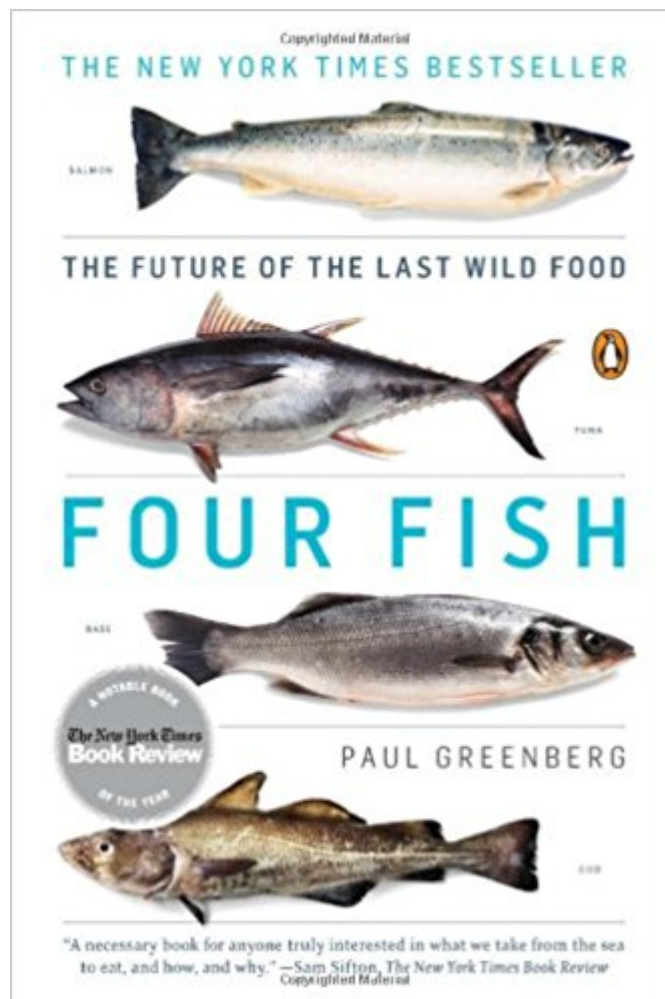




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# Four Fish: The Future Of The Last Wild Food



## Synopsis

"A necessary book for anyone truly interested in what we take from the sea to eat, and how, and why." -Sam Sifton, The New York Times Book Review. Writer and life-long fisherman Paul Greenberg takes us on a journey, examining the four fish that dominate our menus: salmon, sea bass, cod, and tuna. Investigating the forces that get fish to our dinner tables, Greenberg reveals our damaged relationship with the ocean and its inhabitants. Just three decades ago, nearly everything we ate from the sea was wild. Today, rampant overfishing and an unprecedented biotech revolution have brought us to a point where wild and farmed fish occupy equal parts of a complex marketplace. Four Fish offers a way for us to move toward a future in which healthy and sustainable seafood is the rule rather than the exception.

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## Customer Reviews

Paul Greenberg on Four Fish: Fix the Farm, Not the Salmon When the New York Times reported in June of 2010 that the US Food and Drug Administration was seriously considering approving a genetically modified Atlantic salmon for American consumption the cries from environmentalists and food reformers were, predictably, almost audible on the streets. The AquaAdvantage® Salmon uses a genetic on-switch from a fish called an ocean pout (a very different animal) in combination with a growth gene from a Chinook salmon to achieve double the growth rate of the unmodified creature. The animal's creator, AquaBounty Technologies of

