Scuba Confidential :: Southern California's Market Squid Run :: Darina Denali Portfolio

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French Polynesia's
Tuamotu Archipelago

Egypt's
Southern Red Sea

Wrecks
Hospital Ship Po

UW Photo
Black Water

Sharks
Great Hammerheads

POOR KNIGHTS & BAY OF ISLANDS
New Zealand

COVER PHOTO BY MIKE BARTICK

DIRECTORY

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COVER PHOTO: *Juvenile lionfish on black water dive, Philippines*
Photo by Mike Bartick

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Crescent-tail bigeye fish, Tuamotu Archipelago, French Polynesia. Photo by Matthew Meier

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Anatomy of an accident

Oh, wow. In 2017, no passenger jets in service crashed anywhere in the world. In a year where still cheaper airfares and more connections spurred more people to fly to more places than ever before, 2017 was the safest on record for airline passengers.

What does this have to do with diving, you may ask? There are a great many similarities. In both cases, safety is a matter of both equipment, and proper procedures and education. In both cases, technology and understanding has come a long way, over the past decades.

That said, the dive industry obviously does not have quite the same resources that the commercial airline industry does, and we do not get to train the participants to the same exacting standards.

But as our good colleague Gareth Lock, who served in the Royal Air Force for many years, has now taken safety concepts, adding an understanding of human factors into the mix, and applied them to diving, there is still much to be learned from other industries and fields, about risks and safety and the role our behaviour and psychology play in keeping us safe or exposing us to risks, which could and should be avoided.

During some downtime with the flu over the holidays, when my brain was so stuffed up I did not even have the capacity to watch TV one afternoon, I found myself binge-watching car crash compilations on YouTube. Yes, I know, it is not a very bright thing to do, but as I kept watching all these stupid and always avoidable crashes and crunching of metal, it became clear that they always came down to basic rules being broken, such as running a red light; or obvious limitations not observed, such as driving too fast in slippery conditions, or too close. It also struck me that in most, if not all these cases, accidents were down to not just one factor but a series of individual events, which together led to an accident. If only one of those elements had not been present, there would not have been an accident.

I recently witnessed first-hand, a type of accident, which was typical for many of these videos. Driving in the middle lane on a US interstate one rainy evening with bad visibility, we were overtaken by car on the left, already driving too fast for the circumstances, which immediately after passing us, suddenly crossed abruptly in front and across all the lanes to make an exit on the right-hand side. Only, in one of those lanes coming from behind us on our right side, was a big truck, which was also going too fast and was passing us on the wrong side. In the pouring rain, I could not see whether the two vehicles actually collided, or whether the car hit some barrier. But the car ended up being bounced back across all the lanes, skidding and spinning like a top, about to take out several other vehicles in the process.

Thankfully, that did not happen, and I do not think anybody was hurt, but it was a lucky escape for everyone concerned. We were left a bit startled but above all stumped by the whole sequence of stupid choices on behalf of that other driver.

Like I mentioned before, accidents tend to happen when several factors, each of which may not be catastrophic on its own, come together in some combination or sequence of events. It therefore follows, if we can take some of these factors out of the equation in the first place, other mishaps or mistakes—which we, as imperfect beings, are bound to make from time to time despite our best efforts—may not have such dire consequences.

This is why it matters to have proper and well-maintained equipment, sufficient training and practice and never dive (or drive) beyond what is safe under the circumstances, or beyond one's capabilities. This is also why it is important to appreciate why mishaps occur and understand what role our routines and mind-set play in keeping us safe.

A saying goes, "No risk, no fun." I think that is about the stupidest thing one can say. I would say: Live to dive another day, and always make sure to come home safe to your loved ones and share with them your adventures.

Happy New Year!

— Peter Symes, Publisher and Editor-in-Chief

News edited
by Peter Symes

from the deep

NEWS

Fjordia chriskaugei is named after Christian Skauge, publisher of the Norwegian dive magazine *Dykking*, and owner of ScubaPixel.

Nudibranch species named after Gulen Dive Resort and friends

How cool is that? Gulenia is a new family of nudibranchs named after our good dive industry colleagues from Gulen Dive Resort who host an annual nudibranch safari on their house reef in Western Norway. These events have been instrumental in the research on the region's nudibranchs. Over the years, new species have been found and existing species have been moved to other genera while other species are new. Thus, our colleague Christian Skauge writes that the Flabellina family has now gone "extinct" in Norway because the species therein have now been reclassified and put into other genera. He even got one species named after himself, *Fjordia chriskaugei*, while the two owners of the resort, Ørjan Sandnes and Monica Bakkeli, each got a species named after them too: *Gulenia orjani* and *Gulenia monicae*. While one of the new genera, *Gulenia,* is obviously named after the dive center, the other, *Fjordia*, is named after the Norwegian fjords.

Breaking up families

DNA analysis of Flabellinidae, a large family of commonly occurring nudibranchs, showed it is more complex than suspected in earlier works and called for a revision and reclassification of one of the largest subgroups of nudibranchs, the Aeolidace.

Among other findings, it was discovered out that *Flabellina lineata* was really no less than four different species: *Fjordia lineata, Fjordia chriskaugei, Gulenia monicae* and *Gulenia orjan*i. The species which was first described by Lovén in 1846 has been moved to a new family and is now classified as *Fjordia lineata*. *Fjordia lineata* can be found throughout the British Isles, and can also be found south as far as the Mediterranean Sea and north to Norway.

Gulenia monicae and *G. orjani* are easily confused with the similar *F. lineata* and *F. chriskaugei,* but the width of the white lines running along the back and the sides of the body are significantly wider.

Nudibranch safari

The house reef at Gulen Dive Resort probably has the highest documented nudibranch species count anywhere in the Atlantic Ocean, writes Skauge: "Norway is home to just over a hundred nudibranch species. With 82 documented species, we have found approximately two-thirds of them. Overall, we have been able to identify 13 species new to Norway at the Nudibranch Safari—four of them new to science."

The next nudibranch safari at Gulen Dive Resort is scheduled to be held 7-11 March 2018. ■

Kleptocratic nudibranchs

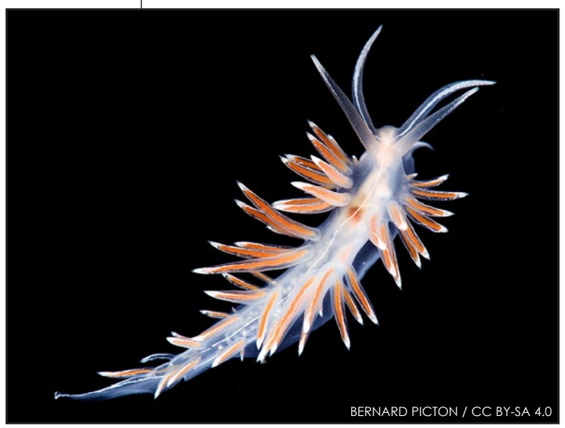
Certain species are known to steal prey from other predators, but nudibranchs have been observed doing something not seen before: stealing prey by eating the original predator, and with it, its prey's prey, which is currently sitting in its prey's belly. Researchers dubbed this sneaky method of getting extra sustenance kleptopredation.

Sneaky slugs

Scientists from the University of Portsmouth in Britain gave 25 captive nudibranchs four different mesh bags: One had nothing in it; the second held shrimp brine; the third a hydroid; and the fourth a hydroid that had eaten shrimp brine.

In 14 out of 25 cases, nudibranchs chose to eat hydroid polyps, its normal prey, while the polyps still had a belly full of zooplankton, their typical prey. Because the zooplankton inside the polyps accounts for about half of nudibranchs' diet, researchers believe the sea slugs actually favour consuming plankton rather than the polyps themselves, which nudibranchs appear to be using "as living fishing nets". ■

SOURCE: BIOLOGY LETTERS



Fjordia lineata. formerly known as Fjordia lineata.

AUGUSTE LE ROUX

Sand hoppers can shred plastic bags into millions of pieces

Inappropriate disposal of plastic debris has led to the contamination of marine habitats worldwide. This debris can be ingested by organisms; however, the extent to which chewing and gut transit modifies plastic debris is unclear.

Marine scientists at the University of Plymouth examined the rate at which bags were broken down by the amphipod *Orchestia gammarellus*, often referred to as the sandhopper or sand flea, which inhabits coastal areas in northern and western Europe.

The researchers found that a single plastic grocery bag could be shredded by marine organisms into no less than 1.75 million microscopic fragments (average diameter 488.59 µm). Although the type of plastic (conventional, degradable and biodegradable) had no effect on the rate of ingestion, the presence of a biofilm—a layer of organic material which accumulates over time—meant the shredding took place around four times as quickly.

Professor Thompson, Head of the University's International Marine Litter Research Unit, stated: "An estimated 120 million tonnes of single use plastic items—such as carrier bags—are produced each year and they are one of the main sources of plastic pollution. They already represent a potential hazard to marine life, but this research shows species might also be contributing to the spread of such debris. It further demonstrates that marine litter is not only an aesthetic problem but has the potential to cause more serious and persistent environmental damage." ■

SOURCE: UNIVERSITY OF PLYMOUTH

FLORIS VAN BREUGEL

The remarkable alkali fly, *Ephydra hians*, deliberately crawls into the alkaline waters of Mono Lake to feed and lay eggs. These diving flies are protected by an air bubble that forms around their water repellant cuticle upon entering the lake.

Meet the diving fly and spider

Mono Lake, just to the east of Yosemite National Park in the US state of California, is not an average freshwater lake. Not only is it three times saltier than the ocean, it is also full of sodium carbonate and borax—which is essentially laundry detergent. The water's high pH gives it a slippery, almost oily texture.

Water-repellant body

No fish or other vertebrates survive in Mono Lake, though algae and bacteria are abundant. Thus, for a fly, the depths of the lake may seem appealing—there are no predators and plenty of food. However, there is just one hurdle to overcome first: how to stay dry while underwater. Alkali flies (*Ephydra hians*) are able to do this, researchers from the California Institute of Technology discovered, because they are hairier than the average fly and coat their bodies and hairs with waxes that are particularly effective at repelling the carbonate-rich water. They also have large claws on their feet, which allow them to crawl on underwater rocks while resisting the naturally buoyant force of the bubble. Remarkably, the bubble does not encase the fly's eyes, allowing the fly to see underwater without the bubble's distorting effect.

Bob, the spider

In Australia, the newly named Bob Marley intertidal spider was discovered along the Queensland coast when the sea waters receded during the night.

This intertidal species has adapted to living underwater by constructing air chambers from silk and hiding in barnacle shells, corals and kelp holdfast during high tide. During low tide, they hunt small invertebrates found amongst nearby rocks, corals and plants.

Both the male and female have predominantly red-brown colours, with orange-brown legs covered with a dense layer of long, thin and dark grey hair-like structures. The female is larger in size, at almost 9mm, while the male is about 6mm long.

In light of the circumstances of their discovery, the marine spider was named "Bob Marley intertidal spider" (*Desis bobmarleyi*), in reference to Marley's song "High Tide or Low Tide." ■

R. RAVEN

A male individual of the new species *Desis bobmarleyi*

(File photo) Scientists found that in Bermuda, coral calcification was relatively insensitive to changes in the seawater pH, but very sensitive to changes in temperature.

Warming is worse than acidification

Observations of coral reefs in Bermuda find that gradual ocean warming may increase growth rates, but only if below a temperature "tipping point".

Many laboratory experiments have demonstrated that increased ocean acidity slows down coral calcification, the process by which corals grow and build their hard structure. But far fewer studies have tested how increasing ocean acidity affects coral growth in the natural environment, where a multitude of additional factors such as light, temperature and nutrients are also important.

To answer this question, researchers at Scripps Institution of Oceanography at the University of California San Diego collected environmental data including temperature, light, and pH from two coral reefs in Bermuda over a period of two years and simultaneously measured the calcification and growth rates of coral samples placed on each of the reefs, as well as seawater chemistry.

The scientists found that in Bermuda, coral calcification was relatively insensitive to changes in the seawater pH, but very sensitive to changes in temperature. And the observed relationship between temperature and calcification was a positive one—as the seawater got warmer, coral growth sped up.

The positive effect of modest warming on coral calcification had been observed in many laboratory experiments. But this comes with a caveat: If the warming is too much or too fast, corals quickly reach a tipping point and bleaching happens. When bleaching stress is severe enough for long enough, the coral dies.

"This doesn't mean that the corals are not negatively affected by pH," said Scripps chemical oceanographer Andreas Andersson. "It just means that the positive effect of the warming may mask any negative effects from pH when you're within the natural variability of temperature."

Andersson said there are some places in the world where it is likely already too late, the water is too warm, and many corals cannot be saved. The planet has already lost 50 percent of its coral reefs, compared to pre-industrial times, not only from over-heating but also pollution, over-fishing, disease, and coastal development. But Andersson said it is not too late to save the remaining 50 percent. ■

SOURCE: SCRIPPS INSTITUTION OF OCEANOGRAPHY

Mexican government creates Revillagigedo Archipelago National Park

Mexican President Enrique Peña Nieto signed a decree creating the Revillagigedo Archipelago National Park, protecting 148,087 sq km (57,176 sq mi) from all forms of fishing and extractive activities. The reserve is North America's largest.

Solmar V at Socorro Island. Diving at the Revillagigedos is done from November through early May when the water is generally calm and visibility can reach an impressive 30m (100ft) plus!

The park, Mexico's largest fully-protected marine reserve, safeguards a chain of four volcanic islands in the Pacific and their surrounding marine habitats, some 800km west of Manzanillo and almost 400km south of Cabo San Lucas. The archipelago and its waters were recognized by UNESCO as a World Heritage Site in 2016.

Upwelling

The islands—Socorro, Clarión, San Benedicto and Roca Partida—are located where the cold waters of the California current converge with the warm waters of the North Equatorial current, creating upwellings that bring nutrients from the bottom of the ocean to the surface. These nutrients help feed 366 species of fish—26 of which are endemic, meaning they are not found anywhere else in the world—as well as 37 species of sharks and rays. And they make the region a critical waypoint for whales, dolphins, sharks, tunas, sea turtles and other migratory species, as well as providing a winter home to humpback whales.

