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Tuna's End

By PAUL GREENBERG

In the international waters south of Malta, the **Greenpeace** vessels Rainbow Warrior and Arctic Sunrise deployed eight inflatable Zodiacs and skiffs into the azure surface of the Mediterranean. Protesters aboard donned helmets and took up DayGlo flags and plywood shields. With the organization's observation helicopter hovering above, the pilots of the tiny boats hit their throttles, hurtling the fleet forward to stop what they viewed as an egregious environmental crime. It was a high-octane updating of a familiar tableau, one that anyone who has followed Greenpeace's Save the Whales adventures of the last 35 years would have recognized. But in the waters off Malta there was not a whale to be seen.

What was in the water that day was a congregation of Atlantic bluefin tuna, a fish that when prepared as sushi is one of the most valuable forms of seafood in the world. It's also a fish that regularly journeys between America and Europe and whose two populations, or "stocks," have both been catastrophically overexploited. The BP **oil spill** in the Gulf of Mexico, one of only two known Atlantic bluefin spawning grounds, has only intensified the crisis. By some estimates, there may be only 9,000 of the most ecologically vital megabreeders left in the fish's North American stock, enough for the entire population of New York to have a final bite (or two) of high-grade *otora* sushi. The Mediterranean stock of bluefin, historically a larger population than the North American one, has declined drastically as well. Indeed, most Mediterranean bluefin fishing consists of netting or "seining" young wild fish for "outgrowing" on tuna "ranches." Which was why the Greenpeace craft had just deployed off Malta: a French fishing boat was about to legally catch an entire school of tuna, many of them undoubtedly juveniles.

Oliver Knowles, a 34-year-old Briton who was coordinating the intervention, had told me a few days earlier via telephone what the strategy was going to be. "These fishing operations consist of a huge purse-seining vessel and a small skiff that's quite fast," Knowles said. A "purse seine" is a type of net used by industrial fishing fleets, called this because of the way it draws closed around a school of fish in the manner of an old-fashioned purse cinching up around a pile of coins. "The skiff takes one end of the net around the tuna and sort of closes

the circle on them,” Knowles explained. “That’s the key intervention point. That’s where we have the strong moral mandate.”

But as the Zodiacs approached the French tuna-fishing boat Jean-Marie Christian VI, confusion engulfed the scene. As anticipated, the French seiner launched its skiffs and started to draw a net closed around the tuna school. Upon seeing the Greenpeace Zodiacs zooming in, the captain of the Jean-Marie Christian VI issued a call. “Mayday!” he shouted over the radio. “Pirate attack!” Other tuna boats responded to the alert and arrived to help. The Greenpeace activists identified themselves over the VHF, announcing they were staging a “peaceful action.”

Aboard one Zodiac, Frank Hewetson, a 20-year Greenpeace veteran who in his salad days as a protester scaled the first BP deepwater oil rigs off Scotland, tried to direct his pilot toward the net so that he could throw a daisy chain of sandbags over its floating edge and allow the bluefin to escape. But before Hewetson could deploy his gear, a French fishing skiff rammed his Zodiac. A moment later Hewetson was dragged by the leg toward the bow. “At first I thought I’d been lassoed,” Hewetson later told me from his hospital bed in London. “But then I looked down.” A fisherman trying to puncture the Zodiac had swung a three-pronged grappling hook attached to a rope into the boat and snagged Hewetson clean through his leg between the bone and the calf muscle. (Using the old language of whale protests, Greenpeace would later report to Agence France-Presse that Hewetson had been “harpooned.”)

“*Ma jambe! Ma jambe!*” Hewetson cried out in French, trying to signal to the fisherman to slack off on the rope. The fisherman, according to Hewetson, first loosened it and then reconsidered and pulled it tight again. Eventually Hewetson was able to get enough give in the rope to yank the hook free. Elsewhere, fishermen armed with gaffs and sticks sank another Zodiac and, according to Greenpeace’s Knowles, fired a flare at the observation helicopter. At a certain point, the protesters made the decision to break off the engagement. “We have currently pulled back from the seining fleet,” Knowles e-mailed me shortly afterward, “to regroup and develop next steps.” Bertrand Wendling, the executive director of the tuna-fishing cooperative of which the Jean-Marie Christian VI was a part, called the Greenpeace protest “without doubt an act of provocation” in which “valuable work tools” were damaged.

But the main damage that took place that day was indisputably to the bluefin. After the encounter, the fishermen aboard the Jean-Marie Christian VI transferred the fish alive into a holding cage and slowly towed them away. Soon those tuna would be brought to feeding

pens where they will spend at least several months putting on weight. Afterward, they will be slaughtered and sent to Japan, where 80 percent of the world's Atlantic bluefin tuna are eaten with oblivion.

