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Issyk-Kul

Iceland
Stýrtan

Columbia
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Decisions

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Tech
Du'an Cave Diving

SHARK DIVING IN
The Bahamas

DIRECTORY

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Reef shark Bahamas. Photo by Peter Symes



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COVER PHOTO: 'PJ' Dunick with four tiger sharks, Bahamas
Photo by Peter Symes



On anthropomorphism

If there ever was a word, or concept, that has stuck in my mind since my first training as biologist, its anthropomorphism: *"We must not attribute human sentiments to animals; we cannot assume they are thinking the same way as we do, or even have feelings or rationale."*

Surely, there is no way we can know for sure, but then again, we cannot really say that about our fellow human beings either. Yet in our daily lives we go about interacting in society and making a living based on the inference that we do understand each other. Without our ability to communicate, our social rules and culture, we would not be able to build complex societies.

I now take some issue with the notion that we cannot assume that animals have feelings and rationale, as there is a growing body of evidence to corroborate that they indeed do. Contending they are not seems more of a matter of philosophers splitting hairs.

The more we study animal physiology and behavior, the more parallels we discover. Fish can count, learn from experience and make deductions. Fish show elevated levels of stress hormones and act scared when

frightened. Cephalopods, which are short-lived molluscs, are so intelligent that they can analyse and devise solutions to problems not encountered before. Chimps and birds are known to both use and make tools. Orcas coordinate complex hunting tactics. Service dogs can be trained to perform a wide array of specialized tasks. The list goes on.

We know how to read the moods of animals with which we are familiar—at least, the intelligent and social species—enabling us to interact with them to various degrees. A snarling dog, for instance, is obviously feeling threatened and shouldn't be approached, whereas the playful puppy is in a completely different mood and may want you to throw a stick.

Over the years I have found that this also goes for sharks, as several of the features in this issue will illustrate in more detail.

Our appreciation of sharks has fortunately come a very long way since the movie *Jaws* scared the living daylights out of the public. Gone are the days when the only good shark was a dead one. How the roles have reversed. We now go out of our way, some of us anyway, often paying top dollar to get into the

water with sharks—the bigger, the better.

That is a good trend. There is nothing like first-hand encounters to make us better understand and appreciate these majestic creatures, which is probably the sharks' best chance of gaining proper protection. It is also an awesome experience on a personal level.

— Peter Symes

Dedication

We dedicate this issue to PJ Dunick who is featured on the cover and in the main feature article in this issue. PJ was an unusually gifted and skilled dive guide who was both a natural in the water and interacted with the tiger sharks with a rare grace and elegance. He clearly had deep respect and love for the tigers and led by example.

Sadly, only a few weeks after shooting the images for these articles, we received the news that PJ was involved in an accident and passed away while doing what he loved, snorkeling and freediving off the Bahamas.

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Troy Cheek, October 2014



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News edited
by Peter Symes

from the deep NEWS

New coral discovered off California



The new species of white coral is most likely closely related to gorgonian corals.

A new species of deep-sea coral and a nursery area for catsharks and skates has been discovered in the underwater canyons located close to the Gulf of Farallones and Cordell Bank national marine sanctuaries.

It was the first thorough exploration of the cold, oxygen-rich waters north of Bodega Head, a small promontory that lies along California's Sonoma coast just 70 miles north of San Francisco. Submarine canyons, such as Bodega Canyon, extend from the continental shelf to the deep sea—making their exploration a difficult but worthwhile endeavor. The canyons are important because they act as a refuge for important species of fish and provide a habitat for sensitive species of deep water corals and sponges.

Difficult to explore

The research team used mini robotic subs to make multiple dives. The submersibles were outfitted with a variety of instruments, including a camera, enabling scientists to document the marine life as the subs descended 1,000 feet and returned. Because deep-sea canyons are difficult to explore, these sorts of expeditions routinely offer up novel finds—like never-before-seen coral species.

Significant discoveries

After multiple dives, the research team made two significant discoveries. One significant discovery was made by a second team on the mission, led by California Academy of Sciences' Gary Williams, who found corals approximately 600 feet deep. Scientists are still analyzing samples of the newly discovered coral, but they say the species is most likely a new species of deep-sea coral from the *Leptogorgia* genus and related to gorgonian corals.

The other major discovery was hundreds of skate egg cases on the seafloor, and in bundles on the rocks surrounding a catshark nursery area. "This is a highly unusual nursery because rarely, if ever, are shark nurseries in the same area as skate nurseries," said Peter Etnoyer, a deep-sea biologist at NOAA's National Centers for Coastal Ocean Science.

In addition to the discoveries, the research team also conducted video surveys of areas that previously were documented only through sonar imaging. ■



Flower Garden Banks National Marine Sanctuary contains some of the most spectacular marine resources in the northern Gulf of Mexico.

Gulf of Mexico reef sanctuary to be expanded

The National Oceanic and Atmospheric Administration introduced a proposal to increase the protected area from 56 square miles to 280 square miles.

The Flower Garden Banks National Marine Sanctuary is located in the northwest part of the Gulf just roughly over 100 miles south of the Texas-Louisiana border. It consists of 14 federally designated underwater areas protected by a federal program.

The sanctuary, first established in 1992, includes the northernmost coral reefs in the continental United States. A series of reefs, sitting atop salt dome sea mounts, are found along the rim of the Continental Shelf between about 70 miles and 150 miles off the coasts of Texas and Louisiana.

The banks host many species, including brightly colored sponges, eels, urchins, shrimp, lobsters and shellfish, eagle and manta rays, sea turtles and whale sharks. The Sanctuary includes some of the healthiest coral reef communities in the entire Caribbean and western Atlantic region.

In February, NOAA's Office of National Marine Sanctuaries announced that it is gathering information and requesting public comments for possible expansion of Flower Garden Banks National Marine Sanctuary. There are several more steps to complete—including an environmental review—before the expansion can happen. The deadline for official comments on sanctuary expansion is 6 April 2015. ■

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Sharks have long memories

Bamboo sharks that have been trained in a range of visual discrimination tasks, such as distinguishing between squares, triangles and lines, remembered the learned information for a period of up to 50 weeks, after which testing was terminated despite the absence of reinforcement. This indicates that sharks are capable of long-term memory within the framework of selected cognitive skills.

Researching the intelligence of the grey bamboo shark, a team of researchers at Rheinische Friedrich-Wilhelms-University in Bonn, Germany, showed that sharks could be trained to recognise and remember shapes for an extended period of time.

First juvenile sharks were subjected to three different cognition experiments, one at a time, and then tested to see how long the sharks could remember their training.

Squares and triangles

During the initial experiment, sharks were placed in a special holding tank and an image of a basic shape was projected onto one of its walls. Some of the sharks were shown a triangle and would receive a small piece of food for pressing their nose on the triangle. Other sharks were taught to always recognise a square for which they were similarly reward-

ed. Some individuals were faster learners than others and they also varied in their ability to learn and retain memories.

Long-term memory

Up to 50 weeks later however, almost all the sharks still remembered which shape to select, despite the absence of any reinforcement in the interim. This is certainly significantly better than the seven seconds that urban legend has associated with the memory of fish.

It is quite possible that the fish could remember even longer but at that juncture the researchers ended the study to begin investigating which part of the shark brain is responsible for such feats of memory. Unlike with mammals, it is currently completely unknown how and where in the brain sharks process, store and retrieve memories.

These cognitive skills are ideally suited to a predator living in a complex, variable and unpredictable environment allowing them to adapt behaviour, ultimately improving their feeding efficiency.

The grey bamboo shark, which was used in the experiment, is, however, a benthic feeder, swimming along the ocean floor, scooping up sand with its mouth and hoping to catch small fish, worms, shrimps, mollusks and crabs. As such it is less dependent on its vision than open water hunters. This implies that visual hunters such the great white shark and tiger sharks might be capable of even greater mental feats.

Studies by other researchers have previously shown that sharks also remember stimuli associated with their electro-receptive sense, which detects bio-electric fields emitted by prey. ■

The study also conducted experiments that showed that sharks can perceive optical illusions.

Bamboo shark stores sperm for almost four years

Researchers at the California Academy of Sciences say a brownbanded bamboo shark laid a viable egg—from which hatched a healthy shark pup—while secluded from any contact with males for an incredible 54 months.

While they were unable to determine which of the female sharks in the aquarium's tank had laid the viable egg, DNA examination of the pup showed it was not a case of parthenogenesis—in which a female that usually reproduces sexually is able to create off-

spring on her own, observed before in some shark species—but that the pup had the normal two parents.

None of the females had had any contact with male bamboo sharks since they had been transferred to Steinhart from the Aquarium of the Pacific in Southern California in 2007.

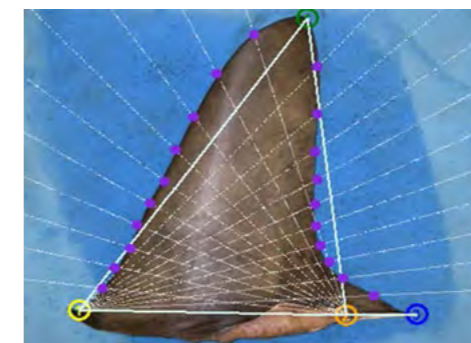
The DNA of the pup showed evidence of genetic material inherited from the father, an unknown bamboo shark male sharing that Southern California tank almost four years ago. ■

iSharkFin

iSharkFin is a new software that uses machine-learning techniques to identify shark species from images of shark fin shapes.

Users only have to take a standard photo, select some characteristics of a fin and choose some key points of the fin shape. iSharkFin automatically analyzes the information and identifies the shark species from which the fin comes.

A first version of iSharkFin is now available for the identification of 35 species of sharks from dorsal fins and seven species from pectoral ones. Many of these species are the most commonly traded internationally and include some that are in the Appendices of CITES. The software, which has been



Screenshot

developed by the FAO in collaboration with the University of Vigo, is aimed at customs officers and inspectors at fish markets and fishermen who want to avoid the capture of protected species. ■

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Acropora millepora red and green color morphs

The key finding is that these so-called 'colour morphs' do not use just one single gene to control the pigment production, but multiple identical copies thereof.

How corals control their colour

The fluorescent pigments that are mostly responsible for coral colors act as sunscreens for the symbiotic algae that live in the coral tissue. Pigment production is controlled by multiple copies of the same gene. Depending on how many genes are active, the corals will become more or less colorful.

Using the staghorn coral *Acropora millepora* as a model, scientists from the University of Southampton have found that the fluorescent pigments that are mostly responsible for coral colors act as sunscreens for the symbiotic algae that live in the coral tissue. These algae require light to produce sugars, which they can contribute to the nutrition of the corals in return for the shelter and the supply of nutrients that are provided by the coral host.

brightly colored corals. This energy might be divided away from other important processes, potentially

resulting in reduced growth rates or lower numbers of offspring. Therefore, being brightly colored

Trade-off

However, the enhanced protection comes at a cost and the corals need to allocate substantial energy reserves to accumulate the high amounts of protein pigments that are characteristically found in

Tiger sharks travel thousands of kilometers

Eleven tiger sharks off the north-western coast of Western Australia were tracked using satellite tags. One individual recorded one of the largest geographical ranges of movement ever reported for the species, travelling over 4,000km during 517 days of monitoring.

However most of the sharks had restricted movements and long-term residency in coastal waters in the vicinity of the area where they were tagged. One shark displayed seasonal movements among three distinct home

range cores spread along most of the coast of Western Australia and generalized linear models showed that this individual had different patterns of temperature and depth occupancy in each region of the coast, with the highest probability of residency occurring in the shallowest areas of the coast with water temperatures above 23°C. These results suggest that tiger sharks can migrate over very large distances and across latitudes ranging from tropical to the cool temperate waters. ■ SOURCE: PLOS ONE

might not be a good investment for corals settling in less light exposed parts of the reefs.

It was one of the longstanding mysteries of coral reef biology—why sometimes individuals of the same coral species can show such dramatic differences in their

color, despite sitting side-by-side on the reef and being exposed to the same environmental conditions. Color morphs resulting from high-level expression of differently colored proteins are not restricted to scleractinian corals, but are frequently found among other anthozoan taxa. ■

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wreck rap



Diver at capstan on wreck of HMS *Warrior II* (right); Historical photo of *Warrior II* (below)

Text and photos by Vic Verlinden
Edited by Catherine GS Lim

During the two world wars, many private vessels were confiscated by the British Royal Navy. These luxury yachts were often employed during dangerous missions, which did not always end well.



The HMS *Warrior II*, once formerly named "Goizeko Izarra", was built in 1904 in Troon, Scotland, as a luxury steam yacht for a private owner. The ship was 284 feet (84 meters) long, an extraordinary size for this type of ship. It was also equipped with two engines and furnished with expensive materials.

During the First World War, she was confiscated and had to serve her duty as a navy vessel. However, it was during the Second World War that this beautiful ship came to her end. On 11 July 1940, the former yacht was in the English channel roughly 20 miles from Weymouth, when it was attacked by a German plane. The pilot had circled the ship once before



HMS *Warrior II*

deciding to attack. The *Warrior II* took a direct hit and sank almost immediately. On that day, the *Warrior II* crew sustained one casualty.

Discovery

A few years ago, the wreck was found by skipper Ian Taylor of the Weymouth dive charter Skin Deep Diving. One of the

divers recovered the ship's bell, leading to the positive identification of the ship. When I visited the wreck myself, I sailed with Skin Deep Diving, in the company of a French group that had adopted me for one week.

As the visibility in another part of the English Channel was bad, we decided to visit wrecks that were more to the north.

According to our skipper, Len Hurdis, the visibility would be better here as the bottom structure was different. The seafloor at the location of the *Warrior II* wreck consisted of gravel and pebbles; hence, the current would not pick up any sand and mess up the visibility.



Diver at rudder mechanism on wreck of *Warrior II*



Diver being lifted out of the water by way of a motorized lift on the 11-meter catamaran *Skindeeper* (right); Divers on the wreck of the *Warrior II* (far right)

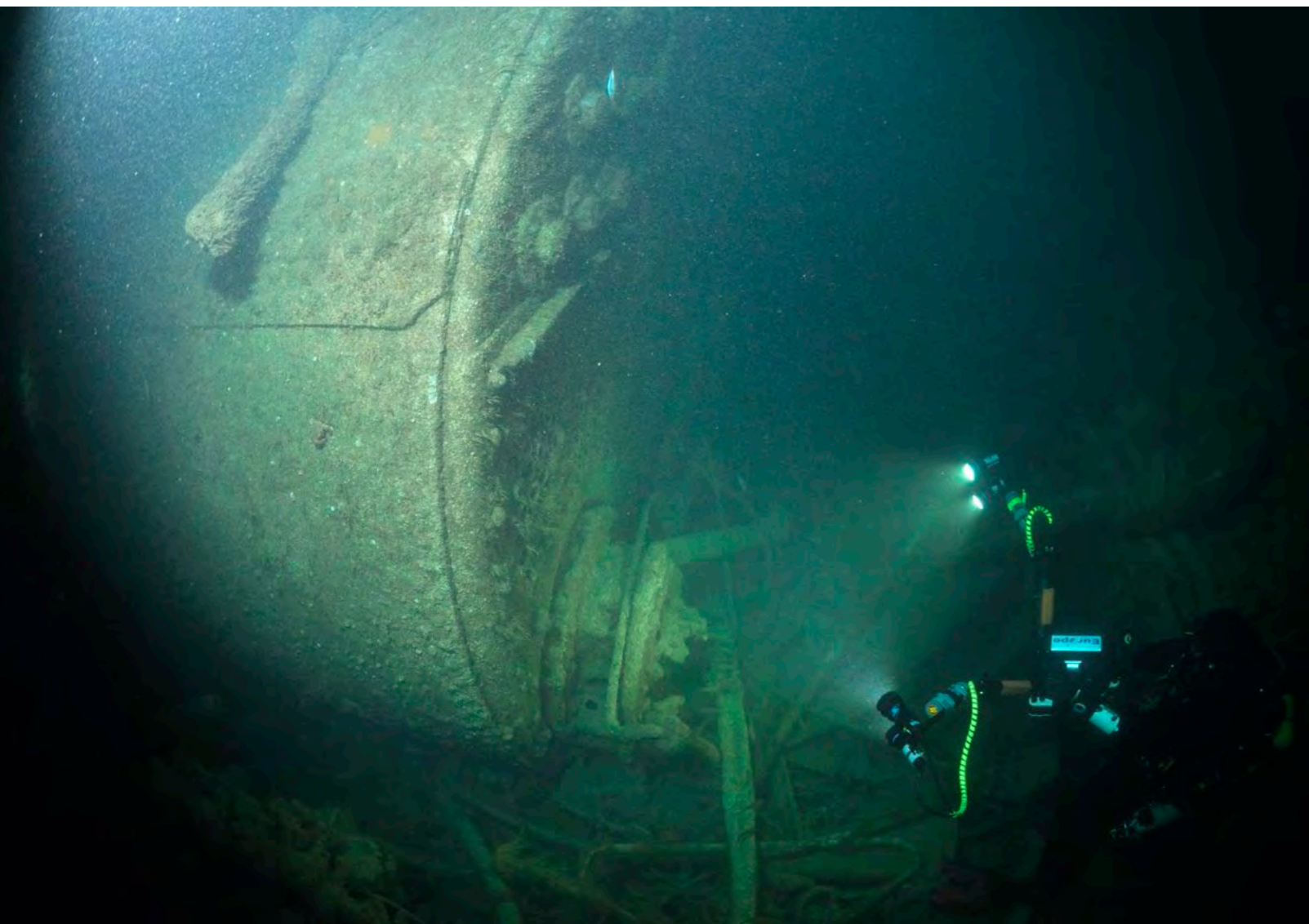


At these times, it's crucial to have an experienced skipper to help divers make the most of the money they invested in the week's worth of diving. Hurdis was an expert on all levels and kept his ship under control in all situations. This was a great reassurance to the participants of this wreck dive trip. He was supported by his wife, Maggie, who operated the eleva-

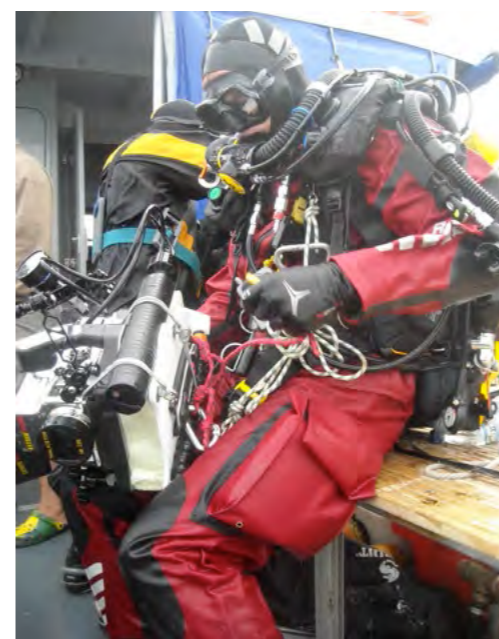
tor that picked up the divers from the water.

That day, we were with 12 technical divers on board, which required a certain discipline to assure that all went smoothly. After the down line was in place, the first teams prepared themselves to enter the water. There were several open circuit divers on board and they would enter the

water first, to ensure they would make their ascent roughly in time with the rebreather divers. It was agreed that the maximum dive time would not exceed two hours.



Diver at keel of the wreck of the HMS *Warrior II*; A film crew prepares video equipment for the dive (right center)



Diving

My buddy on this dive was a cave diver with a different type of rebreather than what I had on; therefore, we worked out plans and agreements in case of an

emergency. Dive planning was one of the most important items to arrange when exploring a wreck at greater depths. The wreck was at a depth of 54 meters. We decided not to exceed the 35-minute bottom time.

After about ten minutes, it was our turn to jump overboard and slowly drift towards the buoy. Because several teams would come in after us, we had to descend as quickly as possible. At six meters below the surface, we did a thorough bubble check to make sure the rebreathers were closed. Then, we descended to the wreck.

At 45 meters, we started to see parts of it. The anchor of the down line was close to one of the steam boilers. Around this boiler, the copper and brass pipes and valves—whose function were to divide the steam—were still

present. The visibility at the bottom was more than eight meters, so we decided not to deploy a guideline. However, my buddy hung a strobe light on the down line to make it easier to find when it was time to start our ascent.

Then, the real exploration of the wreck began as we swam in the direction of the stern.

Trip to the swimming pool

The wreck had degraded and fallen apart over the years, hence we needed to watch out for the sharp edges of the hull plates scattered about on the seafloor. One of the plates still stood upright, and square portholes were still clearly visible on the wreck. Several meters away, we saw the same type of portholes sticking out from the sand. These probably served to bring light to the saloon or dining area.



Diver at engines of the wreck of the *Warrior II*

Several years ago, I had seen similar bronze portholes on the wreck of the *SS Tubantia* in the North Sea. So, it appeared these items were much used in that period on passenger ships. Today, it would be unthinkable and too expensive to equip a ship with such rich materials.

Continuing our exploration, we discovered pieces of a floor covered with bright green tiles. Apparently, these were remnants of a swimming pool, making it abundantly clear that money was no object during this ship's construction. Next to the swimming pool,

we found parts of the mosaic tiles of the showers. Further along, towards the stern, I recognized one of the capstans, probably driven by steam. These served to pull in the lines and hawsers during the mooring of the ship.

Directly aft of



the capstans, we found the rudder mechanism with the rudder axle to which the rudder was connected. By now, we had reached the end of the wreck and it was time to make our way back. On the way back, we swam past two large engines where I took my last pictures before we started our ascent.

Back to the surface

The ascent after a deep dive was an important moment. Before we began, I checked that I had replaced the cover on my dome port so as not to damage this. During the decompression, it was absolutely necessary to focus only on this task and not make any mistakes. Everything went according to plan.

After more than an hour, we surfaced, and it was a happy reunion with our dive ship that patiently awaited our return. Due to the clear visibility and the different spectacular parts on the wreck, this was indeed a memorable dive. ■

REFERENCES: WRECKSITE.EU, WIKIPEDIA.ORG

Having dived over 400 wrecks, Vic Verlinden is an avid, pioneering wreck diver, award-winning underwater photographer and dive guide from Belgium. His work has been published in dive magazines and technical diving publications in the United States, Russia, France, Germany, Belgium, United Kingdom and the Netherlands. He is the organizer of tekDive-Europe technical dive show: tekdiver-europe.com



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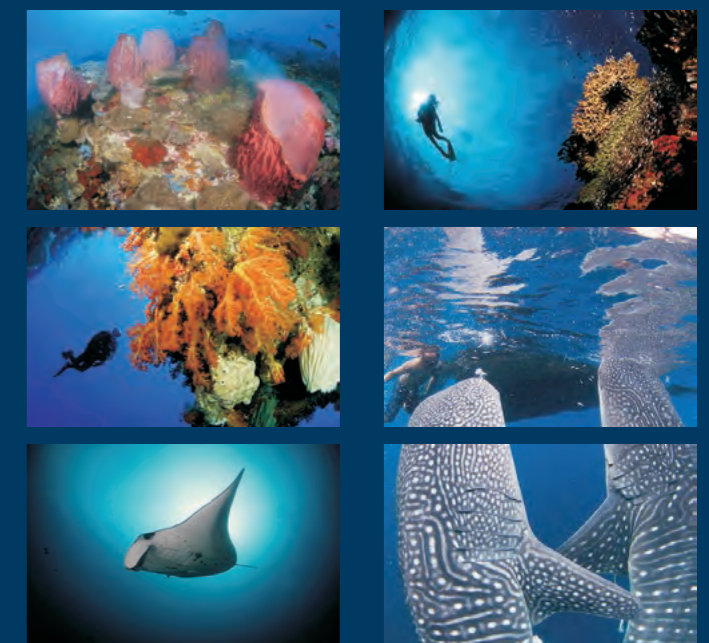


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Divers at porthole on wreck of *Warrior II* (above); Diver exits water after successful dive (right)



Thousands of ancient gold coins found in the port of Caesarea

The largest treasure of gold coins discovered in Israel was found in recent weeks on the seabed in the ancient harbor in Caesarea National Park. A group of divers from the diving club in the harbour found the lost treasure.



The gold coins are from the Fatimid period

Using a metal detector, the Marine Archaeology Unit of the Israel Antiquities Authority's divers found gold coins in different denominations: a dinar, half dinar and quarter dinar, of various dimensions and weight. Kobi Sharvit, director of the Marine Archaeology Unit of the Israel Antiquities Authority said that "the winter storms expose treasures from the sea".

In addition, he said, "The discovery of such a large hoard of coins that had such tremendous economic power in antiquity raises several possibilities regarding its presence on the seabed. There is probably a shipwreck there of an official treasury boat which was on its way to the central government in Egypt with taxes that had been collected."

Historical background

The earliest coin exposed in the

treasure is a quarter dinar minted in Palermo, Sicily, in the second half of the ninth century CE. Most of the coins though belong to the Fatimid caliphs Al-Hākim (996–1021 CE) and his son Al-Zāhir (1021–1036), and were minted in Egypt and North Africa. The coin assemblage included no coins from the Eastern Islamic dynasties and it can therefore be stated with certainty this is a Fatimid treasure.

According to Robert Cole, an expert numismatist with the Israel Antiquities Authority, "The coins are in an excellent state of preservation, and despite the fact they were at the bottom of the sea for about a thousand years, they did not require any cleaning or conservation intervention from the metallurgical laboratory. This is because gold is a noble metal and is not affected by air or water." ■

'Magical metal' found in 2,600-year-old Sicily shipwreck

A team of marine archaeologists have discovered 39 ingots of a red-tinged alloy metal scattered across the sandy sea floor near a 2,600-year-old shipwreck off the coast of Sicily. The vessel foundered in a storm only 300m short of its destination, the port of Gela in southern Sicily. Researchers believe it was likely headed there from Asia Minor.

Orichalcum

But are the ingots really made from an alloy named orichalcum, the mystical, 'magical' metal which is said to have propelled Atlantis to the heights of ancient

technology? Regarded as being second only in value to gold, orichalcum was also said to be mined at the mythical island of Atlantis itself. The metal, like the civilisation, slipped beneath the waves—never to be seen again—in a cataclysmic event in antiquity.

Mystery alloy

Orichalcum may have been one type of bronze or brass, or possibly some other metal alloy. Legend has it the alloy was composed of copper, gold and silver. Today, some scholars suggest that orichalcum is a brass-like alloy, which was made in antiquity the process of

cementation, which was achieved through the reaction of zinc ore, charcoal and copper metal in a crucible.

Brass indeed

The latest discovery of the orichalcum ingots that had laid for nearly three millennia on the sea floor may finally unravel the mystery of the origin and composition of this enigmatic metal. An analysis of the 39 ingots using x-ray fluorescence found they were made of an alloy primarily consisting of copper and zinc, i.e. a form of brass. ■



The dupondius (Latin two-pounder) was a brass coin used during the Roman Empire. With the coinage reform of Augustus in or about 23 BC, the sesterius and dupondius were produced in a golden colored copper-alloy called orichalcum by the Romans and numismatists, and by us brass, while lower denominations were produced out of reddish copper.

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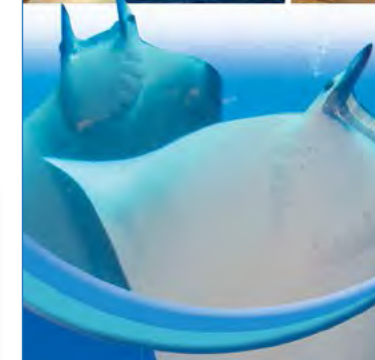


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Edited by
Scott Bennett

Tourists reporting harassment surge by Thai police

Since the 2014 coup that ousted the democratically elected government and implemented martial law, many tourists and expatriates in Bangkok have fallen prey to a criminal practice. The victims have little recourse when reporting incidents to police, as the perpetrators are the police.

The Twitter feed of former Lonely Planet author Joe Cummings, is riddled with stories detailing police harassment and extortion. "Random police searches of foreigners in BKK is getting bad," reads a typical entry dated December 6. "Many reports of

innocent tourists forced to pay bribes."

As tourism receipts and indirect tourism activity account for 15 percent of Thailand's GDP, why would police be allowed to make omelets from Thailand's golden eggs? The most popular theory is that low-ranking street cops, some of whom earn as little as US\$1 an hour, are seeking out new sources of income. Foreigners are easy targets, as they can be intimidated and are comparatively wealthy compared with the local population.

Airport scam

These reports follow the cases only a few years back when several European tourists said they were falsely accused of shoplifting at Suvarnabhumi, Bangkok's main international airport, and held until they paid hefty sums to buy their freedom. According to Associated Press, a British couple paid the equivalent of \$11,000 to secure their release five days after being accused of stealing a Givenchy wallet that was never found, say police, who along with airport authorities deny any wrongdoing. The scandal spawned warnings on travel blogs and a string of overseas travel advisories on the perils of duty-free shopping in Bangkok.

False allegations

"We have received reports that innocent shoppers have been the subject of allegations of suspected theft and threatened that their cases will not be heard for several months unless they plead guilty and pay substantial fines," an Irish government travel advisory wrote. It tells shoppers to keep receipts to avoid "great distress".

By law tourists must also carry your passport with you at all times. Tourists have been arrested because they were unable to produce their passport. ■



PETER SYMES

Tourists in transit in Suvarnabhumi international airport. Travellers have been warned about "scams" that target foreign tourists shopping at the airport.



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Edited by
Peter Symes



Issues with "hidden city" fares

"Hidden city ticketing" can offer steep discounts on airfare. Basically, you book a flight past your destination, with your target destination as a stop on the route, and save more than if on the direct route.



Airlines, however, don't like "hidden-city ticketing" as it reduces their revenue. So US Airlines and Orbitz's have filed a much publicized lawsuit against the website Skiplagged to stop them from promoting and selling such tickets. Also as known as "point beyond ticketing," most airlines, United among them, have language in their contracts of carriage, which you nominally agree to when you buy a ticket, forbidding this ploy. So United Airlines is suing Skiplagged's founder, asking in the suit for reimbursement of lost revenue and other remedies.

Not all airlines prohibit hidden-city ticketing, but some of those that do have been known to kick passengers out of their frequent-flier programs for using the tactic too often, and they've also charged agents for the higher fare when tickets have been arranged through travel agencies. There are also other risks and inconveniences to consider. You can't check your bag, because it will end up on the ticket final destination city. You also only want to do it for the first leg of the trip on a one-way flight, in case the trip gets canceled past that. Weather or other delays could cause a problem as well if you're rerouted to another connecting city. □

Hotel chain told to stop jamming guests' mobile hotspots

Marriott International fined \$600,000 after a complaint that it had jammed mobile hotspots at a hotel in Nashville.

The US Federal Communications Commission (FCC) investigation revealed that Marriott employees had used containment features of a Wi-Fi monitoring system at the Gaylord Opryland to prevent individuals from connecting to the Internet via their own personal Wi-Fi networks, while at the same time charging consumers, small businesses, and exhibitors as much as US\$1,000 per device to access

Marriott's Wi-Fi network. The FCC described the action as "unacceptable", and on top of a fine, the watchdog ordered the firm to submit compliance reports every quarter for the following three years to ensure it ended the practice.

Threat of hackers?

Marriott, however, defended its right to block mobile hotspots



used outside guest bedrooms on the grounds that it needed to tackle interference and security issues. While it has now changed its policy, Marriott has not backed away from claims that the move could play into the hands of hackers. ■

SOURCE: US FEDERAL COMMUNICATIONS COMMISSION

Europol warn over data theft through public hotspots

Europol's cybercrime centre is advising travellers to exercise extreme caution when using Wi-Fi hotspots when out and about and warns that sensitive information should not be sent over public Wi-Fi hotspots. Troels Oerting, head of Europol's cybercrime centre, told BBC the warning was motivated by the growing number of attacks being carried out via public Wi-Fi. "We have seen an increase in the misuse of Wi-Fi, in order to steal information, identity or passwords and money from

the users who use public or insecure Wi-Fi connections," he said. "We should teach users that they should not address sensitive information while being on an open insecure Wi-Fi internet."

Wait if you can

Singled out for particular attention is online banking, which Oerting suggests people should do "from home where they know actually the Wi-Fi and its security" rather than in a coffee shop.

The numbers of people who

seek out free Wi-Fi connections in towns and cities, many of whom have little or no knowledge of internet security, show no signs of declining. The best attitude for anyone to adopt is to use only networks that are encrypted, stick to using mobile data connections rather than Wi-Fi, or just wait until you get home—and turn off the auto-connect feature on your phone and tablet so you don't automatically get put online when you're in range of a network you have connected to before. ■

In-Flight Wi-Fi grinding to a halt while getting pricier

Passengers are paying more for a slower service.

Wi-Fi providers like Gogo, which works with Virgin America, Delta and American Airlines, say that Internet speeds have gone down because of growing demand. "When we started in 2006, there was no iPhone, and tablets didn't

really exist," Anand Chari, chief technology officer at Gogo, tells *New York Times*. Chari said that almost two million passengers a month now connect to Gogo's wireless network in the air. "Any given flight from Boston to Los Angeles will have 70 users," he said. But while the number of Wi-Fi customers has grown drastically,

so has the price (in some cases more than double).

Gogo plans to offer a new Wi-Fi service on select flights this year, 2Ku, which is satellite-based and upward of 22 times faster than the company's current air-to-ground technology in some planes. However it won't be available on all flights until 2016. ■

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Dancing with Tigers

Text and photos by Peter Symes

I felt apprehensive heading out to Tiger Beach where I was supposed to enter open water in the presence of some big, wild apex predators, without any protection other than holding up my camera as a shield in case I was singled out as a snack. Before the week was up, I could not get back in the water fast enough, moving around with growing confidence amongst several of these huge but most graceful sharks and having encounters and interactions that left a deep and indelible impression, which will stay with me for the rest of my days.



Bahamas



Tiger Beach is not an actual beach but a location along the western rim of Little Bahamas Banks.

The trip started off on a somewhat chaotic note. The marina in West Palm Beach, our point of embarkation, was temporarily undergoing construction making the vessel, *Dolphin Dream*, difficult to locate. A couple of the other guests did not show up before our skipper, Scott, finally conceded defeat, after waiting all evening, and proceeded to set a course for the Bahamas. As we were also in for a rather windy and bumpy ride across the Straits for Florida, I felt as if all the bad omens were piling up and that I would surely come home missing a limb or two.

A week later when I had the

benefit of hindsight, all those sentiments, probably fuelled by all the compounded stresses and worries from my everyday job piling up, all seemed quite laughable, but at that juncture, being thrashed around in my cabin, I did question the sanity of what I had now committed myself to.

After clearing Bahamian customs in West End at some desolate pier with nothing in sight, we went for a short test dive on the reef along the nearby coast. There were no sharks, but having listened to briefings about constantly keeping an eye out for sharks sneaking up behind made me somewhat

watchful for what may suddenly appear out of the shadows, yet nothing did—no big monsters with sharp teeth, at any rate.

Shark fin soup

The next morning I woke up to find the boat being berthed on Bahamas banks in what at first glance seemed like the middle of nowhere. I could not see any land. What I could see, aft of the stern, was a dozen shark fins cleaving the still choppy surface and the outlines of agitated shark bodies jetting here and there—lemon sharks, I was told. Still pensively clasping my morning coffee, the realization

A congregation of mostly lemon sharks hung out behind the boat at most times. They didn't seem to care much for divers or snorkellers.

No land in sight on Little Bahamas Bank

sunk in that I was supposed to soon jump into the middle of that bar fight. Hmmm.

The clutter of shark fins looked like the opening of a cheap horror movie from the 1980s. Nevertheless I kitted up, reminding myself that four operators would probably not have been able to build up and sustain a stable operation for decades if their customers came home some limbs short. Murmuring "Morituri te salutant" (the Ancient Roman gladiators' traditional greeting: "Those who are about to die, greet you").

I took a giant stride and made my way through the shark tussle to the sandy bottom under the boat. The lemon sharks seemed to largely ignore my presence and just kept on doing their business of swimming around.

I could not get my head around what attracted them to the boat, because while there were a few bait boxes out dangling after the boat, I don't think there was anything in them at that juncture. The sharks did not come across as one bit interested in us bipeds either. It was more like they congregated just to hang out among themselves, although that is pure speculation on my part—however, that was my impression, in this instance.

The lemons are quite graceful, having a very smooth and hydrodynamic body. They don't really interact much, they do not seek out contact, and they don't seem to look much at you as they just slide by looking for... whatever.

At any given time, there were probably around 30 lemon sharks swimming leisurely about in smaller groups as if they had all the time in the world. Perhaps it was





"Aw, shoot... I am dinner."

exactly what they had. It was not the last time I would wonder what went on in the head of a shark that week.

A smaller number of reef sharks were seen patrolling leisurely at the perimeter as if they preferred to keep the shuffle right under the boat at fin's length.

The reef shark stands out as the archetypal shark, like an ignorant cartoonist would likely draw them with their sleek and perfectly shaped bodies. They too seemed rather oblivious to our presence, except they did not fancy being approached too closely but keep their distance. Yet they also seemed keen to keep an eye on what was going on with all this commotion.

A tiger in the din

It was not until after the first dives, during a coffee break, that we got word that a tiger shark had now shown up at the scene. That got everyone's attention.

During the initial briefing Captain Scott went over some safety rules and recommended practices while diving with tiger sharks—first and foremost, to stay in front of them and keep eye contact. It was also impressed upon us to always watch our six and check if there were any sharks behind us. Apparently tiger sharks have a mischievous streak and like to sneak up behind inattentive divers. And we wouldn't like to be nibbled, would we?

Back in the water, I could not immediately see any tiger shark. Apparently, it was seen over at the next sandy patch behind a fringe of reef. Making my way over there pushing my big camera rig against a bit of current, I kept down low, going over the reef, so I could get my back up against a boulder or coral head if necessary... as if that would make much of a difference. And then I caught my first glimpse of it.

Majestically, she appeared out of the din, slowly passing by at some distance, as if she was vetting us. Later, I came to understand how some of these individuals have been traumatized encountering other and less appreciative specimens of homo



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Checking out the party. Having it right under the boat made it real easy.

what kind of biped I was.

I could of course, like so many before me, just have fallen foul of anthropomorphism—attributing human characteristics or behaviors to animals—but the tiger sharks do instill a sensation of contact and communication from the onset. Whether it is indeed the case, who can really say? Looks can be deceptive, and it is easy to jump to conclusions.

But in so many other contexts, we have learned to interact and to some degree communicate with animals. Any pet owner will testify to that.

Once we get to know animals, we can read their body language and their state of mind. In so many other cases, we can tell whether an animal is relaxed and pleased or upset and a possible a threat. And while a tiger shark is surely neither a purring kitten or a snarling dog, sharks too have body language that gives away their state of mind.

It is obviously quite possible, to some extent anyway, to read them.

should read into them. Where is the point where we are just making unfounded inferences, and possibly making a mistake? When chimpanzees, the species closest to our own, seem to grin, it is not because they are amused, it is a sign of fear.

The tigers were, however, never agitated or excited in our presence but moved about calmly and gracefully. At first, they cautiously kept a bit of distance as if they needed to get a feel for this particular bunch of bubbling bipeds before moving in any closer, but after a while, they gradually seemed to overcome their initial apprehension and moved in closer while eyeballing each one of us, big time.

