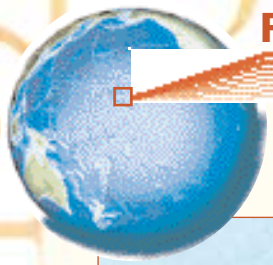

PACIFIC OCEAN:

Bikini's Nuclear Ghosts

LAURIE GRACE (*map*); WILLIAM F. HAXBY (*globe*)

The atoll survived some of the worst destruction that humankind has ever dished out to become a lush paradise once again

by Glenn Zorpette

ANTONIO RAMÓN-LEBLANC

BAKER BLAST (*right*) on July 25, 1946, was the fifth atomic explosion ever and the first beneath the surface of the sea. At the base of the mushroom cloud are obsolete warships, positioned near ground zero to test blast effects. Among the ships sunk by early tests is the destroyer USS *Lamson* (*above* and *above right*), whose guns still point skyward.

I am at ground zero of the most powerful explosion ever created by the U.S. Forty-six meters (150 feet) underwater near the edge of Bikini Lagoon in the central Pacific, I am kneeling in the sand with a 27-year-old Majorcan divemaster at my side. At this moment, he's laughing into his scuba regulator at the sight of an array of big, five-pointed starfish on the seafloor, which evokes for him an American flag.

The divemaster, Antonio Ramón-LeBlanc, and I have come to a place where very few have ever ventured: a submerged crater formed shortly before dawn on March 1, 1954, when the U.S. military detonated a thermonuclear bomb on a spit of sand jutting out from Nam Island, in the northwest corner of Bikini Atoll. The experts anticipated that this nuclear test, codenamed Bravo, would have an explosive yield equivalent to somewhere between three and six megatons of TNT. Instead they got 15 megatons, a crater 2,000 meters wide and a fireball that swelled far beyond expectations, terrifying the nine technicians left as observers in a concrete bunker 32 kilometers away.

The Bravo blast was roughly 1,200 times more powerful than the atomic explosion that destroyed Hiroshima. Its fallout trapped the nine technicians in their bunker and sickened the 82 residents of Rongelap and Ailinginae atolls, 195 kilometers downwind, as well as the 23 Japanese fishermen on the trawler *Fukuryu Maru* (*Lucky Dragon*), which was 137 kilometers to the east. In September of that year, one of those fishermen died; whether it was from radiation-related complications is a moot point.

Seeing Bikini for the first time now, I find it difficult to picture the island as it was during those days. The atoll, a precious necklace of some two dozen islets surrounding a sapphire lagoon, is inhabited by only two or three dozen people at any given time. Almost all of them live on Bikini Island, the largest, and are studying the atoll's radioactivity, running a recently established scuba-diving and fishing resort or building infrastructure. The Bikinians themselves are living on other islands and atolls, as they have been since 1946, when the start of nuclear testing on Bikini rendered it unfit for habitation.

In the era of testing, which lasted until 1958, as many as tens of thousands of military people, technicians and scientists camped on Bikini's islands or lived on navy vessels just offshore. The nuclear blasts sank surplus ships, vaporized whole islands and sent millions of tons of seawater and pulverized coral kilometers into the sky. The atoll was the site of 23 atomic and thermonuclear tests that had a combined yield of 77 megatons. (On nearby Enewetak Atoll, there were 43 tests, with a total yield of 32 megatons.) The Bravo blast so contaminated the entire atoll that the remaining five tests in that series had to be set up by technicians wearing protective suits and respirators.

Paradise Reborn

The site of some of the most intense destruction wreaked by humankind, Bikini today is a testament to nature's ability to heal itself. Although the white, powdery floor of Bravo crater is desertlike, I am surprised by how much marine life we

ANTONIO RAMON-LEBLANC

encounter. Besides abundant starfish, we see scores of basketball-size anemones, dozens of sea cucumbers, a school of thousands of tiny, silvery, free-swimming fish larvae and, unexpectedly, a lionfish surrounded by little blue-and-yellow damselfish. Later, hiking along the western shores of nearby Nam Island, just tens of meters from ground zero, we encounter purplish lobsters and a huge sea turtle. A silvery-white, speckled moray eel flashes in the sun as it slithers amphibiously from one tidal pool to another, hunting the crabs scurrying on the rocks at water's edge. A more animated or idyllic scene would be hard to imagine.