THERE ARE TWO reasons that a mere fish should have inspired such a high-strung confrontation reminiscent of Greenpeace's early days as a defender of whales. The first stems from fish enthusiasts who have for many years recognized the particular qualities of bluefin tuna — qualities that were they land-based creatures would establish them indisputably as “wildlife” and not just another “seafood” we eat without remorse. Not only is the bluefin's dense, distinctly beefy musculature supremely appropriate for traversing the ocean's breadth, but the animal also has attributes that make its evolutionary appearance seem almost *deus ex machina*, or rather *machina ex deo* — a machine from God. How else could a fish develop a sextantlike “pineal window” in the top of its head that scientists say enables it to navigate over thousands of miles? How else could a fish develop a propulsion system whereby a whip-thin crescent tail vibrates at fantastic speeds, shooting the bluefin forward at speeds that can reach 40 miles an hour? And how else would a fish appear within a mostly coldblooded phylum that can use its metabolic heat to raise its body temperature far above that of the surrounding water, allowing it to traverse the frigid seas of the subarctic?

Yes, bluefin tuna are warmblooded.

That bluefin can be huge — 10 feet and more than a thousand pounds — is a side note. For those of us who have seen their football silhouettes arise and vanish in less than a blink of an eye or held them alive, their hard-shell skins barely containing the surging muscle tissue within, they are something bigger than the space they occupy. All fish change color when they die. But with tuna the death shift feels more profound. Fresh from the water, their backs pulsing neon blue, their bellies gleaming silver-pink iridescence, they seem like the ocean itself.

And in a way they are, which explains the second reason bluefin have come to possess such totemic power. For bluefin tuna and all species of tuna are the living representation of the very limits of the ocean. Their global decline is a warning that we just might destroy our last wild food.

In prehistoric times, the hunting of fish began close by, in freshwater rivers and lakes and coastal ocean waters. But as human populations grew, easily accessed grounds fell short of demand. By the late Middle Ages, European stocks of freshwater fish and near-shore ocean

species proved insufficient. By then, Basque and Viking fisherman had already moved on to the continental shelves off Canada, ushering in the Age of [Cod](#) — an age that escalated until the late 20th century, when some of the largest fishing vessels ever built devastated the once-two-billion-strong stock of cod on the Canadian Grand Banks. But there were still new places to fish. In the 1980s and '90s, virgin fishing grounds were found in the Southern Hemisphere, and supplies of replacement fish like New Zealand hoki and Chilean sea bass helped seafood supplies keep pace with demand.

But appetites continued to outstrip supply. Global seafood consumption has increased consistently to the point where we now remove more wild fish and shellfish from the oceans every year than the weight of the human population of China. This latest surge has taken us past the Age of Cod and landed us squarely in the Age of Tuna. Fishing has expanded over the continental shelves into the international no-man's territory known as the high seas — the ocean territory that begins outside of national “exclusive economic zones,” or E.E.Z.'s, usually 200 nautical miles out from a country's coast, and continues until it hits the E.E.Z. of another country. The high seas are owned by no one and governed by largely feeble multinational agreements. According to the Sea Around Us project of the University of British Columbia's Fisheries Center, catches from the high seas have risen by 700 percent in the last half-century, and much of that increase is tuna. Moreover, because tuna cross so many boundaries, even when tuna do leave the high seas and tarry in any one nation's territorial waters (as Atlantic bluefin usually do), they remain under the foggy international jurisdiction of poorly enforced tuna treaties.

The essentially ownerless nature of tuna has led to the last great wild-fish gold rush the world may ever see. The most noticeable result of this has been the decline of the giant Atlantic bluefin tuna. But the Atlantic bluefin is just a symptom of a metastasizing tuna disease. The [United Nations](#)' Food and Agriculture Organization reports that 7 of the 23 commercially fished tuna stocks are overfished or depleted. An additional nine stocks are also threatened. The Pew Environment Group's tuna campaign asserts that “the boats seeking these tuna are responsible for more hooks and nets in the water than any other fishery.”

Tuna then are both a real thing and a metaphor. Literally they are one of the last big public supplies of wild fish left in the world. Metaphorically they are the terminus of an idea: that the ocean is an endless resource where new fish can always be found. In the years to come we can treat tuna as a mile marker to zoom past on our way toward annihilating the wild ocean or as a stop sign that compels us to turn back and radically reconsider.

“WE FIND OURSELVES in a precarious situation.” So wrote Ritchie Notar, a co-owner of the internationally acclaimed Nobu restaurant chain, to Greenpeace U.K. back in 2008 after Greenpeace intensified its tuna-defense efforts and put forward the idea that bluefin should no longer be served at Nobu’s establishments. “We are dealing with thousands of years of cultural customs,” Notar continued in correspondence Greenpeace forwarded to me. “The Japanese have relied on tuna and the bounties of the sea as part of their culture and history for centuries. We are absolutely appreciative of your goals and efforts within your cause, but it goes far beyond just saying that we can just take what has now all of a sudden been declared an ‘endangered’ species off the menu. It has to do with custom, heritage and behavior.”

