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COVER STORY

Not too many fish in the sea

Seafood stocks have been dangerously overexploited worldwide—yet modest changes in fishing practices could restore the health of the oceans. By Thomas Hayden

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FISHED OUT

It's not too late to rescue the oceans—
and keep seafood on our plates

BY THOMAS HAYDEN

The conversion from living animal to antipasto takes only seconds. A thumb pries off the head like a bottle cap. A finger splits the abdomen and with two practiced tugs removes first viscera, then exoskeleton. The proffered meat glistens in the predawn lights of New York City's Fulton Fish Market—translucent, almost glowing with the faintest coral hue. A day ago, this was a spot prawn, swimming and scrabbling off the coast of British Columbia. Tomorrow, its companions will be served, still twitching, as a \$13 appetizer in one of Manhattan's finest restaurants. But right now, at 4:30 in the morning, it is simply delicious, as different from the chewy curls of cocktail shrimp as a vine-fresh heirloom tomato is from a foil packet of off-brand ketchup.

The prawn muscle gave a final jerk as I lifted it to my mouth, but I barely hesi-

A swordfish, in decline like many other fish, is snared off the island of Sardinia.



tated. Dave Pasternack, chef at the tony southern Italian seafood restaurant Esca, knows his seafood, and I knew the morsel would taste exquisite. Most Americans don't get their seafood this fresh, but they did eat a whopping 4.2 billion pounds of it in 2001. Prized by chefs for its variety and boosted by nutritionists for its heart-healthy oils, seafood is now a \$55 billion industry in the United States. But just as we're learning to really love the stuff, we may be cutting off the supply.

In a series of recent reports, scientists warn that fish stocks are dangerously overexploited and that many of the methods that provide the fish, crustaceans, and mollusks we so enjoy are destroying the very ocean habitats and ecosystems needed to rebuild the stocks. Wild shrimp, for example, live on the seafloor and are usually caught with bottom trawls, weighted nets that drag along the bottom like submarine bulldozers. The spot prawn cost me only a moment's queasiness, but the cost to the ocean could include a swath of flattened habitat and more than 10 pounds of discarded fish and other animal life for every pound of captured crustacean. Even fish farming, which was supposed to take the pressure off wild stocks, turns out to pose so many environmental concerns that a major report this week will call for a moratorium on new farms until the problems can be resolved. Yet the bad news also holds an encouraging message: Modest changes in fishing practices and management could reverse decades of misuse, restoring the health of the oceans and ensuring their bounty for the future.

In the swim. America used to be fish stick and tuna fish salad country. The 188,675 tons of canned tuna—over a billion 6-ounce cans—imported in 2002 are still nothing to sneeze at, but times have changed. In 2001, shrimp overtook tuna as America's favorite seafood. And with high-end seafood eateries like Esca thriving despite the poor economy, swordfish with papaya salsa and miso-glazed mahi-mahi steaks are becoming as common as the once exotic sushi, which can now be found at 50 Washington, D.C.-area Starbucks stores and in just about every food court in the country.

An international fleet of fishing vessels



works year-round to supply the new hunger in the West and to feed the growing demand in affluent areas of Asia. Fishers now scour every corner of the ocean, snapping up everything from sea urchins at the water's edge to orange roughies in the abyss, thousands of yards down. Spurred by government subsidies, guided by sonar, satellites, and aircraft, and deploying acres of nets and lines 50 miles long, this global armada has taken one recreational fishfinder's boastful motto—"The fish have nowhere to hide"—and made it the simple truth.

After decades of trying—and often failing—to manage fisheries one stock at a

time, scientists are finally learning how to assess the effects of fishing on whole communities of species. The big picture is disturbing. In a report last month, fisheries scientists Ransom Myers and Boris Worm showed that the abundance of large ocean fish—bottom-dwelling groundfish like cod and open-ocean swimmers like tunas, swordfish, marlins, and sharks—has plummeted by 90 percent since industrialized fishing got going after World War II.

The researchers, who tracked scientific studies from coastal areas and catch data from Japanese long-line fishers in the open ocean, also saw a repeated pattern: Just about every time a new species becomes

Red snapper



Many species share this name. The American red snapper, found from the Gulf of Mexico to the mid-Atlantic, can grow to 35 pounds but is usually eaten at less than 10 pounds. It has

been depleted by decades of heavy fishing. Adults live on rocky reefs, but red snappers spend their first two years on sandy or muddy bottoms, where they are often killed as

bycatch in Gulf of Mexico shrimp trawls. The loss of juvenile snappers, before they can spawn, has accelerated the depletion of this fish.



