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Toyama Bay

Bahamas
Tiger Beach

WWI Wrecks
**Hospital
Ships**

Tech
**Training
Crisis**

Profile
**Jakub
Šimánek**

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COVER PHOTO: *Cave diver*, by Laurent Miroult
(www.cavediving.pictures)

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North Pacific giant octopus, Toyama Bay, Japan. Photo by Martin Voeller



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Reassessing Our Priorities

— and keeping a cool head

Who would have thought that the day would come when I would publicly state that there are more important things in life than diving. After all, the aquatic environment has been my passion and calling for as long as I can remember. I was that toddler on the beach collecting starfish and small crabs in my red bucket, the public swimming pool was my preferred playground after school, and I specialised in aquatic ecology for my master's degree, not to mention taking up diving early on and becoming an underwater photographer.

That day has now come. In these trying times, we have suddenly been thrust into a new reality laden with uncertainties, if not fear, for the short to long-term consequences of the coronavirus outbreak. We now need to reassess what is really important and dear to us—such as the well-being of others and keeping our societies working.

Sporting tournaments and major events such as the Olympics have been postponed along with many other sorts of gatherings while we wait this one out.

Diving can bring us so many joys, and it surely will again in the not-too-distant future. It is just on the short to medium-term that many activities must be halted in order to deal with the virus.

Diving will still be there on the other side of the outbreak—it is not going anywhere—at which point, dive operators will eagerly be awaiting divers, welcoming us all back as patrons. In the meanwhile, I am sure they will appreciate you letting them know that you intend to come back.

Meanwhile there are so many other meaningful activities to keep us busy. There are always plenty of things in need of a fix or an upgrade, as well as things to learn and preparations to be made for when business resumes normal operations—which it will.

So, stay cool and make the most of the situation. We are all in this for the duration.

In that regard, I have another plea: Please heed the advice from the proper authorities and listen and learn from the scientific community, those who know the most about the virus and the best way to deal with the situation.

In particular, resist sharing dubious news and "tips" on social media and from so-called influencers. Many of these are fake or unfounded and therefore potentially harmful.

Knowledge and sound judgement are our strongest weapons. In fact, they are our only weapons currently, as we do not yet have any vaccines against the virus itself, but we can restrict or sever its pathways.

A virus is little more than a stump of genetic code, just 30 genes in this case, in the form of mRNA, encased in a protective shell of proteins and lipids. It is such a simple structure that it is debatable whether it really is a lifeform at all. In any case, you may think of it as a biological automaton, a mindless machine that automatically follows a predetermined sequence of operations—a bit like the ghosts in the classic game of Pacman. We cannot stop them yet, but we can avoid them, and thanks to our scientific insights, which are increasing by the day, we are also able to change the playing field to some degree—hence, the restrictions and social distancing now in place.

Stay safe, keep a cool head and we will meet on the other side.

— Peter Symes
Publisher & Editor-in-Chief





Edited by
Peter Symes

from the deep
NEWS

Coral reefs in the Cook Islands are in good shape

The Khaled bin Sultan Living Oceans Foundation has published its assessment of coral reef health and resiliency in the Cook Islands.

Released earlier this month, the *Global Reef Expedition: Cook Islands Final Report* contains critical information on the health and resiliency of coral reef ecosystems in the Cook Islands.

Many reefs in good shape

The report contains a comprehensive summary of the research findings from the Global Reef Expedition—the largest coral reef survey and mapping expedition in history. Scientists on the expedition found that many coral reefs in the Cook Islands were in good shape, with high coral cover and diverse and abundant fish communities. For the most part, reefs in remote areas tended to be healthier than those near population centers.

COTS a problem

But while the reefs surrounding Palmerston Atoll were healthy, and the reefs in Rarotonga were doing all right, Aitutaki's corals were being ravaged by

an outbreak of crown-of-thorns starfish (COTS). The reef was in crisis. In some places in Aitutaki—one of the more popular island destinations in the Cook Islands—crown-of-thorns starfish had

damaged 80-99 percent of coral on the seafloor. "We couldn't help but intervene," said Alexandra Dempsey, the director of science management at the Foundation and one of the report's authors.

Over the course of a few days, scientific divers on the Global Reef Expedition collected 540 COTS from reefs around Aitutaki. When scientists later returned to Aitutaki, they noted that healthy fish populations and a diverse coral community allowed new coral to settle and grow on damaged reefs, beginning the process of recovery.

The Cook Islands is regarded as a global leader in marine conservation, most notably for establishing Marae Moana marine park and expanding it to include all of their waters. The development of a zoning plan for the marine protected area is currently underway to determine which activities will be allowed where. ■ SOURCE: KHALED BIN SULTAN LIVING OCEANS FOUNDATION



KHALED BIN SULTAN LIVING OCEANS FOUNDATION

Coral Reefs in the Cook Islands



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Edited by
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Dive shows postponed or canceled due to COVID-19 pandemic

As countries around the world continue to try to halt the rapid spread of the coronavirus COVID-19, which was declared a pandemic by the World Health Organization (WHO) on 11 March, increasing travel restrictions, border closures, quarantines, curfews, facility closures, gathering restrictions and social distancing measures have led several dive shows and ocean expos to postpone or cancel their events.



Dykmässan, which was supposed to be held

March 14-15, 2020 in Gothenburg, Sweden, is postponed until August 22-23, 2020. For more information, please visit: dykmassan.se.



Oceanology International, which was supposed to be held March 17-19, 2020, in London, United Kingdom, is now postponed until December 1-3, 2020. For more information, please visit: oceanologyinternational.com.



Beneath the Sea, which was supposed to be held March 27-29, 2020, in Secaucus,

New Jersey, USA, is postponed to October 9-11, 2020. The organizers have confirmed that all tickets sold for the March show will be honored for the rescheduled dates in October. For more information, please visit: beneaththesea.org.



More Aqua Show (MAS), which was supposed to be held March 27-29,

2020, in Madrid, Spain, is postponed until February 12-14, 2021. For more information, please visit: feriamas.com/en.



Asia Dive Expo (ADEX), which was originally supposed to be held April 17-19, 2020, in Singapore and

then moved to May 29-31, 2020, is now postponed until further notice. For more info, go to: adex.asia. In response to the challenges of the coronavirus crisis, organizers are now developing an online platform, ADEX Pixel Expo, and invite exhibitors, speakers and industry partners to participate. For more information, please visit: adex.asia/pixel.

TEKDiveUSA, which was supposed to be held April 24-26, 2020, in Orlando, Florida, USA, has been moved forward a year. The confer-



ence will now take place April 16-18, 2021. All exhibition spaces, sponsorships, attendee tickets will be honored at the rescheduled conference. For more information, please visit: tekdiveusa.com.



Diving Resort Travel Expo (DRT) in Taiwan, which was supposed to be held May 29-31, 2020, in Taipei, has been canceled.

For more information, please visit: drtexpo.com.



Deep and Extreme Indonesia (DXI), in Jakarta, Indonesia, has been postponed until June

4-7, 2020. For more information, visit: deepandextremeindonesia.com.



Australia International Dive Expo (AIDE), which was supposed to be held in conjunc-

tion with the Sydney International Boat Show in Australia from July 30 to August 3, 2020, has now been canceled. For more information, visit: australiadiveexpo.com. ■





Diver at the stern of the WWI hospital ship *Lanfranc*

Text and photos by Steve Jones

In World War I, unrestricted warfare meant ships that were traditionally off limits became targets for surprise attacks by German U-boats. Steve Jones visits two of the most endearing wrecks in the English Channel that were a direct result of this highly controversial policy.

An upright stern emerged through the grey-green water around 10m below me. The last time I visited this wreck on a cold October day, I was in total blackness at this depth, but today was different and the high sun overhead at last revealed the HMHS *Lanfranc* in its full glory.

Our group of divers paused for a moment to gain our bearings, an easy job with the shot line placed squarely on the rear of this huge ship. As we hovered, a large school of pouting (one of the cod family) swam around us, hiding the wreck from our torch beams and only parting as we began our long swim forward.

We resisted the opportunity for further exploration at the stern. Here, it was possible to enter the ship through a missing skylight and descend several deck levels to the dining area, but we wanted to see the entire ship, and even with a long slack water period, it would take an

entire dive to get end-to-end. *Lanfranc* is one of those wrecks you need to visit multiple times.

History of *Lanfranc*

The *Lanfranc* was a 6,287-ton former liner built in Dundee and commissioned by

the British government in 1915 to serve as a hospital ship. On 17 April 1917, she set off in full Red Cross markings from Le Havre for Southampton with over 500 on board, including 387 patients from both Britain and Germany. However, less than a third of the way through the

journey and with no warning, a torpedo from UB-40 slammed into the port side between the engine room and the number 3 hold, causing a huge explosion.

Lifeboats began to be lowered once *Lanfranc*'s speed had slowed, but the horror continued as one immediately

Hospital Ships

— Casualties of WWI



wreck rap



Lanfranc is a huge wreck that needs several dives to fully appreciate (right); Diver exploring the scattered deck machinery on Lanfranc (below)



sank, throwing the occupants into the sea from where they were picked up by other boats. *Lanfranc* had only an hour left afloat, and in rough seas, the escorts put themselves at great risk to get the survivors off, and their quick action limited the loss of life to 34.

Lanfranc's assailant, UB-40, continued to wreak havoc amongst Channel shipping, sinking around 100 ships during its career, including a number of well-known wrecks on

remains of the decking, which had started to collapse inwards. Near the area of the impact damage, we saw some of the ship's contents scattered on the seabed at around 50m depth. With this wreck lying in French waters, the removal of artefacts is strictly forbidden.

As we proceeded toward the front deck, which was further twisted to starboard, the lines of the ship became recognisable again. Careful to avoid

the southern coast of England, such as the *Salsette*. It was eventually scuttled in October 1918 during the evacuation of Belgium.

Diving the wreck

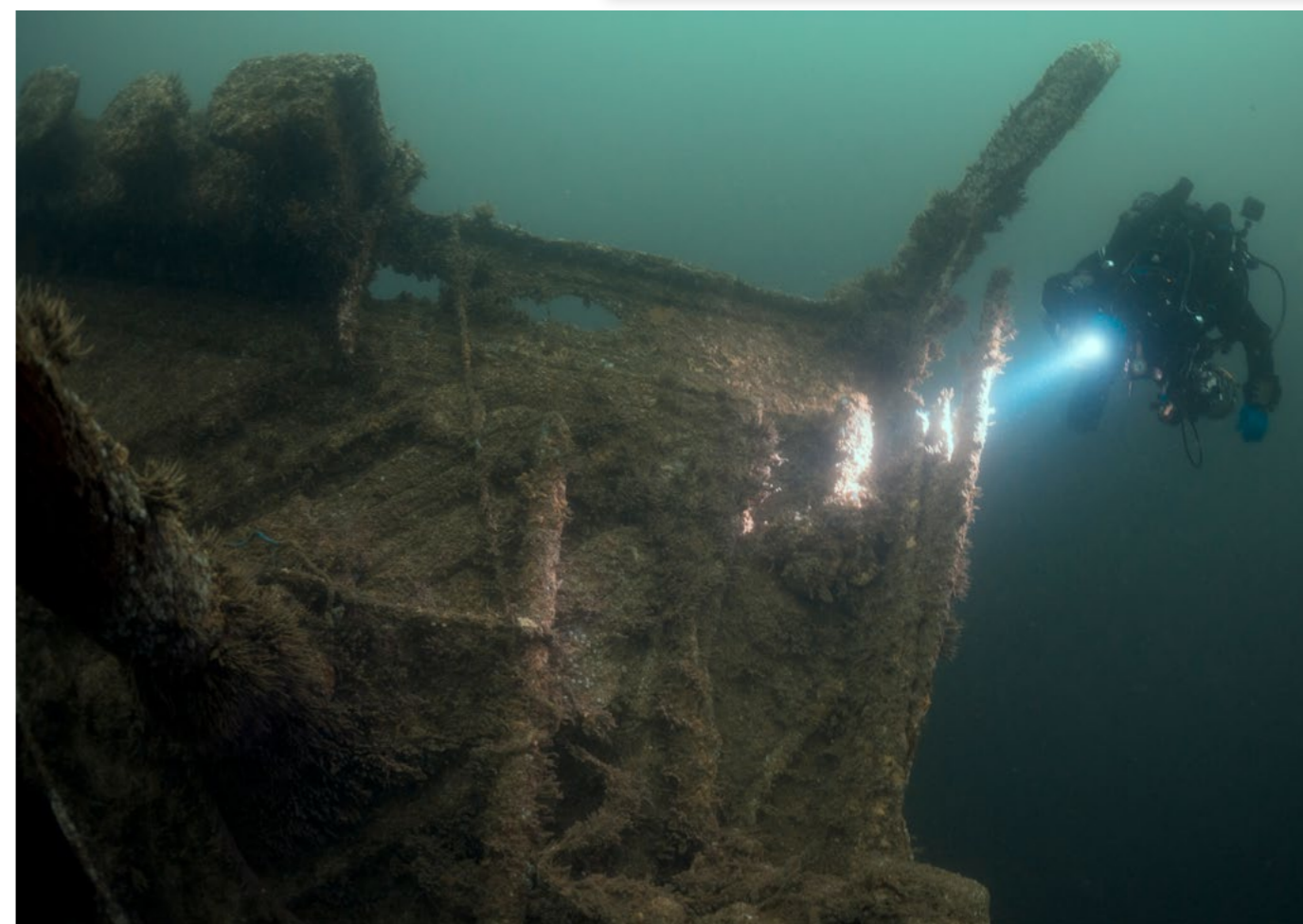
Continuing our dive, we swam forward to amidships where the wreck begins to twist. Here, we found machinery and fittings amongst the

the snagged trawl nets in the steadily increasing current, we drifted off the wreck at the point of the bow and commenced our ascent with our slack water window now firmly at an end.

Unrestricted U-boat warfare

That month of *Lanfranc's* sinking, April 1917, became the worst of the entire war for allied shipping, following an already disastrous March, during which 25 percent of all inbound shipping had been sunk. The resumption of "unrestricted" U-boat warfare on 1 February had been a gamble for Germany, which had to balance the increased damage to Britain's shipping against the risk of incurring the wrath of the United States, currently still out of the war.

Normal rules of engagement, which required U-boats to surface and assure the safety of merchant crews before sinking the vessel, were viewed by German command as particularly dangerous for the submarine crews since escort vessels frequently accompanied merchant ships and the merchantmen themselves were often armed



Diver at the distinct bow of *Lanfranc*



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Diver at vent funnel (above); Bollards visible amongst wreckage on the *Lanfranc* (left); The forward anchor winches are amongst the most spectacular sights on this endearing wreck (lower left).

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with a bad harvest, it would quickly knock Great Britain out of the war.

With 500,000 tons of shipping sunk in both February and March, which increased to 860,000 tons by April, it left only six weeks of wheat supply left. Yet the gamble failed, Britain persevered, and by late March, seven US ships had been sunk, thus straining German-US relations beyond breaking point. On 6 April 1917, US President Woodrow Wilson declared war on Germany, and even though losses remained high throughout 1917, the introduction of trans-Atlantic convoys slowly brought the situation back from the brink of disaster. All in all, over six million gross tons of allied shipping was lost that year.

Rules of engagement

The propaganda war between Britain and Germany clouds some of the facts that surround *Lanfranc's* sinking. Under the Hague Convention, if an enemy suspected a hospital ship was being used for other military pur-

with guns that could easily damage a fragile U-boat. It was believed these restrictions greatly neutered the effectiveness of the U-boats, and after

much consideration, Germany put faith in unrestricted warfare whereby submarines could attack without surfacing, hoping that in conjunction



This huge wreck lies between 36 and 52m depth.





Diver exploring the forward sections of *Lanfranc*

poses, they had a duty to warn the ship and a right to inspect to determine compliance. However, Germany attempted to justify the sinking-without-warning of hospital ships by claiming they were being used to transport troops and ammunition over to France.

They had already declared such ships would be targeted, and *Lanfranc* had actually been withdrawn by Britain from the official list of hospital ships at the time of its sinking. Yet it cannot be disputed that it was carrying the Red Cross markings and was acting as a hospital ship, returning from France with wounded when it was targeted. With their bright, easily identifiable livery making them vulnerable rather than offering protection, the designation of many hospital ships operating in the Channel was changed to

"ambulance transports," which were better camouflaged, defensively armed and could travel in convoy, yet still carry wounded. Survival rates improved, but there were still casualties and in August 1918, the Australian ambulance transport *Warilda* was sunk.

Diving the *Warilda* wreck

Also lying mid-Channel, a good three hours motoring from the southern coastal town of Brighton, *Warilda* is a substantial 125m long wreck that vies with *Lanfranc* for which is the better dive. The pair make an ideal two-day trip with a pleasant overnight stop in Fécamp, France.

Our group of divers descended to find the shot line lying on the hull near the seabed at 50m depth, so we made our way back to the deck, which we

could see right across, with visibility on this July day exceeding 15m. Ambient light levels matched those normally seen at far shallower depths. The ship's railings glistened with orange and white anemones, surrounded by shoals of fish in a scene that was reminiscent of climates far warmer.

History of *Warilda*

SS *Warilda* entered the war as a transport ship in 1915. At 7,713 tons, she was capable of carrying thousands of troops. In July 1916, she was converted to a hospital ship and subsequently made over 180 trips in this role, carrying thousands of patients. After several near misses in early 1918, *Warilda* met her end on 3 August when she encountered the UC-49 at the surface whilst en route



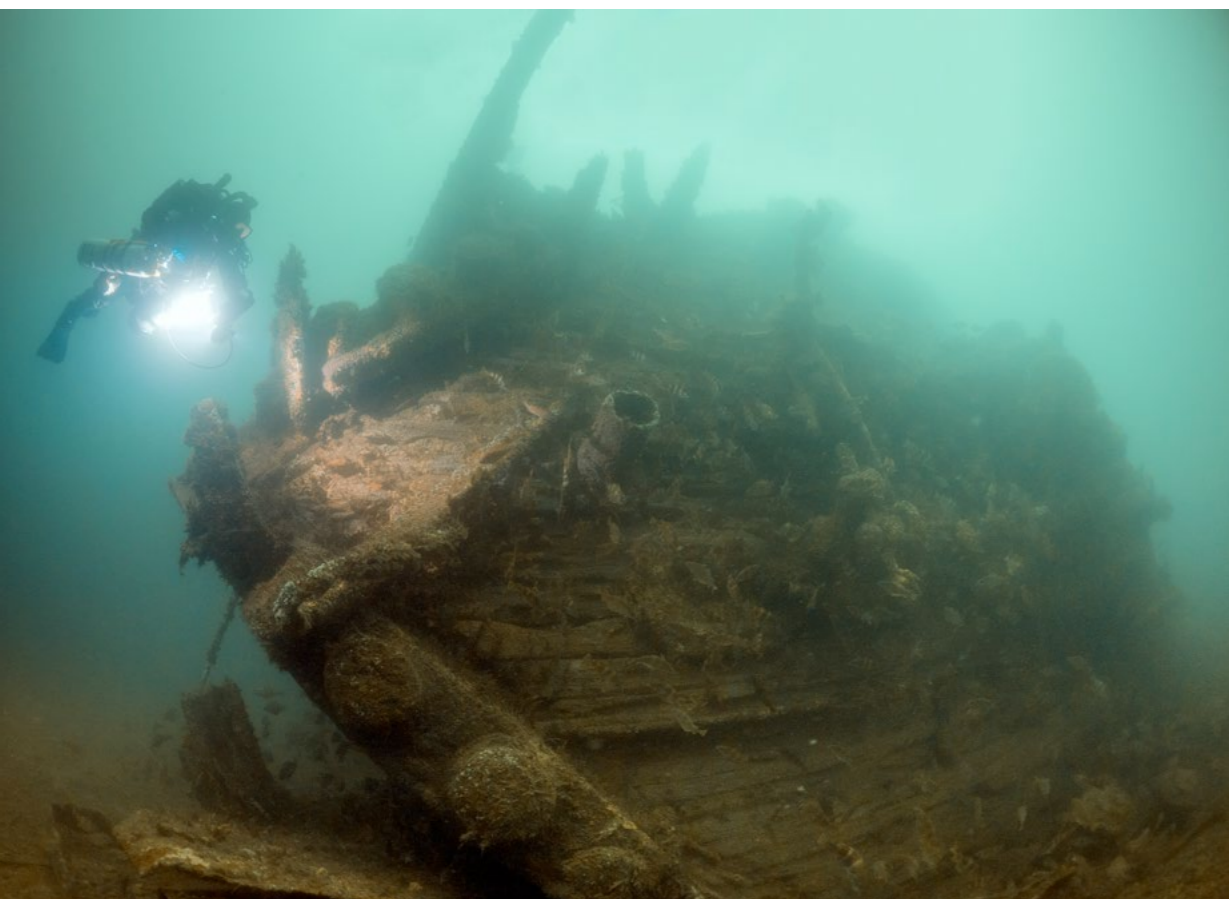
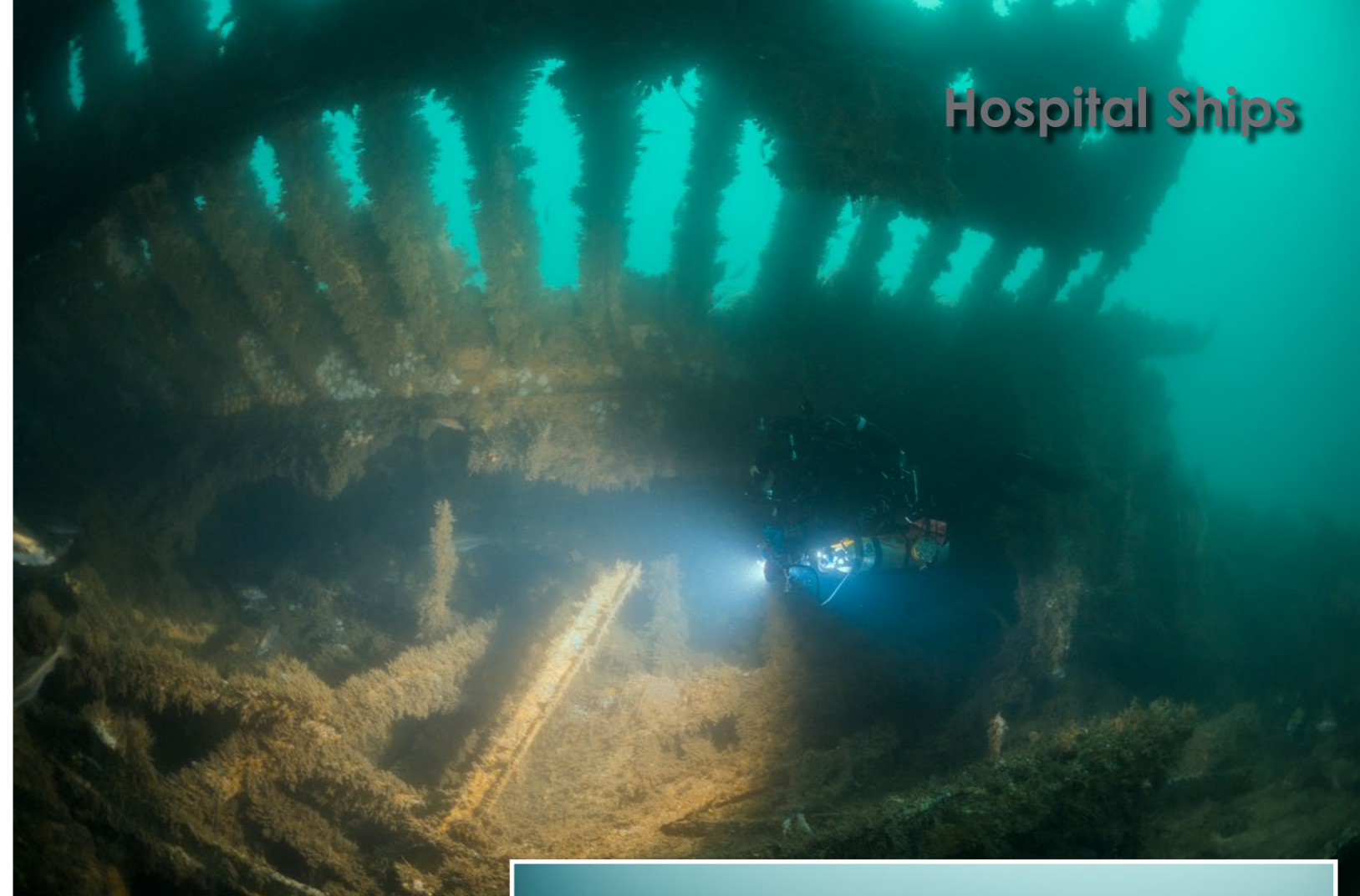
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Hospital Ships



Exploring the keel (top left) and the forward sections (top right) of *Warilda*; Wreckage on *Warilda* near where the superstructure once stood (right)

from Le Havre to Southampton. *Warilda*, which was carrying 801 on board, tried to ram the U-boat unsuccessfully but UC-49 returned a torpedo that struck between the engine room and the number 4 hold, immediately killing 101 patients.

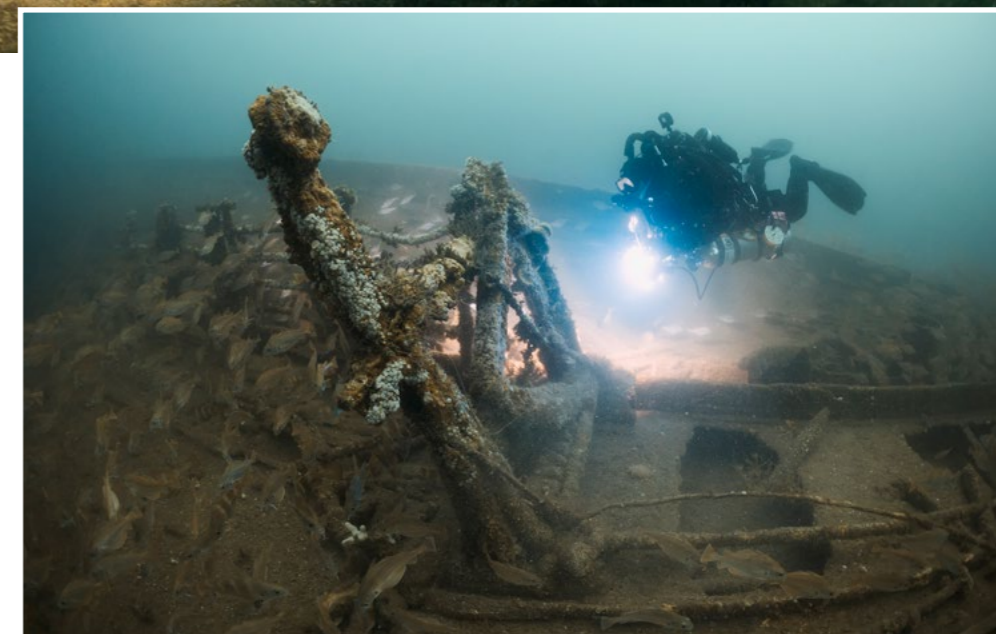
A survivor quoted by *The Times* on 6 August 1918 described the bravery of those on board: "It was a good thing that everybody kept their heads. The medical officials were magnificent; indeed, the whole of the staff did fine work in bringing the wounded men from the wards to the deck. Man after man had to be carried just as he lay in his cot and it was a very trying task to get them into the boats."

Aid came from two escort ships. Had the *Warilda* not been able to stay afloat for several hours, many more lives would have been lost than the 123 that did not survive. *Warilda's* assailant, UC-49, was also about to meet its fate, with the *Warilda* being the last ship sunk by this U-boat. Following

two further attacks, which damaged the *Tuscan Prince* and the *Portwood*, UC-49 was depth-charged by the destroyer HMS *Opossum* off Berry Head, Devon, and was lost with all hands five days after the attack on *Warilda*. It was the first U-boat successfully hunted with the use of hydrophones and the last one sunk in the Channel by surface vessels in World War I.

Diving the wreck site

The wreck of *Warilda* lies on its port side and it is big! In places, it stands nearly 10m from the seabed. As we headed forward, cavernous open sections of the wreck



invited further exploration. The area where the bridge once stood was a mess of tangled metal, but the bow quickly became recognisable, being quite intact and lying on its side.

From here, the journey to the stern was a long one. With there being so much to explore along the way, we took our time, since the rear of the ship could always

The spectacular bow of the *Warilda* is an unforgettable sight.





Deck remains on the *Warilda* (left); These offshore wrecks are a haven for marine life (above and bottom left).

Afterthoughts

Thirteen allied hospital ships were torpedoed in World War I, along with several more on all sides lost to mines, including the most famous of them all—the *Britannic*. Yet even after Germany declared its intentions to target these ships, there were several examples where U-boat commanders chose not to attack, as humanity prevailed against their orders. Whilst the wisdom of hindsight reminds us of the titanic struggle between nations that was raging at that time, these orders went against the Hague Convention and were instructed by a group of men in high command who were suitably distanced from the immense suffering they would unleash on the helpless. Only history can judge the men who gave these orders. ■

The author gives special thanks to Terry Ayling for his tireless modelling, lighting assistance and endless patience.

Steve Jones is an underwater photographer and journalist whose award-winning work has been published in over 30 countries during a career spanning three decades. A true all-rounder, his assignments have included colossal battleship wrecks in the deep north Atlantic and sub-zero encounters with apex polar predators to equatorial seascapes awash with strong currents. He is a Blancpain Edition Fifty Fathoms photographer, a field editor at the Ocean Geographic Society and a member of the Ocean Artists Society. His thoroughly researched writing covers both maritime history and marine ecology. Learn more at: millionfish.com or Instagram @photostevejones.

HOW TO DIVE THE WRECKS:

Launch from Brighton
Contact: Steve Johnson, owner
Channel Diver
channeldiving.com

Overnight trips with a stay in Fécamp can be arranged to dive both wrecks or each wreck can be done on a single (long) day trip.

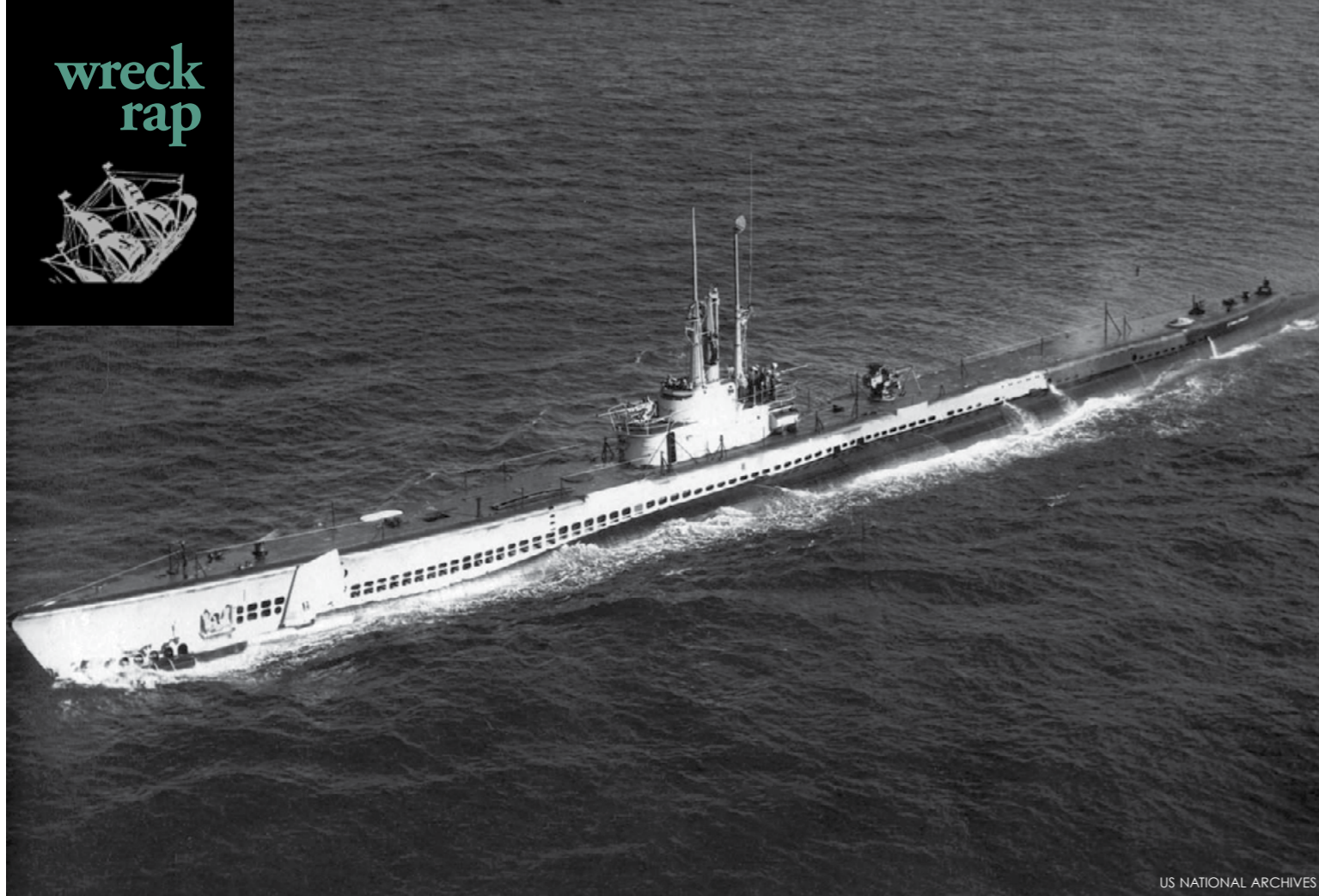
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wait for another dive. The seabed right along the length was strewn with wreckage. Although the superstructure had collapsed, recognisable features such as railings and deck machinery were commonplace.

Marine life was profuse throughout the entire dive. In addition to the masses of fish, lobsters or congers seemed to peer from every hole. Had we made it to the stern, we might have found a 4-inch rapid fire deck gun, one of the features that distinguished the ambulance transport from an unarmed hospital ship. The wreck of the *Warilda* is a dive site that once visited will not be forgotten.

