



Edited by
Ila France Porcher

Samuel H. 'Doc'
Gruber with
lemon shark in
the Bahamas
(right); Scuba
diving early days
(below)

Doc Gruber

— Pioneer of Shark Science, Part II

Text by Ila France Porcher
Photos courtesy of
Samuel H. 'Doc' Gruber

Samuel H. 'Doc' Gruber began studying sharks in 1961, perhaps before any other scientist had done full-time research on a live shark. During his long career, he founded the Bimini Biological Field Station (Shark Lab), the Shark Specialist Group of the International Union for the Conservation of Nature, (IUCN), a United Nations organisation based in Switzerland, and the American Elasmobranch Society. He has published over 200 scientific papers, and his research is still ongoing today.

For Gruber, the study of sharks was more than a profession—it was a calling. He grew up in love with the sea from the earliest age and was already avidly collecting seashells and swimming at the age of three. His family lived in New York during World War II, but when it was over, they

returned to their house in Miami Beach—the region had been taken over by the military during the war years. Compared to New York, Florida's warm blue ocean sparkled even more invitingly, and Gruber couldn't keep away.

He excelled at swimming and practised springboard diving with a coach. Then he would wander on the beach collecting seashells until it was time to bike down to the docks to see the sports fishermen come in. He was captivated by the bizarre appearance of many of the species of fish and sharks, and loved to draw them. His family still recalls that he was infamous for leaving his shoes on the fishing dock; he would go there after school, take them off and forget them. By the time he was 12 years old, he was teaching himself to scuba dive. His childhood was spent pursuing his fascination with the life of the sea.

Between 1952 and 1956, Gruber attended high school at a military prep school, and, as a result of a growing interest in the military, he accumulated a respectable collection of antique guns dating from the US Civil War. So, when he found the scuba gear he wanted, he traded one of his guns for it.

At that time, there was no scuba dive shop and no PADI training courses. His

tank came equipped with straps to attach it directly to his back, and he had to use the fire station's compressor to fill it. There was no buoyancy control device.

The double-hose "Jet Air" regulator he had was not a two-stage regulator, such as what we use today, but had just one stage. The hose took the air pressure in the tank straight to you. So if you had 3,000 lbs of air pressure in your tank and the membrane broke (which it often did!), you would get 3,000 lbs straight into your face!



Gruber dove off the beach and descended usually to about 20 feet. The reef was covered with soft corals, tubeworms, a myriad of invertebrates and a healthy complement of fish. He loved the submarine environment and never tired of exploring it. Though he was almost always alone, he never got into trouble on his many diving expeditions.

Career choices

Gruber emerged from military prep school with a deep love of flying and the military. He enrolled initially at Emory University with the idea of becoming a medical doctor and majored in premedical studies.

While at university, he trained as an Air Force Reserve Officer (ROTC) and wanted to learn to become a pilot. He was qualified and could have enlisted and



shark tales



gone into military-cadet training. Eventually, he did learn to fly.

One day, he followed a beautiful girl, Betty Hunter, into a ballet school. Without further deliberation, he signed up. As a springboard diver, he had already gained the poise and grace required for ballet dancing, and as with his submarine explorations, he poured his heart and soul into his work. For three years, he danced semi-professionally with a ballet company in Atlanta.

When he told his family that he wanted to be a ballet dancer, they were not enthusiastic. He then suggested he could become a jet pilot and fly for the USAF, but they were concerned it was too



dangerous. They felt that being a marine biologist was close to what they wanted for him, but when he told them that he wanted to study sharks, they were dismayed.

Nevertheless, he went ahead and began his studies at the University of Miami. (The full story of his research is told in Part II of this trilogy, in X-RAY MAG issue #64).

Crisis

In 1976, just as his findings on shark vision were published and he was moving on to the study of wild sharks, he suddenly got cancer. It went into remission after six months. As he recovered, he did all he could to stay healthy. With his usual intensity, he practised meditation, visualization techniques, guided imagery and chanting. He had been a vegetarian for many years.

But the cancer returned in 1982. "You don't usually get a second chance with lymphoma," he said, explaining that there is a 30 percent mortality rate right away and only a tiny percentage of spontaneous recoveries.