The Pew Bertarelli Ocean Legacy Project joined local partners Beta Diversidad and the Coalition for the Defense of the Seas of Mexico (CODEMAR) to provide technical and scientific support for the establishment of the reserve, and to raise awareness of the benefits of preserving this archipelago.

Matt Rand, director of the Pew Bertarelli Ocean Legacy Project, said: "We applaud President Peña Nieto's leadership in protecting the rich waters of Revillagigedo. This reserve will protect marine life around the islands and the large migratory species that visit as they traverse the Pacific Ocean; offer a safe haven from many of the pressures humans put on the ocean; and safeguard marine life from the ocean surface to the ocean floor."

Mexico's lead

Dona Bertarelli, trustee of the Bertarelli Foundation, said: "It's clear to me that now more than ever, we need countries all around the world to follow Mexico's lead. By protecting the waters around the Revillagigedo Archipelago, and all the incredible marine life that lives there, Mexico is joining a global movement to fully protect 30 percent of our ocean—as recommended by scientists and the International Union for the Conservation of Nature. It's an amazing achievement and will ensure a healthy and sustainable ocean for generations to come."

"Revillagigedo, the crown jewel of Mexican waters, will now be fully protected thanks to the vision and leadership of President Peña Nieto," said Mario Gómez, executive director of Beta Diversidad. "We are proud of the protection we will provide to marine life in this area, and for the preservation of this important center of connectivity of species migrating throughout the Pacific." ■

All the four islands that make up the Revillagigedo Archipelago are remote, volcanic in origin and offer some of the most unpredictable, wild diving in the world.

wreck rap

The Italian Hospital Ship Po

MAURO PAZZI

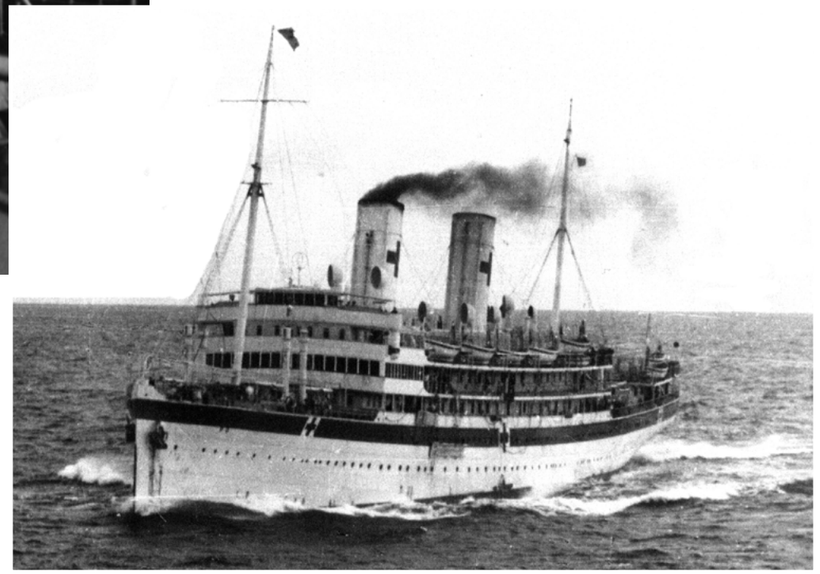
Text by Cesare Balzi
Photos by Michele Favaron and Mauro Pazzi
Translation by Peter Symes
Edited by Catherine GS Lim

In the Bay of Vlora (Valona), Albania, resting at a depth of 35m, lies one of the largest and most impressive wrecks in the whole Adriatic, that of the Italian hospital ship *Po*, sunk by British torpedo bombers on 14 March 1941. In the darkness of the night, the attacking pilots were not aware that the ship was a hospital ship. In the attack that ensued, 21 on board the ship died, including three nurses; one of whom was Mussolini's daughter, Edda Ciano, who was working for the Red Cross.

The background

I am on the coast of the Bay of Valona, together with Massimiliano Canossa, Michele Favaron, Edoardo Pavia, Mauro Pazzi and Igli Pustina for the third IANTD Expedition in Albanian waters. The window of our hotel room overlooks the nearby beach; and as my gaze wanders across the bay, I cannot help but imagine the historical hospital ship Po sitting out there so many years ago. "The Countess shipwrecked right on this beach," an Albanian friend tells me. "Italian soldiers arrived, they got her into a truck and took her away." The countess was Edda Ciano Mussolini, the daughter of the Italian dictator who was travelling on the hospital ship Po as a Red Cross nurse. The Po was one of the 22 white ships used to repatriate sick, shipwrecked and wounded during the Second World War.

The *Po* arrived in the bay of Valona on the evening of 14 March 1941 and moored about a mile from the mouth of the River Seco, quite close to the coast. Thus, it would be possible the following day to transfer the wounded on board to ambulances and trucks from the barracks of military hospital no. 403, which was located on



Historical photos of *Po* (top and left), which served as a hospital ship in WWI and WWII; Fairey Swordfish torpedo bombers (top center) with HMS *Ark Royal* (far left) circa 1939

the hill behind us. By order of the Command of Marina di Valona, the hospital ship was not illuminated by light during the night, as the lights would have made it possible for British reconnaissance planes to identify the other ships moored in the bay.

Shortly after 11 o'clock that evening, five British torpedo airplanes from a base on the Greek island of Paramythia made it across the Karaburuni Peninsula mountain range on the other side of the bay of Valona without being intercepted.

As it reached the sea, a torpedo was unleashed from a Swordfish torpedo bomber under the command of Lieutenant Michael Torrens-Spence. It hit the hospital ship on the starboard side. In the matter of a few minutes, the *Po* began to tilt, so the order was given to abandon ship and launch the lifeboats.

During the ensuing turmoil, a lifeboat capsized, drowning two Red Cross nurses while a third lost her life trying to save them. Ten minutes after the torpedo struck, the ship sank, leaving only the main mast, which for years indicated the exact point of sinking, above water.

Wien, Vienna, Po.

The ship was launched on 4 March 1911 by the Lloyd Austrian shipyard in Trieste, then part of the Austro-Hungarian Empire, and named *Wien* (Vienna) for the Austrian capital. Like her sister ship, the *Helouan*, the *Wien* was a luxurious and fast steamer of 7,289 gross tons, 135m long and 16m wide. It was used for passenger transport on the route from Trieste to Alexandria in Egypt. It had cabins for 185 first-class passengers, 61 in second class and 54 in third class. The engine system consisted of eight boilers and two engines which could propel the vessel at the decent speed of 17 knots.

World War I

On 16 February 1916, after the outbreak of the First World War, it was requisitioned by the Kaiserliche und Königliche Kriegsmarine, the Hapsburg Navy, and transformed into a hospital ship. In this capacity, it was used for a few months until, on 29 June 1916, she ran aground and damaged her propellers, after which she was returned to her owners, the Austrian Lloyd for repairs.

On 7 December 1917, she was requisitioned once more and based at Pula at the tip of the Istrian Peninsula, where she was used as a barracks ship for the U-boat crews of the Kaiserliche Marine base in the Istrian port.

On the night between 31 October and 1 November 1918, the *Wien*, moored inside the port of Pula, became the target in an assault by the Italian Royal Navy.

Two special forces officers, Raffaele Rossetti and Raffaele Paolucci, using an underwater vehicle called mignatta, which was akin to riding a torpedo, managed to make their way past the barriers and obstructions protecting the port and used limpet mines to sink the SMS *Viribus Unitis*, an Austro-Hungarian dreadnought battleship, of the Tegetthoff class.

After placing mines on the battleship, Rosetti was discovered and captured. He informed his captors that the ship was about to sink but was not believed as he did not reveal that he had placed mines on the hull.

When the mines exploded, the *Viribus Unitis* capsized and sank with heavy loss of life. After placing the charges, the manned torpedo was scuttled, activating its self-destruction mechanism.

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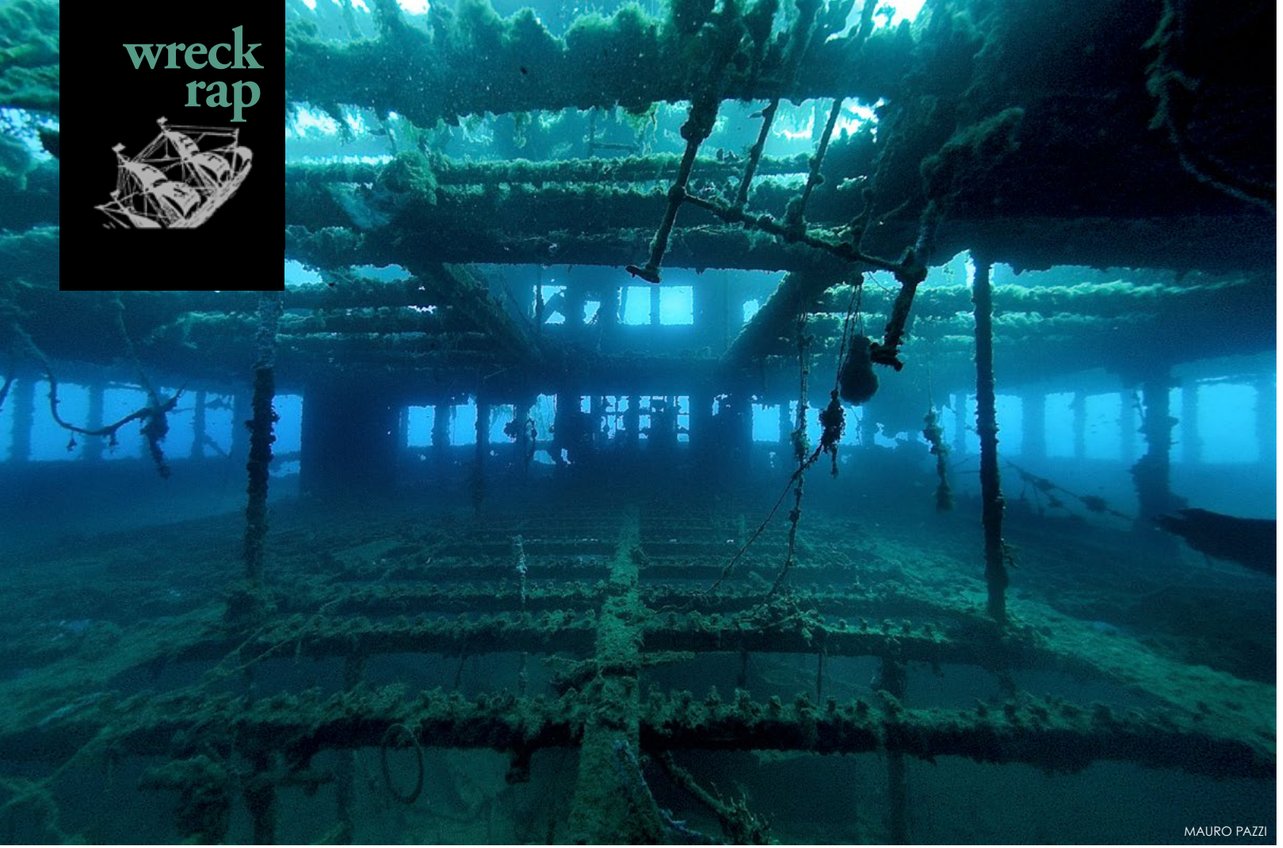
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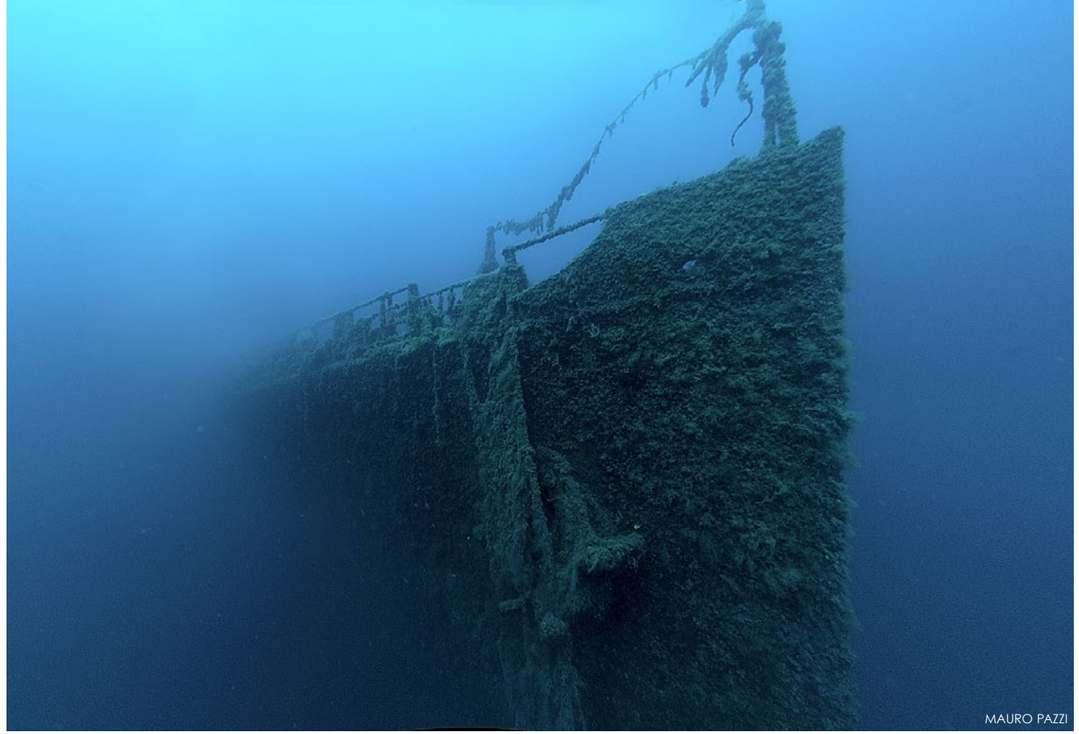
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Po

THIS PAGE: Interior and exterior views of the wreck of the Italien hospital ship *Po*, Valona Bay, Albania

Before exploding, the manned torpedo had come to rest near the *Wien*, and its explosion caused the steamer to sink.

