BOOKS

THE SCALES FALL

Is there any hope for our overfished oceans?

BY ELIZABETH KOLBERT

The Atlantic bluefin tuna is shaped like a child's idea of a fish, with a pointy snout, two dorsal fins, and a rounded belly that gradually tapers toward the back. It is gunmetal blue on top, and silvery on the underside, and its tail looks like a sickle. The Atlantic bluefin is one of the fastest swimmers in the sea, reaching speeds of fifty-five miles an hour. This is an achievement that scientists have sought to understand but have never quite mastered; a robo-tuna, built by a team of engineers at M.I.T., was unable to outswim a real one. (The word "tuna" is derived from the Greek *thuno*, meaning "to rush.") Atlantic bluefins are voracious carnivores—they feed on squid, crustaceans, and other fish—and can grow to be fifteen feet long.

At one time, Atlantic bluefins were common from the coast of Maine to the Black Sea, and from Norway to Brazil. In the Mediterranean, they have been prized for millennia—in an ode from the second century, the poet Oppian describes the Romans catching bluefins in "nets arranged like a city"—but they are unusually bloody fish, and in most of the rest of the world there was little market for them. (Among English speakers, they were long known as "horse mackerel.") As recently as the late nineteen-sixties, bluefin in the United States sold for only a few pennies a pound, if there were any buyers, and frequently ended up being ground into cat food. Then, in the nineteen-seventies, the Japanese developed a taste for sushi made with bluefin, or *hon-maguro*. This new preference, it's been hypothesized, arose from their exposure, following the Second World War, to American-style fatty foods. The taste for *hon-maguro* was, in turn, imported back to the U.S. Soon, fishing for bluefin became so lucrative that the sale of a single animal could feed a family for a year. (Earlier this year, a five-hundred-pound Pacific bluefin went for an astonishing three hundred and forty dollars a pound at a Tokyo fish auction.) First, the big bluefins were fished out, then the smaller ones, too, became hard to find. Tuna "ranching," a practice by which the fish are herded into huge circular nets and fattened up before slaughter, was for a time seen as a solution until it was shown to be part of the problem: as fewer bluefins were allowed to reach spawning age, there were fewer and fewer new fish to fatten.

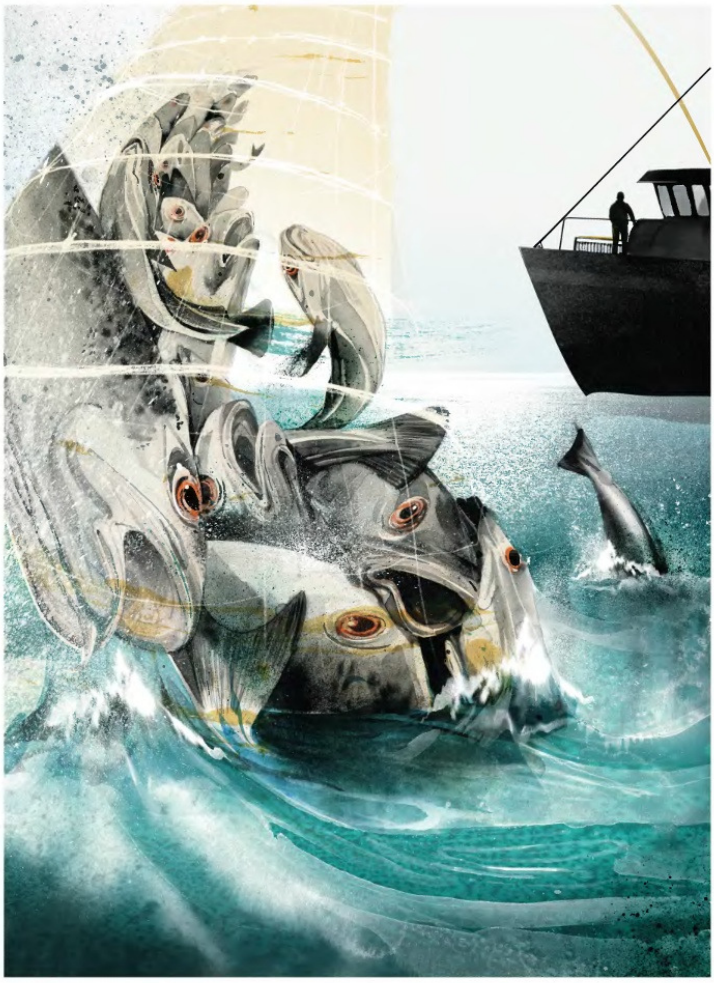
Bluefin catches are managed—the word is used here loosely—by the International Commission for the Conservation of Atlantic Tunas. The commission, known by the acronym ICCAT—pronounced "eye-cat"—is based in Madrid, and its members include the U.S., the European Union, Japan, Canada, and Brazil. In 2008, ICCAT scientists recommended that the bluefin catch in the eastern Atlantic and the Mediterranean be limited to between eighty-five hundred and fifteen thousand tons. ICCAT instead adopted a quota of twenty-two thousand tons. That same year, a panel of independent reviewers, hired by the commission to assess its performance, observed that ICCAT "is widely regarded as an international disgrace." (Carl Safina, the noted marine conservationist, has nicknamed the group the International Conspiracy to Catch All the Tunas.) By most estimates, bluefin stocks have fallen by eighty per cent in the past forty years. According to other assessments, the situation is even grimmer. Callum Roberts, a professor of marine conservation at England's University of York, has calculated that there is now only one bluefin left for every fifty that were swimming in the Atlantic in 1940.