In his case, the cancer got worse and worse. He tried everything available, but nothing even began to restore his health. Then during an experimental procedure in 1986, at Stanford University in California, he had a revelation.

An epiphany

It happened while he was hooked up to a plasmapheresis machine, via a catheter into a major artery. It was filtering out his antibodies and returning the

blood to his body through another tube. During this procedure, he was faxing back and forth with his graduate student in Miami preparing a proposal to the National Science Foundation to renew their funding.

Fax machines in those days had to be fed with rolls of heat-sensitive paper. As the fax came out, each page had to be cut off. Then the next page would come. Gruber was at the fax machine—receiving pages, correcting them and sending them back—when the plasmapheresis machine developed a problem and the blood began leaving his body faster than it was returned.

He fell unconscious while the rolls of paper continued coming out of the fax machine, until he was covered with scrolls of paper. And that was how the nurse finally found him—unconscious and covered with faxes.

When she had put the situation right and awakened him, he lay there, gazing out and wondered, "What is wrong with this scene?" He was supposed to be dying and he was faxing.

"I should not be writing all of this," he thought, "but that is how committed I am." He knew that something was wrong. "I decided that if I lived, and that was



CLOCKWISE FROM FAR LEFT: Gruber in the pilot's seat; Board diving in 1957; Gruber with lemon shark births; Gruber surrounded by family; Gruber with military plane

not at all clear—it was clear that I was not going to live. But if I lived, I wanted to start a little research station, in the Bahamas, where I knew there were still sharks. I had

been working in the Florida Keys, where all the sharks had disappeared, all the sharks were fished out."

But he did not get better; he could not write anymore



and he lost the grant. His doctor told him he was going to die and that he would be well advised to write his will, pay his debts and prepare himself for the inevitable.

Determined to live

But Gruber paid no attention. Though he was gravely ill, he would not give up. He was receiving strong chemotherapy



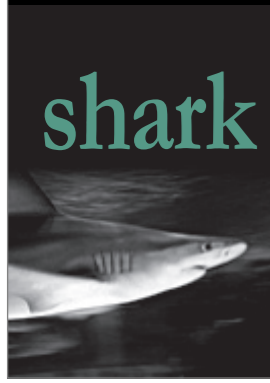
to kill the fast growing cancer cells and was sick from it. His mouth was so painful that he had to drink xylocaine to numb it before he could take a mouthful of food. But the xylocaine wore off after about one minute, so he had to drink more before he could take another bite. So he was constantly drinking liquid xylocaine to numb his mouth. Furthermore, as a result of the treatments, he had gone partially deaf.

He travelled to Boston in 1988 to get a highly experimental bone marrow transplant but was told that his cancer was just too far gone. However, he argued and insisted until the doctors agreed to give him one.

First, he had to be heavily dosed with a toxic substance called cyclophosphamide to lower the cancer cell count as much as possible, after which the poison would be washed out of his body with



shark tales



The Shark Lab location on Bimini Island in the Bahamas (right); Gruber with lemon shark in the Bahamas (below)



litres of saline fluid. The procedure required three doses a month apart.

After that, the doctors would harvest bone marrow from his hips, treat it with antibodies to remove all cancerous cells and irradiate him in a giant "microwave oven" to kill the rest of his bone marrow. Then the cleaned bone marrow could be injected back in.

After the first infusion of cyclophosphamide, the doctors sent him home, told him to take his temperature every three hours and to return if it spiked. It spiked in 24 hours—he had picked up a random infection, so the doctors sent him home to Miami in a wheelchair and told him not to come back.

It took him a month to recover from the infections in hospital, while he tried to come to terms with his mortality. He looked back over his life and was glad—he had studied sharks, he had a wife and children, he flew planes, and he felt that at least if he died, he had already had a good life.

Not yet ready to go

Gruber went back to his oncologist, Dr Martin Liebling, and asked for more chemotherapy but was refused on the grounds that the cancer was too far advanced. Liebling held out no hope and suggested that Gruber was in denial about his true condition. But Gruber would not take no for an answer. He assured Liebling that he knew his own body and had no doubt that he would respond. Still, Liebling refused.

But Gruber persevered, desperately trying to persuade him, and finally he suggested darkly, "If you don't give it to me, I'm going to die and you will have killed me." So Gruber got the chemotherapy, and as he expected, he had a good reaction to it. The tumour shrank and he felt a little better. And that was when he consulted with his friend, Dr John Miller, who was a television reporter for health and science.