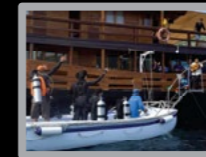


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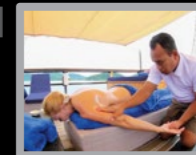
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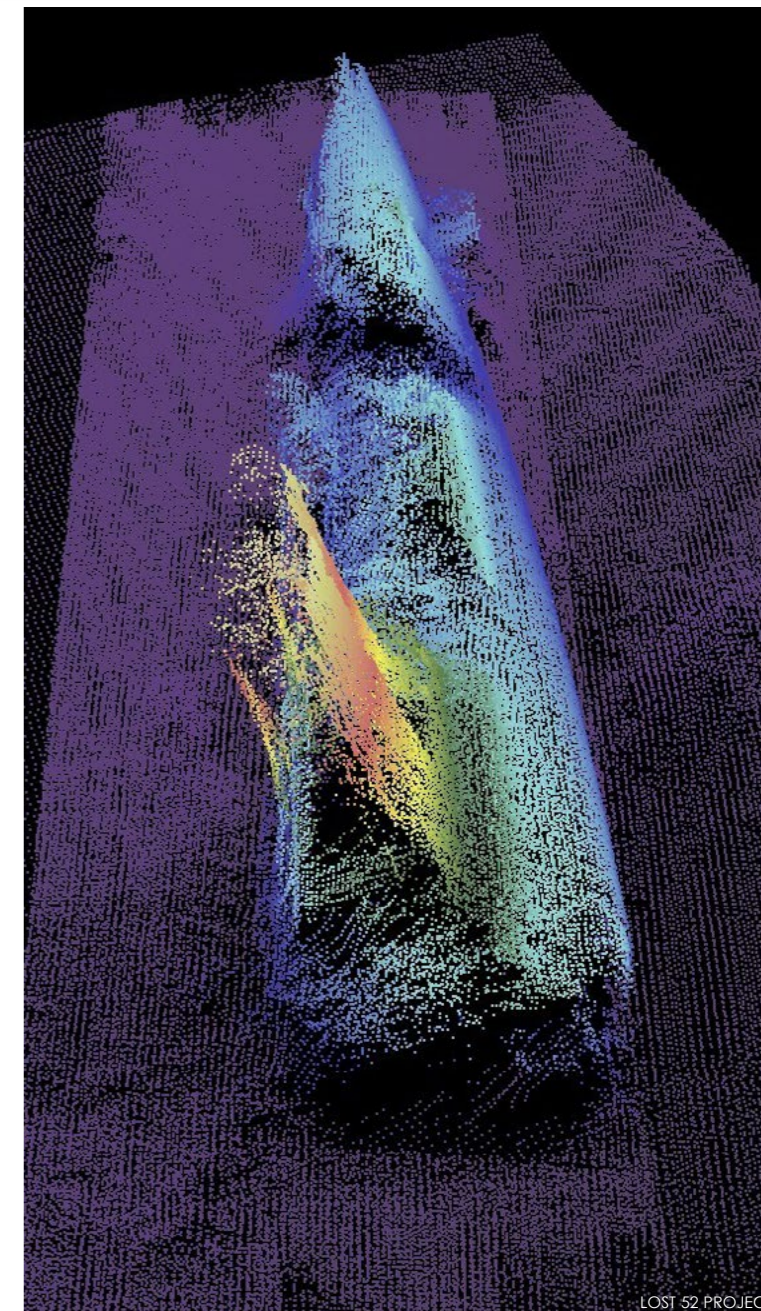


CAMERA ROOM

Dedicated camera room with charging station

USS *Stickleback* is the third submarine to be discovered of the four US Navy submarines lost since the end of WWII.

Sonar scans show the wreck is broken in two parts on the seafloor. This scan shows the submarine's conning tower and bow section.



LOST 52 PROJECT

WWII-era submarine USS Stickleback located off Oahu

The USS *Stickleback* sank on 28 May 1958, after an accidental collision with destroyer escort USS *Silverstein* during a Cold War-era antisubmarine warfare exercise. The submarine was discovered by the Lost 52 Project, a private group based in New York, which hopes to find all 52 of the missing US submarines that sank during World War II, and all four US submarines that sank during the Cold War.

During an antisubmarine warfare exercise with the destroyer escort USS *Silverstein* (DE 534) in 1958, the submarine had just completed a simulated torpedo run on USS

Silverstein and was diving to a safe depth when she lost power and descended uncontrolled to close to 800ft. Emergency buoyancy ballast was added, and she ascended rapidly only to breach approximately 200 yards (180m) ahead of the destroyer, which could not avoid a collision and the submarine suffered a devastating hole on its left side.

Luckily, the entire crew of the *Stickleback* escaped onto the *Silverstein* and other ships nearby, and everyone survived. Combined efforts were made by several vessels to save the submarine, but all compartments flooded

and USS *Stickleback* sank in 1,800 fathoms (3,300m) of water.

Robert Neyland, the head of underwater archaeology for the US Navy's Naval History and Heritage Command (NHHC), said the Lost 52 Project knew the general location of where the *Stickleback* sank in 1958, but they had to search the surrounding seafloor to find the wreck. The great depth of the wreck (over two miles beneath the surface), and the fact that its precise resting place was unknown, allowed the submarine to elude discovery until now. ■ SOURCES: LIVESCIENCE, PRNEWswire, LOST 52 PROJECT

THE AIRPLANE GRAVEYARD
The Forgotten WWII Warbirds of Kwajalein Atoll
BRANDI MUELLER ALAN AXELROD

Never before published in book form, see extraordinary images of the forgotten American WWII airplanes resting on the bottom of the Kwajalein Atoll lagoon, from award-winning underwater photographer Brandi Mueller. Available on: Amazon.com



Edited by
Peter Symes

The US Diving Equipment and Marketing Association (DEMA) posted five ways one can keep a dive business relevant during the coronavirus crisis, plus free graphics divers can share to help support their local dive store. Click on the graphic or go to: dema.org

WAYS TO SUPPORT YOUR LOCAL DIVE STORE DURING THIS TIME

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Dive operators grapple with coronavirus outbreak as demand collapses

As the outbreak of the coronavirus COVID-19 has now grown to become a declared worldwide pandemic, causing an increasingly alarming human toll and suffering reported in the media daily and leading to widespread travel restrictions, social distancing requirements and bans on public arrangements and congregations of larger groups, many dive operators across the world are now left with no guests and bookings that have either been outright cancelled or deferred to some later date.

While various governments, as of writing this, are mulling over various subsidies or bailouts to tide over whole sectors of business to the other side of the coronavirus outbreak, much uncertain-

ty and concern for the future remains at this juncture among operators with whom *X-Ray Mag* has spoken about the matter.

Reactions to economic impact
Running a dive operation in a remote exotic location, many of which are in developing countries, generally means that one is also far away from any subsidies. Several of the operators with whom we have enjoyed long-standing business relationships are now fighting for their very survival, which is of course very disconcerting also on a personal level, as we have gotten to know many of these people well—the dive industry is not that big. Some operators, who remain open, are offering deep discounts on bookings and/or very lax cancellation policies and money-back guarantees.

Others still are battering down the hatches and entering a state of hibernation for some months in an attempt to wait out the outbreak. The reactions and offers vary widely, so if you are planning or hoping to go on a dive trip in the

near future, check in with your choice of operator and do it frequently as the situation may change on short notice.

It is going to be tough—there is no point in sugar-coating it. The dive industry is now facing its worst crisis ever, and the segment that works with hospitality, such as dive operators, resorts and liveboards, is in for a real beating. Dive gear manufacturers appear to be affected too, by association and by the general economic collapse, but that is other side of the story.

As this publication goes to press at the end of March, it appears that the uncertainty itself and the open-endedness of the current situation has led to some panic and perhaps kneejerk reactions, which are inflicting further damage on top of the actual loss of business. It is therefore the hope and expectation of this magazine that the pandemic, which started in Asia and swept westward, will not only pass as a crudely predictable wave in the matter of a few months, but that far more reliable and accurate projections as to when this crisis will blow over can be

made within a few weeks. However, as there is no vaccine yet for COVID-19, it is prudent to also expect that clusters of coronavirus may reappear later.

Light at the end of the tunnel

In the days and weeks to come, more and more data will be collected against which models can be validated, because greater numbers of people will have been tested as more test facilities and testing kits are produced and authorities begin widespread testing—a strategy which seems to have worked well in Taiwan. There are reports that recovery from COVID-19 may be confirmed through antibody testing, after which parts of populations may be able to return to work and some travel restrictions may be lifted. Indeed, some travel bans are already being lifted in some areas of China. At this point, affected businesses will hopefully be able to estimate and possibly plan when they can resume their operations and start taking bookings and orders again. ■ SOURCES: BBC, NEWSIDENTIST

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Interview with Andrea Donati

— Pioneering Technical Diving on Ponza for 30 Years

Andrea Donati (left) and his partner, Daniela Spaziani, run Ponza Diving, which is located in the main harbour (above) of Ponza Island in Italy.

In my line of work as a dive industry professional, I attend a lot of dive shows and get to meet a lot of people, most of them nice and interesting in various ways. It was also at a dive show in Italy, many years ago, that I first met Andrea Donati and his partner, Daniela Spaziani, of Ponza Diving. I clearly remember my first impression of how sympathetic, unpretentious and genuine the two came across, which scores a lot of points in my book. They appeared competent and organised, and with their operation located in one of the most picturesque locations I have ever seen, it did not take any arm twisting to lure me down there for a visit.

Text and photos by Peter Symes

The world is dotted with beautiful locations, and there exist many excellent dive operations across the globe that also rightly deserve praise and accolades for the adventures and wildlife encounters they offer their patrons and for the way they manage their dive centres—and we will probably get more into that in the

future. This profile will be about the virtues of diving Italian-style, as Ponza Diving marks its 30th season.

PS: Please reflect on your three decades of operations and the evolution you have witnessed in the dive industry.

AD: In 1991, when we first started, I recall divers as being more passionate and

driven, and adapting more readily to the services we could offer in those times. Of course, diving equipment was not so sophisticated at that time. We dived only with air, no nitrox, no trimix and no oxygen for decompression and little knowledge about decompression. There was more risk then. Over the years, we have obviously expanded and improved our services, and we are now able to

accommodate a wider range of requests and needs of customers.

We started off with just a 6m dinghy, a compressor and 20 tanks, but already in the first year, I bought another dinghy, another compressor and more tanks. Then in 1993, I came across an opportunity to buy a 12m fiberglass boat. That was the first time I operated a dive boat, and it was not easy to get the hang of

anchoring it. In hindsight, I now consider mooring essential for a successful dive.

Year by year, the number of divers increased, and I kept reinvesting in the operation. In 1998, I bought the *Nettuno*, a 16m former fishing vessel, and converted it into a dive boat. It was always my objective that divers should not be required to change their tanks, so having compressors on board was a require-





ment. A wooden boat is fantastic but requires expensive maintenance, so I ended up selling the *Nettuno* in 2014 and buying an 18m boat with a fiberglass hull instead. We named it *Nettuno II* and spent four months over the winter building and outfitting this new vessel, which is bigger, faster, has more safety and is more comfortable than the older one. I enjoy a good relationship with Coltri Compressors, so we have fitted the boat with two MCH 23 compressors to refill tanks between dives.

PS: If you were to give your 30-year-younger self some advice, what would it be? Would you have done anything differently or not at all?

AD: In retrospect, I feel pleased with our accomplishments, our growth and that we have managed to offer cutting-edge service while specialising in rebreathers. It was hard during the first few years, in particular, but I was 30 years younger, physically stronger and more carefree—but certainly also less experienced.

PS: Why did you set up shop on Ponza Island of all places?

AD: I completed my Open Water Diver course in 1987, and from that moment, I kept diving whenever I got the opportunity. I first dived off Ponza in 1988, and I took to the underwater dive sites here, the clear water, natural arches, walls and a lot of shoals between Ponza, Palmarola and Zannone Island. I wanted to make a living out of diving, so in 1990, I entered into an agreement with a gentleman from Ponza who rented me the shop.

PS: At some point you decided to also become a technical diving facility. How and why did you arrive at that decision? When did you begin offering technical dive training?

AD: I always intended to explore deep-diving techniques as a means of discovering new dive sites. So in 1998, I started studying and signed up for technical diving courses using open circuit. I soon adapted our refilling station with a control unit for mixed gases and booster

pumps. In 2003, I switched my attention to rebreathers, using semi-closed rebreathers at first. But once the first Inspiration CCR became available, I focused my training on closed circuit and became an CCR instructor for Inspiration. I also tried other rebreathers but ultimately ended up with the JJ-CCR, which, in my opinion, is the best performing rebreather and comes with the best features for my needs. I was certified in 2012, and later, became an instructor, dealer and certified service centre for JJ-CCR units.

PS: What do you consider your greatest achievements or successes?

AD: It gives me great satisfaction that we have established ourselves and become known as a dive operation specialising in closed circuit divers and that the number of requests for courses keeps increasing year after year.

PS: Have you had any students whom you felt were not fit—mentally, physically or otherwise—to become a technical



Guest speakers give a presentation at the 2013 international Rebreather Meeting hosted annually by Ponza Diving Center in Italy (above); Ponza Diving Center's dive boat, filled to the gills with technical diving gear (left); Ponza Diving Center's dive boat takes divers out to a dive site, with the picturesque village of Ponza in the background (top left)

diver, or with whom you felt otherwise too uncomfortable about assuming responsibility for their training? How do you assess and handle these situations?

AD: It is never easy to explain to a hopeful diver who wants to sign up for a technical course that perhaps he or she is not adequately fit or capable of what is required in deep diving and decompression types of diving. It is not so much a question of physical capability but mental issues such as anxiety or limited capacity for managing problems underwater.

When I conduct courses on JJ-CCR, the

first thing I emphasise is that closed-circuit diving is not for everyone. It requires a certain attitude, attention and awareness.

PS: You have now conducted a series of international Rebreather Meetings. (Editor's note: See report in issue 92 at <https://xray-mag.com/content/ponza-rebreather-meeting-2019-dive-learn-eat>). Why did you decide to arrange these? Do you think or feel they have helped in building an international awareness about your operation?

AD: As I mentioned before, I have dedi-



PHOTO COURTESY OF PONAZA DIVING



US AIRFORCE / WIKIMEDIA COMMONS / PUBLIC DOMAIN

the leading hyperbaric doctors Pasquale Longobardi, Corrado Costanzo, Simon Mitchell, Neal Pollock and Alessandro Marroni. We have had experts and rebreather designers such as David Thompson and Jan Petersen; technical diving instructors and writers such as Mark Powell; and equipment manufacturers such as Tomasz Stachura of Santi and Lynn and Bruce

Partridge of Shearwater Research. During these meetings, there were daily dives after which divers were monitored with a doppler detector and clinical tests were performed as part of research conducted by doctors from DAN Europe.

PS: What are you doing to make your operation more known outside Italy and to attract dive travellers from other countries?

AD: Ponza is a fairly remote island, so we have organised transfer services from airports in Rome and Naples to the harbour in Ponza to make transit as easy as possible.

sible. We are also advertising in foreign magazines and have constant advertising on social media.

PS: What are your hopes and ambitions for yourself and your dive operation for the near and far future? What unfulfilled potential do you still see and how do you plan to go about realising your plans?

AD: I am hoping that the coronavirus outbreak will end soon. In 2021, we will celebrate the 30th anniversary of Ponza Diving on the island and conduct the eighth edition of the Rebreather Meeting. That aside, I would just like to continue with the training of CCR divers, because I believe it is the right and natural evolution in the experience of the most passionate and experienced divers.

PS: Is there an Italian style or way of diving?

AD: The dive is an important part of the day, but it is also combined with socialis-

ing, good food and enjoying a nice day out on a boat like the *Nettuno II*.

PS: If you are to dive just for your own pleasure, what kind of dive do you prefer?

AD: I just like being in the water, but wall diving is my favourite. I also prefer CCR diving, as I find it safer and it offers better performance than open circuit.

PS: What was your most memorable dive to date?

AD: In 1995, with the help of local fishermen, we located the wreck of a Douglas A20, a warplane from WWII, at a depth of 60m. This was one of the most stimulating dives ever, and the type of dive that initially fuelled my desire to venture into technical diving.

Sunset over Ponza Island (above); Ponza Diving's new dive boat, the *Nettuno II* (top left), is more spacious (left); Andrea's partner, Daniela Spaziani, at work at Ponza Diving Center (center inset); One of Andrea's favourite dives in Ponza was on a newly discovered wreck of a Douglas A20, a WWII warplane (bottom left).

PS: Which personal learning experiences, classes or education has meant the most to you?

AD: Since I started diving in 1987, I have found it is an activity where one never stops learning.

PS: Do you have any role models or mentors, or people you admire, who have inspired you in business... or in life?

AD: I have had many instructors who have taught me a lot, and I owe them many thanks. A special mention has to be made of David Thompson who has been a key instructor in my understanding, and later teaching, of JJ-CCR rebreathers. I was also so fortunate to have a very good instructor for my own open water course in 1987, and it just so happened that he then became my student on a JJ-CCR course in 2019, which brought great satisfaction. ■

Learn more at: ponzadiving.com



Japan's Toyama Bay

— *Mystical Home of Squids* — *Big & Small*

Text and photos by Martin Voeller



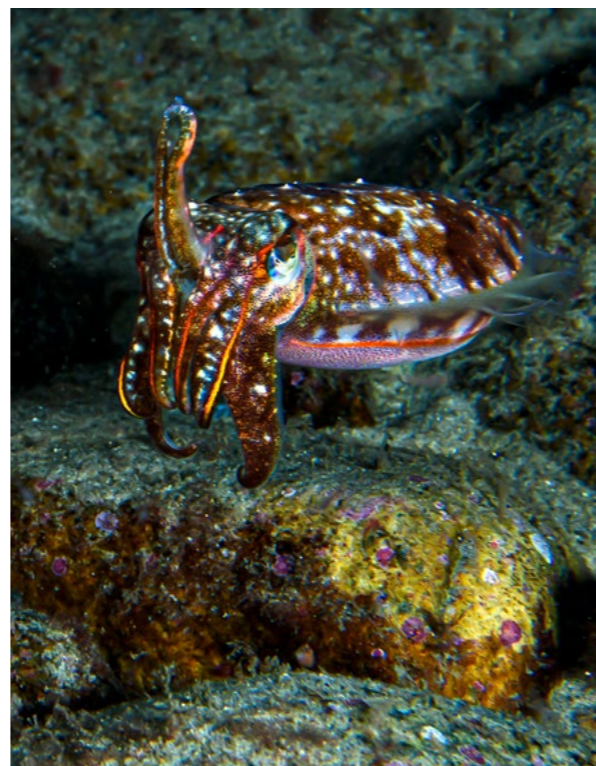


Large squid in Toyama Bay (above); Squid on blackwater dive (previous page)

Many people outside Japan have probably never heard of Toyama or even know where it is exactly, but the ocean enthusiasts who have heard of it probably associate Toyama with squids, both big and small. The video of a 10-meter-long giant squid filmed in Toyama Bay by the owner of Diving Shop Kaiyu during Christmas 2015 went viral globally—such sightings are rare, but these squids pop up on an average of once a year in the bay.

During early spring of each year, the fire-fly squids ascend to the surface and put on a transcendental show of their own—their luminous organs glow bright blue as they spawn and are agitated by waves on the ocean surface near the shoreline. This results in the shorelines being blanketed in blue jewels at night, a scene that attracts many people each year for this special, mystical encounter.

Squids are not the only attraction of Toyama, however. The ocean here is unique in its own right, and although I secretly wished for an encounter with a giant squid like in Jules Verne's *Twenty Thousand Leagues Under the Sea*, I reached out to Mr. Akinobu Kimura of Diving Shop Kaiyu to guide and show me what this mystical ocean offers.



Scorpionfish and starfish (above) and cuttlefish (left) in Toyama Bay, which is located in the Hokuriku region of Honshu, Japan



Toyama Bay, facing the Japanese Alps (above); Pufferfish (right); Japanese pineapplefish (top left); Scorpionfish (left)

Juxtaposing a natural fish tank with the Japanese Alps

Toyama Bay is located in the center of the Sea of Japan and is affected by the Tsushima Current. Whereas the Kuroshio Current brings up warm water filled with tropical fish and exotic sea creatures to Izu Peninsula from the Pacific Ocean (see my previous article in issue #95 on diving in Izu), the Tsushima Current is the north-eastward-flowing branch of the Kuroshio along the western coast of Japan, which reaches down to 300m from the sea surface. This current affects the bay typically during the warm summer months, where the sea temperatures can go up to 30°C (86°F). Sea life which prefers warmer waters thrive in this zone, but during the winter months when this current is absent, the sea temperatures near the surface can dip down to 8°C (46°F). That is a

whopping 22 degrees difference between the two opposite seasons.

One distinct marine feature of Toyama Bay is its steep terrain. Toyama Bay is 1,200m deep, and this depth can be observed just a short distance away from the coast—because of the steep slope to the ocean floor, the bay quickly becomes very deep. The upwelling currents from the sea floor bring exotic, cold-dwelling, deep-sea creatures from the bay's dark depths, and because this is so near the coast, it is not uncommon for divers to encounter such marine life. And due to this close proximity from the port, the bay is like a fish tank for the local fishermen. Some species, like broad velvet shrimp and firefly squid, can only be caught here, and they are local delicacies. Also popu-

lar from the bay as seafood are the red snow crabs and yellowtail fish.

Opposite the bay lies mountainous terrain, which is part of the Japanese Alps, and the mountain ranges covered in snow on a clear, winter day will take your breath away. Snow, which falls on these 3,000m high mountains, eventually melts and becomes part of the seven rivers that pour into Toyama Bay.

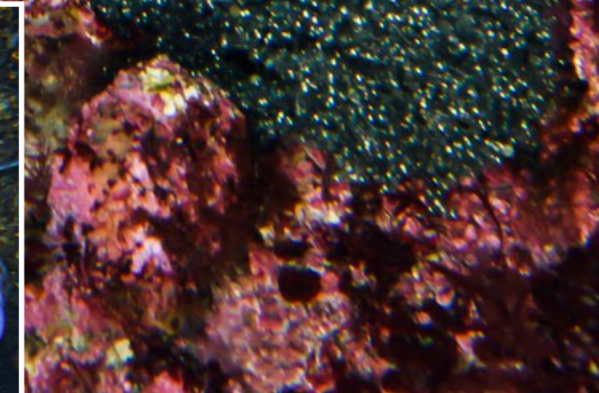
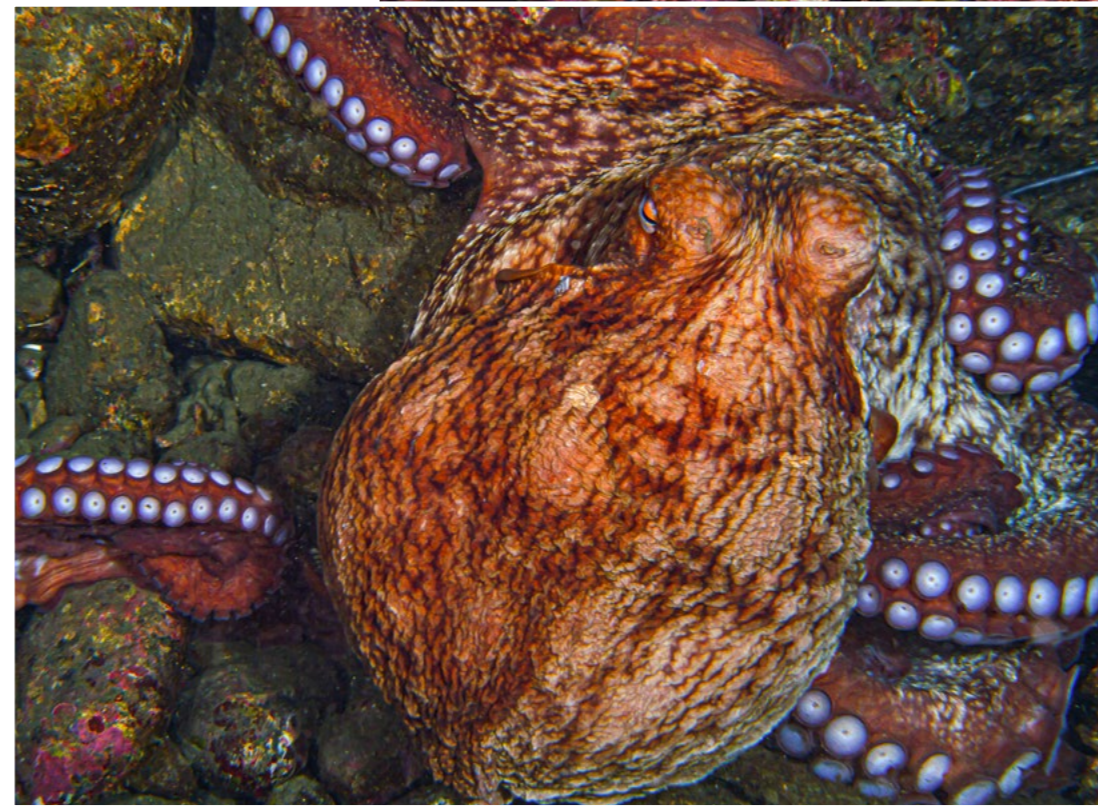
Freshwater pouring into ocean water



creates water of different salinities. As a result, the visibility can become blurry near the surface. Yet, this fast-flowing and nutrient-rich mixture is the reason why the bay has such a fertile marine environment. Out of the 800 species found in the Sea of Japan, 500 can be found in Toyama Bay—the biodiversity is exceptional and unique here.

Breeding and brooding grounds

Because of the lower salinity on this side of the ocean, corals—both hard and soft—do not thrive in Toyama Bay, unlike in Izu's Pacific Ocean. As soon as you enter the water, the terrain is bland: sandy bottom mixed with rock formations and countless tetrapods spread across the shore to prevent erosion. It lacks the vibrant and multi-colored reefs that a lot of the tropical islands offer. However, if you look closely, you will find that these reefs and foundations serve as critical breeding grounds during the winter months for many of the sea creatures that usu-



Ainame or fat greenling adult fish guarding its eggs (above); The North Pacific giant octopus is the dominant predator in Toyama Bay (left and top left); Webfoot octopus (bottom far left)



Ainame or fat greenling fish eggs, freshly lain (above) and about to hatch (right)

ally live in deeper waters—this ocean is filled with life and you can see the inception thereof as well.

The North Pacific giant octopus is probably the dominant predator in this bay. The Guinness World Records lists the biggest as 136kg (300lbs) with an arm span of 9.8m (32ft). These beasts can be heavy, and on land, they are not able to withstand their own weight. The size of these octopuses, which dwell in Toyama Bay, is usually around two to three meters. They seem to be more docile when compared to the same species found in Hokkaido—the ones in Hokkaido tend

to be more vicious, and large adults will typically approach divers who carry large camera equipment and cling onto them.

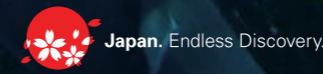
The giant octopuses feed on fish such as the Okhotsk atka mackerel (hokke fish) and its cousin the fat greenling (ainame fish), as well as the smooth lump-sucker—these are denizens of Toyama Bay that also breed and brood around the same time. In fact, I have found the mackerels and fat greenlings to be more aggressive than the giant octopuses in this bay; if you approach their eggs with your camera to take a photograph, the adults, which patrol their recently

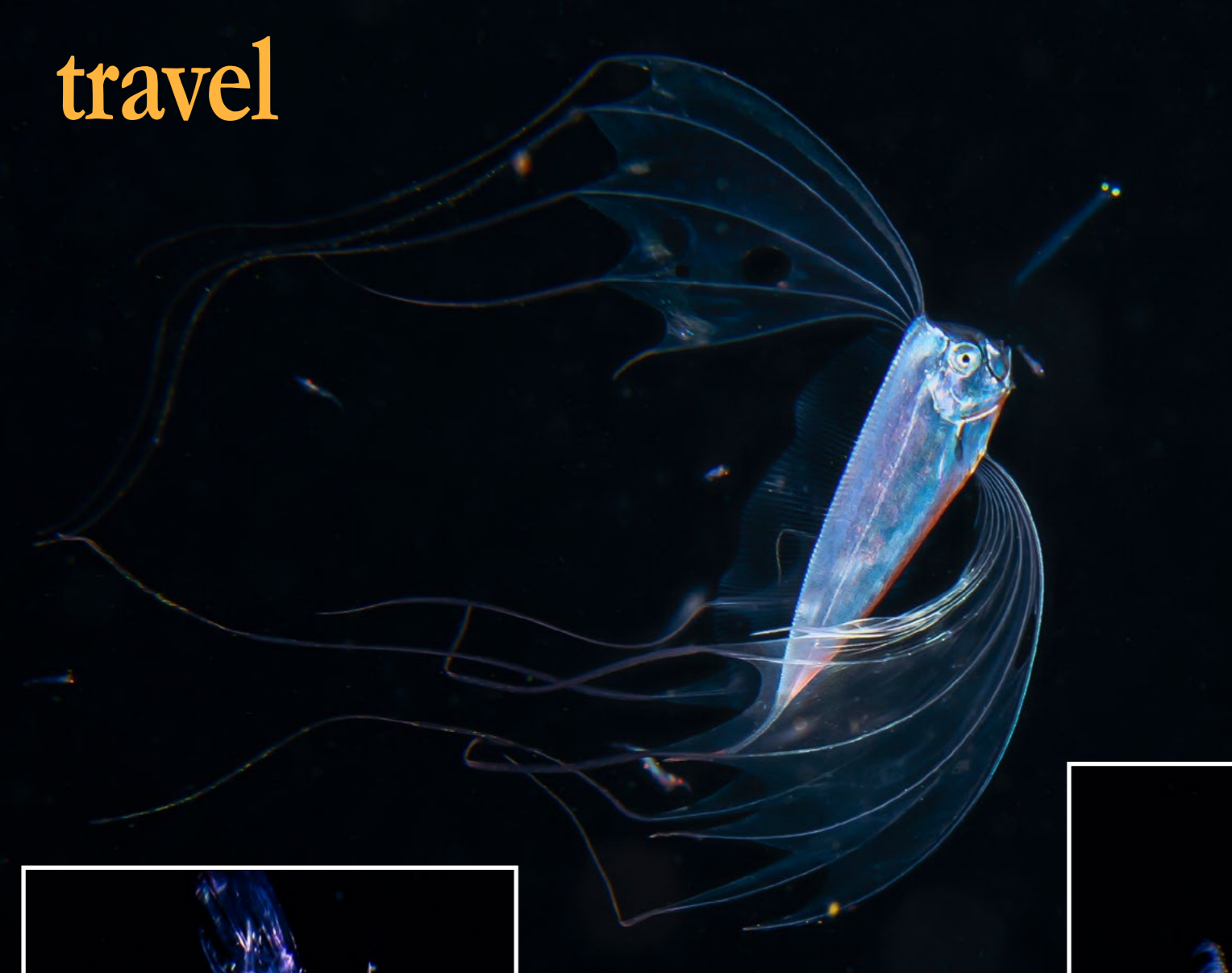


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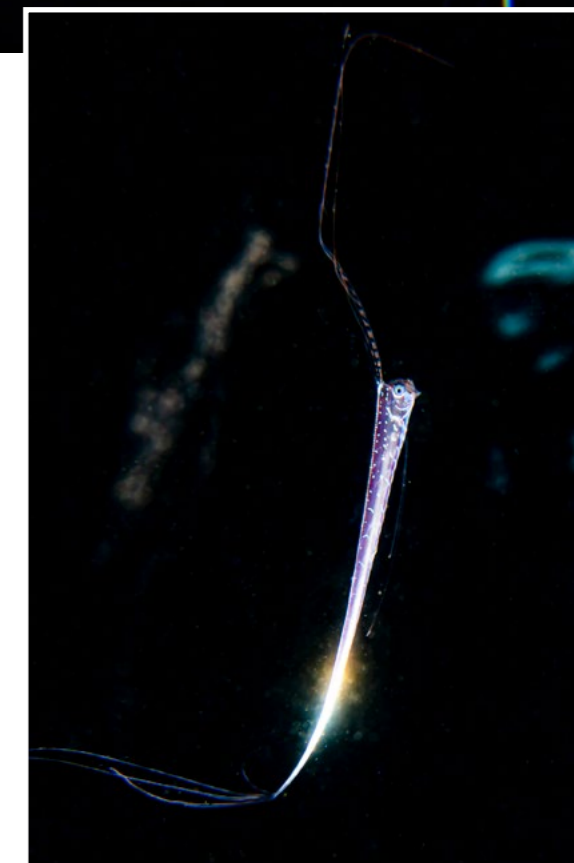


Squid (above and left inset) and juvenile ribbonfish (top left) on blackwater dive

grounds—the photos looked as if they had been shot somewhere in outer space.

Most of these sea creatures (photographed during blackwater diving) are from the deep sea—hundreds of meters below sea level—where no light reaches and pressure is so immense that most animals would not have been able to survive. I then questioned my curious self as to why these deep-sea creatures rise up to the sea surface only during nighttime. With frequent sightings of such deep-sea creatures along the Japanese coastal waters, including Toyama Bay, it seems this is a natural phenomenon and not a precursor to volcanic activity or earthquakes as had been previously thought.

This phenomenon is apparently called diel vertical migration (DVM) and was discovered thanks to satellite image recordings



Juvenile oarfish found on blackwater dive

lain eggs, will feel threatened and will relentlessly dart out towards you and try to dissuade you.

But as a passionate diver and photographer, you will not so easily be deterred by the fish's action as you are mesmerized by the eggs' beauty. The freshly laid eggs are blue and have the majestic looks of pretty pearls. They are true jewels of the sea. Over time, these eggs will turn purple in color, and before the younglings are ready to hatch, you will see their large eyes twirling around inside each of the eggs. You will leave the area with a smile on your face and pray that each and every hatchling will have a safe life ahead.

Observing massive migration on blackwater dives

Over the recent few years, I began to take an interest in this so-called “blackwater diving.” My first introduction to this subject was

probably when I first saw photos of manta rays feeding on plankton in pitch-black waters at night off the coast of Kona in the US state of Hawaii.

Only over the recent years have I started noticing more and more macro subjects—and I mean “macro” as in small, alien-like, translucent critters with peculiar shape and form—showing up in underwater photo competitions and sweeping up prizes. I was intrigued by these subjects with black back-

Shrimp spotted on blackwater dive



Toyama Bay

the most committed divers I have ever met.

Born and raised near Toyama Bay, he is a true local who knows the area inside out. When he is not doing recreational diving, he is a commercial diver working on dams, etc. With many connections among the local fishermen—which is essential in Japan as diving can be carried out only if you have been given permission from the fishermen's association to agree that your dive is not for poaching purposes—Kimura is the first to be informed when rare fish such as the giant squid or adult oarfish are observed in the bay. And because of the variety of fish that thrive in the bay and the fact that rarely encountered behaviors such as mating or spawning of sea creatures occur at certain hours, Kimura offers customized diving—24/7, 365 days a year as well as diving services whenever you wish.

The famous illumination of firefly squids occurs in early spring between midnight to 5 a.m.; sea-horses spawn at night but only at a specific time when the rest of



Lumpsucker (above); Flounder on the sea floor (left); Scorpionfish (top left); Squid (lower far left and bottom right) in Toyama Bay



the coast, upwelling currents from the sea floor brings deep-sea creatures near the surface. In Japan, black-water diving is called "light trap" diving, because multiple spotlights are set up at the sandy bottom (around 10m deep) to attract plankton, which in turn attract deep-sea fish.

