WILDLIFE AND OFFSHORE DRILLING
The 2010 Gulf of Mexico Disaster: Atlantic Bluefin Tuna

ATLANTIC BLUEFIN TUNA © NOBERT WU/MINDEN PICTURES; OIL RIG © U.S. COAST GUARD

The bluefin tuna is the sports car of the sea, from its sleek, muscular, metallic blue and silvery white body to the hefty price it commands–a 500-pound specimen sold at a Japanese fish market for $175,000 earlier this year. Imperiled by the fishing pressure that accompanies such prices, the western Atlantic bluefin now faces a new threat: the heart of its breeding range lies in the path of the oil slick from the BP Deepwater Horizon disaster.

ATLANTIC BLUEFIN TUNA IN THE GULF OF MEXICO

The biology of the bluefin tuna is a world of superlatives. Fully mature, it is one of the biggest bony fish—the largest specimen ever recorded topped 15 feet in length and weighed 1,500 pounds. The species is also one of the fastest fish in the ocean; while marlin or sailfish can out-sprint them, bluefin tuna are capable of sustained speeds of nearly 50 miles per hour. And among those who fish, its reputation as the toughest, most dangerous and most prized of the game fish is unsurpassed.

The bluefin tuna's amazing power is derived from an even more amazing muscular and circulatory system. In most fish, blood flowing to the muscles is the same temperature as the surrounding water. But tuna (along with swordfish, marlins and some sharks) have a "heat exchange" system that transfers warmth from blood in the veins to arterial blood flowing into the muscles. This allows the muscles to operate more efficiently than most other fish. In fact, the muscle cells of bluefins have a higher density of power-generating structures, called mitochondria, than most birds and mammals. This is why a tuna steak more closely resembles beef than fish.

Even more interesting, bluefin tuna appear to regulate their heat exchange mechanism, allowing them to range widely through the Atlantic Ocean, from the tropical waters near the equator to the frigid waters off the coast of Canada. Tuna have been observed making more deep dives in warmer water, and it is unclear whether they can "turn off" their heat exchange in warmer waters, or if they dive to colder waters to cool off.

With choice specimens of bluefin tuna fetching more than $300 a pound at Japanese fish markets like this, fishing is driving the species toward extinction.

Bluefin tuna feed mainly on small fish that swim in large schools: herring, menhaden, anchovy, sand lance, sprat and others. These large schools are often found at upwelling zones at the edge of the continental shelf, where currents bring lots of nutrients to the surface, triggering a feast of plankton on which the small fish feed. The tuna generally feed by opening their mouths and charging at the school, though they will also pursue individual larger fish and squid, and even forage for crabs and other invertebrates on the ocean floor, particularly close to shore.

Atlantic bluefin tuna have two separate breeding areas: one in the Mediterranean Sea and one in the Gulf of Mexico. Fish return to the area where they spawned, so the two populations do not interbreed, even though they intermingle as they forage. Spawning in the Gulf of Mexico is concentrated in a triangular area extending from the western tip of Cuba to the Florida Panhandle and coast of Texas, peaking in mid- to late May. A mature female can produce between 30 million and 60 million eggs, though the vast majority of eggs and larvae are eaten or starve. Eggs hatch within one to two days as larvae that are roughly a tenth of an inch long. Larvae feed on plankton, migrate with currents out to the Atlantic and feed on progressively larger prey (such as small fish, squid and crustaceans) as they grow.

The Gulf of Mexico population appears to breed at a later age than the Mediterranean population: Females from the Mediterranean reach sexual maturity at three to five years of age, but Gulf females do not mature until they are about nine to 11 years old and seven feet long. Their long period to maturity, and the heavy fishing pressure they face in the interim, are major reasons the Gulf population of bluefin tuna is in jeopardy.

Fishing pressure is the leading threat to bluefin tuna. They are managed under the International Commission for the Conservation of Atlantic Tunas, which regulates the fisheries of multiple species of tuna, marlin and swordfish. This group has a long history of failing to set quotas for fish that are clearly in decline, for setting quotas much higher than recommended by their own scientists, and for turning a blind eye when those quotas are exceeded. For instance, in 2007 the catch quota for Atlantic bluefin was 29,500 tons; that year, Japan alone reported the import of 32,356 tons, and the total catch may have been double the legal quota.