Why did they find us so interesting? Were they just hoping for a snack being handed out by somebody? That couldn't be it. For one, they were not one bit pushy just... inquisitive, it seemed.

sapiens who left them scarred by hooks and disfigured by bang-sticks.

At that juncture, however, I was still not quite rid of the notion I had that one of these rather huge apex predators could label me as lunch.

Emma and Smiley

It turned out our first tiger sharks were both old acquaintances. Well, not of me, personally, but they were the very same individuals that had been featured in some other tiger shark features in our magazine in past years. I did not know this fact at the time, though.

As far as I was still concerned I was now out in open water face-to-face with a big wild animal, with nothing between us except perhaps my camera rig. I could not hide; I could not retreat.

However at that point, I no longer wanted to. Instead I found myself mesmerized by this other creature, which had materialized right out of the blue. It swam by quite slowly appearing not to size me up but

more to seek out eye contact as if to assess

Maybe we were just providing them with some entertainment.

Touched!

The tiger sharks have these big and expressive green eyes, which leave a strong, lasting impression of a sentient and pensive intelligent being. During the following days my confidence and appreciation of the many encounters only grew. I was never complacent or over-confident as we were repeat-

The question is more about how much we could and

"I don't think we have met. Your fellow bipeds call me Emma"





"Now sit!" PJ Dunick interacts with the tiger shark known as Emma. Notice her bulging belly. Apparently, she is pregnant.

BELOW: "Expecto Patronum!" A GoPro on a stick may not be much of a Harry Potter wand, warding off dementors, but Smiley seems to prefer to keep some distance regardless.

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edly cautioned that these sharks also have a mischievous streak and like to sneak up on inattentive divers from behind. But I arrived at a point where I felt comfortable and at ease among these big fish, which in return gradually also permitted me to come still closer.

Had anyone, prior to my trip, told me that I would some day find myself in open water facing a couple of big wild tiger sharks and not only remain unfazed but also touch them, I would probably have looked back at the perpetrator with utter disbelief. Yet, that was exactly what I was now doing, and I was having a blast too.

As one of the tigers swam leisurely close by me, I was gently stroked by her body sliding by. Her skin felt like smooth leather on top of toned

muscles.

I have frequently been mulling over their behavior ever since. They are free roaming wild apex predators, yet they chose to interact with humans in so many ways including allowing our dive guides—who were amazing—to handle them physically, rolling them over and stroking them.

Both their initial cautious approach and their curiosity are telltale signs of an analytic capacity. In nature, injuries that are not necessarily fatal in themselves may render an animal vulnerable to attack or unable to feed

and must be avoided at all costs. Yet curiosity and the ability to learn from experience is also a trait that

improves the chance of survival, and the sharks seem to be balancing these opposing urges all the time.





CLOCKWISE FROM LEFT: Waiting in line without shoving and pushing; The *Dolphin Dream*; Dinners were varied and healthy; Smoothies



The *Dolphin Dream*

Back on the boat, we had long since settled into the usual routine: dive, look at photos, dive,

eat and look at photos, dive, eat... etc. The vessel is a converted shrimp trawler, and at first sight, I wasn't overly wowed, I must admit, but as it turned out, she was both a very stable and comfortable ship and the interiors were well laid out, with a spacious salon. The cabins below deck were on the smallish side, not very fancy and clearly just a space to retreat for some shut-eye. However, I did not find it mattered one bit, as one would spend time in the salon going

over and working on images or just chatting with other passengers, perhaps even forging a couple of new friendships.

In the salon there was a drink bar with a refrigerator full of soft drinks and juices, coffee maker and lots of snacks, cookies and fresh fruit. Being an espresso junkie and overall coffee-snob, I did not take fancy to the standard brew, but I was pleased by the selection of quality teas, which were actually quite excellent for a refreshment between dives, along with a biscuit or two.

Fodder

On a related note, I can also report that the home-cooked meals on board were both delicious, varied and healthy and made from fresh produce. Good food is simply a requirement on a live-aboard and the cooking aboard *Dolphin Dream* was no exception to this golden rule.

I noted small but important details (to me anyway): there was quality Greek yogurt, fresh berries and muesli available for break-

fast and the vegetables at dinner were really good.

I could not help having a little chat with the cook about her food shopping principles and was pleased to learn how picky she was in selecting the right stuff



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Bahamas



A pod of Atlantic spotted dolphins showing off their swimming prowess

Dolphin treat

One early evening as I was sitting in the salon quietly relishing the goodness of life sipping a cup of hot tea after an already long day packed with several great dives, some commotion was suddenly heard from the deck outside. A pod of dolphins had been spotted and Captain Scott came out of the wheelhouse to ask the esteemed assembly if we would care for an extra treat. Ask a silly question.

Faster than a six-year-old could nod yes to an ice cream, we were all up for a sunset swim with the dolphins. In no time, as the captain revved up the boat and sped off to get ahead of the travelling pod, we slipped once more into our wetsuits, closed our camera housings and congregated on the dive deck, focused and poised to

enter the water on cue.

Like paratroopers we peeled off the boat in rapid succession and found ourselves bobbing around in the open ocean as the sun started to hang low on horizon.

We were over a completely featureless white sandy bottom some 10-12 meters below. The visibility was generous with no discernible particles in the water, which in combination with the soft and light, created an almost cathedral-like ambiance without shadows. Then the dolphins appeared on stage, moving at great speed.

There were some 20 to 30 dolphins in the pod, their exact number difficult to estimate as they were going all over the place, breaking up into smaller groups, in pairs, in fives, joining and splitting up again, darting in and out of visible range before coming racing





The side dishes to this trip comprised a dolphin encounter of the third degree and a reef dive on the first day.

back. Judging from the considerable variation of coloration and patterns on their skins, they were obviously Atlantic spotted dolphins. Some were uniformly gray, others dark or highly spotted.

ter with these gregarious mammals stood out in contrast to that of the sharks. Where the sharks were apprehensive and swam about almost sedately, the dolphins were all over the place from the onset, energetically performing all sorts of high

speed maneuvers as of they were showing off.

Like the sharks they were also interacting, though not pausing to take a closer look, but observing us in the passing. It was impressive but also a less intimate experience. Whether it was also down

to the lack of a latent fear factor or just another case of comparing apples to oranges, I cannot quite say. The two experiences were both very aesthetic, but where the tigers sharks had a more majestic presence, it was the agile elegance and energy that defined the dolphins.

Also in the presence of sharks, it was all about moving with deliberation, mostly sitting on the sand while regularly checking your six, but with dolphins around, we were swimming freely without scuba gear, struggling just to turn around fast enough to keep them in focus.

We made it back onto the boat just as the sun set over a perfectly flat ocean in an intense display of orange and purple hues. As a perfect day was coming to an end, tranquility settled inside me as I pensively watched the spec-

tacle, clasping yet another mug of hot tea.

Reflections

My journey was about to come to end in more than one sense. We, guests on the boat, had not only now spent our five days on the Bahamas bank but also undergone a transformation in our understanding and appreciation of some of the most majestic and enigmatic wildlife on our planet. The world would surely be a better place and in healthier state if politicians and captains of industry could have these insights, but that's just wishful thinking.

The diving is technically quite easy, with depths mostly in the range of only 10-12m (33-40ft). Decompression limits and decompression illness (DCI) is hardly a concern, and one can enjoy a leisurely, lengthy dive, mostly dic-

tated by meal times. These trips are clearly mostly for wildlife connoisseurs with or without cameras and/or scuba kit.

There is little or nothing for macro-photographers. Technical divers will miss the point entirely, and families with smaller kids would

be better off leaving them ashore with the grandparents. Everyone else will most likely have a very enriching experience. Would I like to go again? Yes, I would. ■

Peter Symes was invited by Dom's Dive Advice and Dolphin Dream.



A Conversation With
Wolfgang Leander
—The Eye of the Tiger Shark

X-RAY MAG: Tell us about your journey and the transformation of understanding about sharks through which you have gone, from your first to your latest encounters.

WL: The first time I saw a shark was in 1968, in the Caribbean (Virgin Islands). At that time,

I was both extremely excited and quite apprehensive. Back then I thought that sharks were extremely "dangerous" creatures and my knowledge about them reflected the general then prevailing perceptions of sharks.

Now, with decades-long personal experiences diving with sharks under many different

circumstances (e.g. while spear-fishing), I know that sharks are not at all what people thought and still think they are. Sharks are basically shy and sensitive animals, non-aggressive, intelligent, fast learners, inquisitive (or you might call it curious as most people and animals are). This is true of all sharks, and

we can safely include the "most dangerous species"—the great whites, the tigers and the bulls.

Accidents occur, but they are, compared with incidents related to other animals—wild and domesticated, extremely rare.

X-RAY MAG: How do you read and understand a tiger shark's mood and behaviour?

WL: Very simple—by observing them very attentively in different circumstances. You can tell by the way they swim and swimming patterns, in what mood they are. You will see if they feel comfortable being around you, also if they are wary.

I am firmly convinced that sharks also read and understand our body language. If you feel relaxed in their presence, they will feel likewise. Erratically moving divers will make sharks nervous.

X-RAY MAG: What do you think they comprehend?

WL: As I said—our behavior. They can tell a sensitive, respectful diver from someone who has no finely tuned feelings for animals. Sharks are highly intelligent animals with a remarkable memory. Tests have shown that sharks learn 40 times faster



than cats, and that they have a memory which enables them to "store" information up to one year—much, much better than my capacity to memorize things!

X-RAY MAG: How do you think they view us?

WL: That's hard to generalize, I guess. But they, too, have their own schemes of seeing us, depending on their own experiences.

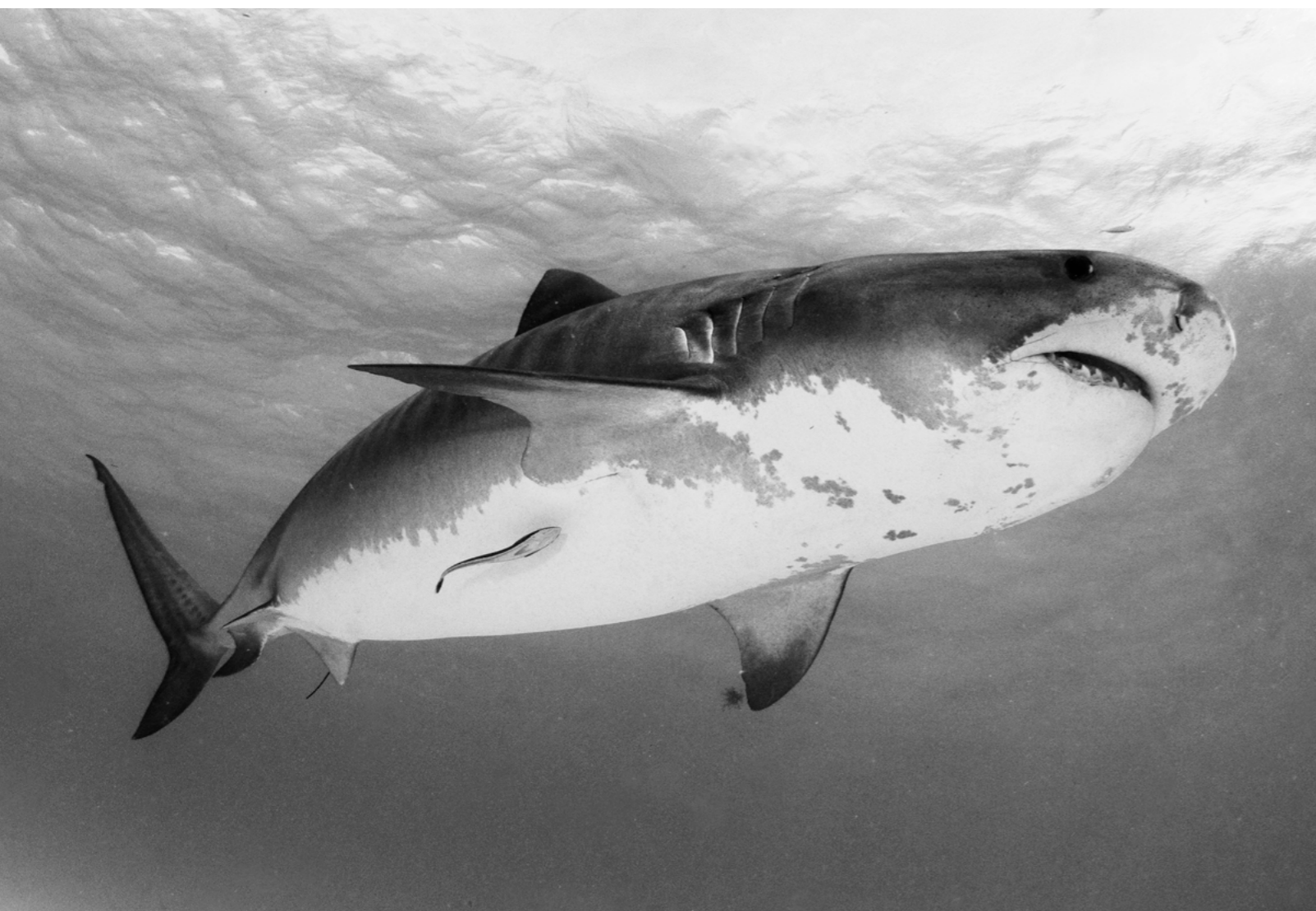
Sharks have different personalities, just like any other animals and people. Again, you

realize this by observing them, ideally in places where the sharks are territorial and where you can see individual sharks over and over again.

Emma and Smiley of Tiger Beach have been there for many, many years. I saw Emma in 2007 for the first time—she is still around—a large and VERY serene shark.

I have witnessed Emma "test biting" a friend of mine. She had his whole torso in her mouth, and the "bite" was so gentle that she didn't even leave tooth marks in his wetsuit!

With her crooked jaw, Smiley is easily recognised. Her jaw was presumably damaged by being hooked.





Once she had my calf in her mouth; I didn't feel anything and as I was busy photographing another tiger. I didn't even realize what had happened. A diver who was next to me told me afterwards, how Emma was "playing" with me.

Tiger sharks tend to be gentle even when they take bait. Before biting hard or swallowing the bait, they

usually mouth it carefully.

Caribbean reef sharks can get easily into a frenzy when there are wounded fish and will bite indiscriminately, without any good table manners, as it were. I am more apprehensive of agitated small reef sharks than I am with 14ft tiger sharks.

Large tiger sharks are, in general, extremely gentle; "Doc" Samuel

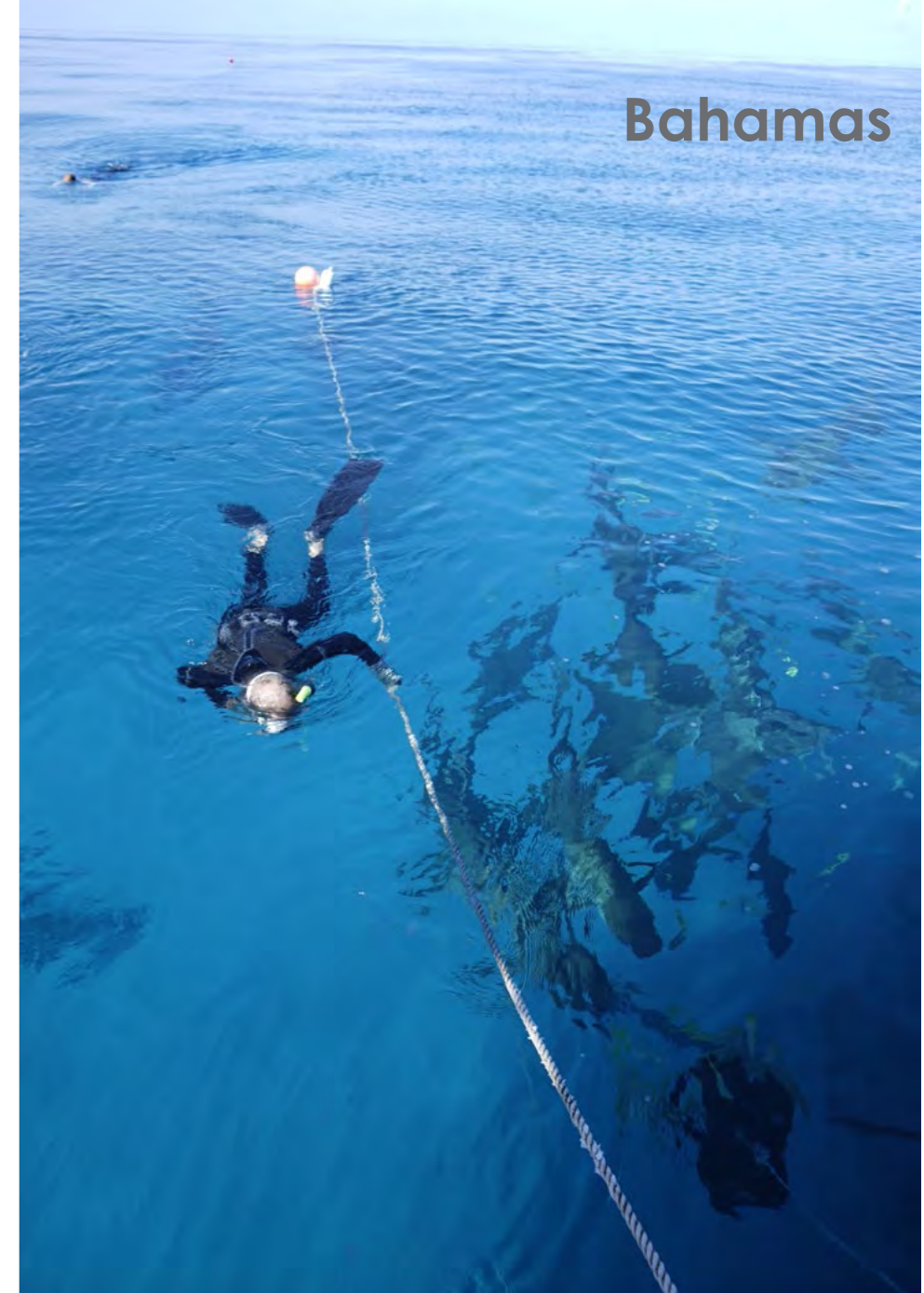
Gruber calls them "buddha sharks".

X-RAY MAG: The individuals we encountered at Tiger Beach are clearly habituated to humans. Is this a good or bad thing? Can these individuals be considered representative for the species or will other specimens encountered elsewhere possibly react in some

very different ways and require other precautions?

WL: I think it is very good as it shows that "the mindless eating machines" who are used to interacting with humans almost behave like dogs. Every diver who has been to Tiger Beach falls in love with the sharks, and many become ambassadors for

Smiley on one of her first wary approaches. Only gradually did she come in closer to the divers. Her apparent apprehension is understandable. Just above her gill arch, a depression in her body can be made out. This is a big scar from a wound allegedly caused by a 'bang-stick'—a specialized firearm used underwater that is fired when in direct contact with the target.



Despite her brutish appearance in this shot, this massively muscular predator was patiently waiting for her morsel.

the cause of protecting them afterwards.

Some people say: "Leave the sharks alone." I cannot share that view. As long as you don't harm the animals, it is good to interact with them. It helps you understand yourself much better—that is, basically, how getting and feeling close to shark has profoundly transformed me as a human being.

It was through sharks that I developed deep feelings for all

animals, large and small. This made me humbly recognize that no life is more valuable than another life.

Wild sharks who are not used to humans behave differently, but, again, once they realize that people are not a threat to them, they will definitely develop into Tiger Beach types of sharks. Experts, such as Ila France Porcher (*X-RAY MAG* editor), were able to prove this quite scientifically.

If I were to sum up what my special relationship with sharks is, I would say without hesitating one second: I just LOVE these animals—pure and simple. Yes, that is what I really think. To understand sharks and be able to relate to them, you must love them. ■

TOP RIGHT: Wolfgang Leander keeping an eye on the action below. RIGHT: The sleek lemon sharks were much less interactive but also took quite an interest in the going-ons.



The Bahamas' **San Salvador Island**

Text and photos by Christopher Bartlett





The beautiful blues of the west coast dive sites of San Salvador Island

A 50-minute flight southeast from the bustle, cruise ships and tourist-centric capital city of Nassau in the Bahamas, lies the sleepy island of San Salvador. Twelve miles long and five miles wide, she is the tip of an underwater mountain rising from 5,000 metres below (15,000 feet) surrounded by picture-postcard, crystal-clear, blue seas.

Now home to 1,200 Bahamians, "San Sal" has a past as colourful as her long sandy beaches are white. The native Lucayan Indians who settled

here around the 6th century AD called her "Guanahani". It is widely believed that, in 1492, Christopher Columbus, in his quest for a westward route to the East Indies, made his first landfall on this island and renamed the island "San Salvador", or "Holy Saviour". In his journal, he noted "the beauty of these islands surpasses that of any other".

I would disagree; as great a traveler as Columbus was, he didn't have air miles and he'd just spent weeks on end staring at the horizon wondering where in salvation land might be. Alcatraz would probably have looked pretty stunning to him at that point too. That said, the long beaches on San Salvadore are almost as deserted as they were then—there is one hotel chain and one 42-room,



Nassau grouper

Caribbean reef shark at Santa's Chimney. PREVIOUS PAGE: Stingray and friend on sandy sea floor off San Salvador





CLOCKWISE FROM LEFT: Caribbean reef sharks turned up and came close on every dive; Parrotfish and schoolmaster; On approach in Stella Maris Air's 6-seater; Schoolmasters and grunts a-plenty; Big-eye jack looks surprised; Sleepy Cockburn town is a short stroll down the sandy road

island only regained her current moniker in 1925, even though, much to the chagrin of the locals, Club Med had tried to rebrand her as "Columbus Isle".

The centre of the island has many lakes, waterways and archaeological points of interest on the sites of native Lucayan settlements and is home to a range of birdlife, wild hogs and goats. The area can be explored by renting a car or golf cart, or on a guided tour. But these are small bonuses—San Sal's big draw is underwater.

Below the surface

Whilst her windward east coast is often rough, the leeward

side is mostly as flat as a pancake—azure blue at the water's edge, turning to cobalt, sapphire and finally indigo blue over the wall. It's only a short boat ride to the wall that



family-owned-and-run hotel on the island.

In the 17th century, British buccaneer and loyalist John (aka George) Watling took over the island. Fittingly, he was known as the "pious pirate" as he forbade attacks and gambling on the Sabbath. The ruins of his large plantation house, estate and lookout tower are still points of interest today. The

starts at ten metres (30 feet) deep.

Striding off the boat, you can see the sandy bottom—a haven for sting-rays—turn into coral reefs, with fans and sponges acting as

meeting points for grunts and snappers. The hue of the blue and its 30- to 50-metre (90 to 150-foot) visibility is mesmerising in itself.

Upon reaching the edge of the wall, more sizeable company generally turn up pretty fast. Nassau groupers are com-





CLOCKWISE FROM LEFT: Stingray on the sand; Pulling in to Riding Rock Marina; View from the room; Riding Rock beach; Grouper and author in Mick Jagger impersonation contest



mon, jacks flit around, and the longest I had waited to see a reef shark was two minutes. Most dive sites seem to be patrolled by two to four of our cartilaginous friends, either Caribbean reef or blacktip sharks.

And when the water temperature drops below 25°C (76°F), scalloped hammerheads return for the winter. I've dived with sharks all over the world, and these ones off San Salvadore Island will come as close to a diver as any I've seen on a baited or fed dive,

just without any food being put in the water—it's a fantastic, natural experience.

The topography of the wall is varied, with overhangs, cracks, swim-throughs, and some stunning chimneys. In particular, Santa Claus' chimney to the south of the island is a cracker (sorry!), dropping from the top of the reef down to 40 metres (130 feet).

The cracks and crevices shelter a variety of eels, lobsters and shrimps, as well as gobies and blennies. The walls are adorned

with barrel, rope and vase sponges—a veritable feast for the healthy hawksbill turtle population. Throw in some wrecks, vertical coral pillars, the "Cathedral", and another 40-plus dive sites, and there is enough diving to keep you busy for at least a week.

Topside attractions

Back on shore, Michelle, Peaches, Jason and the crew of Riding Rock Inn provide simple, comfortable air-conditioned beachfront

accommodation, complete with three hearty meals a day (there aren't many skinny Bahamians). The Driftwood Bar on the premises offers free rum punch and conch fritters on Monday evenings. Cars or vehicles can be hired, and the main, but small, settlement of Cockburn (pronounced "Coburn") Town is a ten-minute stroll down a sandy road. Nature walks, historical tours and game fishing can be arranged. ■

Scene from a shark feeding program in the Bahamas (right); Caribbean reef shark (below)

A Course In Shark Feeding

In the Bahamas

Text and photos
by Christopher Bartlett

Many people are scared witless by sharks, but I love them. I scuba dive and freedive with them whenever I can. Ever since I started diving, I've been an elasmobranch fan. On my open water qualifying dives, I saw sand tiger sharks on every dive. On the deep dive for my advanced open water, I apparently shared it with 12 mantas and swam with a whale shark on the way back. I say "apparently" as I was incapable of counting them; I just stared in awe at the creatures as they cruised around me for 20 minutes.



Then, I moved to South Africa, became a divemaster on Aliwal Shoal, enjoyed hundreds of sand tiger shark encounters and did half a dozen baited tiger shark dives. Recently, I was offered an opportunity to take my passion to the next level—a shark feeder program in the

Bahamas.

The dive centre in the Bahamas, which offered the course in shark feeding, was run by the legendary shark wrangler, Stuart Cove. The centre looked more like a small village, as the 50-odd employees in bright pink t-shirts kept the flow of custom-

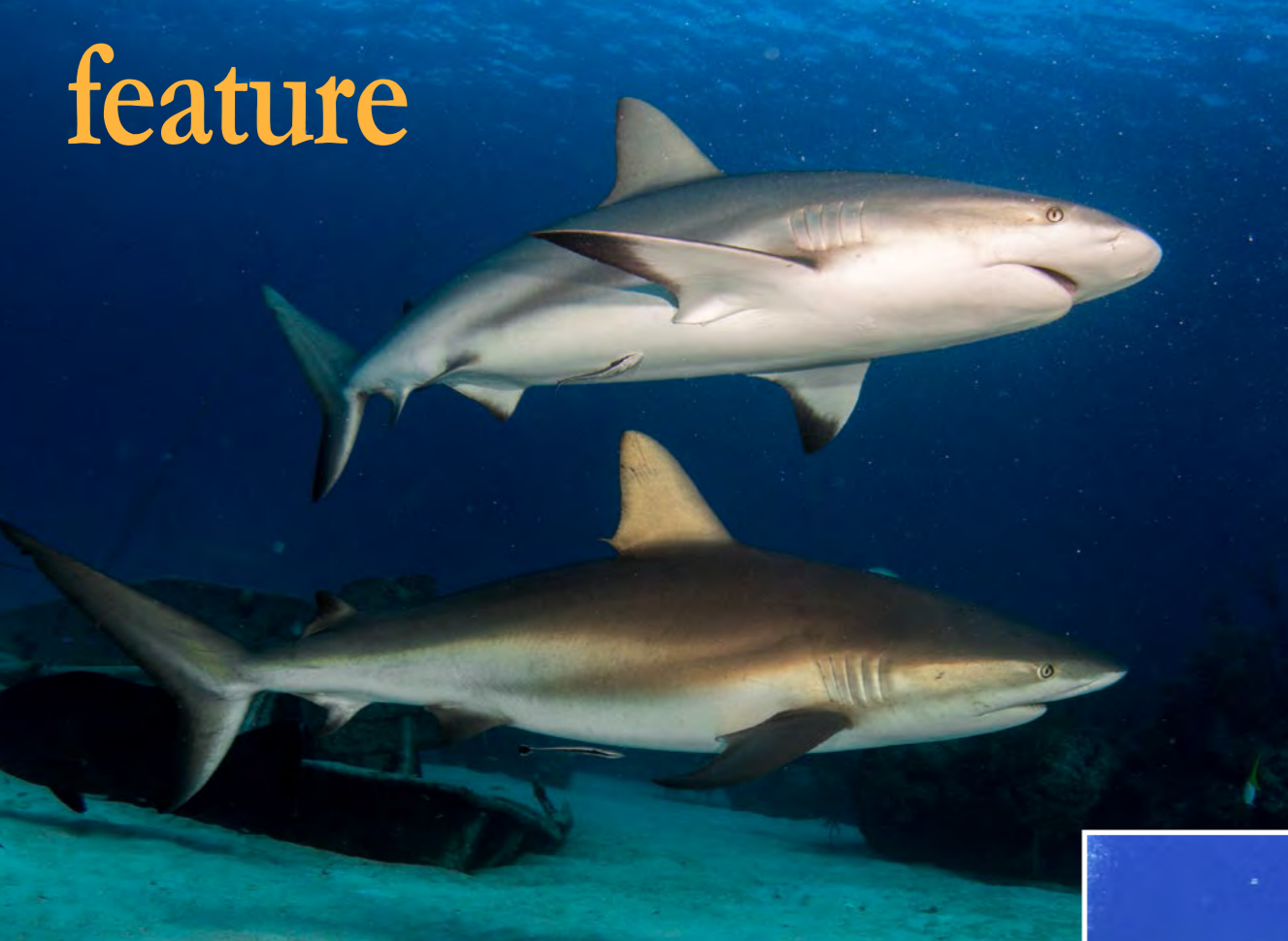
ers moving through the registration, gear-fitting, kit up and departure processes. This was a well-oiled machine run by an experienced team and it was indeed an impressive sight to see.

As soon as I had signed the usual pre-dive paperwork and some rather

lengthier tomes (due to the additional risks involved in giving bait to sharks), I was introduced to two of Stuart's most experienced shark feeders and instructors, Chang and Ryan.

Before the underwater fun could begin, there was a morning of class-





Caribbean reef sharks in the Bahamas

Feeding frenzy at Shark Arena (right); Author Christopher Bartlett encounters reef shark doing a good dog impression (center); Staff trainer feeding reef shark (lower right)

down. Soon, one of the larger sharks cruised in, with mouth wide open, and took the snack.

And it really is just a “snack”. A 2010 study into the effects of “shark provisioning” in Nassau on Caribbean reef sharks by Aleksandra Maljković of Simon Fraser

As Chang moved round the deck, each diver got a close-up experience with the three-metre sharks, and an opportunity to get a shot of them taking the bait right in front of them. The sharks would occasionally bump my strobes out of position in their eagerness to get to the fish, so I had to move my hands and arms around.

At one point, this happened as a piece of fish came off the feeding stick. I hadn't seen it floating towards me, but a couple of the sharks had and zoomed in. I was looking through the viewfinder

room preparation. After taking me through a Shark Awareness Specialty Course—which covered species identification, polite and aggressive behaviours—we talked about the Caribbean reef shark's (*Carcharhinus perezii*) predatory habits and movements. We also looked at shark body language—basically how to spot an aggressive or agitated shark and what to do about it.

Diving

In the afternoon, I was to observe and shoot Stuart Cove's two-dive “Shark Adventure” on a wreck called the *Edwin Williams*. On the first dive, we swam over the wreck to get our bearings and then circled around the site, with some large sharks joining us and then swimming off.

After a 30-minute surface interval, Chang, the shark feeder, kitted up with a suit of chainmail and a Neptunic helmet, and began his in-depth briefing. Carrying more weights than

normal, we would be placed around the rails on the stern by his assistant who would also be the cameraman for the dive. We could either stand or kneel at our stations and observe the feed, keeping our cameras (and arms!) close to our bodies. I was given free rein to move around the deck and had a set of chainmail arms on.

Once we were in position, Chang came down to join us, looking like a cross between a downhill skier and a scuba diving medieval knight. Weighted down by a steel box containing carcasses of dead grouper and lionfish, he dropped into the middle of the deck, somewhat like an underwater rocketman landing. I looked around and counted close to a dozen sharks in or around the aft deck. Most of them were nearly three metres in length.

Chang started his show, slipping a piece of carcass onto a metal rod and slowly waved it up and



University, Burnaby, British Columbia, Canada, showed that the fish given to the sharks during such tourism-related shark feeding activities essentially went to the largest sharks. Even then, it was calculated that the nutritional value of the fish consumed by the sharks was nowhere near enough to constitute their sole food source.

at that point—my left arm outstretched to realign a strobe—when I felt the slightest pressure on it. I looked to my left and saw a 2.5-metre reef shark with my bicep in its mouth! In a second, it realised its mistake and let go. I was glad I had the chainmail suit on!

After everyone had a good eye-ful, Chang closed the bait





THIS PAGE.
Feeding frenzy
at Shark Arena
in the Bahamas

Getting a
first touch
on a shark

beautiful big fish. They would swim out of the arena before circling back round, coming in from all angles. It was pretty intense and I found myself giggling into my regulator.

Day three

Twenty-four hours later, I was giving the briefing under Ryan's supervision. Today, I was going to feed with him.

"Do they ever go a bit crazy?" had been one of my questions. "You just gotta treat them like playful dogs sometimes," he replied.

Except, these were 75 to 100kg, three-metre-long puppies. With a



of the circle. I speared a snack and waved it slowly towards the photographer. Wave it too fast, the bait comes off and a minor free-for-all starts; go too slow and the sharks don't see it. Nevertheless, in she came. Her nictating membrane (translucent third eyelid) closed (as it often

does when a shark is about to use its mouth), and then her jaws similarly closed around the stick, and I slid it away. Ryan gave me the big OK sign and a pat on the back.

As we continued the feed, a couple of bits fell off and the sharks started to get a bit feisty.

box, extended a hand to a passing shark, and began rubbing its snout. Having its ampullae of Lorenzini (electroreceptors on the snout) stimulated by the chain-mail glove, the shark stopped moving completely. In a state called "tonic immobility", the shark looked like it was in a blissful stupor, as if it was having an itchy spot on its back scratched.

Chang put his other hand on its dorsal fin and rotated the shark 360 degrees around, to show it to the group. When he stopped rubbing, the shark came out of its trance after a short while, and then swam off. Incredible.

As we all ascended to the boat and got out of the water, Chang fed the last pieces of fish to the sharks, keeping them busy. Back on the deck, looking around, there was not one person who did not have a huge, shark-like grin on their face.

Shark Arena

On the second morning, we had a debriefing in the classroom and looked at the mechanics of shark feeding: how to get the bait on, how to attract the sharks, and how to give the guests the best experience.

That afternoon, I went out on the shark adventure with Ryan. I listened to his briefing very carefully and observed him even more closely. On the first dive, we headed out to Shark Arena, an area of open sand with large stones placed in a circle. We swam over the site, past a wreck and over the reef wall.

Within a few minutes, inquisitive Caribbean reef sharks appeared, following us along the wall. Circling back and approaching the arena from the other direction, close to a dozen were already milling around the general vicinity.



Forty-five minutes later, back in a shark suit, I was in the middle of the arena with my camera, with the best seat in the house. There were nearly three times as many sharks compared to my experience at the *Edwin Williams*. Here, many were smaller, two-metre specimens. They seemed a little friskier than those the day before, but I was absorbed and loved being in the midst of so many

lot more teeth. And we were in *their* element—underwater. We dropped in together, the weight of the chainmail and bait box requiring a decent amount of air from my BCD. There were 30-plus sharks again, looking pretty playful, I thought. Ryan got the ball rolling and then handed the feeding stick to me. I looked around and found a big shark coming from the edge





CLOCKWISE FROM FAR LEFT: Handling a shark in tonic immobility; Caribbean reef shark in the Bahamas; Kissing a shark in tonic immobility

SHARK FEEDING & BAITED DIVES — for or against?

Shark feeding, or “provisioning” as the scientists call it, and baited shark dives are the subject of considerable debate amongst divers. The main point of contention being that it is not natural and alters sharks’ behaviour. In the specific case of the feeding that takes place off Nassau, a peer-reviewed paper published in a scientific journal states that there is no negative effect in this case. The full paper can be found here: <http://www.sciencedirect.com/science/article/pii/S0006320710004908>.

In other areas where I have been on fed or baited dives—at Aliwal Shoal in South Africa, Andros Island and Tiger Beach in the Bahamas, and in the Turks and Caicos—I believe natural behaviours have been changed. However, I personally consider that these changes are not harmful to the sharks, and the benefits of allowing divers to observe them at close quarters outweigh any potential negatives. A study into the blacktip sharks residing off the southern end of Aliwal Shoal has started and will enable greater understanding of their behaviour. ■

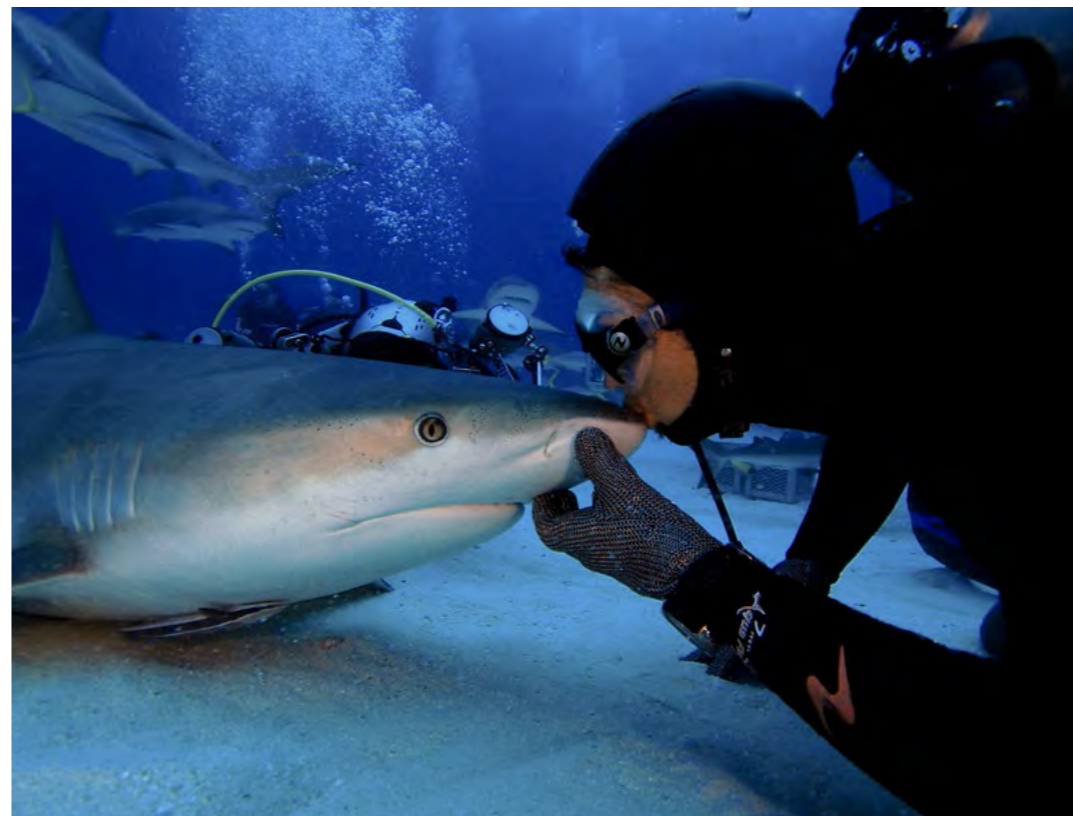
down to the last morsel. I picked out a little shark with a fish hook stuck in its mouth, gave him his sharky snack, and said a silent thank-you and good-bye to them.