The miracle happens

In 1989, there was no Internet at that time but there was already

a medical Internet called Medline, which had been established in the 1970s. Gruber and Miller got on it together and did some in-depth research. They found mention of a drug that was said to have an unexpected effect on late stage lymphoma patients. In a little paper on the response of leukaemia patients to a drug called Fludarabine was a footnote that said that two out of 11 late stage lymphoma patients had a positive response to it.

Gruber looked for a way to get into the testing program, found that there was one at Scripps Research Institute and applied to get in. But they would not accept him because he was "too late". There was another in Texas, and they would not accept him either.

Then he learnt that his oncologist, Liebling, was involved in that trial. It was only a phase-one trial, meaning that the drug was just at the stage of being checked for toxicity—the stage of finding dosage levels was

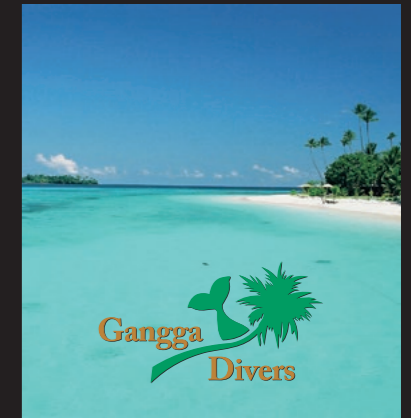
still far in the future. So he went back to his doctor, showed him the journal and asked to be treated with Fludarabine.

Liebling read it and his eyes widened. He took Gruber by the hand and started the infusion. The drug was given to him on a "compassionate treatment" basis [ed.— a case in which, when no other treatment is available, a seriously ill patient is treated with a new, unapproved drug—according to cancer.org] and it cured him. Very quickly, his cancer was gone.

Since 1976, Gruber had been longing to live just long enough to see his girls graduate from high school, and he was indeed able to see them graduate <i>and</i> go to Harvard. One became a surgeon, and one a law professor. He had grandchildren, and he saw it all. [video:<https://www.youtube.com/watch?v=JTwymzmpJI8>]

International research

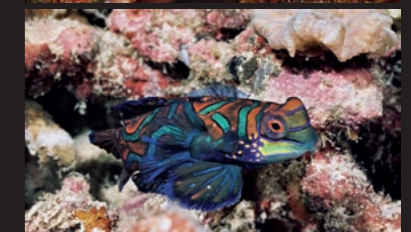
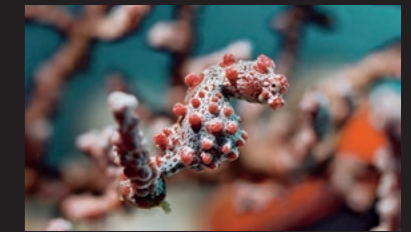
Although he was still seriously ill and still



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Ultra light on research vessel (right); President Anwar Sadat of Egypt, US President Jimmy Carter and Prime Minister Menachem Begin of Israel (below)



under chemotherapy, Gruber began to feel fairly well between treatments. From 1984 to 1986, he was part of an international research project and travelled extensively, with projects in Okinawa, Egypt and Israel.

Egypt and Israel had signed a peace accord in the seventies, when Prime Minister Menachem Begin of Israel and President Anwar Sadat of Egypt met with US President Jimmy Carter. Though it cost Sadat his life, it included a cultural and scientific exchange in which American, Israeli and Egyptian scientists would get together and do

There were two Israeli professors on the Israeli side, Natalie Prior and Elliott Zlotkin, and Gruber was on the American side.

The Egyptian program was called PL484. During World War II, the Americans had provided the Egyptians with a considerable amount of equipment to fight the Germans, which had been sold on "lend lease". The controlled Egyptian currency could never leave Egypt, so it remained in the banks, accumulating interest every year. The US government contractors and other government personnel were able to use the interest for official visits.

Gruber got money from both pots and spent two summers in Israel. He spent another in Egypt; and the Egyptian and the Israeli professors went to the United States to work with him in Florida too.