NOW AND THEN. Because of intensive fishing typified by a boat taking on herring for processing (left), many fish stocks have dwindled. Outsize specimens like the blue marlin (below) hooked by department store magnates Michael and Helen Lerner in the 1930s are now rare.



a quarry or boats move into a new fishing ground, populations nose-dive within 10 to 15 years. With precious few untapped resources remaining in the sea, "this is not just some fish in some areas," says Myers, who is at Dalhousie University in Halifax, Nova Scotia. "This is every large fish you look at, everywhere in the world."

The pursuit of one fish often hits other species hard. Gill nets, trawls, and long-line hooks catch nontarget fishes and other marine life, including seals, dolphins, and endangered sea turtles. This "bycatch," which is generally discarded, makes up roughly 25 percent of the total catch; some 2.3 billion pounds of sea life

fall prey to oceanic collateral damage in U.S. waters every year. Baited long-line hooks also prove irresistible to seabirds; more than 100,000 are killed each year just in the Chilean sea bass fishery around Antarctica. And the trawls used to catch bottom dwellers like shrimp, cod, flounder, and pollock flatten sponges, corals, and rocky nooks and crannies where baby fish need to hide if they're to survive to adulthood. The rush to catch large fish, says Worm, "could bring about a complete reorganization of ocean ecosystems."

Many depleted species, like the North Atlantic cod, may never recover because their habitat has been destroyed or too

few survivors remain to find mates. Extreme fishing pressure can also force magnificent fish to evolve into something considerably less grand. In Alaska, says Stanford University evolutionary biologist Steve Palumbi, the average size of a spawning pink salmon has dropped by 35 percent over the past two decades because only those thin enough to squirm through the mesh of a gill net survive to reproduce. "They're not getting to be the big lunkers we like to catch anymore," says Palumbi. And because the changes are genetic, perhaps they never will.

So why is there still so much seafood in the stores? A walk through the Fulton

Skipjack tuna



This small tuna, no more than 2 or 3 feet long, is a favorite food of larger open-ocean fish. The skipjack, found in tropical and subtropical waters throughout the world's oceans, is also a fa-

vorite of tuna-salad fans; it and another tuna, yellowfin, are sold as "chunk light" canned tuna. The most heavily fished of the tunas, skipjacks tend to school at the surface and are caught

with purse seine nets and hook and line. Yet skipjack populations are healthy, perhaps because their usual predators, such as larger tuna and sharks, have been depleted.



PRIZE SPECIMENS. At a Tokyo fish market, tuna are lined up for inspection, emblems of the world's growing appetite for seafood.

market helps explain the puzzle. Most of the salmon, shrimp, and shellfish come from fish farms, not wild sources. And in a single aisle of stalls, you can find yellowfin tuna from Indonesia, black cod from the Bering Sea, "Chilean" sea bass from Peru, and red snapper from the Galápagos Islands. According to one estimate, more than 80 percent of the seafood Americans now eat is imported.

"The industry is so global now that consumers haven't really noticed what many of the fishers have," says marine biologist Jane Lubchenco of Oregon State University. "But come to Newport, Oregon, and you'll see whole fishing fleets sitting idle." Pacific cod and halibut fisheries have been closed all along the West Coast since last September, in an effort to save four species of rockfish. They're not even the target of fishers, but they are caught—and discarded—in such numbers that they're down to 4 percent of their former numbers in many areas.

A trip uptown from the fish market to the American Museum of Natural History highlights another change that's hidden from most consumers. Curator Melanie Stiassny, surveying the museum's spectacularly renovated Hall of Ocean Life, apologizes for a diminutive model of a swordfish, shrunk to fit a display of fish diversity. Her "laughably small" replica, just 4 feet long, is less than a third of the length real swordfish can reach, but it's still larger than a quarter of the 2000 Atlantic catch. Swordfish lines don't discriminate between babies and behemoths. But with most of the big fish already gone, we are catching and eating mainly juveniles, keeping them from reproducing and replenishing the stocks. "Some people," Stiassny says, "think that if you're on the Titanic, you might as well get a first-class ticket."

America's newly adventuresome approach to seafood means that diners have more ways than ever to go first class. That morning at the market, Pasternack selects a remarkable delicacy. With its swollen lips and superball eyes, the tilefish looks more like a character from the new ani-

Glow of activity

A satellite image made over many nights shows city lights and, at sea, fishing boats using bright lights to attract fish and squid.