It was truly a wonderful experience, and looking back on it, it’s still very difficult to accurately describe my emotions—the best I can do is say, “Fintastic!” ■

The author thanks Indigo Safaris (www.indigosafaris.com), the

dive travel specialists through whom he arranged his trip to the Bahamas.

Christopher Bartlett is a widely published British underwater photographer and dive writer based in France. He leads photographic safaris to locations like the Bahamas, Turks and Caicos Islands, as well as locations in Africa, teaching underwater workshops in Zanzibar and Papua New Guinea. For more information, visit: www.bartlettimages.com.



Ryan was barely a metre away but at times I could hardly see him—the sea was thick with sharks. I got a tail swipe to the head and realised that the helmets were not just for show. Then another tail swipe or passing pectoral fin pulled the regulator out of my mouth. It seemed like “playful dog time” was upon us.

I asked whether I should pause the feed. Ryan agreed and I clipped the heavy box shut. Following Ryan’s lead, I placed my hands on the flank of a passing shark and shoved it sideways. We were back-to-back, clearing space around the bait box. Somehow, it reminded me of the time I trained my German Shepherd... sort of. Rather than agitate them, the action seemed

to calm them down. After 60 seconds or so, things were back to normal.

Patting a shark

So I could feed them. But could I put them into tonic immobility? Again, Ryan led the way, and I copied him, placing my hand palm down on a passing shark’s head, sliding it to the snout and wiggled my fingers inches from its mouth. “The bigger they are, the faster you have to wiggle,” Ryan said in the classroom.

I had picked a medium-sized shark, just about two metres long. I was wiggling and tickling it as fast as I could, and then the shark stopped moving! I maneuvered it onto the sand and knelt down, rubbing its nose and stroking its

back. If I hadn’t had to keep my regulator in my mouth, my jaw would’ve dropped open and hit the sand.

It was quite an emotional experience. Not at all the “man tames shark” testosterone buzz you might expect. There is a definite love-at-first-sight feeling, except it happens every time with every shark, coupled with a weird combination of inner peace and astonishment. I didn’t want to stop, but there were customers to entertain.

I had some fun at the end, getting them as close to the cameraman as possible but, all too soon, I was



Edited by
Rosemary 'Roz' E. Lunn

POINT & CLICK
ON BOLD LINKS



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Equipment



Fly 13D

Finnsb's Fly 13D Rescue Comfort Wing has been designed for single tank diving. This vivid red, 30lb lift capacity, doughnut shaped wing is aimed at the recreational diver, because it can be dived with a 10, 12 or 15 litre cylinder. Fittings on the harness include 2 double-part weight pockets capable of carrying 5kg / 11lb of soft weight. What appeals about this system is the bright colour. It is quite refreshing to see such an intensely coloured piece of equipment, and it should make this BCD visible from afar. Finnsb.com



DiveSystem iX3M

DiveSystem unveiled its iX3M Dive Computer at DEMA 2014. The iX3M is a chunky device with a high contrast colour display protected by Polycarbonate Sapphire coated glass and has a depth rating of 300m (984ft). It comes in three models—iX3m Reb (rebreather), iX3m Tech+ and the iX3m Deep—and utilises a dual core algorithm—Buhlmann ZHL-16 B + VPM-B. The user is able to change the Gradient Factor and adjust the 'Critical Bubble Radius'. I suspect that the claim of adjusting bubble radius is wishful thinking. The adjustment will change the algorithm behaviour, but the true impact in some cases is very likely unclear. Other features include the ability to programme the computer for fresh or salt water; an integrated GPS that uses five types of satellite systems provided by major nations; and a gas mix analyser for oxygen and helium. Each model has wireless connectivity allowing the user to update the operating system and a rechargeable battery via USB. Divesystem.com



Training SMB

Deploying a Surface Marker Buoy by an untrained or out of practice diver can pose some common but preventable hazards, such as getting dragged to the surface. UK manufacturer AP Diving has just released its latest buoy—a Training Surface Marker Buoy. This SMB is identical in design to the rest of the AP self-sealing SMB range. It is just much shorter, and at first glance is probably the perfect sized SMB for a minion. For the rest of us, this two-litre capacity buoy allows the trainee diver to practice deploying their SMB multiple times in confined and open water without seriously depleting their gas supply. The buoy is inflated by inserting a regulator into the mouth of the buoy. The buoy has a self-sealing baffle that prevents gas loss from the buoy when it reaches the surface. Deflation is achieved with the dump valve. APDiving.com

Diveroid

Spotted at the Boot expo, the Diveroid is a casing and app that turns your smartphone into a dive computer with a dive log, underwater camera or video recorder as well as a compass all in one unit. The different functions are keyed into one another so, for example, the dive log will show images taken at specific junctures and vice versa. And when used as a camera, the basic dive information from the dive computer is superimposed onto the camera interface so the diver always has this essential information immediately available. The housing can be mounted on a camera tray and connected to an external flash. Among the additional accessories are adaptors for mounting various lenses and filters. Artisan-ocean.com



[qudos]

Also unveiled at the Boot expo was a high-powered action video light for the GoPro called the [qudos] and pronounced *kudos*. The [qudos] pairs with the GoPro 2, GoPro Hero3, Hero3+ and Hero 4. Should you use the GoPro conversion mounts, you can also attach this light to other action cameras that work with these mounts, including the Sony action camera. The [qudos] has three high-powered CREE LED lights that deliver 400 lumens of light and the user is able to control the beam. Weighting in at 150 grams, the [qudos] is manufactured from marine grade aluminium that acts as a heat sink. It is depth rated to 40m as is the GoPro. Knog.com.au





CCR Liberty

Spotted at Boot where the team explained the main design criteria behind the Liberty rebreather is fault-tolerance. It has been constructed with a maximum operating depth of 300m (984ft) with every part tested to 600m (1968ft). It has been designed so no malfunction in the electronic system could cause a breakdown of the whole apparatus. CCR Liberty state should both handset cables be severed, the HUD cable torn out and the head is damaged, this rebreather should still work. The CCR Liberty is controlled by two interlinked computers. Each computer has its own battery, two oxygen sensors, a pair of depth and atmospheric pressure sensors, and a helium concentration sensor. Each CU controls a separate solenoid. At 100m (328ft) the work of breathing is stated to be only 1.58 J/l. Training is currently offered through IANTD with other technical diving training agencies to follow shortly. CCRLiberty.com

Fourth Element Strata

'Strata' is Fourth Element's new range of casual clothing that performs in a technical manner. It is made from certified environmental sustainable combo fabric that utilises polyester and a recycled fibre from used coffee grounds. The resulting 'coffee clothing' has the appearance and feel of luxurious cotton. It wicks, has excellent UV protection and did you know coffee has anti-odour properties too? 'Strata' translates as 'layer', hence this range of clothing will normally be worn next to the skin. It is flexible in that it can be worn as a thermal base layer, and can double as a lifestyle product too. The Strata collection includes a mens shirt and boxer briefs and a ladies long sleeved top and briefs. FourthElement.com



Divesangha Poncho

There are times when you have struggled out of your wetsuit and all you really want is to be enveloped in a large snuggly blanket. You also need to be able to function safely on a dive boat and sort out your equipment. Divesangha's one-size-fits-all poncho is manufactured from a quick-drying breathable fabric that feels almost like suede. The sleeves are long enough to pretty much cover your arms, whilst being the right length to allow you to work on your scuba set. And they are large enough for you to bring your arms inside the poncho, in order to slip in and out of wet or dry clothing in a private manner, whilst

standing in a public place. As with all Divesangha's clothing, their Hung Dry system enables you to securely hang your garment up to dry around a pole, on a line, or a rope, without it being blown away. Divesangha.com



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Poseidon's CEO Jonas Brandt

— From Cars to CCRs

SE7EN rebreather

Text by Peter Symes and Michael Menduno
Photos courtesy of Peter Symes and Poseidon

The CEO of Poseidon discusses his move from the automotive industry to diving, big data, the role of automation, safety and the future of rebreather diving.

X-RAY MAG: What was your first diving experience and what got you interested in diving?

JB: I've always been a keen diver since I was a boy. Living close to the water, snorkeling and water sports has always been a natural part of my life. Sport diving was never a big thing for me. I spent more time as a freediver and an underwater rugby player. My real passion for diving started when I became involved in the development of the Poseidon MKVI.

X-RAY MAG: What was your first dive on a rebreather like and in what way did it change your perception of diving? What kind of rebreather was it?

JB: It was actually in the pool at Poseidon trying out one of the first prototypes of the MKVI. And yes, it changed my perception of diving big time since I was always annoyed by the mechanical way of breathing and the noise from a "conventional" demand regulator.

X-RAY MAG: Before Poseidon you headed Brandt Systems. What

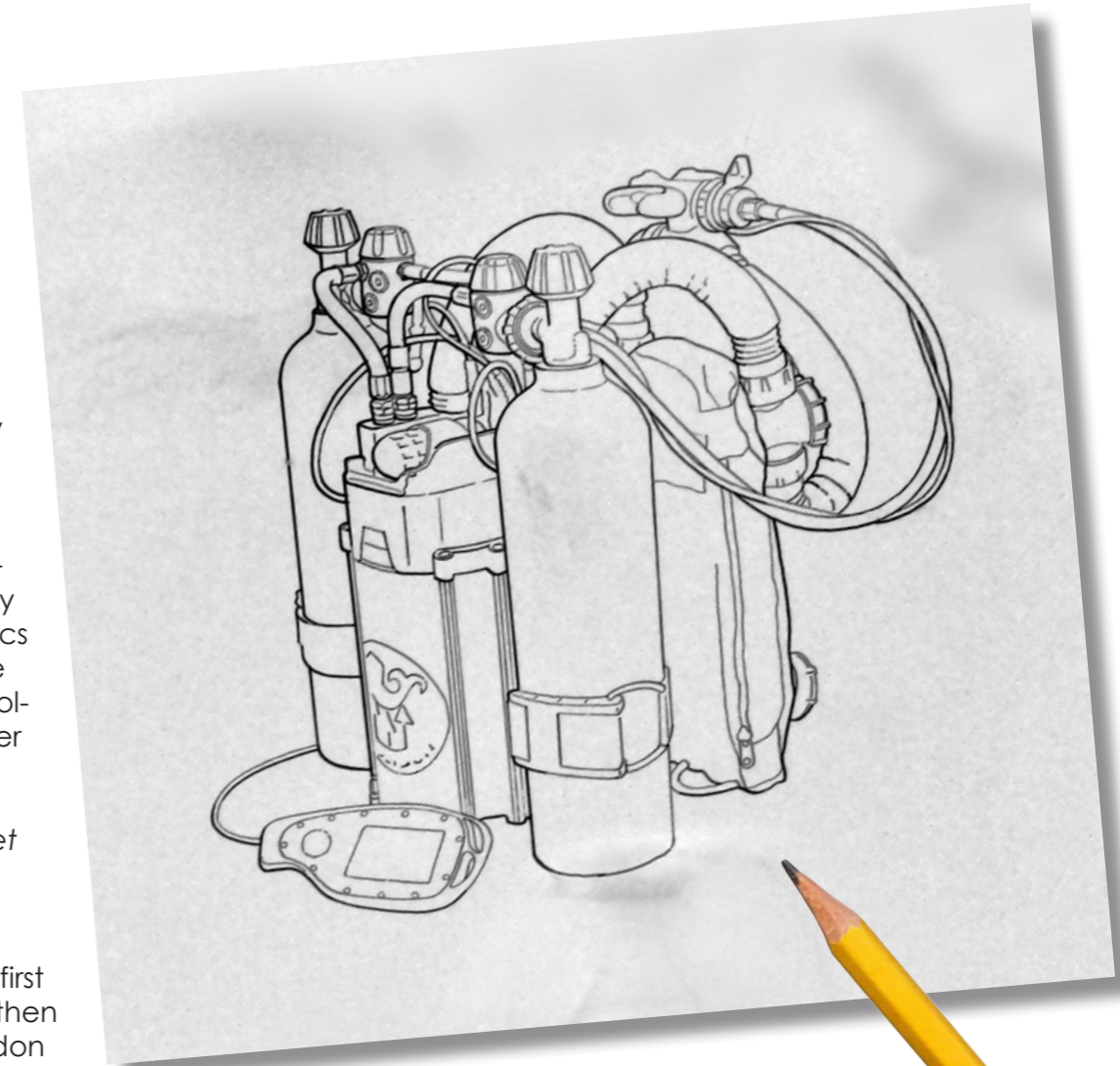
kind of work did you do?

JB: I spent 15 years in the car and automation industry mainly working with integrated automation systems in cars and advanced car manufacturing equipment—everything from basic factory automation, to heavy robotics applications in body in white [BIW] plants, to design of coolant systems in one of the later Volvo cars, the V60 hybrid.

X-RAY MAG: How did you get involved with Poseidon?

JB: I was actually involved in another company first (DP Scandinavia), then later bought Poseidon in the fall of 2007. The company was set up to develop the Cis Lunar MKVI that later became the Poseidon

Discovery. After setting up the MKVI project together with Kurt Sjöblom, Bill Stone, Rich Pyle, Nigel Jones, Barry Coleman and Jörgen Sahibzada, we spent quite a while defining the rebreather, the layout of the unit and particular functionalities such as the calibration and validation of the O₂



sensors. After a while we realized that we needed good regulators. Then Poseidon became a natural first stop since it was close by. I contacted Poseidon and their technical manager at that time, Yaniv Bertele. This was my first real contact with Poseidon as a company, even if I knew about them by name before that.

X-RAY MAG: Have you found it different being a CEO vs. a CTO?

JB: The CEO role in a small company could potentially be somewhat combined with the CTO role, and being hands on with product development is very important for me as an engineer. Being the CEO the work is more financially- and human resources-oriented, but I still have a laser focus on the macro picture in terms of technology development and products pipeline. Being the CTO for the



PETER SYMES



PETER SYMES

The premium electric car, the Tesla Model S sedan (below center); The Volvo V60 Hybrid car (bottom left)

Jonas Brandt

other industries or businesses can we learn from?

JB: I've spent a lot of time looking at the aviation and car industry in terms of development cooperation. Most of the dive manufacturers are small and have limited budgets. To drive the dive industry forward, I'm certain that all manufactures could potentially win by cooperating around non-intellectual property-related technologies especially in rebreathers. Sometimes I believe that the dive industry is too small for its own good.

One of the greatest inspirations right now is Elon Musk, CEO of Tesla, who recently



TESLA MOTORS / WIKIMEDIA COMMONS

released all [electric car patents] to all other car manufacturers to use, only to drive the paradigm forward quickly. I see lots of similarities in between electric cars and sports rebreathers. The buyers are skeptical, the cost is higher, the infrastructure is not in place and the user behavior is different. It takes a strong entrepreneur with stamina to drive these kinds of cases—just like Poseidon

X-RAY MAG: What

X-RAY MAG: Do you have any role models, and from where do you get your inspiration and best ideas?

JB: My creativity comes from other places than the office. I normally get most of my

inspiration when I'm out sailing in summer time. Obviously the interaction with customers and research and development staff is a great source for ideas and inspiration as well. I'm a hands on guy, with a strong feeling for what might trigger people in terms of technology and market, and I like speedy controlled processes; we get an idea in the company, we solid-work it, and then we start to build it, versus a vision-to-mission process.

X-RAY MAG: There are a several major features on the Poseidon rebreather that represents a significant deviation from mainstream thinking most notably the sensor configuration. For example how did departing from the dogma of three sensor voting logic come into the picture? Would you say that Poseidon has fostered a work culture of thinking out of the box?

JB: I think that thinking outside the box is very Scandinavian. The level of freedom within Swedish companies, at least, gives everyone with an idea the chance to do some trial and error, without any fears. That builds a very special company culture where innovation is a key driver. Building a sensor calibration and validation system for O₂ sensors was indeed more challenging than innovative. It was just a different approach in doing things. Calibration of sensors is nothing new, but to provide a means to do it automatically during start up was.

X-RAY MAG: One of your innovations is the blackbox/data logger on your units. I understand it collects massive amounts of data. Users can then upload their data to a central database. How much data have you accumulated? What have you been learning from all this data? Any trends? Surprises? Revelations?

company has been the most challenging work ever, trying to transform a nearly static business and drive innovation towards a paradigm shift in terms of equipment use, has been a great pleasure, combined with huge challenges—especially in terms of very conservative divers, used to diving in a particular way. For me, change and evolution is always good.

X-RAY MAG: You mentioned you have a background in the automotive industry. What techniques and principles can and should be transplanted to the dive industry?

JB: We take a lot of the technology around us today for granted. We have anti-spin regulation, traction control and ABS [anti-lock braking system] as integral parts of our cars today, compared to 20 years ago. When you drive your car today, do you really consider that several computers actually are in control and assist you in terms of steering, braking and controlling the car?

The evolution in cars has been huge; it is almost impossible today to even open the engine compartment and do something by yourself.

I want to transfer this philosophy into diving, so divers are given the same kind of support when something is happening when it's not supposed to. I want to give divers the time to think before they act, based on the huge task load under water. But primarily it is the underwater experience that is the key for future innovation. I believe that with the MKVI and the SE7EN, Poseidon has taken the first step into autonomous diving, and we will continue down that path without taking the diver out of the equation.



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PETER SYMES

profile



POSEIDON

THIS PAGE: Archival photos of early production at the Poseidon plant in Sweden

JB: We have proposed the sharing of data to DAN, as early as the Rebreather Forum 3 in 2012, but DAN has not really been keen on hosting the data, so it's a continual process to find the right host.

X-RAY MAG: What are the current trends? Who is actually buying rebreathers, and is it the same groups that you first expected?

JB: Right now we see end consumers walking into our dealers buying SE7EN rebreathers. Previously, the main customer base has been instructors. We peaked

the instructor market was saturated with units, and instructors had to build time to get instruction going. During 2014 we have seen a 100 percent increase in terms of sold units versus 2013, which supports my first sentence that we see end consumers buying units in a much larger scale than before.

X-RAY MAG: Many dive industry people expected rebreathers to take off a lot quicker than they have. What do you see as the obstacles? Or do you think the growth path has been what it should be?

JB: Obviously training, accumulating dive hours, etc, is a hurdle that I spoke about previously, but in essence, the biggest hurdle for divers, and in particular new divers, is time. It takes quite some time to learn how to dive, and once you have set time aside, it's not even sure that you find yourself comfortable diving. Compared to other sports such as skiing, tennis, etc, the bar in terms of time and money is much higher. I believe technology is something that can change this pattern and drive the business forward. The business needs to evolve and not kill itself by only competing with price. We need to see new types of breathing equipment and breathing systems being born, such as the Poseidon MKVI or SE7EN, for the dive industry to survive long term.

X-RAY MAG: Recreational rebreathers have come a long way. What do you see as the main upcoming challenges to make them even more main-

stream? Is it mainly a question of marketing, technology or economy?

JB: We need to simplify and develop a system that enhances the experience and provides breathable gas in a reliable way to the diver without compromising safety. In terms of safety, we have come a long way, but there are



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still hurdles to overcome without adding complexity. The economy is important but not as important as we think, compared to bicycling where we see a boom due to carbon fiber entering the sport market in a similar way that tennis evolved years ago. In marketing terms, the biggest challenge will be to attract new young divers.

X-RAY MAG: To date, the incident rates on rebreathers have been significantly higher than open-circuit diving (see Rebreather Forum 3). Is rebreather diving safety improving, staying about

the same or decreasing?

JB: This is something that we do not know for sure since we do not have accurate data from all manufacturers in terms of numbers of conducted dives. A joint database of just numbers of logged dives from all manufacturers would be a good start. In terms of safety, we took a huge step forward and launched new technology for sensor monitoring (auto calibration and validation). Unfortunately, parts of the dive industry met this with skepticism. Again, divers desire to be able to manipulate and do everything by themselves in a task-loaded environment, rather than breathing in an almost autonomous system which makes decisions—advice on what divers should do must be the correct thing to do.

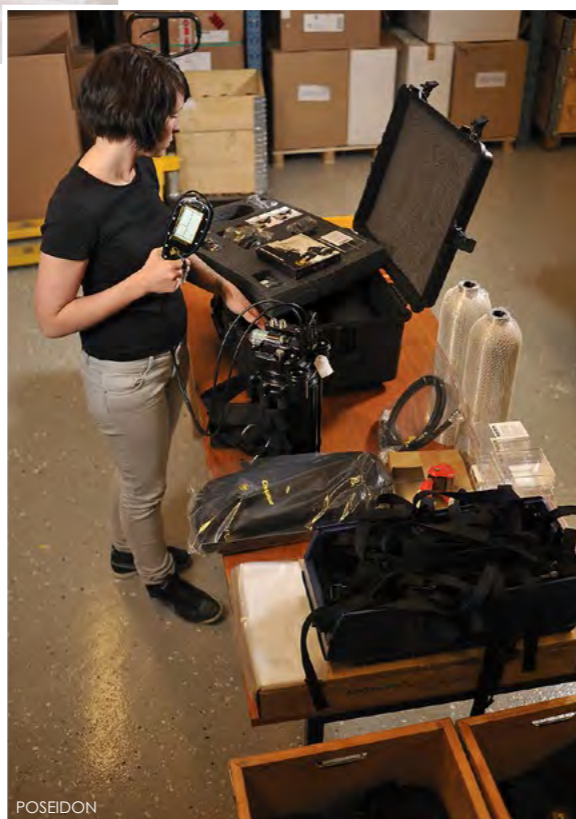
Ultimately, we would like to give the diver more time to decide what to do next rather than [having to act immediately].

X-RAY MAG: An operator recently stated to me that while he was otherwise interested in becoming a rebreather-friendly operation, the lack of common standards between brands of rebreathers made stocking the various spares and different consumables both a

The Poseidon Rebreather MKVI



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in terms of sold units during 2012, then 2013 was a disappointment, but we realized after a while that



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logistical nightmare and economically unfeasible. How can this issue be minimized, and is it something on which you can collaborate with other brands?

JB: I was one of the founding members of RESA [Rebreather Education and Safety Association] and my ultimate target for a manufacturers' organization was to drive standards in terms of commonalities in between the units—the same cylinders, valves and scrubber would have been a great step forward. Unfortunately, RESA has been working solely with training standards and legal questions based on U.S. law interpretation. We need to get to a situation where the 'throttle and the brake' are the same on all units.

X-RAY MAG: Is it possible to build a fully automated don-and-dive rebreather, and how far off are we from that becoming a reality?

JB: We already built one, if you ask me. There are, of course, functions in the SE7EN that can be optimized, but yes, I do believe that we built what you are referring to.

X-RAY MAG: How far should we take automation in diving? Don't we risk introducing complacency

in the user at some point?

JB: Complacency is probably one of the most pressing issues in diving, generally speaking. We need to automate the use of aviation standard checklists. Don-and-dive has obvious drawbacks, but ultimately, we need to come to a place where responsible divers are honored and become role models.

X-RAY MAG: How do you see the future of diving? What do you see as the main challenges and opportunities ahead? Have your visions changed, and if so, in what manner have they been refined?

JB: Our vision is still the paradigm to have people exchanging their old open circuit equipment to closed circuit rebreathers, but in the end, the industry needs to be more innovation across the board, to be profitable. It's hard to reveal the whole product pipeline in an interview, but frankly, the vision has been intact over the years. However, the strategy to reach our targets has been refined and altered many times.

X-RAY MAG: What are your personal hopes, goals or aspirations for Poseidon's rebreather business?

What will the business look like in five years? Ten years? Twenty years?

JB: I see a fast growing business in the next five years, with about five to ten percent of all new certificates issued being on rebreathers. I believe that at least ten percent of divers will dive rebreathers in ten years' time.

X-RAY MAG: And how about you? Any personal hopes, goals or aspirations with regards to diving?

JB: Not really. My goal is to make Poseidon the driving force behind the paradigm shift from OC [open circuit] to ECCR [Electronic Closed Circuit Rebreather] and build our brand even stronger in other areas than just rebreathers, in the next couple of years. It's very easy to become blindfolded, focusing on one new product and forgetting about the long heritage Posiedon has in terms of inventive and high performance products outside the product group of rebreathers.

In terms of diving, then it has to be something like: "Work less, dive more." ■

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The Case for Unsweet Tea

— Thoughts on Diving & Hydration

Text by Steve Lewis

I am an expat Brit, so it may probably come as no surprise to tell you that I enjoy a cup of tea. A few shots of strong espresso in a bowl of hot milk is my morning drink, but tea is on the menu for most of the rest of the day.

Perhaps less easy to fit into the ethnic stereotyping is the way I prefer my tea made. My strong preference is not the traditional British Cuppa (pipping hot with milk and sugar) but ice-cold, black with lemon, and unsweetened—a version of tea drunk in the southern part of the United States and often difficult to find most any place else, especially where I live in rural Canada.

Unsweetened tea is a great drink anytime but it's a particularly good way to punctuate scuba dives. I guess it's common knowledge among the dive crowd that "being well hydrated" is a good tactic that helps one's body off-gas during ascents and surface intervals. We believe, in short, that hydration is a factor in decompression stress management; and although we might debate that this is a sweeping generalization, let's just say that drinking lots of fluid is good behav-

ior for any diver. In my opinion, drinking unsweet tea as well as plain water encourages higher consumption. In other words, tea is less boring than water.

Now just in case you are reading this and saying quietly to yourself: "Guy's an idiot. Tea is a serious diuretic and divers should steer away from it," give me a couple more minutes.

And by the way, if you ARE thinking that, you're not alone. I was recently on a dive boat (an excellent liveaboard working out of the Florida Keys). Always open for suggestions and customer feedback, one of the owners asked what I would change about their operations. I suggested their soda gun have a button for unsweetened tea added. She looked at me with a smile and explained that tea being "the most powerful diuretic known" I would not be seeing it on the menu for her divers anytime soon. I resisted the temptation to argue with her.

For example, I resisted the temptation to point out the boat's soda offerings included cola and root beer, both of which have serious dietary side effects from ingredients not to be found in tea. I also chose to not point out that there was a huge canteen of coffee on the galley counter below decks... surely if tea is diuretic, that must be too. Right?

Facts about tea

Tea is, at worst, mildly diuretic—with the emphasis on mildly. While you may poo-poo the veracity and question the bias of any study I care to cite here, data—and not some hearsay from a dubiously researched diving manual—indicates that everyday consumption of tea (hot or otherwise) does not produce a negative diuretic effect unless the amount of tea consumed at one sitting contains more than 300mg of caffeine. Since the average cuppa contains around 50mg, you'd have to drink about 1.5 litres of tea in one sitting to ingest this level of caffeine. That, my friends, would take some serious guzzling.

It may be worth noting that the British Dietetic Association (BDA) has suggested tea can be used to supplement normal water con-



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sumption! Nothing there about tea being counter-indicated for good hydration... the opposite, in fact. The BDA report went on to state that "the style of tea and coffee and the amounts we drink in the United Kingdom are unlikely to have a negative effect [on hydration]". I think we are safe to apply the same logic anywhere else in the world.

A clinical study published by the British Tea Advisory Panel (admittedly a potentially biased source) stated that a cup of tea can be just as good as a glass of water at keeping your body hydrated. It explained that four to eight cups of tea consumed throughout the day, is thirst quenching "without any diuretic side effects". Now, I am willing to squint a little at one or two of those assumptions without adding some provisos but it's interesting nevertheless.

In addition, the Harvard School of Public Health rates tea as one of the healthiest beverages. Tea contains essential nutrients that are being studied for their value in possibly preventing heart disease and diabetes. For instance, brewed tea is rich in free-radical fighting antioxidants.

Unsweetened ice tea is also naturally low in calories. A 16-ounce glass of unsweetened ice tea (that's a little less than half a litre) will deliver about three calories. The same volume of cola contains about 180 calories, all of which

come from sugar.

Now you are free to drink whatever you want. And if I am on your boat, I will follow your rules and allow you to live by whatever odd dietary foibles you may have. But, please get something straight, unsweetened iced tea is NOT a serious diuretic and, in fact, may encourage divers who have an issue drinking a healthy dose of water to actually better hydrate.

Good hydration—or at least being conscious of it—is a lifestyle choice that one should adopt outside diving. Being well hydrated begins long before walking onto a dive boat or driving to the dive site... days before. But for a great number of people, drinking copious volumes of water simply doesn't appeal. They want flavor. My argument is that unsweetened ice tea delivers it, and at the same time,



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helps, not hinders, one to attain and maintain a good level of hydration.

Of course, when we consider the overall factors that influence decompression stress, hydration is only one of more than perhaps a couple of dozen. But it is a simple one to manage... Anyone for a cuppa? ■

Steve Lewis is a British diver, instructor, dive industry consultant and author based in Canada. He teaches and lectures at home and abroad. His main focus is to dive safety and to make each of us aware of the things that will make us better divers than we are now. His latest book, Staying Alive: Risk Management Techniques for Advanced Scuba Diving, is available through Amazon. For more information, visit www.techdiver-training.org or www.ccrcave.training.



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Craig Willemsen, owner, Silent World Diving



www.wakatobi.com



Panama's
Malpelo Island

Text and photos by Larry Cohen
and Olga Torrey



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Malpelo Island (above). PREVIOUS PAGE: Divers with whale shark at the Aquarium dive site

The main reason for diving Malpelo Island is the sharks. The area is known for large schools of hammerheads, silky sharks, Galapagos and whitetip sharks. In the winter there is a population of sand tigers, and in late summer and fall, whale sharks call these waters their home. Other large pelagics can also be viewed. Tuna, jacks and eagle rays are not uncommon, with the occasional manta ray making an appearance.

The reason for all of this large life is an abundance of food being brought in by strong ocean currents. So diving conditions are not easy. Currents could be very strong and visibility clouded by all the nutrients in the water. But this is the price to pay for hanging out with the big boys.

Two hundred and thirty miles from Panama and 270 miles from the coast of Columbia is the large rock rising from the Pacific Ocean that is Malpelo Island. The rock itself is home to a small Columbian military base, ranger station and colony of sea birds.

A number of boats from Panama and Columbia run trips to Malpelo. Leaving from Panama the journey takes 30 hours,

depending on current and wind.

Leaving Panama in the late afternoon on a Monday, one will not see land until sometime on Wednesday. It is not unusual for sea conditions and weather to be rough. So it is nice to be on a comfortable seaworthy vessel. During the journey, there is time to relax, make new friends and dream about the wonders that will soon be seen below the surface. There is plenty of time to setup scuba gear and cameras.

Before long the rock appears in the distance. As time goes by, it slowly starts getting larger and larger. Before your eyes appears a magical enchanted land. When Robert Lewis Stevenson wrote *Treasure Island*, he must



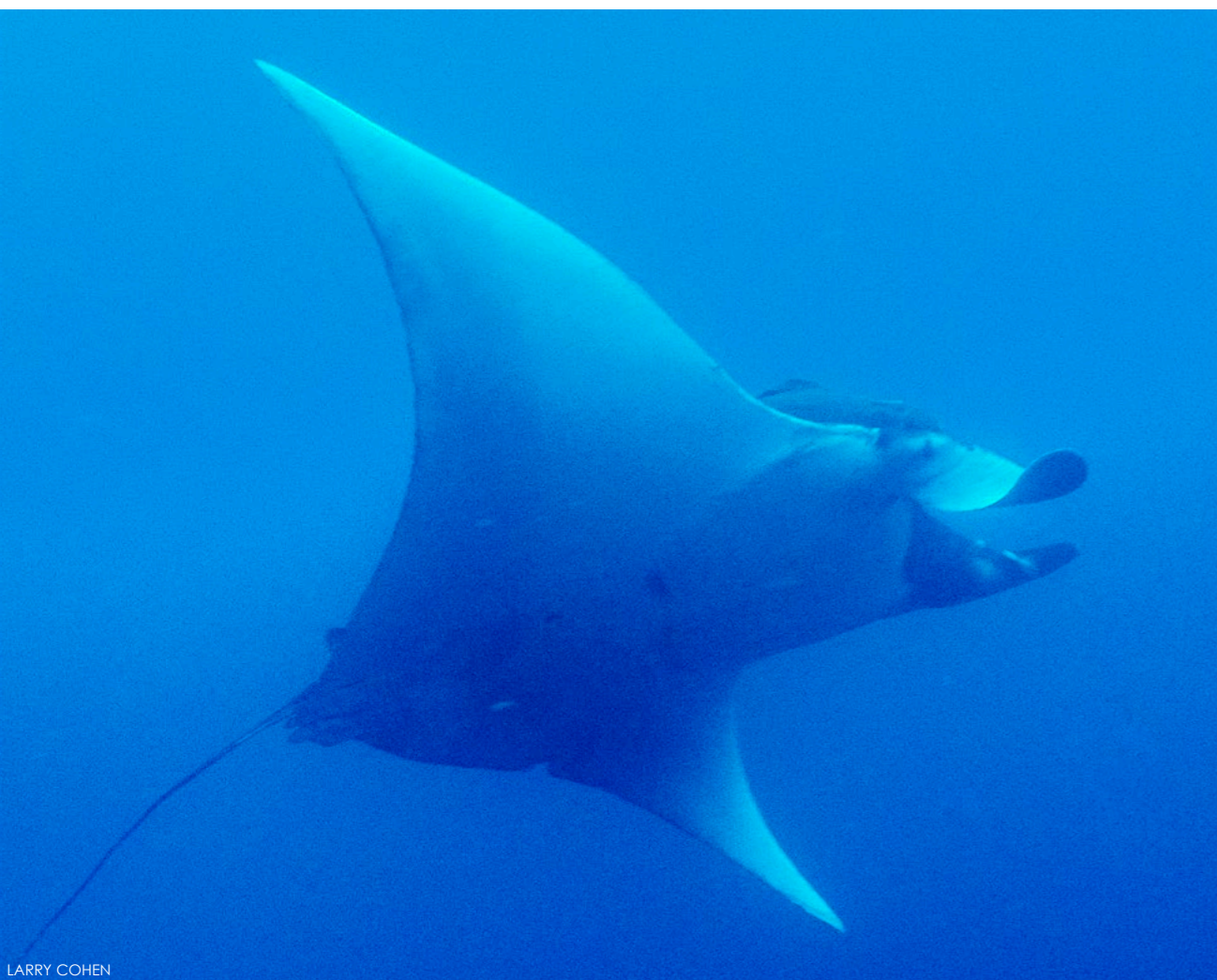
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Trumpetfish on the rocks at Bajo del Monstruo (above); Spanish grunts with eagle ray in background (top right)

Leather bass in swim-through at La Gringa



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Manta ray spotted at La Puerta del Cielo; Large numbers of moray eels on the rocks (top left)



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School of hammerheads in the distance (above); Scorpionfish at the Aquarium (right)

have been thinking of Malpelo. This looks like the perfect place for pirates to hide treasure.

All the diving on Malpelo is done around the rock and nearby pinnacles. If you removed all the large marine life, this would still be a world-class dive site. Sea fans and other soft coral decorate the rock. There are more moray eels here, than we have ever seen. Many are free swimming even in the daylight hours.

Leatherback grouper and Mexican hogfish are everywhere. These fish along with butterflyfish also perform a useful service for the big pelagics. The marine life on all the rock reefs are cleaning stations.

Sharks and other large animals come

in to have the parasites, dead skin and loose scales removed from their mouths and bodies. The butterflyfish and other cleaners use these parasites as food and don't get eaten. Diving on a cleaning station offers the opportunity to observe these animals.

Once arriving, divers do a check out dive at El Altar de Virginia. This site is in a protected area and there is not much current. Divers do a backward roll from the small skiff.

Diving

Coiba Dive Expeditions goes to Malpelo more often than other operations. Their liveaboard vessel is the 115-foot (35m) *Yemaya' II*. The ship has eight comfort-



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able staterooms plus crew quarters.

The diving station is on the lower deck while the top deck is for dining and socializing. Half of the top deck is covered while the other half has lounge chairs for enjoying the sun. There is an indoor salon with a TV, video and book



Galapagos shark at Bajon dive site (left); Butterflyfish on cleaning station at Los Tres Mosqueteros (right)

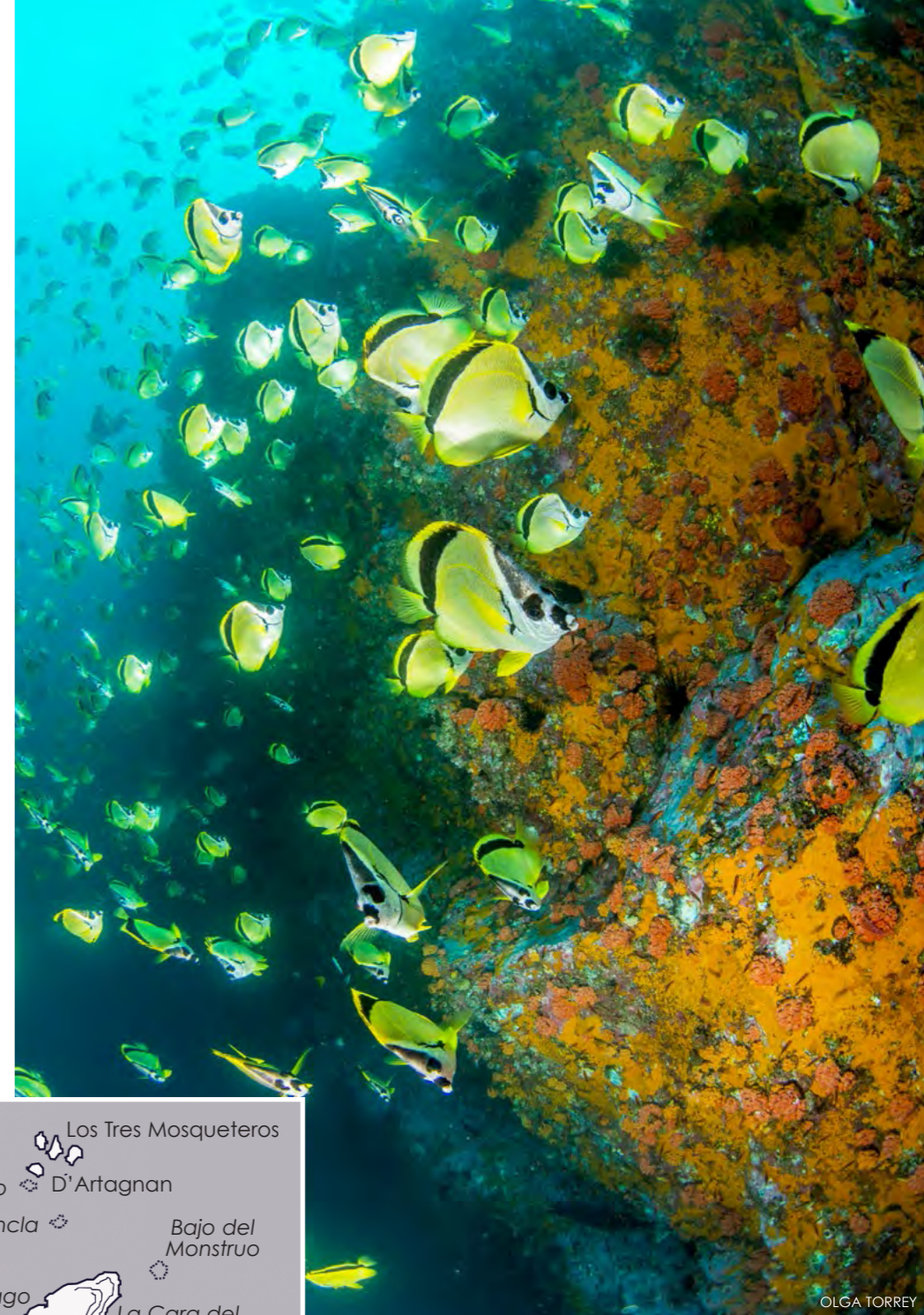
Conditions

In August 2014, El Nino was affecting the area. With water temperatures in August being between 76°F and 87°F (24-31°C), it was comfortable to dive in a 3-5mm wetsuit.