Refloated and repaired in 1919, the steamer was returned to her former owner who, since Trieste had become part of Italy following the dissolution of the Austro-Hungarian Empire, had changed its name to (Società anonima di Navigazione) *Lloyd Triestino*. It was registered under the Naples Maritime Compartment, with the Italianised name of *Vienna*, and returned to its previous functions as a steamer in 1921, on the Trieste - Venice - Brindisi - Alexandria route to Egypt.

Colonial war and WWII

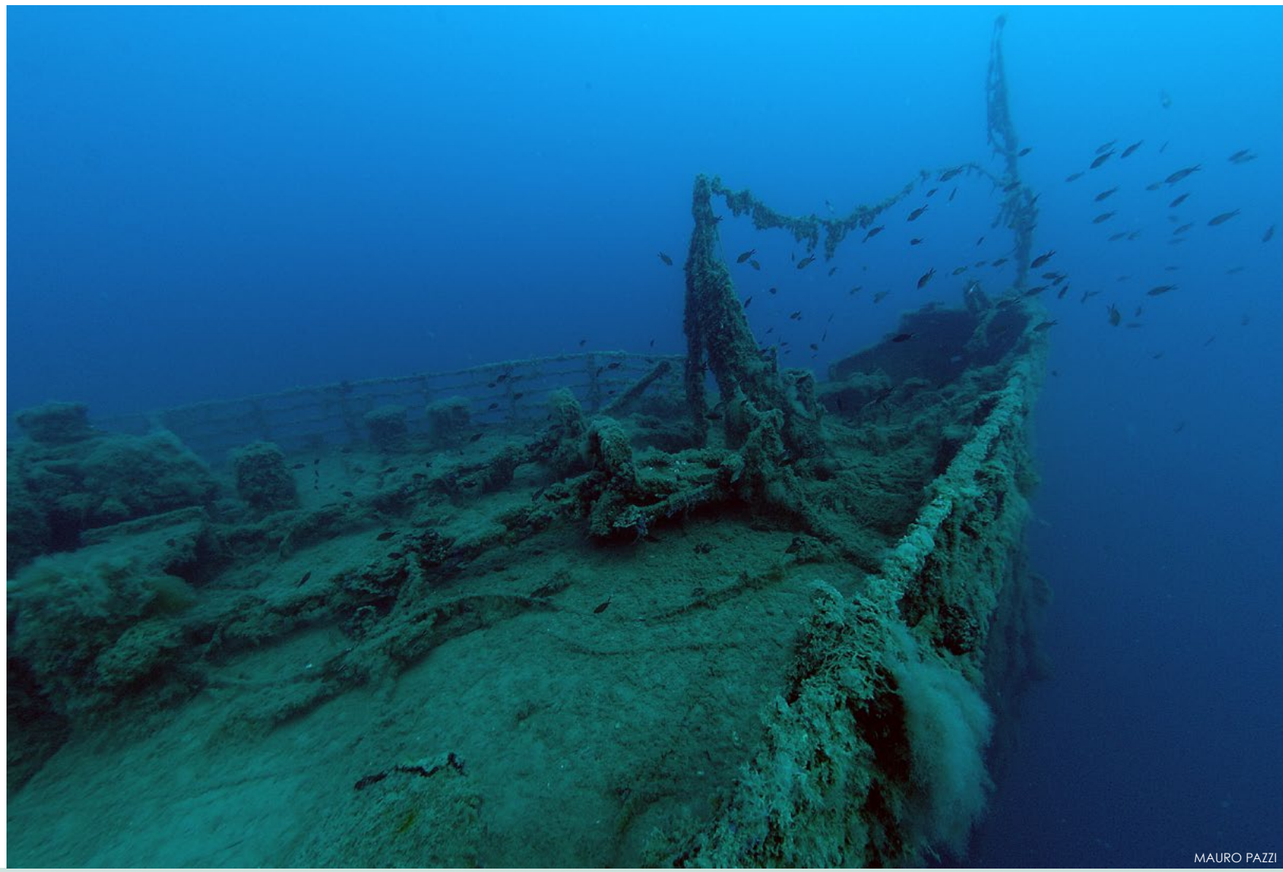
Then, in 1935, with the outbreak of war in Ethiopia, it was first chartered and then requisitioned by the Italian Navy for the transport of the wounded and sick, but classified not as a hospital ship but as some sort of intermediary infirmary ship. The Italian government wanted to take full advantage of every single journey from Naples to Massawa, Ethiopia, by having it carry the soldiers and ammunition on the outward journey and embarking the wounded and sick on the return journey. Hospital ships, which were afforded protection and had to be painted white with green bands and red crosses, could not be used to carry healthy troops and supplies.

After the colonial war, it was returned to Lloyd Triestino, renamed *Po* and returned to civil service. The last years of peace passed until following Italy's entry into the Second World War on 21 November 1940, it was again requisitioned by the Italian Royal Navy, which this time designated it as a hospital ship. It was painted according to the guidelines established by the Geneva Convention: white hull and superstructure, green belt interrupted by red crosses on the sides and the funnels.

After working on the Libyan front, from Tripoli and Benghazi, to repatriate the wounded of the North African campaign, in February 1941, she was sent to the Lower Adriatic to provide assistance to the wounded from the Greek-Albanian front.

The sinking

The legendary British 815th squadron flying Swordfish biplane torpedo bombers were transferred from the aircraft carrier HMS *Illustrious* to the airfield on the Greek island of Paramythia near the Albanian border on 12 March 1941. Their orders were to carry out raids on the ports of Valona and Durazzo, and the Italian military bases of Berat and Tirana.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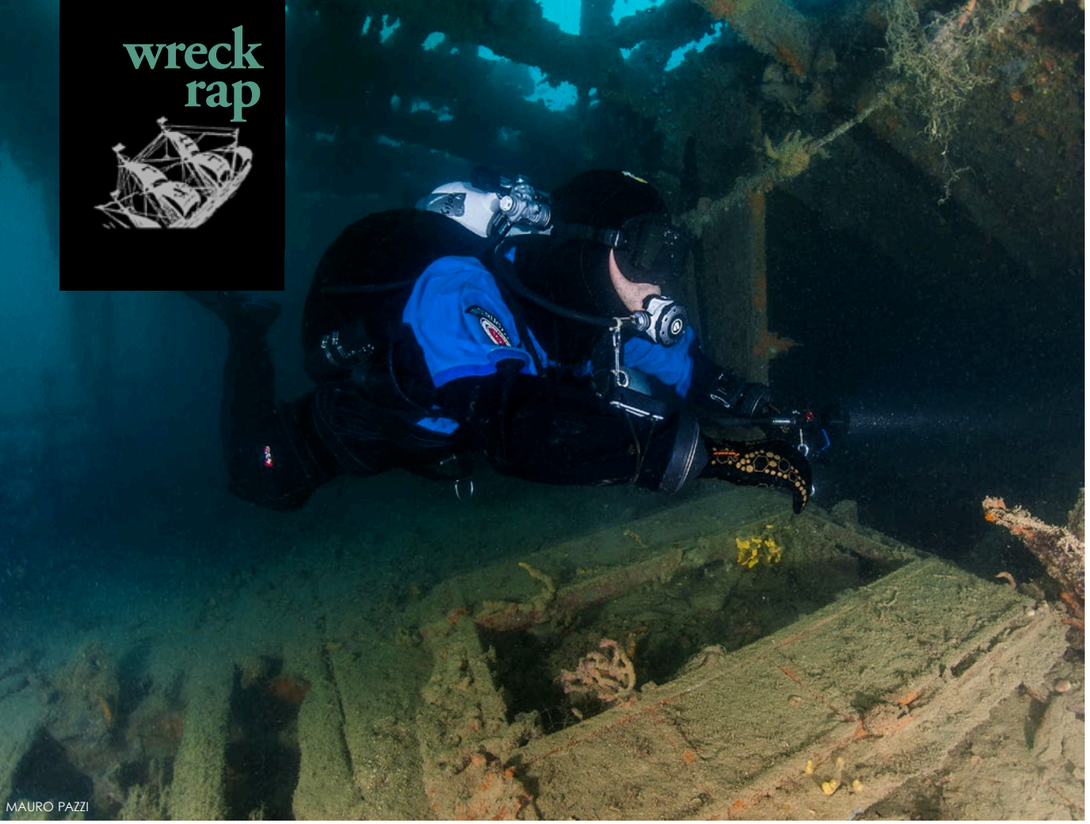
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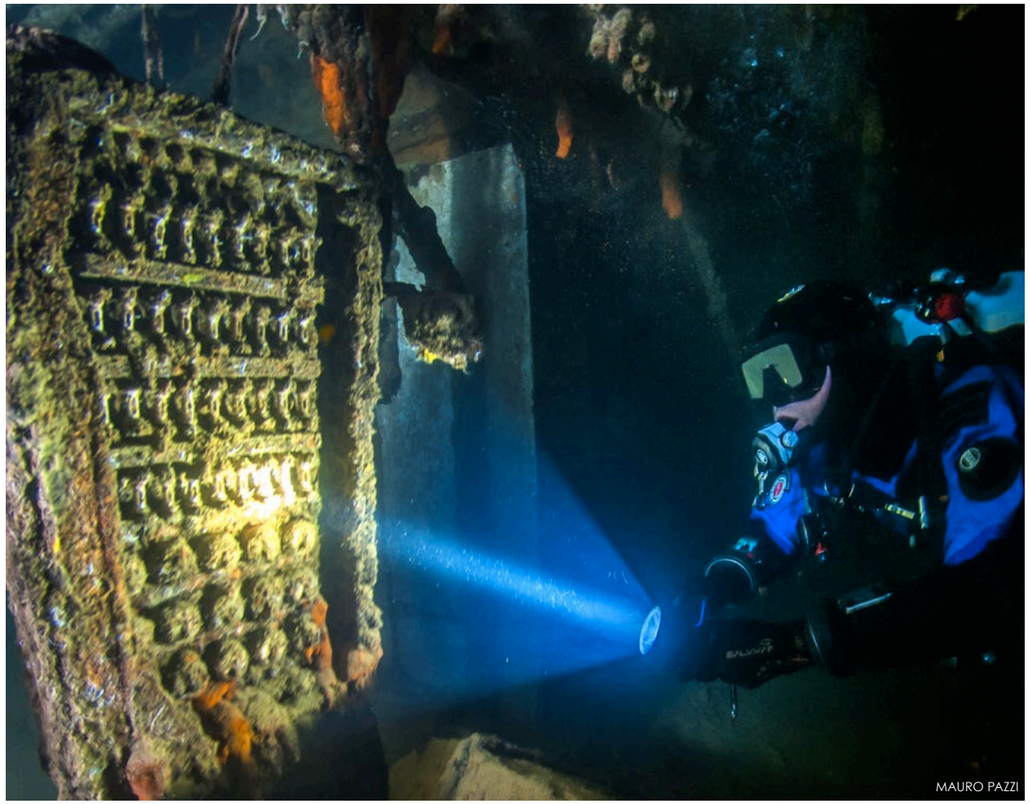
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THIS PAGE: Divers explore the interior of the Italian hospital ship *Po*


MAURO PAZZI

At 9:15 p.m. on 14 March, the Swordfish were each armed with a 730kg torpedo. They passed, at 10,000ft of altitude, the mountain chain south of the bay of Vlora and reached the sea, thus seeing the Italian navy and merchant fleet vessels at anchor in the harbour.

Painted in white, with green bands on the sides and large crosses on the funnels, always illuminated and recognisable during the night, the *Po* hospital ship enjoyed the protection of the norms of humanitarian law. The international agreements—the Hague Convention 1906 and Geneva 1907—foresaw that in order to guarantee the nighttime safety of hospital ships, these should be completely illuminated.

A ship illuminated in the darkness could, however, also serve as a beacon for enemy aircraft. If the *Po* had been lit up that night, the nearby ships, which were legitimate targets, would have been made visible too. Therefore, the Marine Command gave orders to obscure it, making it indistinguishable from normal transport vessels.

Sitting target

On 14 March 1941, the night was clear and moonlit. Descending to the altitude of 5,000ft after passing the mountains of the Karaburuni Peninsula, Lieutenant Michael Torrens-Spence, as he would describe later in his report, managed to identify a quite visible but unilluminated target and launched a torpedo.