Strange-looking jellyfish, salps, pelagic tunicates and other

in the past have been live adults swimming underwater.

Customized diving

Not many dive shops operate in Toyama Bay, but Diving Shop Kaiyu has been around for many decades and is the most experienced dive shop there. The shop owner, Kimura, is probably one of



migration is part of Earth's carbon cycle, and the study shows that

this is a natural phenomenon. Why does this occur? According to the study, this migration of sea creatures—ranging from pelagic tunicates and cope-

pods to salps and transparent alien-like subjects—takes place for them to feed on phytoplankton at night, so that they can avoid visual predators that would consume them near the surface during the day. This is considered the largest migration of animals in numbers.

Because Toyama Bay is very deep and this depth is observed just a short distance away from

transparent sea creatures come near the surface, and the rare juvenile oarfish as well as juvenile scalloped ribbonfish too are not uncommon in this ocean. Adults have been seen in the bay in the past as well, with the adult oarfish easily measuring over six meters. Usually, adult oarfish are found washed up dead on the shore, but the oarfish observed in Toyama Bay



initiated by NASA. At night, countless small sea creatures swim from the ocean abyss to feed near the surface, and they then descend back down before dawn. This





Dam of Toyama located in the mountains

Dive site at Toyama Bay (above); Toyama Unazuki Onsen—hot springs in the city (left)

death experience while commercial diving at a dam, as well as the time he was suddenly pulled from the ocean surface down to 30m by a giant squid!

Uncover the unknown Japanese waters

People have the perception that scuba diving is a luxury sport for people on expensive ocean resorts. This

is not necessarily the case especially in Japan, where even groups of college students can often be seen diving together as part of a school club on the weekends. Whether you are a diver wanting to enjoy tropical diving or a daredevil ready for more challenges diving in freezing cold water, Japan has it all and you will be surprised at its natural wonders as you uncover the Japanese waters. ■

Japan National Tourism Organization (JNTO) has launched a site called “Dive in Japan” to welcome divers from all over the world. You can choose from a menu of over 170 dive locations in Japan. For further information about diving in Japan via JNTO, please visit: japan.travel/diving/en/.

Martin Voeller is an avid diver and underwater photographer based in Tokyo, Japan. Diving since 2011, he is a certified NAUI Divemaster and serves as a dive guide in the Kanto area. Having dived from the southernmost tip of Japan (Okinawa) to the northern tip (Hokkaido) and much more in between, he enjoys the variety of diving that Japan offers, ranging from tropical to cold water. He continues to explore Japan’s diverse undersea formations and topography, and his mission is to share this with the rest of the world. See more of his underwater images at: poseidonphotos.com.



the town sleeps; the arrival of deep-sea fish may only occur for a brief period of time; hence, multiple dives are required throughout the entire night. Being cold is not in his dictionary; during peak seasons, there are times when Kimura will dive for two straight days, with only brief intermittent naps. Besides going underwater with him, on land, Kimura can also give you a tour of the city. He can also entertain you with many underwater stories, including the time he had a near-



Underwater Photography
Cape Town
Off South Africa's Rugged Scenic Coast

Text and photos by
Kate Jonker



Cape Town

Common octopus peers at the camera (above); Cute two-eyed blenny at Sterretjies Reef, Gordon's Bay (previous page)

Cape Town is a cosmopolitan, vibrant and modern city. Renowned for its beautiful landmarks of Table Mountain and the Cape Peninsula, Cape Town is a popular destination for divers who come to explore her colourful kelp forests, historic wrecks and glittering reefs.

The beauty of Cape Town stretches beyond the shoreline and beneath the waves, providing divers and underwater photographers a lively and fascinating playground with a beautiful backdrop to match.

There are three main dive areas in

Cape Town. Although this is a year-round diving destination, the sea conditions are greatly affected by the wind and weather patterns. Where you dive will depend on the time of year you visit.

**Gordon's Bay (Eastern False Bay)
—Summer diving (October to May)**

Gordon's Bay, along the eastern side of False Bay, boasts some of the most beautiful and varied dive sites in Cape Town. The topography differs according to dive site and the pristine reefs range from steep sided, ragged walls starting at 15m, dropping straight down to 30m, to shallower reefs and kelp forests with average depths of 15m.

This is a mecca for macro photographers, with an abundance of nudibranchs, spider crabs, cuttlefish, octopus, pipefish, small colourful klipfish and rocksuckers.

Smaller shark species include pyjama shark, puffadder shyshark and leopard catshark as well as gully sharks. Schools of fish hover above the vibrant reefs, which are densely covered with marine life, colourful soft corals, huge sea fans, feather stars and anemones. There are also a number of kelp forests where divers can sometimes encounter huge stingrays, gully sharks and sevengill cow sharks. Divers are often joined by playful and inquisitive Cape fur seals on their dives here.

**Simon's Town (Western False Bay)
—Winter diving (May to September)**

The reefs along the western (Simon's



Family of fiery nudibranchs (above); Tiny basket star on sinuous sea fan at Sterretjies Reef in Gordon's Bay (top right)





False Bay, photographed towards the Hottentots Holland mountain range above Gordon's Bay (above); Kelp forest at Rooi Els in Gordon's Bay (left); Blue and yellow gasflame nudibranch, one of the most popular subjects in Cape Town (right)

Town) side of False Bay comprise primarily of huge granite boulders and scattered granite rocks surrounded by coarse sand. A number of the dive sites have beautiful swim-throughs to explore. There are dive sites suitable for both Open Water and Advanced divers.

On the reefs, you will find sea fans, soft corals, sponges and feather stars. Many of the dive sites are situated within a marine protected area and the fish life is plentiful and varied. It is quite normal to see the smaller shark species on dives here, including pyjama sharks, puffadder shy-sharks and gully sharks. Macro life includes numerous species of



nudibranchs, crabs, octopus and cuttlefish.

Atlantic Coastline

—Summer diving (October to May)

The Atlantic coastline is known for its huge granite boulders and granite bedrock covered with invertebrates and plant life, colourful sponges, soft corals, sea fans, nudibranchs, crabs and

basket stars. Divers also have the opportunity to snorkel with and photograph the playful and inquisitive seals at Duiker Island at the entrance to Hout Bay and explore a number of wrecks in and around Hout Bay.

What to wear

Water temperatures differ from area to area, and as the water

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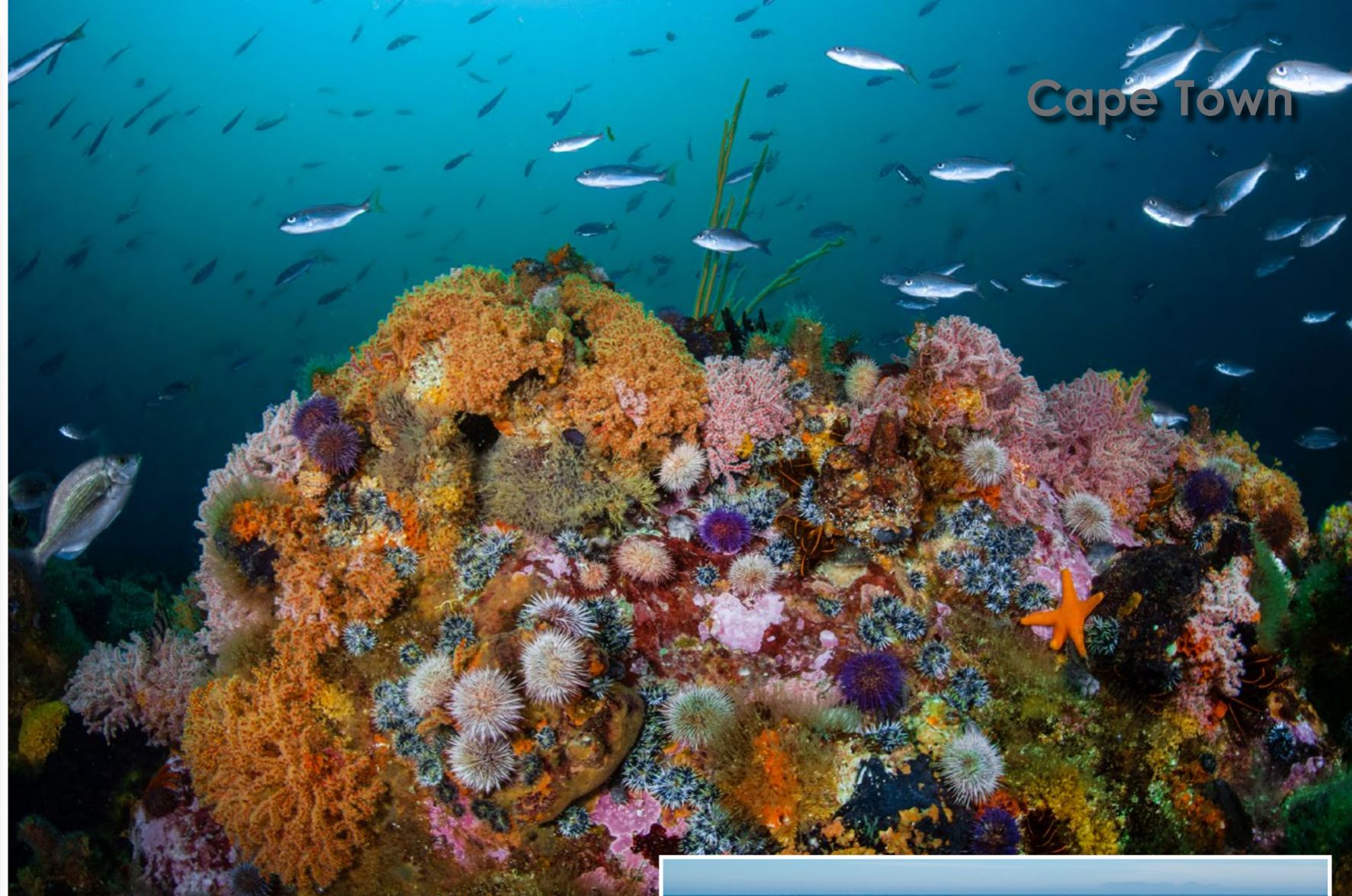


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Cape Town

Reef life in Cape Town is very vibrant (above); Diving is done from semi-inflatable dive boats (right)

along the Atlantic coastline is brought in from the Antarctic by the cold Benguela Current, the water is chilly and temperatures usually range between 8°C and 13°C. The water in False Bay is much warmer and temperatures along the Simon's Town and Gordon's Bay coastlines average between 12°C and 15°C, reaching 19°C in summer.

To remain comfortable whilst diving any of the areas in Cape Town, a 7mm wetsuit or semi-drysuit, or a 5mm with chicken vest along with booties, hood and gloves are advised. If you own a drysuit and are able to travel with the additional weight, you could be better off bringing that and adjusting your undergarments accordingly. Also, as you

will be wearing booties, open-heeled fins will be required. A dive computer, torch and deployable or delayed surface marker buoy with reel are also recommended for all divers.

The diving

Most diving is done from 8m-long rubber ducks, known as RIBs or zodiacs in other parts of the world. The standard procedure is for divers to put their gear together on land, after which it is loaded onto the boat where the



skipper will secure it to dive racks. It is best to pack your camera into a soft cooler bag as most dive operators do not have space on the boats for large camera boxes, nor do they provide special racks for cameras. Affordable cooler bags can be purchased at most of the larger supermarkets once you arrive.



Dark shyshark resting on a comfy bed of yellow sponge (above); Juvenile doublesash butterflyfish, one of the most elusive fish in Cape Town (right); Puffadder shyshark perches on a sea fan (far right)

When ready to launch, divers don wetsuits and booties and climb on board. Most boats launch from either the Simon's Town, Hout Bay or Gordon's Bay harbours. Once at the dive site, the divers kit up for the dive, usually with the assistance of a dive guide or the skipper. When everyone is ready to enter the water, the skipper will slowly count "one, two, three, go!" and the divers all roll backwards into the water at the same time, on the word "go." It is best to roll backwards with your camera tucked tightly to your chest. Some skippers are happy to pass you your camera, but this can be a problem if there is a surface current running or if there are a number of photographers all needing

their cameras to be passed to them!

Divers can usually choose to dive with a dive guide or in buddy pairs without a guide, exploring the reefs at their own pace. This is a suitable arrangement for photographers and more experienced divers who want to take their time instead of rushing to keep up with the dive guide. At the end of the dive, buddy pairs deploy their surface marker buoys, and the dive boat will come to pick them up. It is therefore important for all divers to have their own dive computers and surface mark-

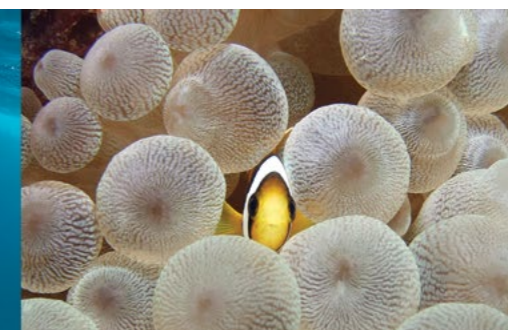


er buoys with them on every dive. Dives tend to be limited by bottom time or a maximum of 60 minutes, whichever comes first.

Underwater photography Underwater photographers are normally well looked after as most



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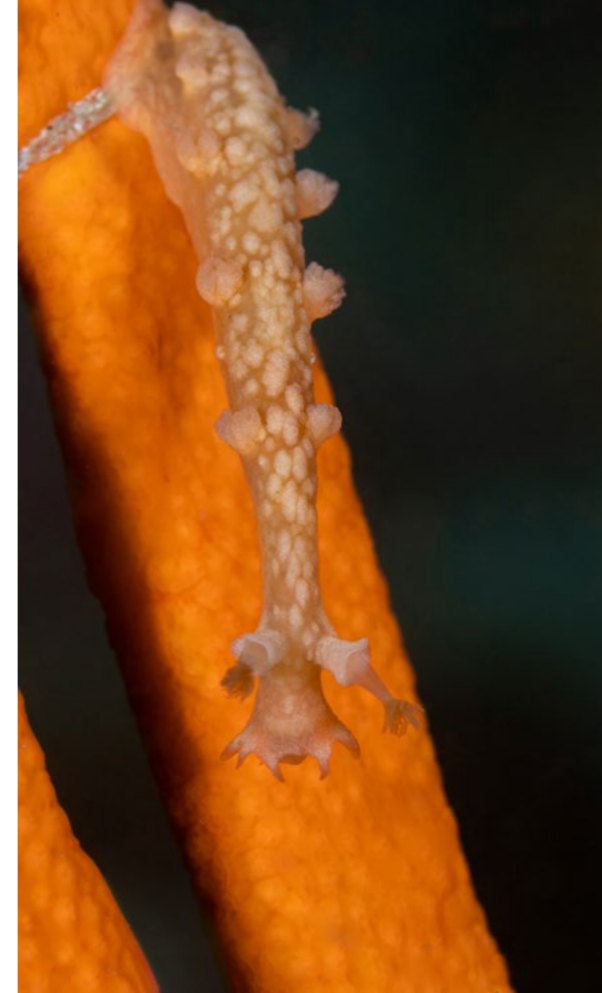


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Salmon-coloured gasflame nudibranch, shot using a snoot to separate the subject from the vibrant reef (top left); Crowned nudibranch photographed using a shallow depth of field to highlight its rhinophore (top centre); Rare Mandela nudibranch at Steenbras Deep in Gordon's Bay (above centre); Whipfan nudibranch stretches across a sinuous sea fan as it moves to another branch (top right); Rare protea dorid at Stone Dog in Gordon's Bay (right)

skippers and boat crew are used to handling cameras and underwater photography equipment. I would advise doing a bit of homework beforehand to ensure you choose a dive centre that is "photographer friendly" and fits your style of diving. They will not allow you to dive on your own, but many operators have dive guides or in-house photographers who will buddy up with you and help seek out those critters you want to photograph.

As conditions can change from one day to the next, it is worth contacting your dive centre the day before you dive to find out what they expect the sea con-

ditions and visibility to be like. Visibility is very variable and can range from 5m to 20m at any time of the year. When in doubt, however, go macro, as you will always find many intriguing macro subjects to photograph on all your dives.

Macro photography

There are many colourful and fascinating macro subjects to photograph in Cape Town's nutrient-rich waters. Macro life is plentiful and incredibly diverse, with a large number of endemic species. Underwater photographers will be kept busy an entire dive with the numerous critters that can

be found on the reefs, and will likely find themselves wanting to do more and more macro photography whilst diving Cape Town's luxuriant reefs.

For nudibranch fanatics, "nudis" can be found everywhere. They range in size from just a few millimetres to just over 10cm in length. Most famous are the beautiful blue and yellow gasflame nudibranchs, inkspot nudibranchs, Cape dorids, frilly nudibranchs,

coral nudibranchs, purple ladies and whip fan nudibranchs. There is even a nudibranch called the Mandela nudibranch that can be found on some reefs, most notably at Steenbras Deep in Gordon's Bay. The best dive sites for nudibranchs include Steenbras

Beautiful soft coral nudibranch at Stone Dog in Gordon's Bay





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Rocksucker on sea fan, shot using a Tokina 10 – 17mm fisheye lens (top left); Tiny amphipods measuring 2mm, photographed using a wet diopter for magnification (top centre); Beautiful tubular hydroid, a favourite macro subject in Cape Town (right); A curious little klipfish surveys the reef (left)

stars, amphipods, tubular hydroids, basket stars and quirky little fish such as tiny smoothskin scorpionfish, rocksuckers (which are all head and no body!), blennies and Cape triplefins as well as the many

shooters, a 60mm macro is a great option and easier to use in occasional surge and low-visibility conditions. This, paired with a wet diopter that fits in front of your port, should have you covered for anything you might encounter on a macro dive. For full-frame cameras, a 100mm (Canon) and 105mm (Nikon) lens will be perfect, along with a wet diopter for smaller critters.

Wide-angle photography

Many of the reefs have fantastic topography well suited for wide angle photography. Most reefs are covered in colourful marine life, anemones, sponges and soft corals in beautiful pinks, purples, yellows and oranges. Orange sea fans add to the riot of colour on the reefs, which contrasts beautifully against the green, temperate waters.

Deep, Sterretjies, Blousteen and Stone Dog in Gordon's Bay as well as Photographer's Reef, A-Frame and Roman Rock in Simon's Town.

Other macro life includes pipefish, spider crabs, common and bobtail cuttlefish, octopus, sea spiders, flatworms, strawberry anemones, feather

colourful and inquisitive species of klipfish. The strange and unusual horsefish and white sea catfish can also be spotted on deeper reefs such as Steenbras Deep and Drop Zone in Gordon's Bay as well as at Whittle Rock in Simon's Town.

For Canon or Nikon crop sensor

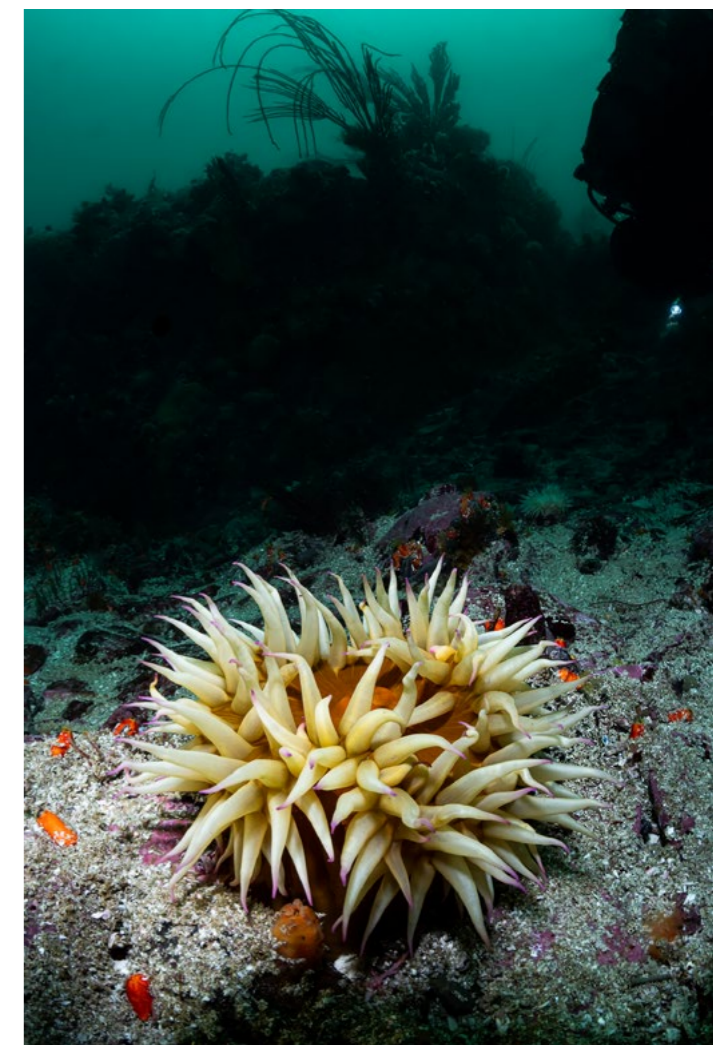




Beautiful kelp forest at A-Frame in Simon's Town



Beautiful basket stars at Sterretjies Reef in Gordon's Bay (above); Underwater photographer explores the reef (top right); Close focus, wide-angle photograph of sea anemone and reef at Outer Castle, Simon's Town (right)



Reefs well worth visiting include Atlantis, Photographer's Reef and Whittle Rock in Simon's Town; Steenbras Deep, Sterretjies and Rooi Els in Gordon's Bay; and Star Walls in Hout Bay.

The wrecks of Smitswinkel Bay in Simon's Town and in Hout Bay provide those with a lust for rust the chance to explore and photograph unique wrecks, many of which are covered in colourful soft corals, sponges and anemones. They also attract schools of fish, providing a confetti of silver glitter against the hulks of the wrecks themselves.

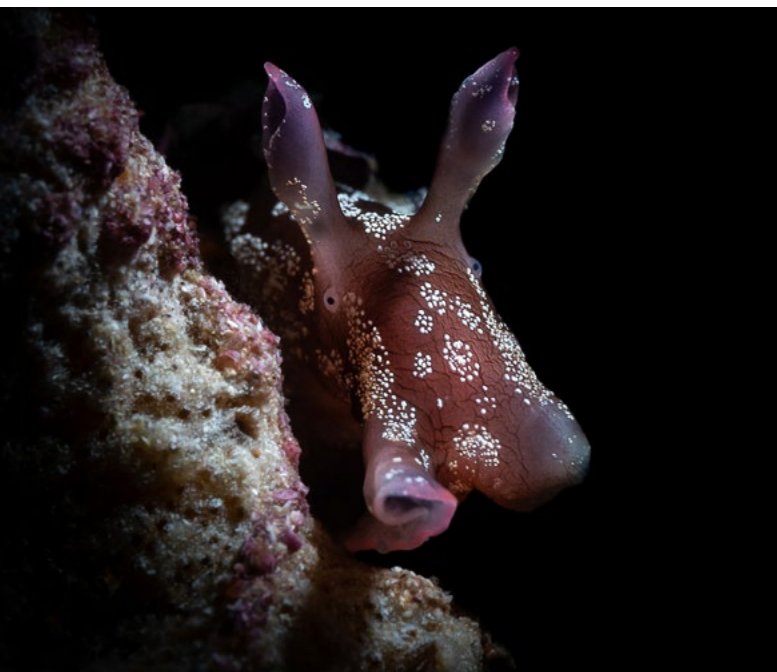
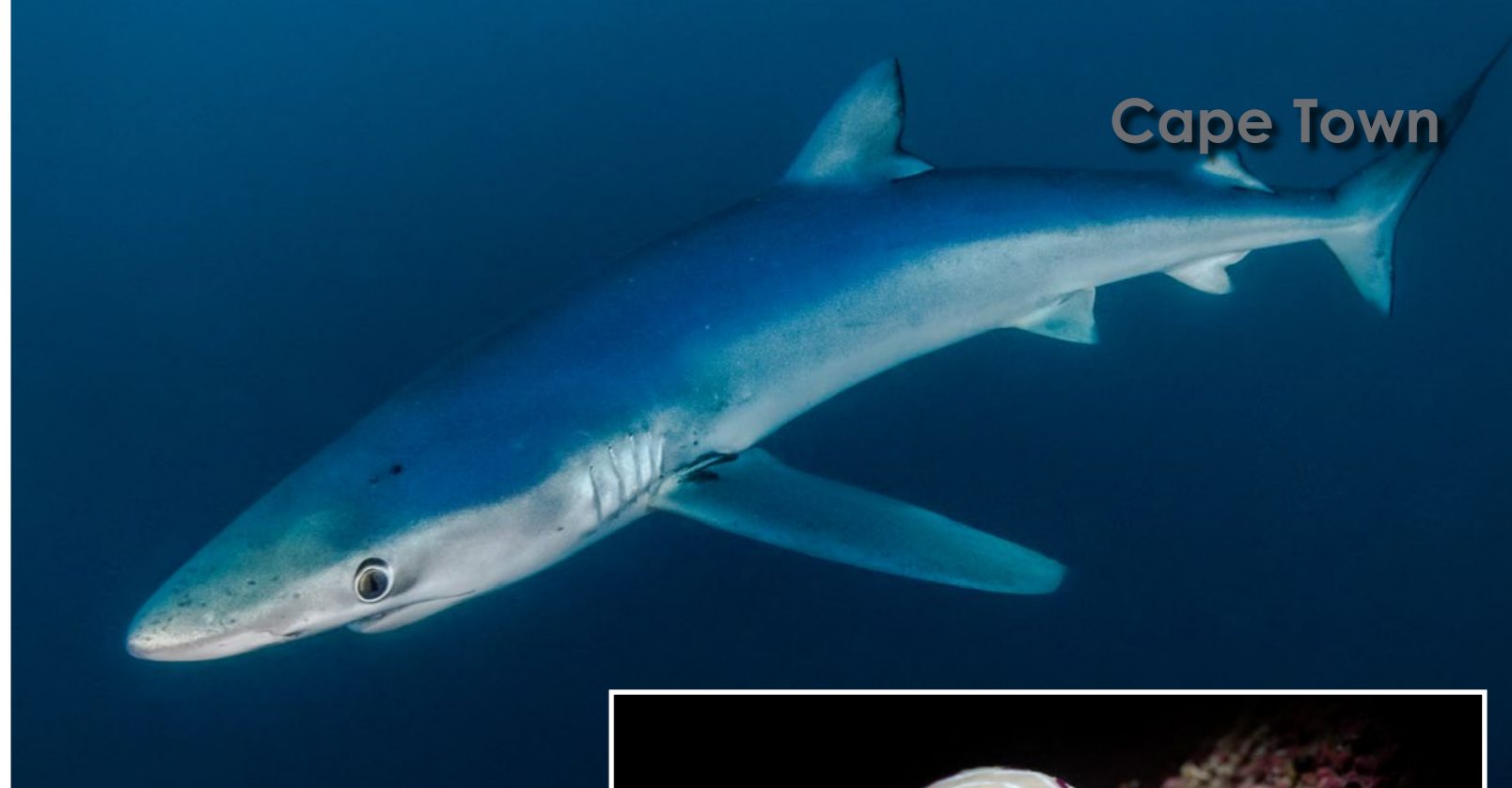
There are also numerous kelp forests to explore and these provide remarkable wide-angle opportunities. The forests are home to many fish species, rays, smaller sharks and seals. The reefs upon which the kelp forests grow are covered with vibrant jewel-like anemones, starfish, sea urchins, sponges and feather stars. There is nothing more beauti-

ful than photographing the sun's rays as they filter through the kelp fronds, lighting up the reef below. Many of the reefs such as Pyramid Rock, Castle Rock and A-Frame in Simon's Town and Blousteen and Rooi Els in Gordon's Bay provide incredible kelp forest dives.

Cape Town's reefs are also perfect for wide-angle macro or close focus wide-angle photography as the vibrant reefs, colourful sea fans, basket stars, anemones and reef dwelling fish as well as larger nudibranchs present beautiful foreground subjects with the rugged topography and green water background perfecting the image.

Cape fur seals

A trip to Cape Town would not be complete without a snorkel or a dive with the Cape fur seals. They are playful and inquisitive and a lot of fun to photograph. The best dive sites to see



Gasflame nudibranch on lacy false coral in Rooi Els, photographed using the wide-angle macro technique (above); Blue shark, photographed in the warm waters 20 nautical miles off Cape Point (top right); Snooting subjects such as the coral nudibranch (bottom right), crowned nudibranch (right), Cape dorid on pink sponge (far right), frilled nudibranch, a large specimen measuring 10cm in length (bottom far right), and dwarf sea hare, one of the more quirky critters that can be found on the reefs (left), creates a black background and great contrast to a photo.



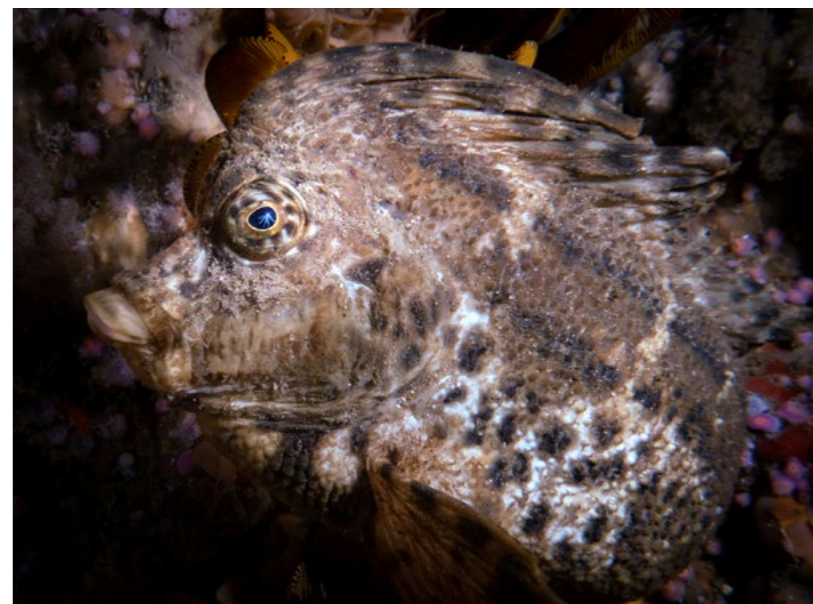
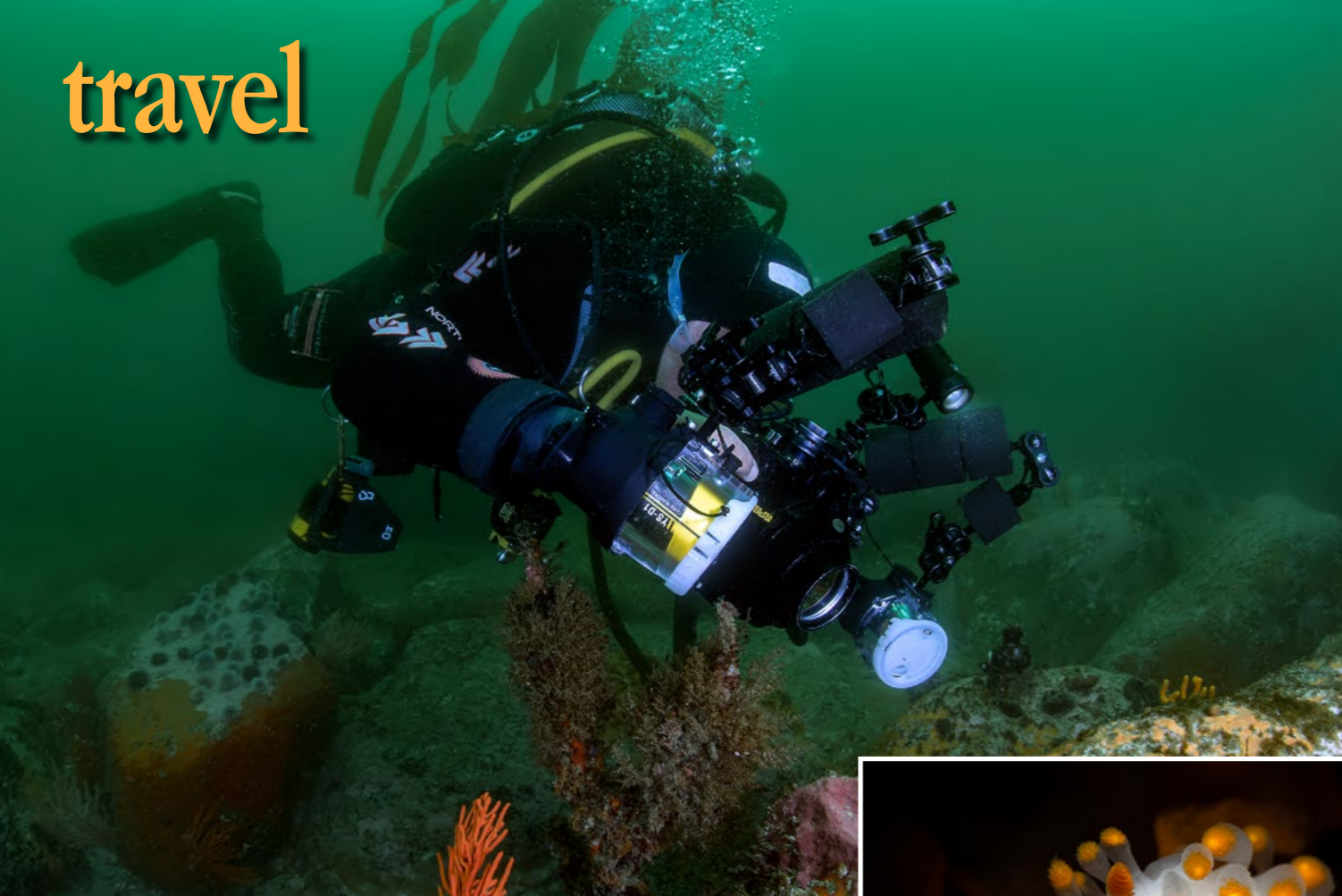
Blue and mako sharks

Dives "into the blue" to see the blue sharks and makos are very exciting. The dive boats take divers out to the edge of the warm Agulhas Current, some 20 nautical miles off Cape Point. This warmer water tends to be clearer and bluer, providing a wonderful blue backdrop to the sharks one can encounter out there.

Wide-angle tips

My favourite lens for wide-angle in Cape Town is my Tokina 10 – 17mm fish-eye behind a mini dome port, which allows me to switch between wide-angle and close focus wide-angle or wide-





CLOCKWISE FROM TOP LEFT: The reefs in Cape Town offer a multitude of photography opportunities; Snooted orange clubbed nudibranch (left inset); Schools of fish hang over the reefs; Rare horsefish at Whittle Rock, Simon's Town; Gasflame nudibranch at Photographer's Reef in Simon's Town; Cape triplefin at Cow and Calf dive site in Gordon's Bay

angle macro; or behind a large dome port for wide-angle as well as half-and-half shots on the same dive. With wide-angle, it is best to use what you are used to and what is easiest for you to travel with.