Last year, in an effort to save the Atlantic bluefin from annihilation,

Monaco proposed that the fish join animals like the giant panda and the Asian elephant on a list of creatures that cannot be traded—either alive or cut up for parts—across international borders. When the proposal came up for a vote at a U.N. meeting in Doha this past March, the U.S. voted in favor of it. "The science is compelling," Tom Strickland, the Assistant Secretary of the Interior for Fish, Wildlife, and Parks, told the *Times*. "That species is in spectacular decline." Nevertheless, the measure was defeated. (The vote—sixty-eight to twenty, with thirty nations abstaining—was widely seen as a victory for Japan.) The following month, the Deepwater Horizon rig exploded, and oil began gushing into the Gulf of Mexico. The Gulf is one of only two known Atlantic-bluefin spawning sites, and April is the start of the spawning season.

If the Atlantic bluefin tuna were the first species to be fished into oblivion, its destruction would be shameful. But, of course, its story has become routine. Cod, once so plentiful off the coast of Newfoundland that they could be scooped up in baskets, are now scarce. The same goes for halibut, haddock, swordfish, marlin, and skate; it's been calculated that stocks of large predatory fish have declined by ninety per cent in the past half century. In 1943, Rachel Carson was a young biologist working for the U.S. Fish and Wildlife Service when she wrote a booklet titled "Food from the Sea." The point of the boosterish guide was to convince American consumers of the delectableness of fish like the wolffish, an enormous creature with a bulbous head, big teeth, and an eel-like body. Wolffish is "one of New England's underexploited fishes, a condition that will be corrected when housewives discover its excellence," Carson wrote. Apparently, she was so persuasive—and bottom trawling so wrecked its habitat—that the wolffish is now considered a threatened species.

The sorry state of ocean life has led to a new kind of fish story—a lament not for the one that got away but for the countless others that didn't. In "Saved by the Sea: A Love Story with Fish" (St. Martin's; $25.99), David Helvarg notes that each year sharks kill some five to eight humans worldwide; meanwhile we kill a hundred million of them. Dean Bavington, the author of "Managed Annihilation: An Unnatural History of the Newfoundland Cod Collapse" (University of British Columbia; $94), observes that two hundred billion pounds' worth of cod were taken from Canada's Grand Banks before 1992, when the cod simply ran out. In "Four Fish: The Future of the Last Wild Food" (Penguin Press; $25.95), Paul Greenberg estimates that somewhere in the range of a hundred million salmon larvae used to hatch in the Connecticut River each year. Now the number's a lot easier to pin down: it's zero. "The broad, complex genetic potential of the Connecticut River salmon," Greenberg writes, has "vanished from the face of the earth."