Atlantic cod



Cod supported a massive fishery in the Atlantic for centuries but has been heavily depleted by factory trawlers since World War II. Many fishing grounds have been closed or restricted,

but stocks have been slow to recover. The cod's delicate, white flesh was a mainstay of fish and chips; it has largely been replaced by Alaska pollock, now the world's largest

fishery. Cod can reach 200 pounds but now are rarely found above 20. The related Pacific cod is in better shape. Young cod are sold as scrod, as are haddock and pollock.

mated fish feature, *Finding Nemo*, than a culinary treasure. "It's a beautiful fish," says Pasternack, patting the 46-pounder's rubbery, yellow-splotched flanks. "They thought these things were extinct." Not yet—holdouts were found in the underwater canyons off Long Island—but that's probably because most people haven't tried Pasternack's signature raw-fish dish, *crudo*. For tomorrow's lunch, the tilefish will join swordfish and bigeye tuna, each magnificent fish matched to one of two dozen virgin olive oils and a full arsenal of different sea salts and served side by side in 1-ounce portions for \$15. The metaphor is obvious: As seafood becomes more rare, the very best transcends luxury to become almost a fetish.

Feeding frenzy. Not all seafood receives such reverent treatment. Much of the seafood eaten in America passes through fryers in fast-food and casual dining establishments. Renowned conservation advocate Sylvia Earle, former chief scientist at the National Oceanic and Atmospheric Administration, has spent more than 6,000 hours underwater during her four decades as a marine biologist. But she'd never spent an afternoon at a Red Lobster until she met me. Earle eats a salad as I take on the \$20.99 Ultimate Feast—two kinds of shrimp, Maine lobster tail, and Alaska snow crab legs—and tells me what my meal means for the oceans. The bottom line? "I don't see anything on your plate that is sustainable," says Earle. "There's an endpoint to everything you've got there."

We've already had hints of what heedless consumption could mean for diners. In the past decade, it drove the orange roughy from abundance to scarcity in just a few years. Only after the fish, which can live 150 years, had become a popular staple did scientists realize that roughies could not stand up to heavy fishing because they take decades to mature. Overfishing has made the bluefin tuna a rarity, sold at high-stakes auctions. And it is gradually driving fishers to smaller, faster-growing fish, further down the food chain. As one species after another is fished out, says Scripps Institution of Oceanography ecologist Jeremy Jackson, we're creating decidedly less appetizing ocean ecosystems. "Jellyfish have



COOK'S CHOICE. Manhattan chef Dave Pasternack prepares dishes including raw-fish *crudo*.

Smart seafood choices

A taste for seafood need not take a toll on the ocean. The Seafood Choices Alliance (seafoodchoices.com) helps cooks make wise selections; the National Audubon Society (audubon.org) and the Monterey Bay Aquarium (mbayaq.org) produce wallet-size lists seafood lovers can take to dinner or the store. Some sample suggestions:

AVOID

Grouper
Atlantic salmon
Imported shrimp

GO EASY

Pacific cod
Wild shellfish
Mahi-mahi

ENJOY

Alaska salmon
Pacific halibut
Striped bass

become a commercial fishery in many places," he says, "because that's all that's left. That and the bacteria."

The lowly barnacle has lately become a hot item in haute cuisine, offering what could be a glimpse of the future—although for now it's simply a culinary adventure. Pasternack serves a gooseneck barnacle appetizer; chef Rick Laakkonen serves a tangy barnacle and sea urchin soup, "the tidal pool," at his Manhattan restaurant, Ilo. And at Patria, also in New York, Douglas Rodriguez made a splash several years ago with giant Chilean pico roco barnacles.

Not every bite of seafood has to come with a side of environmental destruction, Earle admits. "We do have to eat something," she says. "But we do have choic-

es." Conservationists hope to blunt some of the worst impact by steering consumers toward more sustainable seafood (box, above) and by urging changes in fishing practices.

