on windy boat decks, it's time to revise that. And just as aquaculture is exploding as a market and an international economic force, it's also imploding, plagued by potentially catastrophic problems of pollution and disease.

Most aquaculture operations today follow a fairly simple structure: The fish are born in hatcheries, then transferred to net pens in bays or fjords that present reasonable protection from the battering storms of the open ocean. The fish are fed in those pens and eventually scooped up. Unfortunately, the idea that oceans are big enough so that any pollution would be destroyed by dilution hasn't panned out, and foodwaste and fish excrement have led to profound seabed pollution, which has been implicated in other wild species die-offs around the world. And the heavy concentration of fish in pens, especially salmon, has resulted in disease—most notably contagious infectious salmon anemia and the blood-sucking sea lice parasite. As if that's not unpleasant enough, these infestations have led to mass deaths of farmed fish, sea lice infestations of wild fish and pesticide- and antibiotic-pollution.

Salmon have evolved over millions of years to be especially well adapted to their particular streams, rivers and bays, and they are imbued with biological triggers in their DNA that tell them where to go and how. Now, however, each year a few million salmon escape from their net farms—salmon that have been raised to do nothing but breed easily and gain weight fast. Imagine turkey-farm turkeys suddenly breeding with bald eagles, and you'll get some sense of the worry. These catastrophic developments are leading to perhaps the strangest twist of all: This relatively new billion-dollar fish and seafood industry is about to come onshore and into the city—or at least into the suburbs.

## AQUAPONICS 101

Modern farmers are using nature to do their work for them.

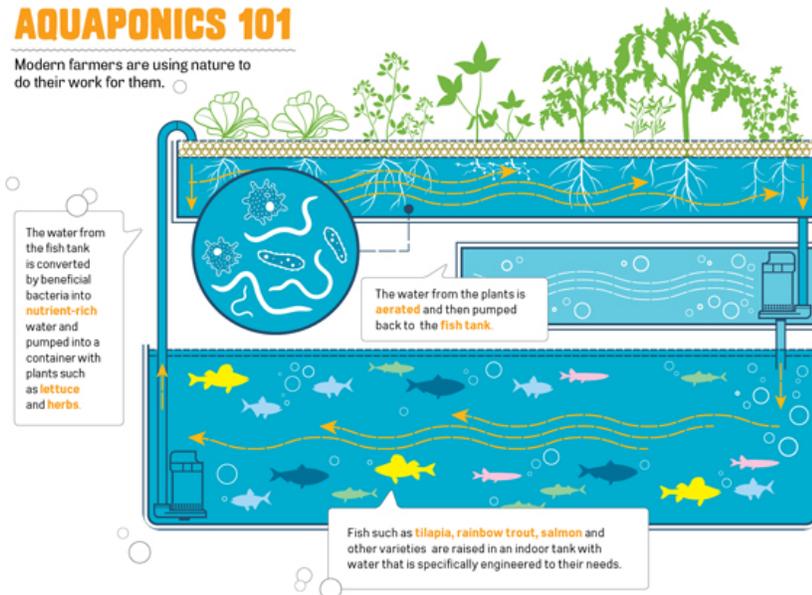


Illustration by Jameson Simpson. Click for larger image.

"The ocean, that old mule, is dead—it just hasn't fallen over yet," says William R. Martin, CEO and president of **Blue Ridge Aquaculture**, an inland Virginia-based aquaculture company. The strange, awful news of ocean overfishing has reached the general reader in scattershot ways: Many remember in the 1990s when Canada closed the Georges Banks cod fishery, among the most abundant cod fisheries in the world, to allow populations to rebuild. Fewer are aware, however, that it never came back. The same sad story is currently under way in Maine. Atlantic salmon are extinct in more than 40 percent of their range. Bluefin tuna are functionally extinct, with the latest stock assessment concluding that the catch has now decreased by 96.4 percent. In 2006, a meta-analysis of various fish assessments published in the journal *Science* warned that most of our fish food species will be in total collapse by 2048.

Not that there aren't good-news stories in the world of fish: Take, for instance, the New England lobster fishery that is managed with input from almost 10,000 license-holders as if it were a bank account, leaving the capital and removing only the interest. But anywhere the principal (so to speak) can be removed by unregulated actors from different countries, it tends to disappear. "The writing is on the wall, and it's been on the wall for a long time," Martin says. "I'm not an environmentalist by nature, I'm an environmentalist because it makes me a better capitalist. We can't just throw away water and other resources anymore. They're going, going, gone."

For 30 years, Martin has been developing what he believes to be the best way to raise fish anywhere. This year, Martin's company is building an 80,000-square-foot facility between central California and northern Nevada, where it will raise millions of pounds of fish and shrimp. The facility will house a closed, recirculating system of tanks to mirror the natural world: fish on top, shrimp on the bottom, beneficial bacteria and special strains of algae acting as filters at every stage. "Nature turns waste into assets," Martin explains. "And it does it without antibiotics and chemicals and hormones and all this madness. That's what we do, too. Put a farm outside and, of course, you're going to catch a disease from everything that swims by."