The world's "peak fish" point came in the late nineteen-eighties, but no one noticed.

HELLOVON

The Great International Fisheries Exhibition, which took place in London in 1883, was a celebration of all things piscatorial. More than two thousand exhibitors from around the world displayed herring nets and salmon ladders, trout rods and eel spears, life buoys and lamprey baskets. Awards—dozens of them were bestowed—included twenty pounds sterling for the best collection of smoked fish, twenty-five pounds for the best model of a sailing trawler, and ten pounds for the "best Apparatus for, or Method of, protecting Young Brood and Oysters against Dog

Whelks and other natural enemies."

Thomas Huxley, who is now mostly remembered for being an early supporter of Charles Darwin, was at the time the president of Britain's Royal Society, and he delivered the exhibition's opening address. As his topic, Huxley chose the question "Are fisheries exhaustible? That is to say, can all the fish which naturally inhabit a given area be extirpated by the agency of man?" The answer, Huxley decided, was a qualified no. Although people might be able to wipe out the salmon in a certain stream by throwing a net across it "in such a manner as to catch every salmon that tries to go up and every smolt that tries to go down," conditions in the ocean were altogether different.

"Probably all the great sea fisheries are inexhaustible; that is to say that nothing we do seriously affects the number of the fish," Huxley declared. To the extent that there was a problem with the fishing industry, it was due to its "relative backwardness." Fishing, Huxley said, had failed "to keep pace with the rapid improvement of almost every other branch of industrial occupation in modern times" and still lagged "very far behind scientific agriculture . . . as to the application of machinery."

Huxley's views dominated thinking about fisheries for most of the next century. In 1955, Francis Minot, the director of the Marine and Fisheries Engineering Research Institute, in Woods Hole, Massachusetts, co-wrote a book titled "The Inexhaustible Sea." As yet, he observed, "we do not know the ocean well enough. Much must still be learned. Nevertheless, we are already beginning to understand that what it has to offer extends beyond the limits of our imagination." In 1964, the annual global catch totalled around fifty million tons; a U.S. Interior Department report from that year predicted that it could be "increased at least tenfold without endangering aquatic stocks." Three years later, the department revised its estimate; the catch could be increased not by a factor of ten but by a factor of forty, to two billion tons a year. This, it noted, would be enough to feed the world's population ten times over. Michael L. Weber observes, in "From Abundance to Scarcity" (2002), that as recently as the nineteen-nineties U.S. policy was predicated "on the belief that the ocean's productivity was almost limitless."

In the meantime, "machinery" beyond Huxley's wildest imagining was being developed. Purse seines were introduced in the nineteen-thirties. These giant nets can be played out around entire schools of fish, then gathered up with drawstrings, like huge laundry bags. Factory freezer trawlers, developed after the Second World War, grew to be so gargantuan that they amounted to, in effect, seafaring towns. In the nineteen-fifties, many fleets added echo-sounding sonar, which can detect fish schools long before they surface. Today, specially designed buoys known as "fish aggregating devices," or FADs, are deployed to attract species like yellowfin tuna and blue marlin. So-called "smart" FADs come equipped with sonar and G.P.S., so operators can detect from afar whether they are, in fact, surrounded by fish.

In the short term, the new technology worked, much as Huxley had predicted, to swell catches. But only in the short term. In the late nineteen-eighties, the total world catch topped out at around eighty-five million tons, which is to say, roughly 1.9 billion tons short of the Interior Department's most lunatic estimate. This milestone—the point of what might be called "peak fish"—was passed without anyone's quite realizing it, owing to inflated catch figures from the Chinese. (These fishy figures were later exposed as politically motivated fabrications.) For the past two decades, the global catch has been steadily declining. It is estimated that the total take is dropping by around five hundred thousand tons a year.

Meanwhile, as the size of the catch has fallen, so, too, has the size of the creatures being caught. This phenomenon, which has become known as "fishing down the food web," was first identified by Daniel Pauly, a fisheries biologist at the University of British Columbia. In "Five Easy Pieces: How Fishing Impacts Marine Ecosystems" (Island Press; $50), Pauly follows this trend to its logical—or, if you prefer, illogical—conclusion. Eventually, all that will be left in the oceans are organisms that people won't, or can't, consume, like sea slugs and toxic algae. It's been argued that humans have become such a dominant force on the planet that we've ushered in a new geo-

logical epoch. Pauly proposes that this new epoch be called the Myxocene, from the Greek *muxa*, meaning "slime."