Waltham, MA asserts that the fish will be sterile and grown in out-of-ocean bio-secure containment structures. Nevertheless the emotional worry of genetic contamination of wild fish, the public preoccupation with health risks a modified salmon could pose, and just the overall ick-factor consumers seem to have about GMO food were all on display across the foodie and environmental blogosphere a few days after the Times article ran. But, curiously, perhaps the loudest groan that I heard in response to the AquaBounty successes came from salmon farmers. “What I have been noticing over the years,” • Thierry Chopin, an aquaculture researcher based in New Brunswick, Canada wrote me, “is that the aquaculture industry is not jumping to embrace what AquaBounty has been proposing.” • For years salmon farmers have been waging a public relations war, trying to gain legitimacy as an industry that could be both profitable and produce more food for a hungry world. When a paper published in the journal Nature in 2000 revealed that it took more than three pounds of wild forage fish to grow a single pound of farmed salmon, the salmon industry responded through selective breeding, increased use of soy and other agricultural products and more efficient feeding practices to lower the wild fish use of farmed salmon to the point where some farms claim to have achieved a fish in-fish out ratio of close to 1 pound of wild fish for 1 pound of farmed salmon. When diseases like infectious Salmon Anemia and parasites like sea lice began to run rampant on salmon farms around the world, some regions, like the Bay of Fundy in Canada, instituted better fallowing and crop rotation practices and appear to have had some success in breaking disease and parasite cycles. But in spite of these improvements, a single mention of transgenic salmon in a major media outlet is enough to spoil whatever gains the industry has made in public perception. Indeed, many lay-people I talk with have the impression that transgenic salmon are already a regular part of the farmed salmon market, this despite the fact that there are still no transgenic salmon sold in the United States or anywhere else that I’ve encountered. Don’t get me wrong. I sincerely do not believe that the salmon industry has solved its environmental problems. But I do think that it suffers an unfair association with the AquaBounty project and that genetic modification distracts from what investment and research really needs to address. The two biggest problems with farming salmon are: 1) Salmon are grown in sea cages, often anchored amidst wild salmon migration routes. This can cause the fouling of waters with wastes and the transmission of diseases and parasites to already seriously threatened and endangered stocks of wild salmon. Selectively bred fish regularly escape and some suggest they may interfere with the lifecycles of wild fish. Even worse, entirely different species of salmon are often raised in non-native environments. Atlantic salmon are regularly farmed in the Pacific and often escape. 2) Farmed salmon consume a huge amount of wild forage fish. Even though feed efficiency on a per fish basis

has improved dramatically, salmon farming overall has grown so much that the per-fish efficiency has been all but erased by a much larger overall presence of salmon farming in the world. Atlantic salmon, once limited to the northern latitudes of the northern hemisphere, are now farmed on every single continent save Antarctica. It's possible farmed salmon escapees may have even reached that most southerly redoubt. Salmon farms exist as far south as Patagonia, South Africa and Tasmania. So what is the way forward and how do we deal with this transgenic issue? If I were tsar of all salmon farming and could redirect investment money at will, I might take all of those dollars that go into transgenic research and put that money into really confronting the problems that plague the industry. I might look to developing efficient, above ground, re-circulating aquaculture systems. These facilities allow fish to be grown in temperature-controlled environments without any interaction with the wild. Disease transfer and genetic pollution are greatly reduced if not eliminated altogether. Yonathan Zohar a professor and Chair of the Department of Marine Biotechnology at the University of Maryland Baltimore County's has created a test facility right in downtown Baltimore that grows an array of species and even manages to recycle the fish wastes into fuel-grade methane gas that can be used to run pumps or heat water. Though these systems are energy intensive the ability to build them in proximity to markets lessens food miles. Furthermore recirculating systems offer precisely controlled growing conditions and can bring fish to market in half the time as open sea cages. I might also try to expand on the work of Thierry Chopin who is piloting a program of Integrated Multi-Trophic Aquaculture or IMTA where mussels, edible seaweeds, and sea cucumbers are grown in conjunction with salmon in a complex polyculture. Rather than just trying to make an artificially efficient modified salmon, Chopin is trying to make a more efficient system where multiple crops radiate out from a single feed source. Because mussels, sea cucumbers and sea weed can all metabolize the wastes from salmon, they have a potential to neutralize and reuse the effluent that has plagued salmon farms in the past. Another place I might put my salmon dollars would be the development of alternative feeds that are synthesized from soy and algae and might eventually obviate the need for using wild forage fish in salmon feed. Finally, I might consider investing in a different fish altogether. Some critics of the aquaculture industry believe we should do away with the farming of salmonids altogether. But to my eye, there is a very entrenched market for salmon flesh and we might be better served finding a different salmon-like fish that has a smaller footprint. The most hopeful alternative I've come across is a fish called the arctic char. The arctic char is from the same taxonomic family as salmon, has pretty good feed conversion ratios, rich flesh, and most interestingly of all, because it frequently finds itself crammed into close quarters when its natural arctic lakes freeze, it has high disease resistance and takes

extremely well to high stocking densities—densities that are necessary to make out-of-ocean aquaculture operations profitable. And this is exactly what's happening with char. Most are grown in re-circulating, above ground tanks in Iceland and Canada. Of course some people will never embrace a farmed solution for fish. There is a camp that feels very strongly that farmed fish are uniformly bad for the world and inferior on the plate. I have to confess that I don't always share this opinion. Arctic char strike me as a good environmental compromise and to my palate, they're pretty tasty. --Paul Greenberg