Many nations have contributed to the Atlantic bluefin’s destruction. Europeans and North Africans do most of the catching and ranching of the fish in the world today. The United States continues to allow bluefin fishing in its waters even though the Gulf of Mexico-spawned stock is considered by many scientists to have entered into full-scale collapse. But it is Japan, the world’s largest bluefin importer, that has taken perhaps the most aggressive pro-tuna-fishing position, sometimes assisted by Westerners like Ritchie Notar, who declaim the country’s long tuna-eating tradition. But history shows that Japan’s stake in tuna fishing is recent and, more important, part of the same endgame that has dragged all of humanity into the Age of Tuna. Before 1800, Japanese tuna sushi didn’t even exist.

Trevor Corson is an East Asia scholar turned popular nonfiction writer and author of the 2007 book “The Story of Sushi,” and for select groups he will act as a “sushi concierge,” hosting dinners often at the Jewel Bako Japanese restaurant in Manhattan’s East Village, one of which I attended this past winter. A Corson-guided meal aims to reveal the historical truth of tuna and to represent the very different fish that were the staples of sushi in earlier times. Plate by plate I watched as Corson walked a group of Manhattan professionals through a traditional Edo-period meal of snappers, jacks and other white-fleshed, smaller fish that most definitely did not include “red” tuna. Afterward, Corson sent me an excerpt from a 1999 Japanese anthology titled “Fish Experts Teach the Secrets of the Deliciousness of Fish” to further underline his point. “Originally, fish with red flesh were looked down on in Japan as a low-class food, and white fish were much preferred,” one of the book’s contributors, Michiyo Murata, writes. “Fish with red flesh tended to spoil quickly and develop a noticeable stench, so in the days before refrigeration the Japanese aristocracy despised them, and this attitude was adopted by the citizens of Edo [old Tokyo].” Other Japanese scholars like the sushi historian Masuo Yoshino confirm this. Murata, meanwhile, goes on to note that tuna were introduced into sushi only 170 years ago, when a large catch

came into Edo one season. On that day a local sushi chef marinated a few pieces of tuna in soy sauce and served it as “nigiri sushi.” The practice caught on. Occasionally a big bluefin became sushi, but Corson notes these fish were nicknamed *shibi* — “four days” — because chefs would bury them for four days to mellow their bloody taste.

By the 1930s, tuna sushi was commonplace in Japan, but demand could be met by local supplies of tuna, including the Pacific bluefin species, which dwells in Japan’s coastal waters. It was World War II that took tuna fishing to the next level. “To recover from the devastation of the war,” Ziro Suzuki, formerly of the Japanese Far Seas Research Laboratory, wrote me, “Japanese fishermen needed more tunas to secure food for domestic demand and also to earn more money by exporting tunas for canning industries in Europe and the U.S. Those needs urged the expansion of fishing grounds outside of the historic grounds of the western Pacific.” But this next fishing expansion was technological as well as territorial. Throughout the postwar period, the Japanese perfected industrial long-lining, a practice that employs thousands of baited hooks. In the 1970s Japanese manufacturers developed lightweight, high-strength polymers that were in turn spun into extensive drift nets that could be many miles long. Though drift nets were banned in the high seas by the early ’90s, in the 1970s hundreds of miles of them were often deployed in a single night. When drift nets and long lines were coupled with at-sea freezing technology invented around the same time, Japanese fishermen were able to fish the farthest reaches of the oceans while keeping their frozen tuna sushi-ready for as long as a year.

A major yield of all of this Japanese fishing effort was yellowfin tuna. Though they ate bluefin, Japanese did not hold them in high regard before the 1960s, and it took a confluence of socioeconomic factors in both Japan and the West to bring bluefin to the fore. By the late 1960s, sportfishing for giant bluefin tuna was starting in earnest off Nova Scotia, New England and Long Island. Like the Japanese at the time, North Americans had little regard for bluefin on the plate, usually discarding them after capture.

Bluefin sportfishing’s rise, however, coincided with Japan’s export boom. In the 1960s and ’70s, Japanese planes stuffed with electronics unloaded in the U.S. and returned empty — a huge waste of fuel. But when a Japanese entrepreneur realized he could buy New England and Canadian bluefin for a song, he started filling up all those empty cargo holds with tuna. Exposure to beef and other fatty meats during the U.S. occupation had already drawn the Japanese to appreciate bluefin’s fatty belly (*otoro*, in sushi terms). The Atlantic bluefin, the biggest bluefin, became the most favored of all. This appreciation boomeranged stateside when Americans started to develop their own raw-fish habit in the late 1970s.