In spite of his medical condition, he was so glad to be alive that he enjoyed every moment. At the Heinz Steinitz Marine Biological Laboratory, he was researching the Moses sole (a toxic fish and shark repellent). He would drive up from

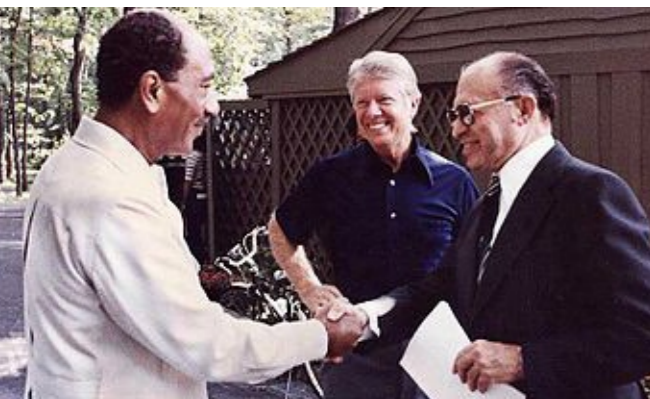
Eilat to Tel Aviv to get his chemotherapy, and when he felt better, would return to his work. With some students and family members, he dove in the Red Sea, travelled around on camels and had the time of his life.

The Shark Lab

After recovering from lymphoma, Gruber quickly got back his strength. He went to his dean at the University of Miami and told him, "You have to let me start my shark lab." He reminded him that he had brought in six million dollars over the years in grants and told him the story about the fax machine. Then he asked for a commission to start his own research station in the Bahamas.

He knew there were still sharks in the Bahamas because he had been studying them there in the course of his bio-energetics research four times a year. After eight years and 32 two-week cruises through those islands, he knew exactly where he wanted to set it up.

He told the dean he didn't need money—he had a business plan. He only asked for permission to teach



projects with one another. Gruber was involved with one of these projects.

There were two pots of money. One was called the US Israeli Binational Science Foundation, and Gruber was given a grant for that.

„If the sharks die,
the oceans will die!“

Andrew Cobb, Ambassador Sharkproject South Afrika



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his marine ecology course in Bimini instead of at the University in Miami. The dean gave him the green light. Gruber and his wife mortgaged their house and found a location in which to build the center. At last, he made the transition from being a pure, sensory physiologist working in the laboratory, to a field ecologist, studying the behavioural ecology of the lemon shark.

Bimini field station

Bimini is like a little natural lab, more like a marine lake than the open ocean. It was a very shallow, enclosed lagoon. It had been known since the 1940s that Bimini was a nursery because of the many lemon shark pups there. There had even been a marine laboratory—the Lerner Marine Laboratory—in that location from 1948 to 1972, which had accumulated much information about them.

Furthermore, as a lemon shark

nursery, Bimini was unique. Gruber had studied lemon sharks in several different places—in Brazil, the Florida Keys, on the west coast of Florida and in the Grand Bahama Islands—and Bimini was different. It was an isolated mangrove island, and the lemon sharks were constrained to stay near it.

In the other locations, there was so much habitat that they could roam far away, so it was not easy to find the same shark again and again. After the first six or seven months of life, most left their birth sites and were gone. But in Bimini, the young sharks remained for six or seven years, or even more, so it was possible to catch them repeatedly.

Back in 1990, Gruber was looking for a site to establish the laboratory when a friend, Pat O'Neal Esq., contacted him to say that he had a house available. Previously, during the late seventies and eighties, when Gruber and his re-

search teams had used research vessels to pursue their bio-energetics and autecological studies, they had used O'Neal's beach for their film teams and as a landing field for their ultralight aircraft.

A double-wide trailer had been put on the site in 1962, and over the years, many people had lived in it. O'Neal had bought it from drug dealers when they were kicked off the island, ironically for the use of the police department. He had renovated it for them, and as a result, it was more like a barracks than a house. But the police had never moved in.

O'Neal rented it to Gruber for a pittance on a handshake. All along, till 2013, they never signed a piece of paper. And O'Neal only increased the rent once during the 25 ensuing years.