Often, it wouldn't take much to ease the pressure on the oceans. Ratana Chuenpagdee at the College of William and Mary in Virginia and Lance Morgan of the Marine Conservation Biology Institute (MCBI) in Redmond, Wash., enlisted a team of scientists, fisheries managers, and commercial fishers to assess the relative bycatch and habitat damage caused by 10 types of gear. They ranged from bottom trawls (the worst) to purse seine nets and hook and line fishing (the least damaging). Remarkably, Chuenpagdee says, all the parties agreed

Bluefin tuna



Among the most spectacular fish, bluefin tuna can reach 1,500 pounds in the Atlantic. Smaller Pacific bluefins are born in the Sea of Japan, then migrate thousands of miles

east. These powerful, warm-blooded swimmers can reach 25 miles an hour and cross an ocean in three weeks. They are caught with long lines and now are also herded into nets and

fattened like cattle in a feedlot. Bluefins are so scarce in many regions that a single fish can fetch tens of thousands of dollars in Japan, where this tuna is prized for sushi.

Decline of the cod divides a New England fishing village

CHATHAM, MASS.—These days, the Cod is pretty much gone from the Cape. Bob Luce, 63, sits on a bench and explains why. Luce, who has an artificial knee from the wear and tear of fishing and knuckles tattooed "love" and "hate" in honor of the Robert Mitchum movie *The Night of the Hunter*, fondly remembers the days in the 1970s when he could drop hooks to the seafloor 15 miles out and reel in 30-to-50-pound cod. By the 1990s, the Cape Cod fishing grounds were barren. Fishing had gotten too efficient for its own good, says Luce.

In 1980, many fishers began switching from hooks that caught individual fish to nets that snared cod by the gills, whole schools at a time. At the same time, big

trawlers began dragging rollers across the rocky seabed to force the bottom-dwelling fish upward into nets, capturing massive amounts of cod and, some critics claim, destroying its preferred habitat. "They caught all the big ones and wiped them out," says Luce. Now New England is trying to rebuild its cod fishery, opening deep divisions among fishers in places like Chatham.

When cod stocks collapsed in the 1990s, the federal government closed thousands of square miles of fishing grounds and limited fishers' "days at sea." The cod population has rebounded, says Steve Murawski, a scientist at the National Marine Fisheries Service, but to reach historic levels, the total mass of cod



still needs to grow eightfold on Georges Bank, east of the cape, and about threefold in the Gulf of Maine.

Regulators have now proposed slashing the allowed days at sea by an additional

55 percent and reducing the daily limit on Georges Bank codfish from 2,000 pounds per boat to 500 pounds. Some trawler owners think they could live with such cutbacks. Barbara Stevenson,

on the rankings, presented in a report entitled "Shifting Gears." "The consensus blew my mind," she says. "Now we can start managing fisheries according to their environmental impact." That means things like using traps instead of bottom trawls for shrimp and harvesting scallops by hand instead of scraping them up with dredges.

Commercial fishers, who can be ruined by fishery closures, have long resisted stricter management. But now that the consequences of overfishing are unmistakable, some in the industry are taking a leading role in the effort to save it. John Pappalardo, a commercial hook fisherman in Chatham, Mass. (box, above) and member of the New England Fishery Management Council, says that after years of bad news, the local outlook is finally improving, in large part because of

the creativity of the fishing community. "We had a whiting fishery that was closed for like five years," because so many other fish were taken as bycatch, he says. "They went away and came back with a new net, and we just opened the fishery back up to them." The new gear, called a raised footrope trawl, catches whiting but leaves lobsters and flatfish alone. Similarly, Gulf shrimpers have equipped their bottom trawls with grates that keep out turtles, and long-line fishers deploy lines of brightly colored streamers to keep birds away until the freshly baited hooks sink out of their range.

Out of mind. But politicians and the public have been harder to sell on fish conservation. The fish are still showing up from somewhere, and the destruction is out of sight under the waves. "The catastrophe is already happening," says

University of British Columbia fisheries biologist Daniel Pauly, who tracks historic fishing in the North Atlantic in his new book, *In a Perfect Ocean*. "But we don't see it because people don't remember what used to be in the seas."

Even the major environmental groups have been slow to embrace marine conservation, but that's changing. In a conference from May 30 through June 3 called "Defying Ocean's End," the largest groups are meeting with scientists, economists, and government representatives to hammer out a global strategy for preserving sea life. And on June 4, a blue-ribbon commission sponsored by the Pew Charitable Trusts is releasing an in-depth report on the state of U.S. oceans, including an outline for overhauling the fisheries system. (Another federally mandated commission is expected to make

Patagonian toothfish



Rechristened Chilean sea bass by savvy marketers, this fish is actually unrelated to any salt-water bass. It is a favorite of chefs because of its mild, oil-rich flesh, which stands up well

to cooking. But it has been hit hard by legal and illegal long-line fishing—a "pirate" fishery that is worth \$500 million a year. The toothfish takes 10 years to mature and can live at

least 40 years, grows to 7 feet, and is found at depths of up to 4,000 yards in waters near Antarctica. Little else is known about this member of the unique family called the cod icefishes.