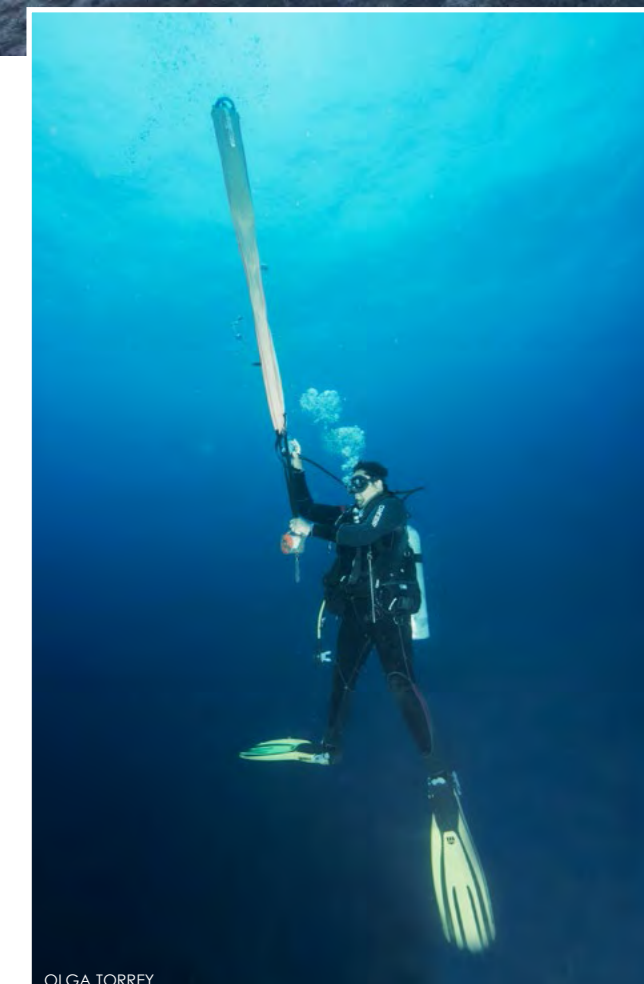
These warm temperatures push the hammerheads and other sharks away from the wall. They seek out cooler waters away from Malpelo.

At times we hit a thermocline where the cold water and warm water mixed, creating a hazy look of gauze in the water.

Once on the bottom, everyone lined up looking into the blue—hoping to get



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library. Two skiffs are towed behind the ship. All diving takes place from the skiffs. Nitrox 32 is produced from a membrane system and whips are used to fill tanks without removing them from the skiffs.

All diving is done in groups. The dive guide counts, "Uno, dos, tres!" and everyone rolls in at the same time. Doing this comfortably with a camera housing and strobes takes some practice.

After seeing the first cleaning station and a large school of hammerheads in the distance, it is time to surface. Everyone is asked to deploy a surface marker buoy (SMB) for practice.

From now on, many dives will be in a current, so a negative entry is necessary. With BCs empty everyone rolls in at the same time and frantically swims to the rock before the current wipes them away. If everything

goes right, the group stays together and the dive guide shoots the surface marker buoy at the end of the dive. If someone gets separated, they have their own reel and SMB.

The boat supplies Nautilus Lifelines to all the divers. This device invented by Nautilus Explorer owner, Mike Lever, is perfect for this diving environment. It is a combination radio and GPS. The lifeline has three buttons. The green button allows a diver to chat with the boat and skiff. The GPS numbers are displayed. If you are lost, you can tell the skiff driver where you are located.

The orange button allows a diver to communicate on Channel 16. This channel is reserved for emergencies and is monitored by all vessels. This way divers can tell any nearby ship their location.

The red button will keep transmitting a diver's location to all stations, but divers are not able to talk when using this function. Having a Nautilus Lifeline on all dives will give one a warm and fuzzy feeling, but this device is a requirement when diving remote locations in these conditions.



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Map of Malpelo Island

a glimpse of a school of hammerheads or other pelagic animals. We felt like we were at a theatre waiting for the show to begin.

If everyone stays close together the bubbles will scare away the animals. By spreading out and being observant, divers might get to see a shark or eagle ray. Because of the current, it is important to not get too far away from the dive guide. Also keep an eye out behind you. While everyone is looking for the actors to appear on the stage, sometimes one might sneak back to perform in the balcony.

Diver inflates a surface marker buoy



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If no sharks appear, the group swims, or drifts in the current, to a different area. While looking for the large animals, don't get tunnel vision and forget about the rocks. Spanish grunts, giant hawkfish, coral hawkfish, puffers and other creatures put on a colorful show.

Dive sites

There are many dive sites around the island. There is an area in the rock that looks like a face staring down at you. The dive site below

the face is known as La Cara de Fantasma, or the ghost face. The skiff ride could be as interesting as the dive. It is possible to see bait balls and humpback whales breaching close to the tiny boat.

La Gringa is a site named because a dive instructor from the United States had a butt the size and shape of the rock. But the great feature of this site is a long swim-through. Fish of all



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Swim-through at La Gringa (left); Gunieafowl puffer in golden phase (above); Divers with whale shark at the Aquarium dive site (right)

kinds are inside this rocky passageway. On the other side of the swim-through, one might spot a large school of hammerheads.

One of the other dive sites of note was the Aquarium. Cur-



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Coral hawkfish can be seen at La Cara de Fantasma dive site

rent varied from strong to insane, but at least the dive staff deployed a buoy decent line for reference.

At the time of our visit, a male and pregnant female whale shark could be seen on this site. To have a 30-foot (9m) fish swim overhead and block out the sun, then swim down and look you in the eye was a life-changing experience. These gentle plankton eaters were as curious about the divers as the divers were curious about them. It was hard to tell who was watching

whom, but the whale sharks did not have cameras.

After the diving days were finished, it was time for the long ride back to the mainland. There was now time to relax, socialize with new friends, pack gear and dream about the incredible wonders we just experienced under the surface.

Topside attractions

When planning a trip to Malpelo, one should also plan to explore Panama. Both the city and the remote areas have much to offer.

Panama City. Panama City is an important town since the Panama Canal allows ships quick access





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Traditional fishing boats in front of modern Panama City (above); Freighter enters Panama Canal (right)



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Old Town has the look and feel of many cities in Spain combined with a bit of New Orleans flavor



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between the Pacific and Atlantic Oceans. Before the canal was built, ships had to go around South America to make the trip. At the ports, trains would transport cargo across the narrow country to the other side. Then the containers were distributed onto ships going to different locations. The first ship entered the canal on 15 August 1914.

The influence of the United States is everywhere. This is because the United States had complete control of the Panama Canal from 1914 to 1979. From

1979 to 1999, the canal was under joint American–Panamanian management. In 1999 the canal was handed over to the Panama Canal Authority, a Panamanian government agency. But the U.S. dollar is still the local currency, and 110v with North American outlets are still used for power.

Panama City is a study of con-

trast. The new city has modern skyscrapers with a variety of quirky architecture. One building has a twist while another is designed to look like a ship, influenced by the Burj Khalifa skyscraper in Dubai. Many of these buildings are residential. This modern skyline can be seen from the water with a fleet of traditional fishing boats sitting in the fore-

ground.

Old Town Panama City has the look and feel of many cities in Spain, combined with a flavor of New Orleans in the United States. Colorful buildings with shops, restaurants and bars line the narrow streets. There are many squares and public areas for people to gather and enjoy the hot tropical weather. Around the squares are

churches and government buildings.

Visual arts play an important roll in the life of the Panamanian people. Parades, public events and parties always include a host of decorated floats. On our visit, a number of artists could be seen working on these floats into the evening through open doorways. School buses purchased second

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Kayaking where the Chagres River meets the Panama Canal forming Gatun Lake (above); Mono Titi monkeys are the smallest found in Panama (right inset)



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hand from the United States were used as public transportation. Artists used the buses as canvases for their work. Known as *diablos rojos* (red devils) they are

now being replaced with modern buses. But some of these buses are still on the road.

Gamboa. Gamboa is a town near Panama City that was populated by people from the United States. It is now an international community with a pristine rainforest in its backyard. The canal

needs millions of gallons of water to feed its lock system. For this reason the rainforest has been preserved to provide water. The Smithsonian Institute maintains their tropical research facility in Gamboa. The institute's mission is to understand the past, present and future of tropical biodiversity and its relevance to humankind.

This is where the scenic Chagres River meets the Panama Canal forming Gatun Lake. A boat tour with kayaking was an excellent way to explore this area. It was interesting to see the contrast of dredging and other work being done on the canal right next to a tropical wonderland where a variety of birds, monkeys and reptiles could be observed. Snail kites could be seen looking out for their prey.

One of the highlights was being able to get up close to the rufous-naped tamarin, also known locally as the Mono



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Titi monkey. This is the smallest monkey found in Panama. Bringing our kayaks close to the tress, we could observe Titi monkeys running, galloping and leaping from tree branch to tree branch. They did not hang from their tails but used them for balance.



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THIS PAGE: Wildlife found in the rainforest at Soberania National Park, such as the snail kite (top center) and a family of mantled howler monkeys (top right)

Soberania National Park. Hiking in Soberania National Park is another way to observe life in the rainforest. As we walked on the main trail, we heard the sounds of many different birds.

Part of life in the rainforest is hiding, trying not to become a meal. So seeing these birds needs patience.

The way the light filtered through the trees was magnificent. As our eyes adjusted, we began to see movement in the trees. Magnifying the spectacle with binoculars or a telephoto lens, we could spot a community of mantled howler monkeys. Howlers are



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among the largest monkeys in Panama. We could see them hanging, climbing and leaping on the tree branches. Sometimes they walked upside down and wrapped their tails around the tree. Their prehensile tails are strong enough to support their entire body weight. Vocal communication was an important part of the howlers' social behavior. When they barked, we felt like King Kong was coming down from the trees to kidnap us—just like what happened to Faye Ray.

Guna region. One third of the Caribbean side of Panama is the Guna region. The population of these indigenous people is round 40,000. The name was Kuna until 2012, when the spelling was changed to Guna. The Guna region starts at the Continental Divide and continues offshore to a chain of about 360 coral reef islands that stretch along the





CLOCKWISE FROM FAR LEFT: Guna Yala, as it is called by locals, is known as San Blas Islands in the tourism industry; Beadwork known as Wini is traditionally worn on the limbs (left inset); Molas are sold as art work and used for clothing; Portrait of a Guna woman; Traditional wooden canoes are used to bring supplies to the island; Guna men are excellent free divers and spearfishers; Guna women own their homes (lower left inset)

from the Guna for US\$30. Tourism is now a big part of the Guna economy. The tradition of trade and self-determination is one of the reasons the Gunas have been able to successfully function independently, compared to other indigenous groups.

so many unique experiences. Diving with a variety of sharks and other pelagic marine life and then having encounters with the wildlife in the rainforest is a well-rounded trip for which it is well worth spending as much time as possible to enjoy. ■

of the Yemaya' II, as well as Yala Tours Panama (www.yalatour-spanama.com).

Larry Cohen and Olga Torrey are well-traveled and published underwater photographers based in New York City, USA. They offer underwater photography courses and presentations to dive shops, clubs and events. For more information, visit: Liquidimagesuw.com.

The authors wish to thank Coiba Dive Expeditions (www.coibadive-expeditions.com) and the crew



coast down to Columbia. The tourist industries call these islands the San Blas Islands, but the locals know them as Guna Yala. *Yala* translates to *mountain* and *land*. In the past, the Panamanian government tried to dominate Guna culture, suppressing traditional customs in order to control the people. In 1925 the Dule Revolution resulted in a treaty in which the Panamanians agreed to recognize the Guna people's cultural freedom and semi-auton-

omy of the well-functioning traditional democracy they maintain. The Guna religion is called Baba and is based on nature, involving a Father Baba and a Mother Earth. The governmental process in the big meetings of the Guna includes (religious) metaphors of their view of the world. Artwork known as Molas decorate the blouses of the Guna women and are used as the base for clothing. The designs replace what used to be body paint. The women wear attractive beadwork on their legs known as Wini. The men farm, collect coconuts and fish. Scuba diving is illegal for both locals and tourists, but many Guna men are excellent freedivers and spearfishers.

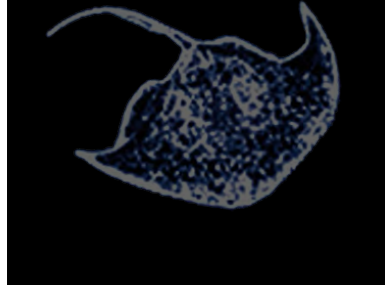
The women are the owners of their houses and many of them manage businesses. They create the Molas and Wini. Preparing the fresh food and cooking is a part of their activity. Many Gunas used to work on the U.S. bases in the former Canal Zone. Having a strong sense of community, money was sent back home to build schools and hospitals. Now many are professionals, working in Panama City. The Guna people have a history of selling goods through family-owned venues. They place a strong emphasis on economic success. Small retail stores owned by the Guna people sell Molas throughout Panama and abroad. Coconuts and lobster are important exports. Colombian trade boats buy a hundred coconuts

Afterthoughts

An adventure to Malpelo Island and a tour through Panama offers



fact file



Panama



SOURCES: U.S. CIA WORLD FACTBOOK, XE.COM, OECD.ORG, DATA.WORLDBANK.ORG

History In the 16th century, the Spanish settled in Panama. In 1821, Panama gained independence from Spain and—together with Colombia, Ecuador and Venezuela—formed the Republic of Gran Colombia. This was dissolved in 1830, but Panama formed an alliance with Colombia. However, in 1903, Panama separated, and collaborated with the United States for the construction of a canal. The Panama Canal was opened in August 1914, after a decade of construction work undertaken by the U.S. Army Corps of Engineers. In 1977, it was agreed that the Canal would be transferred to Panama by the end of the century. Over the years, certain portions and responsibilities over the Canal were transferred to Panama. In 1989, the dictator Manuel Noriega was deposed. A decade later, the Canal, the area supporting the Canal and the remaining U.S. military bases were turned over to Panama. Government: Constitutional democracy. Capital: Panama City

Geography Panama is located in Central America, and borders the Caribbean Sea and the North Pacific Ocean, between Costa Rica and Colombia. Coastline: 2,490km. Terrain: Panama's interior comprises mostly of sharp, rugged mountains and divided, highland plains. The country's coastal areas

are primarily comprised of rolling hills and plains. Lowest point: Pacific Ocean 0m. Highest point: Volcan Baru 3,475m. Note: Panama occupies a strategic location at the eastern end of an isthmus which forms a land bridge that connects North and South America. The nation controls the Panama Canal, which links the North Pacific Ocean with the North Atlantic Ocean, by way of the Caribbean Sea.

Economy About 75% of Panama's GDP comprises the services sector, which covers various areas such as the Panama Canal, the Colon Free Zone, logistics, banking, insurance, container ports, flagship registry and tourism. In 2013, the unemployment rate dropped to 4.5%. Part of the economic boost stems from the expansion of the Panama Canal, which started in September 2007. Costing US\$5.25 billion, it sought to double the waterway's capacity by creating a new lane of traffic along the

Canal. This would improve economics of scale, boost the international maritime trade and maintain the Canal's competitiveness. To date, more than 30,000 jobs had been created as a result of the expansion. As at December 2014, the project was 83% completed. Although Panama's economy has performed progressively well over the years (thanks to its strong transportation, logistics services sectors and infrastructure development), the income distribution is the second-worst in Latin America. In 2013, 25.8% of the population lived in poverty. This figure has been steadily falling, down from 38% in 2006. Panama's most important trad-

RIGHT: Global map with location of Malpelo Island, Columbia
BELOW: Map of Panama



Language Spanish is the official language, with 14% speaking English, as many Panamanians are bilingual.

Visa Visas are not required for visitors from Europe, Australia, Great Britain, United States and Canada for visits of up to 180 days.

Travel advisory From the U.S. Department of State, Bureau of Consular Affairs, recommends avoiding travel to remote areas off the Pan American Highway in the Darién Province. The number of incidents remains low, tourist and Panamanian citizens are potentially at risk of violent crime in this area.

Environmental issues Water pollution due to agricultural runoff, deforestation, siltation due to soil erosion and land degradation, urban air pollution and natural resources threatened by mining are problems. On the positive side, the government is creating

parks and wildlife refuges, passing environmental laws, and establishing conservation agencies.

Currency United States Dollar and Panama Balboas (PAB)
Exchange rates: 1USD= 1PAB;
1EUR= 1.13PAB; 1GBP= 1.50PAB;
1AUD= 0.77PAB; 1SGD= 1.74PAB

Population 3,608,431 (July 2014 est.) Ethnic groups: mestizo (Amerindian and white) 70%, Amerindian and mixed (West Indian) 14%, white 10%, Amerindian 6%. Religions: Roman Catholic 85%, Protestant 15%. Internet users: 959,800 (2009)

ing partner is the United States. The U.S. Congress approved the U.S.-Panama Trade Promotion Agreement in 2011, and this was entered into force on 31 October 2012. In December 2003, the Organisation for Economic Co-operation and Development (OECD) listed Panama as one of the jurisdictions committed to improving transparency and establishing effective exchange of information in tax matters.

Climate Panama has a tropical maritime climate that is cloudy, hot and humid. The rainy season is May to January and the dry season January to May.

Health Routine vaccines should be current, including measles-mumps-rubella (MMR), diphtheria-tetanus-pertussis, varicella (chickenpox), polio, Hepatitis A & B, Typhoid and yearly flu shot. Tourists from countries where yellow fever is endemic must be vaccinated for yellow fever in order to enter Panama.

Decompression chamber
Multiplace Chamber
Panama Canal Authority Bldg.
706, Balboa Panama City.
Telephone (507) 272-8738
Transportation from Malpelo to the chamber is not practical. In-water decompression procedures are used.

Websites
Visit Panama
www.visitpanama.com ■



Strytan

Diving Iceland's Hydrothermal Vents

Text and photos by Michael Salvarezza and Christopher P. Weaver



The waters of the Eyjafjordur Fjord were still and calm. There was a sharp crispness to the air and snow covered the hills lining the shore. Except for the gentle lapping of water against the sides of our inflatable dive boat, the world around us was silent. To the north we could see heavy gray clouds hanging low to the horizon, the first signs of an approaching storm undoubtedly born in the Arctic wilderness just a few miles away. In a few short hours, the weather would turn bad and diving would become impossible. For now, all was calm and we were focused on preparations for an underwater adventure to an alien world.



In 1997, divers Erlendur Bogason and his friend Árni Halldósson discovered an amazing hydrothermal vent in the dark waters off the shores of Hjalteyri, a small fishing village located near the town of Akureyri. Strýtan, as this location has been named, is a towering chimney-like geological forma-

tion rising to over 200ft (230m) from the ocean floor to nearly 50ft (15m) below the surface.

Hydrothermal vents have been discovered in many places throughout the world, usually along continental rift zones, but they are generally located many thousands of feet

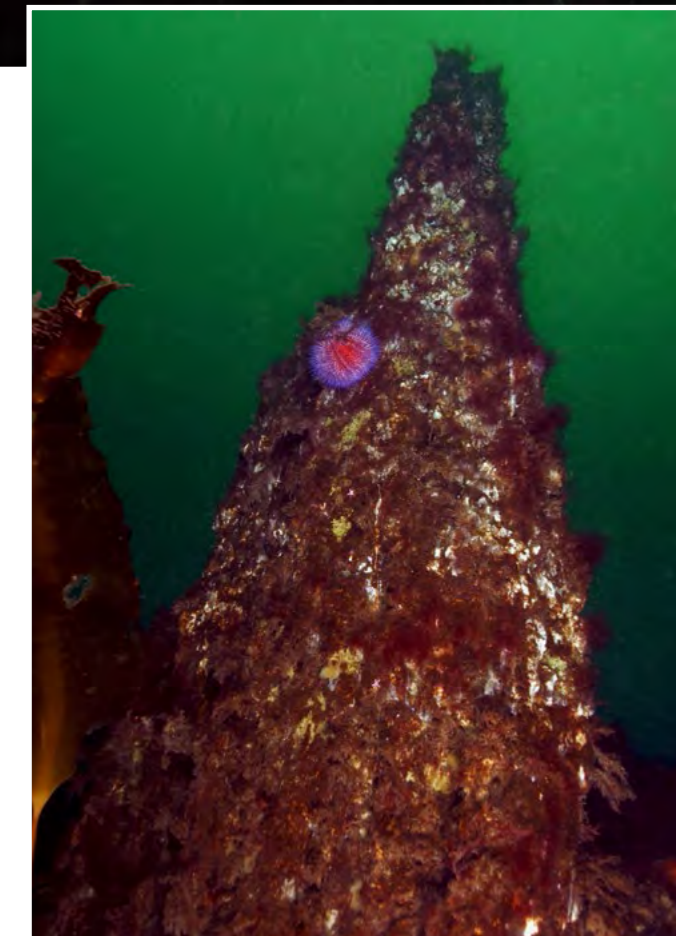
deep. Currently, Strýtan is the shallowest known vent in the world and the only place where scuba divers can actually dive on an active hydrothermal vent. A white smoker, Strýtan is a set of chimneys that continually emit very hot water 167°F (75°C) at an estimated rate of 26 gallons (100 liters)

per second.

These geological formations are formed by smectite, a white clay material that mixes with other crustal elements and minerals as it circulates through the oceanic crust under very high pressure and temperature. When this material mixes with the cold



CLOCKWISE FROM FAR LEFT: Divers exploring Strýtan's vents; Hot water emerges from Strýtan at an astonishing rate; Dramatic scenery at one of Iceland's fjords; Strýtan's chimney



ocean water after emerging from the ground, it coagulates, hardens and forms the chimney. Strýtan started forming at the end of last ice age 10,000 years ago.

At Strýtan, divers can explore these towering formations and will marvel at the marine life that abounds in these waters.

Diving

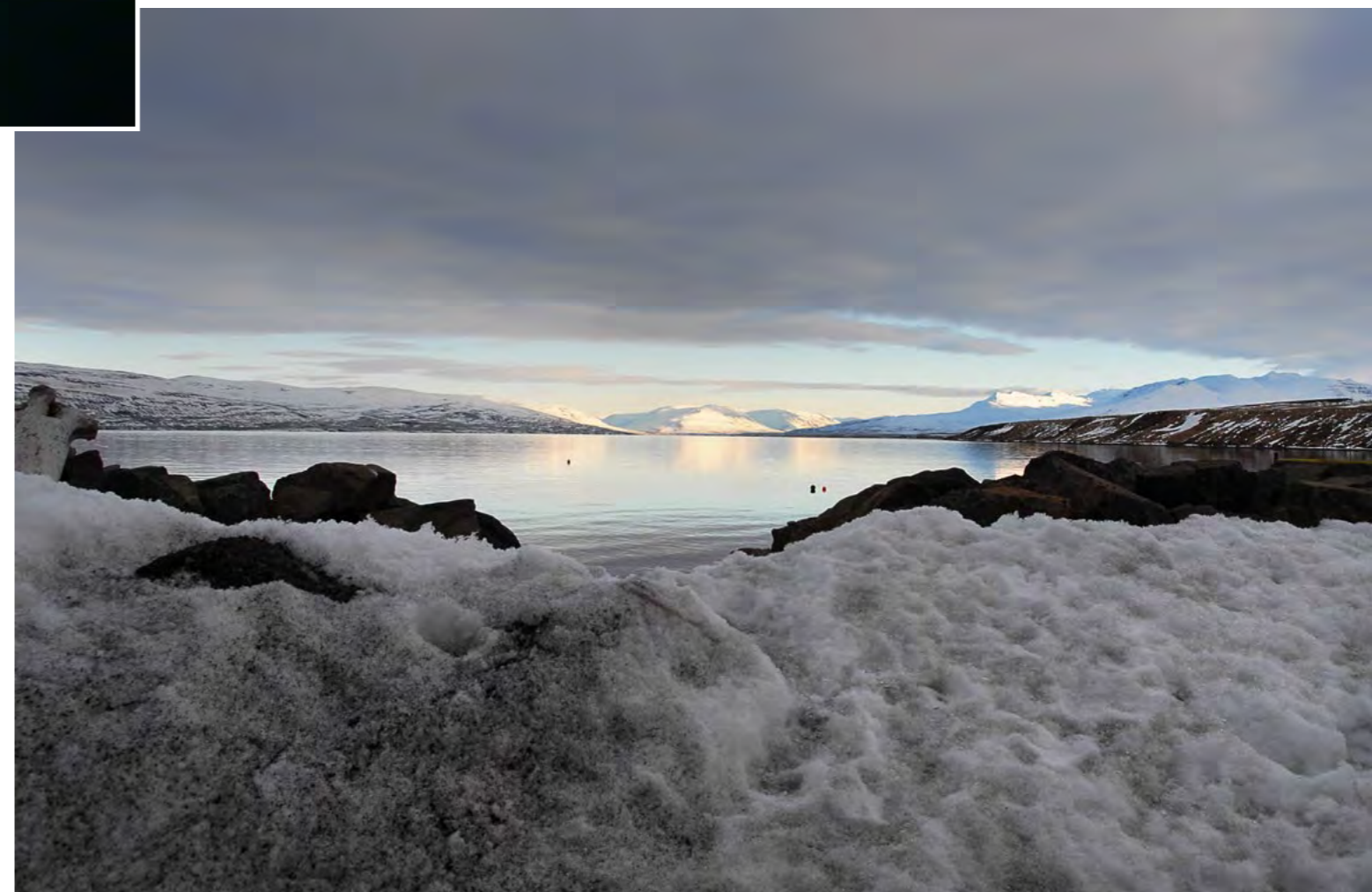
Our dive began with a routine back roll into the teeth-chattering 34°F (1°C) water. Instantly, our eyes adjusted to the dim light of the greenish-black water. Peering down through 50ft (15m) visibility and searching for something to orient ourselves, we focused first on the down line.

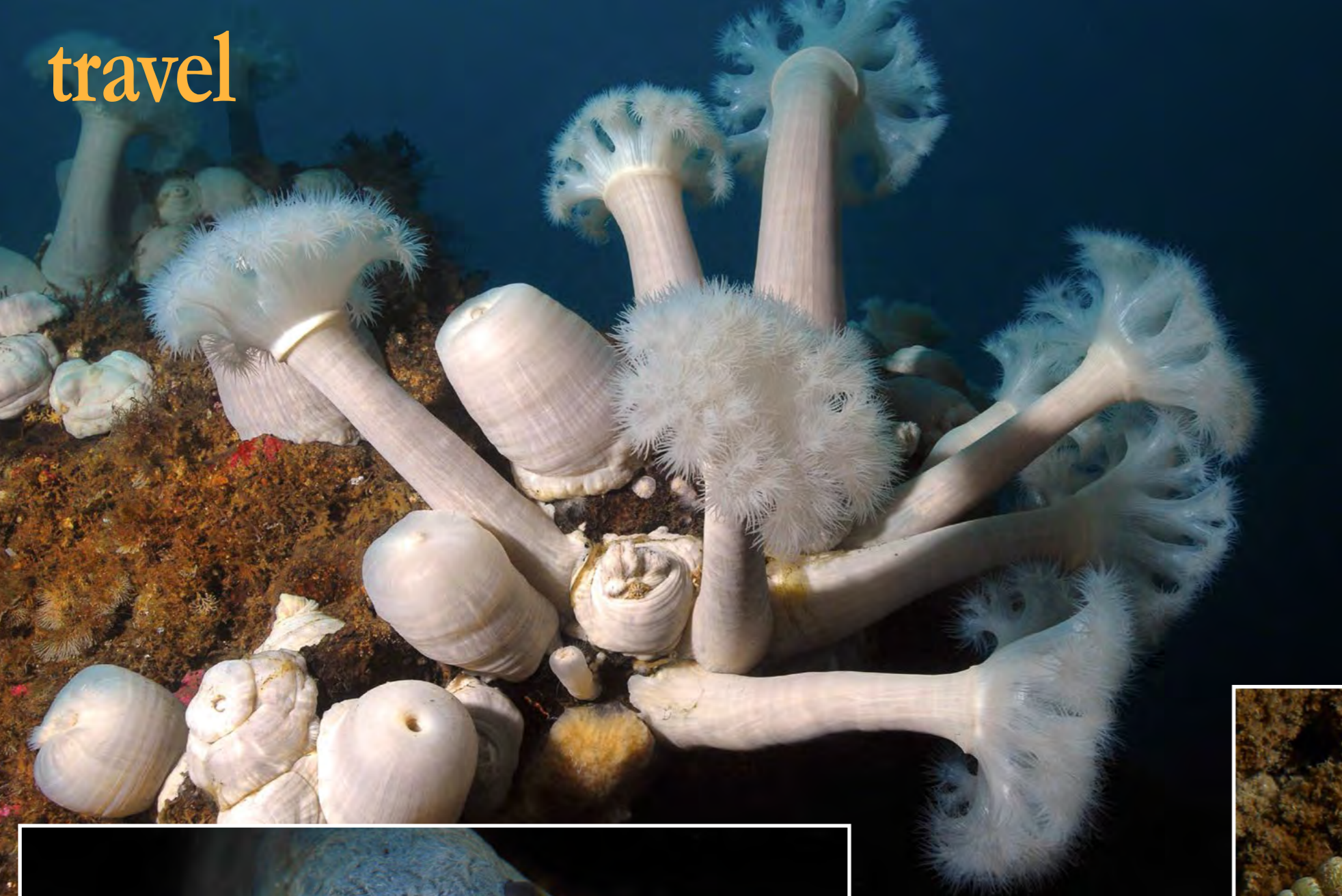
Bogason, who operates the nearby Strýtan Divecenter, has

installed a mooring buoy to ensure the protection of this delicate environment and to help divers find their way to the site. Descending into the waters of the fjord, our eyes opened wide as the first glimpse of the chimney came into view.

At first, Strýtan appears as a tall, narrow spire—rocky, covered with multi-colored plumose anemones, but otherwise somewhat uninteresting... until you get close.

After just a few minutes, we became aware of hazy, "out of focus" water—the telltale sign of hot fresh water mixing with cold salt water. These haloclines and thermoclines were easy to spot and were the best evidence of the rushing geothermal water flowing into the fjord. Scientists





CLOCKWISE FROM LEFT: Ferocious looking but harmless wolffish; White-plumed anemones decorate Strýtan's chimneys; Weird-looking lumpsucker; *Flabellina sp.* nudibranch; Hermit crab

studying this phenomenon estimate that the water emerging from the cone is about 1,100 years old.

Normally, divers in very cold water never remove their gloves—but at Strýtan, things are a bit different! Divers here can carefully remove their gloves and warm their hands in the hot water flowing out from the cone—a unique method of hand warming on a cold-water dive!

Marine life and protected areas

In addition to geological marvels, Strýtan is

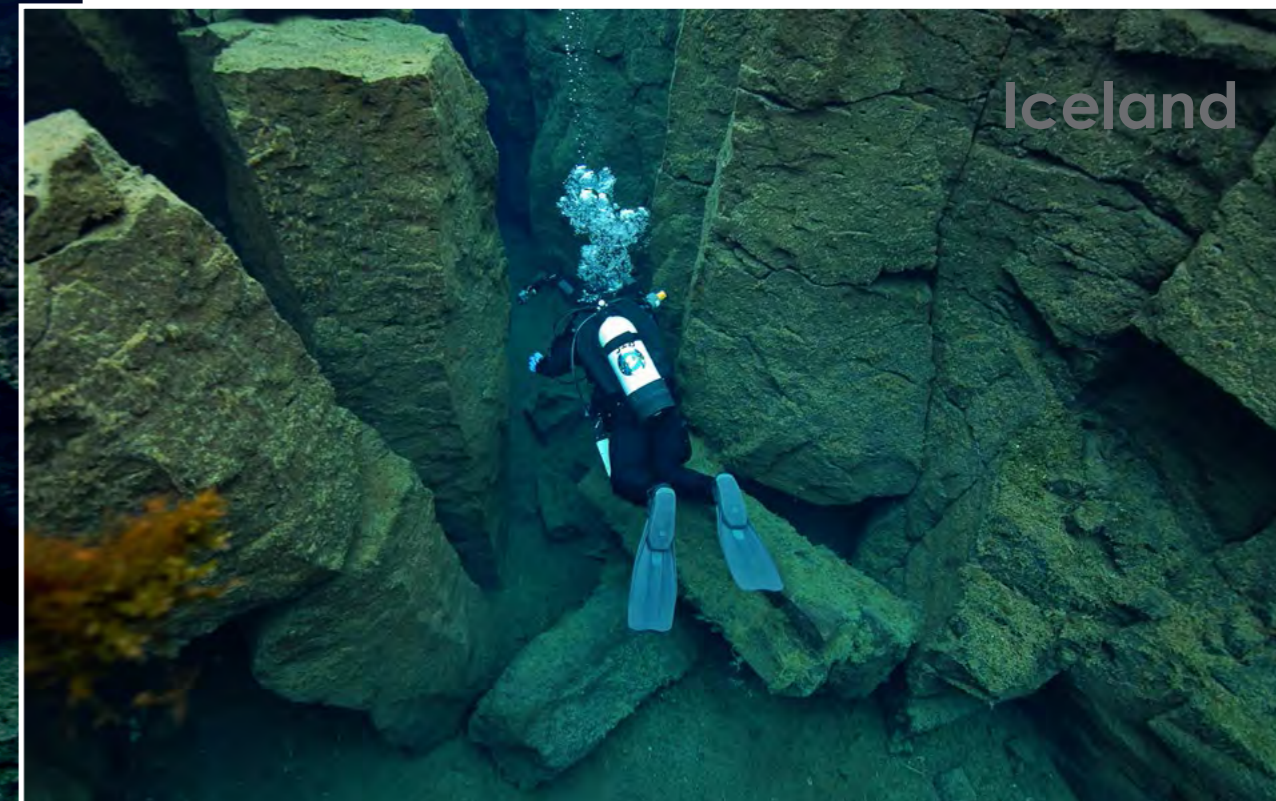
home to a wide array of interesting marine life. Macro enthusiasts will spot colorful *Flabellina sp.* nudibranchs, along with crustaceans, sponges, starfish and anemones. Swirling around the chimneys are schools of cod and pollock. Sharp-eyed divers will also encounter starry rays, the curious lumpsucker fish and the ferocious looking wolffish.

Strýtan is the first protected underwater area in Iceland, gaining this status in 2001. This unique location has received world-wide scientific attention as well as being

filmed by Bogason for National Geographic. Despite the rugged appearance, it is actually a fragile environment. Careless divers who don't pay attention to proper buoyancy can quickly damage rock formations that have taken thousands of years to form. Visitors are strongly advised to be careful and respectful.

Nearby in the same waters are other dive sites worth visiting.

Arnarnestrýtur, sometimes referred to as "Little Strýtan", is a cluster of smaller hydrothermal vent cones covering an



Iceland

Nesgla underwater (left); Diver explore the famous Silfra fissure (above)

This water, filtered for 50 years through miles and miles of lava rock, emerges here as clear and clean as possible. It is here that divers can visit

Silfra, one of these geological cracks and one of the most iconic dive sites in all of Iceland.

At Silfra, divers descend a set of



area 1,312 feet (400m) by 3,281 feet (1,000m) with an amazing variety of marine life. Arnarnesstrýtur was protected in 2007 and became the second protected underwater area in Iceland.

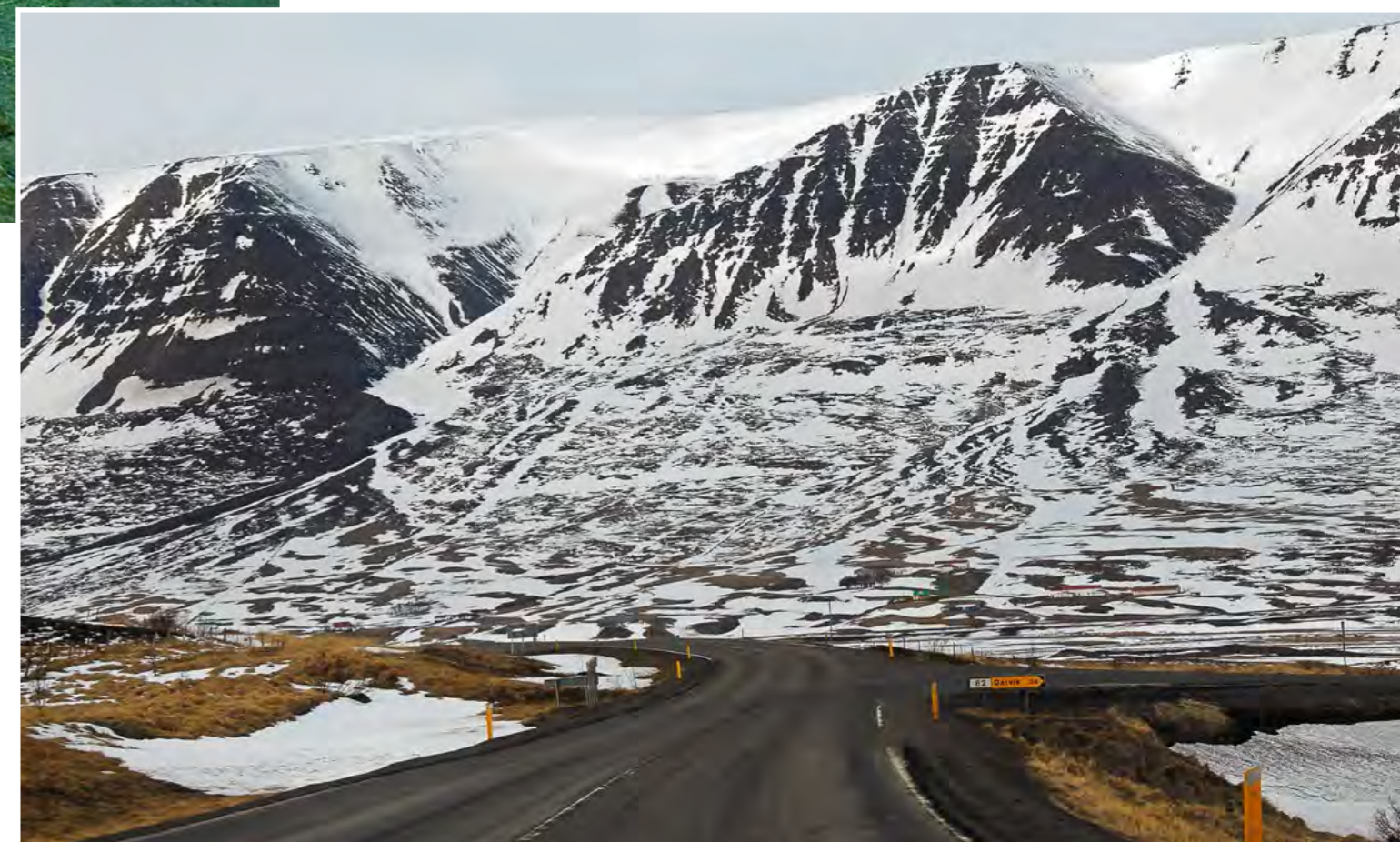
The French Gardens is a sublimely beautiful, though rarely visited site consisting of additional cones and vents.