Recommended accessories

- A focus light is strongly recommended to help with focussing as the deeper reefs can sometimes be dark, especially in winter

when there is a cloud cover.

- Snoots are also a lot of fun and can help isolate your subjects from the very busy and vibrant reefs and really make them "pop"!
- A pointer or muck stick is also useful to steady yourself on the reef if there are surge conditions.
- Wet diopters for macro photography are also useful to help magnify your subjects as some of the critters can be smaller than 1cm in length.

Compact camera users have the luxury of adding a wet diopter or wide-angle wet lens to their housings and have the best of both worlds on any dive!

Having travelled to many destinations across the globe, I always look forward to diving in Cape Town. With year round diving—whether it be kelp forests, reefs or wrecks, shallow or deep, wide-angle or macro—there is something for everyone in this beautiful underwater paradise! ■

Kate Jonker is an underwater photographer and dive writer, underwater photography instructor, dive guide and dive boat

skipper based in South Africa who leads dive trips across the globe. For more information regarding diving and underwater photography in Cape Town, divers are welcome to find her at: katejonker.com.

fact file



South Africa



SOURCES: US CDC, US CIA WORLD FACTBOOK, US DEPT OF STATE, XE.COM

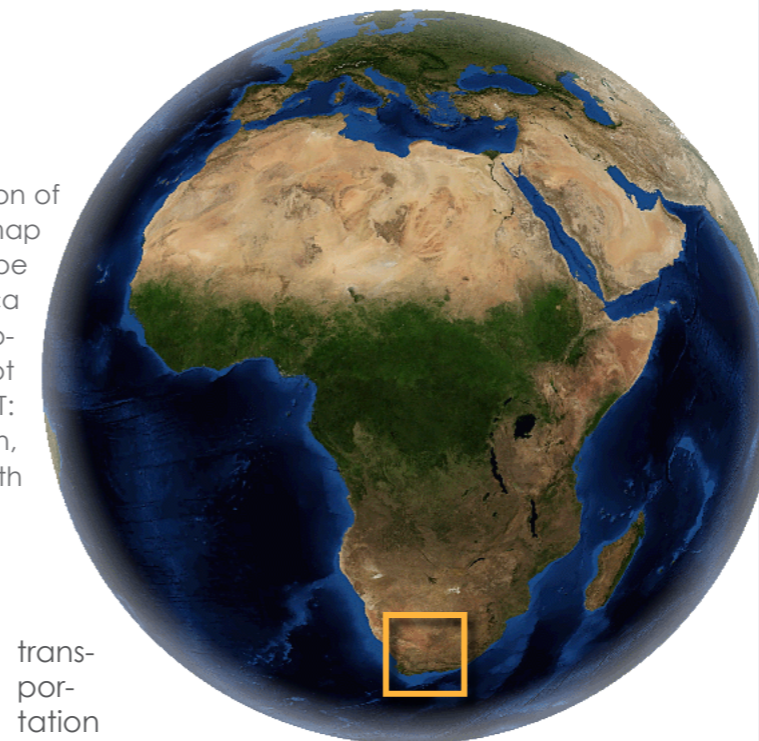
History In 1652, Dutch traders landed at the southern tip of modern-day South Africa and founding the city of Cape Town, establishing a resupply station on the spice route between the Netherlands and the East. In 1806, many Dutch settlers (the Boers) travelled north to establish their own republics after the British seized the area of the Cape of Good Hope. In 1867 and 1886, the discovery of diamonds and gold encouraged wealth and immigration. This intensified the subjugation of the indigenous population. The years 1899-1902 saw the British defeat the Boers resistance during the Boer War; but the British and the Afrikaners, as the Boers became known, governed together

under the Union of South Africa. The National Party was voted into power in 1948 and instituted a policy of apartheid—the separate development of the races. In 1994, the first multi-racial elections saw the end of apartheid and brought in black majority rule. Government: republic. Capital: Pretoria.

Geography Southern Africa is located at the southern tip of the continent of Africa. The country of Lesotho is completely surrounded by South Africa, which also almost completely surrounds Swaziland. Coastline: 2,798 km. Terrain: vast interior plateau surrounded by rugged hills and a thin coastal plain. Lowest point: Atlantic

Ocean 0 m. Highest point: Njesuthi 3,408 m. Natural hazards: extended droughts. Environmental issues: extensive water conservation and control measures are required due to the lack of important arterial rivers or lakes; water usage increases outpace supply; agricultural runoff and urban discharge cause pollution of rivers; acid rain due to air pollution; soil erosion; desertification.

Economy A middle-income, emerging market with a large supply of natural resources, South Africa has well-developed financial, legal, communications, energy and transport sectors. Its stock exchange is the 17th largest in the world. Its modern infrastructure supports an efficient distribution of goods to major cities throughout the region. Since 2004, growth has been strong, as South Africa reaps the benefits of macroeconomic stability and a boom in global commodities. However, there is still high unemployment and an outdated infrastructure limits growth. The country began to experience an electricity crisis at the end of 2007, due to supply problems of the state power supplier Eskom. It necessitated “load-shedding” cuts to businesses and residents in the major urban areas. Remnants of the apartheid period include daunting economic problems, especially poverty, and public



RIGHT: Location of South Africa on global map
FAR RIGHT: Location of Cape Town on map of South Africa
BOTTOM LEFT: Violet sea anemone photographed using a snoot to direct the light; BOTTOM RIGHT: Orange gasflame nudibranch, large at 10cm in length



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shortages. The economic policy of the country is fiscally conservative but pragmatic. It focuses on controlling inflation, sustaining a budget surplus, and—as a means of increasing job growth and household income—employing state-owned enterprises to provide basic services to low-income areas.

Climate South Africa is mostly semiarid with sunny days and cool nights. There are subtropical areas along the eastern coast.

Population 56,463,617 (July 2020 est.) This figure factors in the effects and mortality rate of AIDS. Ethnic groups: black African 80.9%, coloured 8.8%, white 7.8%, Indian/Asian 2.5% (2018 est). Religions: Christian 86%, ancestral, tribal, animist or other traditional African religions 5.4%, Muslim 1.9%, (2015 est). Internet users: 29,322,380 or 54% (2016 est.)

Currency Rand (ZAR). Exchange rates: 1EUR=18.71ZAR, 1USD=17.49ZAR, 1GBP=20.53ZAR, 1AUD=10.16ZAR, SGD=12.05ZAR

Language isiZulu 24.7%, isiX-

hosa 15.6%, Afrikaans 12.1%, Sepedi 9.8%, Setswana 8.9%, English 8.4%, Sesotho 8%, Xitsonga 4%, SiSwati 2.6%, Tshivenda 2.5%, isiNdebele 1.6%, Khoi, Nama, San and other languages 1.9% (2017 est).

Health & Safety Before your trip, check with your state and health departments for travel advisories and updates. There is an intermediate degree of risk for food or water-borne diseases such as bacterial diarrhea, hepatitis A and typhoid fever. Vectorborne diseases include Crimean Congo haemorrhagic fever and malaria. Water contact diseases include schistosomiasis (2008).

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The Bahamas' **Tiger Beach**

— *Petting Zoo or the Real Deal?*

Text and photos by Don Silcock



Tiger shark with remoras, eyeball-to-eyeball with diver (left) and interacting with dive-master (previous page) at Tiger Beach in the Bahamas; Caribbean reef shark (above)



Hammerhead shark

Tiger Beach in the Bahamas is firmly established as one of those global dive destinations of which almost everybody has heard. Its fame is largely derived from the many published images of its most celebrated visitor—*Galeocerdo cuvier*, the tiger shark.

Tiger sharks are considered one of the “big three” most dangerous sharks, and along with the great white and bull sharks, are believed to be responsible for the vast majority of unprovoked attacks on humans. They are renowned for their inherently predatory behaviour in which, much like their terrestrial namesakes, they close

in on their intended prey slowly and silently before pouncing with deadly efficiency.

They are also infamous for consuming almost anything and are often referred to as the “garbage cans of the sea,” since inspection of dead tiger sharks’ stomach contents have revealed everything from sheep, goats and even horses, to bottles, tires, license plates and (believe it or not) explosives!

Tiger sharks are one of the ocean’s largest sharks and typically grow to between 3m and 5m in length and weigh in at around 350kg to 700kg. They are formidable creatures with an intimidating reputation. So, how can it be that week after week in the season, dozens of divers enter the waters of Tiger Beach for open-water, eyeball-to-eyeball encounters?

Tiger Beach is not a beach

Physically, Tiger Beach is about a square mile in overall size and is located on the western edge of Little Bahama Bank, about 30km west of the town of West End on the north Bahamian island of Grand Bahama. And the first thing you need to know about Tiger Beach is that it isn’t one—it is actually a shallow sand bank that looks like there is a beach nearby.

The general area used to be known locally as Dry Bank and was first dived by Captain Scott Smith of the *Dolphin Dream* liveaboard back in the late 1980s. But who actually started the whole shark diving thing is the subject of great discussion.

Smith would seem to be the person who started tempting sharks to the stern of *Dolphin Dream* on those early trips, and the first published tiger shark

TIGER SHARKS

The tiger shark (*Galeocerdo cuvier*) is the largest predatory fish in tropical seas. Tiger sharks get their name from the dark, vertical stripes found mainly on juveniles, which as they mature start to fade and almost disappear completely.

Their large, blunt nose and significant girth gives them a very commanding presence. They have a reputation as man-eaters and are considered second only to great white sharks in attacking humans. But because they are complete scavengers, with their predilection towards eating virtually anything, they are unlikely to swim away after the initial strike as great white sharks frequently do.

Tiger sharks are found in tropical and sub-tropical waters throughout the world. With the largest specimens reaching as long as 20ft (6m) in length and weighing in at more than 1,900 pounds (900kg). They are hunted extensively for their fins, skin and flesh, plus their livers contain high levels of vitamin A, which is processed into vitamin oil.

Tiger sharks have extremely low repopulation rates and long gestation periods, which makes them highly susceptible to fishing pressure, and as a result, are listed on the IUCN Red List as “Near Threatened” throughout their range. ■

images apparently were captured from the boat. While the legendary Jim Abernathy, owner of the *Shearwater* liveaboard, seems to be the person who first took bait boxes into the water in late 2003. Abernathy is generally credited with starting the process of tempting tiger sharks with the bait boxes and was the person who renamed the area “Tiger



Tiger Beach



Diver with tiger shark at Tiger Beach in the Bahamas (above); Divemaster strokes a tiger shark near the bait box behind him (top right); Curious tiger shark eyes the camera (right); Sharks gather around the *Dolphin Dream* (left)

Understanding Tiger Beach

The Bahamas are said to take their name from *baja mar*—which is Spanish for “shallow

Beach.” Whoever did what does not really matter now, but what does matter is that we divers and underwater photographers owe a significant debt of gratitude to both Smith and Abernathy for creating what has become the premiere location in the world for tiger shark encounters.

seas”—because the archipelago of 29 main islands and roughly 700 cays that form the country reside on top of two main limestone carbonate platforms called the Bahama Banks. The Great Bahama Bank covers the southern part of the archipelago, and Little Bahama Bank covers

the northern part, with incredible channels as deep as 4,000m separating the two.

Those channels are flushed with the clean rich waters of the Atlantic Ocean, as the Gulf Stream makes its way through the Caribbean and then up the Florida coast. It is the combination of those rich waters and the shallow, sheltered cays and reefs of the Bahama Banks that make the area so prolific.

Satellite tagging of tiger sharks in Bermuda has revealed two really interesting facets of their behaviour. Firstly, they spend a lot of time at the surface, which is believed to be related to feeding and hunting patterns. Secondly, their migration patterns are very consistent,





Hammerhead shark (above and left) at Tiger Beach in the Bahamas

with five to six months of the northern spring and summer months spent in the open Atlantic Ocean to the north and west of Bermuda, followed by a migration south to the Bahamas where they spend the autumn and winter months.

It is believed (but not yet proven) that the months in the open ocean are related to mating and feeding on the migratory loggerhead turtles that pass through at that time of year, while the time spent in the Bahamas is related to gestation, as most of the tiger sharks observed at Tiger Beach are females and many of them are pregnant. Clearly, if the Tiger Beach area is the "tiger shark nursery," it

GREAT HAMMERHEAD SHARKS

The great hammerhead (*Sphyrna mokarran*) is a truly iconic shark, which typically grows to around 11ft (3.5m) in length and weighs in at about 500lb (230 kg)—although much larger specimens are seen occasionally.

It takes its name from its incredible hammer-shaped head, which it uses so effectively to hunt its favourite prey—stingrays. The front part of the "hammer" is where the ampullae of Lorenzini are located on great hammerheads, and they enable the shark to locate stingrays hidden in the sand.

The hammer-shaped head also enables great hammerhead sharks to pin stingrays down once they have been located. Typically, great hammerheads are solitary and nomadic predator creatures, which when in the presence of other sharks, such as at Tiger Beach, are given a wide berth.

Although potentially dangerous to humans, they are not known to be particularly aggressive and usually avoid divers completely, making good photographs difficult to achieve. Great hammerhead sharks are extremely vulnerable to overfishing and by-catch due to their low overall abundance and long gestation time. They are currently rated as globally "Endangered" on the IUCN Red List. ■

appears to be incredibly important to the long-term conservation of these animals, which are currently on the IUCN Red List as "Near Threatened" and have a declining population globally.

Conservation in the Bahamas

This island nation in the Atlantic Ocean, famed for its picturesque beauty and crystal-clear waters, has in many ways led the world in marine conservation. Although far from perfect, and indeed guilty of allowing periodic over-exploitation of its fish stocks together with the



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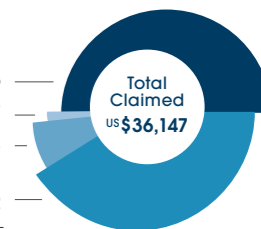
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The scenario summarized above is offered only as an example. Coverage depends on the facts of each case and the terms, conditions and exclusions of the policy. Coverage may not be available in all states or outside of the U.S. Visit DAN.org for complete details.



THIS PAGE: Lemon sharks with remoras. Lemon sharks are one of the most researched sharks as they are able to cope with captivity for significant periods, allowing researchers the chance to make observations of their behaviours.

Shark tourism in the Bahamas
While establishing the Bahamas as a complete sanctuary was an excellent step forward for shark conservation generally, it was also tacit recognition of the significance of sharks to the overall health of Bahamian fisheries. The marine environment is a complex and multifaceted thing, but if there is one global truism, it is that everything has its place in the greater scheme of things, and 400 million years of evolution have produced what could be referred to as a "fine balance." Sharks are a very necessary part of that balance and can be thought of as the masters of their ecosystems. Their role at the top of the marine food chain is to clean up the oceans with ruthless efficiency—the very thing that seems to most intimidate us humans!

Without sharks, the dead, the dying, the diseased and the dumb of the oceans would pollute and degrade the health of those ecosystems and



LEMON SHARKS

The lemon shark (*Negaprion brevirostris*) is one the best known and most researched sharks because it is able to handle captivity for extended periods of time, thereby providing scientists with extensive opportunity to observe its behaviour. Adult lemon sharks often reach up to 3.5m in length and about 190kg in weight, making it one of the larger sharks. Named for its bright yellow or brown pigmentation, it is found in tropical and subtropical waters in coastal areas of the Atlantic and Pacific oceans, usually in moderately shallow water no deeper than 80m.

Lemon sharks are a social species and are often seen in groups, which have a structured hierarchy system based on size and sex, and are known for migrating from area to area, often over hundreds of kilometres to reach mating locations. They are viviparous, and females give birth to 15 to 20 live pups after a gestation period of around 12 months. Lemon sharks rarely if ever demonstrate any aggressive behaviour to each other or towards humans, and there has never been a recorded fatality from one of them attacking. ■

what can now be considered as an incredible piece of foresight. The Bahamas have since added another 26 national parks, covering over one million acres of land and sea, together with enacting substantial supporting

development of tourist resorts in ecologically sensitive areas, the Bahamas was the first country to establish a marine protected area (MPA).

That was way back in 1959 when the Bahamas National Trust was established to manage the 112,640-acre Exuma Cays Land and Sea Park in

environmental legislation, including making Exuma Cays a no-take marine reserve in 1986. Then, in 2011, the government went one step further and became the fourth country in the world to establish a shark sanctuary by formally protected all sharks in Bahamian waters.





Caribbean reef sharks can grow up to 3m and weigh up to 70kg. Though thought dangerous, they have no history of attacks on humans, but can become aggressive when food is present, and will display aggressive postures when threatened.

nonsensational way—from how to prepare to go in the water to how to enter the water and what to do when under the water. But the fact of the matter is that waiting for a gap in the patrolling sharks and then carefully rolling in amongst them is not something you do on a daily basis.

Once underwater, however, nerves settle, and an awareness starts to form for the sharks and their behaviour patterns. From the pushy way the Caribbean reef sharks approach and tend to work in a bit of a pack, to the sneaky way the large lemon sharks come in low to the bottom, with a leery look straight out of

the genetic quality of its inhabitants. The many species of sharks are there for a reason, and they have evolved superbly, in true Darwinian fashion, to execute their mission. Remove the sharks and disruption occurs, something marine scientists refer to rather prosaically as “trophic cascades.” Think of the shark as the first in a long line of finely balanced dominos, and if it is tipped over, the rest start to go down as well.

But all that said, there is also the cold hard fact that a live shark is worth a lot more in tourist dollars than a dead one. With one study published in 2017 indicating that 99 percent of the almost US\$114m in annual revenue generated by

the Bahamas dive industry came from shark tourism.

Eye of the tiger

Arriving for the first time at Tiger Beach is somewhat of a soul-searching experience. It is one thing to read and hear about the sharks that congregate there, but quite another to actually be there preparing for that first dive—particularly when there are up to a dozen two to three-metre sharks circling the back of the boat and lots of others visible in the clear waters!

The briefings provided on these trips are both extensive and exemplary, with everything clearly explained in a logical and



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CARIBBEAN REEF SHARKS

The Caribbean reef shark (*Carcharhinus perezii*) is almost the shark from central casting. Its distinctive robust and streamlined shape, coloration, large eyes and short but rounded snout is so shark-like to the human eye! Found on the eastern coast of the United States and southwards down as far as Brazil, Caribbean reef sharks grow up to a maximum of 3m in length and weigh up to 70kg.

Although considered dangerous to humans, they do not have a history of attacks on humans and are generally passive towards divers, snorkelers and swimmers. They can, however, become aggressive in the presence of food, and if threatened, they will exhibit threatening behaviour by zigzagging while dipping their pectoral fins at intervals of one to two seconds.

Adults begin to mate once they reach between 1.5 to 2m in length, but the reproduction cycle is long because females only get pregnant every other year and the gestation period is another 12 months. Caribbean reef sharks are viviparous, and the usual litter size is four to six pups, which are about 0.5m long when born. ■

Up close and personal

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Tiger sharks are intelligent and curious animals, which tend to approach divers because their sensory systems pick up the tiny electrical and audible signals emitted from our instrumentation and photographic equipment. They will tend to bump with their

snouts, as they investigate the stimuli further, and there is always the chance that they will use their mouths. As their jaws are so powerful, even a gentle nip would be life-threatening. So, photographers are instructed to use their cameras as shields, with

the strict instruction to let go if a tiger shark decides to do a taste test—but remember to press the video button.

Petting zoo?

Being in open water with so many large and potentially very

one of those horror movies.

But that new awareness fades to grey when the first tiger shark arrives. Tiger sharks have an incredibly commanding presence that indicates they know their place at the top of the food chain. They move slowly and carefully, checking out what is going on, and the other sharks clearly defer to them.

The protocol at Tiger Beach is not to even worry about the lemon and reef sharks, as the only real chance of being bitten is if you break the cardinal rule of getting too close to the bait box. Even then, a bite is unlikely to be life-threatening, but you should always know where the tiger sharks are, and you should always face them—literally keeping the eye of the tiger in view at all times!

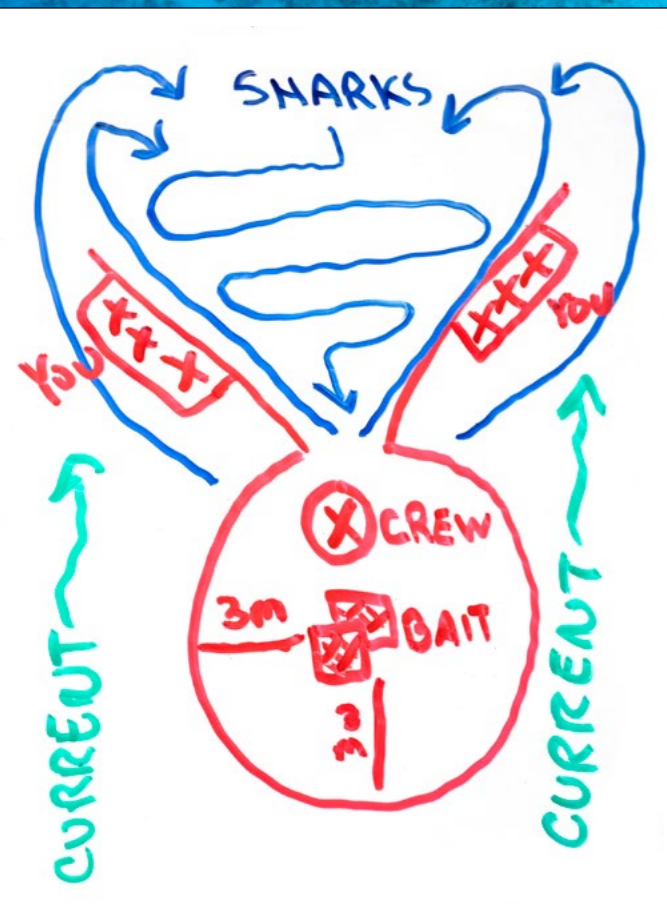


Hammerhead shark (above); Bull sharks (left and top left) are considered one of the “big three” most dangerous sharks, alongside tiger sharks and great white sharks.





Overview of the shark dive at Tiger Beach (left); Shark handler's interaction with a tiger shark (above)



Dive briefing map on Jim Abernethy's Shearwater liveaboard

dangerous sharks verges on a life-changing experience. It really is a big deal to be there, and the first few days are a kaleidoscope of feelings—fear, awe, intimidation, excitement and an incredible sense of adventure at what you have done.

Then, a degree of complacency starts to settle in as you begin to think that maybe these animals have simply been misunderstood all along and they are really just kind and gentle creatures. This, for me, is when Tiger Beach becomes dangerous, because you are in a very special place where these creatures are both protected and well fed naturally, plus they get the snacks from the bait box. So, you are not really seeing them in their natural environment and, in a way, yes, it is a kind of petting zoo.

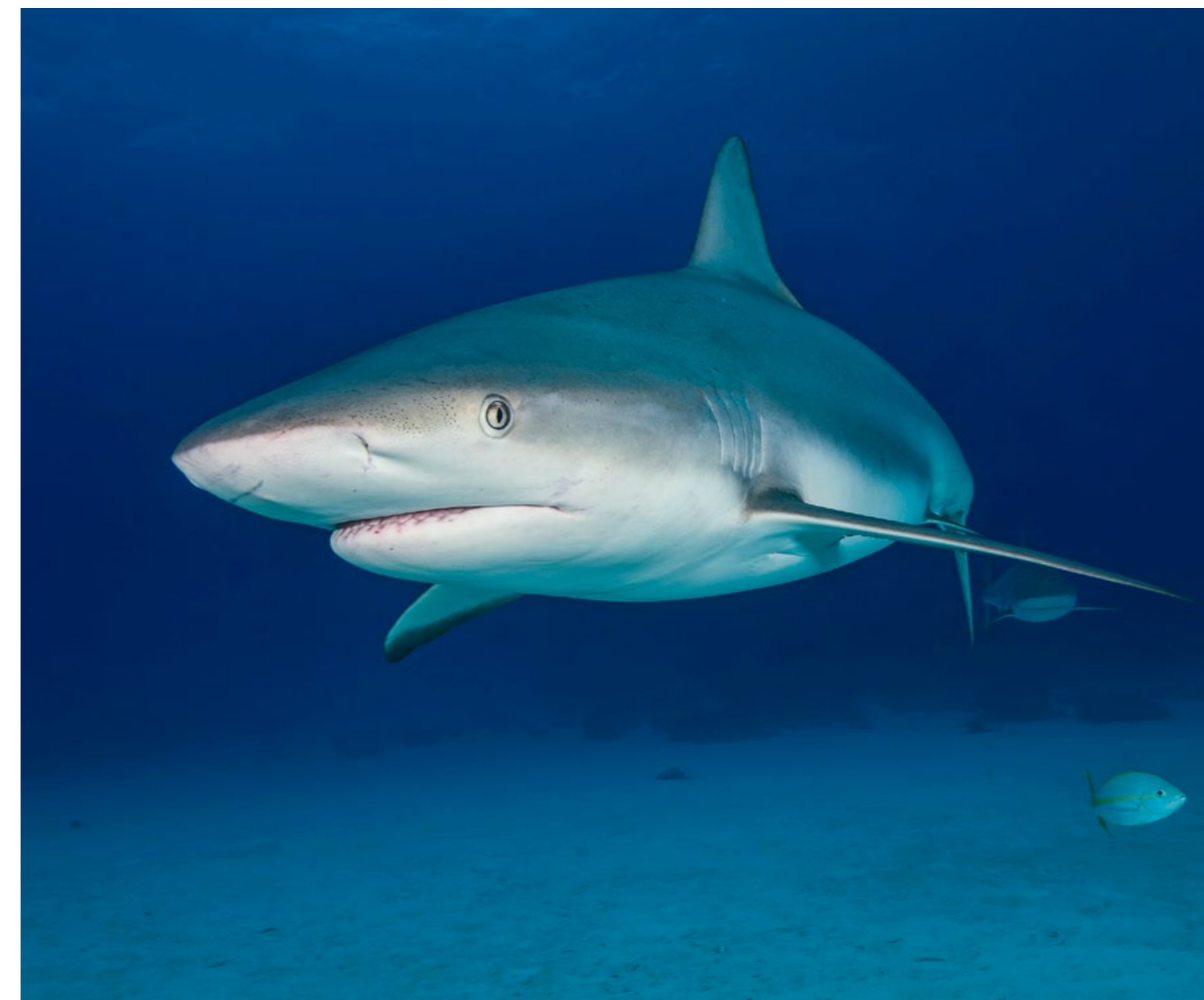
Or the real deal

Tiger Beach is quite unique in that there

really is nowhere else like it. Where else can one can be in open water, in “relative” safety, with so many large and potentially dangerous sharks?

The relative safety comes from the fact that the sharks at Tiger Beach have basically become accustomed to the presence of divers and, because they have plenty of other things to eat, they do not regard us as a principal food source. So, while it is absolutely not a completely natural setting, there is simply nothing else like it, if you want to see these creatures up-front and personal. It is the real deal! ■

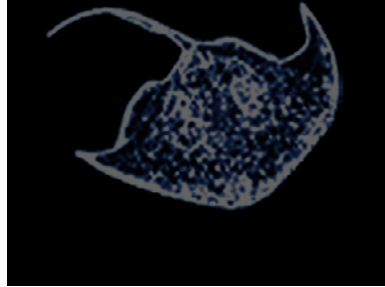
Asia correspondent Don Silcock is based in Bali, Indonesia. For more information and extensive location guides, articles and images on some of the world's best diving locations, check out his website at: Indopacificimages.com.



Caribbean reef shark

fact file

The Bahamas



SOURCES: US CIA WORLD FACTBOOK, CDC, GOV, STATE.TRAVEL.US, WIKIPEDIA.ORG, XE.COM, BAHAMAS.COM, CARIBBEANMAG.COM

Text by Matthew Meier

History The Spanish gave the island the name Gran Bajamar, meaning "Great Shallows", and what the eventual name of the Bahamas islands as a whole is derived from. The islands were claimed by Great Britain in 1670. Grand Bahama was to remain relatively quiet until the mid-nineteenth century, with only around 200-400 regular inhabitants in the capital, West End. The island finally gained a stable source of income when in 1955 a Virginian financier named Wallace Groves began redevelopment with the Bahamian government to build the city of Freeport under the Hawksbill Creek Agreement and create the Grand Bahama Port Authority.

Geography Grand Bahama Island is approximately 150km (93 mi) long west to east and 20km (12 mi) at its widest point north to south. It has an area of 1,373km² (530.1 sq mi) and is the closest major island to the United States, lying 90km (56 mi) east of the state of Florida.

Climate The Bahamas are slightly cooler than other Caribbean island groups owing to their proximity to the continental North American cold air systems. The subtropical climate sees about 340 sunny days per year. Average air temperatures: Winter and Spring (December to May): 18-25°C / 65-77°F. Summer (June-August): 24-33°C / 75-91°F. Average water temperatures: Winter (December to March)

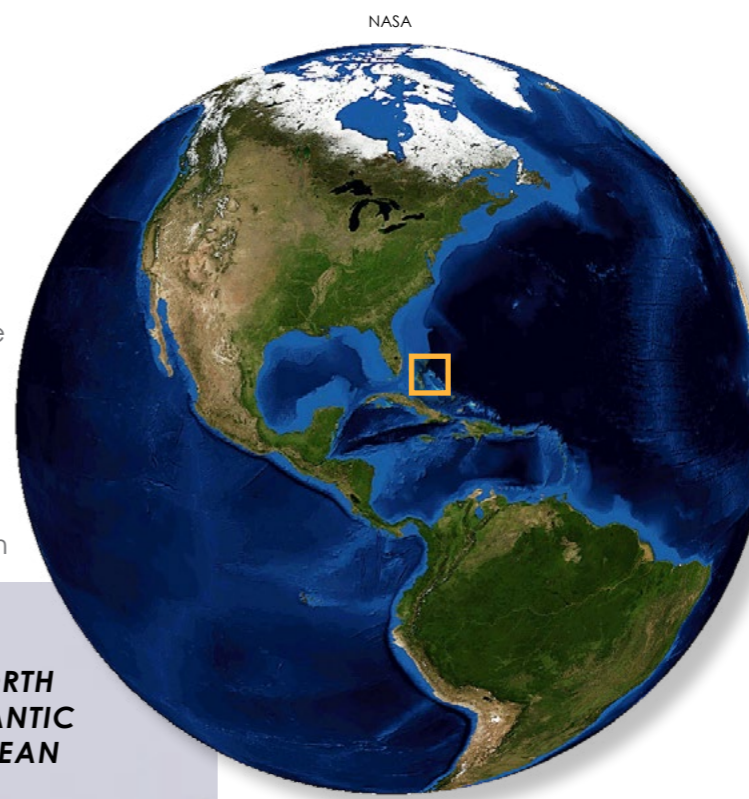
24°C / 75°F. Spring 27°C / 80°F. Summer (June to August) 31°C / 88°F. Average water visibility: 24-30 metres / 80-100 feet

Economy The Bahamas is a stable, developing nation with an economy heavily dependent on tourism and offshore banking. Tourism alone accounts for more than 60% of the GDP and directly or indirectly employs 40% of the archipelago's labor force.

Currency Bahamas Dollar The Bahamian dollar (B\$) is freely interchanged with the American dollar throughout The Bahamas. It is not necessary to change U.S. dollars into Bahamian currency. Traveler's checks in dollar denominations may be cashed almost anywhere. Credit cards are widely accepted. The Bahamas maintains cordial relations with all international banks and is known internationally for its banking and financial services.

Population Grand Bahamas population is approximately 75,000 (as of 2007)

RIGHT: Location of the Bahamas on global map
BELOW: Location of Grand Bahama Island on map of Bahamas
LOWER LEFT: Caribbean reef shark at Tiger Beach



US CIA WORLD FACTBOOK / PUBLIC DOMAIN

Tipping The usual tip on the islands, similar to the U.S. practice, is 15 percent. Sales tax does not exist in the Bahamas.

Driving British rules apply, so please drive on the left and watch those roundabouts. Visitors may use their home license for up to three months and may also apply for an international driver's license.

Airports/Visa Daily flights are available from Ft. Lauderdale (FLL) and Miami's (MIA) International airports to Grand Bahama International Airport (FPO). Citizens of the United States, Canada and The United Kingdom and Colonies do not need a passport for a visit that does not extend beyond three weeks. Visitors from these areas do need to present adequate proof of citizenship, such as birth certificate and photo identification.

Telephone From North America, dial 1 + 242 + the seven-digit local number. From elsewhere, dial your country's international direct dialing prefix + 1 + 242 + the seven-digit local number.

Hyperbaric Chamber The Bahamas Hyperbaric Centre The Lyford Cay Hospital Nassau, Bahamas

Language English

Time Zone Eastern Standard Time prevails on all the islands except during the summer, when Eastern Daylight Savings Time is adopted.

Voltage Electricity in The Bahamas is the North American standard 120 volts at 60 cycles.

Food Grand Bahama offers a wide variety of international cuisines for all tastes. The local Bahamian cuisine consists mainly of seafood, poultry, or pork, typically fried, steamed, or curried, with various kinds of rice and salads.



Scene from West End on Grand Bahama Island in the Bahamas

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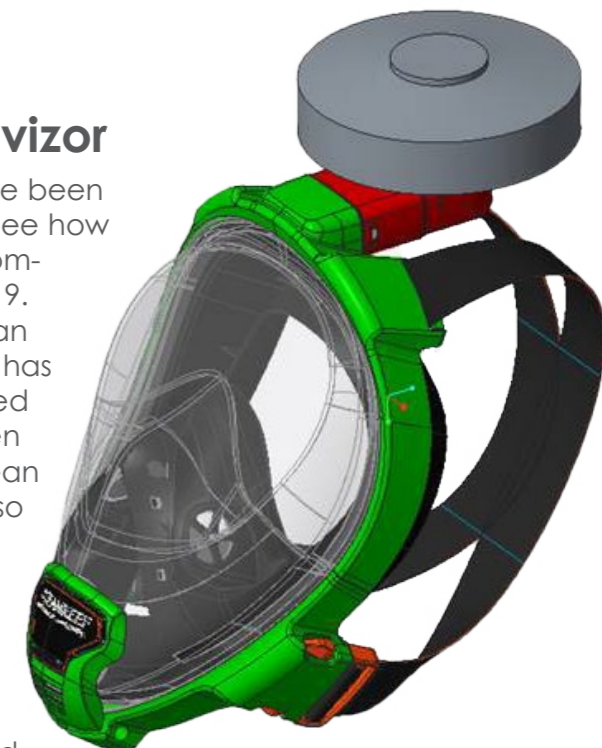


Edited by
Rosemary E. Lunn

Equipment

Snorkel mask as personal protection vizor

Various dive manufacturers have been reviewing their technology to see how it can be adapted to help combat the coronavirus COVID-19. One such company is Ocean Reef. The Italian company has announced it has patented an adaptor that has been designed to fit any Ocean Reef-produced mask, so that it can be turned into a personal protection mask.