Disease and parasites are obviously part of nature, too, a natural limit to population explosions. Fish raised in indoor hatcheries, however, don't catch diseases from outside fish. Right now, the Scottish company [FishFrom](#) is building a facility in Scotland that will raise 800,000 salmon a year indoors, feeding them a sea critter called ragworm that's raised on-site and recycling 99.8 percent of the water used. The first indoor, wholly contained system-raised Scottish salmon are scheduled to reach the market in summer 2014. Near Port McNeill, on the northern edge of Vancouver Island, the 'Namgis tribe has built a closed-containment salmon facility to raise 2,000 metric tons of salmon a year. There are similar projects happening all over the world; [Grace Village Aquaponics](#) in a rural Haitian village is even raising tilapia and vegetables to feed orphaned children and the elderly. "We're where the chicken industry was 40, 50 years ago," says Martin, who sees a future America dotted with inland, completely closed containment aquaculture systems. "We're just going to do it better than the chicken folk did. Better especially in terms of managing the waste stream of highly concentrated animals. Fish waste, as anyone who haunts garden stores knows, is highly prized for its ability to super-charge garden produce."

The old stockyards of Chicago are not traditionally associated with live fish and garden-fresh pesto. That may change because of [The Plant](#), an old meat-processing plant in the city that industrial designer John Edel is using for closed-system aquaponics. The Plant, an enormous 93,500-square-foot building, houses five farms, two bakeries and one brewery. Edel's section is filled with tilapia, one of the easiest fish to raise indoors, and garden produce such as basil, lettuce and kale. "This is a project that seeks to close loops," Edel says. "Energy loops, material loops, money loops, labor loops—if the loops are closed, that's a sustainable system." The Plant is powered by an anaerobic digester, a 220-foot-long vessel that takes in food waste from neighboring industries and grocery stores and turns it into electrical power. The digester is fed by waste that Edel is paid to haul away from nearby meat-processing plants and food manufacturers. The power goes to grow lights that shine on garden greens that grow on the waste from some 2,000 tilapia. "We've been doing this for about four years now," Edel says. "It works. So we're getting ready to scale up and introduce prawns and perch."

[Nelson and Pade, Inc.](#) is one of the United States' leading design-build aquaponic engineering firms; co-founder Rebecca Nelson says her firm is helping small- and large-scale aquaponic growers set up shop all over the country. "In this whole country, I'd estimate we have less than 15 acres of aquaponics," that is, plants grown using fertilizer from living fish. "But I'd guess that will double in two years, and double again after that. I think that in 10 or 15 years most urban areas will have aquaponics facilities in the city or just outside it, growing everything that doesn't ship well—butterhead lettuce, red and green leaf lettuce, fresh herbs, tomatoes, you name it." Nelson is currently working on large aquaponic facilities being constructed in Tennessee, Iowa and Wisconsin.

Another benefit of these new fish farms, or fish and produce farms, is that they can fit into otherwise low-value existing real estate. At another location in St. Paul, a company called [Urban Organics](#) is putting an aquaponic fish farm into the long-abandoned Hamm's Brewery, a vast brick structure that turns out to be perfect for a fish farm because of the floor drains and sturdy construction that once supported massive brewery tanks.

"We have a former meatpacking plant," says Edel of The Plant in Chicago. "And a former meatpacking plant is ideally suited for raising plants and fish—there are floor drains everywhere, nonporous surfaces, stainless steel elevators, a floor-loading capability that can handle giant tanks and poured concrete [construction], which doesn't have a problem with rotting. But this was very standard industrial construction in the United States, starting around 1910. There are lots of buildings of very low value in and around almost every older American city, and if the question is how can we repurpose vacant or derelict buildings for today, one good answer is to recycle them into aquaponic structures."

And it's not just urban structures that can be made into fish farms; they can also be found in the rolling hills of the bucolic countryside. [Future Farm](#), in Baldwin, Wisconsin, is a 27,000-square-foot greenhouse and tilapia operation that began as a way to recapture the heat generated by the farm's dairy operations; today, fish, lettuce and cows interact happily. In New Windsor, just up the Hudson River from New York City, [Continental Organics](#) is building a 900,000-square-foot facility to raise fish and vegetables for New York City—yes, the city that was founded where it was because of the ocean harbor.

And if that's not strange enough, these aquaponic systems may next be coming inside, to your kids' room. In 2009, entrepreneurs Alejandro Velez and Nikhil Arora started [Back to the Roots](#), a company that makes mushroom-growing kits out of old coffee grounds. To date they've sold more than 300,000. This Christmas, the company is marketing a new product, a home aquaponics garden with a goldfish below and pots of herbs fed by the goldfish waste above. There may even come a day when your grandchildren find it strange indeed to hear about a world in which wild fish were hunted to extinction, a time when goldfish bowls were cleaned by kids, rather than monetizing the waste stream. //

*Dara Moskowitz Grumdahl is a James Beard Award-winning writer and senior editor of Mpls.St.Paul Magazine and a frequent contributor to Saveur and Bon Appétit. She lives with one husband, two kids and a herd of My Little Ponies.*

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## ◀ PREVIOUS

### SPILL IT: TELL US WHAT YOU THINK!!

[Arthur King](#)

Very well observed. Thanks.

5/25/2013 9:38:14 AM

[Janean Kelly](#)

I loved this article and am sending to sister as suggestion for her on how to use her old building.

5/29/2013 8:47:01 PM

[Una Collins](#)

I am doing market research on urban aquaponics farms as a sustainable business here in Buffalo NY. We have one such farm, MAP, which seems to be a success in that they are also a 501c3, catering to the community at risk. Buffalo is in need of more programs like this because we are an impoverished city. We have too many children starving here and not enough programs to support the families in need.