Additional adventures

Diving in Northern Iceland is a unique adventure. Here, divers can experience the wonders of Earth's geological forces by visiting the underwater hydrothermal vents or by diving in Nesgla, a crack or fissure in the Earth's crust formed through tectonic activity

and flooded with water of unbelievable clarity. Opportunities also exist to dive with spawning cod fish in early April, and to experience diving sea birds off Grimsey Island, a small island north of Iceland and located right on the Arctic Circle. In the harbor near Akureyri, the wreck of the *Standard* lies in shallow water. A German bark, *Standard* was built in 1874, sunk in 1917 and discovered in 1997.

Two hours outside of Reykjavik is Thingvallavatn Lake, home to a ruptured landscape torn apart by geological forces. In and around the lake are many fissures and tectonic cracks, many of them filled with glacial melt water from Iceland's second largest glacier, Langjokull.



Dramatic views from the road through Northern Iceland; Comb jelly in frigid waters of Northern Iceland (left)



Divers enjoy crystal clear water in Silfra (left and top right); Dramatic waterfalls adorn the Icelandic landscape (above)

stairs installed for safety and access, and then enter a labyrinth of rock walls, boulder piles, cavities and crevices all filled with some of the world's purest water. In fact, divers are encouraged to taste the water along the way!

Unique to Silfra, divers can actually reach out and simultaneously touch both the North American and Eurasian tectonic plates. Diving here is akin to being transported to another world—with visibility exceeding 300ft (91m), temperatures hovering around 34°F (°1C) and a gentle flowing current, the dives are magical and transformative.

Northern Iceland boat harbor (left inset); Sea urchin (above inset)

canoes, the land is relatively young and is still being formed. It is also a country steeped in history, including strong cultural ties to the Vikings, and is home to the

site of the very first Parliament meeting in the year 930 AD.

In fact, visitors can experience the most exciting natural attractions Iceland has to offer in one afternoon by taking the Golden Circle tour. The Golden Circle is a very popular tourist route covering about 186.4 miles (300km). The tour loops from Reykjavik into central Iceland and back again.

There are a number of tour companies that offer this tour, most of which offer

Topside wonders

Topside, Iceland is an amazing contrast between civilization, history and wilderness. With only 320,000 people residing in the entire country, many of them in the main city of Reykjavik, much of the country's landscape is natural and undisturbed. Visitors can experience black, barren fields of pumice and lava stone, breathtaking waterfalls, lovely seaside communities and dramatic mountains.

Home to more than 30,000 live vol-



ICELAND INFORMATION

GETTING THERE: International visitors arrive in Iceland into Keflavik Airport. Most passengers do not require a visa to enter Iceland as long as their stay does not exceed three months. Transport to other regions in Iceland can be accomplished either by driving or through domestic air travel. There are domestic airports in Reykjavik, Akureyri and several other towns. Drive time from Reykjavik to Akureyri is 4-5 hours, while air travel is 45 minutes.

BAGGAGE: Baggage allowances vary for each international carrier, so check before you leave! Note: Some international carriers are now enforcing weight and size limits for carry-on bags as well as what is considered a personal carry-on type of bag.

WEATHER: Iceland lies on the edge of the Arctic and, at its northernmost point, is only 30 miles south of the Arctic Circle. Accordingly, the winters are long, generally from September to April. In the depths of the winter, daylight is almost nonexistent and in the summer the days are almost 24 hours long. However, due to the moderating influence of the Gulf Stream, winter weather in the south can be milder than in New York or Zurich. Winter is harsher in the north, with fierce storms, wind driven snow and low temperatures. Temperatures are the lowest in the highlands.

CURRENCY: The local currency is the Icelandic Krona, but U.S. dollars and Euros are often accepted.

ELECTRICITY:
Voltage: 220-240V/50Hz
Primary Socket Type: Europlug, Schuko
Travel Adapter: Round pin universal plug

the following highlights: National Park Þingvellir, Gullfoss Waterfall, Strokkur Geysir and Kerid Volcanic Crater Lake. Some tours may also include trips to The Blue Lagoon, Skálholt church, and the Nesjavellir geothermal power plant.

Afterthoughts

If you are an experienced cold-water diver in search of underwater geological adventures, put northern Iceland

high on your list. Where else can you take a thermos on your dive, fill it with hot, geothermal water, and make some hot chocolate with 1,100 year old water with it before returning to the dock? ■

The authors wish to thank Dive.IS (dive.is) and Strytan Dive Center (strytan.is).

Michael Salvatore and Christopher P. Weaver are underwater photog-



raphers based in New York. For more information about this and other expeditions, visit: ecophotoexplorers.com/iceland.asp



fact file



Iceland



SOURCES: US CIA WORLD FACTBOOK, XE.COM, US TRAVEL.STATE.GOV, LONDONDIVINGCHAMBER.CO.UK

History In the period between the late 9th and 10th centuries AD, Celtic Irish and Scottish people as well as Norwegian immigrants settled in Iceland, which is home to the world's oldest legislative assembly, established in the year 930, called the Althing. For 300 years, Iceland was independent until Norway and Denmark took over ruling the land. In 1875, fallout from the Askja volcano caused economic devastation and widespread famine, leading to a fifth of the nation's population emigrating to the United States and Canada. In 1874, Denmark granted limited home rule. By 1944, Iceland was independent once more. The fishing industry drove economic growth in the latter part of the 20th

century, but diversification of the economy followed Iceland's joining of the EU in 1994. The country was particularly hard hit by the 2008 economic crisis. Iceland ranks among the highest in the world for longevity, literacy and social cohesion. Government: Constitutional republic. Capital: Reykjavik

Geography Iceland is located in Northern Europe. It is an island which lies northwest of the United Kingdom, between the North Atlantic Ocean and the Greenland Sea. Coastline: 4,970km. Terrain: Iceland is comprised primarily of plateau scattered with mountain peaks and icefields; fjords and bays deeply indent the coast. Lowest point: Atlantic Ocean

0m. Highest point: Hvannadalshnukur 2,110m (at the Vatnajökull glacier). Natural hazards include earthquakes and volcanic activity.

Economy With a Scandinavian-style social market economy, Iceland mixes free-market principles and capitalist structure with a broad welfare system. Before the 2008 economic crisis, there was low unemployment and high growth with an even distribution of income. The main industry is fishing, however declining fish stocks and changes in world prices for fish and fish products, ferrosilicon and aluminium, has spurred the country to diversify into service industries and manufacturing, with specific development in tourism, biotechnology and software production. In addition, oil exploration off Iceland as well as abundant hydropower and geothermal sources are attracting foreign investment in the aluminium sector, boosting economic growth and luring high-tech firms to establish cheap green energy cen-

ters there. Domestic demand has boomed after rapid growth in the financial sector, however the 2008 crisis led to several banks collapsing forcing the nation to procure 10 billion in loans from the IMF and other countries in order to stabilize the krona. Other challenges include implementation of capital controls, reducing the budget deficit, reigning in inflation, decreasing high household debt, financial sector restructuring and increasing diversity in the economy.

Currency Icelandic kronur (ISK) Exchange rates: 1USD=131.45 ISK; 1EUR=150.14 ISK; 1GBP=200.94 ISK; 1AUD=102.46 ISK; 1SGD=97.67 ISK

Population 317,351 (July 2014 est.) Ethnic groups: Icelanders are a homogeneous mix, descending from the Norse and Celts 94%; foreigners account for 6% of the population. Religions: The official church is the Evangelical Lutheran Church of Iceland with 76.2%, Roman Catholic 3.4%, other churches and religions 9.6% (2013

est.) Internet users: 301,600 (2009)

Language

Icelandic, English, Nordic languages; German is widely spoken.

Visa

A passport valid for 90 days is necessary for visitors, with the exception of citizens of Denmark, Norway, Sweden and Finland. Schengen visas for Iceland can be attained through the Danish embassy.

Citizens of the United States may enter the country for up to 90 days without a visa, for tourist or business purposes. Visitors from other countries should check Iceland's consular services to see whether they need a visa by going to: www.iceland.is/iceland-abroad/uk/consular-services/visas/

Travel advisory

Iceland has a low crime rate and is, for the most part, free of terrorist incidents. However, tourists are advised to exercise common sense in regards to personal security.

Health

There is high quality medical care in Iceland, but remote areas have limited services. You must pay your own medical costs if you are a nonresident. Expect to pay your medical bill in full prior to leaving the medical center.

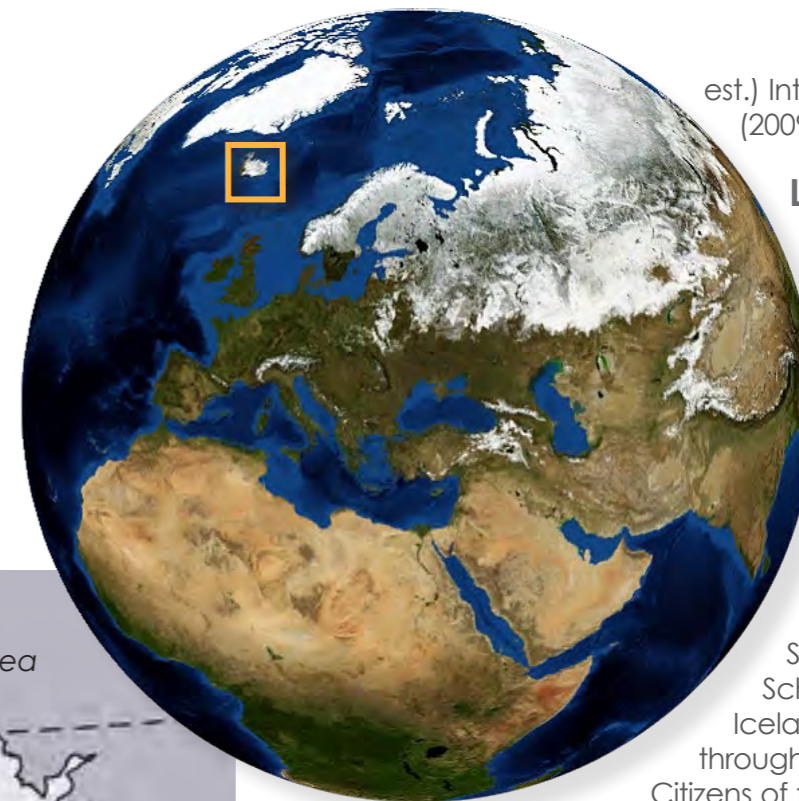
Decompression chamber

Chamber Landspítali Föðvogli Föðvogur, Reykjavík Tel. 354 543 1007

Websites

Iceland Tourism www.iceland.is

RIGHT: Global map with location of Iceland
BELOW: Map of Iceland
BOTTOM LEFT: Photographing the marine life of Strýtan's chimneys

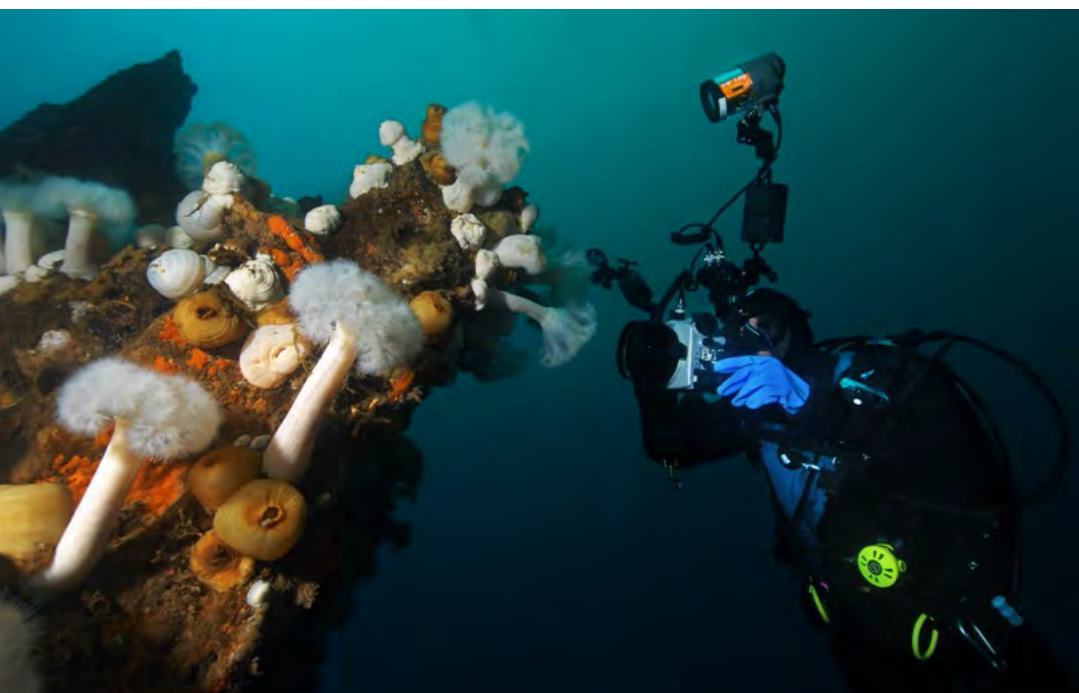


Climate

Iceland has a temperate climate that is influenced by the North Atlantic Current. There are mild, windy winters and cool, damp summers.

Environmental issues

Challenges include water pollution due to fertilizer runoff as well as inadequate wastewater treatment





opinion

The MV *Salem Express* wreck, Red Sea. A poor decision on the part of the skipper meant this wreck sank with hundreds of lives lost

Text and photos by Gareth Lock

— How you can improve your performance and safety by understanding why we make good (and bad) decisions.

There is a significant body of evidence which shows that divers involved in diving incidents often make poor decisions— sounds obvious, doesn't it? So if it is so obvious, why do we continue to make them? Simple decisions such as continuing a dive when they should have ended it, choosing the 'wrong' gas for narcosis/density/decompression reasons, wearing the wrong thermal protection for the conditions, diving with the 'wrong' buddies, the list goes on. This article will cover how we make decisions, and more importantly, why we make poor decisions and the pitfalls we encounter when doing so. We won't always be able to stop ourselves making poor decisions, but if we can recognise when we are likely to make them, we can at least try to put controls in place to check ourselves.

So, how do we make decisions? In its basic form, decisions are made by referring to a set of 'rules' or 'models' we have in our conscious and unconscious memories. Those models may have been developed through direct experience or by a proxy i.e. learning from someone

else's account of an event or by someone explaining it to us (teaching/training/coaching).

Referring to these 'models' in our memory is very simplistic and doesn't necessarily highlight the problems we face. So the following sections break this down

further and show how we can improve things.

Knowledge-based decision making

The first type of decision making is known as *knowledge-based decision making*

and is grounded on your own knowledge or understanding of a scenario. Again, simple, you would think. But your knowledge of a scenario isn't necessarily complete and there are short-cuts your brain makes to speed up our decision making (even when it isn't required).



Decisions, Decisions, Decisions

— Improving performance & safety with good decision making





opinion

Diagram 1



Look at Diagram 1 (right), what do you see? Now look at Diagram 2 (on next page) and see what was really there.

Your brain made a number of automatic decisions comparing the scene to what was in your long-term memory about what those shapes looked like.

Now think about a diving scenario you have been in where you have used a quick generally accepted rule in the past to make a decision. It might have been how much gas to plan for on a dive, whether to continue on a dive in poor visibility because it was ok last time or to undertake a 'trust me' dive assuming that the person you are diving with will look out for you.

Those decisions are based on previous experiences but what you face now might not be the same as you might have missed something. Our situational awareness might not be complete.

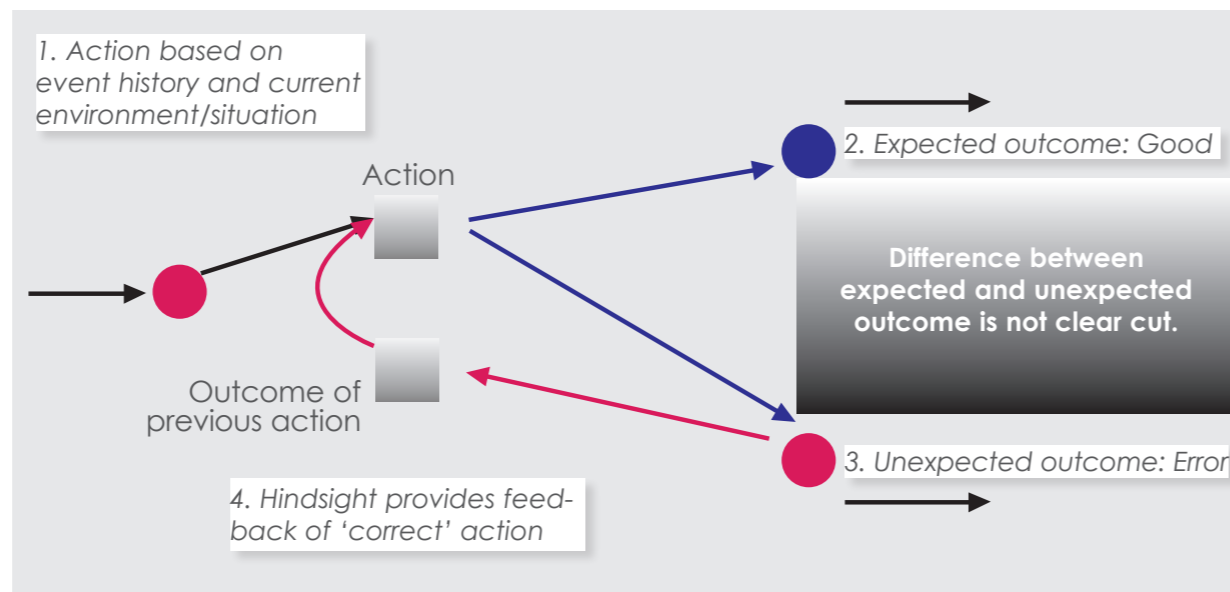
As an example, follow this link, www.youtube.com, and think about whether you saw what was asked of you in the clip? As it says, about 50 percent of people watching the clip miss the obvious. (There are a number of other clips by the same author that are worth watching to show you how we miss the obvious).

Given that you were sitting in a calm environment watching the video, now think about how easy it would be to miss something whilst diving, or getting prepared for a dive, because you are task fixated or distracted. That might be because you are still mastering the skills needed to dive and still focussing on buoyancy and/or trim, maybe just the wonder of being underwater, it might be because you are actively doing something like photography or videography or

chatting to colleagues whilst kitting up.

Once your 'awareness' channels are full, you try to fill the gaps; you are assuming knowledge. This is known as complacency, where your 'model' of the world is not the same as what is going on around you. e.g. valves not opened properly, buddy check not completed thoroughly, gas not analysed, CCR checklist not complete.

The list of shortcuts is long but think back to the shortcuts you take, think why you do it and whether you should continue to do so. Just because something didn't go wrong the last time, doesn't mean it won't this time! Consider the model below.



Cause and Effect Tree

This shows that our knowledge increases with feedback from previous experiences. However, our knowledge might be incorrect because nothing went wrong, which means the model you will use in the future to make a decision will be potentially incorrect (bottom right).

Finally, there is lots of evidence to show that our knowledge of what we think we know is lacking. The most well known is the Dunning-Kruger effect where the under-skilled are over-confident and the skilled are slightly under-confident in their abilities.

The graph (on the next page) shows the results of an experiment to ascertain students' knowledge of how well they did in an exam. The adage, "You don't know what you don't know", comes from this effect.

There a number of ways to resolve poor knowledge-based decision making:

- Continually question what is going on around you, noticing (not just seeing), thinking about what that means, and then anticipating how it might impact your dive, your buddy's or your safety, and then adding corrective action. It's no use saying after the event, "I knew that was going to

An extruded o-ring might not be an issue on the surface, but can be underwater with lost gas as a consequence. Fix small errors early

happen", when you had an opportunity to resolve it!

- If you are taking shortcuts, consider using a checklist and get your buddy to follow it with you, ensuring you (and he or she) do the items on the check.

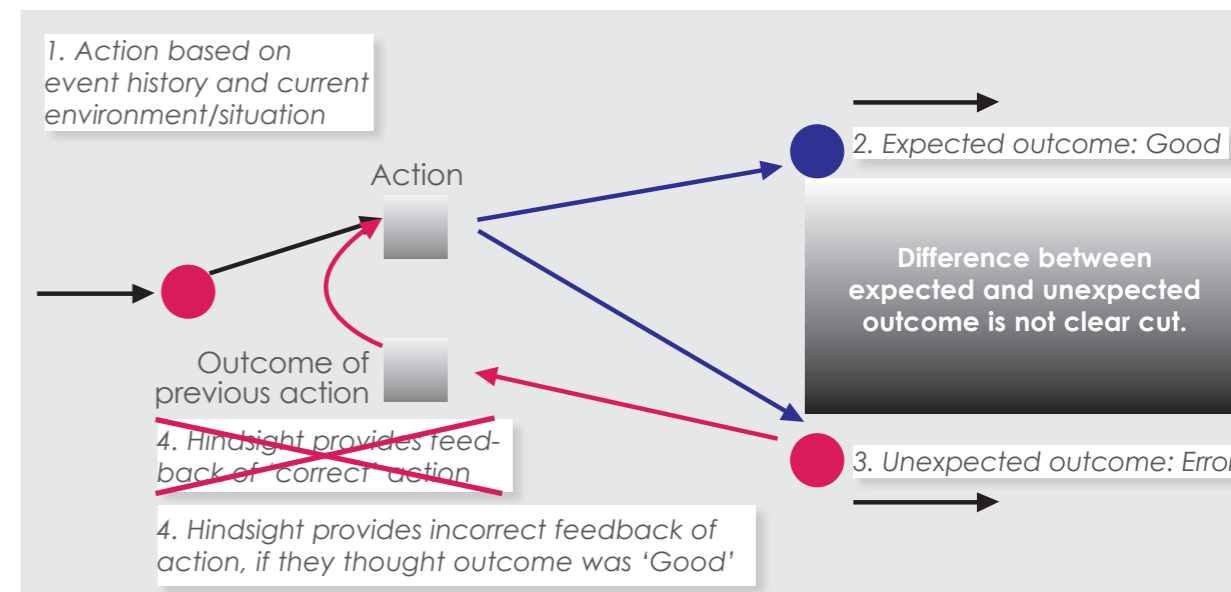


Having a checklist and completing the items without actively checking is worse than not having a checklist because you have a false sense of

security—your model is incorrect.

- Have a debrief after each dive and talk through what went well, why did it go well and what you could do to improve. My personal experiences in other domains (aviation, and oil and gas)

have shown that getting people to start having debriefs is hard, but once they realise the benefits, they become part of the routine and they





recognise the benefits, which then improves the knowledge for future situations.

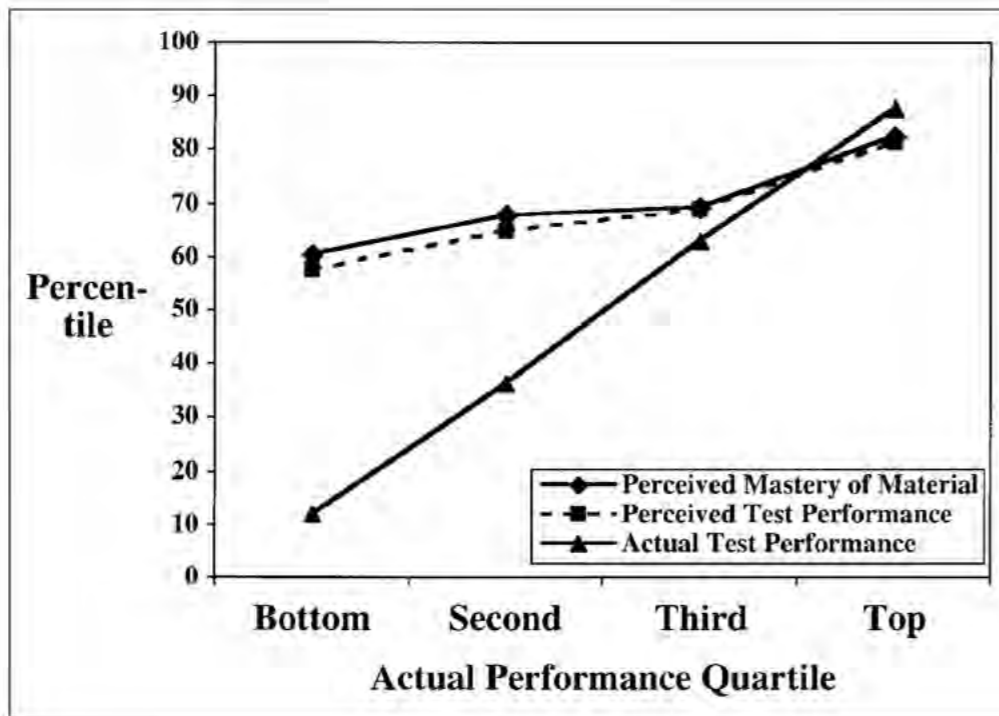
Rule-based decision making

The second type of decision-making is known as *rule-based decision making* where we have a formal set of rules to follow.

In driving this could be compared to when you approach a red light and you know to stop until the green light shows. In diving where there is no formal supervisor, there are very few 'formal' rules to follow, you can do what you like as there are no dive police out there.

There is best practice or 'safe

diving practices' but no real 'rules' because there is no form of punishment if you break them. However, when you undertake diving and hold a level of supervision, this means that you are very likely to have formal rules that need to be followed. These might be training agency rules, Health and Safety rules or local/national legislation; and if you break these, there are serious consequences if an incident occurs and it was down to the rules being broken.



Breaking rules, or committing a violation, has been shown in some fields to increase the likelihood of a fatality occurring (compared to a non-fatality), and this is why the rules are there.

The graph below from a study examining errors in General Aviation (GA) in the United States shows that whilst there are more fatal accidents due to skill-based errors, the ratio of fatal to non-fatal accidents is much greater when violations take place.

Simply put, breaking rules means you are more likely to die than be injured.

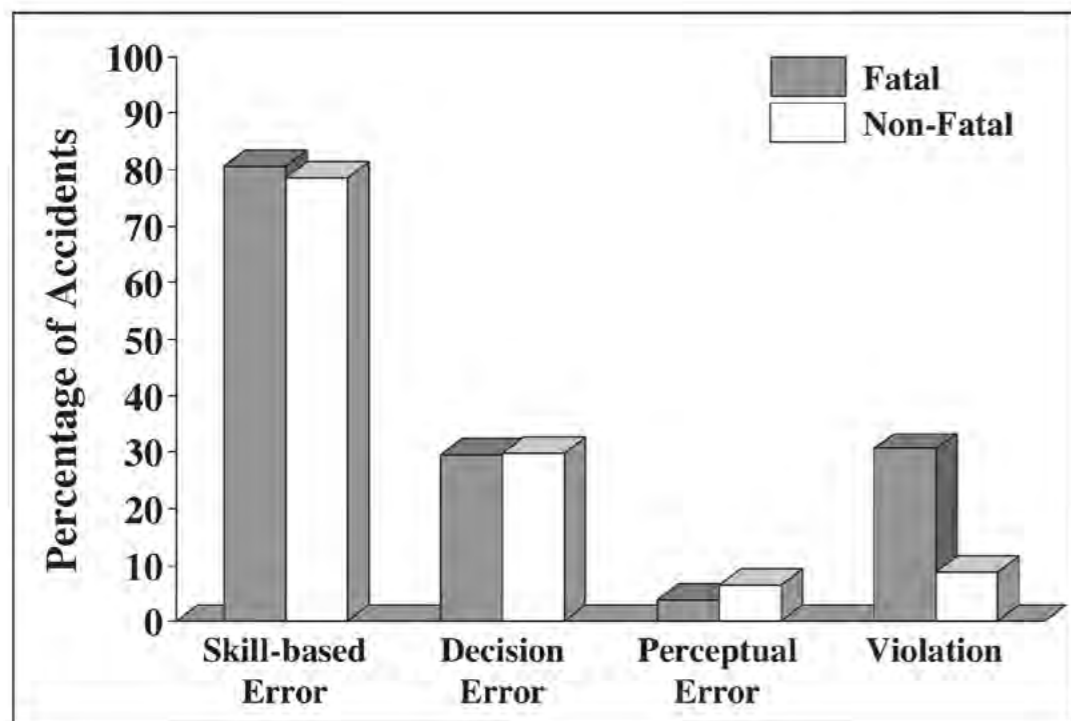


Fig. 2. "Percentage of fatal and non-fatal GA accidents associated with each unsafe act."

SOURCE: Wiegmann, D., Shappell, S., Boquet, A., Detwiler, C., Holcomb, K., & Faaborg, T. (2005). Human error and general aviation accidents: A comprehensive, fine-grained analysis using HFACS. Federal aviation administration, office of aerospace medicine technical report no DOT/FAA/AM-05/24

Fig. 1. "Perceived percentile rankings for master of course material and test performance as a function of actual performance rank."

SOURCE: Dunning, D., Johnson, K., Ehrlinger, J., & Kruger, J. (2003). Why people fail to recognize their own incompetence. *Current Directions in Psychological Science*, 12(3), 83-87. doi:10.1111/1467-8721.01235

American pioneer cave diver Sheck Exley came up with the six rules for cave diving after examining hundreds of cave diving fatalities; these were contained in his book, *Blueprint for Survival*, where case studies were used to show how the rules were broken and the consequences of doing so. (See the green side box.)

Technical divers Michael

Diagram 2



Meduno and Billy Deans did something similar for technical diving, although it wasn't as simple as Sheck's, containing more detail. The *Blueprint for Survival 2.0: Technical Diving* can be found here: www.anaspides.net

Stopping violations

So how do we improve poor decision-making when rule-based

decisions have to be made? Or, how do we stop violations taking place?

Fundamentally, we must understand why the rule is in place to start with. That might be the need for medical cover or equipment, it might be minimum gas requirements, or it might be maximum depth limits. Each of the rules has been put in place for a reason,



If penetrating a wreck with poor visibility, make sure that you understand the risks and mitigate them



When operating in overhead environments, one needs to ensure that tie-offs are secure.

is almost endless.

Some of those decisions have minor consequences if a poor decision is made. Some of them have a very major impact—you (or someone else) can die. That is not being melodramatic but trying to bring the reality of the situation to the fore.

Divers don't get up in the morning thinking this is a good day to run out of gas or make a rapid ascent to the surface; a number of factors and

poor decisions have been made, which come together and lead to the incident or accident.

By understanding the way in which we make decisions, and the fallibility of the human brain, then we might be able to reduce the occurrence of poor decisions and make better decisions, which we can then learn from.

Experts make good decisions more often because they have a much bigger library of experiences to refer to; they are also normally keen to learn and increase that library. Talk about your dives and your incidents; learn from

Decision Making

each other. Fortunately not everyone has an incident, but you can learn from others who have. ■

Gareth Lock is an accomplished technical diver based in the United Kingdom. Recently retired from the Royal Air Force, he is now teaching Human Factors in the Oil & Gas sector. Lock is also undertaking a part-time PhD examining the role of human factors in scuba diving incidents. For more information, visit the Cognitas Incident Research website at: www.cognitas.org

SHECKS' 6 RULES OF CAVE DIVING

Failure to use a continuous guideline to the surface

Failure to reserve a minimum of 2/3 of beginning gas supply to reach the exit

Failure to limit the dive to the operational limits of compressed air or 40msw

Failure to be trained, or exceeding the level of training

Failure to carry at least three battery powered lights

Undertaking cave diving solo

primarily to protect you (or others) from human fallibility and the subsequent incident which occurs.

Whilst this might appear to limit your own activity or enjoyment, consider and understand the consequences of not following the rules and make an active decision about whether the impact of the risk being materialised is worth the benefit gained by breaking the rule. Sometimes that impact might be your or someone else's death!

Rules can be broken. Consider driving to hospital with an injured relative or friend in the car. You arrive at a red light for temporary road-works on a clear stretch of road where you can see past it to the lights on the other side. Your light stays red for two minutes, then five minutes. Do you jump

the red light because you can see ahead? What about 10 minutes? At some point you will make the conscious decision to break the rules and jump the light as long as the road is clear.

The same goes for diving. It might be your buddy is injured and you need to ascend to the surface missing decompression stops, or you need to rescue them from below the Maximum Operating Depth (MOD) of the gas you are breathing. These are conscious decisions where you have a choice and you decide what to do.

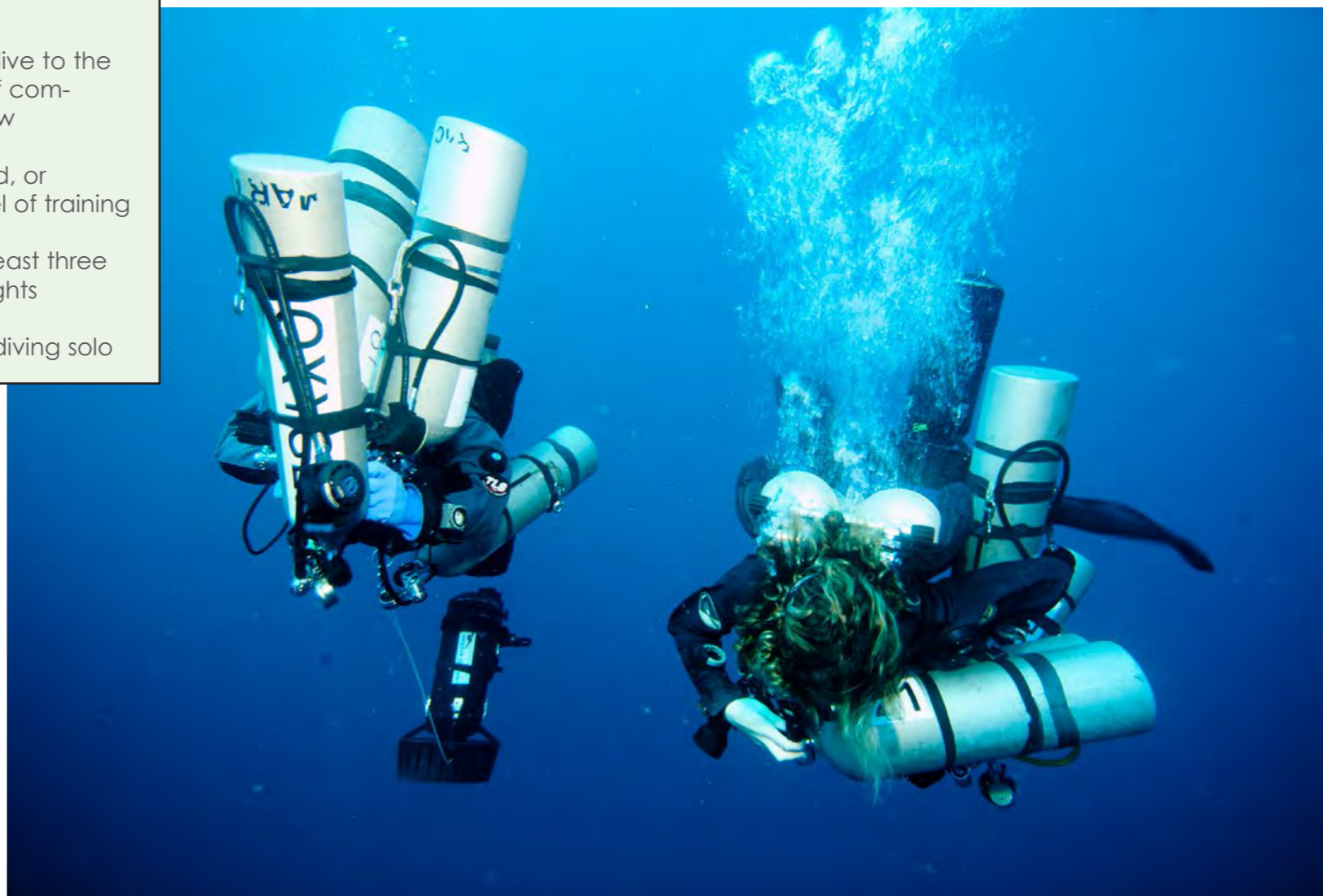
What shouldn't happen is breaking 'rules' because you are too lazy e.g. not analysing gas, buddy check, checklist, conduct skills regularly.

Therefore, the introduction of

more rules in 'non-supervisory' diving situations is not the answer to improving safety, getting divers to recognise the risks they are taking by improving their knowledge is key, and feedback is essential if divers are to improve.

Summary

We make decisions every day of our lives, from choosing what clothes to wear, what route to take when driving to work, to what dive to go on, who our buddies will be, what the run time will be, when to end the dive based on gas remaining or decompression obligation or something going wrong... the list



It is essential when using multiple gases that you analyse the gas, mark it correctly, check depth and MOD, then switch. Short-cutting can lead to a fatality—there are plenty of examples of that



Text and illustration
by Konstantinos Alexiou

It is estimated that approximately seven million divers are active worldwide and 500,000 new divers are training annually.¹ Moreover, professional divers actively carry out diving operations for the purposes of commercial, scientific or military diving. The underwater environment is unique and any exposure to it presents a number of stresses to the human system. The human body makes physiological responses to adapt to the environmental changes. Moreover, diving equipment, training, knowledge and skills also minimize stresses and increase safety while diving. In rare cases, certain hazards can occur to divers, such as nitrogen narcosis, oxygen toxicity and decompression illness (DCI). One risk factor that has been under research for approximately 30 years and statistically associated with DCI is the patent foramen ovale (PFO).

The persistence of a fetal heart characteristic

The right side of the human heart contains venous blood with a low oxygen content, and the left side contains arterial blood, rich in oxygen and nutrients. In the unborn foetus, the lungs are not fully formed.

In order for the foetus to constantly receive oxygenated blood, there is an opening in the wall between the two atria, the foramen ovale. The foramen ovale (Latin for *oval hole*) is a flap valve in the septum (the wall of the heart) separating the right and left atria. It is a one-way valve, allowing direct blood flow from the right upper chamber of the heart (right atrium) to the left upper chamber (left atrium).

The foramen ovale allows oxygenated blood coming from the mother via the placenta to the right atrium and then directly to the left atrium of the foetus. The left atrium pumps the blood into the foetus circulation, providing the oxygen and nutrients required for growth and healthy development.