Added to the already significant fishing pressure from the tuna canning industry, Japan's and now the West's sushi jones has come to stress populations of large tuna around the world, starting with the most environmentally sensitive Atlantic bluefin but with the risk of spreading to other species. In fact, one subpopulation of Atlantic bluefin has already vanished after heavy fishing by Japanese long-liners: The bluefin that used to congregate off Brazil disappeared in the early bluefin boom of the 1970s. The remaining Atlantic bluefin stocks are trending similarly, and the two other species of bluefin — the Pacific, which ranges between California and Japan, and the southern bluefin, which plies the waters around Australia — are not far behind. In the United States, the direct fishing pressure on bluefin continues — but perhaps a larger problem is that a large quantity of North American bluefin are caught accidentally as “by-catch” when industrial long-liners deploy their legions of hooks in search of yellowfin tuna over the bluefin's spawning grounds in the Gulf of Mexico. By law, nearly all bluefin caught as by-catch must be dumped back into the sea. Usually by that point they are already dead.

All of this has led the bluefin to become a cause célèbre among conservation groups and the target of several organized “save the bluefin” campaigns. None of them have influenced Japanese consumers. In the case of Nobu, after numerous exchanges with Greenpeace, the sushi restaurant's owners remained unpersuaded of the need to stop serving the fish. Their only concession was a haiku-esque warning on the menus of its London eateries:

“Bluefin tuna

Is an environmentally threatened species

Please ask your server for an alternative.”

Willie Mackenzie of Greenpeace U.K. responded angrily in a note to Ritchie Notar: “Despite the assurances that you take these issues seriously and that you want Nobu to be a leader in this field, you have essentially tried to abdicate responsibility by suggesting that it is down to your customers to decide if they want to eat an endangered species.”

AWAY FROM RESTAURANT menus and the entree preferences of individual consumers, more far-ranging choices are presenting themselves to humanity than picking a California roll or a sliver of *otora*. These are choices that will shape the fate of not just Atlantic bluefin tuna, not just all tunas, but all the great sea creatures — sharks, swordfish, marlin, even whales. For every one of these animals is highly migratory and roams the high seas, the vast, ownerless seascape that makes up some 60 percent of the oceans.

Until the 1970s, fishing in the high seas tended to be based on the principles of Hugo Grotius's 1609 treatise "Mare Liberum" — a document that advocated free use of the oceans by all. But in the last 40 years, Grotius's "free sea" has grown progressively more circumscribed. Today, high-seas and highly migratory fish are overseen by 18 regional fisheries-management organizations. These "consensus-oriented" institutions, in which each member nation has equal status, can be guided more by political horse-trading than by sound science. A former chairman of the scientific committee of the International Commission for the Conservation of Atlantic Tunas (or Iccat), the body responsible for Atlantic bluefin, told me, "Even though scientific advice says you should stick to a specific catch number, in order to negotiate a deal they tend to nudge that number over a little bit." That little nudge can be enough to put a population of tuna in jeopardy.

In 2008 Iccat set Atlantic bluefin catch limits that were nearly double what its own scientists recommended. Conservationists howled, and the quotas were reduced sharply. But by the time Iccat met again, in November 2009, environmentalists had come to home in on the historic mismanagement of Atlantic bluefin, many of them arguing that a simple reduction in catch quotas for the coming fishing season was not enough — that in fact a zero-catch quota was the only thing that would stave off the fish's extinction. Iccat rejected the zero-quota idea. This in turn forced a much more high-pitched confrontation this spring between parties like Japan, which seems to feel that fishery-management problems can be resolved within the status quo, and those who are looking to take the high seas in a profoundly different direction.

The debate was joined when delegates gathered this past March in Doha, Qatar, for a meeting of the United Nations Convention on the International Trade in Endangered Species of Flora and Fauna, or Cites (pronounced SY-tees). It was a meeting that, for fish, could have been as important as the 1982 meeting of the International Whaling Commission that voted to establish a moratorium on commercial whaling worldwide. For if conservationists got their way, Atlantic bluefin would be included in the Cites treaty's Appendix One — a result that would ban the international trade of the tuna and put them under the jurisdiction of the same U.N. body that oversees tigers, white rhinos and giant pandas. It would be the beginning of a process that would transition Atlantic bluefin tuna from seafood to wildlife.

It is precisely this kind of recasting that happened with whales in the 1980s, and Japan was intent on avoiding a similar recategorization with Atlantic bluefin tuna. As Masanori Miyahara, the director of the Fisheries Agency of Japan, put it to me: "Cites Appendix One is

too inflexible . . . once a species is listed in a Cites appendix, it will never be delisted or down-listed as the history of Cites clearly shows.” In other words, once a fish becomes wildlife, it will stay wildlife. A Cites treaty would also allow those countries that happen to have bluefin in their territorial waters to continue to catch them for their own market while excluding all the other treaty member nations — a result that Masanori would surely find not only unfair but also capable of leading to further overfishing. (The [European Union](#) has indicated it will continue to catch its allowable quota even if a Cites resolution is passed.)