In this unusually entertaining and nuanced investigation into global fisheries, New York Times seafood writer Greenberg examines our historical relationship with wild fish. In the early 2000s, Greenberg, reviving his childhood fishing habit, discovered that four fish--salmon, tuna, bass, and cod--"dominate the modern seafood market" and that "each is an archive of a particular, epochal shift": e.g., cod, fished farther offshore, "herald the era of industrial fishing

Four Fish makes fish INTERESTING—and I don't even eat fish! The four fish that are investigated are the Tuna, the Salmon, the Bass, and the Cod—the four fish that dominate the menus at fancy restaurants and fast food chains and family dinner tables. The underlying premise is that globally we are overfishing. We are harvesting more fish every year than are produced. In some cases we have less than 10% of the fish that were there when commercial fishing started. This is obviously not sustainable. For each of the four fish, the book discusses what attempts are being made to solve the problem, and the pros and cons of each method. Some advanced genetic techniques are working to a degree (implants that release hormones so that fish will spawn yearlong and not just all at the same time once a year, and breeding fish that can gain weight at quadruple the rate of the original versions, etc). A lot of people have tried farming the fish, some species are more successful than others. Some of the fish are more sustainable than others, and Greenberg makes the case that we need to choose our "everyday" fish from the fish that are plentiful and easy to raise and which can turn a high percentage of their feed into pounds of meat, and to consider the other fish to be "special occasion" fish. For example, it can take over TWENTY pounds of feed for a bluefin tuna to produce one pound of meat. This is not a good trait for farmed fish, and it also makes tuna inappropriate as a main source of wild caught meals for us. Regular salmon takes up to six pounds of feed to produce a pound of flesh, while breeders have improved farmed salmon to the point where it takes as few as three pounds. This is obviously much better for the environment and the world of "fish as food"—and more sustainable. Yet,

the amount of salmon consumed has doubled over the last 20 years, and we are not able to keep up with the demand. Sea bass also requires almost three pounds of feed for every pound of flesh. Another way to solve this problem would be to select the fish we eat based on how easy they are to farm, and how efficiently they turn feed into flesh to enable us to have the 2.2 billion pounds of fish that is consumed annually without depleting the resources. Greenberg's book is compelling and concerning. Destined to become a classic like the iconic Cod!!

We who like to fish often focus on the fragile nature of the balance between keeping and releasing, of conserving both the fish and the environment they live in, of getting access and protecting our rights. I wonder how many of us understand the dire straits the fish of this world are in? This book doesn't discuss flies or lures or trips to New Zealand for trophy brown trout. It expands the reader's view to the broader picture, the crisis that faces the fish, the world and each of us. The author is not a hysterical zealot raging against the injustice of it all. Rather he presents a scientific and scholarly discussion of where we are all heading with regard to fish as a food source in a very readable and entertaining way. As we lobby to protect our recreation, we better also pay attention to this topic, as once our fish are needed to feed the world, priorities are bound to shift and we will be left with tofu and stories of the fishing that once was.

I loved it, as the 5 stars indicate, but it is a very scary scenario. SALMON, BASS, COD and TUNA...pay attention! The world's fish are not theoretically being depleted and/or erroneously farmed. This has been happening for decades to humanity's loss! This does for fish in what Michael Pollan's book *The Botany of Desire* did for four plants. The scary thing is that fishing cannot be controlled by the US, as the bigger fish travel across the oceans. Other fish like wild salmon are being depleted, while the farming of Salmon is ruining the environments where it is taking place. Other nations are demanding their "fair share", and this should be condemned. On a personal level, eat what you catch, and throw back what you cannot eat. It is clear we need to pay attention and, using the Monterey Bay Aquarium's Guide to fish, order fish from reputable fish mongers and in restaurants only when they can tell us the origin of the fish, and how it was caught. Here is an important tip: Never eat farmed Salmon, always eat farmed tilapia. Here's another tip, generally, eat line-caught swordfish (yet not long-line), but don't eat a lot of it (mercury). Know what is happening in our food halls and restaurants, then order and catch your fish sustainably.

As residents of a blue world with finite resources, we need to become more aware of our effects,

and act accordingly, especially given the events of the past few months to eliminate regulations dealing with the preservation of life on this planet. Oh, the book is a better read than my previous sentence!

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