Although Gruber had to start from scratch to set up his shark lab, he found many friends who were willing to help. He hired a

Shark pens at the Bimini Biological Field Station (left); Doc Gruber with students and lemon shark on Bimini (below)

carpenter to work on the building, outfitted the laboratory and built a dock. A pilot from US Airways who was interested in his work, loaned him a huge yacht to bring all of the supplies from Florida into Bimini. When he arrived with everything needed to set up a hotel-like living area, with a kitchen and bedrooms, the yacht got stuck on the sand flats in the receding tide, and they had to get a tug boat to pull it back to deep water.

Gruber had no official status with the government of the Bahamas. He rented the property and was allowed to carry out his work there under the same research permit (issued by the Department of Fisheries to the University of Mi-

ami 20 years before) that he had used while conducting his studies from research vessels. The University of Miami would not recognise his facility because they were afraid of the liability. But starting in 1988, he was selected as a member of the Bahamas National Trust Council and remained one for 16 years.

The government was perfectly happy with the presence of the shark lab, for the researchers made the region look like a paradise, especially in the television documentaries filmed there. They did have trouble for a time because of their anti-development stance, when there was an effort to kick them out, but the Bimini

Shark Lab was ultimately so beneficial that it stayed. Finally, in 2013, Gruber purchased the property and incorporated it for the first time. □

Illa France Porcher, author of The Shark Sessions, is an ethologist who focused on the study of reef sharks after she moved to Tahiti in 1995. Her observations, which are the first of their kind, have yielded valuable details about their lives, including their reproductive cycle, social biology, population structure, daily behaviour patterns, roaming tendencies and cognitive abilities. Her next book, On the Ethology of Reef Sharks, will soon be released.





Text by Ila France Porcher
Photos by Mary O'Malley

Sharks would not come to shark dives without the promise of something good in it for them. So shark dive clubs usually bring some fishy scraps—in most cases, the remains left over after big fish have been cut up for sale. The scent attracts the sharks into view and provides a bit of excitement as the animals investigate and try to get a piece.

But little actual food or nourishment is given. The sharks circle far and wide through the vast volume of the visible ocean, in a memorable and dramatic display, as they look over the scene, zoom in for a closer look, try for a scrap and socialize.

The divers generally remain in an agreed-upon position so that the sharks can come and go from the food unobstructed. The procedure works well, and is followed by divers around the world, almost without incident.

Unfortunately, this practice has been singled out for criticism, though no evidence to support arguments against it has been offered. Scientific studies have shown that there are no ill effects on the



Shark "Feeding" Dives

— *Plagued By Unsubstantiated Criticism*



sharks and their subsequent behaviour. Further, no correlation between shark dives and shark attacks has been found, in spite of decades of shark attack studies and many researchers seeking to find just such a connection.

So little food is brought for the sharks that no one animal gets enough supplementary food to make much difference to its dietary needs, and long-term studies of the travelling patterns of different animals have shown no association with the presence or absence of shark dives.

One can see for oneself, when watching the actions of one shark at a time on a shark dive, that not all of the sharks present actually approach to eat, and many seem to be there for social rea-

sons. Sharks don't appear to have the strong bite reflex observed in mammals and related vertebrates—they neither fight, nor bite each other. They don't bite the divers either.

Criticism and the media

The criticism seems to stem from the idea that sharks really are the blood thirsty monsters presented by the media. Taking this idea a step further results in an unquestioning belief that attracting such creatures into the presence of divers just has to be bad. The idea is fully supported by shark fishermen, who themselves have no idea how sharks behave and for whom fighting such monsters demonstrates their own superiority.

Yet they turn a blind eye to the shark fishing practices of using not only food but also special, bloody mixtures called "chum" to attract sharks, often in the vicinity of beaches. Two examples are the Lake Worth Pier and the Juno Beach Pier in Florida. Shark fishing and baiting goes on 24/7, while lifeguards on the nearby beaches signal that everything is all right to beachgoers. Bull sharks and hammerheads are caught there. Yet, divers are prohibited from putting even scent in the water, and shark divers are obliged to go to the Bahamas.

One reason this double standard is accepted is because sharks are assumed to be as dangerous as they are depicted in the media. Such examples can be





found quite widely. In French Polynesia, for example, divers began lobbying for shark protection when shark finning began. The fishermen counter attacked by claiming that the divers were responsible for the sharks being there in the first place, and that because of shark dives, soon the sharks would be coming out on the beaches to eat their babies—they were doing everyone a service by finning them.