The new fish stories can be read as parables about technology. What was, once upon a time, a stable relationship between predator and prey was transformed by new "machinery" into a deadly mismatch. This reading isn't so much wrong as misleading. To paraphrase the old N.R.A. favorite, FADs don't kill fish, people do.

In an effort to figure out what ocean life was like before the modern era, marine scientists have, in the past few decades, cored through seafloor sediments, measured the size of fish bones tossed out at ancient banquets, and combed through the logs of early explorers. As Callum Roberts reports in "The Unnatural History of the Sea" (2007), the work suggests that humans have been wreaking havoc in the oceans for centuries.

Consider the example of Britain. Archeological deposits show that around the year 1000 Europe's freshwater fisheries were already in decline, perhaps owing to overfishing or perhaps to the erection of dams and mills that impeded river flows. To make a living, British fishermen set out to sea. Initially, the marine catch appears to have been bountiful; analysis of what might be described as eleventh-century garbage shows that people in what is now Scotland dined on four-foot-long cod and five-foot-long pollack. But gradually local stocks were fished down, and by the fifteenth century British ships were venturing as far away as Norway and Iceland. (The Danes, who claimed Iceland for themselves, complained that the English were setting up entire villages on the island, "putting up tents, digging ditches, working away.") When, in the early sixteenth century, British fishermen turned their attention to the newly discovered fisheries off Newfoundland, they encountered, in the words of one early settler, "Cods so thicke by the shoare that we heardlie have been able to row a Boate through them," and the cycle began all over again.

At this point, there are probably no new fishing grounds to be discovered, or, to use Rachel Carson's phrase, any "underexploited fishes" to start serving for dinner. (In parts of Asia, jellyfish are already considered a delicacy.) After the collapse of so many freshwater fish, migratory fish, oceanic fish, and groundfish, like the wolffish, it might seem that we've finally reached the end of the line.

And yet this is never where the new fish stories, or stories about the fish stories, wind up. Just when things seem bleakest, hope—dolphinlike—swims into the picture. David Helvarg concludes his memoir-cum-ecological-disaster narrative "Saved by the Sea" by declaring that, owing to a new attitude in Washington, things seem "to be looking up for the ocean." Similarly, Roberts closes his chronicle of more than a millennium of overfishing by asserting, "We can restore the life and habits of the sea because it is in everyone's interest that we do so."

The way to keep fishing, according to Roberts, lies in not fishing—or, at least, in not fishing everywhere. He proposes that huge swaths of the sea be set aside as so-called "marine protected areas," or M.P.A.s, where most commercial activity would be prohibited. In "Four Fish," Paul Greenberg argues that the salvation of wild fish lies in farmed ones, though not in the kind you'll find on ice at Stop & Shop. (Today, most farmed fish are fed on wild-caught fish, a practice that only exacerbates the problem.) Greenberg is a believer in what's sometimes called "smart aquaculture," and thinks we should be eating species like *Pangasius hypophthalmus*, commonly known as tra. Tra happily feed on human waste and were originally kept in Southeast Asia to dispose of the contents of outhouses. Michael Weber, the author of "From Abundance to Scarcity," is encouraged by the introduction of new regulatory mechanisms such as "individual transferable quotas," or I.T.Q.s. The idea behind I.T.Q.s is that if fishermen are granted a marketable stake in the catch they will have a greater economic interest in preserving it.

M.P.A.s, smart aquaculture, and I.T.Q.s—these are all worthy proposals that, if instituted on a large enough scale, would probably make a difference. As Roberts notes, it is in "everyone's interest" to take the steps needed to prevent an ocean-wide slide into slime. But it is also in everyone's interest to save the Atlantic bluefin tuna. Still, it is being fished to the edge of extinction, which is why a hopeful ending is not always the most convincing one. ♦