Japan's touchiness about fairness on the high seas is understandable given its dependence on seafood. Its per capita seafood consumption is among the highest of any industrialized country. And Japan has not been blind to the problems that come with overfishing and excessively large fishing fleets. Indeed, in the last few years it has tried to rein in its industrial fishing effort, decommissioning vessels, literally pulling hooks out of the water. But this has failed to resolve another problem of the Age of Tuna. Just as the industrialized countries are starting to realize the need for more sensible management of the high seas, developing countries are heading in the opposite direction. “Developing countries firmly believe they have a right to expand their fisheries and that developed countries should reduce their fishing effort to compensate,” Ziro Suzuki wrote me. “In the process of trying to resolve the conflict of interest, the stocks become overfished, and overall fishing effort grows to an unacceptable level. . . . It's really just another example of the North-South problem, just like CO2 emissions.”

The conflict between the developing and developed world plays an increasingly greater role in tuna negotiations, and at a certain point it is hard to figure out who is manipulating whom in an intrigue involving 175 countries, each trying to game the system.

Representatives from both the WWF and the Pew Environment Group told me of a curious imbroglio as the Qatar Cites meeting neared its vote on bluefin. Japanese delegation members supposedly told African representatives that European bluefin fleets would relocate to the coast of Africa and catch African yellowfin tuna if the Cites bluefin motion passed. This despite the fact that European vessels are geared up specifically for bluefin fishing and lack the capacity to pursue yellowfin. Masanori Miyahara of the Fisheries Agency of Japan dismissed this claim as “completely wrong and unfounded. We never told such a thing to anybody. We even haven't thought such an idea, ever.”

True or not, African nations lined up with Japan. After Libya and Sudan forced a vote, the Atlantic bluefin's Cites Appendix One listing was rejected by a large majority.

Delegates flew away from Qatar with the status quo in place. The monthlong bluefin purse-

seining season set earlier by Iccat for the Mediterranean would stand as it was with quotas above what many scientists had recommended. A month after the Cites meeting, BP's Horizon Deepwater oil rig collapsed into the sea and spewed oil into the only bluefin spawning ground in the Americas just as the few remaining North American stock giant bluefin were preparing to mate in the Gulf of Mexico. Though the U.S. [National Marine Fisheries Service](#) has been deeply critical of the Mediterranean bluefin catch — in 2007, it went so far as to call for a moratorium — it has been noncommittal about the American fishery. When I asked the Fisheries Service if it would consider closing the bluefin season on the heels of the BP spill, I was offered a statement, part of which, recast in verse form, has an almost Nobu-type haiku quality:

“N.O.A.A. Fisheries is carefully monitoring

The spawning of bluefin tuna in the Gulf of Mexico

By collecting larval samples and analyzing reports from scientific observers.”

It seems then that no single nation is ready to commit to a sustainable future for the fish. Some would argue that extirpation might just have to be the bluefin's fate. Other, smaller tuna might be better suited to industrial exploitation. The bigeye and yellowfin tuna generally grow faster and spawn earlier. And indeed these lesser tuna are already starting to fill in for the bluefin's absence. In the United States most Americans usually end up eating bigeye when they order *otono* — the fatty zebra-striped flesh that fetches the highest price on most sushi menus nowadays. But major populations of bigeye tuna are also declining. Should they go away, it's hard to say what would come next.

we get ourselves out of the Age of Tuna with our moral center and our food supply intact? Can we develop a civilized hunter-gatherer relationship with tuna and indeed with all other fish and reach a point of equilibrium with our last wild food? Can the management bodies that have overseen the collapse of the most magnificent food fish we've ever known be trusted to manage what is left in its wake?

The answer depends on where you fall on the fairly broad political spectrum of the world's different tuna watchers. The Fisheries Agency of Japan maintains that “Japan is committed to ensure the recovery” of the Atlantic bluefin and has stipulated it will support a complete shutdown of the bluefin fishery at next fall's Iccat meeting, should the scientific committee recommend it. Greenpeace meanwhile has punted on the bluefin political process. “Others have failed our oceans,” Oliver Knowles told the press as he prepared his mini armada off

Malta, “so Greenpeace will act.” Greenpeace is calling for a radical realignment of the high seas, to take stewardship away from regional fisheries-management organizations and establish 40 percent of the world’s ocean territory as a marine reserve, a kind of Antarctica-style agreement with shades of whale, where nations, instead of bargaining over quotas, would simply not be able to do any fishing at all in large areas of the oceans. Most other environmental organizations are behind the marine-reserve idea, but they vary in opinion on how big those reserves should be. The Blue Ocean Institute calls for a five-year moratorium on Atlantic bluefin fishing everywhere. The WWF further advocates that the industrial fishing methods that spread during the Age of Tuna — the drift nets, long lines, purse seines and spotter planes — be done away with. In their view, the “artisanal” single-hook-and-line fishing practices of old are the only way to sustainably hunt big and naturally scarce predators like bluefin.

But if we are to embark on a global project of ramping down tuna fishing, what are we to eat?