Fictitious though it was, the argument nearly resulted in shark dives being banned in the country, even though divers were responsible

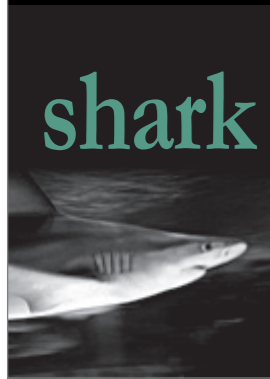
for bringing in a high fraction of the tourist dollar, and shark feeding had been practised there for decades without incident.

Sharks are able to distinguish one event from another and easily differentiate shark dives from spear fishermen. Such fishermen are themselves responsible for attracting sharks to their activities, as they always have. The scents and sounds they cause are different from those of a shark dive setting.

Most shark enthusiasts are divers, since diving is the only way to see sharks in their own realm, so shark dives form an important

basis for shark conservation. Given that a quarter of shark species are threatened with extinction, the benefits of shark dives take on greater significance. Divers seeing sharks for the first time typically use such words as “terrific”, “so beautiful”, “amazing animals”, and speak of being enraptured by the sight.

The sense of awe expressed is so powerful as to often change the person's attitude forever. They never forget, and many return again time after time to see sharks in their natural habitat, and become informed supporters of shark conservation. ■



shark tales

Most attacks are just bites

The International Shark Attack File (ISAF) is a global database of shark attacks. It began as an attempt to catalogue shark attacks on servicemen during World War II. The file contains information on over 5,300 shark attacks.

ISAF investigated 130 incidents of alleged shark-human interaction occurring worldwide in 2014. Upon review, 72 of these incidents represented confirmed cases of unprovoked shark attacks on humans. "Unprovoked attacks" are defined as incidents where an attack on a live human by a shark occurs in its natural habitat without human provocation of the shark.

Florida again led the United States in shark attacks last year, with 28 incidents and no fatalities. The vast majority of the Florida incidents were minor ones in which a shark quickly bites an arm or leg in poor visibility, releasing it as soon as the shark realizes its prey isn't a fish.

"Most of them are better called bites than attacks. They're the equivalent of dog bites."

According to George Burgess, curator of the ISAF, Florida's place at the top of the shark-bite chart owes more to geography and tourism than any particular fondness that the sharks off its shores have for biting people. The state has the largest coastline in the United States after Alaska, where swimming in the ocean is not particularly popular, and attracts millions of tourists who splash in its coastal waters. ■



Male white shark observed off Mexico's Guadalupe Island

Great whites takes decades to reach maturity

Male great white sharks take 26 years to reach sexual maturity and females take 33 years.

Age and growth of the white shark can be estimated by counting "band pairs," which are series of rings that alter-

nate between translucent and opaque within the sharks' vertebrae in a manner similar to counting tree rings.

Looking at band-pair data from 77 sharks that were captured between 1963 and 2010, researchers found that great white sharks were considerably

older than previously thought, with the oldest individual in the study reaching 73 years of age. They also found that the great white sharks—at least in the Atlantic Ocean—matured more slowly than previously thought, thus making them even more vulnerable to threats. ■

Katharine the Great has returned to Florida

Katharine, a 2,300-pound great white shark that was implanted with a transmitter in August 2013 and tracked by research team Ocearch, has been spotted off Florida heading south possibly on her way to the Gulf of Mexico after spending the winter around Cape Cod. Katharine, who is 14 feet long, sends a signal every time she surfaces as part of a pioneering program to show shark movements live online. In the first 10

months, she traveled over 5,000 miles. Last June, Katharine was spotted off the Gulf coast of Florida, heading towards Texas.

Warmer water

Having spent most of the season off Massachusetts, it was believed that Katharine would stay there. However, as the Massachusetts waters got colder, Katharine made a sharp journey south and within days she was spotted in Pamlico Sound, North

Carolina. Soon after that, she was localized off Jacksonville, and now everyone is excited to see whether Katharine revisits the route she took last year, when she traveled all the way down to the Gulf of Mexico. Another white shark, Mary Lee, which at 3,456 pounds, is much larger than Katharine, prefers to stay in far-out Atlantic, keeping off Georgia and the Carolinas. ■

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