Apparently, the user can connect any type and brand of filter to the adaptor using the 40mm threading. One advantage with a full-face snorkelling mask (FFM) is that it does cover the face, i.e. the eyes, nose and mouth. Unlike most single-use medical face masks, a FFM can be worn many times, and it is easy to clean and sanitize. Ocean Reef states, "We are offering a possible solution, in a time of dire need, to physically create a barrier, with the possible addition of a filter." [Oceanreefgroup.com](https://www.oceanreefgroup.com)

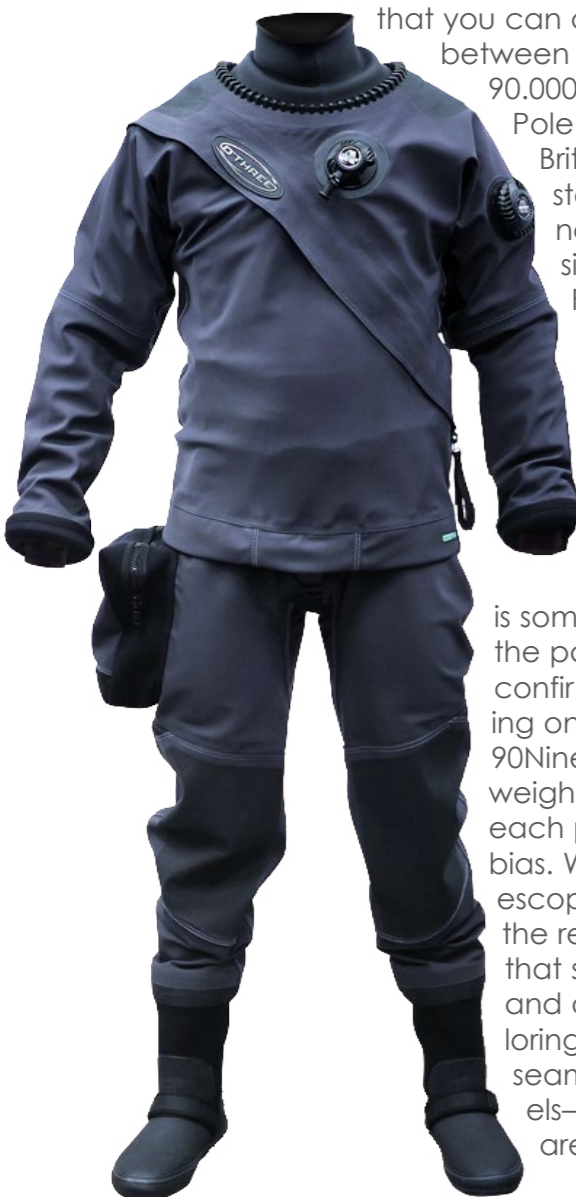
90Ninety

O'Three—the renowned neoprene drysuit manufacturer—has launched its inaugural membrane drysuit. The name "90Ninety" acknowledges

that you can dive this suit between 90.0000°N and 90.0000°S, or from Pole to Pole. The

British manufacturer stated, "We've not lost our passion for neoprene. Following customer demands we're bringing our ethos and standards to a membrane drysuit."

The 90Ninety comes in six male sizes, and because each suit is made to order, there is some latitude to adjust the pattern. O'Three has confirmed it is currently working on a ladies cut suit. The 90Ninety is made from a light-weight, rip-stop material and each panel has been cut on the bias. When you then add a telescopic torso and crotch strap, the result is a flexible, stretchy suit that should be a joy to don, dive and doff. There are other small tailoring touches: pre-bent arms, and seamless crotch and armpit panels—a smart move for dynamic areas on a drysuit. [Othree.co.uk](https://www.othree.co.uk)



"Elaskin" gloves

You need some kind of hand protection on most dives, and there is a massive range of gloves out there that cover all eventualities. In the main, you want your hands protected against mechanical damage—scrapes, scratches and bangs when wreck and cave diving. To this end, Beuchat has covered the palms, the front of the fingers and the finger tips of its "Premium Gloves" with Kevlar. This will help make these gloves far more durable and should mean they do not get worn so quickly when a diver does underwater tasks, i.e. clips and unclips bolt snaps. You also want your hands thermally protected when immersed in very cold and temperate waters—Beuchat has made these gloves out of 4.5mm ultra-soft "Elaskin" neoprene. Apparently this is pretty stretchy material, so they should be straight forward to doff and don. Available in five unisex sizes. [Beuchat-diving.com](https://www.beuchat-diving.com)



Medical O₂ adaptor

If we suspect a diver is suffering from decompression sickness, the immediate first aid response is to provide the diver with pure oxygen. So how do you access the gas in an alternative scuba cylinder, so that it can be delivered through a specialist oxygen regulator at a set flow rate, via one of these specialist masks? AP Diving has designed an adaptor with a standard 5/8" 'male' DIN at one end, and a medical oxygen pin index at the other end. This can be screwed into a scuba tank. The first aider can then attach a medical oxygen regulator into the PIN index pillar valve.

It should be noted that this adaptor should only be used in an emergency when the medical oxygen cylinder is not available or exhausted. AP Diving has confirmed that it has also made a M26 version of this adaptor. [APDiving.com](https://www.apdiving.com)



Made from fishing nets

Allergic to neoprene? Check out Fourth Element's Thermocline range! You can wear this next-generation Oceanwear as a barrier to reduce contact between your skin and a neoprene suit, or simply replace your 2mm neoprene garment. You will be environmentally responsible too—this neutrally buoyant wetsuit system is manufactured from a unique, machine-washable fabric that is environmentally friendly. The material is primarily ECONYL 100% recycled nylon. It is sourced from ghost fishing nets and other discarded waste, and then laminated with a waterproof membrane and a thermal fleece. The result is a high performing, aesthetically pleasing, lightweight suit that is breathable, wind and waterproof. Fourth Element says it feels as good as it looks. Positive wear for the ocean! [FourthElement.com](https://www.fourthelement.com)





Text by Simon Pridmore

— *The Scuba Confidential* column in this issue is adapted from a chapter in Simon's book *Scuba Exceptional: Become the Best Diver You Can Be*.

On 11 May 1996, five people died near the summit of Mount Everest. Two were expedition leaders, one was a professional guide and two were their clients. The events were first recounted in the book *Into Thin Air* written by journalist Jon Krakauer, who was up there on the mountain that day.

The clients died mainly because the professionals persisted with attempting to reach the summit despite the fact that they had passed their turnaround time; that is, the point in the day at which an attempt on the summit would normally be aborted for safety reasons. The concept of establishing a turnaround time and sticking to it religiously had been a major factor contributing to the professionals' hitherto exceptional safety record on Everest.

Krakauer concluded that, perhaps out of a desire to please their clients, burnish their reputation or because they thought they were "bulletproof," the professionals got their priorities confused on

this particular day. Normally, they were extremely well aware of where their main focus should always lie. Indeed, one of the two expedition leaders was fond of telling people: "with enough determination, any bloody idiot can get up this hill.

The trick is to get back down alive."

People who sign up for Everest expeditions are, in the main, not mountaineers or hard-core climbers. They are folk with a little climbing experience, plenty of money, plenty of guts and a dream. If

you ask them, I am sure they will say that their dream is to stand at the top of the world's highest mountain but, if you press them further, they will certainly add that the dream also involves surviving to tell the tale.

What has this all got to do with scuba diving?

When I first read the quote about "any bloody idiot" getting up this hill, it reminded me of one of the most frequently highlighted and re-quoted paragraphs in



A Brick Can Do That!

ILLUSTRATION COMPILED WITH IMAGES FROM PIXABAY





“In scuba diving, going down and staying down are not the difficult bits (a brick can do that). Coming up again is the part that requires skill.”

my book *Scuba Confidential*, which runs as follows:

“In scuba diving, going down and staying down are not the difficult bits (a brick can do that). Coming up again is the part that requires skill.”

Many people who sign up for technical

diver training are goal-driven in a similar way as Everest climbers, as the following two case histories show clearly.

Charlotte

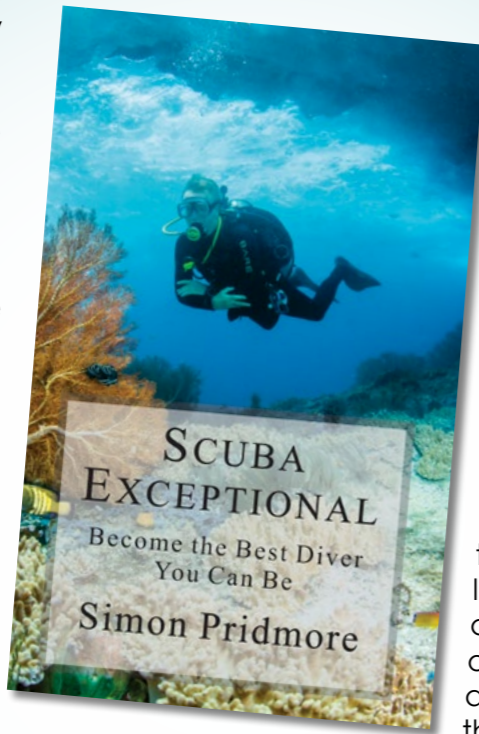
In the mid-1990s, an instructor in Florida had a student named Charlotte. Her

A New Book for Scuba Divers!

Scuba Exceptional may be the fifth in Simon Pridmore's *Scuba* series, but it is actually the true follow-up to his first book, the best-selling *Scuba Confidential*.

The philosophy of safer diving through the acquisition of knowledge and skills is the same, although this time the themes are different. As before, Pridmore provides us with a whole host of extremely useful advice and techniques, illustrated by real-life experiences and cautionary tales.

The focus this time, though, is more on issues that experienced divers face. There is more technical diving content, and Pridmore covers some relatively complex issues in his usual clear and easy-to-read style. In many cases, the issues that concern technical divers reflect those that affect scuba divers at every level. After all, as Pridmore writes, technical diving is on the same spectrum as conventional sport diving:



It is just a different frequency.

Scuba Exceptional also deals in more detail with the psychological approach to scuba diving, broaching familiar topics from new angles and borrowing techniques and procedures from other areas of human activity.

While most of *Scuba Exceptional* focuses on the diver, it also takes a look at the wider picture and highlights a number of areas where scuba diving professionals and the “industry” as a whole are letting divers down.

As always, Pridmore is realistic in his assessments. He may shine a little light on the dark side of the scuba diving world, but he does this in order to illuminate bad practices and encourage change, while offering solutions.

Scuba Exceptional: Become the Best Diver You Can Be by Simon Pridmore is available on: **Amazon.com**.



dream was to do a 90m dive. The instructor signed her up for a full trimix diver course and invited her to join him and a number of qualified trimix divers on a dive the following weekend.

The descent was uneventful. The group reached the seabed at just over 90m and the instructor and the other divers all gathered around and shook Charlotte's hand in congratulations. They later told reporters that she had looked extremely happy.

They then began their ascent through blue water. On the way up, as they approached their first required decompression stop, the instructor inflated a delayed surface marker buoy (DSMB), sending it up to the surface. The other divers gathered loosely close by, using the instructor as their depth reference, and switched to their deep decompression gas. Charlotte copied them and, ini-

tially, seemed to be doing just fine. After a while, however, the instructor noticed that she had drifted some distance away and was having difficulty staying at her stop depth. He tried waving to get her attention, but her face was turned away from him. She was still breathing steadily but was dropping deeper and deeper.

One diver tried to swim down to her to help, but she was falling too fast and he eventually gave up the chase, worried about depleting his breathing gas reserves and increasing his decompression burden. All the group could do was watch, uselessly and helplessly, as Charlotte's body just fell away, down through the murky blue sea, until she disappeared out of sight.

They hung there, eyes fixed on the stream of bubbles that still rose past them from the depths, each hoping against all hope and logic that somehow Charlotte

would emerge from the darkness and rise towards them, flashing an OK sign.

The stream of bubbles then stopped.

Charlotte's body was recovered a few days later.

Eli

Just a couple of years ago, in a different ocean off the coast of a different continent, Eli was another diver making his way through the technical diver levels. He had a 100m dive as his goal. He dived regularly with a technical diving instructor, who was shepherding him through the levels. After completing a dive to 70m a few weeks earlier—his deepest to date—Eli heard on the grapevine that his instructor and three friends were planning a dive to 100m. He asked if he could join them and they agreed.

PIXABAY





opinion



PIXABAY

On his descent, Eli had difficulty switching from travel gas to bottom gas and needed a little help, but the team all eventually reached the seabed. Seeing the magic number of 100m appear on his computer, Eli threw his arms up in a victory salute and fist-bumped his fellow divers enthusiastically.

After a few minutes, the group began to ascend. Each of the divers, including Eli, sent up a DSMB as they began their decompression stops. At the depth where they switched from their bottom gas back to their travel gas (which was air), Eli began to have difficulty controlling his buoyancy and started to float up beyond his decompression stop depth. One of the divers

swam over as quickly as he could to attempt to arrest his ascent but by the time he arrived, Eli was well out of reach and going up fast. He was still conscious when he reached the surface and screamed something unintelligible to the surface support crew, but he passed out soon afterwards and was not breathing when he was pulled into the boat. Attempts were made to revive him but with no success.

What had happened?

On a superficial level, in the first incident, Charlotte probably switched to the wrong decompression gas and suffered an oxygen toxicity hit. In the second, Eli's inexperience with switch-

ing gases, already apparent on the descent, was exacerbated by the narcotic hit he would have taken when switching from trimix to air at 51m (most technical diving experts would not recommend this gas strategy) and this caused him to lose control and make a rapid ascent, blowing over an hour of required decompression stops.

On a deeper level, neither diver was sufficiently skilled to attempt the dive that they died on and the instructor in both cases was negligent, irresponsible and failed to supervise them adequately.

However, just like the people on Everest on that day in 1996, everyone involved in both these dives was also

guilty of getting their priorities mixed up. The way the divers in both incidents behaved when they reached their target depth betrays their state of mind and suggests that their heads were in the wrong place. Just as the top of the mountain is never the main goal on any climb: On any dive, the target depth is not the main goal (a brick can do that), the end of the cave is not the main goal, nor is the back of the engine room. Survival is the main goal, every time, without exception.

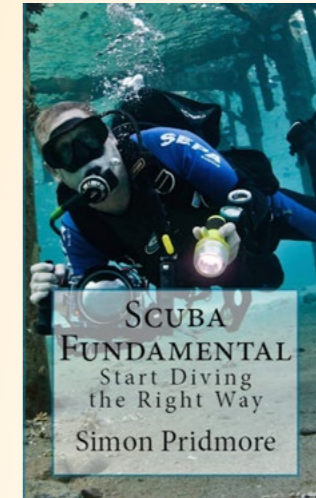
In 1961, President John F Kennedy proposed to Congress and the American people that: "...this nation should commit itself to achieving the goal, before this decade is out, of landing a man on the Moon and returning him safely to the Earth."

The last few words of this proposal were the key. Kennedy and his people knew that it was futile to get an astronaut to the moon if the astronaut did not make the journey there AND back, and live to tell the tale. The only achievement that mattered was survival, not standing on the moon. ■

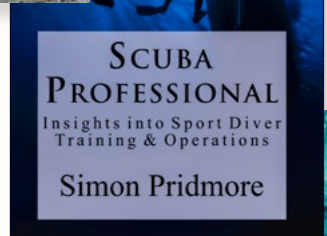
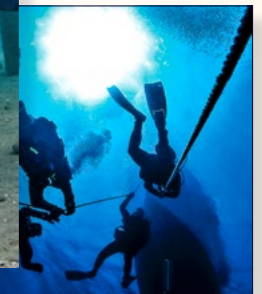
Simon Pridmore is the author of the international bestsellers Scuba Confidential: An Insider's Guide to Becoming a Better Diver, Scuba Professional: Insights into Sport Diver Training & Operations and Scuba Fundamental: Start Diving the Right Way. He is also the co-author of the Diving & Snorkeling Guide to Bali and the Diving & Snorkeling Guide to Raja Ampat & Northeast Indonesia. His recently published books include Scuba Exceptional: Become the Best Diver You Can Be, Scuba Physiological: Think You Know All About Scuba Medicine? Think Again!, the Diving with Divers series of cookbooks and Dive into Taiwan. For more information, see his website at: SimonPridmore.com.

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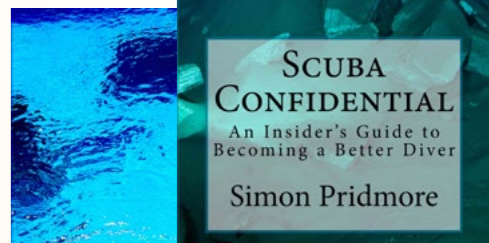
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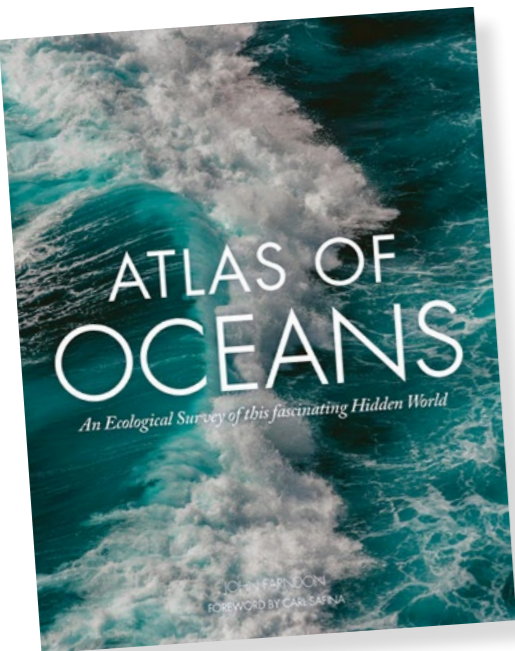
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Catherine
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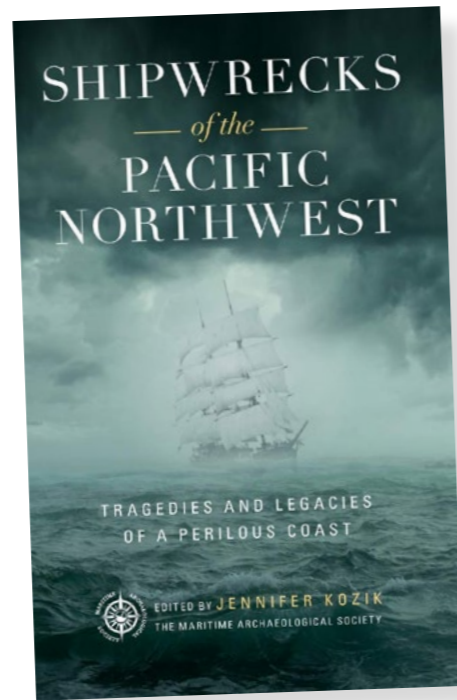
Marine life

Atlas of Oceans: An Ecological Survey of Underwater Life, by John Farndon

Find out more about the endangered species in our oceans, and how they are possibly more vulnerable to environmental problems than their

land-based counterparts. This book also contains special features on threats to particular animals, plants and habitats, as well as issues like overfishing, global warming and pollution. In addition, it covers success stories, recommendations on what can be done and has a rundown of the most endangered marine species. Fully illustrated with colour photos, maps and diagrams.

Hardcover: 256 pages
Publisher: Chartwell Books
Date: 28 April 2020
ISBN-10: 078583835X
ISBN-13: 978-0785838357

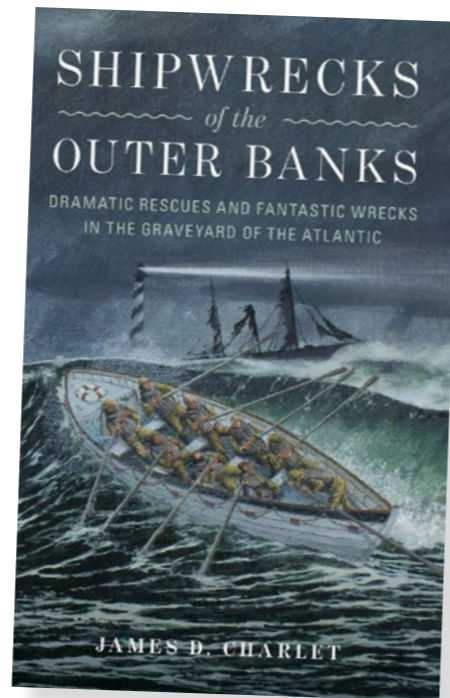


Shipwrecks

Shipwrecks of the Pacific Northwest: Tragedies and Legacies of a Perilous Coast, by Maritime Archaeological Society, Jennifer Kozik

This book explores the shipwrecks along the northern Oregon and southern Washington coasts of the United States, from the infamous to the nearly forgotten. Backed by archaeological analysis and new research, the writer focuses on a handful of these wrecks, uncovering tales of peril, tragedy and heroism as well as tangible legacies and an exploration of what remains.

Hardcover: 200 pages
Publisher: Globe Pequot
Date: 1 March 2020
ISBN-10: 1493044532
ISBN-13: 978-1493044535

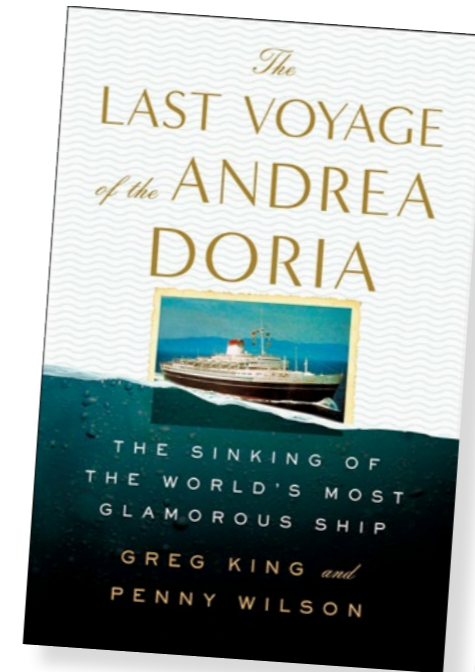


Graveyard of the Atlantic

Shipwrecks of the Outer Banks: Dramatic Rescues and Fantastic Wrecks in the Graveyard of the Atlantic, by James D. Charlet

The waters along the North Carolina coast have sealed the fates of more than 6,000 ships. It was here that seafarers had to navigate amidst mixing currents, treacherous coastlines and shifting underwater sandbars. History has witnessed countless tales of heroism and courage being played out here, alongside daring rescues, tragic failures, enduring mysteries, buried treasure and fascinating legend.

Hardcover: 264 pages
Publisher: Globe Pequot
Date: 14 February 2020
ISBN-10: 1493035908
ISBN-13: 978-1493035908



Andrea Doria

The Last Voyage of the Andrea Doria: The Sinking of the World's Most Glamorous Ship, by Greg King and Penny Wilson

In 1956, the Italian ocean liner *Andrea Doria* sank after being struck by a Swedish vessel. Its sinking marked the end of the golden age of ocean liner travel. Drawing on extensive research, interviews and never-seen-before wreck photos, this book presents a fresh look at the legendary ship and the lives of some of its passengers, as well as the effects the tragedy had on the survivors. The latest expeditions to the wreck are also covered.

Hardcover: 352 pages
Publisher: St. Martin's Press
Date: 7 April 2020
ISBN-10: 1250194539
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Edited by
Catherine GS Lim

Imagine you are on a dive. Suddenly, you sense movement and as you turn, you see what looks like a dolphin swimming in the distance. Excitedly, you swim towards it. As you get closer, you realise with bewilderment that this is no dolphin, but an underwater robot in the shape of a dolphin.

This scenario may one day become reality. And to be efficient, such robots would need to be maneuverable and stealthy, and be able to closely mimic the movements of the marine creatures.

Scientists like Keith W. Moored are working on the next generation of underwater robots by studying the movements of dolphins and whales. "We're studying how these animals are designed and what's beneficial about that design in terms of their swimming performance, or the fluid mechanics of how they swim."

Moored is an assistant professor of mechanical engineering and mechanics in Lehigh University's P.C. Rossin College of Engineering and Applied Science. He is also the principal investigator on a *Journal of the Royal Society Interface* paper that examined the fluid mechanics of cetacean propulsion by numerically simulating their oscillating tail fins.

Kinematics

Cetaceans' tails come in many shapes. The scientists wanted to find out whether the shape of the tail fin affects the way animals moved their fins (called "kinematics").

Focusing on five species (bottlenose dolphin, spotted dolphin, orca, false killer whale and beluga whale), the team ran simulations to determine the propulsive efficiency for each species. Then, they swapped the data around, for example, by running a simulation of the orca's fin shape with the kinematics of a dolphin.

Fin shape and efficiency

The findings of the 25 swapped simulations surprised the team.

"The pseudo orca fin shape was always the best, meaning it was the most efficient. It didn't matter what kinematics we gave it. And the beluga whale kinematics were always the best, regardless of which shape it was attached to. We didn't expect that, so we started digging into it more and developed this relatively simplistic model of how efficiency scales with different kinematic and shape variables," said Moored.

The model also predicted efficiency

beyond the data set and revealed that specific shapes were tailored to specific kinematics.

Circulatory & added mass forces

The team made an interesting revelation about the relationship between circulatory forces and added mass forces that contribute to an animal's movement.

"A tail that's flapping up and down generates forces just like an aircraft, but it also generates added mass forces that have to do with how fast the fluid is being accelerated," Moored explained. "...We found that the accelerations of

the fin are integral to predicting the trends of efficiency, and that was fascinating to us. It ultimately gives us a predictive model that's accurate."

The model can provide a basic design equation for building an underwater robot that performs like a cetacean. Such a robot can be deployed to test hypotheses, to better understand the behaviour of fish schools, to detect submarines and other submersibles and to monitor climate change impact on fish stock populations. ■

SOURCE: LEHIGH UNIVERSITY

Learning the swimming secrets of dolphins and whales

PETER SYMES





marine mammals

Edited by Catherine GS Lim

Of seals and their whiskers

A study on three pinniped species revealed that their whiskers served an active sensory function.

Some land animals like rats and shrews use their whiskers to explore, forage and move around. For the first time, a team of researchers, led by Robyn Grant of Manchester Metropolitan University, were able to show that pinnipeds too use their whiskers in a similar fashion.

The study, published in the *Journal of Comparative Physiology A* sought to measure and compare whisker movements and control amongst three pinniped species—California sea lions, harbor seals and Pacific walrus.

Whisker and head movements

The research used a video camera to film the animal's head and whisker movements as a trainer moved a fish over the animal's whiskers from one side to the other.

It was found that all the three species positioned their whiskers toward the fish by orienting their heads. At the same time, their whiskers also moved.

In addition, some species displayed

whisker control behaviors that have previously only been observed in land-based animals. For example, the walrus' whiskers would demonstrate head-turning asymmetry (in which the whiskers move ahead of a head rotation to scan the area that the head turns into. Another example involved the walrus and sea lion engaging in contact-induced asymmetry (where the whiskers are positioned asymmetrically toward an object).

Whisker positioning

The researchers also noticed some major differences in whisker positioning and orientation amongst the three species. Walrus, which had densely packed whiskers that are more forward-facing, did not move them around as much as the other two spe-

cies. When foraging in murky waters, they would move their heads around; their whiskers would scan the seabed for prey, much like a brush.

On the other hand, seals and sea lions had fewer whiskers that were spread out on the sides of their faces. "Both the sea lion and the harbor seal move their whiskers in a similar way and we think it's related to the way they orient toward fish while hunting," said Grant.

Active touch sensing

For the next phase in the research, she intends to focus on active touch sensing. "Now that we've learned that sea lions move their whiskers the most and are able to orient the most to contact, we want to see if they are capable of task-specific whisker movement—using their whiskers much like we move our fingertips."

"For example, if you train them on an object softness task or a texture or size task, would they make different whisker movements depending on the task? We, as humans, would make lateral fingertip movements to discriminate textures, squishy movements on a softness task, and feel around the edge of an object to judge shape or size." ■ SOURCE: MANCHESTER METROPOLITAN UNIVERSITY



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Text by Denise F. Blake, MD
and Neal W. Pollock, PhD

The diving community understands that oxygen administration is a first aid treatment priority for divers with suspected decompression illness. The goal is to deliver oxygen at the highest possible concentration, being mindful of oxygen supply limits. A variety of portable oxygen delivery systems have been designed for use in diving accidents. These systems consist of two basic operating configurations: an adjustable constant flow regulator or a patient-triggered demand valve.

Constant flow systems have flow meters with settings ranging from 0.5 to 25 liters per minute ($L \cdot \text{min}^{-1}$). They are usually open-circuit, with expired gas released to the environment, but they can also be used with closed-circuit devices. Closed-circuit devices allow gas to be

rebreathed after passing through a "scrubber" that removes carbon dioxide from the mixture. These devices allow for oxygen conservation since the unused gas is effectively recycled. The required oxygen flow rate can be very low, often between 0.8 and 1.5 $L \cdot \text{min}^{-1}$. The

increased efficiency is achieved through increased complexity.

The recommended initial oxygen flow rate for open-circuit systems employing a non-rebreather mask has long been 15 $L \cdot \text{min}^{-1}$. Given typical supply limitations, there is a natural interest in reducing the

flow rate to extend oxygen delivery duration. Dropping the oxygen flow rate closer to 10 $L \cdot \text{min}^{-1}$ has been suggested as a compromise, but the effect of this lower flow rate on tissue oxygen delivery needs to be considered.

Previous research has found that the

non-rebreather mask set at 15 $L \cdot \text{min}^{-1}$ can provide better tissue oxygenation than the demand valve with an oronasal mask.¹ A subsequent study showed that the demand valve performed best with an intraoral mask and nose clip, supporting the thought that poor mask fit led to



Comparing the Performance of First Aid

Oxygen Delivery Systems





PHOTO COURTESY OF DENISE BLAKE AND NEAL POLLOCK

Figure 1: Demand valve with intraoral mask (upper left), non-rebreather mask (upper right), intraoral mask and nose clip (lower left) and oronasal mask (middle bottom) used with the medical oxygen rebreathing system (lower right).

the underperformance of the demand valve in the earlier research.²

This article summarizes the oxygen delivery achieved with three different commercially available oxygen delivery configurations. Additional details are available in the published report.³

Methods

Five different oxygen delivery configurations were tested: a demand valve with an intraoral mask (NuMask®) and nose clip; a first aid medical oxygen rebreathing system (MORS) (Wenoll-System, EMS GmbH, Möhrendorf, Germany) with an oronasal mask or with an intraoral mask and nose clip; and a non-rebreather mask with oxygen flow set at 10 or 15 L·min⁻¹ (Figure 1).

When using the demand valve, participants were asked to breathe deeply enough to trigger the valve. The MORS circuit was primed with oxygen at 40 L·min⁻¹ and the oxygen flow rate then set at 1.5 L·min⁻¹ (in accordance with the manufacturer's instructions). The non-rebreather mask was positioned and adjusted to obtain the best seal possible. Participants were asked to breathe normally.

Oxygen delivery was measured in two ways: as the fraction of oxygen reaching the back of the throat (nasopharynx) and as tissue oxygen levels measured through the skin with transcutaneous oximetry. For the latter, sensors were taped on the skin at six standard sites (arm and leg), the skin was warmed to ensure good blood flow, and peak tissue oxy-

gen levels were recorded non-invasively at the end of 10-minute oxygen breathing periods.

Following each trial, participants were asked to rate the mask configuration for comfort, ease of breathing, and ease of holding the apparatus in place.

Results

Data were collected using 12 healthy volunteer diver-participants (nine female; three male) under dry laboratory conditions.

The highest levels of nasopharyngeal oxygen were achieved with the non-rebreather mask at 15 L·min⁻¹ oxygen flow. The demand valve delivered slightly less, and the non-rebreather mask at 10 L·min⁻¹ delivered the lowest levels. The delivered fraction required more time to reach peak levels with the MORS and the non-rebreather mask with a 10 L·min⁻¹ flow rate (Figure 2).

The tissue oxygen levels ultimately achieved were statistically similar for the non-rebreather mask at 15 L·min⁻¹, the demand valve with intraoral mask and nose clip, and MORS with either the oronasal mask or the intraoral mask. The non-rebreather mask with 10 L·min⁻¹ was the poorest performer (Figure 3, next page).

Subjectively, the non-rebreather mask was rated as the most comfortable, easiest to breathe through, and overall easiest to use.

Discussion

There are many portable oxygen delivery systems designed to provide effective first aid oxygen to injured divers. Evaluating tissue oxygen levels is probably the most meaningful way to assess effectiveness. Our findings confirm that

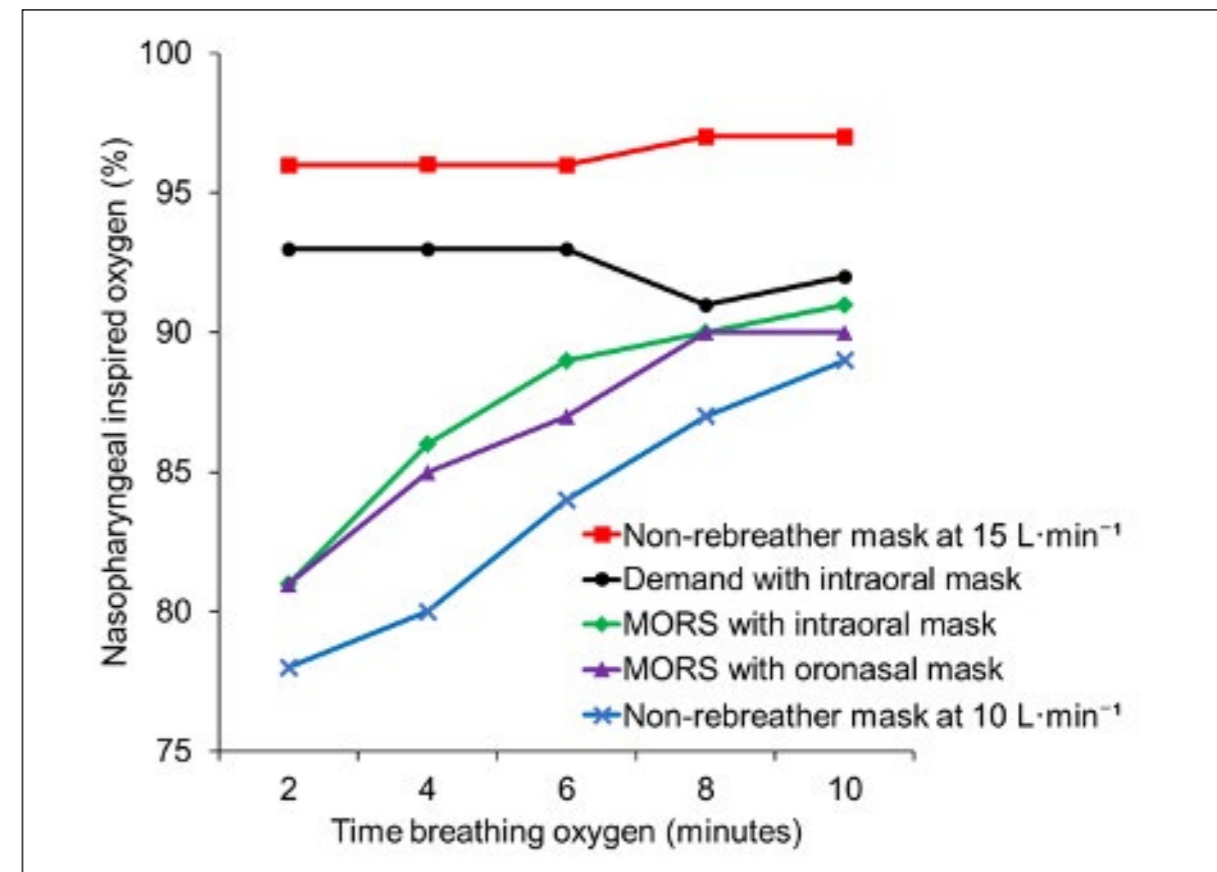


Figure 2: Nasopharyngeal oxygen levels measured every two minutes over the 10-minute breathing period for each oxygen breathing system. MORS – medical oxygen rebreathing system.

the three systems evaluated can provide similar tissue oxygenation, but that oxygen flow rate and configuration can play an important role.