BY HOOK. Off Cape Cod, Paul Parker fishes with hook and line. He says hooking cod—the traditional method—is more sustainable than netting or trawling.

ago. "How do you compare what we're doing today to when frigg'n Adam and Eve were around?" fumes Craig Pendleton, a Saco, Maine, fishing captain.

While trawlers can go after some 16 other fish species, hookers and gill netters depend more heavily on cod, and many say the cuts will put them out of business. Sustainable fishing practices will be hurt the most, says Paul Parker, director of the Cape Cod Commercial Hook Fishermen's Association. "For hundreds of years, cod were caught using a hook and line on Georges Bank, and it was sustained for generations," says Parker as he sips a pint at the local watering hole, the Chatham

Squire. "Fish don't bite all the time if the current, tide, or wind is in the wrong direction. That built-in inefficiency allowed some to escape."

By contrast, he says, the trawlers inevitably scoop up baby cod, and the gill netters often snag much more than the 2,000-pound limit, throwing the excess overboard. The trawlers dispute Parker's contentions, noting that they've switched to larger mesh nets that allow small cod to escape. They also say the hook fishers have done the most damage by snagging juvenile fish, before they have time to reproduce.

Regardless of who bears the most blame for the cod decline, Chatham's hook fishers worry that their rustic municipal pier will give way to a tony yacht club and that Nickerson Fish & Lobsters market will be replaced by a seaside restaurant—serving fish trucked in from somewhere else. —Jeff Glasser

who runs three 87-foot trawlers out of Portland, Maine, supports lowering the daily catch limit on Georges Bank. "That's the most stressed stock," she says. "Many people in the in-

dustry are frustrated more hasn't been done to date."

Fishy numbers? But other fishers argue that the proposals are based on little more than guesswork about what the ocean contained lifetimes

similar recommendations later this year.) The Pew commission will call for a new approach to fisheries management, based on preserving ecosystems and habitats rather than just setting catch limits for individual species. And, says Oregon State's Lubchenco, one of the commissioners, they'll recommend setting up a network of marine reserves, linked by protected corridors, to safeguard fish breeding and nursery grounds. Existing sanctuaries account for less than one tenth of a percent of American seas, and offer very little real protection, says Pauly. Right now, he says, "a sanctuary is a place you can fish. So what does a sanctuary mean? It means nothing."

The most controversial recommendation in the Pew report is the call for a moratorium on new marine fish farms. Aquaculture now accounts for one third

of all seafood. Some is benign, or even beneficial—cultured clams and oysters actually clean the water as they grow. But the most popular ocean "crops," Atlantic salmon and shrimp, pose serious problems. Salmon are predators, so producers feed them fishmeal made from wild-caught fish. That depletes ocean stocks even further and also explains why farmed salmon have to be dyed to replace the orange color that wild fish pick up naturally from their usual diet of small crustaceans. And shrimp farmers in places like Ecuador and Southeast Asia—major producers—often clear stands of coastal mangrove trees to build their pens. The trees' submerged roots are essential habitat for wild shrimp and for the juveniles of dozens of food fish species. "I feel sure that aquaculture will be very important" for

the future food supply, says Lubchenco, "but we have to step back to consider how to implement it in a way that's not detrimental."

"If we give the oceans a chance now," says MCBF President Elliott Norse, "we'll be able to take food from the sea for as long as there are people on Earth. But we have to start now, not in five years, not in 10 years." For now, Pasternack has found enough seafood at the Fulton market to delight and intrigue his customers for another day. "You never know what you're going to find out here," he says as the sun comes up through the suspension wires of the Brooklyn Bridge. "But that's OK; I can sell anything."

I've eaten his barnacles, so I know he could do jellyfish right, too. But with a little effort on our part, maybe we'll be eating jellyfish by choice, not out of necessity. ●

Swordfish



Found worldwide, swordfish migrate from the tropics to temperate waters in the summer and are caught by long lines and drift nets. The fish, which use their swords to kill other fish

and squid, can reach 1,400 pounds, but heavy demand for swordfish steaks has led to overfishing and pushed the average size down to less than 100 pounds. Smaller specimens are,

however, less likely to have high levels of mercury contamination, a concern in large predatory fishes. In the North Atlantic, depleted swordfish populations show hints of recovery.