As fishermen avoided the atoll for decades, the local sea life proliferated, and the atoll now has some of the most thriving and diverse populations of marine creatures on the earth. The small groups of anglers staying at the resort on Bikini Island routinely run into vast schools of tuna, as well as mahimahi, wahoos, snappers, barracuda, leatherskin jacks, trevally, mackerel, coral trout, sharks and marlin.

During a fishing excursion, I watch an angler hook a mackerel, which is struck by a big barracuda, which is chomped off behind the gill plates by a shark, all in the space of six or seven minutes. On a single dive to a coral reef just inside the lagoon, I spot tangs, sergeant majors, butterfly fish,

ARCHIVE PHOTOS

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KEVIN DENLAY *Action Unlimited*

U.S. DEFENSE NUCLEAR AGENCY, COURTESY OF NATIONAL GEOGRAPHIC SOCIETY

BRAVO BLAST (*right*), at 15 megatons, was the largest ever created by the U.S. It vaporized two small islands and left an underwater hole two kilometers across. This crater is the dark-blue, circular area seen above and slightly to the right of Nam Island (*top right*). Author Glenn Zorpette (*above*) displays a starfish, which are common on the silty crater floor.

parrot fish, groupers, a lizardfish, striped grunts, snappers, giant clams and a few other species I cannot identify. Above the surface huge flocks of boobies, shearwaters and terns swoop and dive for baitfish.

Swimsuits, Bravo and Godzilla

More than just a pretty place, Bikini is a 20th-century cultural icon. But few remember the details of how it became one. On July 5, 1946—four days after the first atomic test on the atoll—French fashion designer Louis Reard introduced a two-piece swimsuit. The coincidence of earthshaking events forever attached the name "bikini" to the suit, perhaps to suggest its explosive effect on the heterosexual male libido. And in the 1954 Japanese motion picture *Gojira,* nuclear tests aroused the titular monster from hibernation near the fictional Pacific island of Ohto, a thinly disguised Bikini. The Tokyo rampage of Gojira, known to English-language moviegoers as Godzilla, was a cinematic resonance of the tragedy that befell the crew of the *Fukuryu Maru.*

On Bikini, too, there are reminders of the days when business was (literally) booming. As I step off the airplane that brought me to the island of Eneu, in the southeast corner of the atoll, one of the first things I see is the control bunker for the Bravo blast. It is overgrown with vines, a forgotten relic behind the airport's tiny terminal building. Inside, the bunker is cool, musty and full of old truck tires and bags of cement mix; behind it stretches Bikini's impossibly blue lagoon. It takes considerable effort to imagine the room as it was 44 years ago, with nine frightened technicians in it, awaiting rescue after the Bravo blast.

Unfortunately, landmark bunkers are not the only mementos of the nuclear years on Bikini and Enewetak. The topsoil on the atolls has high levels of radioactive cesium 137, strontium 90, plutonium 239, plutonium 240 and americium 241. Of these fallout elements, only

GLENN ZORPETTE

CRUMBLING BUNKER on Aomen Island, in the north of the atoll, was used 45 years ago to film the thermonuclear tests.

the cesium 137 precludes permanent habitation because it emits relatively energetic and penetrating gamma rays, and it is present in high levels in the atoll's vegetation and fruits, such as coconut and pandanus. Studies by Lawrence Livermore National Laboratory have shown that if people lived on Bikini and regularly ate fruits grown on the islands, up to 90 percent of their radiation exposure would come from the cesium in the local produce. Almost all the rest of their dosage would come from the cesium in the soil. On the beaches and in the sea, cesium is not a problem: it is soluble in water, so the tides and currents washed it away long ago.

Taking Back Bikini

In addition to the Livermore group, which began doing research on Bikini in 1978, there have been five other scientific panels that have studied the atoll. All have concurred with a plan developed by William L. Robison, the leader of the Livermore contingent. Under Robison's proposal, which the displaced Bikinians are now considering, the atoll's topsoil would be treated with potassium chloride. In a matter of months, Livermore's experiments have shown, the potassium would replace most of the cesium in the vegetation and fruits. There would still be cesium in the topsoil, so the plan also calls for the soil to be stripped away in the areas where homes are to be built. Robison says that Bikinians would be exposed to radiation dosages no greater than those of people living in the continental U.S.