At birth, when the baby begins to breathe, a flap valve closes over the opening in the atrial septum and starts sealing the opening. This fusion is complete by the age of two in about 75 percent of the individuals, while in the other 25 percent, the foramen ovale is not fully closed. The reasons the PFOs fail to close are unknown and the size of PFO in individuals varies, ranging from one to

19mm.^{2,8}

The persisting, "patent", foramen ovale allows blood from the right atrium (blood from the veins) to move directly into the left atrium (blood from the lungs) and from there into the arterial circulation. Normally, this cardiac defect will cause no serious symptoms to those who have it because the pressure on the left atrium is always bigger than the right, which tends to keep the valve closed.

However, this differential pressure is reversed while performing a Valsalva manoeuvre or while engaging in strenuous activities, e.g., lifting heavy dive gear and climbing into the boat.⁹ Hence, PFO poses a concern for divers as free inert gas forming in the body during decompression or after surfacing, bypass the vital lung filter and enter into the arterial circulation.

PFO and decompression illness

Decompression illness is caused by bubbles in blood or tissue that are formed as a result of reduction in ambient pressure (decompression). The term includes both arterial gas embolism (AGE), in which alveolar gas or venous gas emboli (via cardiac shunts like patent foramen ovale or pulmonary vessels) are introduced into the arterial circulation, and decompression sickness (DCS), which is caused by

Patent foramen ovale

PFO & Diving

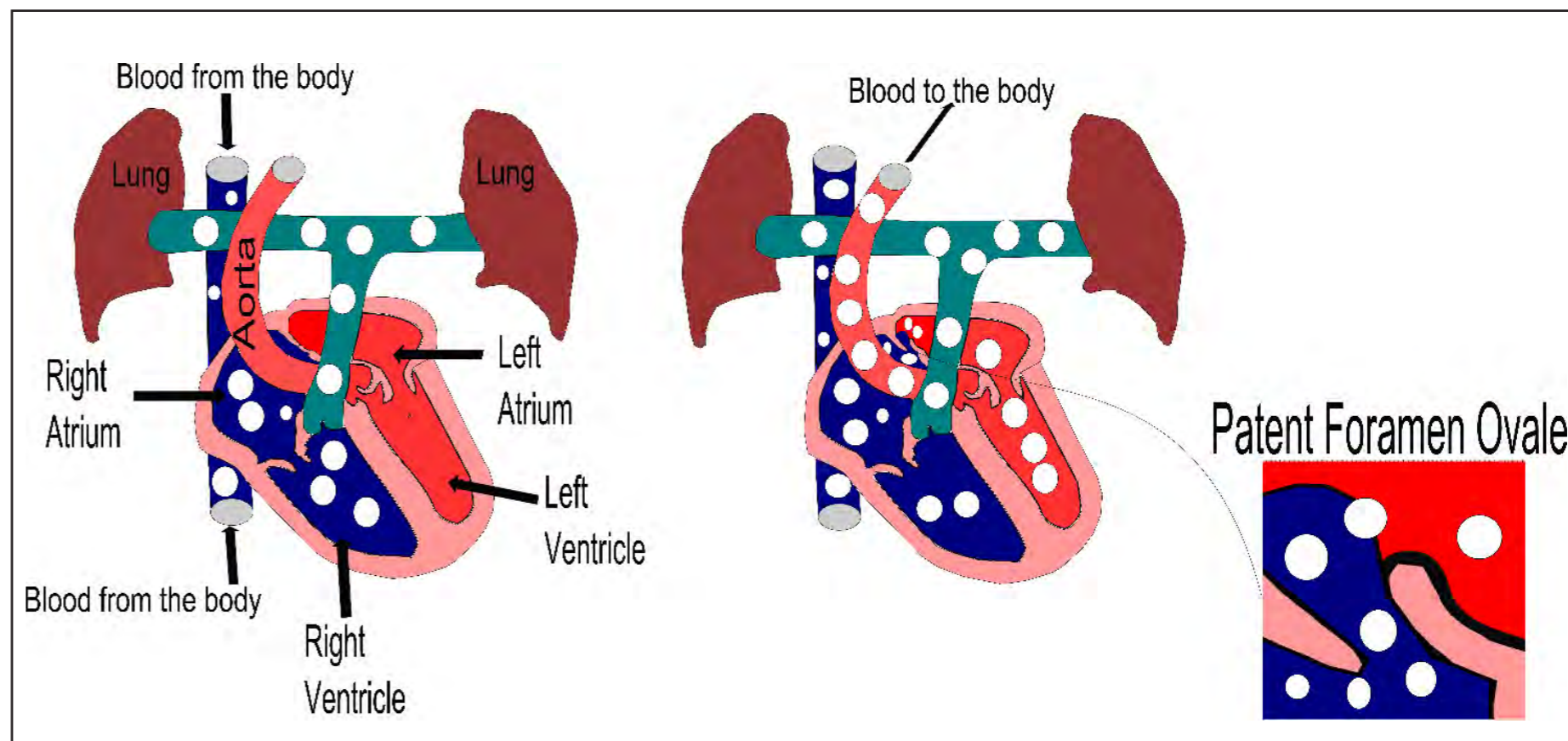


Figure 1. A simple scheme demonstrating the normal circulation of blood and bubbles in the heart (left), and the right-to-left cardiac shunt in the presence of a patent foramen ovale (right). In the latter case, venous gas migrates from the right atrium via the patent foramen ovale to the left atrium and from there into the arterial circulation. (Illustration by Konstantinos Alexiou, 2015)



KATE CLARK

in-situ bubble formation from dissolved inert gas.³

Small quantities of venous gas emboli are common in diving although they are usually asymptomatic, "silent bubbles", because most of the time they are effectively filtered by the pulmonary circulation. However, large numbers of venous gas emboli can cause DCI.⁴ (Fig. 1)

A patent foramen ovale is present in about 27 percent of the normal population, and theoretically, some venous gas emboli could enter the arterial circulation and even reach the central nervous system (CNS). It was first suggested in 1986 by Dr Wilmshurst and colleagues that a right-to-left cardiac shunt may be important for venous gas embolism (VGE) in scuba divers. They observed neurological decompression sickness in recreational scuba diver after a 15-minute dive to 38 metres, and attributed its cause to venous gas.⁶

Overall, the presence of a PFO is related to a low absolute risk of five major DCI events per 104 dives, the probability of which is five times as high as in divers without PFO. The risk of suffering a major DCI increases with the PFO size.⁷ However, the absolute risk of serious (neurological) decompression sickness is smaller than 0.02 percent. In addition, the patent foramen ovale is unlikely to be the triggering factor behind decompression sickness since a substantial amount of venous gas should be present, which is unlikely if the diver follows con-

servative depth-time profiles.^{4,5}

PFO closure and screening

—*Current recommendations*

A procedure of closing the PFO is possible, and it is reasonable to expect that the closure could reduce the probability of DCI occurrence. Since an evidenced-based risk-benefit analysis does not still exist, the specific issue remains controversial.¹²

Closing a PFO contains some risks and has a complication rate of around two to five percent, while the risk of a DCS event in recreational diving is much lower—about 0.02-0.05 percent.¹⁰ Closure should only be

performed after serious discussion and evaluation of the risks and benefits of such an operation.

According to Dr Peter Germonpré from the Centre for Hyperbaric Medicine of the Military Hospital in Brussels, a systematic screening of PFO is not recommended since PFO is so common and DCI is so rare. Testing for a PFO is useful only in instances where there have been several DCI incidents of a type known to be PFO-associated. In short, having patent foramen ovale is not considered an absolute contraindication to diving by dive physicians.

Conclusion

Patency of the foramen ovale is a risk factor for DCI and all divers should be aware of this. Dive training organizations should indicate the patent foramen ovale as a reason of caution.

Dr Vann, Department of Anaesthesiology and Centre for Hyperbaric Medicine and Environmental Physiology, Duke University Medical Centre, points

Patency of the foramen ovale is a risk factor for DCI and all divers should be aware of this. Dive training organizations should indicate the patent foramen ovale as a reason of caution.

out that PFO is a common anomaly in the general population and many individuals that suffered from DCI did not have it. Therefore, there is not a causal link between patent foramen ovale and an individual case of decompression sickness.³ The primary cause of DCI is the inert gas bubbles,

not the PFO.

A study shows that a reduction of inert gas when diving, i.e. by performing shallower dives, non-decompression dives, avoiding repeat dives, and breathing oxygen-enriched mixtures (nitrox) under air profiles, helps to significantly reduce the risk of a decompression illness. The average DCI risk could be reduced by a factor of 10 in divers with a PFO and up to 40 times in divers without a PFO.¹¹

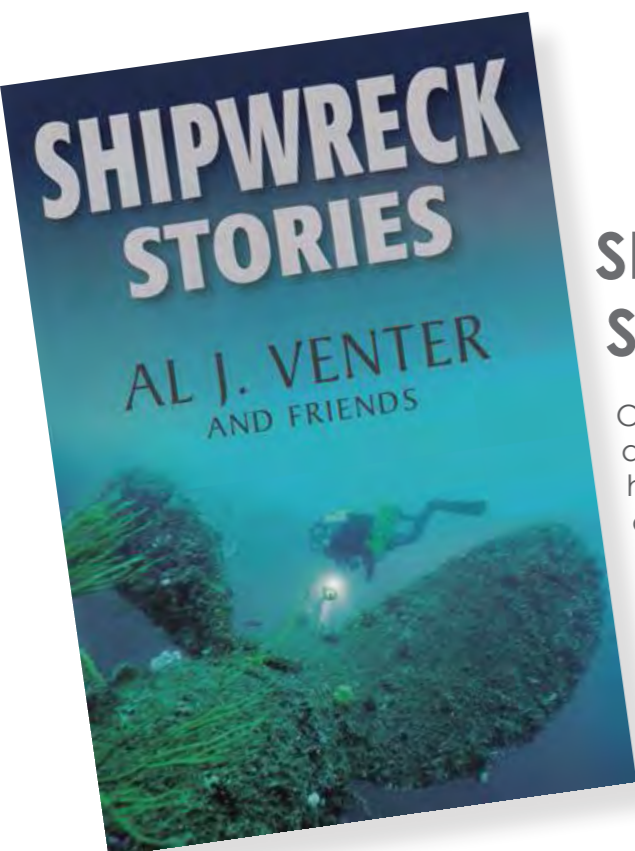
■
The editorial staff wish to thank Dr Neil Pollock of DAN for his assistance with this article.

PFO

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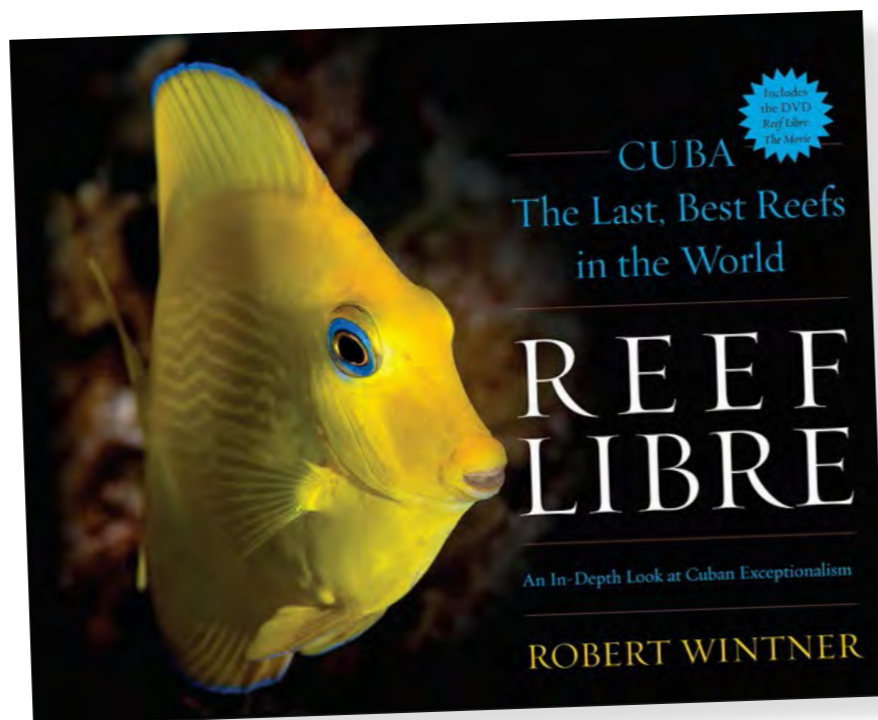


Shipwreck Stories

Over the centuries, about 3,000 ships had perished while attempting to sail around the Cape of Good Hope, on their way to and from the Spice Islands of the East. Today, the tales surrounding some of

these vessels have been compiled in this book by South African-born writer Al J Venter and his friends. Comprising more than 400 pages and hundreds of illustrations, sketches, photos and diagrams, this book about shipwrecks and diving is the fourth in Venter's series on South Africa.

Paperback: 432 pages
Publisher: Protea Boekhuis
Date: 1 March 2015
ISBN-10: 1485300401
ISBN-13: 978-1485300403

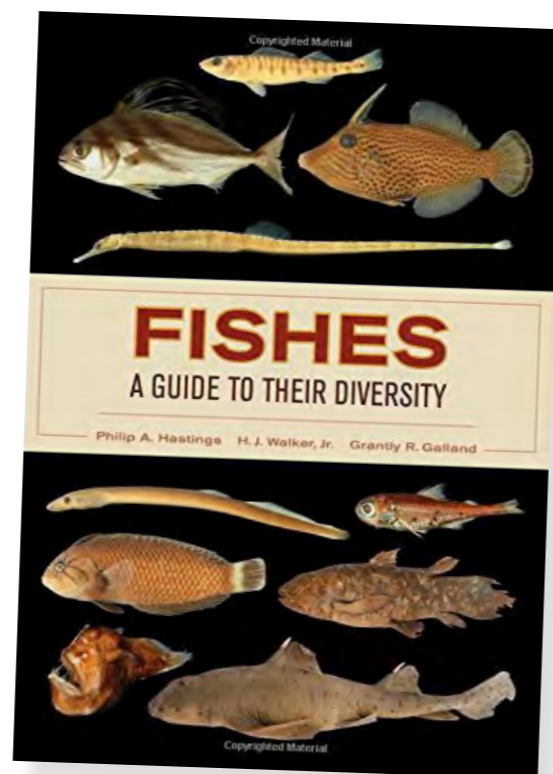


Cuba's Reefs

Reef Libre: Cuba—The Last, Best Reefs in the World, by Robert Wintner.

Thanks to decades of isolation, Cuba's coral reefs are one of the world's most pristine. While showcasing Cuba's marine environment, the book also delves into the sober question of whether Cuba's reefs can still thrive as the country opens its doors to the outside world. Images and accounts of life 'above water' are also featured, giving readers an insight into terrestrial life in the cities and villages of this island nation.

Hardcover: 272 pages
Publisher: Taylor Trade Publishing
Date: 1 February 2015
ISBN-10: 1630760730
ISBN-13: 978-1630760731

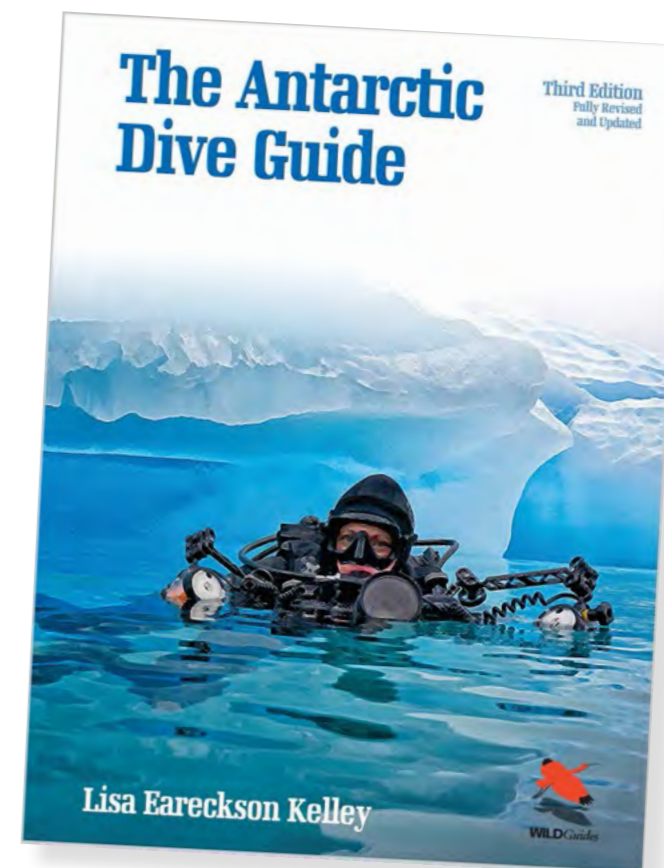


Fish Guide

Fishes: A Guide to Their Diversity, by Philip A. Hastings, H. J. Walker Jr., and Grantly R. Galland.

Written to serve as a reference for students, marine biologists and ichthyologists, this book gives an overview of the global diversity of fishes. It details the morphology, characteristics and basic ecology of fishes. All 82 orders of fishes and more than 150 of the most commonly encountered families are featured, with details of their morphology, anatomy, characteristics and basic ecology, alongside clear photographs of preserved specimens.

Hardcover: 336 pages
Publisher: University of California Press
Date: 10 January 2015
ISBN-10: 0520278720
ISBN-13: 978-0520278721



Diving Antarctica

The Antarctic Dive Guide (WILDGuides) by Lisa Eareckson Kelley.

Diving in the waters of Antarctica is now a possibility for recreational divers, and those intending to take the icy plunge should read this book to learn more about this unique dive destination. This fully-revised and updated third edition features 31 key dive sites and maps, complete with information about Antarctica's wildlife and history of diving. There is also useful advice on diving in subzero waters and how to prepare for your adventure.

Series: WILDGuides
Paperback: 144 pages
Publisher: Princeton University Press;
(Fully revised, updated third edition)
Date: 22 February 2015
ISBN-10: 0691163448
ISBN-13: 978-0691163444



Kyrgyzstan's

Lake Issyk-Kul

— *Timeless Eternity*

Text and photos by Vladimir Gudzev
Translated and edited by Catherine
GS Lim and Andrey Bizyukin



research center on the coast. The 'hotel' was actually a small construction trailer, or mobile home, equipped with all the amenities we needed right there on the lake shore. Around the lake were fairly high mountains that dropped off steeply, directly into the lake, and therefore the water depth increased quite rapidly. Despite the very hot weather (and this is in the mountains!), the water in the lake remained cool. However, this wasn't really a suitable place for a long swim.

We rented some equipment and decided to start our diving along the coast. The water was very clear and also quite cool, at about 14-16°C. Our 5mm wetsuits certainly came in very handy! At the bottom of the lake were crystalline formations, which at a first glance appeared to be coral boulders. However, these structures were not formed by living organisms, such as coral polyps, rather they were comprised of precipitated salt crystals. Admittedly an interesting sight, but rather monotonous after a while. There were also traces of commercial activity in the form of fragments of ancient ceramics.

Although the dive proved to be inter-

In Medieval times, when Lake Issyk-Kul in Kyrgyzstan was a stop-over on the Silk Route, which connected Europe and Asia, the lake level was some 8m lower than it is today. In areas along what used to be the coastline but have since become submerged, divers have discovered the remains of a 2,500-year-old advanced civilization. Vladimir Gudzev and his buddies went to the area to have a look.

The first account I heard of diving in Lake Issyk-Kul was an expedition many years ago headed by Academician Orbeli and comprised of a group of volunteers using ISA-M 48 oxygen rebreathers to explore the shallow waters along the coast. The story stuck in my mind—in case I ever got the opportunity to go there.

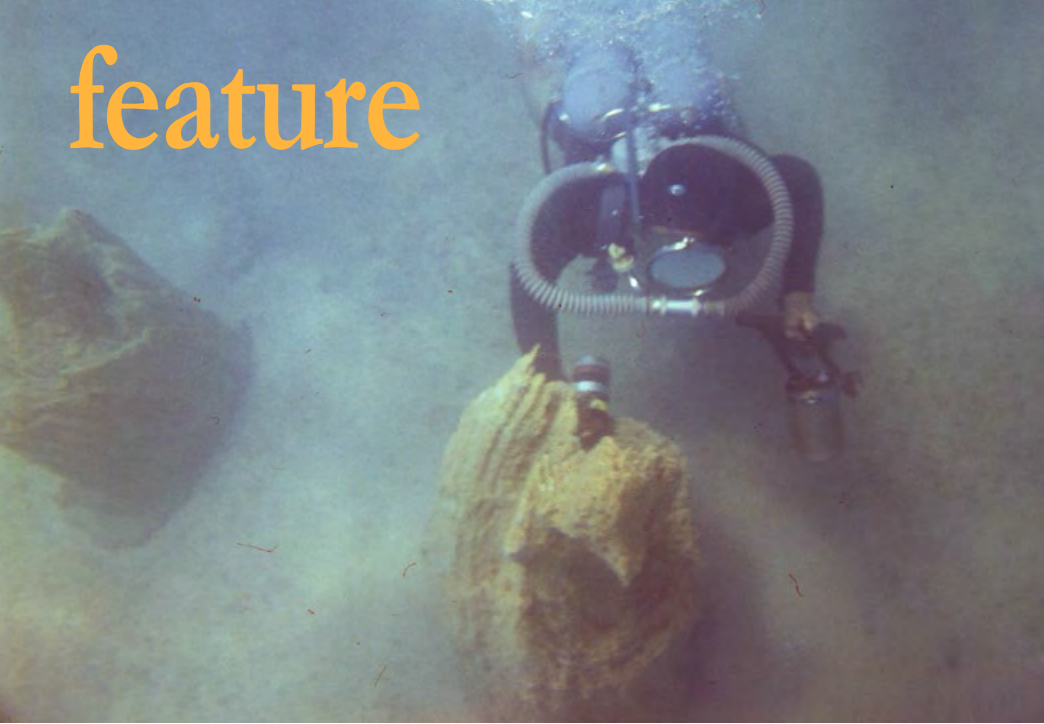
As matters eventually turned out, I did. A friend of mine, Valentin Bukin, happened to work in a small research center on the coast of Lake Issyk-Kul, near the village of Cholpon-Ata. So I decided to go visit and dive this mysterious lake, to see if there was something interesting and to reunite with an old friend.

The lake is situated at an altitude of about 1,609m and can, in many ways, be compared to the more famous Lake

Baikal in Siberia. However, there is one significant difference: Lake Baikal is a freshwater lake whereas Lake Issyk-Kul is not. It contains a large amount of soluble mineral salts, thus giving it a slightly salty 'taste'.

Reaching Lake Issyk-Kul wasn't exactly easy. First, we had to fly to Alma-Ata, and then, we had to get on a domestic flight at the airport at Cholpon-Ata. The lake was so large that when the plane came in for a landing, it felt as if we had flown over the ocean. We were fortunate to get accommodation at the





THIS PAGE: Scenes from Poplar Alley, where trees were planted in rows

esting and mysterious, we were hungry for more. After chatting with a local scientist, we learned about some interesting places further up the coast. Two of these sites were nearby and fairly easy to reach, and although they were located within the resort area where the public could freely access them, there were no visitors. Along the coast there were also some no-go areas—military installations where research and testing of military equipment for deep sea took place.

According to other sources, the Soviet Navy used to test submarine and torpedo technology in the eastern end of the lake.

Underwater garden

The first site that we recommend to us was the so-called "poplar alley". In ancient times, the water level of the lake was lower. A few thousand years ago along the old coastline, which later became submerged, were buildings and

gardens. Today their remains can be found at a depth of 1.5 to 2m. Underwater there are also lines of tree trunks sticking out of the bottom, running in straight lines. Above water nothing was preserved, having rotted away a long time ago. But on the lake bottom, the trees and their roots were nicely preserved.

Following the directions given to us by local residents, we soon found our designated point of entry and plunged into the water. Almost immediately we

found the remains of trees, which stood in a straight line. After following the line out into the lake, the depth increased to three meters, after which, the line of trees turned a sharp right. After about 30 to 40m, the line of trees headed back to the shore as if it was tracing the perimeter of a yard. Inside this garden, there was a flat, sandy bottom. If we had done some digging, we would probably have found some relics. However, since we did not have a permit to dig up any artifacts

or do excavations, we were restricted to just filming the area.

Diving a cemetery

The second location was a submerged cemetery, which was under 1.5 to 2m of water. The locals had agreed to take us there with a motor boat. Along the way, the skipper explained that the people who lived in these areas led simple lives and had to look for ways to make some additional income. Hence they looked at



THIS PAGE: Scenes from the ruins of an ancient cemetery at 2m depth. The bones were highly mineralized in the lake so they did not dissolve. Local craftsmen made vessels out of the skulls for wealthy collectors.

gyzstan and one of the 25 largest lakes in the world by area. It is the seventh deepest lake in the world, located in the northeastern part of Kyrgyzstan, between the ridges of the Northern Tien Shan Kung

Ala-Too and Terskey Ala-Too at an altitude of 1,609m above sea level.

Around 118 rivers and streams flow into the lake, the largest being the Djyrgalan and Tyup. It is also fed by springs, including many hot springs, as well as snow melt. The lake has no known current outlet, but it is hypothesized that deep underground, lake water filters into the Chu River. The water level of Lake Issyk-Kul changes cyclically, rising and falling; this cycle occurs over a few decades. The lake water salinity is approximately 0.6 percent, which makes it brackish. The bottom of the lake contains the mineral monohydrocalcite—one of the few known lacustrine deposits.

The volume of the water in the lake is equal to 1,738 cubic kilometers, and has an area of 6,236 square kilometers. The coastline is 688km long and the average depth is 278m, with a maximum depth of 702m. The length of Lake Issyk-Kul from east to west is 182km, and from north to south, it is 58km. □

We spent hours swimming about taking photographs before we returned to the boat. Nearby we noticed a couple of boats with locals using hooks to collect remains. It was a rather sad sight, really. Even in the grave, the deceased were

not allowed to rest. I can only hope that a more civilized attitude will eventually prevail where both the remains of ancestors and the material artifacts from ancient cultures will be treated with due respect and studied by scholars rather than exploited by grave robbers in search of Tamerlane's treasures.

There should be a lot to be investigated in these areas because the Silk Road went strait through the region, leaving plenty of remains and artifacts to be found not only along Issyk-Kul but also in other high mountain lakes. It could be interesting to set up a proper expedition, with the right equipment and led by professional archaeologists and not amateur volunteers.

Geographical information

Lake Issyk-Kul is the largest lake in Kyr-

this old cemetery as an opportunity to make use of their handicrafts, picking up bones and making drinking vessels out of skulls.

Over time, the water movements in the lake had gradually uncovered the graves in shallow water and those buried in the open cemetery. As the water was highly mineralised, the bones remained perfectly preserved, particularly if they were situated in a layer of soil that resembled clay. Contributing to the uncovering of the bones were the many

motor boats whose propellers' wash and wake also removed soil, laying bare well-preserved human skeletons. The drinking vessels the locals made out of the skulls were covertly sold on the black market. For them it was a way to connect eternity to present life.

Once we reached the sunken cemetery, we kitted up, grabbed our photo equipment and went in. Thanks to the strong sun at high altitude and the clarity of the water, we could enjoy some

splendid visibility. We could make out some small bumps and stripes on the bottom and swam closer to take a look. It was only then we realized it was a human skull protruding from the ground. Nearby were other skeletal parts, such as spine, ribs, etc. The bones that were in the ground were light colored, whereas the bones that had been laid bare were dark.





opinion

Text by Simon Pridmore
Photos by Peter Symes

Confronted by a genie with a lamp and three wishes, many new divers would ask for a magic spell to make their air last longer on a dive.

The good news is that you don't actually need a genie or a lamp and the key to better air consumption is not a secret. Divers usually find that their breathing rate drops as they become more experienced, simply as a consequence of their becoming more relaxed and comfortable in the water. There are also a number of other things you can do, such as wear less weight, work to improve your buoyancy control, avoid unnecessary movement when you swim and learn to keep a horizontal, streamlined position in the water.

However, the single most effective way to reduce the amount of air you consume on a dive is to learn to breathe like a diver.

Don't just breathe normally

Despite what many new divers are told when they begin, you do not breathe "normally" when you are underwater on scuba. Instructors only say that to try to reassure new students that diving is easy

and dispel their fears.

When you are underwater, you are breathing air under pressure and the air is therefore denser than the air you breathe from the atmosphere when you are on land. You are also breath-

ing through your regulator, an artificial device that extends the distance between your lungs and the source of the air, something referred to as "dead air space."

Because of these two factors, if you

breathe haphazardly without thinking about it, as you do on land, turbulence within the dead air space will prevent much of the air you breathe in from reaching your lungs. You will just breathe it all out again without the important oxy-

gen-carbon dioxide exchange having taken place—which is the whole point of breathing after all!

So to breathe efficiently underwater, you have to develop a controlled long, slow breathing style, pull the dense air

To breathe efficiently underwater, you have to develop a controlled long, slow breathing style, pull the dense air down deep into your lungs with each inhalation and then expel it in a long, slow exhalation.



Scuba Confidential

The Perfect Diving Breath





opinion



down deep into your lungs with each inhalation and then expel it in a long, slow exhalation.

The perfect diving breath

You need to learn to breathe from the diaphragm, rather than the chest. How do you do this? When you inhale, push your stomach out so that it distends to allow your lungs to expand and draw as much air in as possible. Push it all the way out. Don't worry, no one is watching!

When you exhale, compress your stomach muscles to reduce your lung volume to a minimum and breathe out slowly and continuously until it feels like there is no air left to exhale.

Then breathe in again. Ideally, each inhalation should last for five to seven seconds and each exhalation at least seven seconds, giving you a breathing cycle of around 12 to 15 seconds and therefore a very efficient breathing rate of about four to five breaths per minute.

Avoiding stress

As well as reducing your breathing rate, this extended cycle of deep inhalation and full exha-

lation will also ensure that the transfer of gases is as effective as possible. More of the oxygen you breathe in will be transferred from your lungs to your bloodstream and more carbon dioxide will be removed from your body.

This benefits the diver enormously. A build up of carbon dioxide in the body induces stress and anxiety and can lead to panic, so breathing in such a way as to reduce your carbon dioxide levels helps you become more relaxed.

It also enables you to deal better with problems that occur underwater, as a calm mind can think rationally. Additionally, if you have developed your long, slow breathing technique to the point where it has become instinctive, your breathing rate will not increase in an emergency, giving you more air and time to solve the problem.

Get into the habit

Breathing from the diaphragm does take a little getting used to, but you do not have to be actually diving to practice the technique. This is something you can do any time, anywhere, while

you are riding the bus, sitting in your car in a traffic jam or watching TV. A good exercise is to lie on the floor, put a dive weight on your stomach and focus on moving the weight up and down by slowly breathing in and out. The idea is that your chest should move as little as possible during the breathing cycle. As you do this, breathe through lips pursed, as they would be around your regulator mouthpiece. Draw the air in slowly and release it slowly, don't guzzle and belch!

Practice until the perfect diving breath becomes an automatic component of your diving behaviour. You will be impressed at the difference it makes to your comfort level in the water and you will notice your air consumption rate start to drop dramatically—no magic required! ■

Simon Pridmore has been part of the scuba diving scene in Asia, Europe and the United States (well, Guam) for the past 20 years or so. His latest book, Scuba Confidential, is available in paperback, audiobook and e-Book on Amazon.

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Baleen whales hear sound through their bones

Trying to get a grip on just how baleen whales hear underwater has been quite a challenge for researchers, but a new study conducted by San Diego State University biologist Ted W. Cranford and University of California–San Diego engineer Petr Krysl reveals that the skulls of baleen whales can capture low frequency sounds in their bones and direct it to their ears.

Baleen whales (blue whales, minke whales, right whales, gray whales, fin whales, etc) are the largest animals on earth and can emit extremely low frequency vocalizations that travel extraordinarily long distances underwater.

There are two ways cetaceans gather sound. The first occurs when sound waves pass through soft tissue and reach the ears (and most of what scientists know about how whales hear comes from anatomic studies of just that activity) but this becomes ineffective once the sound wave itself gets longer than the length of the whale's body.

In other words, if the sound frequency sent out by one whale was very low (extremely common among baleen whales), other whales would not be able to hear it unless they

were equipped with another way to detect the call.

Bone conduction

The second occurs in a process called bone conduction, where sound actually vibrates the bones of an animal and amplifies the sound waves so they can be heard.

Cranford and Krysl wanted to find out if bone conduction was allowing the whales to hear super low frequencies so they built a three-dimensional computer model of a baleen whale's head—including the skin, skull, eyes, ears, tongue, brain, muscles, and jaws—and then ran simulations on how sound might travel through it to establish whether or not sound waves were vibrating along the skull.

Using an X-ray CT scanner, Cranford and Krysl mapped with precise detail the skull of a young fin whale that had beached itself in Orange County, California.

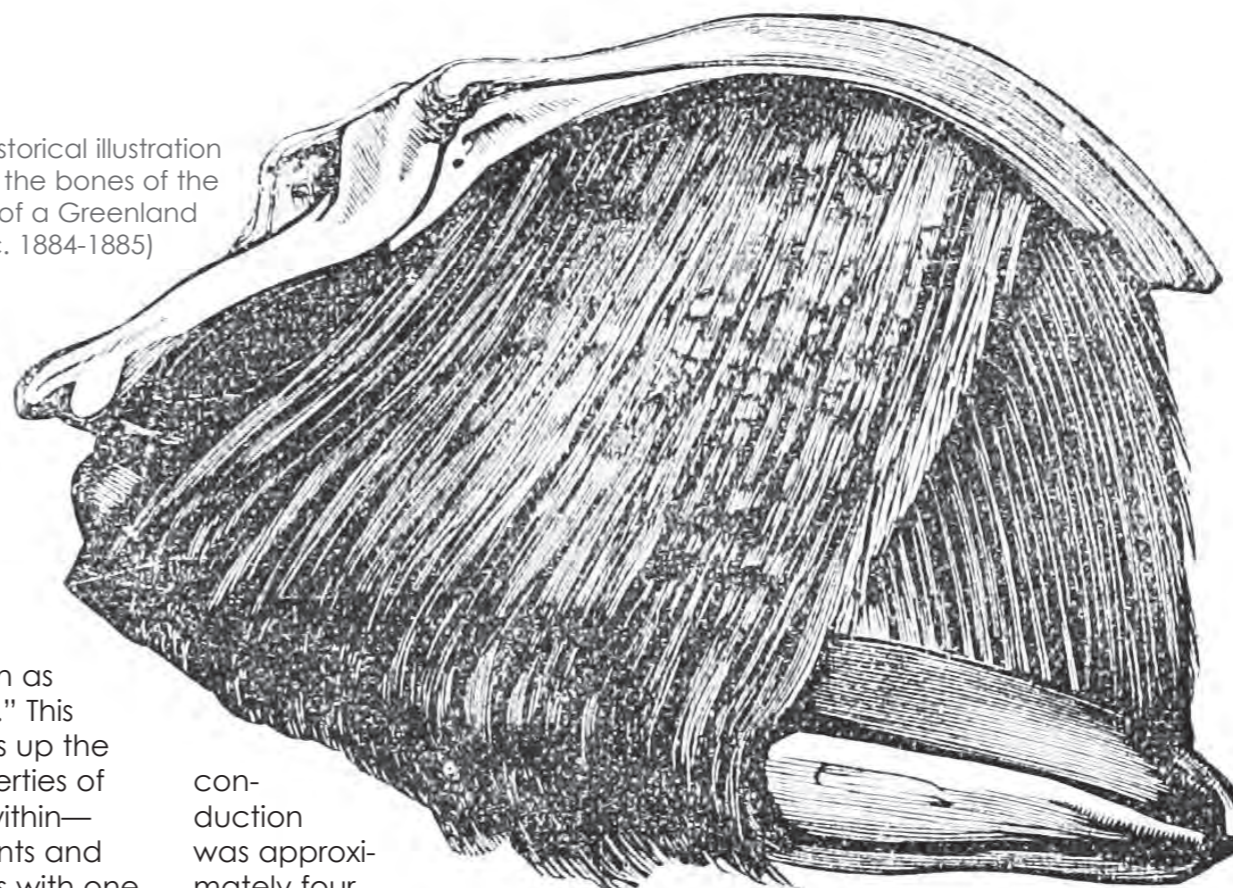
Once they had their data, the sci-

entists used what is known as "Finite Element Modeling." This technique digitally breaks up the skull—as well as the properties of the bones and muscles within—into millions of tiny elements and assesses their relationships with one another. By running simulated sound waves through their computerized skull, they could see how each tiny fragment of bone vibrates in response and thus amplifying the sound.

"At that point, computationally, it's just a simple physics problem," Cranford explained. "But it's one that needs lots and lots of computational power."

When Cranford and Krysl modeled various wavelengths traveling through their computerized skull, they found that bone

Historical illustration showing the bones of the skull of a Greenland whale (c. 1884-1885)



conduction was approximately four times more sensitive to low frequency sounds than the soft tissue mechanism and that for the very lowest frequencies used by fin whales bone conduction was up to 10 times more sensitive.

"Bone conduction is likely the predominant mechanism for hearing in fin whales and other baleen whales," Cranford concluded. "This is, in my opinion, a grand discovery. What our contribution does is give us a window into how the world's largest animals hear, by an odd mechanism no less. This research has driven

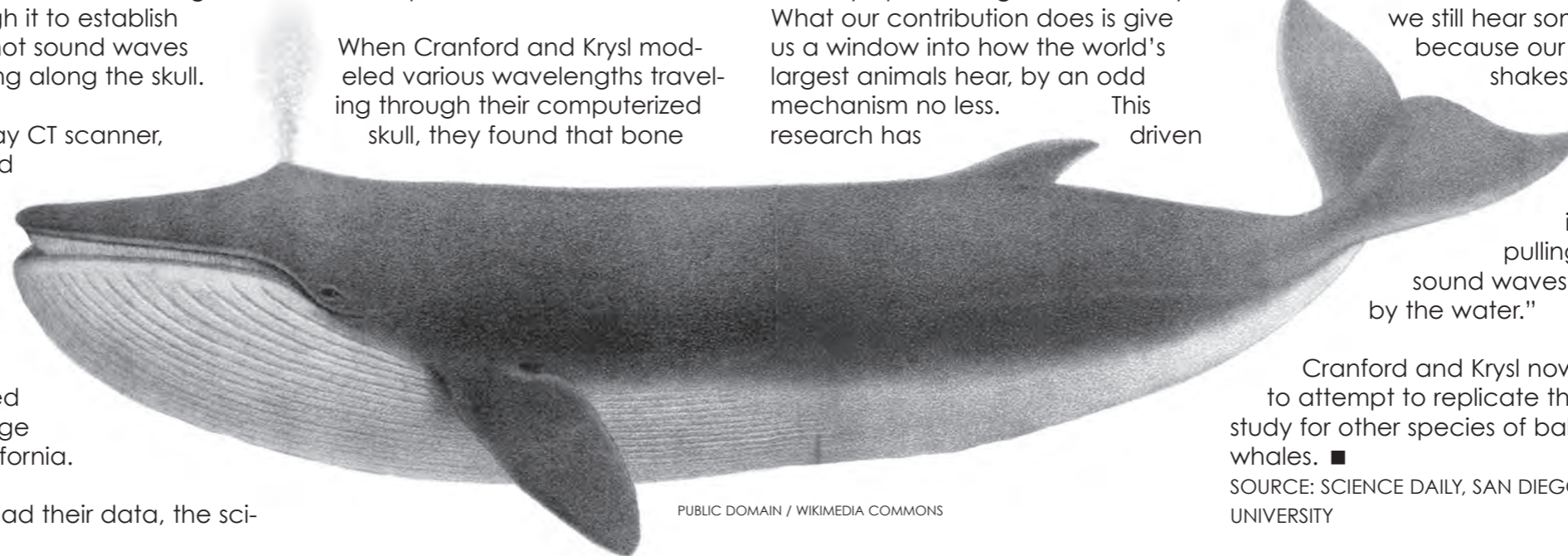
home one beautiful principle: anatomic structure is no accident. It is functional, and often beautifully designed in unanticipated ways."