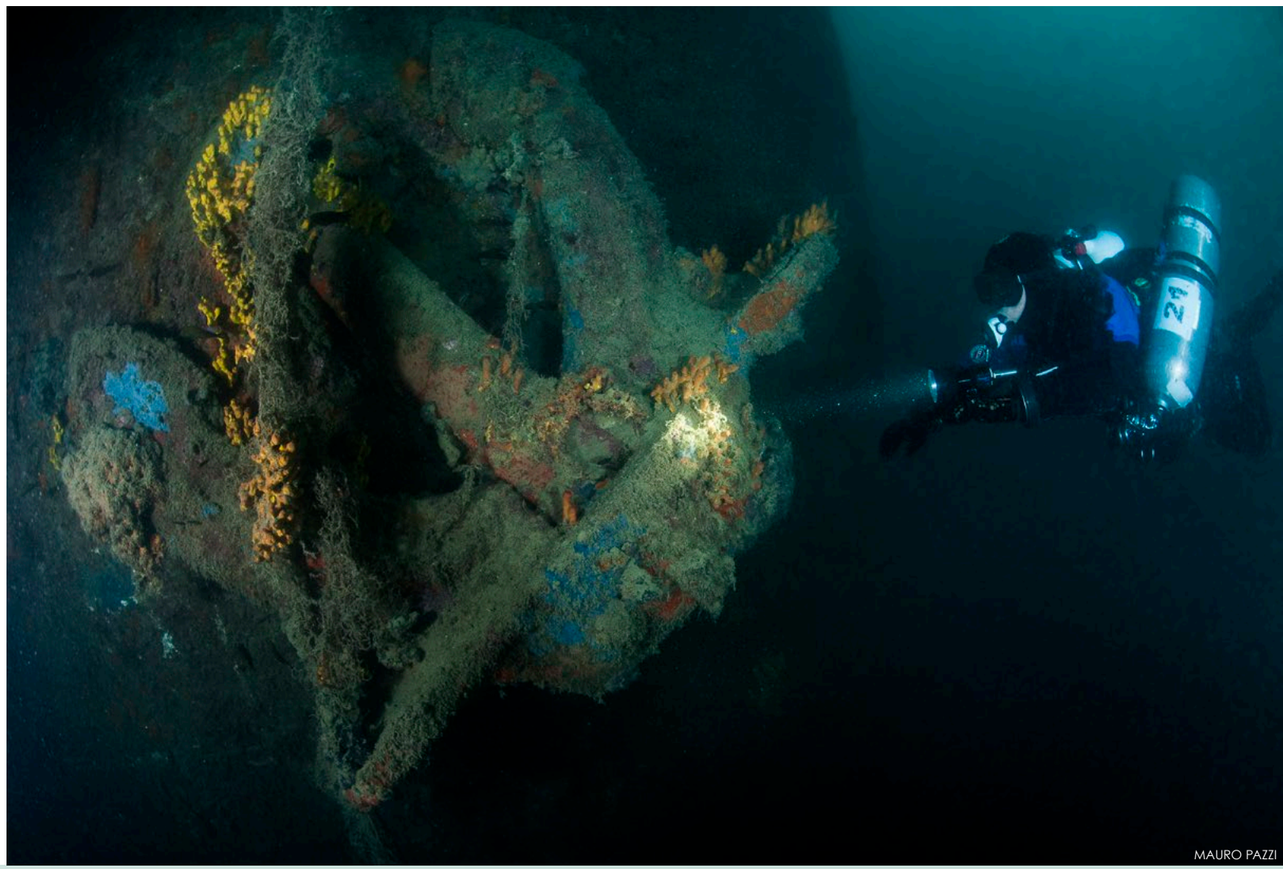
At 11:15 p.m., the *Po* was hit by the torpedo on the starboard side, and following the explosion, a large hole opened that caused the ship to sink so quickly that it prompted the commander to immediately give the order to abandon ship.

MAURO PAZZI

MAURO PAZZI

Po

THIS PAGE: Dive team members of the expedition shed light on artifacts on the wreck of the *Po;* Diver at anchor on the *Po* (below)



MAURO PAZZI

Just two minutes after the torpedo hit, the sea water began to enter the stern, and four sailors were trapped in the now submerged compartment.

Of the 240 people on board, 20 crew members lost their lives, as well as four Red Cross nurses—Wanda Secchi, Emma Tramontani and Maria Federici—during the shipwreck; and a few months later, Maria Medaglia, from blood poisoning, for ingesting contaminated water.

The then 30-year-old Red Cross nurse, Edda, the eldest child of Benito Mussolini, was saved by reaching the beach of Radhima on a makeshift craft. The *Po's* keel settled on a depth of about 35m. The steamer was so imposing that the top of the mast stuck out of the water by over a meter, thus indicating exactly the point of the shipwreck. Since then, the wreck has remained in the bay of Valona, less than a mile from the Albanian coast.

The dive

Once in contact with the wreck, we noticed that visibility was good and there was a total absence of current. In the beginning, it was easy to be overwhelmed by the desire to want to visit everything, finding yourself in the end, swimming in a frantic way, between the decks, but the experience gained in previous dives and timely planning made us proceed with utmost caution. The first image we glimpsed was an evocative one of the bow, which immediately highlighted the vertical seams of the ship.

From the ship's left-hand-side hawse pipe, the anchor chain emerged, which on that fateful night of 14 March 1941 kept the ship stationary at anchor. On the starboard side, Maximilian, lingered near the anchor, which still sat in its hawse pipe, on the side of the bow. Leaving the end of the prow, our dive proceeded towards the stern. What immediately caught the eye was the excellent state of preservation of the bridge deck, whose wooden tables in marine teak were still intact, clean and perfectly aligned with each other.

After passing a group of bow winches, we passed the mast, now lying on the deck after years of rising up to more than a metre above the surface of the sea. Today, the mass of beams and cables were lying horizontally on the main deck, across the openings of the two bow holds. Inside the first one, in a boatswain's cubicle, we found large quantities of tools for mooring the ship. In the

MICHELE FAVARON

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THIS PAGE: Divers shed light on details and artifacts found on the wreck of the Italien hospital ship *Po*

second were bathrooms, within which the ceramics that covered the walls, sinks, toilets and baths were still perfectly preserved.

After the exploration of the forward part, we arrived at the imposing superstructure, which we easily entered through the large windows and got into what was once the bridge. It was necessary, however, to pay attention to sharp metal and abrasive surfaces, and be mindful that visibility could be reduced. In this manner, we explored the internal compartments, using a reel to lay out a guideline with positioning markers and cookies, as underwater signage led us to the safe way out.

The missing decks made the interior a unique and scenic environment. From where once there were the windows, the light penetrated, creating a spectacular and evocative play of shadows and colour. It is a place where everything had come to an abrupt stop, and the diver, between those walls and those well-known rooms, could not help but reflect on the events of the war.

The ship, in addition to transporting the injured, also provided medical treatment. On board were an operating room, several clinics, and even x-ray facilities and laboratories. The wide hatches that passed through several decks were used to lower the most injured (on stretchers) to the various decks.

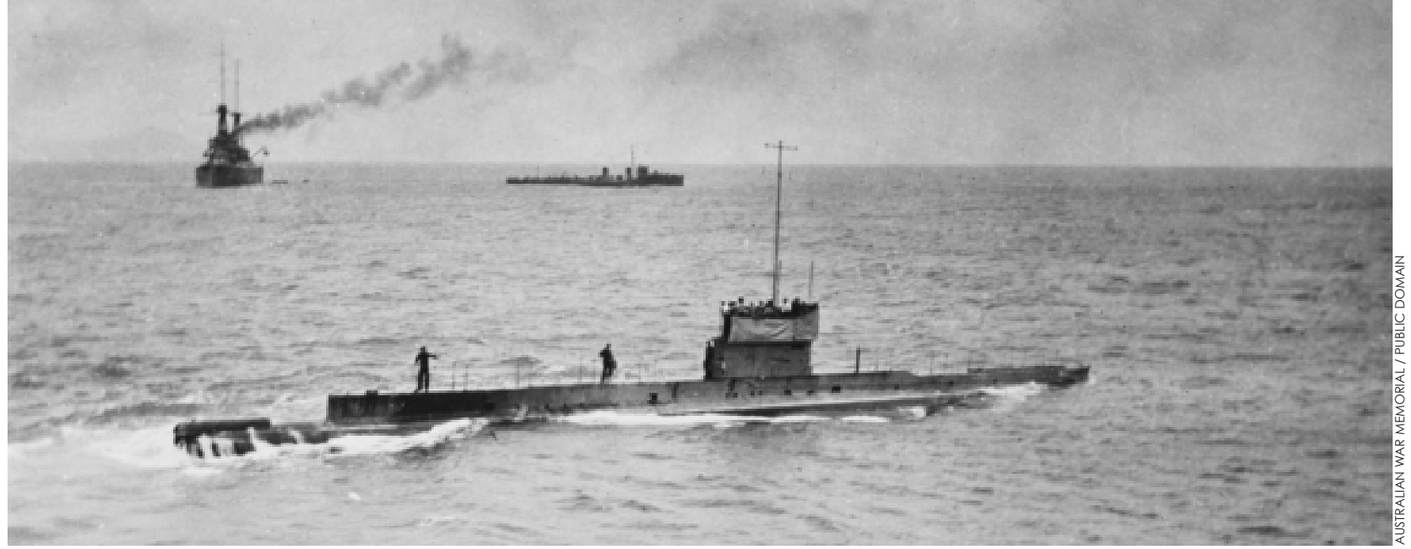
It was still possible to go down into the rooms below and explore the lower decks of the ship, but it was important to pay attention to sedimentation and ferrous material, which, when disturbed by passing divers or their bubbles, tended to move or detach from the ceiling, jeopardising visibility.

Under the fans still hanging from the ceilings, between stacks of plates and cups perfectly interlocked into each other (not to mention glasses, bottles, vials, hospital instruments and stacked beds), one could take a leap in time and feel immersed in history. Outside the hull, proceeding towards the stern, one could see the cranes of the boats, and, just below, two floors of external corridors.

Even in the stern area, the deck was perfectly intact. Moving away a few metres in clear water, one could appreciate the elegant profile of the stern and the rudder, standing up ten metres tall. The propellers were partially covered up, but still visible, at a depth of about 30m.

The gash caused by the torpedo was located in the middle of the starboard side. The opening was wide enough to enter, while the jagged edges and metal curving inward testified to the violent explosion and the subsequent, sudden inflow of water, which spelled the ship's demise. ■

wreck rap



AUSTRALIAN WAR MEMORIAL / PUBLIC DOMAIN

Last known image taken on 9 September 1914 of Australia's first submarine, HMAS *AE1*, shown here off the coast of Rabaul. The sub was lost off the coast of the Duke of York Islands in Papua New Guinea on 14 September 1914.

AUSTRALIA GOVERNMENT DEPT OF DEFENCE

The helm of HMAS *AE1*

Australia's first submarine HMAS *AE1* has been found

Australia's Minister of Defence, Marise Payne, has announced that Australia's oldest naval mystery has now been solved, following the location of HMAS *AE1* in more than 300m (984ft) of water off the coast of Papua New Guinea.

HMAS *AE1* was the first of two E Class submarines built for the fledgling Royal Australian Navy and was manned by Royal Navy officers with a mixed crew of sailors drawn from the Royal Navy and the Royal Australian Navy. The submarine was lost off Rabaul on 14 September 1914, and the fate of her 35 crew members remained one of the significant mysteries of Australian military history. It was the first loss for the Royal Australian Navy and the first Allied submarine loss in World War I.

The current search was jointly funded by the Australian government, the Silentworld Foundation, the Australian National Maritime Museum and Find *AE1* Ltd, utilising Fugro Survey's vessel and search technology. The team of maritime surveyors, marine archaeologists and naval historians scoured the search area with a multi-beam echo sounder and side-scan technology in an underwater drone flying 40m above the sea bed on pre-programmed 20-hour missions. Its success is due to the efforts of these teams. The first images captured by the expedition show the vessel is remarkably well-preserved and apparently in one piece.

The Australian government will work closely with the Papua New Guinean government to consider a lasting commemoration and recognition of the crew of *AE1* and to preserve the site.

The information gained from this expedition and from the research to date will greatly assist in unravelling the mystery of the loss of HMAS *AE1*, and will be held by the Australian National Maritime Museum for future generations to remember. Lest We Forget. ■

SOURCE: ROYAL AUSTRALIAN NAVY

War grave

Following the discovery of the submarine, a small commemorative service was conducted by those on board the survey vessel to remember those officers and sailors who lost their lives 103 years ago. Efforts are being made to contact the descendants of the crew.

AUSTRALIA GOVERNMENT DEPT OF DEFENCE

Survey data showing HMAS *AE1* on the sea bed

wreck rap

Edited by Peter Symes

One hundred and thirty-six years after her disappearance, the wreck of the steamer *Jane Miller* has been discovered in Lake Huron.

Ship lost in 1881 found in shallow waters in Lake Huron

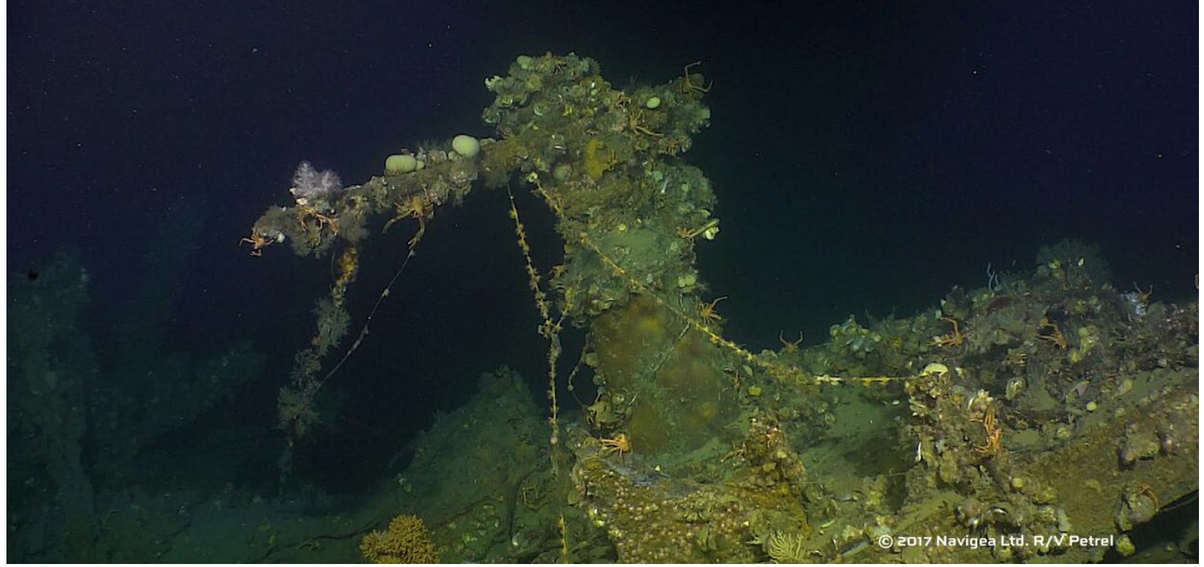
The ship is mostly structurally intact with its mast still standing, rising within 23m of the surface. The shipwreck hunters also reported spotting what could be the remains of bodies.

The *Jane Miller*, a 78ft passenger and cargo steamer, has been found on the bottom of Lake Huron after going missing while en route to Manitoulin during a storm 136 years ago with over 25 people on board, all of whom drowned. The ship is mostly structurally intact with its mast still standing, rising within 23m of the surface. The top deck and pilot house have collapsed, and are structurally non-existent. The ship's wheel is still evident near the bow. The hull and main deck remain intact. A small debris field surrounds the wreck.

Shipwreck hunters Jared Daniels, Jerry Eliason and Ken Merryman revealed their summer discovery to coincide with the anniversary of the *Jane Miller's* sinking on 25 November 1881. The wreck was found in Colpoys Bay, an inlet of Georgian Bay leading to Wiarton on the eastern side of the Bruce Peninsula north of Owen Sound in Georgian Bay.