A recent effort to impose a trade ban on bluefin tuna through the Convention on International Trade in Endangered Species failed, with only 43 countries (including the United States) voting in favor of a ban, and 72 countries voting to continue fishing the species toward extinction. Barely a month after that dismal result, bluefin tuna were hit with an even greater catastrophe: the Deepwater Horizon disaster—spewing oil into the Gulf at the exact time and place where the fish concentrate to spawn, threatening not only the current generation, but also future generations of bluefin.

IMPACTS OF OIL

From the perspective of bluefin tuna, the oil spill could hardly have come at a worse time or place. May is their peak spawning time, and one of the two areas where most larvae concentrate lies directly in the path of the spill.

Eggs and Larvae

The harmful effects of oil on fish larvae have been documented for several species, and it is likely tuna larvae will be similarly at risk. For example, among Baltic herring eggs exposed to oil concentrations of just 3.1 to 11.9 parts per million, most hatched, but 70 percent to 100 percent were malformed or died within a day of hatching. Survivors showed impaired heart rates and growth. Researchers found that effects worsened with increasing temperatures; water temperatures in the Gulf of Mexico are warmer than the highest temperatures investigated in that study. Another study examined young Pacific herring following the 1989 *Exxon Valdez* oil spill in Prince William Sound, Alaska. Researchers found that oil-exposed larvae had abnormal accumulations of fluid in their hearts and abdomens, along with damage to liver, skeletal, brain and eye cells. Furthermore, while the use of chemical dispersants to break the oil into smaller particles may help keep it away from sensitive coasts and wetlands, it also keeps many more tiny droplets of oil in the water. This actually increases the exposure for marine animals such as bluefin tuna larvae. The dispersants themselves are also toxic.