Krysl added that people use a version of this phenomenon while underwater as well. "We have that experience when we submerge entirely in a pool," he said.

"Our ears are useless, but we still hear something because our head shakes under the push-ing and pulling of the sound waves carried by the water."

Cranford and Krysl now want to attempt to replicate their study for other species of baleen whales. ■

SOURCE: SCIENCE DAILY, SAN DIEGO STATE UNIVERSITY



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Rare orcas spotted in the Antarctic

A rare type of killer whale, almost never seen and almost certainly never filmed, was spotted and recorded for nearly an hour in the south Indian Ocean recently.

The anti-whaling group Sea Shepherd was chasing a toothfish poaching boat last December when they sighted a pod of ultra-rare "Ecotype-D" orcas.

An ecotype is a distinct race within a species that occupies a specific geographic area and has adapted to certain unique environmental conditions, giving it distinct variations of form, coloring, etc.

Very little is known about the Ecotype-D orca, also known as the sub-arctic orca, except that it is one of four Antarctic ecotypes (the others being Type A, B or C) and is characterized by very tiny, white eye patches and a more bulbous forehead.

American marine ecologist and killer whale expert Robert Pitman examined Sea Shepherd's photos and video and confirmed that they had indeed had a Type-D sighting. He was particularly excited that they

were able to get video of the whales as well.

"I don't think they have ever been filmed alive," he said.

Divergent species

Type-D orcas were first identified in 1955 when a pod stranded themselves on a Paraparaumu Beach north of Wellington. Scientific studies and DNA analysis soon revealed that this unique type of killer whale diverged from other orca species about 390,000 years ago.

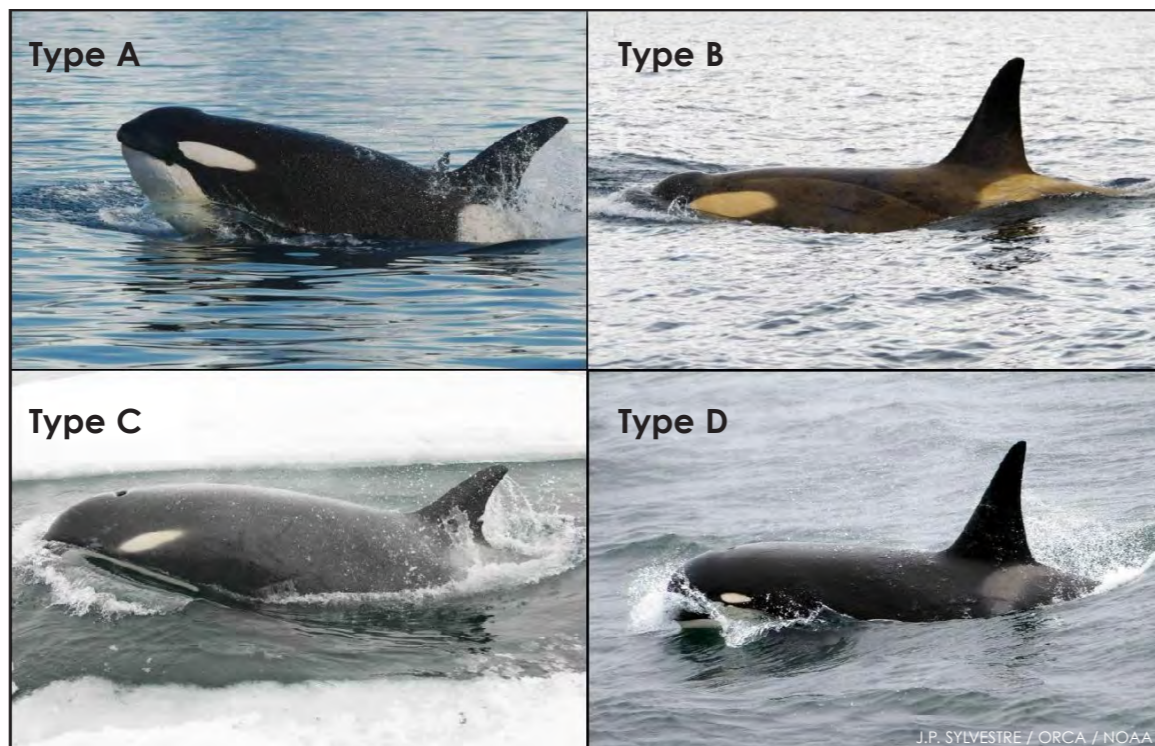
Following that particular event, there were not seen again for over 50 years and only 12 total sightings have ever been reported before Sea Shepherd got

lucky and witnessed them.

Chief engineer Erwin Vermeulen said that the stunned and delighted crew watched in fascination as 13 orcas played and showed-off in the rough seas. "For almost an hour the surf show continued, and was accompanied by bow riding, tail slaps and breaches."

He went on to say that establishing how many species of orcas there are is vital to determining what kind of conservation efforts should be implemented for different areas and gives researchers better insight into the role of these top predators in our world's oceans. ■

SOURCE: SEASHEPHERD.ORG



There are four Antarctic ecotypes of orca

Seven-million-year-old stranding riddle solved?

Near the end of 2011, the world's largest and best preserved whale and dolphin fossil deposit was found in north Chile. After members of a construction crew practically tripped over the bones—seven million years old—during a project to widen the Pan-American highway, paleontologists excavated one of the most astounding and diverse fossil discoveries ever.

They were given just two weeks to find as many remains as they could and remove as many samples as possible before road construction resumed, but in that time scientists unearthed over 80 fossils cataloged them and removed many for further study.

Among those found were 40 individual rorquals (the type of cetaceans that include today's blue whale, fin whale and minke whale) and dozens of other long extinct predators and grazing creatures, including a bizarre aquatic sloth and a walrus whale—dolphins that had evolved a walrus-like face.

Sudden fate

As soon as the teams began to dig they all began to report commonalities among the fossils. For one, almost all the whales and dolphins were found fully intact facing the same direction and almost all of them were upside down.

Paleontologists immediately concluded that these animals must have succumbed to the same sudden fate. But this wasn't just one isolated event. The varying depths of the fossils indicated that whatever had killed them had done so at least four separate times over a period of several

thousand years. But what was the cause? No one seemed to know until recently.

Finding the culprit

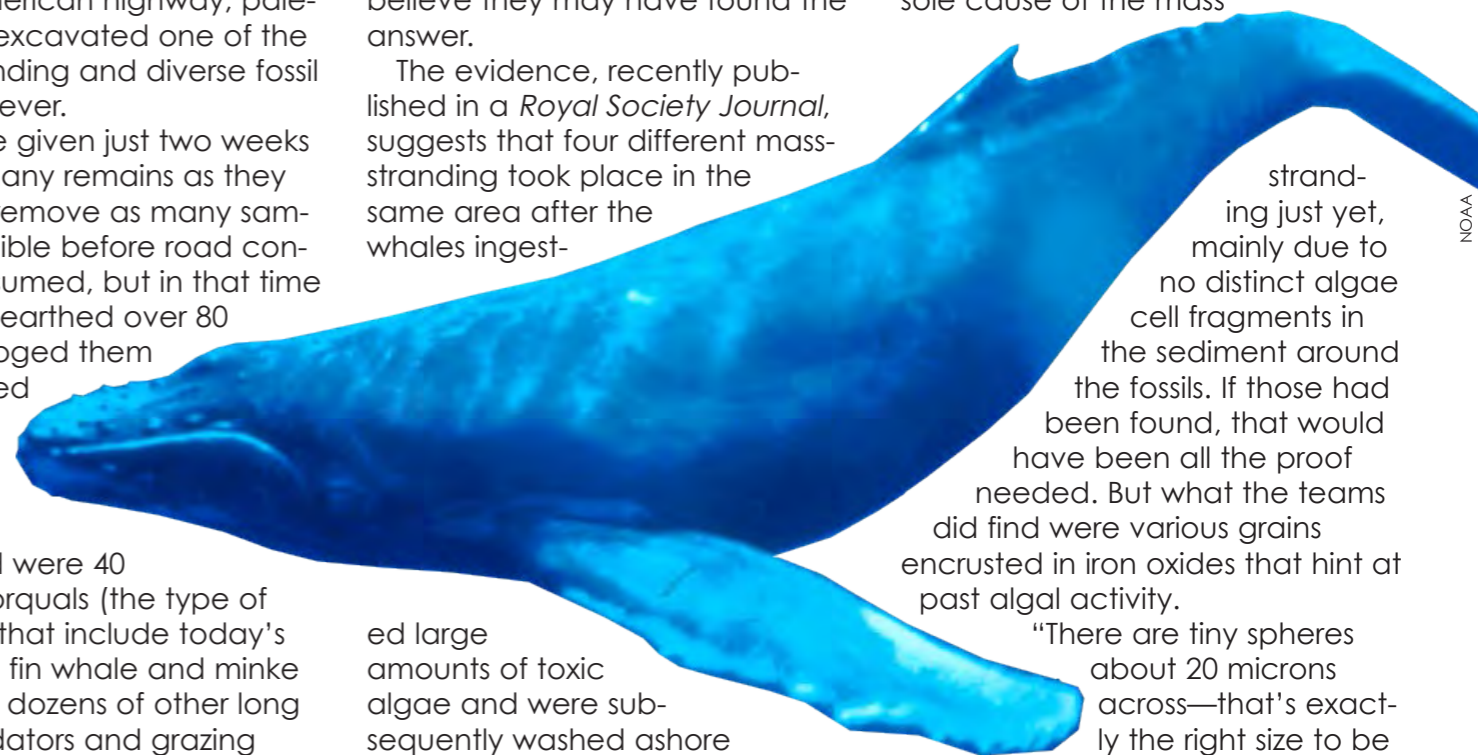
After three years of intense study and research, the scientists who continued to work on these fossils believe they may have found the answer.

The evidence, recently published in a *Royal Society Journal*, suggests that four different mass-stranding took place in the same area after the whales ingest-

land creatures about to steal the bones.

Algal evidence

But the evidence found is not proof and paleontologists are not yet ready to claim that these ancient algae blooms were the sole cause of the mass



ed large amounts of toxic algae and were subsequently washed ashore and buried over time.

"All the creatures we found, weather whales, seals or billfishes, fed high up in marine food webs and that would have made them very susceptible to harmful algal blooms," said Dr Nicholas Pyenson of the Smithsonian's National Museum of Natural History.

If large quantities of algae contaminated prey are eaten, or the algae are inhaled, death can overtake an animal suddenly. The researchers believe the unique configuration of the Chilean coastline actually worked to push the dead whales onto large sand flats just above high tide line. This would have put the bodies beyond the reach of most marine scavengers, and being a desert region, there would have been very few

stranding just yet, mainly due to no distinct algae cell fragments in the sediment around the fossils. If those had been found, that would have been all the proof needed. But what the teams did find were various grains encrusted in iron oxides that hint at past algal activity.

"There are tiny spheres about 20 microns across—that's exactly the right size to be dinoflagellate cysts," said Pyenson. "They're found in algal-like mats all around the site. We can't say whether those were the killer algae, but they do not falsify the argument for harmful algal blooms being the cause in the way that the sedimentology falsifies tsunami being a potential cause."

Obviously more exploration and study needs to be conducted, but happily this area of Chile is one of the most prolific and dense fossil sites in the world for whales and other marine life. Researchers estimate there could be hundreds of undiscovered fossils still buried below the surface. Ongoing research is being conducted by the University of Chile in Santiago. ■ SOURCE: BBC

NOAA





tech talk

Xiaming Cave
of Du'an county
in Guangxi
province of
Southern China

Text and photos
by Pierre-Eric Deseigne
Edited by Catherine GS Lim

In October 2011, Pierre-Eric Deseigne traveled to South Central China and dived the underwater caves of Da'un county for the first time. On his return to the cave system three years later, Deseigne reflected upon the impact of the historic discovery of these underwater caves.

It was during my long decompression stops, after a deep exploration dive in Daxing spring in Du'an county in China, that I remembered my first dive there, three years earlier. At that time, I could never have imagined all the things that would happen over the next few years. Nobody could have imagined what the discovery of this new area meant for cave diving and cave exploration.

This "El Dorado" of karsts has existed for millions of years and it is indeed one of the most incredible cave systems on Earth—akin to a new underwater Himalaya. It's a huge place, with thousands of new 'peaks' for cave divers to explore.

Located in South China, in Guangxi



Cave Diving In

China's Du'an County

province, the magnificent Du'an county landscapes offer deep valleys surrounded by mountains. A beautiful place inhabited by the charming Yao people, the local ethnic minority. The ancient

karst here heralds a promise of a brilliant future.

Of course, this is not just a story of cave diving. For westerners, visiting inner China is a fantastic culture shock. Everywhere,

people are the same yet they are also different. We all desire love, happiness and peace but not necessarily in the same way. The discovery of virgin caves is a major point, but getting to know the

Chinese people is more important. This adventure wouldn't have been so beautiful without the heart-warming welcome of the Du'an people. Without them and their enthusiasm, nothing would have





The beautiful Red River, or Hongshui River, in Guangxi province of Southern China

been possible.

In the late '80s, the first explorers of these caves were a British team. They had started exploring the dry caves and dived some springs and karst windows, but the story fell into oblivion for three decades after that.

Then, five or six years ago, well-known French caver Jean Bottazzi, who had lived in China for several years, worked in this area. He saw the caves and, after two dives, sent pictures of the Du'an caves to the French cave-diving community. My friend and cave diver, Sebastien Lissarrague, was immediately fascinated. He decided to take a look.

After his first trip to Du'an, he came back and convinced our team to follow him in this adventure and to organize an expedition there. Six months later, in October 2011, we too discovered China and the multitude of virgin caves in Du'an. We were immediately convinced by the high

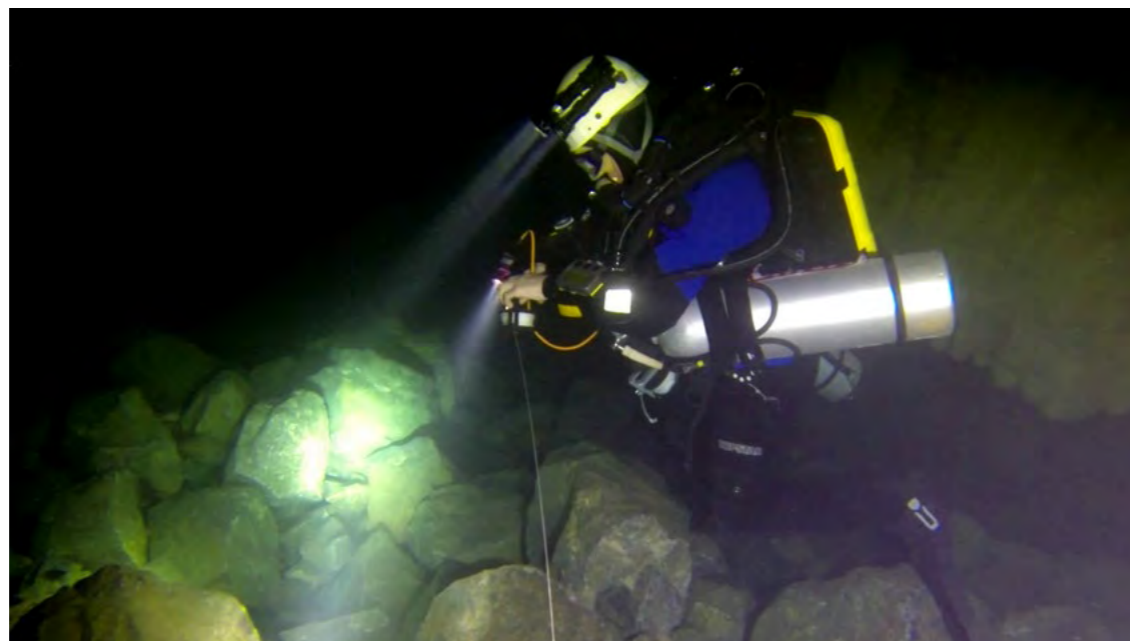
exploration potential.

Every day, we were amazed by the dives and especially by the environment. All the villagers came out to look at us. They were fascinated to see divers in their springs, which they use for washing fruits and clothing, and for drinking water. In the beginning, we did not imagine the waters to be something else other than just water. But, to the villagers, the

springs and karst windows were highly spiritual places. Many spirits lived in each spring, such as the white cow of local mythology. Soon, we too learnt about and respected these faiths and traditions.

Second expedition

We returned a year later for a second, more ambitious project. Every dive offered hundreds of meters



Team member Hervé Cordier in first sump of Ya Yan Spring

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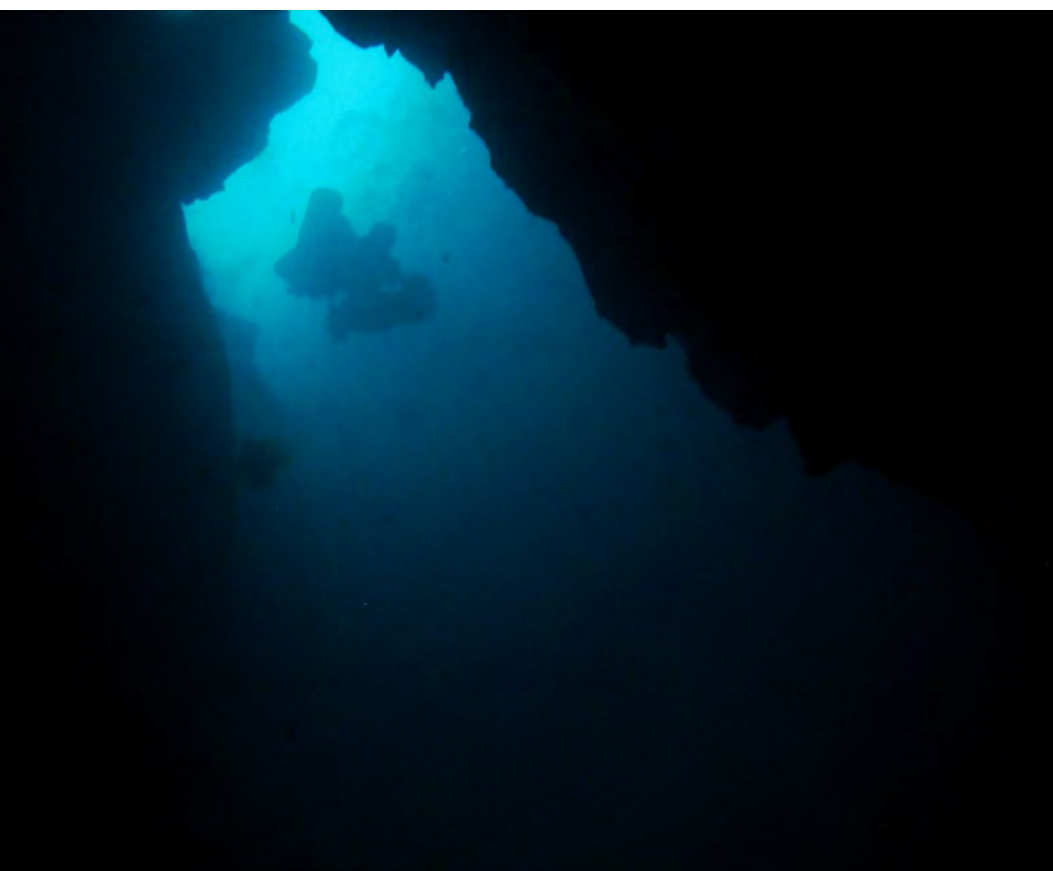


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of virgin tunnels. We soon realized just how massive the discovery was. Team member Serge Cesariano and I made a 121-meter dive at Daxing spring. This spring was rather like a Chinese Wakulla (a major spring in Florida)—it was so big, so deep... a masterpiece.

But this was not the only one; there were many other caves that were deep—very, very deep. They were on a country-size scale—so huge and disproportionate. Depending on the seasons and water levels, the depths may run to 180 and 200 meters—a *helium paradise!*

Our base camp was in the house of our guide's mother, Mandy, in Du'an city. We filled our tanks using an old compressor in the backyard, close to where the chickens and ducks stayed. We traveled to the dive sites in tired pick-up trucks on chaotic roads. Even now, we still felt like Martians, with the villagers still coming out to see us—those strange west-

erners with their strange habits. Around the pool, they talked and laughed. They were very curious, very happy and honoured to welcome us in their village.

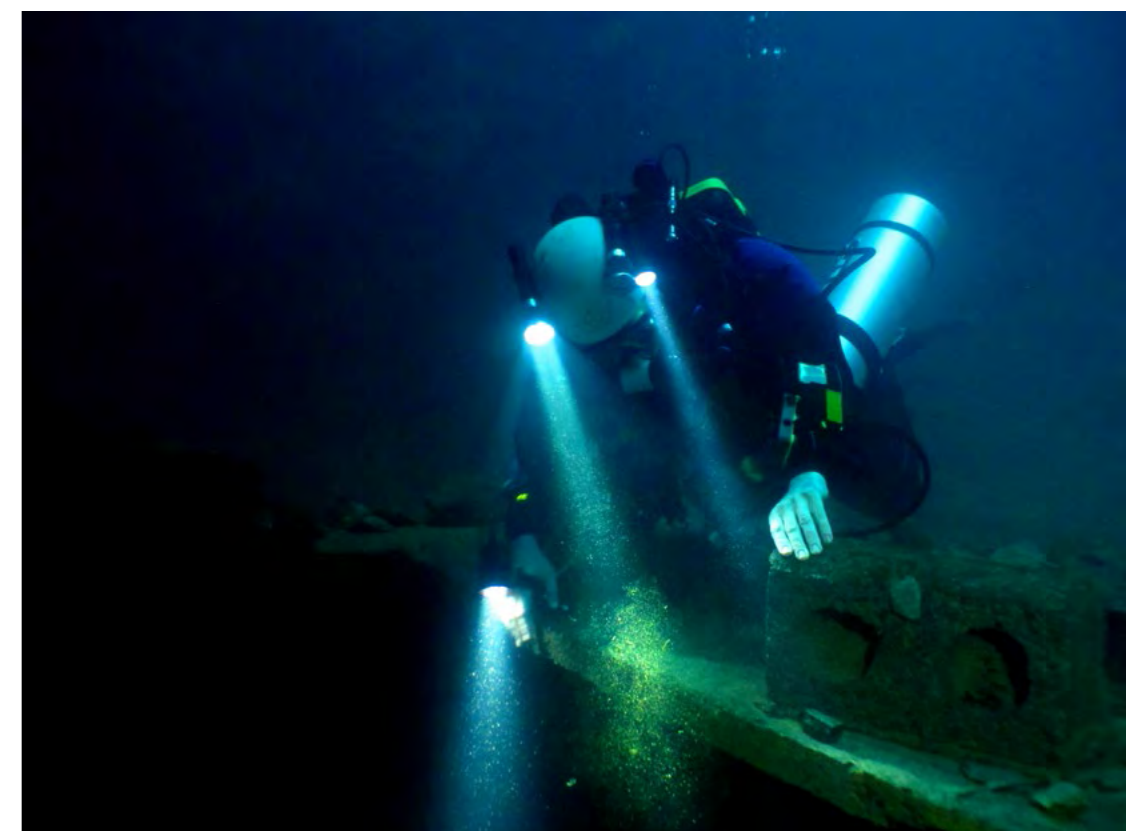
Often, after the dives, villagers invited us into their homes to share a meal. We showed them photos and videos of the caves, and they were excited to learn about the flooded regions underground. We immersed ourselves in the caving adventure and also in authentic and warm China. Then, we returned to Du'an to fill the tanks and prepare gear for the next day. The days ended by sharing meals with our new Chinese friends. During the long evenings, we sang and laughed and enjoyed good times together.

Governmental intervention

At the end of our second expedition, the local government realized the significance of the discoveries. This was not only a place with pools, springs and karst

windows, it was also a location that could become a major destination for scuba diving, technical diving and cave diving. Certainly, this was one of the most impres-

sive sites for cave diving in the world, much like the Yucatán in Mexico, the state of Florida in the United States, or the department of Lot in France. Du'an was



CLOCKWISE FROM TOP LEFT: Author Deseigne and team member Hervé Cordier before the push dive in Ya Yan Spring; Deco and safety tanks at Daxing Spring before 151m dive; Filmmaker Nathalie Lasselin in "stairs gallery", Daxing Spring; Diver at Daxing Spring; Cordier during decompression stops at Jiu Song



Bai Lai Spring

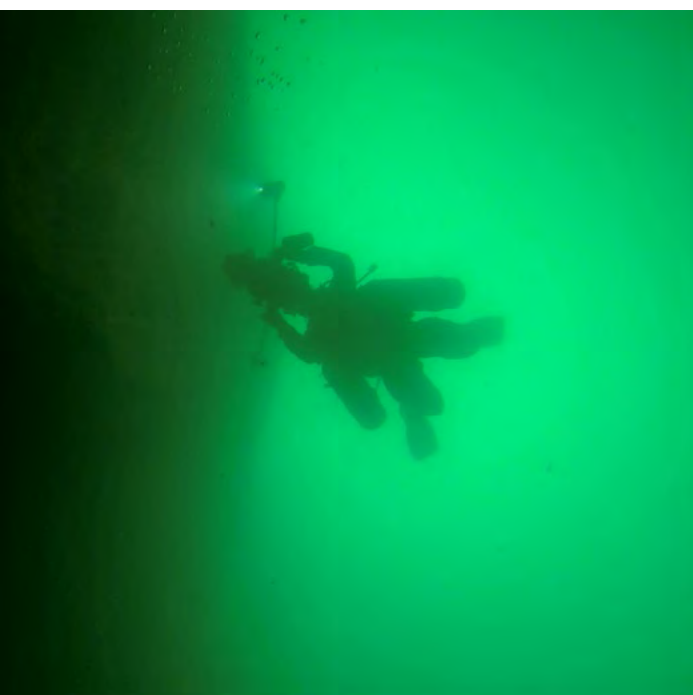
Du'an

in the Du'an government's bid to promote this natural resource to a worldwide audience. Just take a look at the guest list full of prominent personalities in the cave diving world: Martyn Faar, Curt Bowen, Richard Harris, Mia Pietikäinen, Pascal Bernabé, Nathalie Lasselin and Sebastien Lissarrague.

During that one week, we discovered incredible dive locations. All were very excited by the dives. By the end of the week, they all promised to return for more, as soon as possible.

In April 2014, the French team returned to continue their studies and exploration. More than one kilometer of new gal-

Diver searching new galleries in Daxing pool at Daxing Spring (left)



Filmmaker Nathalie Lasselin in Jelly Fish

not only a new Mecca for exploration, but also a new paradise for cave diving and tourism.

To our great surprise, the Du'an government decided to promote tourism in Du'an and diving in particular. Some of us were a little apprehensive by this rapid decision, but we soon discovered that this was the Chinese way.

Seven months later, I was introduced as an official consultant on the diving project. The government wanted to open a dive center in December 2013. It was a fantastic challenge.

We started from scratch to create a modern and brand-new dive center.

Another six months later, after many trips and much hard work, the first Chinese dive center was established in Du'an. Opening a dive center so close to virgin caves is astounding. For explorers, it would be an extraordinary base camp; for divers from China and beyond, it was a chance to discover an amazing new dive destination.

The dive center opens

In December, I helped the Du'an government organize

a grand opening ceremony. It was the first time in diving history such an event took place. Usually, explorers dive and explore caves over a long period of time before anything like a dive center is developed. Only after about ten years or so, do recreational divers finally come to a newly explored cave system just for fun. In Du'an, the dive center opened first, at the beginning of exploration, not at the end. Exciting!

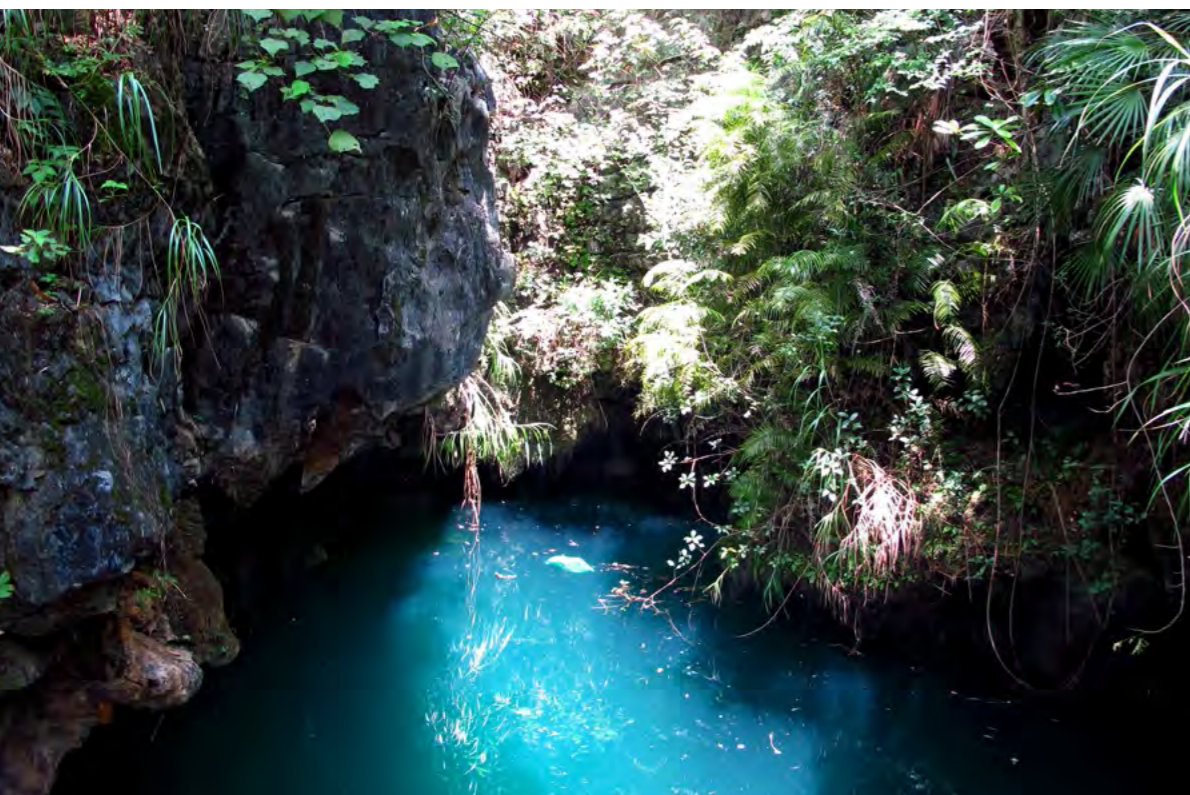
For this event, some high profile divers and explorers were invited to draw attention to the new destination,



Local kids in Jiu Song village



Du'an



THIS PAGE:
Scenes from
Du'an county;
Location of
Du'an Yao coun-
ty in Guangxi
province on map
of China (left)

Xia Tun Spring (above); Daxing Spring and the source of the Chengjiang River (top left)

leries was discovered with several deep dives, like in Daxing where we reached 151 meters in the south gallery. In some caves such like Ya Yan and Jiu Song, we explored fantastic tunnels with crystal clear water. I applied the rule of no exploration without survey and tried to take measurements of these

huge cavities during every dive—certainly not easy when it's this big or deep!
Nathalie Lasselin also joined us to continue filming for her movie on the Du'an caves, and we spent time with her. We were all very happy to star as divers in her new movie.
Adventure and exploration

continue as more teams make their way to Du'an every year. Indeed, two or even three lifetimes wouldn't be enough time to explore this incredible network of caves. This was just the beginning, full of dreams and hopes—not just for explorers and cave divers, but also for the Yao people and the villagers.
In the documentation of the new dive destination and the establishment of a new dive center, we had tried to help the

local Du'an people as much as possible. Now, it is up to them to develop and promote their incredible natural resource. To quote Martyn Faar: "The future belongs to you." ■
Pierre-Eric Deseigne is a French cave explorer, specializing in difficult caves, with muddy waters, critical depths and restrictions. He shares his passion by speaking, writing books and articles for magazines. He is also professional a TDI technical and cave diving instructor.



A local elderly woman close to Xia Tun (above); Tun Lie karst window (top right)

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=JTwymzmpJl8]

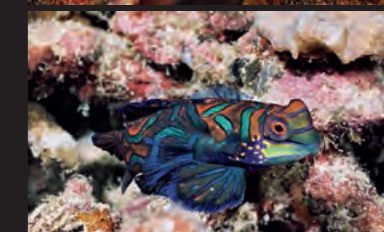
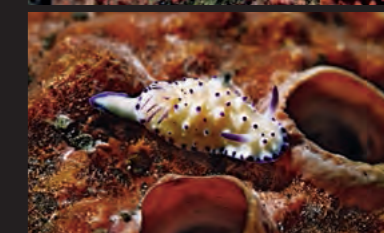
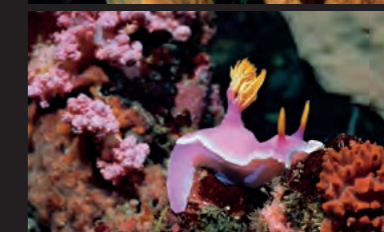
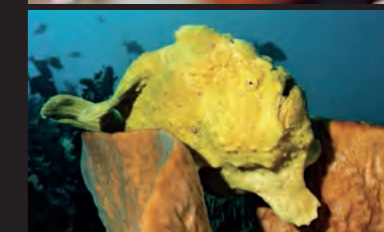
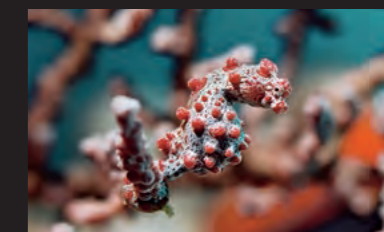
International research

Although he was still seriously ill and still



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shark tales



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

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

Andrew Cobb, Ambassador Sharkproject South Afrika



SHARKPROJECT
www.sharkproject.org

© Andreas W. Seracki Sharkproject





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. □

Ila 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.





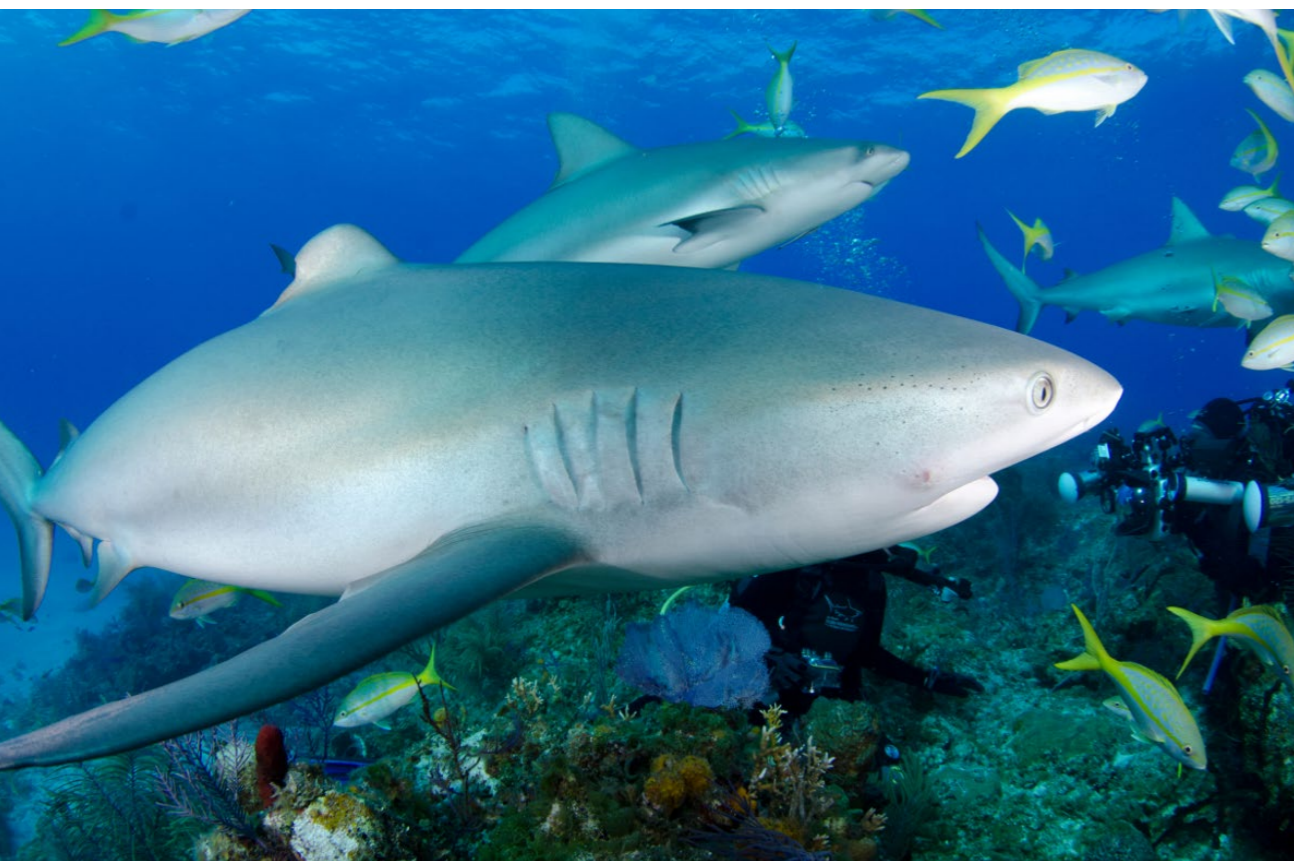
Text by Ila France Porcher
Photos by Mary O'Malley

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





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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Hold the
Jaws
Flexclamp
at the
top for a
steadier
shot

Text by Peter Bucknell
Photos by Dr Michael Rothschild

The GoPro has changed the underwater video game forever. This handy camera seems easy to use but a quick browse of YouTube underwater videos tells the real story: Ninety percent of such GoPro videos are wobbly, blue, poorly-framed and badly-lit video footage. Fortunately, with a few simple steps, a diver can greatly improve the quality of their GoPro images.

Today, divers need no longer be intimidated by the price and size of the GoPro underwater video cameras. There are three types of new videographers: divers who are happy with their footage, divers who are so dismayed at their footage that they leave the GoPro in the closet, and divers who investigate ways to get better footage by reading, asking questions and perhaps even taking a class.