Discovery

Finding the ship is a major discovery for the area, local marine history author Scott Cameron told the *Toronto Sun*. He said there are not many ships left from that era, and it holds substantial archeological significance. See the discovery of the *Jane Miller* described in a post at: **Scubaboard.com.** ■



Gun on the deck of USS *Ward*. Photo courtesy of USS *Ward* Media Assets

Wreck of USS *Ward*, the first US ship to open fire in WWII, has been found

Underwater footage taken by the R/V *Petrel*, an exploration ship owned by Microsoft cofounder Paul Allen, shows what remains of the USS *Ward* where it lies at the bottom of Leyte Gulf in the Philippines, near Ponson Island. Images coming from the drone inspecting the wreck ship on 1 December showed the ship's remains heavily overtgrown by marine life.

USS *Ward* fired the first American shot in World War II, when she engaged a Japanese submarine before the attack on Pearl Harbor, and successfully sank her opponent. The target sunk was a Japanese Ko-hyoteki-class, two-man midget submarine, thus *Ward* fired the first American shots of World War II a few hours before the Japanese carrier aircraft formally opened the conflict with their attack on the Pacific Fleet inside the harbor.

Three years later

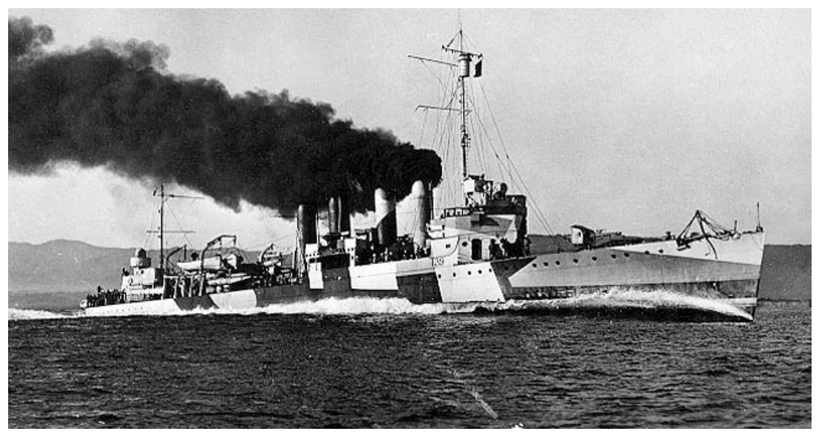
On the morning of 7 December, three years to the day after she fired the opening shot of America's involvement in the war, while patrolling off the invasion area at Ormoc Bay, Leyte, she came under attack and was hit by a Japanese Kamikaze midship. The resulting fires could not be controlled and *Ward's* crew was ordered to abandon ship.

Further exploration

The National Museum of the Philippines has given the team of Microsoft co-founder Paul Allen the green light to explore Philippine waters for World War II-era shipwrecks, focusing particularly on the areas of the Surigao Strait and Ormoc Bay where key battles took place in October 1944, as part of the massive Allied undertaking to liberate the country from Japanese occupation.

The US billionaire's team recently found the wreck of USS *Indianapolis* in the Philippine Sea at the depth of 5,500ft. Meanwhile, it located the Italian WWII destroyer *Artigliere* in the Mediterranean Sea in March, according to Allen's website. In 2015, it also discovered the wreckage of World War II-era Japanese battleship *Musashi* 1km under the Sibuyan Sea off Ramblon. The *Musashi* was commissioned in 1942, and was then the largest battleship in naval history. It measured 263m in length, and weighed 73,000 tons when fully loaded. ■ SOURCE: PAULALLEN.COM

Bow of USS *Ward*. Photo courtesy of USS *Ward* Media Assets



USS *Ward* running speed trials off the California coast in September 1918, while painted in disruptive camouflage

US NAVY / PUBLIC DOMAIN

travel news

Edited by
Peter Symes and
Scott Bennett

TIM FELCE / CC BY-SA 2.0

(File photo) Royal Jordanian Air Force C-130 photographed in 2004

Retired Air Force C-130 Hercules becomes artificial reef in Jordan

Renowned for its wide-ranging ability to ferry large amounts of cargo and passengers over long distances, the Lockheed C-130 Hercules airplane is one of the most popular for military forces worldwide. In Aqaba, Jordan, one has just assumed a rather unconventional role: an artificial reef.

The Jordanian Air Force owns about a half dozen of the planes, but recently decommissioned one to sink it off the coastal resort city of Aqaba. It is hoped the aircraft will create a habitat for marine life to flourish, a benefit not only to the environment, but also the economy by drawing tourists to snorkel or dive at the unique underwater site.

Click so see video from the sinking

Preparations for sinking

Prior to sinking, all the fuel, paint and hazardous materials were removed from the aircraft and then it was dropped off a massive barge about 1,000ft from shore. The plane now rests at a depth of approximately 50ft, making it easily accessible to recreational divers and visible to snorkelers and glass-bottom boats.

Donated to Aqaba

The aircraft was donated to the Aqaba Special Economic Zone Authority, which governs tourism activity along the coastal towns and port areas of Egypt, Israel, Jordan and Saudi Arabia. The decommissioned plane is 112ft long with a wingspan of 132ft. When in operation, it could carry more than 120 troops as well as ample cargo and weapons. ■

Hawaii hyperbaric chamber closed until further notice

PETER SYMES

(File photo) Hyperbaric chamber in a hospital

The Hyperbaric Treatment Center, located at Kuakini Medical Center in Honolulu and operated by the University of Hawaii under the John A. Burns School of Medicine, closed in October 2017 due to a shortage of doctors able to staff the facility. The facility will remain closed through February of 2018.

Interim solutions

Meanwhile, the Divers Alert Network has asked The Queen's Medical Center about potentially treating some cases of decompression sickness to help bridge the gap. The Queen's Medical Center said they were not equipped to handle cases of the bends, as their facilities are designed to treat diabetic ulcers and bone infections.

Dr Matias Nochetto, DAN's director of medical services and programs, said they were trying to see how DAN and the wound heal center could work together until the Hyperbaric Treatment Center reopens. "We would all be in a much better position … if they would be willing to receive divers even during business hours," he said.

For now, patients would need to be transported to Guam or the mainland, which introduces extra time and risk of complications, not to mention the financial cost of transoceanic emergency care. The university continues to seek interim solutions for physician coverage to care for divers who need treatment. In the meantime, divers hit with the sickness are advised to seek treatment at the nearest emergency room. ■

New Zealand

Poor Knights & Bay of Islands

Text and photos by Scott Bennett

Diver with fronds of kelp at Poor Knights Islands; Sheer clifs and rugged landscape of Poor Knights Islands (top right); Common anemone (right). PREVIOUS PAGE: School of blue maomao at Northern Arch, Poor Knights Islands, New Zealand

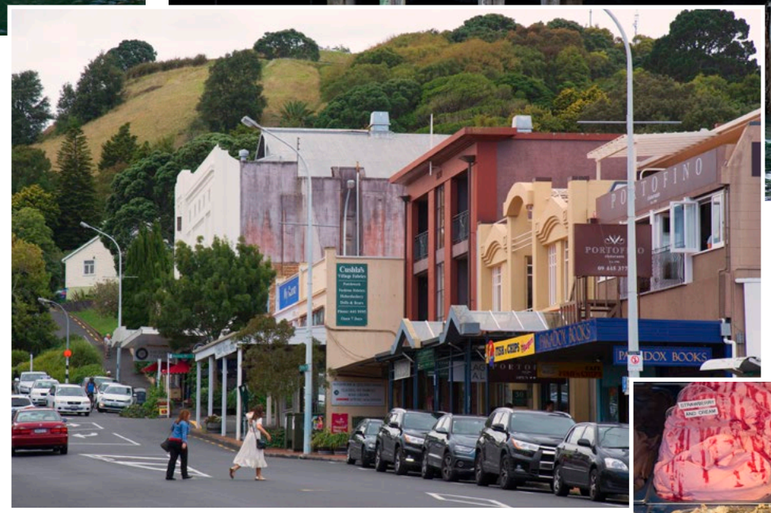
Ever since the release of the Lord of the Rings, New Zealand has been synonymous with Middle-earth—a South Pacific wonderland of forests, mountains, volcanoes and geysers featured in the Lord of the Rings and Hobbit trilogies. Although revered for its topside beauty, New Zealand remains somewhat obscure as a diving destination. Yet, the North Island is home to a place Jacques Cousteau considered one of the world's top ten diving locations—the Poor Knights Islands.

Situated off the Tutukaka Coast, a three-hour drive north of Auckland, the islands have long been on my radar. Featured in documentaries, including BBC's original Planet Earth series, they have captivated me from the get-go. From the reefs to the fish life, everything was unfamiliar and exciting. Additional research revealed the nearby Bay of Islands had some intriguing wrecks. After years of tropical diving, I was hankering for something new. Considering my previous trip to New Zealand was 30 years ago, a return visit was long overdue.

Auckland

My first three days would be spent visiting friends in Auckland, after which I would drive up to Tutukaka and the Bay of Islands for the remaining six days. Fortu-

nately, the trip proved much easier the second time around. From Toronto, it was a five-hour flight to Los Angeles, followed



THIS PAGE: Scenes from Aukland, New Zealand. CLOCKWISE FROM ABOVE: Ferry Building; Viaduct Harbor; The Cloud event venue at Queen's Wharf; Gelato is very popular in Aukland; Devonport

by a 12-hour flight to Auckland on Air New Zealand. The two-bag allowance was a godsend, especially with all my underwater camera gear. I arrived on a beautiful late summer day, a vast improvement over the winter I left behind.

The first day was a rest day, catching up on old times accompanied by numerous cups of coffee. I also arranged my rental car for the drive up to Tutukaka. Surprisingly, I had no jet lag. Perhaps it was due to leaving at 10:00 p.m. and arriving just before 7:00 a.m. (it was an entire day ahead, though) or maybe it was just the coffee. Regardless, I managed to sleep the entire night and woke up refreshed. A real first!

Having missed Auckland the first time around, I was eager to explore New Zealand's biggest city. Nestled between twin harbors and punctuated with volcanoes (some dormant), Auckland is certainly blessed in the scenic department. Home to the world's largest urban Polynesian population, the skyline is dominated by the Sky Tower—at 328m, the tallest structure in the Southern Hemisphere.

After parking, we headed for the waterfront, the city's traditional front door. Occupying a prominent location was the Ferry Building, resplendent in yellow Edwardian Baroque. Completed in 1912, it is a hub for the Auckland ferry network that connects the city with North Shore suburbs, west and south Auckland, and nearby islands.

Devonport. From here, we caught a ferry to Devonport, located to the north across Waitemata Harbor. A mere 12-minute journey, it soon proved a world away from the downtown's urban bustle. Enjoying a relaxed seaside village vibe, it is renowned for its beaches and restored Victorian and art deco buildings. After some exploration, we stopped for a gelato, which I suspected was a national obsession based on the number of shops serving it.

Viaduct Harbor. Back in Auckland, we strolled over to Viaduct Harbor. A residential, commercial and entertainment district on the waterfront, it is home to over 30 bars and restaurants as well as New Zealand's Voyager Maritime Museum. The marina was home to some seriously impressive cruisers and yachts—not surprising, as Auckland is called "The City of Sails." It could also be called "The City of Shipping Containers," as it has found plenty of creative uses for them, from fish and chip shops to public lavatories. My favorite rendition was a pair of containers converted into open-sided mini-libraries.

One Tree Hill. The next day, we ventured to One Tree Hill, Auckland's second highest volcanic peak at a height of 182m and home to some controversy. Once a massive *pā* (fortified village) that was home to several thousand people, it was named for the lone tōtara tree that once stood at the summit. Felled by a white settler in 1852, a radiata pine was planted in the 1870s to replace it, after repeated failed attempts to grow native trees.

The tree was attacked twice by Māori activists, first in 1994 and again in 2000. Irreversibly damaged, it was finally removed due to risk of collapse. In 2016, nine tōtara and pohutukawa saplings were planted and remain well-protected. Ascending sheep-laden hills to the summit, the views were superb, extending from the city to the Tasman Sea and Pacific.

Driving

Finally, the moment of truth had arrived: D-Day (driving day). I was apprehensive as it had been many years since my last left-side drive excursion. With my tiny Toyota Corolla packed, I was off! Driving proved easier than expected, and once over the Auckland Harbor Bridge, traffic lightened considerably. Outside Auckland, the highway became a toll road, which turned out to be the shortest I had ever seen. Upon exiting a tunnel, that was it for the toll road—more meters than kilometers. There wasn't a toll booth, but the NZ$2.00 fee can be paid online, with a five-day payment window.

About an hour north of Auckland was a sight I remembered from my first trip: SheepWorld! A sheep-themed tourist attraction, my friends and I thought it was the funniest thing ever (well, we were in our 20s) and stopped to photograph the sign. I thought it fitting to stop for an updated photo and grab a coffee. However, there was something I did not expect—pink sheep! (No, I had not been drinking). Park staff originally dyed the 60-strong flock pink for breast cancer awareness week, but it proved such a hit with visitors, it was maintained as a permanent fixture. Actually, the sheep appeared red, but maybe it was due to the rain.