When providing oxygen with an open-circuit non-rebreather mask, oxygenation was significantly influenced by oxygen flow rate. Given the critical goal of providing divers with the highest oxygen concentration possible (close to 100%), 15 L·min⁻¹ flow rates should be used when practical. Monitoring the reservoir bag for constant inflation, as suggested in oxygen training courses, does not guarantee high levels of oxygen delivery. The higher oxygen flow rate likely provides enough oxygen directly during the inspiratory period to deliver a higher oxygen content.

When providing oxygen with a demand valve, an intraoral mask is known to be effective.² The use of an intraoral mask may be a better option for divers with large amounts of facial hair or other conditions that may impair an oronasal mask seal. If an intraoral mask is not available, a regulator mouthpiece could also be used. A standard regulator

mouthpiece is included with the MORS.

The MORS may be a good choice when the oxygen supply is limited, or if access to additional medical supplies and/or care is likely to be delayed. A Jumbo D size oxygen cylinder (640 liters) may last for up to 6 hours (1.5 L·min⁻¹ x 60 min then 0.8 L·min⁻¹) when using the MORS.

Several other factors should be considered when selecting oxygen delivery equipment, including cost, availability, local regulations and training and maintenance requirements. Figure 4 provides a summary of factors for comparison.

The MORS regulator is multi-function with a demand valve and constant flow settings from 0.5 to 15 L·min⁻¹ allowing it to be used with either the rebreather circuit or a non-rebreather mask. The MORS circuit is sold as a single-use device, requiring replacement after every use or after four years of storage due to the life expectancy of the scrubber material. Its replacement cost is considerably more than the disposable parts of the other systems (MORS circuit €175 (\$192USD), intraoral mask with nose clip €10 (US\$11), non-rebreather mask €4.5 (US\$5)).

ILLUSTRATION COURTESY OF DENISE BLAKE AND NEAL POLLOCK



Numerous organizations provide emergency oxygen therapy courses for use of the demand valve and non-rebreather mask. At present, courses for the MORS are only offered in Europe, but the system does come with a comprehensive operating manual. With the growing popularity of closed-circuit rebreathers for diving, there may be an increased interest in MORS systems for first aid use.

Rescuers may have to manage potentially complex situations, including those with unconscious, non-breathing patients. A non-rebreather mask cannot be used for a non-breathing patient, but the oxygen tubing can be removed from a non-rebreather mask and attached to the inlet port of a pocket face mask to

improve oxygenation during mouth-to-mask resuscitation. Similarly, while standard scuba regulators should not be used to manually ventilate a patient due to the high purge valve pressures that can cause tissue damage or promote regurgitation of material from the stomach, some medical oxygen delivery systems are designed to be used safely. Some closed-circuit systems may also have adjustable pressure limiting valves to allow ventilation of a non-breathing patient.

Appropriate training is important to ensure knowledge of the strengths and limitations of any delivery system, and ongoing practice is needed to ensure physical skill readiness during emergent events.

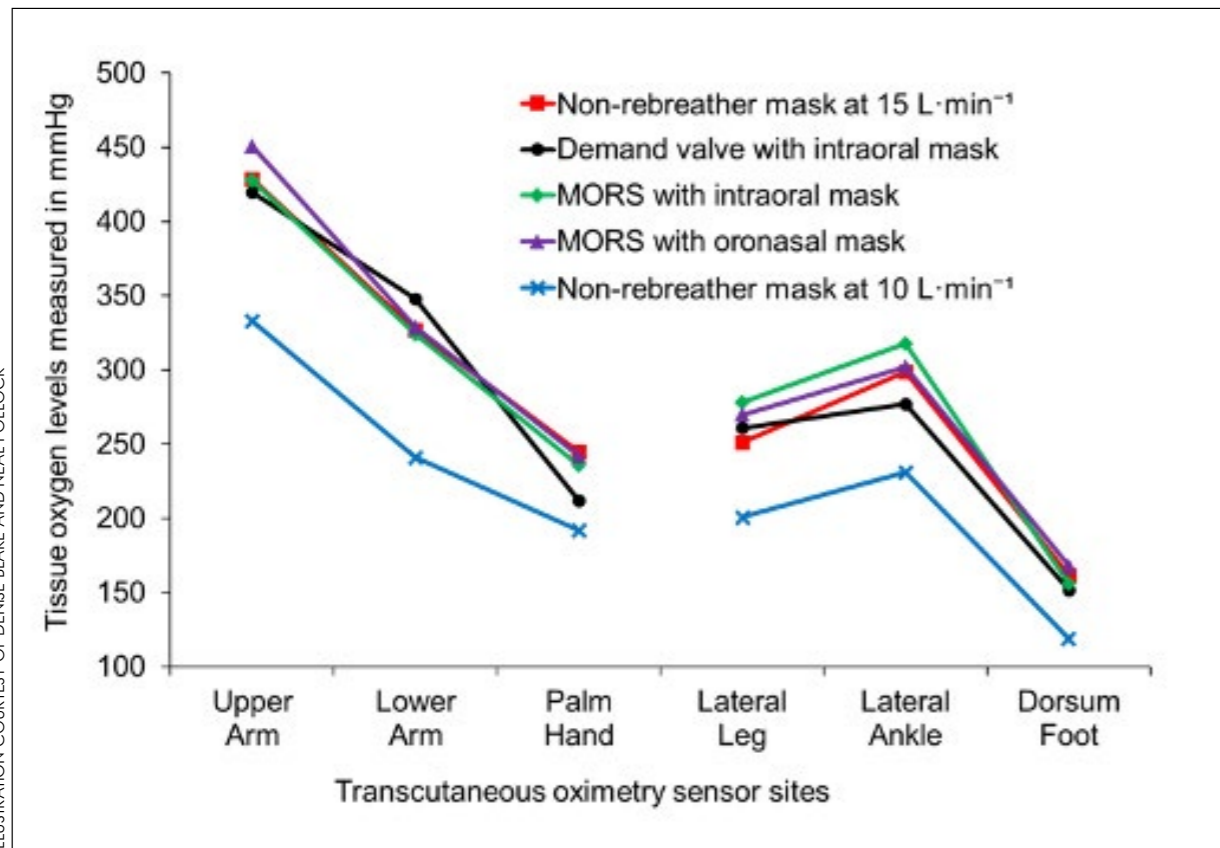


Figure 3: Tissue oxygen results while breathing oxygen using the different oxygen systems and flow rates. MORS – medical oxygen rebreathing system.

Figure 4: Emergency oxygen breathing systems choice consideration matrix.



Conclusion

Three devices (in five conditions) were tested for their ability to deliver oxygen to simulated patients. Oxygen levels were highest with a constant flow system paired with the non-rebreather mask and a 15 L·min⁻¹ flow rate, and lowest with the non-rebreather mask at 10 L·min⁻¹. MORS with either an oronasal mask or mouth-piece may provide an alternative for prolonged oxygen delivery with limited gas supply. ■

Dr Denise F. Blake is an emergency and diving physician in Townsville, Queensland, Australia. This research is part of her current PhD program at James Cook University.

Dr Neal W. Pollock is an associate professor in Kinesiology at Université Laval, Québec, Canada.

The authors acknowledge research grant support from the Emergency Medicine Foundation (EMF), Queensland and in-kind support from Divers Alert Network Asia-Pacific. Thanks to Chris Chivers for the graphic design (Figure 4).

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ILLUSTRATION BY CHRIS CHIVERS

Stings & Scrapes

— Part 2

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In this installment of our series on marine life injuries, we will be covering wounds caused by urchins, stingrays and octopuses. These wounds have the potential to be more serious than injuries from other marine organisms, but they are easy to prevent with a little knowledge and planning. Pay close attention to your surroundings and view these creatures from a distance, and it is unlikely you will encounter trouble. If you do get injured, here is what you will need to know.

Stingrays

Stingrays are frequently considered dangerous or threatening but largely without cause. These are shy fish that generally present no threat to divers unless stepped on or deliberately antagonized. Most stingray injuries occur in shallow water when beachgoers step on the animals. Stingrays can vary in size from just a few inches to more than six feet wide and have a serrated barb at the end of their tails that can cause serious injuries. At the base of the barb are two venomous glands that can cause infections and exacerbate an initial penetrating wound. These barbs can easily cut through wetsuit material and cause lacerations or puncture wounds, and if a barb breaks off in a wound, it may require surgical care.

Treatment of stingray injuries will vary

based on the type and location of injury, but many can be treated like traditional puncture wounds. Remove the injured party from danger, control bleeding and clean the wound thoroughly, then seek immediate medical attention. Due to the nature of stingray venom and the resulting infection risk, these wounds must be addressed by a professional.

Urchins

Sea urchins are echinoderms, a phylum of marine animals shared with starfish, sand dollars and sea cucumbers. Fearsome relatives these may not be, but urchin spines can cause painful injuries that can last for weeks. The creatures are omnivorous and subsist primarily on algae and decomposing animal matter. They have tubular feet that are covered in hollow spines, which can easily penetrate a diver's wetsuit, puncture the skin and break off. These puncture wounds are typically associated with redness and swelling. Pain and injury severity range from mild to severe, depending on the location of the injury. Very rarely, life-threatening complications can occur. Preventing urchin wounds is as simple as practicing good buoyancy and keeping an eye out as you walk into the water. Know the types of areas that urchins inhabit (typically, these are rocky

and algae-covered), and keep a particularly close eye out if your entry involves such terrain.

Treating urchin injuries depends significantly on the location of the wound—a penetrating injury near a major vein or artery may require surgery, while a single barb with little penetration may be addressed without medical intervention. Begin by applying heat to the area of the wound for 30 to 90 minutes while removing superficial spines. Wash the area without forceful scrubbing (to avoid causing additional damage if there are still some spines embedded in the skin). Apply antibiotic ointment to the skin and seek medical evaluation if there seem to be additional embedded spines or any signs of infection.



Blue-ringed octopus

The blue-ringed octopus has the unique distinction of being the only cephalopod known to be deadly to humans. This small species of venomous octopus lives in tropical tide pools from southern Japan to the coastal reefs of Australia and the western Indo-Pacific. They rarely exceed eight inches in size and are marked distinctively with blue iridescent rings that cover their yellow bodies. Note that this color is only displayed when the animal is hunting, mating or disturbed. At rest, the blue-ringed octopus may display an overall yellowish, grey or beige coloration without blue rings.

These creatures have a strong beak similar to that of a parrot, and a paralytic venom called tetrodotoxin, which can be nearly 10,000 times more potent than cyanide. The lethal dose of this venom for most adults is about 0.5 milligrams (about the amount that could fit on the head of a pin). A

bite from a blue-ringed octopus is usually painless or no more painful than a bee sting but should be taken very seriously. Neurological symptoms are common with blue-ringed octopus envenomation, and symptoms can progress to paralysis or death. Symptom onset typically occurs within minutes and includes paresthesia of the lips and tongue, excessive salivation, trouble with pronunciation, difficulty swallowing, sweating, dizziness and headache. In severe cases, these symptoms may progress to muscle weakness, loss of coordination, tremors and paralysis.

There is no antivenom available for tetrodotoxin, so care for envenomation is supportive. Wounds should be cleaned with freshwater and pressure-immobilized, and injured divers should be monitored and transported to emergency medical care as quickly as possible. Due to the potential lethality of a blue-ringed octopus bite, it is imperative that anyone with a suspected bite seek emergency care immediately, rather than wait for symptom onset. ■

For more information on hazardous marine life, visit DAN.org/Health.



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MATTHEW MEIER



Interview with
Jakub Šimánek
— *“I get to play at work and call it my job”*



Text edited by Nikola Valtosova
Photos by Miloslav Dvoracek, Eva Simankova, Martin Štrmiska, Dusan Urban and Dan Valek

Jakub Šimánek lives for diving and dives for a living. He inherited his passion for the underwater world from his father at a young age. Currently, a Factory Instructor Trainer for the Liberty closed circuit rebreather (CCR), Jakub has been a part of the development team at the dive equipment manufacturer Divesoft since 2012. While his main focus is Liberty CCR and Liberty Sidemount training, he also works as a dive analyst, consultant, test diver and “crash test dummy.”

He has been diving with a Liberty since the very first prototype and has helped with many SW and HW innovations (CCR bailout mode included). Since 2017, he

Jakub Šimánek diving the flooded Czech iron mine of Hranicna

MILOSLAV DVORACEK

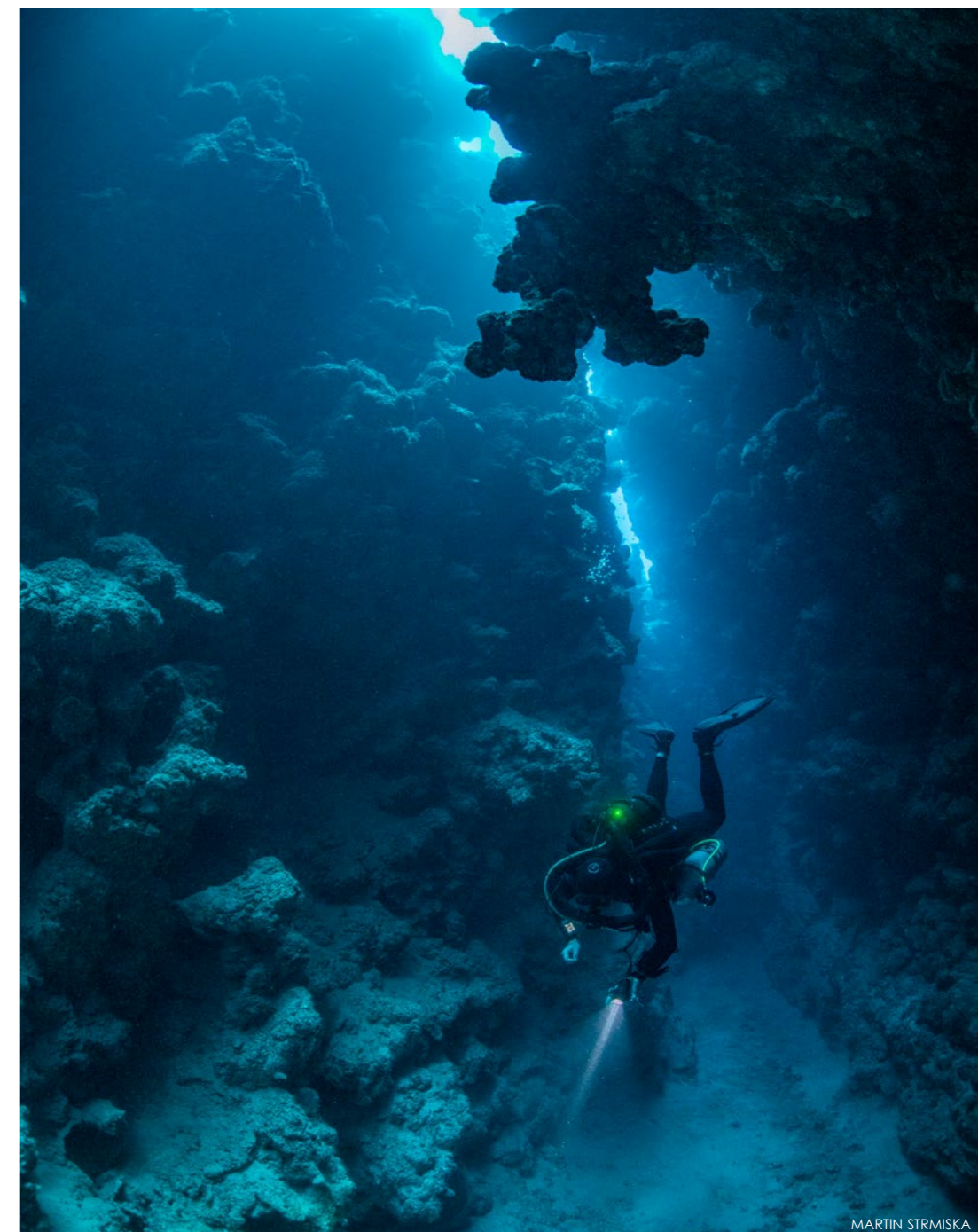




COURTESY OF JAKUB ŠIMÁNEK



DUSAN URBAN



MARTIN STRMIŠKA

Jakub Šimánek diving the flooded Czech iron mine of Hranicna (above) and in Egypt (right)

has been collecting and recording his experiences and methods using bailout rebreathers. In addition to obtaining a master's degree in education, Jakub has developed a rebreather training program and trains instructors, trainers and divers from all around the world, military included.

NV: We heard the story about how you got into diving is very interesting. How did your passion for diving come to be?

JS: My passion for diving began as soon as I was able to walk and talk. My dad was my hero, emerging from the mysterious depths below, and I wanted to

be just like him. I was drawn to the magic of the unknown world that my dad described to me in vivid detail. As a three-year-old, I often pretended I was a diver, playing under restaurant tables or under bus seats en route to Yugoslavia to entertain those around. I saw every puddle as a lake or sea that I imagined diving into.

NV: What do you enjoy most about diving?

JS: Of course, there are many things I love about diving: the underwater life, beautiful scenery, crystal-clear waters and the simple feeling of floating in a three-dimensional space like you

are flying. I also enjoy trying different types of dives that give me the opportunity to learn something new.

NV: Taking into account your many years of experience, I would say it is safe to assume you have found the place you like to dive most. Would you be willing to reveal its location to us?

JS: I have had the opportunity to dive in many places and have seen wonderful things in Australia, the Red Sea, Florida, the Mediterranean Sea, the Hranice Abyss and even the Danube Delta. So, it is quite hard to say where the best dive was or where

the best place is, but there is one spot that is really special to me in many ways. It is a flooded city in a reservoir, which was originally designed to hold drinking water. Diving is forbidden there, of course, but I managed to get in the water several times and was the first to discover the flooded remains of a castle as well as a perfectly preserved Jewish cemetery. Diving there was a real adventure and was the culmination of many hours of careful planning and searching old maps and archives.

My other favorite place is my "home reef," the Borek quarry, where I have logged hundreds of dives and still enjoy going to today.





MILOSLAV DVORACEK

Jakub Šimánek diving the flooded iron mine of Hranicna in the Czech Republic

NV: When did you decide this hobby of yours would also become your career?

JS: Of course, I had always dreamed of diving becoming my career, and when I look back, it seems that everything I did in my life was actually in preparation for what I am doing now. All these paths came together in one place and at one moment when I met Lucie Šmejkalová (CEO and co-founder of Divesoft) and decided to cooperate with Divesoft. It might seem like a coincidence, but, as I do not believe in them, I am not sure it was.

NV: You are not only a diver, but you also do consulting, analyses

and new product testing. Could you tell us something more about these other activities you are involved in?

JS: Being as diving is my lifelong passion, and perhaps even my lifestyle, I sometimes feel a bit silly that I actually get to play at work and call it "my job." I love thinking of new ways and solutions for diving gear, instruments, techniques and training.

NV: In your bio section on the Divesoft website, readers can learn about how you developed the rebreather training program. Why did you decide to specialize in the rebreather?

JS: I have been interested in rebreathers since I first learned about them during my first official CMAS* diver course. At that time, I overwhelmed my instructor with a ton of questions that he could not answer, because he only had a theoretical knowledge of rebreathers. In those days, few people had ever had the opportunity to even try a rebreather. When the Dräger Dolphin appeared on the market, I was blown away and wanted to create one of my own!

NV: What is so special about this type of diving technology?

JS: I have always liked the efficiency of the gas consumption; the absence of bubbles allows the

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MARTIN STRMIŠKA

diver to better blend in with their environment and this opens the possibilities of staying underwater longer and descending to greater depths. Overall, I just really like the whole principle of the CCR.

NV: In addition to your courses, do you have the option to train others in diving? Who are your typical clients?

JS: Unfortunately, I do not have much time left for courses outside of Divesoft. My clients are mainly rebreather instructors and instructor trainers from all over the world. And if anybody has managed to convince me to teach another course, it is usually my friends.

NV: Your work schedule is truly multi-colored. We heard that you will also be taking part in the TekDive 2020 Conference. What exactly will this event be focused on? What should the conference attendees be looking forward to the most?

JS: TekDive USA is always full of interesting presentations and speeches about technical diving, physiology, new technologies and intriguing projects. I definitely want to visit presentations by Neal Pollock, Frauke Tillmans, Gareth Lock and Rick Stanton.

NV: You have also been asked to speak at TekDive. Have you already selected

the topic you will speak about at the event?

JS: Yes, I will be part of a panel discussion on bailout rebreathers. This is a very hot topic because this trend, which until recently, was limited to just a handful of individuals, has infiltrated the general diving community thanks to the Liberty Sidemount. This way of diving is still in its infancy, so I would like to use my experiences and knowledge to help educate others on safe diving practices using bailout devices.

NV: In closing, I would like to ask you about your vision, dreams and plans for diving. Is there anything specific you

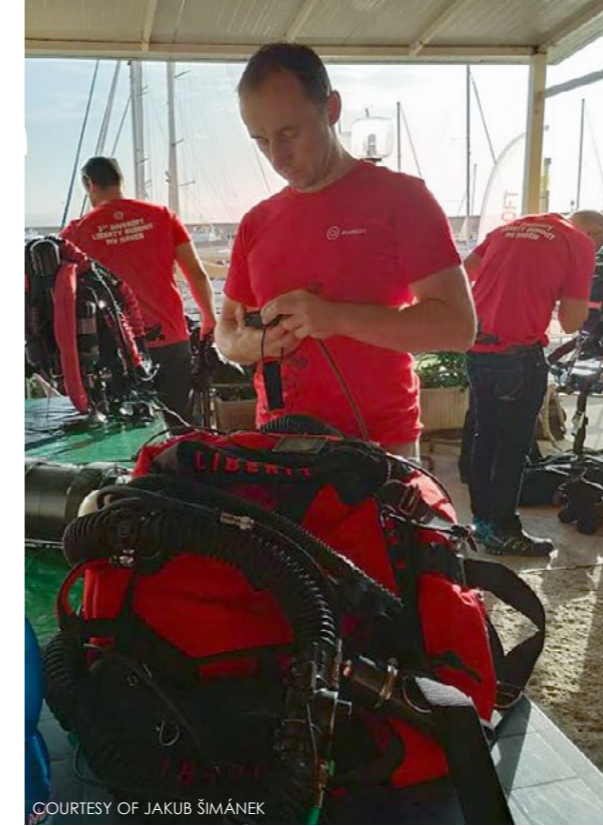
Jakub Šimánek

to make rebreathers even more effective, more user-friendly, powerful and safe. But these are just ideas on paper, and without all the other wonderful members of our team, they will just stay that way.

NV: Do you have any motivational advice, which has helped you achieve your diving goals, to share with our readers who love diving as much as you do?

JS: I do not think there is anything that can replace one's internal motivation, but if I was to advise others, then I would say: "If you love diving, get as much information as possible from all the areas it touches and let that propel you forward, not only with regard to your diving skills, but also towards a more enriching life." ■

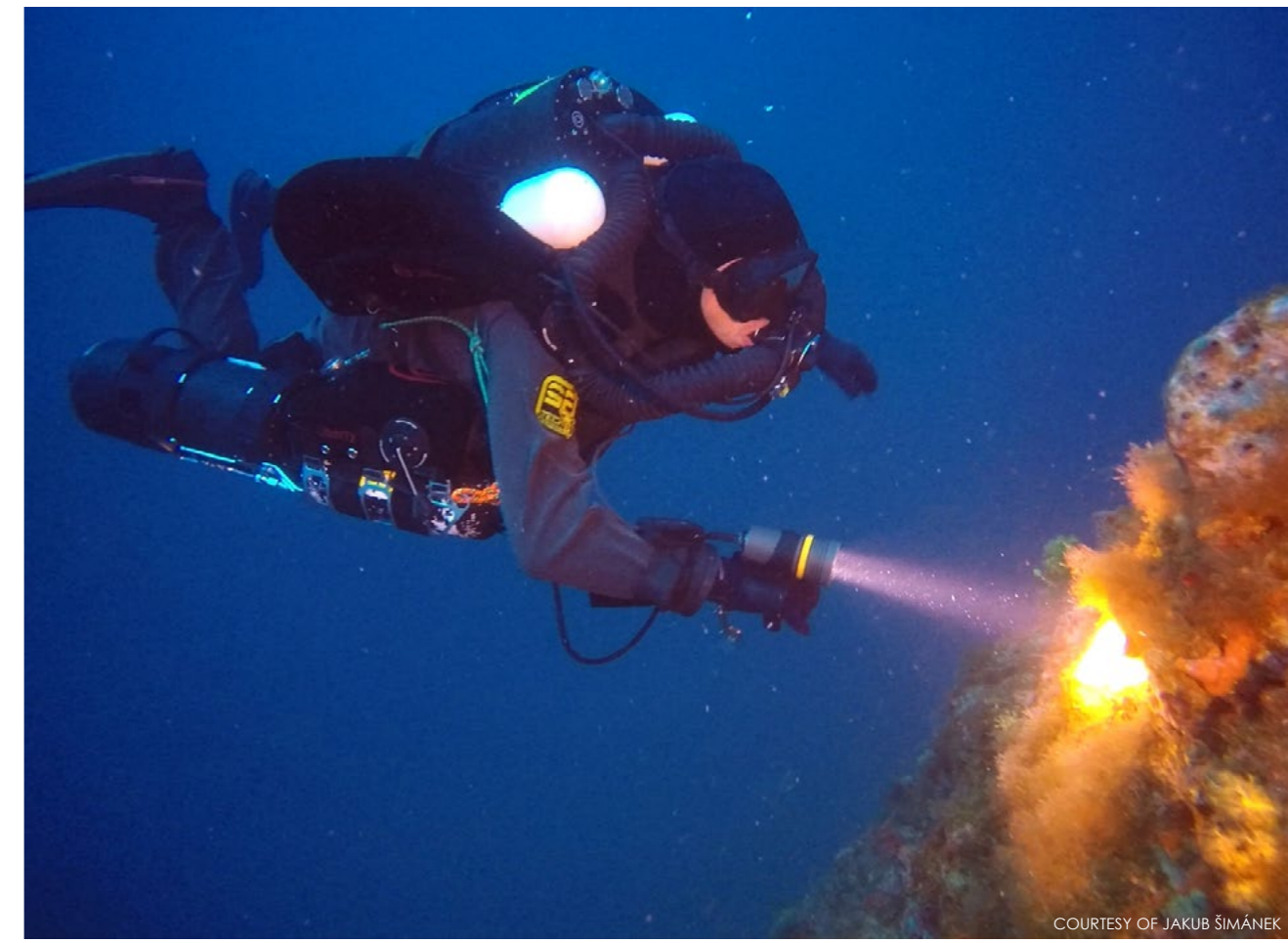
Nikola Valtosova is a dive and travel writer and project manager based in Prague.



COURTESY OF JAKUB ŠIMÁNEK

would like to fulfil in the coming years?

JS: I would like to continue to participate in the development of dive gear. For example, in my head are ideas on how



COURTESY OF JAKUB ŠIMÁNEK

Šimánek diving in Egypt (above and top left) and checking gear as an instructor trainer (top right)



What are sharks aware of?

Text and illustrations
by Ila France Porcher

Sharks have a very different set of senses than we do, yet the eyesight of the free-swimming species is good. So, when they look at you, they are seeing you. But you may have the impression that they are using senses other than their eyes most often. Indeed, apart from our shared good eyesight, it is impossible for us to imagine how sharks experience their liquid realm.

Sound and vibration are very important to sharks. Sound travels a long way in

water, spreading in a uniform spherical pattern, and sharks hear well. They are particularly sensitive to low-frequency vibrations, such as those caused by movement in the water and crashing waves. They can also detect pressure waves with the sense organ called the lateral line.

The lateral line

The lateral line is found in fish, sharks, and some amphibians, and is made up of a series of receptors in a line along the length of the animal. The receptors consist of a sensor within a cupola of jelly, which is directly affected by pressure in the water, just as the hair cells in our inner ears, which keep us balanced, are directly affected by movement. It is thought that the lateral line and the inner ear have a common origin far back

in evolutionary time when life was selecting the basics.

A complex nervous system analyses the incoming information in each tiny receptor, enabling sharks to perceive events beyond visual range through these pressure vibrations.

Sharks can be aware of a person or large animal moving in the vicinity, while remaining unseen,



beyond the blue curtain of the visible range. Some of the sharks present at a shark feeding dive may have come to investigate, after hearing the submarine uproar caused by other sharks feeding. On their first approaches into visible range, you will see that these late comers generally pass just barely into view. A few minutes later, they will come again, probably closer.

Ampullae of Lorenzini

Then there are the electro-receptive organs, the *ampullae of Lorenzini*. They detect voltage—electrical potential across a barrier. This is not the same as the ability to detect current flowing through a conductor, such as along a nerve—sharks cannot detect brain waves. But they can hear the beating of your heart, and sense other signals about your subjective state.

The ampullae of Lorenzini can pick up the voltage emitted by working muscle tissue. Sharks easily detect such voltage down to the microvolt range, which is the range emitted by most sharks' prey. Since sea water is saltier than blood, the

difference in ionic concentration produces an electrical potential between the inside and the outside of fish. The animal's skin shields most of it, but there are places, such as the gills, that emit a faint electric field that sharks can detect.

It has been calculated that in a perfect ocean, a typical shark could detect a one-and-a-half-volt AA battery from a distance of hundreds of kilometres, but the ocean is full of background noise that limits the range to about a metre. So, sharks and rays use their electro-sense to detect living prey at close range. This works even when the prey is hidden in murky water or when it is buried in sand.

Sensitive mouth

Lastly, a shark can taste and feel its prey with its sensitive mouth, which is the only part of its anatomy designed by nature for contact with the solid environment.

All of these senses are used in different combinations, depending on species and circumstance, just as we at times use hearing more than sight, and at other times are focused on an odour or touch. The more than 470 species of sharks, diver-

sified across eight orders, inhabit a wide variety of environmental niches, so their senses are adapted accordingly, and doubtless vary widely, just as bird species adapted to different habitats are very different from each other.

Different reality

Sharks are aware of a very different reality than we are, yet underwater they appear as peaceful and very rational animals as they pass, looking at divers looking at them. It is possible that they can sense whether you are stressed or frightened, or completely relaxed, which could indicate to them that you are not in attack mode. Shy sharks will avoid you most when you are purposely finning and looking for them, for example, and if you want one to approach, stay very quiet in the water, and maybe it will come closer for a look.

The majesty of being in the presence of a shark is unforgettable, and shark dives present one of the best ways to discover them. ■



"Until Mexico takes action, hammerheads will keep being killed by the thousands for their fins."

Alejandro Olivera, Mexican representative for the Center for Biological Diversity



ANDREY BIZYUKIN

In Mexico, hammerhead sharks do not have any specific protection.

Lawsuit pushes Mexico to protect hammerheads sharks

The Center for Biological Diversity has filed a groundbreaking lawsuit seeking protection for three species of hammerhead shark. The legal action is likely the first-ever lawsuit aimed at forcing wildlife protections under NOM-059, Mexico's equivalent of the US Endangered Species Act.

The Mexican fishing industry catches thousands of tons of hammerheads a year. The suit, filed in district court in La Paz, notes that Mexico's Secretariat of Environment and Natural Resources (Semarnat) ignored scientific evidence demonstrating that hammerhead sharks urgently need protection, as is already recognized internationally.

The lawsuit focuses on three hammerhead species threatened by shark finning and fishing, including in Mexican waters. The scalloped hammerhead (*Sphyrna*

lewini) and great hammerhead (*S. mokarran*) are classified worldwide as "critically endangered" by the International Union for Conservation of Nature (IUCN). The smooth hammerhead (*S. zygaena*) is "vulnerable" to extinction. Scalloped hammerheads are also protected under the US Endangered Species Act.

Unprotected in Mexico

Yet in Mexico, none of these sharks have any specific protection and can be targeted for fishing like other shark species. Once the hammerheads are added

to NOM-059, Semarnat can issue measures and regulations to ensure sustainability, including limits on catching hatchlings, juveniles and pregnant females to ensure the populations' recovery.