Some 2,400 people are eligible to live on Bikini. The number includes some of the 167 Bikinians moved off the atoll by the U.S. before testing began in 1946, as well as the direct descendants of those 167 and others who are related by marriage. All of them benefit to some extent from a total of $195 million in three trust funds set up with reparations paid by the U.S. government starting in 1978.

Today, although a plan exists to make Bikini suitable for habitation again, there is no timetable for resettlement. "The major issue for us is that the president of the United States has to give us assurances that the U.S. government agrees with and believes in the conclusions of these scientific studies," says Jack Niedenthal, who, having married a Bikinian, has become a liaison and spokesperson for the group.

There is historical precedent for this insistence. In 1968, on the recommendation of the U.S. Atomic Energy Commision, President Lyndon Johnson officially declared Bikini Atoll safe for habitation. A decade later, however, radiologic studies showed the declaration to be premature, and the small group of Bikinians who had resettled on the atoll had to be moved off once again. Because of Johnson's assurance, the Bikinians were in a strong position to demand reparations from the U.S.

"We believe that, morally, the U.S. government is in the exact same position," Niedenthal says. "I mean, as laymen, how are we to believe these studies, if the president of the United States, as a layman himself, can't believe in them?"

Although resettlement of the atoll is years off, a tourism program is well under way. Many Pacific atolls host impressive marine menageries, but few can boast almost a score of storied naval wrecks. During the early atomic tests here in 1946, military officials studied the effects of the blasts on ships by anchoring obsolete vessels around the intended ground-zero site in the lagoon. What they unwittingly created, in a 3.75-square-kilometer patch of lagoon, is perhaps the best wreck-diving spot on the earth.


GLENN ZORPETTE


EMIL JONAIE

RADIOACTIVE FRUITS are exhibited by Lawrence Livermore National Laboratory's William L. Robison, who is studying ways to reclaim Bikini Atoll. Zorpette (*at right*) prepares to descend 48 meters to the wreck of the USS *Arkansas* with diving buddy Antonio Ramón-LeBlanc.

Wreck Diving: It's a Blast

In 1996 the Bikinians, preparing for the day when they will need to generate income from their singular homeland, began operating a scuba-diving and fishing resort catering to well-to-do adventurers. In an economically grim part of the world, where tourism is essentially the only hope for earning foreign exchange, Bikini's past tragedy could be the foundation of its future success.

Scuba divers are paying almost $3,000 and anglers nearly $4,000 for a week's stay on the atoll. Is it worth it? So far there haven't been many dissatisfied customers. I found the diving to be spectacular and even moving. The 270-meter-long *Saratoga,* for example, was the first U.S. aircraft carrier and the victim of kamikaze attacks at Iwo Jima that killed 123 sailors. Damage from the attacks is still visible on its flight deck. Swimming down its elevator shaft to the hangar deck, I come across a Hell-diver airplane in excellent shape, with its gauges, stick and windshield intact.

The diving is not only stirring, it is challenging as well. Seven of my eight dives range between 39 and 52 meters, and each requires decompression in stages at the end of the dive so that I can surface without risking a case of decompression sickness (the dreaded "bends").

On the deepest dive, I experience severe nitrogen narcosis in the dark underneath the stern of the wreck of the famous Japanese battleship *Nagato*. The 216-meter-long flagship of the Imperial Navy during World War II rests upside down on its massive rear gun turrets. Although narcosis is temporary, it is not taken lightly among divers, because it impairs judgment. Glancing at my primary depth and pressure gauges, I see they are flashing zeroes, and I become confused. (I later realize that the unit is either malfunctioning or unable to cope with the depth.) Fortunately for me, Antonio, the divemaster, is vigilant and inured to narcosis. He spots my predicament and guides me toward open water. As we ascend to about 50 meters, the murk in my head clears instantly.

By the time I leave the atoll, I begin to understand why many Bikinians, especially those of the older generation, long to go back. At 245 hectares, Bikini is huge for a coral atoll island. In addition, it is completely ringed by a broad, powdery, white-sand beach, a highly unusual feature among such islands.

"It is an overwhelming place," Niedenthal says. "You realize what the Bikinians gave up when you've been there."

GLENN ZORPETTE is a staff writer for SCIENTIFIC AMERICAN.