Until the modern era, the response to wild-game decline has been a primitive one: widespread destruction of the animals that can’t stand up to our hunting followed by the selection of a handful of ones that we can tame. Out of the many mammals that our forebears ate before the last ice age, humans selected four — cows, pigs, sheep and goats — to be their principal meats. Out of all the many birds that darkened the primeval skies, humans chose four — chickens, turkeys, ducks and geese — to be their poultry.

And indeed, this is a process that is taking shape rapidly with fish. Atlantic salmon are now commercially extinct throughout almost the entirety of their range but have become one of the most widely farmed fish in the world.

But while leaps have been made in taming marine fish, tuna, particularly bluefin tuna, may not make very much sense for the farm. Bluefin ranching as it is practiced in the Mediterranean, and with the Pacific bluefin in Japan and the southern bluefin in Australia, rightly faces strong environmental criticisms since it relies on catching juveniles from the wild and denies those baby bluefin a chance to reach adulthood and breed. Now, however, the final steps of fully taming or “closing the life cycle” of bluefin tuna are under way, which will make it possible for bluefin to be grown from an egg in a laboratory to a full-size adult. In such a system, an isolated “domestic” family of bluefin can be established that need not have any interaction with the wild at all. For several years Japan has been producing small amounts of closed-life-cycle Pacific bluefin (known as Kindai tuna in the market). In Europe and Australia, scientists have used light-manipulation technology as well as time-release

hormone implants invented by the Israeli endocrinologist Yonathan Zohar to bring about the first large-scale captive spawning of Atlantic and southern bluefin.

But there are considerable complications ahead. As Richard Smullen, an Australia-based feed-company specialist working to come up with a suitable diet for farmed bluefin, explained: “The thing is the metabolic rate of these fish is very high compared to other fish; they swim fast, they heat their brains and vital organs and are warmer than the surrounding water, so this is energetically expensive. An analogy is like trying to feed an ultramarathon runner — they have the potential to eat a lot and not put on any weight.” Though Smullen says that it is possible to bring feed-conversion ratios for bluefin down, currently it may take 15 pounds of feed to produce a single pound of tuna, roughly 10 times as much as is needed for farmed salmon.

As fisheries decline globally, more and more countries are trying to replace their wild fish with farmed ones. Today 30 million tons of small forage fish are removed from the oceans yearly, with the majority of it going to feed farmed fish. If we end up farming bluefin on the same scale as we now farm salmon, the tuna, with its poor feed-conversion rate, may end up taking the food of the remaining wild fish that we haven't yet got around to catching.

In addition there is little evidence to suggest that taming a species saves its wild forebear. Tiger farms in China have not halted tiger declines in the wild. Hundreds of millions of farmed Atlantic salmon have not stanchd wild Atlantic salmon's continued decline. Just because we can tame something doesn't mean we should. The example of whales again rises. As the science historian D. Graham Burnett points out in a coming book on the Save the Whales movement, collaborations between American nuclear scientists and marine biologists were once proposed in the 1960s whereby tropical atolls, leveled by nuclear testing, could be used as giant corrals for the commercial farming of cetaceans. But fortunately for the whale — and I think for us too — we have come to see the whale not as something we fish for, not as something we farm, but as something we appreciate and maybe empathize with. Instead of expanding our stomachs or our wallets, whales have expanded our consciousness, our very humanity. So we have to ask ourselves, is there any rational argument for humans to eat bluefin tuna, wild, ranchd or farmed? Is the fish really so special that no substitute will do? If the Japanese adapted to a higher-fat diet in half a century, could they and all sushi lovers not shift gears again and adapt to a sustainable diet?

It was in answer to these questions that I went looking for a farmed fish that could satisfy tuna-eaters at the sushi bar. A fish that had the dense “bite” of tuna but with a smaller ecological footprint — a Volkswagen instead of a Hummer.

My search led me to the coast of the Big Island of Hawaii, where I motored with a tall, optimistic Australian named Neil Anthony Sims. As we donned wetsuits, fins and scuba tanks, Sims rejoiced in telling me tales of his adopted land. Eventually we spat in our masks, adjusted our regulators and dived into the water above Sims's farm — a huge underwater ziggurat that is the center of his company, Kona Blue Water Farms.

Until recently, most of the fish we've chosen to domesticate have been accidents. Salmon, striped bass, trout — we have chosen those species because we knew them as wild game. We seldom considered their biological profiles or whether they jibed well with the ecological limitations of a crowded planet.

But Neil Sims was a fisheries biologist before he was a fish farmer. And it was his direct personal experience with the limitations of fisheries management that persuaded him that fish farming, done right, was a better choice than fish catching.

Sims began his career in the remote Cook Islands of the South Pacific. There he was responsible for managing a giant snail called a trochus that produces an attractive pearly shell, valuable to native jewelers. Over half a decade, he implemented numerous management strategies. Nothing worked — not even shortening the harvest season drastically. The day after one season ended, he came across a bare-chested Polynesian elder who had pulled his dugout canoe onto the beach. Sims looked inside the boat and saw it filled with trochus.