Existing Mexican regulations do address shark-fishing but allow directed, indiscriminate catch of sharks, and thus do not distinguish between threatened and less-threatened shark populations. Regulations also allow sharks to be caught and killed before they breed. ■ SOURCE: THE CENTER FOR BIOLOGICAL DIVERSITY

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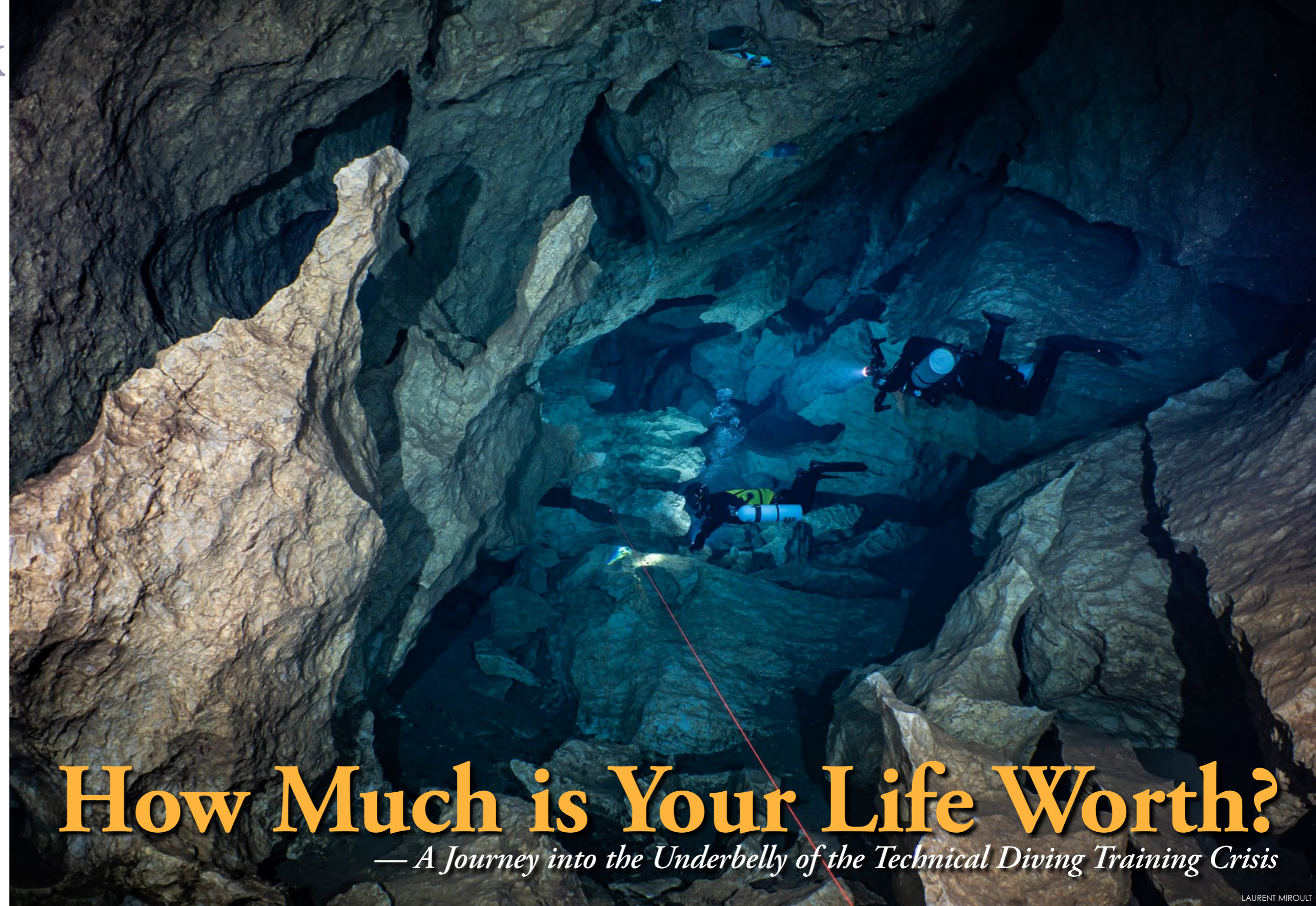
tech talk

If a fast-track technical diving course was too short, could it mean that the training in general was compromised, or worse still, without the student even being aware of it?

Text by Stratis Kas and Matteo Ratto
Photos by Laurent Miroult and Christos Petrakis

There was a time when “time” meant something very different than it does today. In the past, dive courses needed student commitment, were expensive, and yes, essentially, needed more time. Sadly, these days, the dangerous trend of fast-track courses, which turn inexperienced candidates overnight into “independent and advanced” divers in the recreational world, has managed (incredibly) to spoil even the most demanding specialties, like advanced full cave diving courses.

This is frightening, as not only do students risk their lives when participating in these “farces” of training trying to pass as dive courses, but these fast-track courses also endanger the credibility of the entire dive industry.



How Much is Your Life Worth?

— *A Journey into the Underbelly of the Technical Diving Training Crisis*

LAURENT MIROULT

Seriously now, how much is your life worth?

When I started diving in Europe in the late 1990s, even the open water courses were much longer and more skill-oriented than they are now—resembling a more military-

style of training rather than a recreational activity. One was supposed to know how to swim (not just how to float), and yes, there were tables, physics and math involved. Technical courses were what they should be, appropriate for only a

select few who: a) wanted to invest the time, money and hard work; and b) had the actual basic training in order to even enroll in an advanced course.

As years passed, diving became an “industry,” and training became

commercialized. Like everything else which aims for profit, training agencies had to find a way to make that profit happen. The actual equipment did not change much, nor did the background of the divers who were taking these courses.





LAURENT MIROULT

Courses are meant to simulate teams, to recreate possible scenarios. If dive teams are more efficient when they consist of two or three (better) divers, teaching should take note.

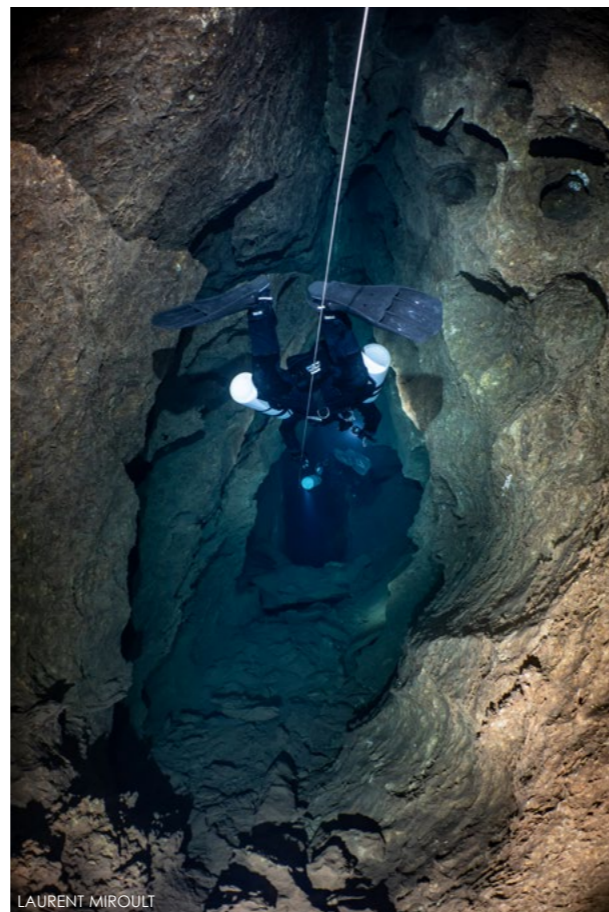
So, the only way to increase the profit margin was to change the training itself.

Divers became clients, and as such, started demanding from the industry that their conditions be met. This forced standards to bend year after year. The first open water courses, lasting just two days at vacation dive resorts, became the foundation for cavern-to-cave courses consisting of a single cave dive.

The fact that nobody talks about it does not mean that it is not happening. As the client-diver now fully dictates (with exceptions, of course) the training-to-cost equation, professionals are often tempted to re-adjust crucial elements, such

as instructor-to-student ratio, minimum dives or time in the water, the importance of theory and the need for exams—just to name a few.

Because dive training is not my primary occupation, I enjoy some very important benefits of a reciprocal commitment between my students and myself. They commit to a much longer and more costly training. They know that not getting certified is a real possibility if they fail even theoretically important sections and exams. But they also know that I do this out of a love and passion for the genre. I teach cave diving simply



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because I am in love with cave diving. All I want is to share with others the awesome experience of diving in caves.

On the other hand, I highly value each day and each hour I take away from my family, so I demand proper

payment for my time. The trick is simple: Remove the total economic dependency of the instructor, and you will most probably get an individual who is not driven by financial reasons and will not be constantly looking for ways to make the course cost-

effective, but instead will focus on how to make it as good and as fun as it can be.

A good friend and a very respected colleague of mine once said to me: "Being paid well is sometimes the only way for clients to show that they like



tech talk

GUE-inspired training has become a model for many new organizations and independent instructors who want to promote and participate in a safer, more holistic, diving style.

and appreciate my work." At the time, I was in the middle of my artistic self-discovery phase and pricing high felt like a sell-out to me. However, today, I realize the truth of my friend's observation. Not everyone is capable of or interested in finding a way to show proper appreciation for the quality of your work. Sometimes, money simply talks.

How are divers born?

As with all new activities, in the beginning, the number one drive

for people is curiosity, i.e. trying to figure out if the new hobby speaks to them. Next, they look for a group with which to bond, to share their common love for the activity. But prior to that, students tend to trust an expert, an instructor or a school, to show them how to do it safely, while having the most fun doing it. Even if their adventurous spirits urge them to jump full speed down a slope on a snowboard or fly great distances on a paraglider, the original question is the same for

all newbies: How can I learn this? However, the second question should be: How can I do it without hurting myself?

In diving, this critical question often gets tucked away in a drawer full of "medals" and certification accolades. Novice divers, more often than not, learn minimum skills and theory just to be able to "breathe underwater" (spoiler alert: You already know how to do it). Any thinking person should question everything at that point, including all

Training Crisis



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the stories and wisdom the occasional divemaster—who can impressively float like a weird flying Buddha—brings to the table. Chances are that while they are looking for answers, novice divers will encounter more questions, and therefore keep looking for even more answers, and so on. Well, this is the primary foundation of knowledge. Not a bad place to be after all—so, we are getting somewhere.

At this point, new divers have two options: Either they "remember" diving each summer, or they truly fall in love with it and their lives are never the same. Those who do the latter are the only candidates that eventually become true divers. So, what should these divers do next? How can they make wise choices in something they do not know anything about?

A long time ago, my open

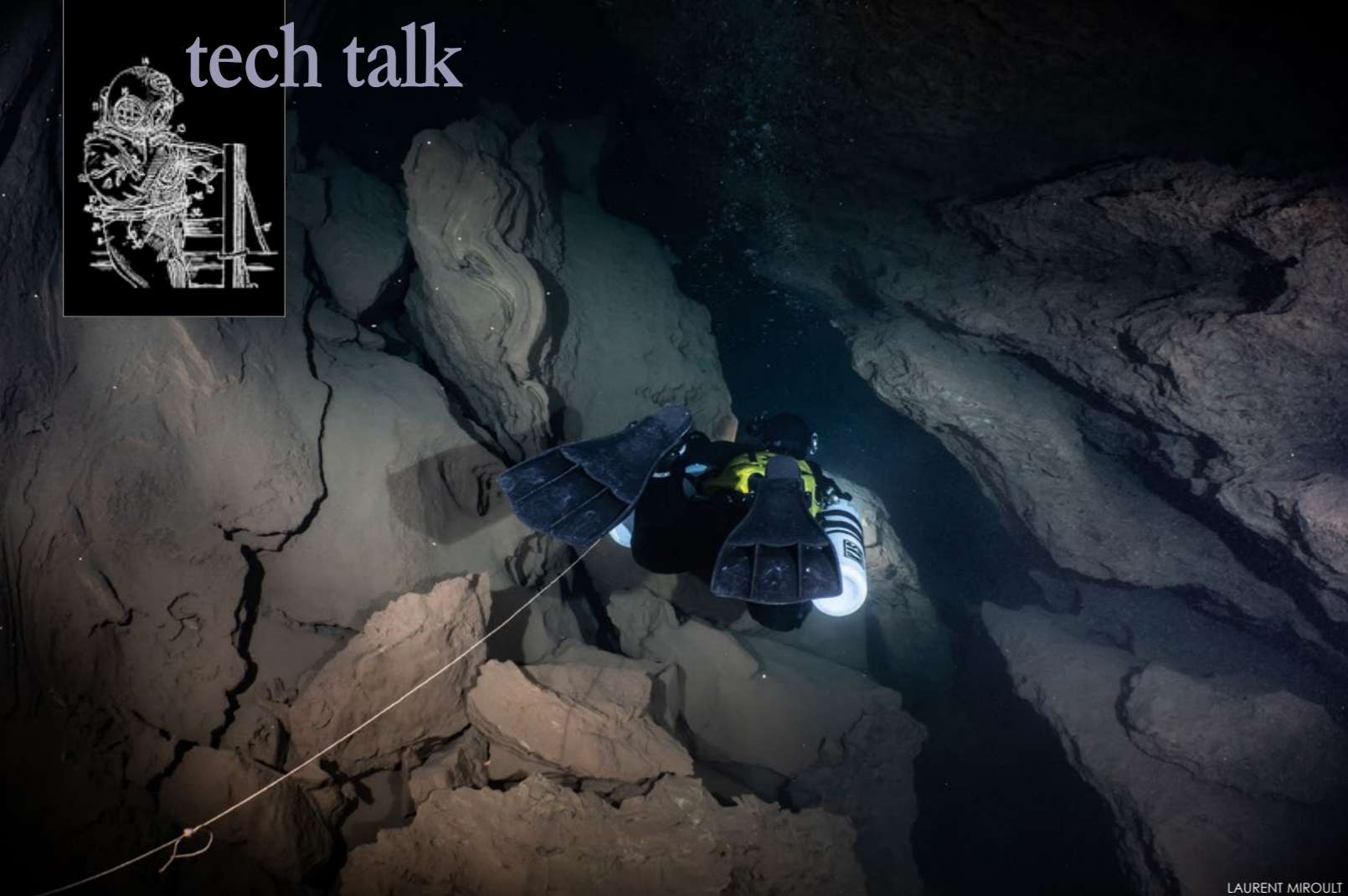
water instructor denied my request to jump back into the water and help me become an advanced certified diver as soon as possible. My goal was to be ready for my first trip to the Red Sea. I was devastated. (Note to self: Plan better next time). Today, I am so grateful to the instructor—not just for saving me from a possibly dangerous dive vacation, but for instilling in me the power of saying "NO." Needless to say, NO is much more common than YES in my vocabulary today and this is one of the most important advantages for my students.

Today, two decades later, working as an instructor teaching only advanced courses by choice (mostly cave diving), these "NO's" are lifesavers—not just for the students whom I reject when they want to enroll in a cave diving course without the proper experience, but also for me.

Experience with stress and what I call simply "the ability to stay still in the water" is critical. Most cave diving instructors have at least one scary story to tell regarding badly screened students who proved, in the worst moment, that they did not belong in an overhead environment, or perhaps even in open water.

So, what is happening? Is this a trend in technical diving? Well, for starters, as more people learned to dive and wanted to stand out, they needed to look for more advanced kinds of diving. Unfortunately, some of them brought along some bad habits, which were often easily overlooked during their recreational dive training. (Note: Of course, not all recreational instructors are cutting corners; there are plenty who will "disappoint" anyone in a rush—look for them).





LAURENT MIROULT

The advanced technical courses rely a lot on emergency-solving protocols. Therefore, the difference between great instructors and average instructors is more important than ever.

and I need to properly plan dates for a course. On one occasion, I was asked to take an advanced open water diver all the way to full cave diver, combined with a PADI Tec50 and a drysuit specialty, in a week. Needless to say, this person, whom I admire for his determination and optimism, never became my student. However, he got certified in all of the above, in the requested time.

When courses go as planned, students genuinely learn and are exposed to the fundamentals and the attitude needed for this kind of diving. But what happens when they are not able to finish; when—for their own good—they need to

dedicate more personal diving time in order to get ready and THEN add the extra knowledge that the course they enrolled in is meant to offer; when they are not skilled and focused enough for the actual course? What then?

I feel lucky to have met and taught many who understand that more time spent means just one thing: a better and more complete education. Some unfortunately value the “when” or “how long” more than the “what.” As much as a student should search for the proper instructor, I firmly believe that we, as instructors, need to teach selectively. Not everyone should be diving.

Training Crisis

2) Too expensive

Cost matters. Undeniably, diving and especially technical diving is very expensive, when you consider all the equipment, courses and actual diving costs involved. The truth is, however, that nobody forces anyone to become a technical diver. No one complains about the cost of car racing or horseback riding, just to mention a few pricey endeavors. Yes, tennis might be cheaper. Instead of complaining that a course, which teaches one to survive in an environment unsuitable for human life, is “expensive,” students should be happy it is not cheap!

All joking aside, over the last

Here are six excuses for bad quality dive training today:

1) Not enough time

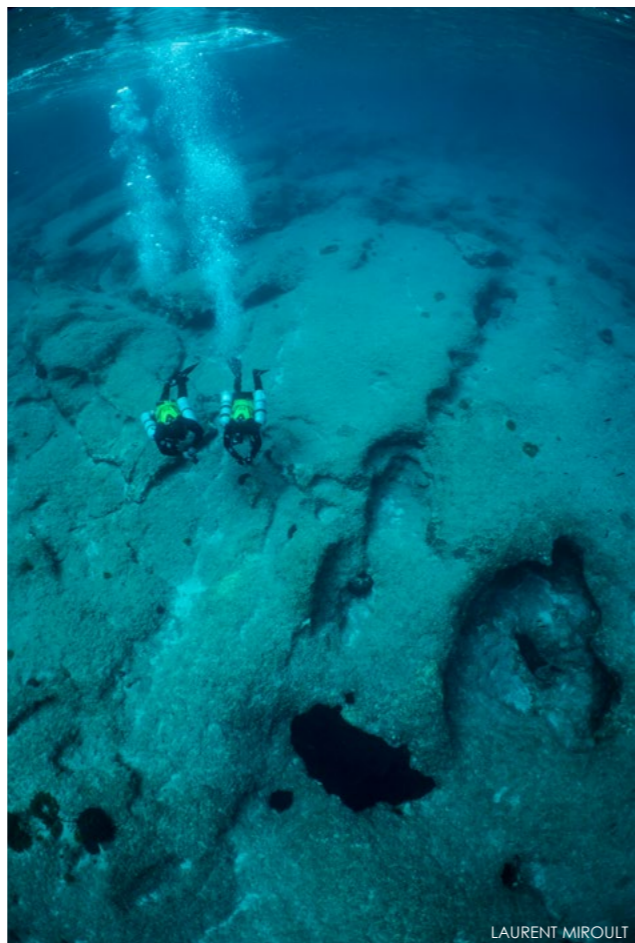
Stories from the good old days will make any dive center accountant get chills. Even open water courses used to last many weeks to months. In some cases, when they were semi-government run (yes, in Europe), they could stretch to over a year of active diving. Sounds good, but who (including me) has time for that? And how much should a course like that cost? The truth lies, as always, somewhere in the middle. Why is such an important step rushed?

This does not happen exclusively anymore in tropical resorts that need to “finish students off” before the cruise boats leave town. It happens also in many European cities, where people have the time and could invest in it, along with the proper budget

to master the basics for their survival in the water. Not all students are the same. However, there is no one that can be considered ready to go diving after a weekend open water experience or to go cave diving after one (cavern-stretched-to-cave-standards) experience. Today, we see more and more “explorer-level” courses, with single-digit training dives.

Explorer? Take a minute to digest that. Divers with a handful of “supervised” cave dives can penetrate and lay line by themselves. Again, take a minute to digest that.

As a part-time instructor, my students

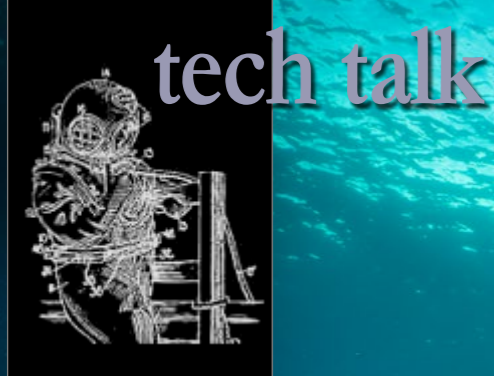


LAURENT MIROULT



LAURENT MIROULT





LAURENT MIROULT

Once your safety is second nature, let Mother Nature surprise you; I guarantee you, it will be worth it.

few years, the dive industry has seen an acceleration in the competitive price race. Dive organizations, schools and independent instructors are all offering a similar product to a (by definition) uneducated client. The ones who maintained their prices, also managed to maintain the time that they dedicated to each student, and in doing so, kept the quality of instruction at a good-to-excellent level. The ones who chose to lower their prices to get more business tried to compensate in ways they should not have. It is all just common sense. Courses that cost less than they should are never a good deal. Dive training is not like a jacket that has gone out of fashion or a box of milk close to its expiration date that needs to go and sold at a discount. Knowledge and experience cannot be sold as a special offer. Low-cost courses

represent only a mirage of the possibility to grow and learn. To gain a better focus on this, anyone who wonders about the true cost of training should look at it from a different perspective. They should imagine it as if it was their own profession. Would they teach what they do for a living, for a very low profit margin? Why would they? Doing so would be a sign of a lack of self-respect, or (worse) the awareness of selling a product of low (or no) quality. Nobody should trust courses with prices that are too good to be true. Consumers should carefully examine all the information they can get and properly shop around before they take a decision. They should find out before they buy, if their prospective instructor is serious and if former students were happy—happy not because it was easy and/or they got

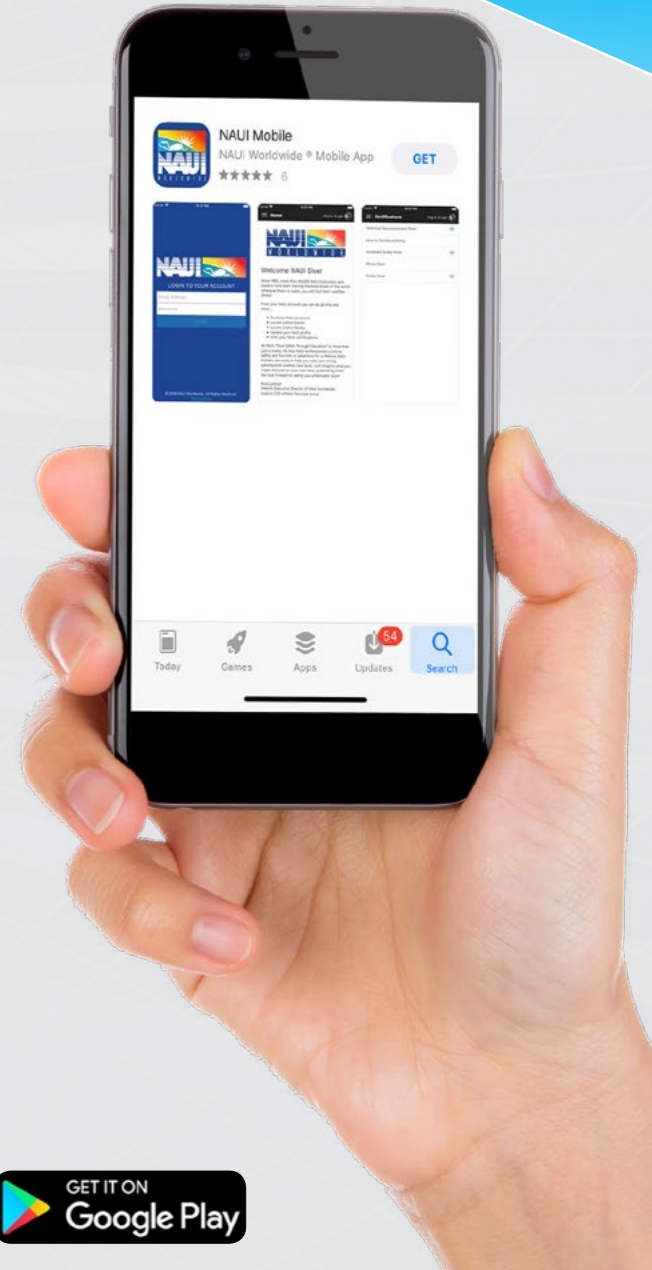
certified, but because they reached the desired result. And the result is not simply passing the course but learning the proper method to keep growing. **3) Too many students** Nobody can or will convince me that there is no difference between a cave diving course with two or three students and a course with five or more. Courses are meant to simulate teams, to recreate possible scenarios. To be efficient, a team should consist of two or three divers. Teachers take note. Again, professionals that are looking for ways to maximize profit, can easily add more students, but it can be a dangerous approach to take. Consider cave diving. It is true case-book negligence if an instructor believes that if a new student is uncomfortable in an



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overhead environment, they will simply call the dive. Remember, it is never the student's fault. Even if they were briefed properly and thoroughly, this is a new environment with immense psychological effects for most humans, and a new student could panic. The instructor needs to plan for that, but it becomes very difficult to do if they have a large number of inexperienced students who could lose their cool.

I do not teach courses of more than three people, as most standards require. But it is not the standards that make me do this; it is common sense and a very accurate assessment of how much I am able, or willing, to handle. Regardless of the organization certifying you, do not choose courses with less than two students (as single-student courses are not ideal), and do not accept courses with more than three.

Students need to have peers. It

helps build team spirit and gives them someone to compete with graciously. At that point, they will not be better than their instructor (albeit, never say never). So, to have a goal of trying to be a bit better than someone else creates some healthy competition. Beginning instructors, however, should stick with a one-to-one student-teacher ratio, and be aided by a certified second diver who acts as a student for their first courses, or they should try assisting more experienced instructors.

4) Assisting is dead

Having former students assist with classes used to be the foundation of most and the best dive training programs. Nowadays, it is pretty much considered a vintage path, at least in Europe. When you see instructors employ former students to act as assistants—even students who never aspire to become instructors themselves—

consider it a big plus. This tells you a lot about the respect and bond between the former student and the instructor. It is also a great opportunity for the students to see first-hand what their skills will be as a result of taking the course.

I am blessed to be able to call many of my ex-students, friends. They are the people I get to trust as my dive buddies or to assist me in teaching. I often encourage them to help me or even lead a debriefing, film the class and or participate actively in the entire process. This is an equally valuable gift for the new students, the former student, and me.

5) Too many rules ruin the fun

Even if diving is statistically a safe activity, it is only so as long as we consider knowledge and experience as being the diver's most precious tools. As divers attempt more difficult dives

A Hogarthian-style kit can take any diver from his or her open water course all the way to cave exploration and can probably even be passed on to one's children. How is that for investment value?

and venture deeper, longer and farther, their knowledge and experience must grow as well. They may need some new equipment, which will cost them both money and the time it takes to become proficient with it. But mostly, they will need to focus on their overall growth as divers. If they do not, they will inevitably allow their "avoidable" risk to increase.

Some types of diving, like diving in overhead environments or using gas mixes other than air or standard nitrox, require a very high degree of knowledge and experience. Improvisation, or do-it-yourself teaching, are not proper alternatives to a technical diving course. Technical diving

requires time to learn and even more time to "metabolize," so that the knowledge becomes second nature. That is the only state of knowledge that I consider truly valuable. A weekend is not enough. It is even worse if the people teaching these express courses lack the depth of knowledge and experience to properly teach it.

I have had students who expressed a lack of interest in the academic components straight from the start, and I denied them entry into the course before they even got into the water. Even if technical diving is a hands-on activity, it requires a strong theoretical foundation. Students who think that theory is ruining

Training Crisis

the fun, simply do not belong in my classes.

Divers who want to pursue technical diving but are not happy with the fact that it needs to be done properly, should choose something else (to brag about). Technical diving is not meant to be a skill for showing off. It is also not the cure for a certification-card-hungry personality disorder (CCHPD). Decades of accident analysis have given us statistically proven protocols, which need time and proper teaching methods. There is no instructor in the world who can teach a student who does not really want to learn and only wants to pass. These courses are meant to teach new divers how



LAURENT MIROULT





CHRISTOS PETRAKIS

No "true" instructors can afford to teach at a bargain—unless their costs are greatly reduced, a factor that will reflect in the overall quality of the course itself.

equipment maintenance, management expenses, taxes and a decent profit margin (insuring the proper enthusiasm and engagement on the part of the instructor as a professional), and compare it to the cost of the course. Isn't that what you would do in your own profession?

Divers should consider that no proper instructors, who invested time and money in becoming what they are, can afford to do it cheaply. It does not make sense, unless their costs mentioned above, are greatly reduced, a factor that



CHRISTOS PETRAKIS



CHRISTOS PETRAKIS

to survive conditions that are not survivable by untrained individuals.

6) Too much to choose from

Each training agency defines its parameters, methods and standards, but training duration can vary greatly depending on what the instructor decides. Instructors' decisions also impact

a course's effective value, both monetarily and otherwise. Before making a choice, students should try to understand the actual needs of the course and estimate the time that will be required.

In real-world terms, students should consider the time commitment along with the instructor's costs for insurance,

will impact the overall quality of the course itself.

It is important that divers choose their instructors wisely. Fortunately, not all instructors are the same. For trimix, cave diving or rebreather courses in particular, choosing a proper educator is always far more important than the choice of the training agency. Almost all new divers (somehow understandably so) put all their focus on the differences between the various training agency programs,

evaluating the locations of possible classes, the overall cost, and only then find out (surprise!) who is teaching the actual course. The advanced technical courses rely a lot on problem-solving protocols. Therefore, the difference between great instructors and average instructors is more important than ever.

Of course, there are many parameters that matter, but I suggest future technical divers should stick to one golden rule. Make sure that your future instructor is involved and practices what they are teaching outside of the classroom!

This is very important because it is a clear sign of their passion. Only with passion (along with an appropriate portion of experience) comes greatness. This way, instructors should have an embedded sense of safety protocols and a deep knowledge of the most effective response

to all of the possible "what if" scenarios. Also, instructors who dive often and practice what they teach, tending to show respect for their craft, are more demanding. Finally, they have real stories to share. Emergencies will happen, especially in cave diving. Instructors who have their own real stories to discuss offer a priceless asset to any new diver.

If the course was too short, and or if it did not delve deeply into all the scenarios that could arise and how to deal with them, safety could be compromised without the student even being aware of it. In technical diving, this is critical, as consequences from errors are considerably more serious.

Final thoughts

In conclusion, is it worth it to try to "save" money on a course if the product delivered is not as good as it should be? Is it worth it, enough to risk your life? Because



LAURENT MIROULT

Diving is fun, but the main goal is to stay alive.

at the end of the day, that is what it is all about. Diving is fun, but the main goal remains to stay alive.

You, the future technical diver, need to make sure that the quality of your technical training is as good as it gets. There are many good choices out there that can provide the needed foundation with respect for safety. That way, you can focus on the fun part of diving. Once your safety is second nature, let Mother Nature surprise you. I guarantee you it is going to be worth it.

Don't put a low price on your fun—or on your life. ■

Stratis Kas is a professional award-winning photographer, filmmaker, trimix, cave and DPV instructor

and is the co-author of cave diving manuals, exams and related materials. Widely published in international magazines like *Vogue* (Italy, Russia, Greece) and *GQ* (UK), his images have been exhibited in London, New York and Paris, and have been used by brands such as Christian Dior and Levi's. Diving since 2001, Kas has truly global experience in diving, from South America to Hawaii, from high-altitude lakes and Florida caves in the United States to the Red Sea and beyond. Since 2016, Kas has led the Top2Bottom cave-filming team, which specializes in adventure film. In 2017, he finished his first film, *Amphitrite*, which won a finalist place in the *SHORT to the Point* international short film festival in 2018. Currently, he is filming

his first full-feature film, *Echoes of Silence*, produced by *Because I Can, Ltd.*, and *FilmO2 Paris*.

Matteo Ratto is a full cave diving instructor trainer, mixed gas diving instructor (nitrox, trimix hypoxic), and rebreather diver (CCR / P-SCR, CMAS, UTRtek). A developer for the credit and public administration sector, he began diving in 2003 and technical diving some years later. He has made many cave dives in Europe, and in recent years, he has been dedicated to teaching Hogarthian and team diving, and cave and trimix classes. His main interests are the study of decompression strategies and new experiences in diving.



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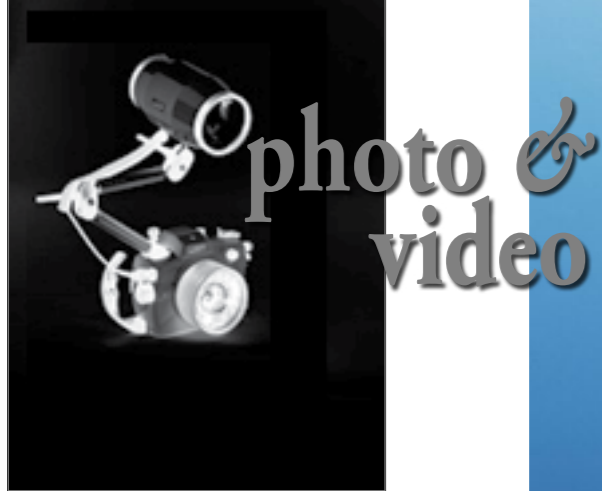
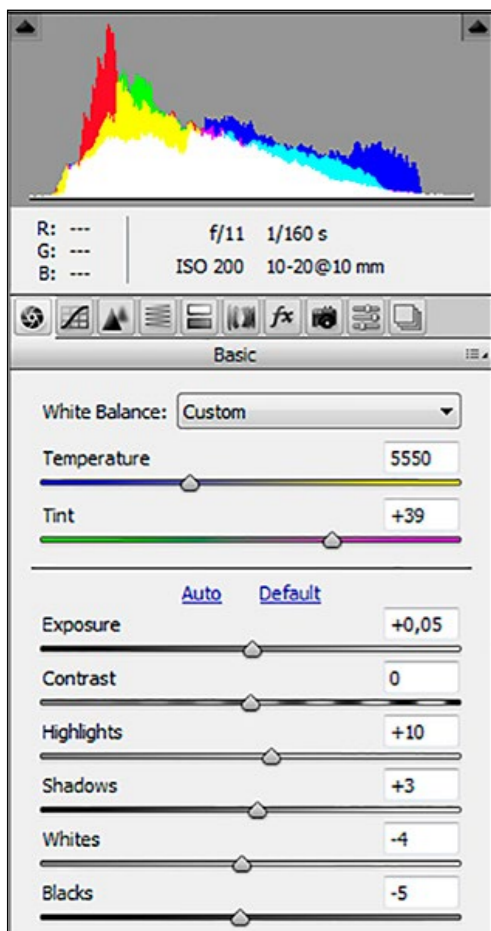


Image 1. Tutorial image (right);
Histogram in ACR (below)

Text and photos
by Rico Besserdich

Colour is often the key factor in underwater photographs. A keen photographic eye and a few fine adjustments in postproduction can improve colours and give your image the final touch.



Essential adjustments of **Colour** *in Postproduction of Underwater Images*

The fine-tuning of our underwater images in postproduction requires a closer look at colours and a skilled photographic eye. Just aimlessly sliding sliders in Photoshop or Lightroom software and seeing what happens rarely

results in pleasing images.

The ideal starting point is to have an image in RAW or DNG format, a calibrated computer screen, proper lighting in your workspace and image-editing software such as Adobe Photoshop or Lightroom.

Ninety-five percent of image editing can be done in Adobe Camera Raw (ACR)—the RAW processor of Photoshop—or in Lightroom, which offers the same functions but has a user interface that looks a bit more fancy.

How you want your image to look after editing is your choice alone. It is your photograph and you can do with it whatever you want. But let's see how we can improve images with just a few basic steps!

The very first step in solving colour problems is always the white balance. I adjusted the white balance in the example shown (see Image 1 above) and applied a few subtle exposure and contrast adjustments (see the





Image 2. With slight adjustments to exposure and contrast and the Vibrance slider at +20 (below)



Image 3. With the Vibrance slider at +50 percent (left)



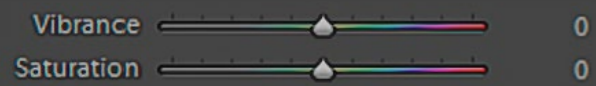
Image 4. With the Vibrance slider at +100 percent (below)

Adobe Camera Raw



Vibrance and Saturation sliders in Photoshop ACR and Lightroom (left)

Adobe Lightroom



regarding the colour.