Pink sheep at SheepWorld, just north of Aukland

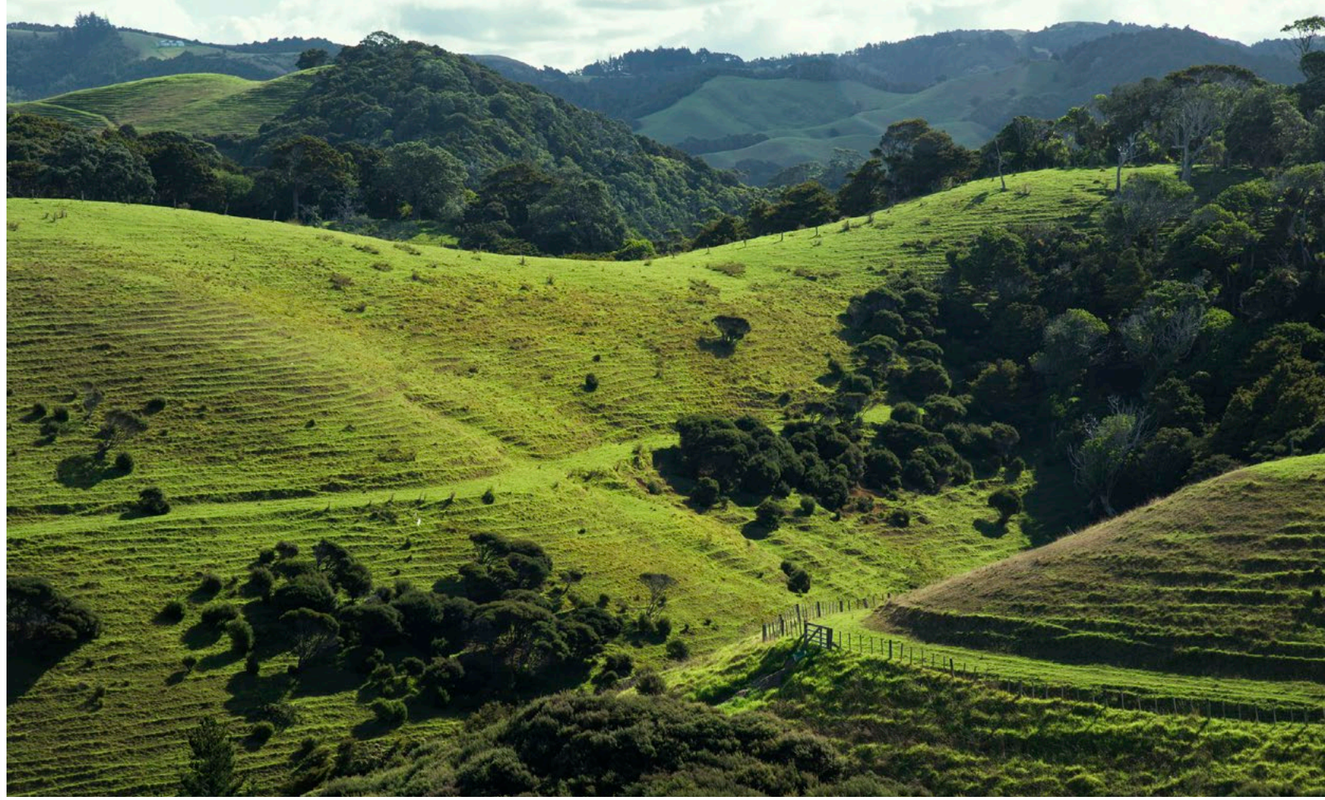
I also frequently encountered the squashed remnants of New Zealand's most hated animal: the common brushtail possum. Introduced from Australia in the 1850s by European settlers to establish a fur trade, the marsupials proved catastrophic, chomping through native vegetation and native birds' eggs and chicks. With no predators, numbers skyrocketed, peaking at around 60 million by the 1980s. Stringent control measures have reduced numbers to a mere 30 million. Still, with only four million human residents, the possums could stage a coup.

Mini-library and fish-and-chips shop at the City of Shipping Containters (left); One Tree Hill (above); Matapouri coastline (right)

Tutukaka

Just north of Whangerei, I reached my turnoff and soon arrived at the pleasant seaside town of Tutukaka. Despite the town's compact size, the marina was huge, being a major departure point for both dive and sport fishing excursions, with black marlin particularly sought after. I promptly found Dive Tutukaka and stopped in to say hello. The shop was quite striking, like a cave interior hewn from solid rock. I was warmly greeted by co-owner Kate Malcom, who runs the shop with partner and director Jeroen Jongejans.

Dive Tutukaka is New Zealand's largest dive charter company,



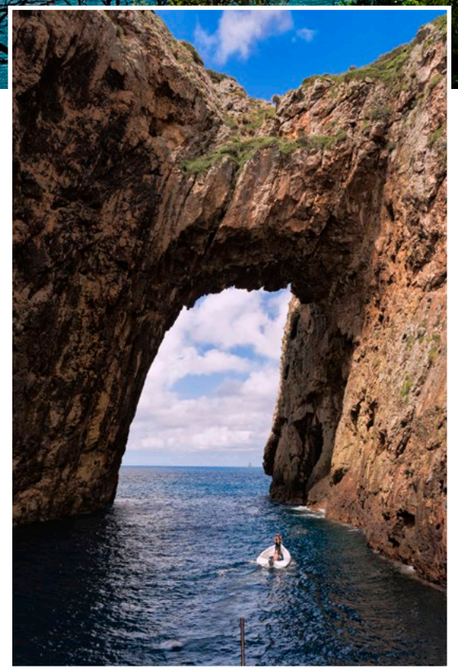
Matapouri countryside (above) reminds one of Middle-earth; *Acheron* liveaboard at Poor Knights Islands (right)

with five vessels that take over 12,000 people to the Poor Knights Islands annually. Although daily trips are offered year-round, I would be doing things a little differently—courtesy of the *Acheron*, their 24m liveaboard. Equipped with four twin-share en-suite cabins and one twin-share cabin, our trip would cover three days and two nights, with three to four dives daily.

I then headed to the equipment counter to organize gear. A 7mm suit is standard, along with an underlying vest with attached hood. While getting sorted, I glanced over to the "Sightings of Cool Stuff" board and my jaw dropped. Sightings that week included giant kingfish, Bryde's whale, pregnant eagle ray, hammerhead, seven-gill and bronze whaler sharks, mola mola and manta rays. Kate then showed me a video of the latter—a 6m behemoth encountered the previous day. I wanted to leave that very second!

Afterwards, I headed to my room, located in their newly-opened accommodation adjoining the dive center. It was quite a big operation. Especially impressive was the training pool, raised above ground level with large windows on the sides. By 4:00 p.m., the dayboats returned and I finally caught up with Jeroen, whom I had previously met at a few DEMA dive shows. Although born in the Netherlands, Jeroen is a true Kiwi, having run dive operations on the Tutukaka Coast for nearly 30 years. I was pleased to discover he would be joining us on the *Acheron*.

With a few hours before dinner, I opted for some hiking in the nearby Matapouri. Parking near the beach, a marked trail led to the nearby headland. Ascending to the top, the views were spectacular. Rugged cliffs dropped to the sea, while in the distance, I could



White sandy beach at Whale Bay (above); Archway island (left)

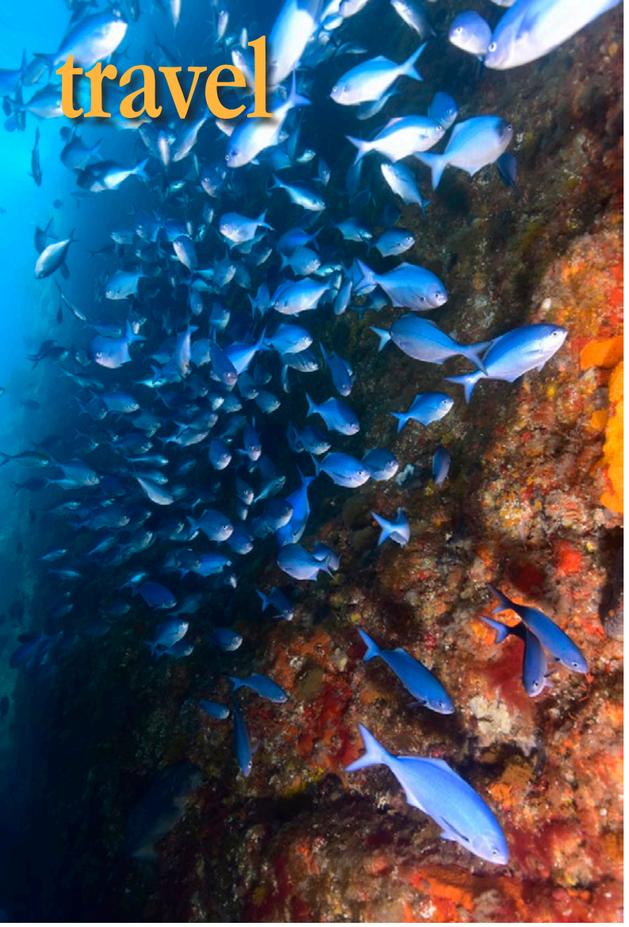
just discern a few craggy islets of the Poor Knights. Inland, the green hillsides were straight out of Middle-earth. I half-expected Bilbo and company to pass by. However, the best was yet to come. Further along was a glorious vista straight from a postcard. Lapped by turquoise waters and fringed with pohutukawa trees, Whale Bay's talcum-powder beach was one of the most idyllic spots I have ever seen.

Poor Knights

After breakfast, I grabbed my gear and headed to the jetty for the 9:30 a.m. departure. En route, I met the crew and fellow divers. The former included my dive buddy Cameron Barton, another underwater photographer, cook Mandy, instructor Ashleigh McKenzie, Skipper Kevin Delonge and Jeroen. My fellow divers included Dan and Deb from the United States and Andrew, a UK native living in New Zealand. With only four guests, we each got our own cabin. With roughly an hour to the site, we all prepared for the first dive.

Perched on the cusp of the continental shelf 23km from Tutukaka, Poor Knights is an archipelago of two primary islands, Aorangi and Tawhiti Rahi, along with a multitude of smaller islets. Encompassing an area of just over 200 hectares, they were created ten million years ago by a series of eruptions from a massive volcano 25km in diameter and 1,000m high.

Precipitous cliffs plunge up to 100m below sea level, creating an aquatic wonderland of caverns, sea caves and arches. Here, cool water merges with the warm East Auckland Current, fashioning a marine melting pot where subtropical endemics mingle with tropical exotics. Approximately 60 dive sites are found throughout the islands, playing host to over 125 fish species.



Huge school of blue maomao (left) at Northern Arch (right); Crater sponge (below)

ing the dinosaurs, geckos, 25cm centipedes and giant crickets called wetas. Bird species include bellbirds, red-crowned parakeets, New Zealand shags (cormorants), Australasian gannets and 200,000 pairs of Buller's shearwaters. During the winter months, New Zealand fur seals visit the islands.

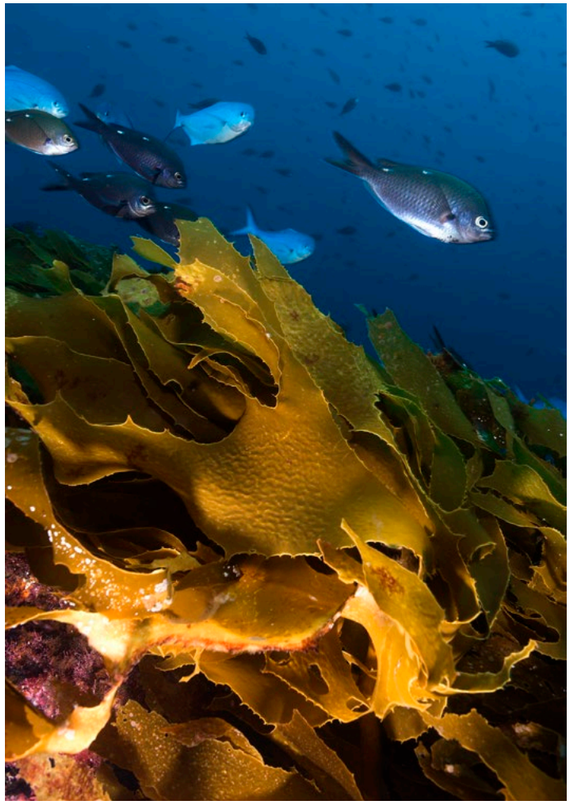
Discovered by Captain Cook on 25 November 1769 (is there any place in the South Pacific he did not discover?), the name's origins are open to debate. Cook purportedly named them after poor knight's pudding (French toast). At the time, pohutukawa trees were shrouded with red blossoms and the islands resembled his favorite dessert covered with jam. Another source claims they resemble effigies of crusader knights lying down. Jeroen indicated one island he said looks like either a chicken sitting on a nest, a cowboy riding a bullfrog or a naked lady lying down. Personally, I prefer his interpretation.

Protected as the Poor Knights Islands Marine Reserve since 1981, it extends 800m out from all parts of the islands, associated islets, rocks and stacks. In 1998, full protection was established over the entire area, with access restricted. The islands have been uninhabited since the 1800s, when invaders from the mainland massacred the resident Māori population. Today, access is restricted to purposes of scientific studies only.

Ecologically separate from the mainland for about two million years, the islands are a vital sanctuary for some of New Zealand's endangered flora and fauna. This is the realm of insects, reptiles and birds, which flourish in the absence of introduced predators. Notable residents include the tuatara, an ancient reptile species predat-

Diving

Northern Arch. Our first stop was Northern Arch, positioned at the northern end of Tawhiti Rahi island and famous for the large numbers of stingrays that congregate during the summer months. Despite being a bit of a cold-water wuss, I could not wait to get in. I was especially eager to try out my brand new Seacam housing for my Nikon D810. Only one other boat was in sight and it was from Dive Tutukaka.



Two-spot damoiselles and kelp at Northern Arch

Short-tail stingray (left), porae (below), yellowtail kingfish (lower left) and blue maomao on wall (right) at Northern Arch, Poor Knights Islands

Entering via giant stride, the water was 21°C but the 7mm suit kept me toasty and gloves were not even necessary. Although a bit of a surface swim to the wall, conditions were superb with no current. Visibility was around 25m but was a veritable salp soup, with vast numbers of the planktonic tunicates pulsing through the open water.