"I yelled at him," Sims remembers. "Then he yelled at me. He started to cry. Then I started to cry, and then the old bugger finally says: 'Why? Why did you close the season? There are still some left!'" This moment prompted him to look beyond fishing, to an entirely different approach.

Sims was drawn to Hawaii, with its deep near-shore waters and strong currents — attributes favorable to aquaculture that he believed could make ocean farming sustainable. But the fish farming he found on arrival in Hawaii didn't impress him. "People were trying milkfish and mullet," Sims recalled. "They start with the letter 'm' and they're all really kind of hmmmmm in the mouth, if you know what I mean." Sims found the fish too bony and small, with loose, mushy flesh. This was important. Sims's long-standing beat in the South Pacific had persuaded him that "there was an opportunity for a high-value, sushi-quality fish," a fish that could fit into the dense-flesh category that the Age of Tuna had cultivated in Japan and indeed throughout the developed world.

After parsing many species he came across *Seriola rivoliana*. Known in Hawaii as kahala, it is a speedy, firm-fleshed animal of the same family as yellowtail and amberjack. They are only very distantly related to tuna and do not have tuna's ruby red color, but they still have dense flesh and could easily pass for white albacore sushi. The fat content in Sims's farmed kahala is around 30 percent, and indeed it is the presence of fat that accounts for much of a sushi fish's tunalike flavor.

Sims was further intrigued when he found that kahala had barely been fished commercially. In their wild form kahala can carry ciguatera poison — a toxin sometimes deadly to humans that kahala ingest when they feed around coral reefs. But when kahala are isolated away from reefs and fed a traditional aquaculture diet of soy and fishmeal, they are ciguatera-free. (Sims asserts that ciguatera has never been detected in the flesh of his fish.) Since they have not been fished commercially, wild kahala populations are large and unlikely to be severely damaged through interaction with farmed fish. Moreover, kahala are much more “feed efficient” than tuna. The amount of fish required to produce a pound of kahala ranges from 1.6 pounds to 2 pounds, an order of magnitude better than bluefin. And Sims recently began feed trials using diets that contain no directly harvested forage fish. Lastly, unlike tuna, which require a tremendous investment in spawning technology, kahala are naturally fecund: they breed frequently, at least weekly, throughout the year.

THERE ARE, OF COURSE, those who would disagree with Sims's approach. When I asked Casson Trenor, author of the 2009 book “Sustainable Sushi,” for his impression of the kahala as a farmed fish, he responded that the farming of any carnivore is “fighting the current.” “You may have a farm that has a more efficient protein ratio,” Trenor wrote me, “but produces more waste streams. Perhaps you have a feed pellet that knocks your feed conversion ratio down to 1 to 1, but you continue to host a rampant parasite infestation. . . . We need to identify fish that through their physiology and life history actually lend themselves to clean farming operations.” Trenor's own compromise is to serve wild “small format” tuna like skipjack or albacore, fish that he feels can embrace the “principles of seasonality, local awareness and sustainability” that sushi originally expressed before it was “transformed through cultural misinterpretation and overzealous globalization into exactly the opposite.”

But as I plunged into the calm blue waters off Kona and inflated my diving vest to gain equilibrium in the water column, I couldn't help thinking that in a world of environmental evils prosecuted against fish, the farming of a more efficient carnivore than a bluefin under the stewardship of a knowledgeable, environmentally conscious biologist was a good deal

better than the rapacious industrial harvesting of “large format” tuna. Looking down at this “cathedral” of fish, as Sims called it, the possibility of a certain balance presented itself. Using technology developed over the last 10 years, Kona Blue has constructed diamond-shape cages that can be moored in the open ocean away from sensitive coastal areas. As I glided down, past the fish swimming in unison in their net pen, I felt a cautious optimism. The site of these pens had been carefully chosen; the swift currents meant that nutrients did not accumulate below the pens. And regular monitoring has found the fish to have no internal parasites, unlike the wild kahala. Sims’s commitment to transparency is also encouraging. He regularly posts water-quality reports on his Web site and presumably will do the same as the operation expands.

Sims waved me over to the side of the net pen. I floated above him, close enough to see that the fish actually seemed to recognize him. In what he would later describe to me as the “rock-star effect,” the fish crowded to be close to him. Sims spread his arms out wide and seemed to take in their adulation.

Sims has trademarked his kahala with the name Kona Kampachi — “Kona” for its point of origin, “Kampachi” for the similar animal in Japan. They retail for \$18 to \$20 a pound in fillet form and to date have a tenuous foot in the market. Production reached more than a million pounds in 2008, about a third of the amount of bluefin caught in American waters that year. After a hiatus during most of 2009 and the first part of 2010 while Sims reconfigured his cages, the product will be reintroduced this July with even more capacity. Kona Kampachi may not have the rich ruby color of tuna (a color that is often enhanced artificially by “gassing” with carbon monoxide), but it is an extremely pleasant sushi experience. It satisfies the sashimi yen that has been created over the last 30 years — the yen for the firm, energy-rich musculature of a fast-swimming open-ocean fish.