On first impression, the easiest tools to use seem to be the Vibrance and Saturation sliders, found in ACR and in Lightroom's development module. However, with these controls in particular, a lot can be done wrong, especially when overusing them.

inserted screenshot from ACR above). After that, the image now looks like Image 2 (top left). The photo generally looks ok. There are lots of colourful subjects in it, and the histogram looks fine. But I believe that more can be done with it

Vibrance

Vibrance boosts the saturation of your lower-saturated colours.

This might sound nice, but let's have a closer look.

While a slight boost of +20 to the right brings slight improvements (see Image 2, above), a value of +50 results in unnatural colours (see Image 3, top right) and "full-power" at +100 almost destroys the image (see Image 4, right).

Let's look at the extreme version of +100 vibrance boost in Image 4 (right). We might think, "Wow, that really pops!" But actually, a lot of the colour details are wrong. In simple terms: it's too much of everything (I hope you agree with me).



Image 5. With Saturation slider at +25 percent (below)



Image 6. With Saturation slider at +50 percent (left)

Image 7. With Saturation slider at +100 percent (below)



Adobe Camera Raw



Vibrance and Saturation sliders in Photoshop ACR and Lightroom (left)

Adobe Lightroom



saturation to the image but when overusing it (+50 or even +100), things go nasty. Let's check the "+100" boost in Image 7 (right).

What appears as "colourful" in this image

actually consists of mercilessly oversaturated colours.

Conclusion: I would use the Vibrance and Saturation sliders extremely carefully, or even better, not touch them at all. The thing is, we do not want to "boost" all the colours in an image; we want to do subtle adjustments

to specific colours that we find could use a little help in postproduction. This means that we first need to see and understand what to fix by focussing carefully on all the colours in the photo. And secondly, we need to use a precise tool to work on those specific colours. By the way, this is the last call for calibrating your computer screen (which should be done before moving on to the next step).

Let's have a closer look at the tutorial image and mark a few colour areas that could use improvement (Image 8, next page).

Saturation

Now, our next try involves saturation. Saturation increases or decreases colour intensity across all channels. Let's have a look at Image 5 (above).

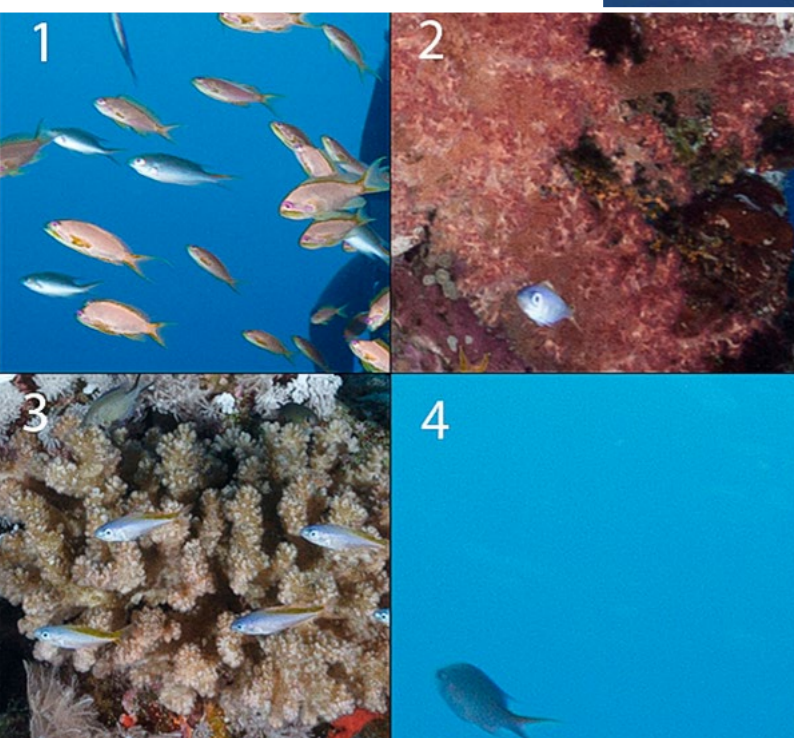
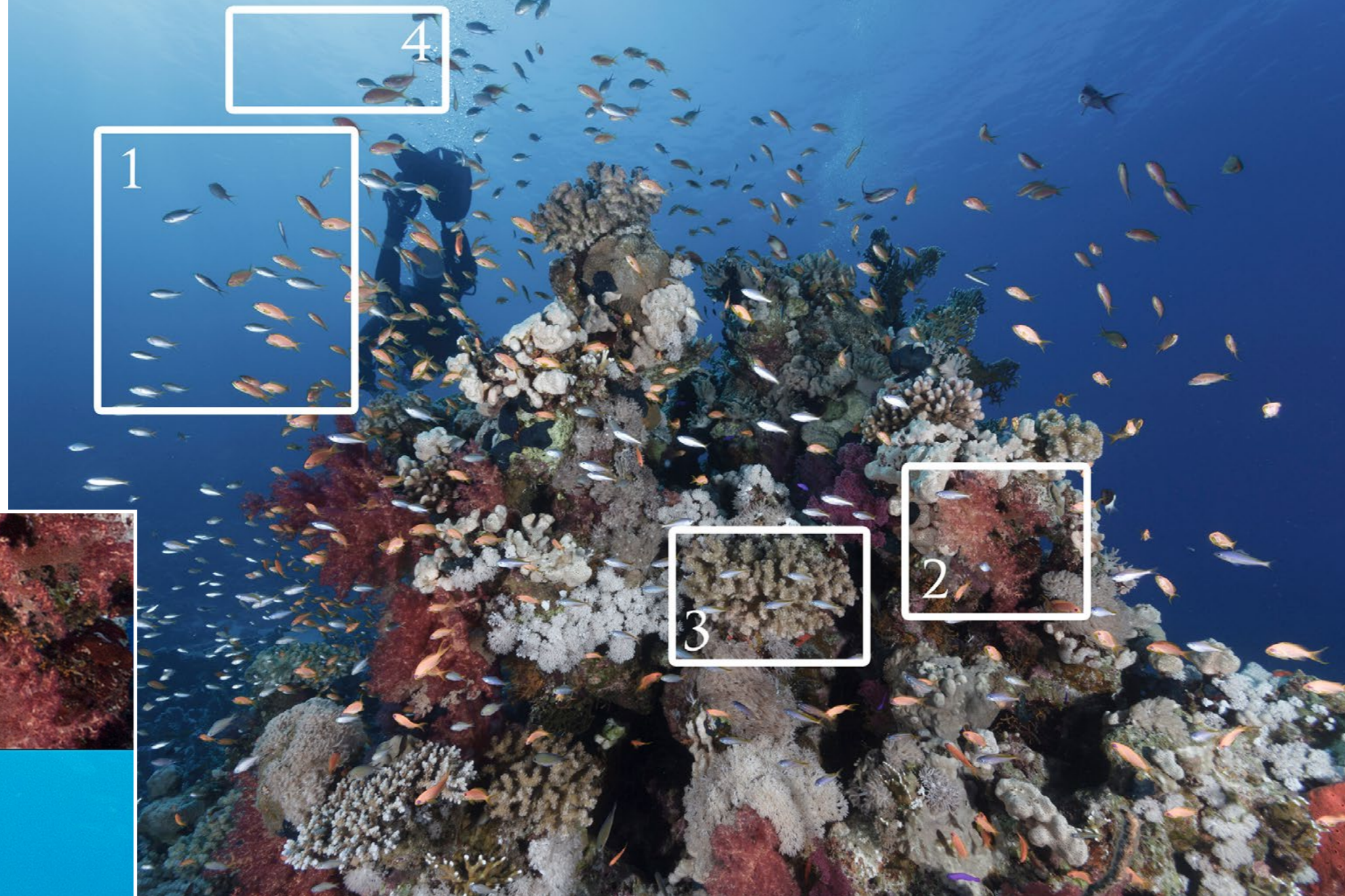
It is the same story here: A subtle move to the right indeed adds a little helpful



photo & video

Image 8. It is good practice to zoom in to 100% magnification to scroll through and look around the image to find the "problem zones" (right).

A detailed close-up of each zone reveals specific problems with colours in the image (below)



As always, in proper post-production, it

is crucial to zoom in to 100% and then scroll and look around in the image to spot the finest details or

"problem zones."

As we are still working in the RAW processor, the most powerful tool

to use to work on fine adjustments of specific colours (in ACR and Lightroom alike) is the HSL control tab.

You access the HSL control tab by clicking on the fourth icon in the top menu bar of the ACR window (left). In Lightroom, it is in the development module, just below the tone curve control.

H (Hue): A gradation or variety of a colour

S (Saturation): The degree of chroma or purity of a colour

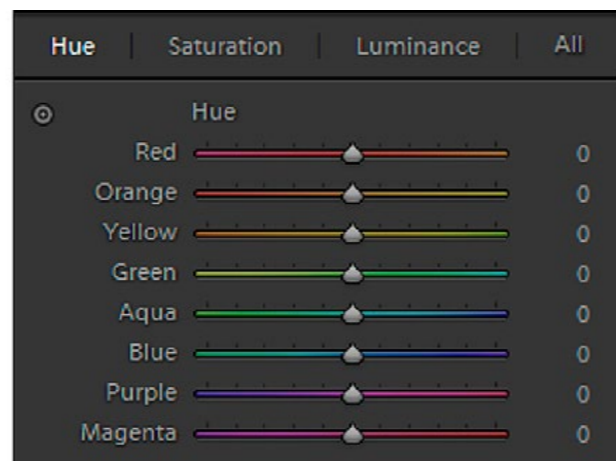
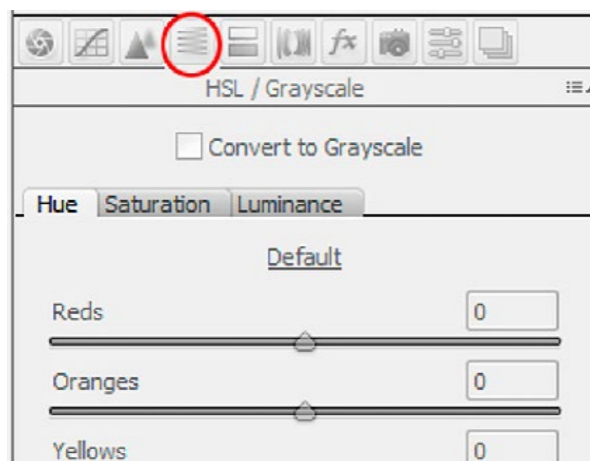
L (Luminance): The quality or condition of radiating or reflecting light

Zone 1: The orange colour of those fishes is pretty poor and flat.

Zone 2: The red and purple tones of this soft coral are slightly washed out.

Zone 3: The colours of this hard coral look flat.

Zone 4: All the blue tones of the water look a little flat.



HSL control tab in Photoshop ACR (left) and Lightroom (right)

SeaLife

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Mini Dive Lights

Mini 900S
900 lumens 14° Spot beam

Mini 1300S
1300 lumens 8° Spot beam

Mini 1000F
1000 lumens 130° Flood beam

SeaLifeCameras Instagram SeaLifeCameras
www.SeaLife-Cameras.com



Image 9. The final result after adjustments to hue, saturation and luminance (right)

Adjustments in the Hue control palette (below)

Adjustments in the Saturation control palette (above)

Adjustments in the Luminance control palette (below)

Hue Saturation Luminance

Default

Reds	-4
Oranges	+39
Yellows	+37
Greens	0
Aquas	0
Blues	-6
Purples	0
Magentas	0

Hue Saturation Luminance

Default

Reds	-15
Oranges	-27
Yellows	0
Greens	0
Aquas	0
Blues	-5
Purples	0
Magentas	0

Hue Saturation Luminance

Default

Reds	-7
Oranges	-22
Yellows	+1
Greens	+1
Aquas	+25
Blues	+5
Purples	0
Magentas	+33

We can now optimise or alter specific colours in the image by moving the single colour sliders of the colours we want to edit (this means that if there is no problem with the reds, there is no need to play with the red slider). This counts for each colour and for each state (hue, saturation and luminance).

Back to the tutorial image: After focussing mostly on the orange, yellow,

red and blue tones and altering their hue, saturation and luminance values, the photo now looks like Image 9 (above).

The orange-coloured anemonefish are now in nice contrast and harmony with the blue water—and those soft and hard corals are looking fancier now as well.

Please bear in mind that all editing steps in Photoshop ACR or Lightroom are non-destructive, thus providing the welcome

option to alter specific editing steps or (in some cases) just go back to zero and start again from scratch. ■

Rico Besserlich is a widely published German photographer, journalist and artist based in Turkey. For more information, visit: Maviphoto.com. See his latest book at: Songofsilence.com.



Ikelite DS Strobe

The new Ikelite DS strobe is likely to be released within this year. This successor of the well-known Ikelite DS160 and DS161 will feature improved energy savings (33%), a chrome-plated reflector for improved output, a fast recycle time, and an improved design for more field of coverage and softer fall off. The new DS strobe will work with the same batteries as the DS160/161. It is compatible with the Ikelite TTL converters and can be triggered by a fiber optic cable or electronic sync cable. ikelite.com



Godox Color Effects Set

Already well known in classical photography, the colouring of strobe lights can add some spice and artistic creativity to underwater images. The Godox Color Effects Set for round flash heads contains two each of 15 creative colour gel filters. Included in the set are Bastard Amber, Straw, Light Amber, Light Flame, Golden Amber, Light Red, No Color Pink, Middle Rose, Light Rose Purple, Surprise Pink, No Color Blue, Daylight Blue, Primary Blue, Moss Green and Blue Green filters. Each single filter has a diameter of around 6.5cm, which makes it possible to place it behind the diffusers of the most commonly used underwater strobes such as Sea&Sea, Ikelite and Inon. godox.com



Canon EOS R5

Still in development but likely to be released within the year, Canon's new mirrorless full-frame camera will include lots of useful features for underwater photographers and videographers alike. The EOS R5 will be able to shoot 8K 30p video at full width (no crop) with Dual Pixel AF in all 8K modes. Dual card slots, in-camera image stabilisation, 12 fps with mechanical shutter (20 when using the electronic shutter) and a new "animal detection" AF system are already confirmed features. Sensor resolution is expected to be in the 40-50 MP range. global.canon.com



Anti-Reflection Ring

To avoid the reflection and thus visibility of camera lens inscriptions and ring details in underwater images created with a wide-angle lens in a dome port, Ikelite offers a series of self-adhesive vinyl labels that can be easily mounted onto the lens. Reflection rings are available in different dimensions for the most commonly used wide-angle lenses underwater. ikelite.com



WACP-2 Wide Angle Conversion Port

Nauticam's WACP-2 is designed to work with 14mm lenses to produce a (maximum) 140° field of view while maintaining full zoom-through optical capability. It is designed for full-frame cameras. Since it can focus on air, it is suitable for split-shots as well. When used with wide-angle zoom lenses, i.e. from Canon or Nikon, the wide-angle conversion port provides a field-of-view range from 140-72°, depending on the lens model used. Its lens construction consists of four elements in four groups. Its weight at the surface is 7.06kg, while underwater it is 0.85kg (when using the included float collar). The WACP2 is depth-rated to 100m. nauticam.com



Edited by
G. Symes

Stuck inside? Improve your underwater photography while at home

While divers around the world find themselves landlocked during the coronavirus pandemic, many are looking to online learning to increase and improve skills. California underwater photographer Brent Durand has announced he is developing a new series of free video tutorials for underwater photographers.

"Let's stay stoked on our underwater photography so that we're ready to join the next exotic dive trip and support our local dive shops," writes Durand. The first video in the series focuses on depth of field, exposure challenges, composition and creative lighting techniques.

Image editing

Now may also be a good time to learn more about editing one's images. On Durand's YouTube channel, underwater photographers will find a variety of free helpful videos about postproduction tips in Adobe Lightroom, covering topics such as backscatter removal, white balance and how to speed up one's workflow.

Get to know your gear

It may also be a good time to get to know your camera rig

better. Brush up on underwater photography camera settings and how to use camera gear with free video tutorials about lights, strobe positioning, black backgrounds, wet lenses and composition tips.

Virtual photo lesson

You can even register for a virtual photo lesson, available to those who want individual custom instruction on specific aspects of underwater photography, gear and postproduction. "The lesson will cover exactly what YOU want to learn!" states Durand. Book your virtual lesson here: tutorials.brentdurand.com/virtual-photo-lessons/

About the photographer

An avid diver for over 20 years,

Durand is a widely published underwater photographer and dive writer who has served as editor-in-chief of the Underwater Photography Guide and imaging expert at Scuba Diving Magazine and Sport Diver. With a reputation for insightful-yet-simple reviews and tutorial articles, he has written for most of the top dive publications. Helping hundreds of divers "take their photography to the next level," Durand has led underwater photography workshops in California, the Bahamas, Indonesia, Mexico, the Philippines and Sri Lanka. ■

For more information, visit: tutorials.brentdurand.com. To watch the free video tutorials, go to the photographer's YouTube channel at: youtube.com/brentdurand.



Click on the image to go to the free video



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Amadeo Bachar



P O R T F O L I O

portfolio

The artist Amadeo Bachar in his studio (right); *Big Sur Blues* by Amadeo Bachar (far right). PREVIOUS PAGE: *La Jolla White Seabass* by Amadeo Bachar

California artist Amadeo Bachar holds degrees in both marine biology and science illustration and has published work with *National Geographic*, United Nations, *Scientific American*, the US National Oceanic and Atmospheric Administration (NOAA) and the US Geological Survey (USGS), among others. *X-Ray Mag* interviewed the artist to learn more about his artwork and his passion for the marine environment.



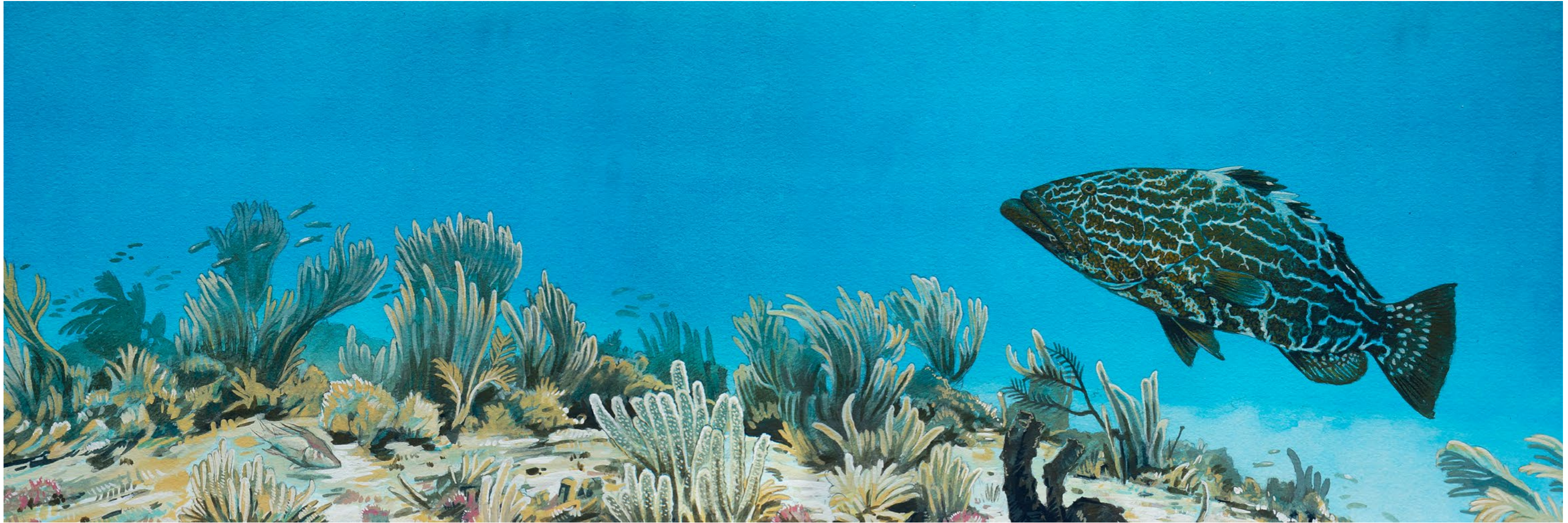
So-Cal Kelp Forest by Amadeo Bachar

X-RAY MAG: Tell us about yourself, your background, and how you became an artist.

AB: I have been making artwork since I was young—maybe really into it by the age of 11, but I remember always

enjoying drawing and being creative. My pursuit of art and illustration took a windy road. I began pursuing an art degree at a junior college. Midway through that, I took a physiological psychology course that dealt with a lot of human anatomy. It was a wonderful





Keys Black by Amadeo Bachar (above); The artist at work on a painting of a sailfish (left)

class and I really took to it—probably the only “A” I got in college until then. Because of that, I decided to switch courses and changed my area of focus to marine biology. I wanted to study some sort of science, but also wanted to keep close to the ocean, which I was always near, growing up.

While attending the University of California at Santa Cruz, I stumbled across a book of entomological illustrations by a French illustrator named Bernard Durin. They were absolutely mind-blowing, and I could not help but be infatuated by them.

Around the same time, I found out about a scientific illustration program at the same university. I was thrilled. It was a world-renowned program and it was in my backyard. I was accepted into the program and completed a year of intense classes focused on science and natural history illustration.

From there, I went on to an internship and worked with *National Geographic Magazine*. At that point, I felt like my illustrations and art were given legitimacy and reason. I felt I belonged. Because of this, I pursued a free-

lance illustration career, focusing on scientific subjects.

X-RAY MAG: Why marine life and underwater themes? How did you come to these themes and how did you develop your style of painting?

AB: I can divide my career as an illustrator into three chapters up to this point. The first chapter was heavily focused on scientific illustration. The second chapter began when I got a project painting all the important saltwater fish off the California coast. It was so refreshing to work with marine

critters again and I realized that I wanted to focus on this subset of the field. I started building my library of fish illustrations as well as selling reproductions and originals at the fishing shows up and down the California coast.

At the moment, I am in the midst of a third chapter. I am really trying to integrate my background in scientific illustration into a more focused fine art world where creating originals and large bodies of works in which telling more detailed stories about ecosystems and the supporting characters is the focus. The style, theme and



Wahoo Dodo (above) and *Nor-Cal Vermilion* (right) by Amadeo Bachar; The artist at work on *Nor-Cal Vermilion* (left)

composition are all heavily rooted in scientific accuracy while absorbing influences from some of my favorite painters—Winslow Homer, Georgia O'Keefe and Stanely Meltzoff, to name a few.

X-RAY MAG: *What is your artistic method or creative process?*

AB: I use many different media for finished illustrations. For fish identification images, I use watercolor or oil. For large scenes, I use mostly oil and occasionally acrylic. For more published work, I will work digitally. Even within each finished project, I use a series of media. For example, for a fish identification image,

I start with many photo references of that fish taken as soon after it has been caught as possible. This helps maintain the integrity of the colors as they fade soon after death.

From these photos, I will make a digital drawing in Adobe Illustrator. This software program helps me keep smooth curves as well as work out the repetitive elements like fin rays and scales in a more mathematical approach. From there, I will print that file out at size and transfer it to a piece of watercolor paper.

Once the transfer is down, I will go over the rough lines, sharpen them up and add all the details needed so that there is no guessing while paint-

ing. Since these are mostly watercolor, I begin with light washes of the purest colors, then build up layers from there. I usually incorporate some graphite along the way and finish highlights and spot colors with gouache.

X-RAY MAG: *What is your relationship to the underwater world and coral reefs? How have your experiences underwater influenced your art? In your relationship with reefs and the sea, where have you had your favorite experiences?*

AB: As long as I can remember, I grew up surfing and fishing. I took on freediving and spearfishing after high school. I did a bit of scuba diving, but I did

not like all the gear you had to wear, and I felt that freediving was a much more peaceful and natural way to be part of the underwater environment.

Because of this lifetime in the water, there is no doubt that this environment has influenced my work—not only for subject matter, but for scale, perspective, atmosphere and color, which are all so much different underwater than above the water; therefore, I think those are the biggest subconscious influences.

My interactions with underwater life come mostly through freedive spearfishing and surfing. While surfing, you only see a thin ribbon,

but when you dip your head underwater, there is so much more. I think you have a special view when spearfishing, because you are always alert, and you are most likely putting yourself in part of the marine ecosystem that has the most action and life. This allows you to see things that many do not get a chance to see.

X-RAY MAG: What are your thoughts on ocean conservation and coral reef management and how does your artwork relate to these issues? What can divers do to help?

AB: We must have a conscious role in conservation—all of us, at all levels. Obviously,



Nor-Cal Great White by Amadeo Bachar

I am a hunter and a diver, so I identify as a consumptive conservationist. When I think of the coral reefs, I am not so specifically focused on them, but the larger issue of habitat loss. I think that is the key issue. It has been proven over and over, when there is habitat for critters and reasonable regulations for take, they will take hold and proliferate.

Diving is the best way to help people understand what that environment is like. So, divers should take pride in sharing and educating people about their experiences underwater. Keep people aware.

Obviously, with coral reefs, this is not too difficult as they are beautiful and full of life and color. So, when we see a bleached-out reef, it is shock-

ing and causes us to consider its immediate impact as well as what it entails down the road.

X-RAY MAG: What is the message or experience you want viewers of your artwork to have or understand?

AB: The ecosystem defines the critters in it just as much as the critters make up the ecosystem. What I try to do is include as many players in that system as possible in my scenes, so that there is a more complete portrait of that system.

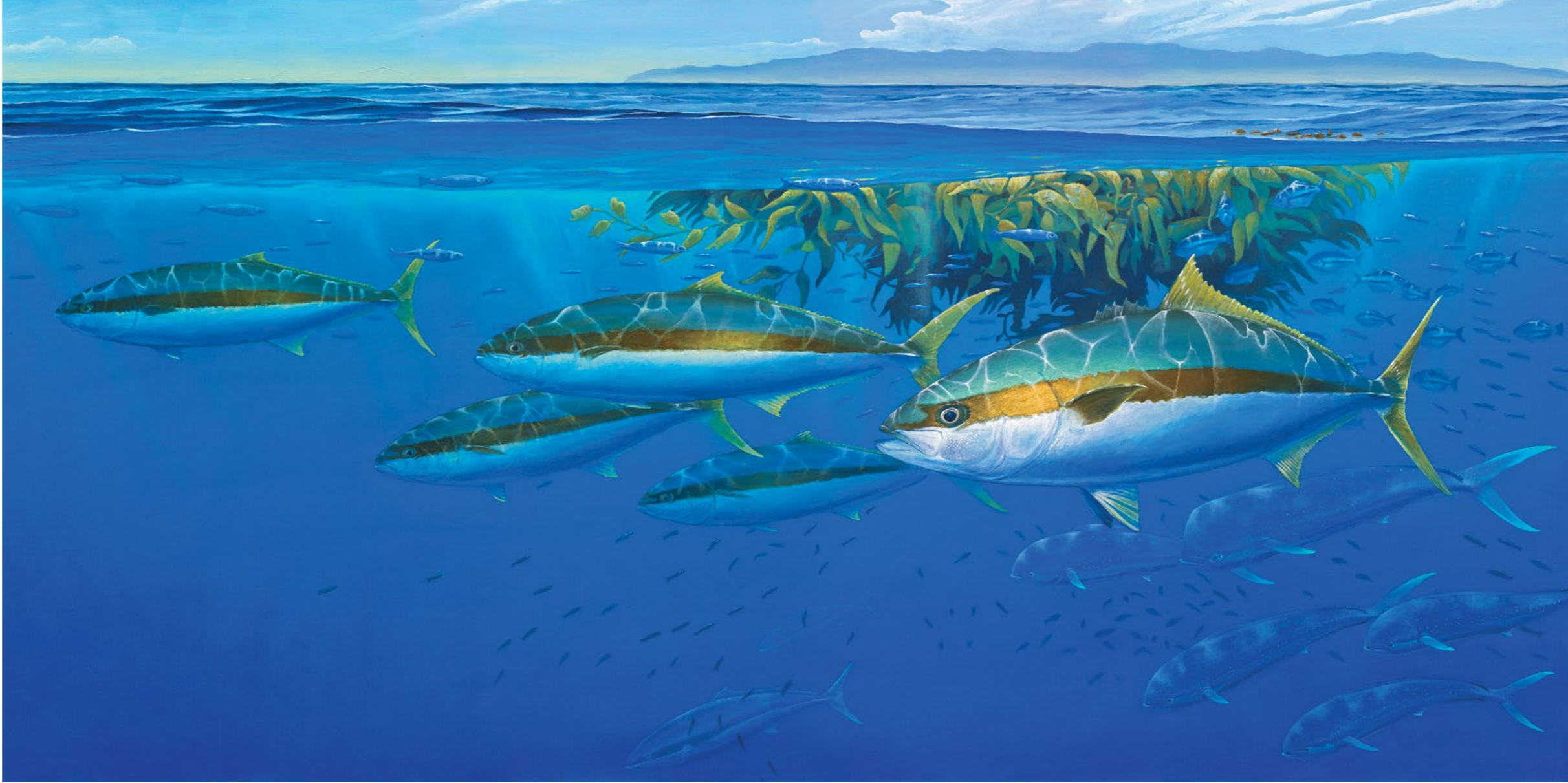
X-RAY MAG: What are the challenges or benefits of being an artist in the world today? Any thoughts or advice for aspiring artists in ocean arts?

AB: I think they are the same as they have always been: finding a time and place to focus on your art and finding a market for it so that you can continue to do so. My best advice to aspiring artists is to do as much art as you can when you have the time.

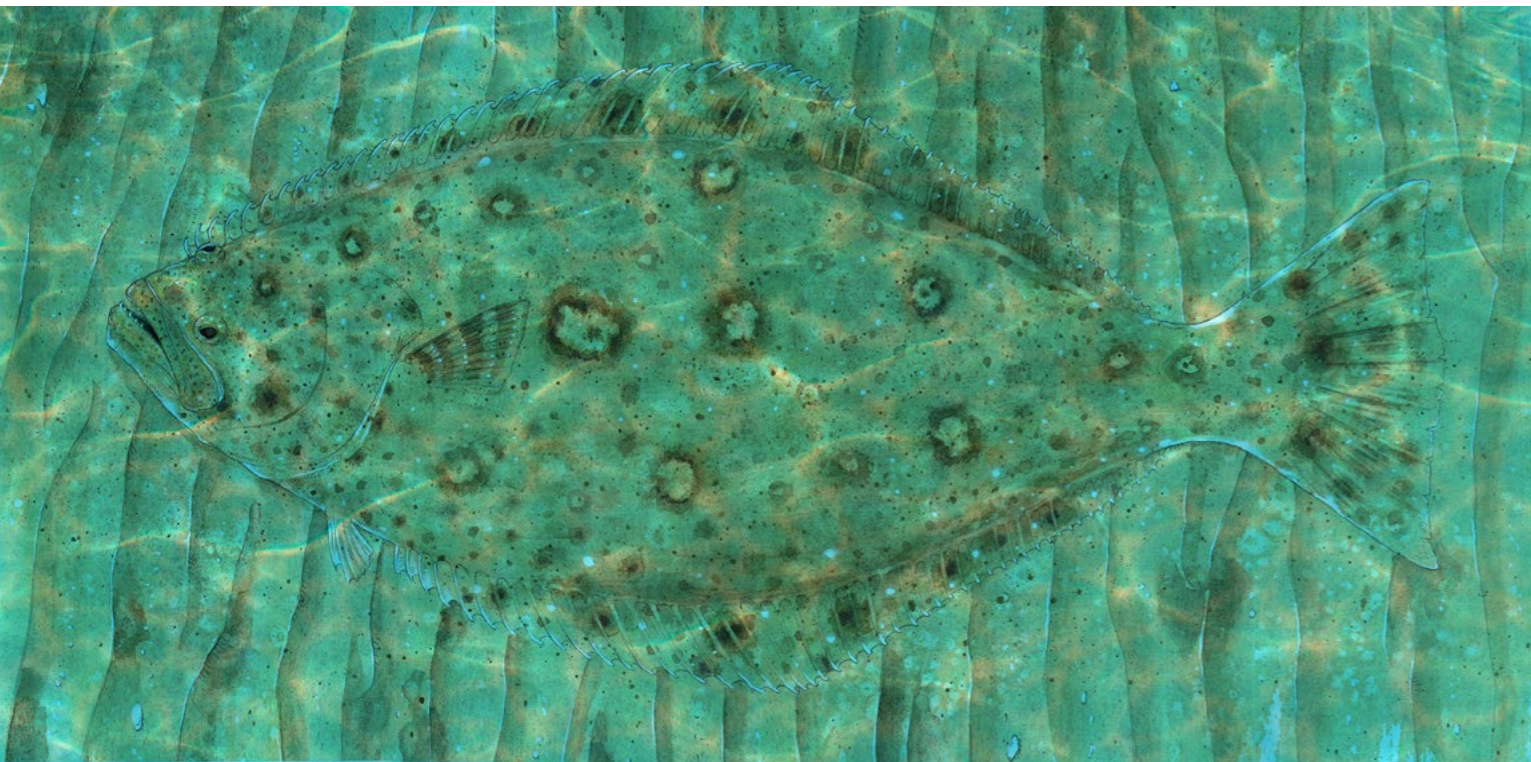
Get off the phone, put your head down and do the work. You cannot fake technical skill, and once you are good technically, it is so much easier to expand through different mediums and develop a look and style.

Don't worry about what others are doing so much. We are overloaded with visuals from talented artists via social platforms. Go look at real art in museums, both by masters and

Parrotfish by Amadeo Bachar



Paddy #2, by Amadeo Bachar



Halibut by Amadeo Bachar

by contemporaries.

Observe nature as closely as possible. It has all the answers to every artistic problem. You just need to find the pathway there.

X-RAY MAG: How do people—adults and children—respond to your works?

AB: From adults, I usually get some sort of fish story, but most of their responses tend to be complimenting the attention to detail that I try to achieve. They mostly appreciate that the fish I paint actually look like the fish and not a cartoon representation. For kids, it is mostly

the amount of species that I have done. They really love all the different kinds of fish and the way they look. Most of the time, kids know more about the fish I have hanging up at a show than the parents do.

X-RAY MAG: What are your upcoming projects, art courses or events?

AB: At the moment, I am finishing up an underwater scene of a vermilion rockfish swimming over an understory kelp forest, and I just started a large sailfish and dorado painting. The science illustration program in which I teach starts at the end of September. I am showing my work

at a few trade shows at the beginning of 2020 in southern California.

X-RAY MAG: Is there anything else you would like to tell our readers about yourself and your artwork?

AB: Thank you. I could not do this for a living if it was not for the people out there who are passionate about diving, fishing and the marine environment. This is what drives me to paint. ■

For more information or to order artwork and prints, please visit the artist's website at: studio-abachar.myshopify.com.