For the last group, there are a few simple things a diver can do to vastly improve the quality of their GoPro footage. Unfortunately, spending more money is one of these things.



GoPro Video Camera

— *Do's & Don'ts*

Filters

If you look at the GoPro cameras on the dive boats, you will notice that there are often divers who haven't spent the extra money on a filter. Don't be one of them! GoPro makes very affordable filters, which are well made, simple and effective,

that will improve the quality of your footage by taking out the cyan color typical of underwater images.

There are two basic colors of filters: red (orange) and magenta. The red filter will cut out some of the blue from your footage, and the magenta filter will cut out

the green. Choose the appropriate filter for your diving environment.

Camera rig

Be aware that the GoPro "Dive Housing" uses a different size filter to the GoPro "Standard Housing". The ten-dollar filters

that fit inside the GoPro are problematic and should be avoided. They will distort your images and won't allow you to take the filter off for surface shots. Unless you like a heavy orange or magenta tint in your shots, taking the filter off is a good idea.





photo & video



Videographer diving with the GoPro mounted on an Equinox housing

GoPro Video

on an overcast day without sunlight, take a video light.

Practice skills

Shooting techniques need to be practiced. A diver with excellent buoyancy is halfway there. I find that cave divers make good videographers as they have been trained to lie still in the water column without moving. Quite a few dive instructors have taken my GoPro course and I usually just have to work on their camera hold, camera movement and framing, with some fin kick modifications to iron out the bumpiness. The steadiest shots

come when a diver keeps their limbs stationary. In a wreck, this can be achieved by making contact with a part of the wreck. In general, don't flap your hands and fins around while shooting.

As we know, the GoPro is a tiny camera. One thing many divers don't know, however, is that there is an inverse relationship between the size of an underwater camera rig and its inherent steadiness in the water. The bigger a housing is, the steadier it will be. Shooting with the GoPro by itself, unmounted, makes it extremely difficult to get steady footage. Mounting a GoPro on something will help a diver get a steadier shot. There are a variety of mounts available from GoPro. I personally recommend the Jaws Flex-clamp as part of your arsenal.

There are several brands of telescopic poles which also help greatly with the task of holding the GoPro steady. A tray for the camera housing and two lights are the optimal setup. The lights and the arms that hold them will help steady the camera.

Video lights

Buying a video light may be a daunting purchase as lights usually cost more than the GoPro camera itself. Abundant lighting is vital for the GoPro. We see jaw-dropping films of skiers and skydivers

and expect the same for our underwater shoots, but the water actually cuts out more light than most of us realize. Our eyes adjust to the darker underwater environment and, similarly, the GoPro can automatically adjust its iris to a certain extent. This enables it to operate well in shallow depths when the water is clear and the sun is shining.

Beyond these conditions, the GoPro will try to automatically amplify the video signal, giving the footage a grainy look. Of course, the color will diminish with every increment of depth. So, if you are diving

come when a diver keeps their limbs stationary. In a wreck, this can be achieved by making contact with a part of the wreck. In general, don't flap your hands and fins around while shooting.

Etiquette & safety

Good diver behavior and etiquette seems to have gone out the window with the proliferation of the GoPro. New videographers tend to concentrate on the wrong things, or they just have their priori-



Goliath Grouper Photo Competition 2015

In an effort to increase awareness on the plight of [Atlantic Goliath Grouper \(*Epinephelus itajara*\)](#) and to further their Federally protected status, the [South Florida Underwater Photography Society \(SFUPS\)](#) is holding the first international photo competition in support of the species.

Atlantic Goliath Groupers were on a fast track to extinction but thanks to conservation efforts they thrive in South Florida waters. Every year from August through October hundreds return to local waters off West Palm Beach County for a mating ritual of collective spawning. Start planning your underwater photographic expedition to swim with one of the friendliest fish in South Florida.

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GoPro Video

Make contact with a part of the wreck for a steady shot, being sure not to damage any marine life on the structure

of shots, but some experimentation will show you the effect that this resolution has on subjects moving in and out of the frame.

Frame rates, on the other hand, can be altered to great effect for different conditions. A lower frame rate can really help in lower light situations. The higher frame rates offered on the GoPro are very useful when it is time to slow down footage in the editing process; twenty-four frames per second can yield good results underwater. The Protune setting is turned off by default. When people come to me with their new GoPro, I will usually turn Protune on for them. Simply put: Protune intensifies the footage and makes it more robust and hence easier for color correction.

Get used to the buttons before going on a dive. Take time to play with the GoPro on dry land. Learning the timing of button-presses will help you avoid the accidental switching of modes during a dive. Try to develop some muscle memory so you are not distracted by the camera functions when underwater.

In short, the GoPro is an amazing little camera. It is capable of shooting incredible footage if handled the right way. ■

*Dr Pete Bucknell is an underwater filmmaker, a cave diver, a music professor and a public speaker. His publication, **The Underwater GoPro Book**, has introduced divers to methods of getting the most out of their cameras, and following better and safer practices for shooting video while diving. He conducts workshops at dive conventions and events, and instructs in New York City.*

recording. It only takes a few seconds to check on these things and it could save a piece of coral, soothe an angry buddy or it could even save a life.

The main thing to remember is that the shot is of secondary importance to everything else, and that includes other divers' enjoyment. Quite often, I find that I would get a better shot of a critter if I

wait until everyone has moved off. Finding your own critters gives you first dibs on shooting, which is ideal. However, other divers will like you more if you step aside and let them take a look in a timely manner.

Another behavior that the GoPro seems to encourage is that of divers charging toward marine life in attempts

to film them before they swim off. This almost always results in the critters fleeing in the opposite direction; thus, it is always more productive to approach them calmly and slowly.

Settings

Read up on GoPro settings. Don't just go with the default factory settings. It is best

to choose an appropriate resolution and stick to it. Changing your resolution can be confusing when it comes to editing as software compatibility varies; research is required to understand what is going on, as well as the pros and cons for each resolution. The Superview setting causes some distortion at the sides of the frame; this is not a bad thing for many types





photo & video

Edited by Don Silcock

PRODUCT SHOTS COURTESY OF THE MANUFACTURERS



Sea&Sea MDX-D810 Housing

Sea&Sea has released its new housing for the Nikon D810. The MDX-D810 housing is compatible with Sea&Sea's internal optical YS converter, which offers the functionality of a sync cord system while simultaneously offering the benefits of a fiber optic system. The YS converter takes the camera's TTL signal and converts it into a light signal to enable TTL strobe exposure, rapid fire and a reduced recycle time. The MDX-D810 also features a zoom/focus gear that can be retracted in order to insert large diameter lenses. The new housing is shipping now at a retail price of US\$3,500.



Subal ND750 Housing

Subal has announced the release of its new housing for the Nikon D750 camera. The new ND750 housing features access to most of the the D750's camera controls, includes a built-in leak detector and is fitted with Subal's new port lock system as standard. Fiber optic ports for strobe triggering are supplied as standard with the ND750, but the housing can be fitted with additional Nikonos, Ikelite or S6 connectors as required. The ND750 housing is available at a U.S. retail price of \$3,800.



Nauticam NA-LX100 Housing

Nauticam has released its new housing for Panasonic's top-of-the-range Lumix DMC-LX100 compact camera. The NA-LX100 housing provides access to the LX100's aperture, shutter speed and aspect ratio control rings—all of which are lens mounted. Nauticam pointed out that providing that access to those rings presented some unique challenges; however, the company succeeded, although it means pre-setting the

three controls when inserting or removing the camera. The housing utilizes the new N50 port system, which Nauticam has developed for high performance compact cameras with long throw lenses so that precise optical solutions can be offered. The NA-LX100 is available now at a retail price of US\$1,200.



TRAYS, PIVOTS, AND ARMS FOR CAMERAS, HOUSINGS, STROBES, AND LIGHTS

The original arm with o-rings in the balls for ease of use. Accept no imitations.

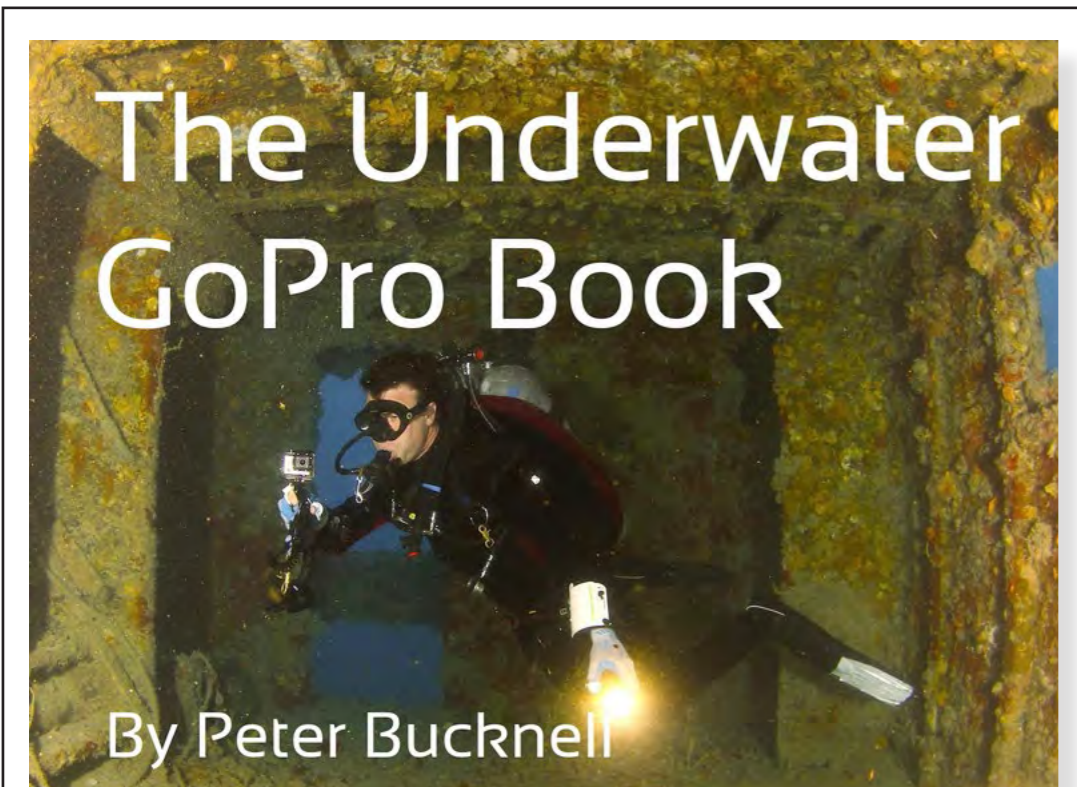
Your quest for the best arm system is over, once you have an Ultralight arm you will never need to upgrade.

Visit our website: www.ulcs.com

for product info & to locate a dealer near you. Unable to find a dealer?



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It's here: An instructional book for divers who want to use the GoPro Video Camera. Peter Bucknell, an experienced filmmaker, lays out the positively best way to set up a GoPro for use underwater in easy-to-follow steps. He covers all the angles on how to get steady, beautiful footage in a safe and reliable way, and takes readers through the various modes of editing. All models of GoPro are covered in the book. Download it from: itunes.apple.com.

Nauticam G7X Housing

Nauticam has also released its new housing for the Canon Powershot G7X compact camera. The NA-G7X features the new Nauticam N50 port system, and retails at US\$1,100.





photo & video

Edited by Don Silcock

PRODUCT SHOTS COURTESY OF THE RICO BESSERDICH



One housing fits all (well, almost!)

Italian manufacturer Easydive has released the 'LEO III', its newest flagship of a universal underwater camera housing. The LEO III is completely electronically controlled and can be used with more than 50 different DSLRs from Canon and Nikon. Switching between different camera models only requires swapping the camera tray and updating the housing's firmware, which can be downloaded from the manufacturer's website and transferred with an USB stick. The Leo III comes with two Nikonos-style strobe cable connectors but also supports fiber-

optic strobe cables. An audiovisual leakage alarm is standard. Vacuum system, flash-trigger for fiber-optics, engraving of name and port-adaptors for use with third party dome- and flatports (such as from Subal, Seacam, Sealux, Hugyfot and Sea&Sea) are optional. The backplate is sealed by two o-rings, and wet contact magnetic control buttons, which are embedded in the ergonomic handles, are not affected by water or pressure. The housing, which is depth rated at 150m, is made from aluminium, weighs 3.8kg and comes with a lifetime warranty. The LEO III costs €2,790—ready for a camera of the client's choice. Upgrade costs for switching between different cameras are €389 per camera. www.easydive.it

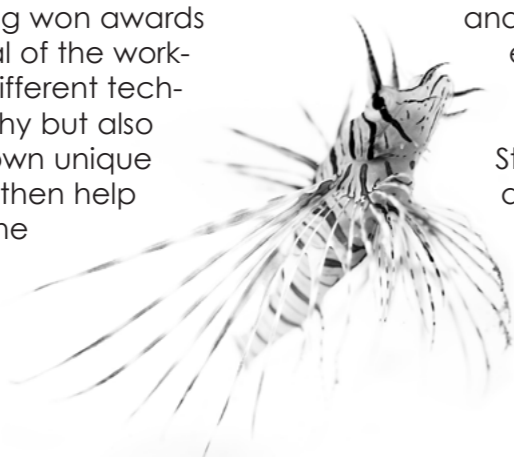
Upcoming photo workshops by X-RAY MAG contributors

Rico Besserdich will conduct a photo workshop at Sharks Bay Umbi Diving Village in Sharm el Sheikh, Egypt, May 23-30. Rico is a photographer, journalist and artist renowned in the underwater photographic world, having won awards and acclaim worldwide. The goal of the workshop will not only be mastering different techniques of underwater photography but also to develop the photographer's own unique style and personal vision. This will then help each participant to step out of the masses with their photographic work and images.

More info - Rico's workshop

Steve Jones. In October 2015 renowned British underwater photographer and X-RAY MAG contributor, Steve Jones, will be leading an east coast safari in Bali that will explore all of these sites and culminate with several spectacular encounters with Mola mola or sunfish, the largest bony fish in the ocean. An instructor since the age of 21, Steve spent most of the '90s working as a professional dive guide, spending thousands of hours underwater in the Red Sea, Indian Ocean, Caribbean, Mediterranean and North Atlantic.

More info - Steve's workshop



Cathy Church's Underwater Photo Fest 2015

SUNSET HOUSE

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Cathy Church's Underwater Photo Fest Grand Cayman at the Sunset House May 9th-16th, 2015

Cathy's famous extra-long-bottom-time photo dives

Enjoy exciting classes with Cathy and her fabulous staff:

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Separate photo contests for every level. One special category where only the worst photo can WIN!

Photo-friendly dive boats with photo coach on board

Fabulous Fun ** Plentiful Prizes **
Free Darn Good Demo Gear ** Great Giveaways



Includes :

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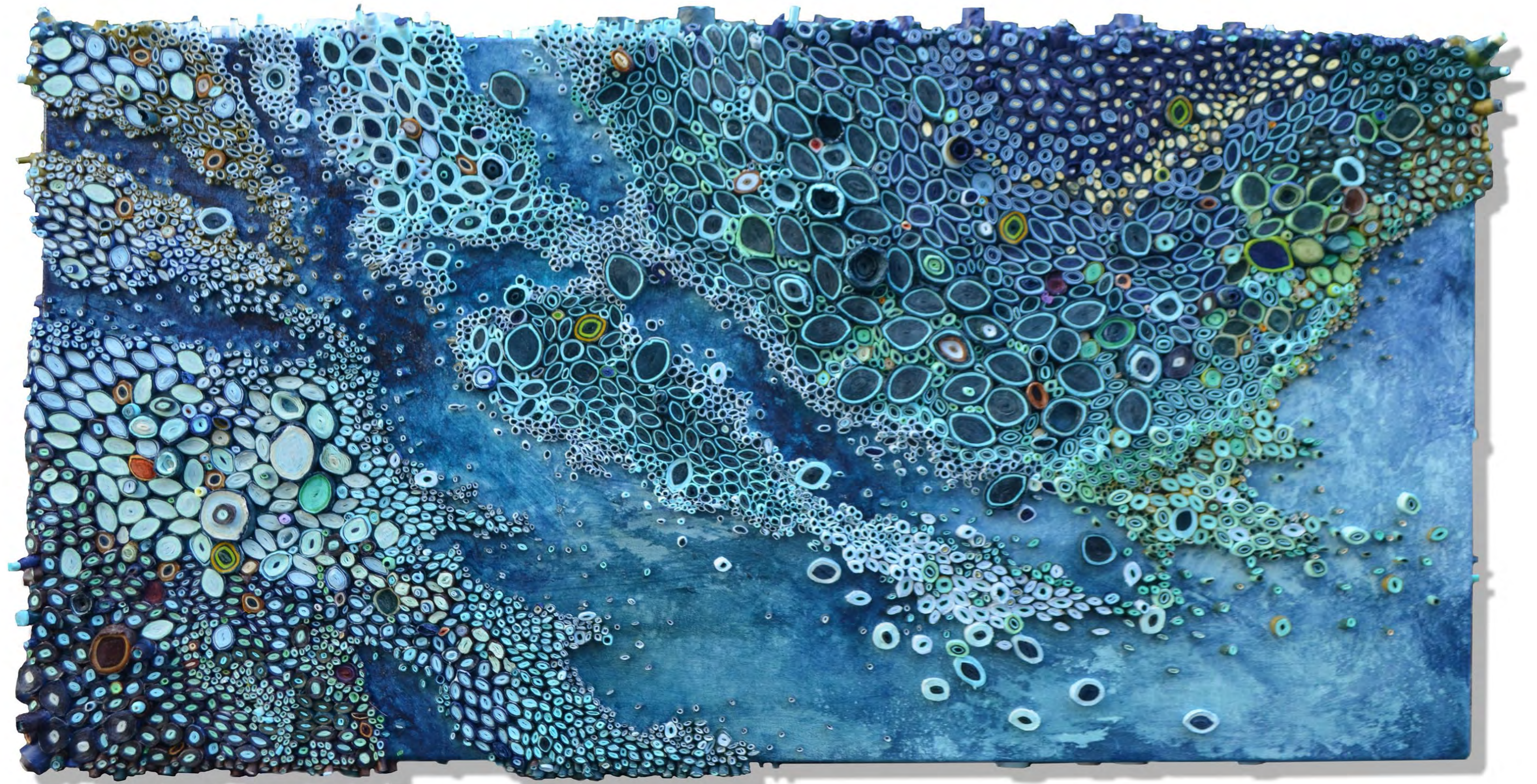


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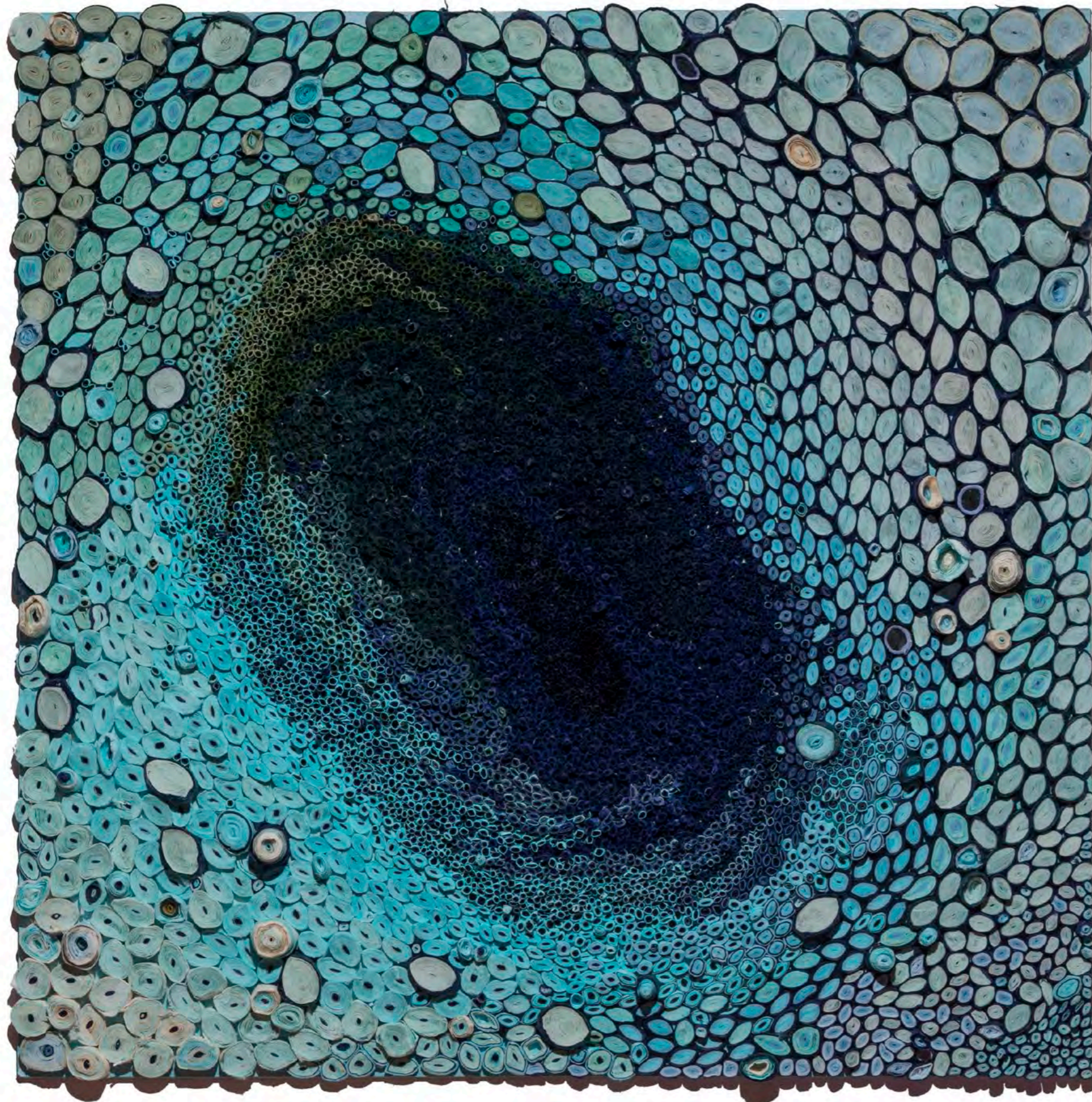


Amy Genser



P O R T F O L I O

Blue Abyss by Amy Genser
Paper and acrylic on masonite, 36 x 36 x 1.5 inches



Text edited by Gunild Symes
All artworks and photos courtesy of Amy Genser

American artist Amy Genser works wonders with paper, transforming it into vibrant liquid images and cellular studies reminiscent of forms found in coral reef colonies and aquatic environments. A Connecticut native, Genser grew up by the sea, which greatly inspired and influenced her works of art. We caught up with the artist to gain an insight into her mesmerizing, textural pieces.

X-RAY MAG: Tell us about yourself, your background and how you became an artist.

AG: I'm a mixed-media artist and mom of three sons (ages nine, eight and five) from West Hartford, Connecticut. I'm obsessed with paper and paint, color, patterns and texture. If I don't keep my hands busy working, I feel my whole system gets kinked up. I have energy that I am somehow only able to release through my work. I found my way to my paper medium while studying for my master of fine arts degree at the Rhode Island School of Design.

My plan was to become a graphic design professor, but I took a detour after taking a paper-making class. After graduation, I kept playing around with paper and making all kinds of sculptural forms.

I wasn't able to make my own paper anymore, but found lots of options available from all over the world. When I discovered the layered, circular form, I loved how I could use this one simple module to create worlds of compositions.

I created a body of work and gave

myself two years to try to make a go of it in the fine art world. That was 14 years ago.

My studio is on the third floor of home. I work about five hours a day while my kids are in school. It is a juggling act. Because my studio is in my home, it's sometimes hard not to get "mess-tracted" as I call it (starting to do laundry, clean dishes, etc) but having the studio on another floor helps.

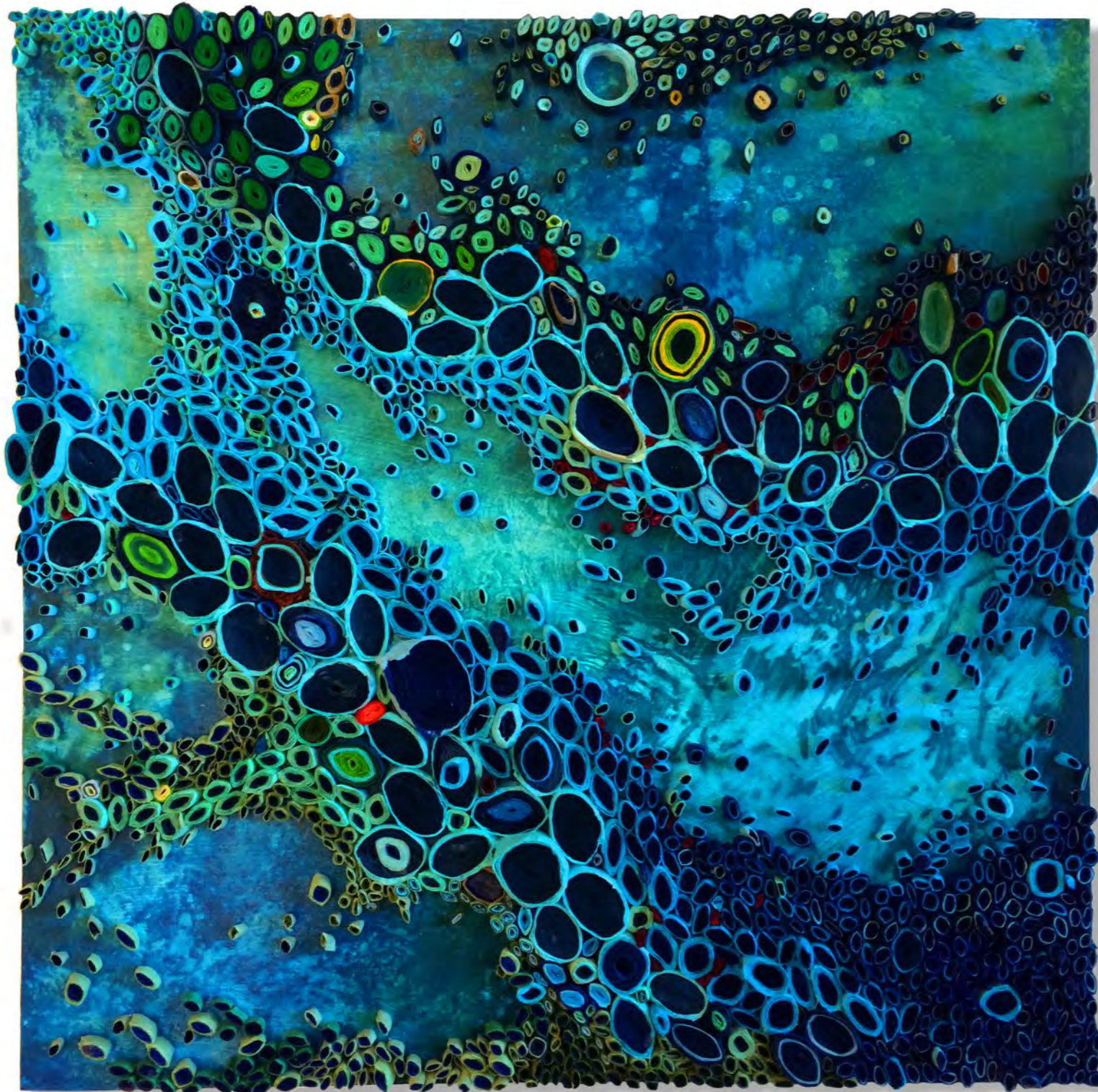
Going up the stairs is like crossing a threshold. I also listen to books on tape while I work. Time flies when I'm working on a piece and into a great story, but when I see the bus coming down my street at 3:45 PM, my work day is over.

X-RAY MAG: Why coral, ocean and underwater themes? How did you come to these themes and how did you develop your artwork with paper over time?

AG: It's the place where I feel the most at peace and is a tremendously rich visual source. I love everything about the ocean. It is perfectly imperfect—the colors, patterns, layers, light, sounds,

PREVIOUS PAGE: *We Are Water 2*, by Amy Genser
Paper and acrylic on masonite, 25 x 49 x 3 inches

Red Tide, by Amy Genser
Paper and acrylic on masonite, 18 x 18 x 2 inches



Mineral Lemon Lime, by Amy Genser
Paper and acrylic on masonite, 18 x 18 x 1.5 inches



compositions, changes, life and energy. We spend a lot of our summers on the beach in Rhode Island. I love watching the water, the rocks and the light. Our beach has giant rocks with these really

neat barnacles and seaweed. Their colors are always changing. Sometimes there's a lot of it, and sometimes just a little. It's neat to watch the progression. One day when the seaweed was

purple, brown, yellow and green, my husband made the awesome observation that nature never clashes. I love that.

X-RAY MAG: What is your artistic method or creative process? How do you create your artworks?

AG: I primarily work with mulberry paper

from Thailand, but I have hundreds of papers in my studio from all around the world. I treat the paper almost as a pigment, layering colors one on top of the other to create different colors.





Everlasting Urchin, by Amy Genser

Paper and acrylic on masonite, 18 x 36 x 1.5 inches

Gulf Coasting, by Amy Genser
Paper and acrylic on masonite, 18 x 36 x 2 inches



My pieces are about a foot wide. Then I roll one layer on top of the other in all different thicknesses. I seal the roll with acid-free, archival glue stick, and then cut the long piece into sections with scissors or pruning shears. I have pruning shears of all different sizes to accommodate different widths.

The rolling and cutting process is actually pretty quick. At this point I can pretty much do it in my sleep. It's the composition/editing process that usually takes the longest.

I paint my surface, either canvas or masonite board, with acrylic and a lot of gel medium. Then I place my paper pieces

on top and manipulate them until I have a satisfactory composition.

It's like putting a puzzle together, only I don't know the final picture until I see it. I roll my pieces accordingly as I develop and build the piece.

It's a back-and-forth process. The paper and the piece lay on different tables in my studio. I attach the paper onto the canvas with PVA once I have the pieces where I want them.

X-RAY MAG: What is your relationship to the underwater world and coral reefs? Are you a



Shallow End, by Amy Genser
Paper and acrylic on masonite,
18 x 18 x 1.5 inches

Amy Genser



Sea Kelp #1, by Amy Genser
Paper and acrylic on
masonite, 25 x 25 x 2.5 inches



Sea Kelp #2, by Amy Genser
Paper and acrylic on
masonite, 25 x 25 x 2.5 inches

AG: Because every viewer brings their own experiences to my artwork, they appreciate it on their own terms. I do have a lot of scuba fans. I hope my work brings an awareness of the beauty of water.

X-RAY MAG: What are the challenges and/or benefits of being an artist in the world today?

AG: My biggest challenge as an artist is to maintain my self-motivation, stay focused and inspired. I'm lucky that there is a demand for my work and my

schedule is steady.

I am also thrilled by the notion that I never know what project will be coming down the pipes next. I also get to work with great clients, galleries and art consultants.

X-RAY MAG: How do people respond to your works? What feedback or insights have you gained from the process of showing your work to various audiences?

AG: People are curious about my work and intrigued by the materiality and process. They are

scuba diver or snorkeler and how has this influenced your art? In your relationship with reefs and the sea, where have you had your favorite experiences?

AG: I have snorkeled since I was a kid. I love being in another world. I think it's about time I take the plunge and try scuba myself! I have spent time in the Caribbean and Hawaii.

X-RAY MAG: What are your thoughts on ocean conservation and coral reef management and how does

your artwork relate to these issues?

AG: My work indirectly relates to these issues. I seek to highlight the absolute beauty of the ocean. My thoughts on ocean conservation are that we should do everything in our power to protect the balance throughout our whole environment. But I do have a soft spot for our oceans and marine life.

X-RAY MAG: What is the message or experience you want viewers of your artwork to have or understand?

Sea Kelp #3, by Amy Genser
Paper and acrylic on
masonite, 25 x 25 x 2.5 inches

Sea Kelp #4, by Amy Genser
Paper and acrylic on
masonite, 25 x 25 x 2.5 inches



Installation by Amy Genser at
Nemour's Alfred I Dupont Hospital for
Children in Wilmington, Delaware,
45 x 9 feet

Amy Genser



Detail
view of
installation
(left inset)

drawn to the
bold colors and
compositions and
then become
involved with
the fact that it

is created from paper. A lot of people are surprised. They think it is clay or fabric.

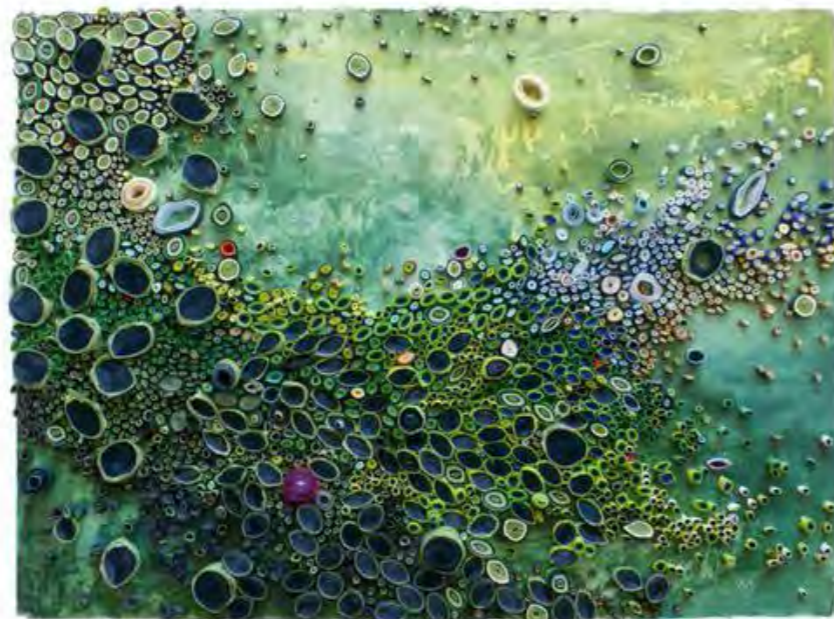
I love hearing people react to my work. Everyone sees something different, yet there are many similarities. Children love my work because it is colorful and bold.

I recently created a very large installation at a children's hospital in Wilmington, Delaware. I know that children at the hospital will be wowed by the colors and ocean-like feel.

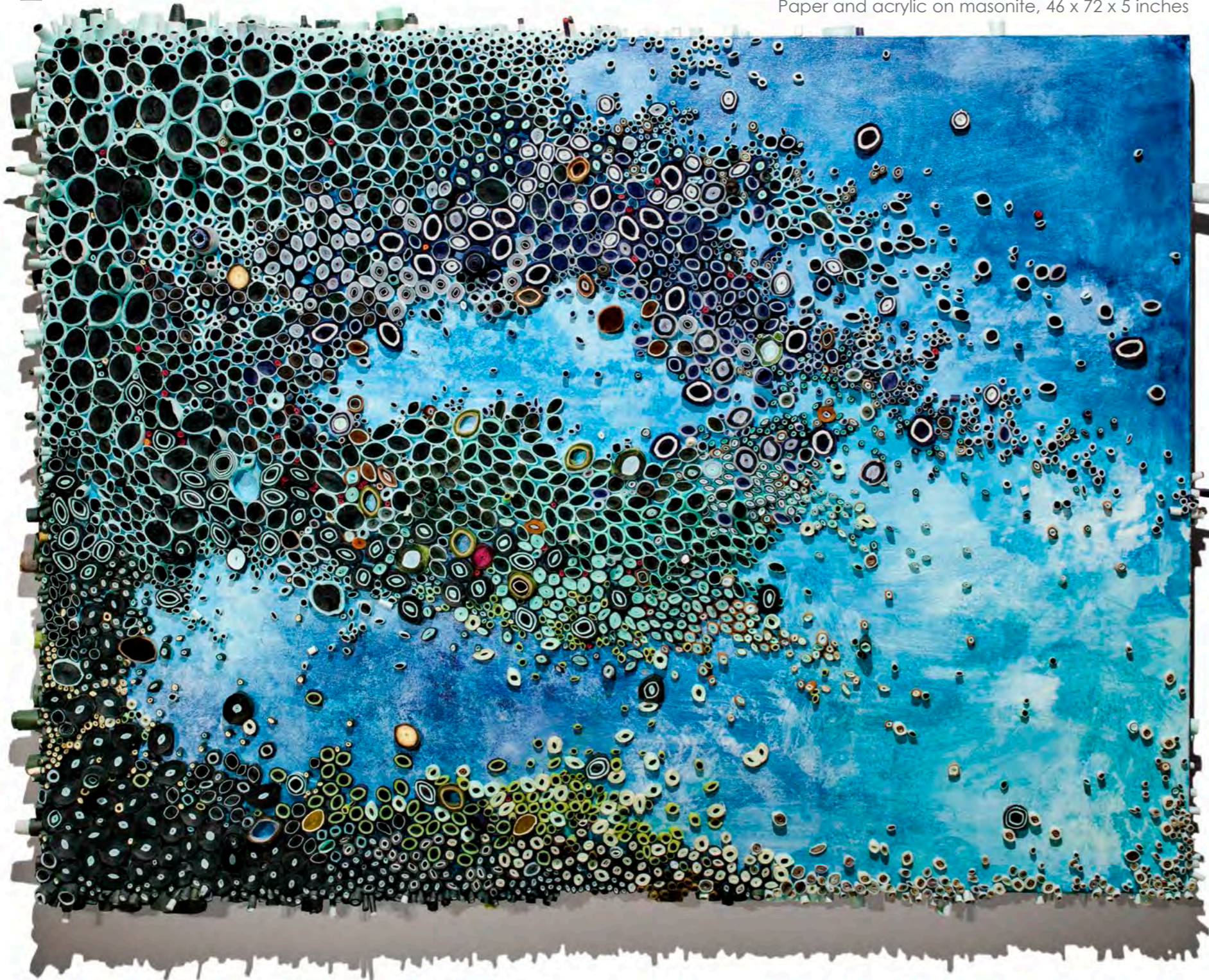
Children always find things in my work I didn't plan. They will see shapes and even letters.

X-RAY MAG: What are your upcoming projects, art courses or events?

Sea Glass Three
by Amy Genser
Paper and acrylic
on masonite,
24 x 32 x 1.5
inches each



Float, by Amy Genser
Paper and acrylic on masonite, 46 x 72 x 5 inches



AG: I am working on a number of residential commissions at the moment. I have a few shows in New York City in March and will be exhibiting throughout Europe with one of my galleries over the year. Please see my website for specifics or to be added to my mailing list.

X-RAY MAG: Is there anything else you would like to tell our readers about yourself and your artwork?

AG: Hopefully the visuals will speak to you! I'm happy to answer any questions you may have. If anyone wants to sponsor my visit to a specific area to

create a body of work... that would be my dream come true. ■

For more information, visit the artist's website at: www.amygenser.com.
Or go to her Facebook page at: www.facebook.com/amygenserstudio



Swish, by Amy Genser
Paper and acrylic on masonite, 36 x 54 x 3.5 inches