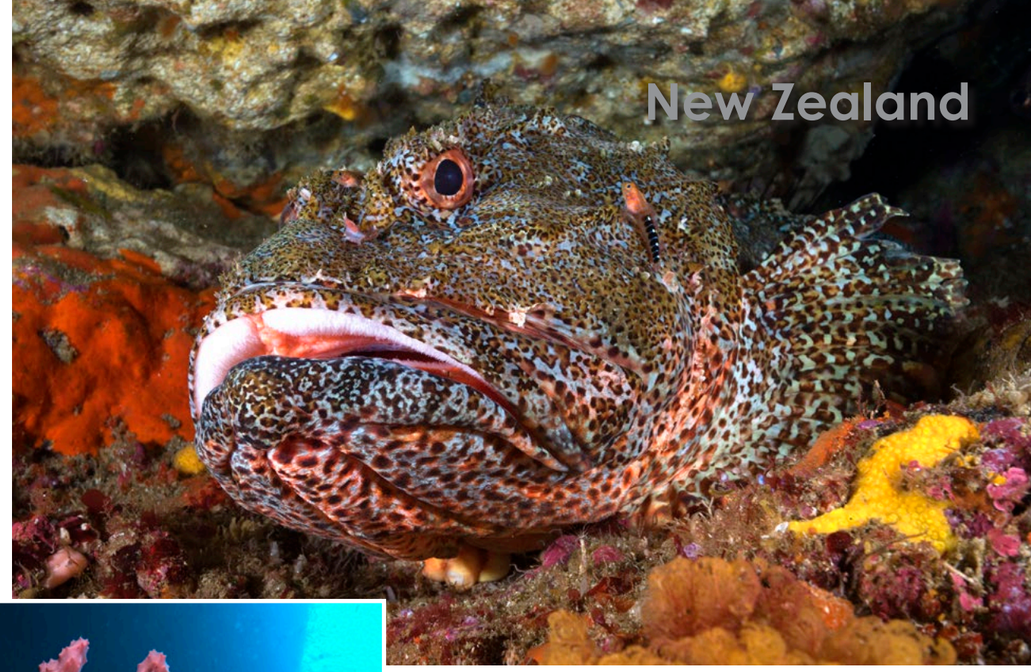
Our descent revealed a marine environment unlike anything I had seen before. Brown algae shrouded the walls, along with sea plumes and strap kelp as yellowtail kingfish over a meter long hovered outside the arch. Until now, I knew kingfish as giant trevally in the tropics, but these streamlined titans were entirely new.

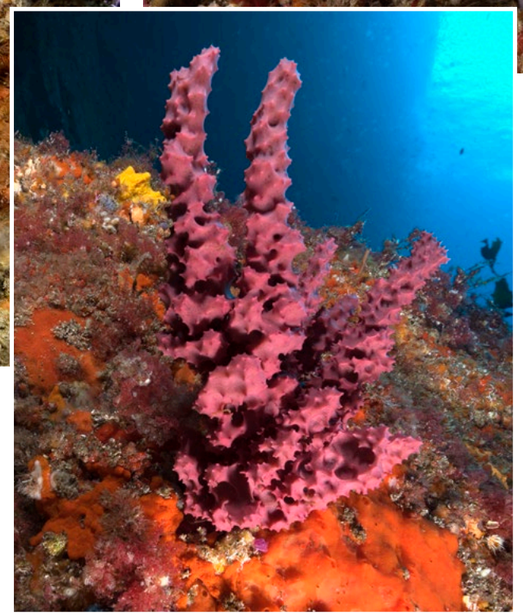
Entering the arch revealed a new array of wonders. Clouds of demoiselles and blue maomao cascaded down the walls along with schools of porae or blue morwong, creating a dazzling symphony in blue. I was immediately struck by the tameness of the fish. Even with my 16-35mm lens, my camera's 36MP sensor allowed frame-filling portraits, even of nudibranchs. It ended up being my primary setup for the remainder of the trip.

Although no ray formations were present, a few huge short-tail stingrays glided near the bottom. Also called the smooth stingray, it is the world's largest, growing upwards of 2.1m across and weighing up to 350kg. Longtail stingrays and eagle rays are also frequently encountered, the latter looking nothing like their tropical cousins.

Although the arch descended 40m to the bottom, we did not go below 28m. While the cave floor was barren, the walls were ablaze, bursting with sponges, bryozoans, hydroids and miniscule common anemones, their delicate bases striped green and white. Soft, hard and gorgonian corals were also present but on a compact scale. Gawping with wonderment, everything was new and exciting and I did not want the dive to end.

Back on board, Mandy had lunch waiting: a pair of delectable-looking quiches alongside some equally enticing salads. Delicious and healthy to boot. Mandy proved to be a wonder, crafting culinary marvels from the tiny galley, from entire roast chickens to freshly baked pies and hot cross buns.





Primnoides gorgonian

Wall of jewel anemone (above); Northern scorpionfish (*Scorpaena cardinalis*), also known as eastern red scorpionfish (top right); Finger sponge (right)

Middle Arch. Our second dive was Middle Arch, also on Tawhiti Rahi. Descending from 10-20m, it was shallower than Northern Arch but equally enthralling. Gray pillow sponges sprawled across the reef, along with tiny Primnoides gorgonians, finger sponges, crater and orange golfball sponges. Cam led me upwards to a small cave with an air pocket, allowing us to remove our regulators.

Northern scorpionfish (*Scorpaena cardinalis*), also called eastern red scorpionfish, quickly became a photo favorite. Larger than their tropical relatives but lacking their venomous punch, they proved abundant and tolerant, allowing a close approach for photography. One hefty specimen beneath an overhang carried some tiny hitchhikers: A duo of blue-dot triplefins perched on its head. I didn't even see them until I looked at the image on my laptop. Highly inquisitive, red pigfish were another favorite—the males bright red and females paler, with red on top and white bellies. Cam demonstrated his technique to lure them in. Smacking his palm with his fist, the noise enticed one immediately.

Yellow morays curiously poked from crevices, as Sandager's wrasse, black angelfish, demoiselles and blue maomao sent my camera into overdrive. Contrasting the fray was the occasional pink maomao, totally unrelated to the blue and not even a true maomao. Cam gestured excitedly, and I just managed to glimpse a pair of Lord Howe coralfish, a sub-tropical species found nowhere else in New Zealand. Other rarities include spotted black grouper and mosaic moray. Bronze whaler sharks arrive in winter, but it was still early in the season.

World's largest sea cave. The islands feature some geological superlatives, and after the second dive, Jeroen wanted to show us one of the most famous. Located in Maroro Bay on the northwest side of Aorangi Island, Rikoriko Cave is the world's largest sea cave. Encompassing a surface area of roughly a hectare, the

New Zealand

Sandager's wrasse (above), yellow moray eel (right) and red pigfish pair (left) at Middle Arch, Poor Knights Islands

interior is 130m long, 80m wide and 35m from waterline to ceiling.

Kevin steered the *Acheron* right inside, but the scale was impossible to comprehend. It was only when Cam set out in the tender that the enormity sunk in. Pods of orca have been known to enter, and during the Second World War, a Japanese submarine was concealed inside for two weeks while undergoing repairs. The rear of the cave is home to a cup coral species normally found at depths of 200m. Here, it is found at 10-15m, the low light levels deceiving it into thinking it is deeper. Even the remains of a sperm whale lay strewn across the sea bed.

Jeroen wielded a typical Kiwi sense of humor, and I soon became an unsuspecting recipient. After one dive, I noticed a red blemish on my face that was not there earlier. Upon expressing my concern, Jeroen replied it was from too much sun and would eventually go black and sprout long hairs. My alarmed expression resulted in a mischievous grin from Jeroen.

By late afternoon, the day-trippers had gone, and we had the entire place to ourselves. After dinner, Jeroen took us out on a sunset cruise. Setting out, the rugged cliffs glowed russet-orange in the waning daylight. Skirting the cliffs, crabs scuttled among the weeds at the waterline with surf and the occasional seabird the only sounds.

The Gardens. Still game for more, Cam and I did a night dive at The Gardens. I was surprised there were not more critters about, but the dive itself was superb. The kelp forest was otherworldly, lit by the beams of our torches.

For the pre-breakfast first dive, we returned to Northern Arch. The highlight was a close encounter with a smooth stingray sitting right in the open. I also had my first sighting of a Verco's tambja, a striking greenish yellow species with blue spots. One of the most common of the Poor Knights nudibranchs, it is usually found on *Bugula dentata*, a green plant-like bryozoan that is its primary food. Another new species for my list was a pair of longfin boarfish, whose body shape reminded me of freshwater angelfish. Alas, they proved shy. I was shooting with a fish-eye lens and could not get close enough for a shot.

Oculina Point. Our subsequent dives would both be at Oculina Point. With

Black angelfish, Middle Arch, Poor Knights Islands

Colony of leopard anemone (left), which can disengage from the reef and float to another area; Spiral of nudibranch eggs (above); Verco's tambja nudibranch (right)

Close-up of jewel anemone

a mild current running, we were able to drift dive along the wall. Inhabitants included speckled morays, firebrick starfish, banded wrasse, leatherjackets. Leopard anemones were especially captivating, their delicate white bodies punctuated with brown spots. While anemones normally spend their existence permanently anchored, these can disengage. If there is not enough space for them to occupy, they will detach and float up or down in currents to inhabit new areas. Further on, an immense wall of magenta jewel anemones made my jaw drop. Later, I had to tone down the colors in the photos. Although accurate, they even looked oversaturated to me.

Critters

Macro life. Yet, the Poor Knights' magic is not restricted to the grandeur of its seascapes and schools of fish. For the next dive, I swapped wide-angle for macro. Looking closer, I marveled at the intimacy of its microcosms, from jewel anemones to colorful nudibranchs. There was certainly no shortage of the latter. All were species I had never seen before, including sweet ceratosoma (also known as clown nudibranch), mournful aphelodoris, a mating pair of green *Tambja tenuilineata* (fine-lined tambja), Denison's dendrodoris and even a Verco's tambja with eggs.

Triplefin. My main quarry was one of New Zealand's most endearing endemics: the blue-eyed triplefin. One of five triplefin species found in the Poor Knights, they are a photographer's dream, sporting a red-and white striped body and googly blue eyes. I was baffled as to how I had not yet seen one.

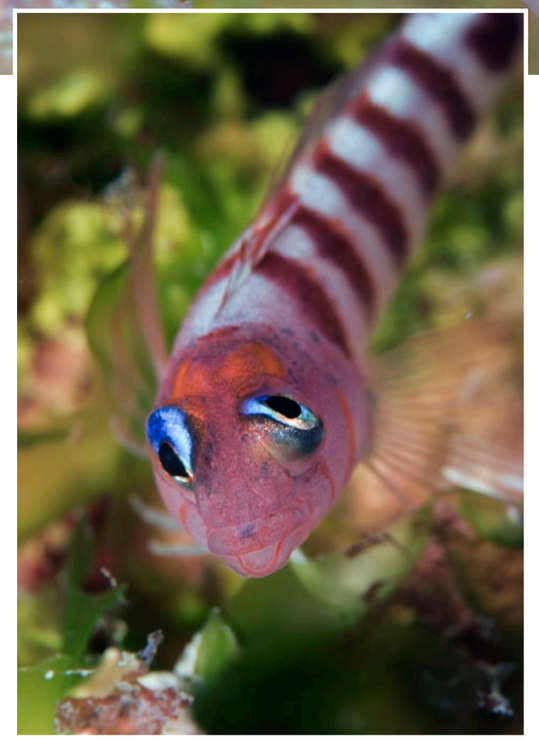
Once I started looking, they were simply EVERYWHERE. Oozing personality, they proved exceedingly cooperative, resulting in frame-filling macro portraits. One rotated its eyes, resulting in one of my favorite shots of the trip. Other notables included crested blennies, yellow-black triplefins and oblique-swimming triplefins, the only one to form schools, swimming close to the reef to feed on plankton. After another wonderful dinner courtesy of Mandy, Jeroen took us out on another sunset cruise. By the time we returned, both Cam and I were simply too knackered for a night dive.

More diving

The next morning had a pre-sunrise wakeup call from Jeroen, as he had something special for us to see. With

Denison's dendrodoris nudibranch

New Zealand



Archway Island (left); Blue-eyed triplefin (above)—rotating its eyes (right), resulting in one of my favorite photos from the dive

Crested blenny

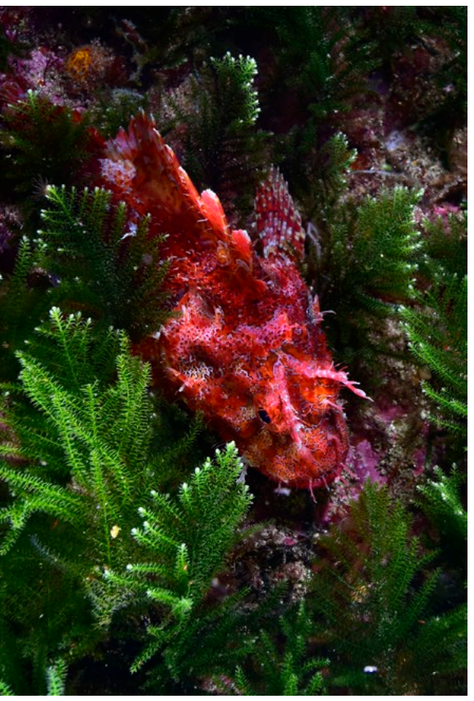
coffee in hand, I arrived on deck, wondering what was in store. Ahead lay a Maomao Arch, which appeared heart-shaped from our angle of view. "Watch this," beamed Jeroen. On cue, the rising sun burst through, illuminating the opening with a crimson glow. "A little late for Valentine's Day, but there you go!" he enthused.

Middle Channel. Heading back south, we stopped to dive Middle Channel, situated amongst the cluster of islands between Tawhiti Rahi and Aorangi Islands. Armed with a macro lens, I happily photographed the exquisite roster of morays, scorpionfish, triplefins and anemones. Topside, the islands continued to dazzle, with Archway Island home to the largest sea arch in the Southern Hemisphere. Kevin steered us right through, where its titanic scale left me gobsmacked.

Blue Maomao Arch. We then continued to Blue Maomao Arch, one of the Poor Knights' most iconic sites. As the archway faces east, it cannot be dived during heavy easterly swells, but conditions were perfect. Plunging in, we headed straight for the arch with no stops en route. Yet, distractions are commonplace in the Poor Knights, this time in the guise of a smooth stingray resting on the bottom. A few photos later, we continued to the arch but something was amiss. The eponymous residents were restricted to a few scattered individuals. Where had they gone? Continuing farther, we came to a ridge of rock and boulders ablaze with red, orange and magenta encrusting sponges. Photogenic yes, but still no maomao.