Can we embrace a new set of species that we don’t know intimately in their wild form? Can we come to an understanding of which fish work for us as “seafood” and which fish don’t? I would hope so. The survival of the wild ocean could very well depend on it. I took one more look at Neil Sims floating with arms outstretched, his kahala finning in the current, each one mutely appraising this conductor of a silent concert. The only sound was the whirl of bubbles rising by my ears.

SEAFOOD. HOW MANY species suffer those two mean English syllables? Other languages are no kinder. Romance European cultures use the expression “sea fruit,” while Slavs say “sea gifts.” So-called [vegetarians](#) rue the killing of farmed terrestrial animals but regularly eat wild fish. Kosher laws mandating merciful animal slaughter don’t apply to fish.

These thoughts were in my head recently when I got perhaps my last look at a wild bluefin tuna, just a month before the Deepwater Horizon rig exploded and collapsed into the Gulf of Mexico. I was 20-odd miles off the coast of Cape Hatteras, N.C., aboard the Sensation, a vessel chartered by the Tag-a-Giant Foundation, a nonprofit organization trying to decode the complex migration patterns of the bluefin and help lay the scientific foundation for the fish's protection. Tag-a-Giant had been fishing for a couple days, and many people had sat in the fighting chair I now occupied, reeling in tuna after tuna. But for me this was a first. I had never caught a bluefin before.

In the past I would have wanted to savor the fight, to do battle with the fish with lighter, more "sporting" tackle. But considering everything I'd learned about tuna, humans and the chances of the great fish's survival, it suddenly seemed infinitely more appropriate to fight this tuna with the full expression of humanity's power. For in the end tuna are no match for us. We have in this final phase of exploitation achieved dominion over the entirety of the watery world, from inland lakes and rivers to the littoral zone to the continental shelf out to the abyss of the high seas. Sitting in the huge fighting chair with the huge rod and reel, in the well of the huge sportfishing vessel, it was inescapably apparent who had the edge.

As my bluefin breached, one of the scientists opened a door at the stern of the boat. A blue vinyl mat was laid down on the deck. The fish came through the door, still "hot," banging its tail excitedly. But in an instant a biologist named Andre Boustany placed a moist cover over the tuna's giant eye and a hydration hose in its mouth. The tuna motor mellowed, and at last the fish was beatifically still.

"Do you want to tag him?" Boustany asked me.

I took the sharp four-inch needle from his hand and positioned it just behind the fish's dorsal fin. Pricking the skin slightly I started to pull my hand away.

"No," Boustany said, "you gotta really stick it in there."

Applying more pressure, I felt the needle slide into the flank, felt the resistance of the dense sushi flesh, raw and red and most certainly delicious. But for the first time in my life I felt tuna flesh for what it was: a living, perfect expression of a miraculous adaptation. An adaptation that allows bluefin to cross oceans at the speed of a battleship. An adaptation that should be savored in its own right as the most miraculous engine of a most miraculous animal, not as food.

Perhaps people will never come to feel about a tuna the way they have come to feel about

whales. Whales are, after all, mammals: they have large brains; they nurse their young and breed slowly. All of that ensconces them in a kind of empathic cocoon, the warmth of which even the warmest-blooded tuna may never occupy. But what we can perhaps be persuaded to feel, viscerally, is that industrial fishing as it is practiced today against the bluefin and indeed against all the world's great fish, the very tigers and lions of our era, is an act unbecoming our sentience. An act as pointless, small-minded and shortsighted as launching a harpoon into the flank of a whale.

Paul Greenberg is a frequent contributor to the magazine. This article is adapted from his book "Four Fish: The Future of the Last Wild Food," which will be published next month by Penguin Press.

Tunas are fast-swimming fish spread widely through the world's oceans and seas. They often travel and forage as schools of diverse tuna species sharing similar body size. Members of the Scombridae family have two dorsal fins with five to 12 finlets behind the second dorsal and the anal fins (Nelson 1994). The first dorsal fin has nine to 27 rays, the pelvic fins have six rays and are placed behind the pectoral fins, which are high on the body (Nelson 1994). Read the Tuna's End discussion from the Chowhound Food Media food community. Join the discussion today. Tuna's End. New to Chowhound? Sign up to discover your next favorite restaurant, recipe, or cookbook in the largest community of knowledgeable food enthusiasts. Tuna's End_magazine Spread - Free download as PDF File (.pdf), Text File (.txt) or read online for free. Magazine concept-spread for the "Tuna's End" article featured in the "NYT". Magazine concept-spread for the "Tuna's End" article featured in the "NYT". Copyright: Attribution Non-Commercial (BY-NC). Download as PDF, TXT or read online from Scribd.