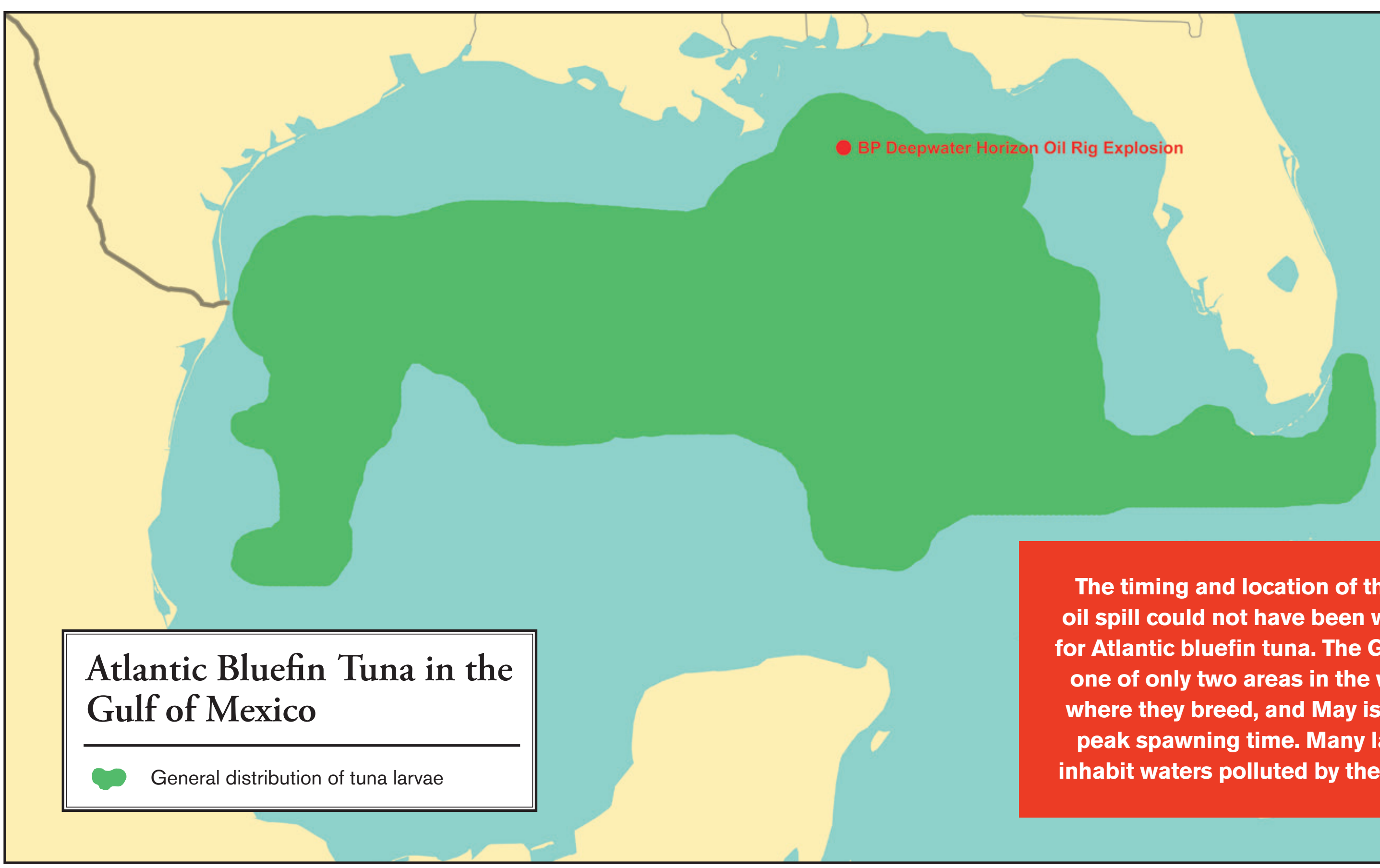
Adults

The adults producing the at-risk eggs are themselves in danger from the spill. Researchers from Stanford University have been using satellite tagging to track adult bluefin tuna as they travel between spawning and feeding grounds. One adult tagged last year entered the Gulf on March 23 and spent much of the next two months in the area now covered in an oil slick. If that animal or others track a similar course this year, they will almost certainly come into contact with large quantities of oil. Fish swimming through oil slicks risk fouling of the gills, which interferes with oxygen uptake. Adequate oxygen is crucial to bluefin tuna, due to their high-powered muscle structure. Females also need more oxygen when they spawn.

Because of their gulping style of feeding, tuna are also at risk of ingesting oil or tar balls along with prey. Ingested oil can damage the liver or heart, and suppress egg production. Furthermore, even if they don't directly encounter the oil slick, bluefin can be harmed by long-term exposure through the small amounts of oil that accumulate in the fatty fish they eat. Some bluefin tuna sampled from sushi restaurants has been found to contain high levels of mercury, and oil residues could similarly accumulate in tuna, potentially leading to human health effects.

Impacts of oil spills combined with climate change and other threats

Oil in the water is not the only problem for bluefin tuna. The burning of oil and other fossil fuels is a leading



The timing and location of the BP oil spill could not have been worse for Atlantic bluefin tuna. The Gulf is one of only two areas in the world where they breed, and May is their peak spawning time. Many larvae inhabit waters polluted by the spill.

SOURCE: ADAPTED FROM ROOKER ET AL. 2007

Oil poses a serious threat to tuna in every life stage. It can kill or cause organ damage, malformations or impaired growth in young fish; adults swimming through and ingesting oil may have difficulty taking in enough oxygen or sustain liver and heart damage.

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contributor to climate change. Climate change adds an additional burden to an already imperiled species. For instance, one impact of climate change is increasing sea surface temperatures. For bluefin tuna, water temperature is an important factor in triggering spawning, which occurs when the Gulf of Mexico temperatures are between 72 and 81 degrees F. Over the past 30 years, sea surface temperatures in the tropical Atlantic Ocean have increased by about 2 degrees F. Warmer waters hold less oxygen, which could stress both juvenile and adult tuna. In addition, since the species' ability to control its internal heat exchange mechanism is not fully understood, tuna may overheat in warmer waters. Furthermore, climate change is altering the timing, pattern and extent of nutrient upwellings, which govern the population and location of the huge schools of small fish that bluefin tuna rely on for food.

WHAT CITIZENS CAN DO

- Don't buy bluefin tuna in restaurants and markets. More sustainable alternatives include troll or pole-caught albacore, bigeye, skipjack and yellowfin tunas.
- Urge your elected officials to pass comprehensive climate change legislation that addresses the impacts of global warming on wildlife and our natural resources.

WHAT POLICY MAKERS CAN DO

- Ensure that BP funds long-term restoration of bluefin tuna populations in all Gulf areas affected by the spill, including mitigation for the long-term damage caused to tuna from nonlethal exposure.
- Impose greater safety and environmental standards and develop comprehensive spill response plans on existing offshore drilling operations.
- Prevent expanded drilling operations off the coast to limit future spill risks.
- Enact comprehensive energy and climate change policies to transition away from harmful oil and fossil fuels.

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