Heading back, I turned for a final look and my eyes bulged. Unbeknownst to Cam, an immense school had materialized from nowhere and were practically on top of him. Now, that was more like it! The remainder of the dive was spent photographing the school, with the contrast between the blue fish and colorful wall simply dazzling. Back outside, a Verco's tambja foraged on bryozoans

Massive school of blue maomao at Blue Maomao Arch



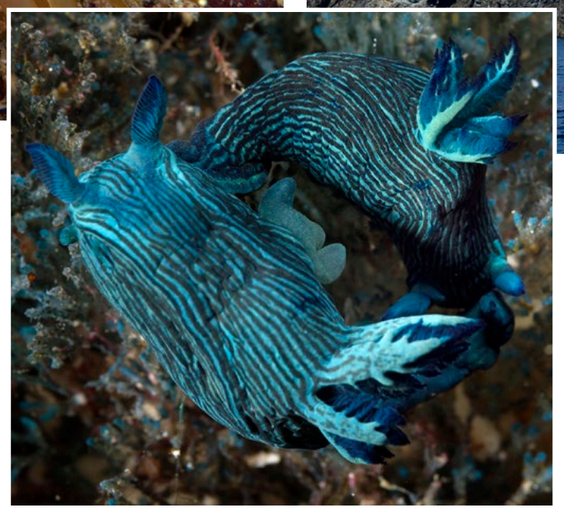
Dwarf scorpionfish

while a Sandager's wrasse posed for a portrait. It was only after I later examined the latter that I realized a perfectly camouflaged dwarf scorpionfish was sitting right beneath it.

Jan's Tunnel. Our final dive was Jan's Tunnel, a spot we entered on the first evening's sunset tour. Inside, the cave widened into a kelp-fringed rock pool, only a few meters deep, providing an ideal alcove for sleeping fish. Towards the rear was an impressive congregation of Waratah anemones right at the waterline. Buffeted by the persistent surge, photography proved to be a real challenge. Poking my head above water revealed the natural arch we had seen from the boat.

Exiting the tunnel, we finned alongside the wall for the remainder of the dive. Incredible congregations of jewel anemones shrouded the walls in a variety of colors. As well as the usual magenta specimens, there were also colonies in orange and pink. In a few spots, all three crowded together in a patchwork of sheer audacity rivaling any coral reef. Unreal.

Sadly, it was time to head back to Tutukaka. Even having sampled only a few sites, I could have easily spent a solid week here. Although I missed the mantas, mola molas and mosaic morays, (that's a lot of M's), I was hardly disappointed. The Poor Knights is one of the most surprising yet wildly beautiful locations I have ever dived. This, combined with the fantastic experience on the *Acheron*, had



New Zealand

Bay of Islands, New Zealand

Ceratosoma ameonum nudibranch

Dahlia anemone (above); *Tambja tenuilineata* nudibranch pair (right)

me already contemplating a return visit. After all, how can one argue with Jacques Cousteau?

Bay of Islands

Back in Tutukaka, I bid everyone farewell and set out for the Bay of Islands. After a pleasant 90-minute drive, I arrived in Paihia, the Bay of Islands' prime tourist town. One of Northland's most beautiful areas, the Bay of Islands encompasses 144 subtropical islands scattered between Cape Brett and the Purerua Peninsula.

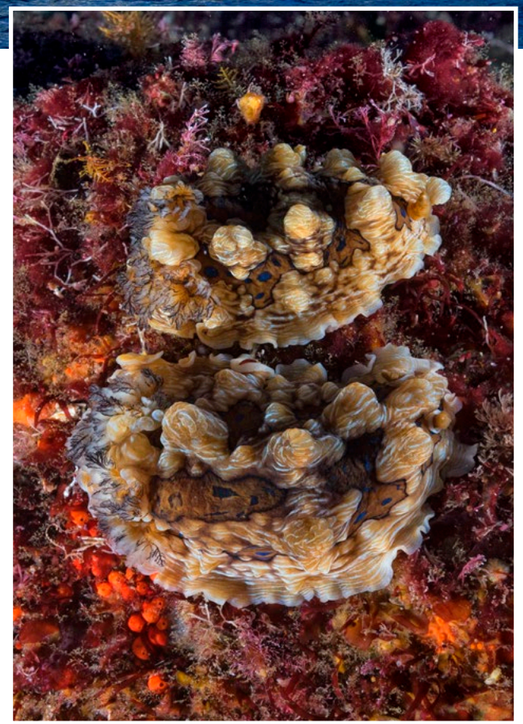
Despite the 30-year gap, things looked vaguely familiar. The downtown was busier than I remembered but still maintained a small-town feel. Ahead lay something I did recall, a single-lane wooden bridge to the Waitangi Treaty Grounds, one of the country's most significant historic sites. It also led to my accommodation at the Copthorne Hotel, occupying a prime location overlooking Te Ti Bay. After dinner at the hotel, I prepared my camera gear for the next day. After the wonders of the Poor Knights, I surmised the diving could not possibly compare. How wrong I was!

I would be diving with Paihia Dive, a shop Jeroen recommended to me before leaving home. Upon arrival, I met owner Craig Johnston, a long-time diver and Bay of Islands native. Craig had spent nine years as senior skipper for Dive Tutukaka, and in 2010, returned to purchase Paihia Dive.

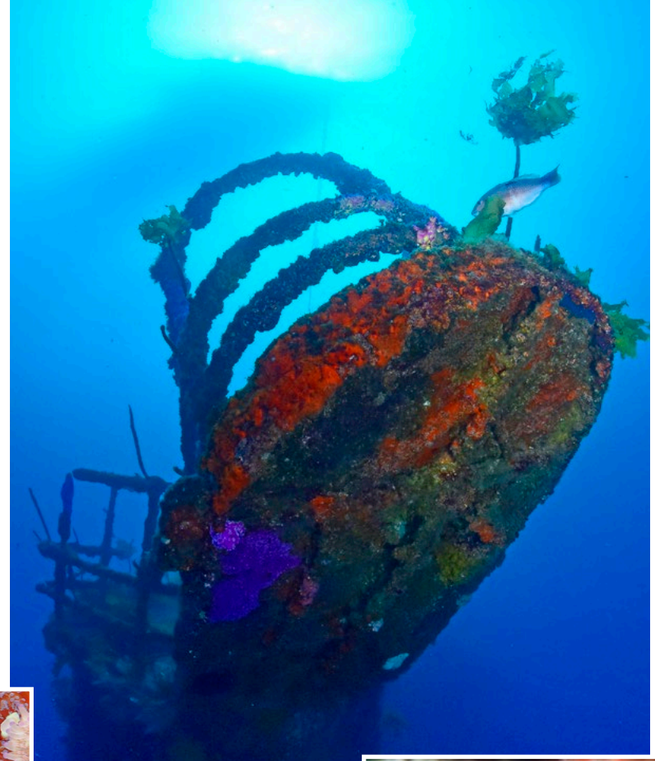
Upon arrival, the shop was a hive of activity, with around 15 divers participating in the day's excursion. As my gear was getting sorted, Craig introduced me to Faye Stimpson, a divemaster at the shop who would be my dive buddy. Tall, with flowing blonde hair, she proved to be the best model I had ever photographed.

The Rainbow Warrior. Our first dive would be at a vessel known worldwide and one synonymous with New Zealand: T*he Rainbow Warrior*. Greenpeace's flagship, the vessel was en route to the Mururoa Atoll to protest French nuclear testing when it was sunk in Auckland Harbor by French saboteurs on 10 July 1985.

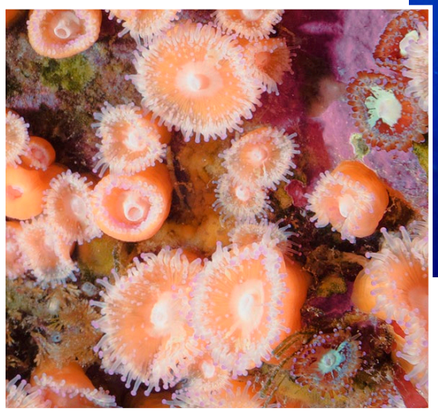
The Kiwis were outraged. In today's charged climate, the bombing would be regarded as an act of terror and incredu-



Dendrodoris denisoni nudibranch pair



Gray moray eel



Diver in kelp (top left); Salisbury wreck (above); Yellow-and-black triplefin (right) Jewel anemone (left)

Diver with kina sea urchins at Bay of Islands

lously, conducted by a nation friendly to New Zealand on its own soil. Although France initially denied involvement, two French agents were captured by New Zealand Police and charged with arson, conspiracy to commit arson, willful damage and murder. Membership applications to the organization skyrocketed, especially in New Zealand. Greenpeace soon became a household word and the Warrior eponymous to its cause.

After the bombing, Greenpeace donated the *Warrior* to the sea and it is now an artificial reef in the Cavallii Islands, situated north of the Bay of Islands. Resting at 22m, it is now a world-renowned dive site and home to a spectrum of marine life. According to Craig, the site is especially popular among visiting French divers.

After a 45-minutes' drive north, we arrived at the launch site at Matauri Bay. Our transport was an inflatable boat on a trailer hitched to a tractor. With everyone geared up, boat and trailer were backed into water deep enough for the boat could slide off. From the shore, it was only eight minutes to the wreck.

Descending the mooring line towards the sandy bottom, the *Warrior's* ghostly silhouette emerged from the blue, an image that was almost eerie. After a few wide shots, we headed for the stern and slowly worked our way towards the bow. Having been underwater for three decades, kelp, bryozoans and sponges were rampant, along with legions of fluorescent jewel anemones.

I concentrated on wide-angle shots, although I suspect closer scrutiny would revealed a wealth of critters. Although we did not enter, the interior contrasted sharply. While rather silty, it was a daytime refuge for crayfish, conger eels, bigeyes and slender roughies. We finished at the bowsprit, the railings festooned with sponges, hydroids and bryozoans along while oblique-swimming triplefins and red moki milled about. This is a dive that absolutely warrants repeat visits.

The Teapot. After our shore lunch, our second dive would be at The Teapot. A relatively shallow dive at 18m, the reef was volcanic in origin and home to huge swathes of kelp. Just like the Poor Knights, the fish were curious and easily approachable. The usual suspects were all here: northern scorpionfish, Sandager's wrasse, leatherjackets, red moki and

Salisbury wreck (left); Kina sea urchins on rocky reef (above), red moki fish on wreck (right), leatherjacket (below), and Snadager's wrasse (lower right) at Bay of Islands

yellow morays all seemed to gather for their photo moment. Sponges abounded, as did kina, an indigenous sea urchin I did not see at the Poor Knights Islands.

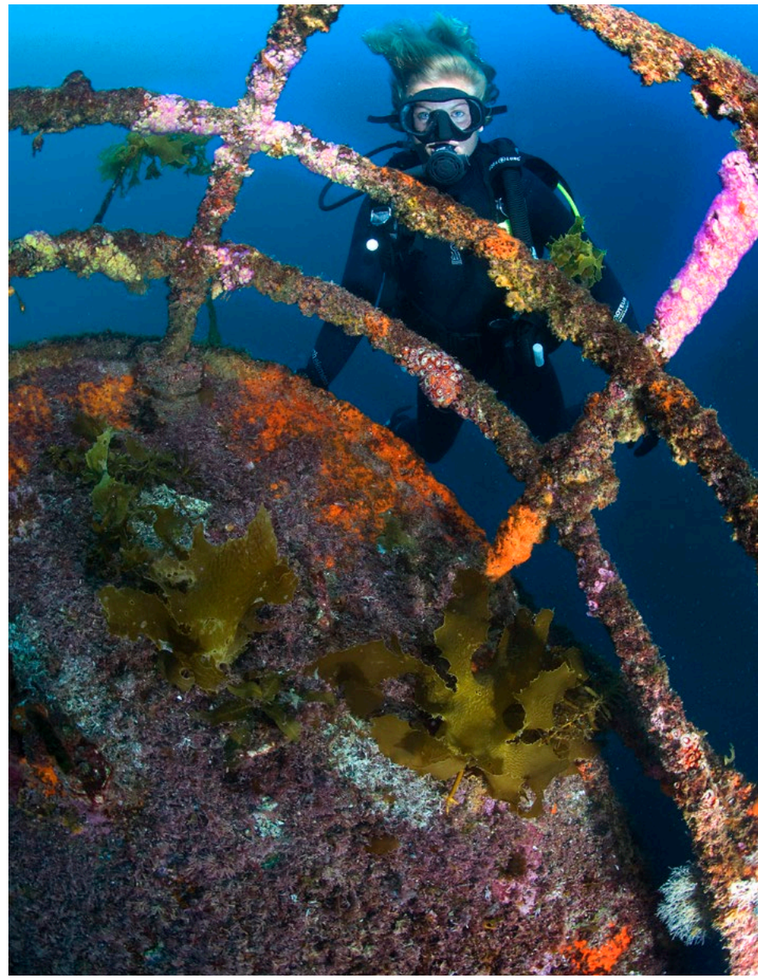
HMS *Canterbury*. My final day began with another wreck, albeit a far larger and newer one—the HMS *Canterbury*—which was situated right in the Bay of Islands. This time, we could take a boat right from the town jetty. After 35 years of service in the Royal New Zealand Navy (RNZN), the vessel was taken out of commission in 1995 and sunk on 3 November 2007. Situated in Deep Water Cove (Maunganui Bay), the wreck rests upright on the seabed at around 33-37m, with the upper decks between 22-28m. Penetration is also possible but is only recommended for those with wreck diving qualifications.

Descending the mooring line, visibility was among the clearest I have seen on a wreck. Still, it was impossible to see the entire vessel, and with good reason; at a length of 113m, it was BIG! Despite being underwater for only a decade, the *Canterbury* was already teeming with life. The bow was especially colorful, bedecked with large clusters of jewel anemones. Due to the ship's immense size, we opted to stick to the uppermost portions to maximize our bottom time.

Once again, Faye proved a superb model, posing in corridors and looking through windows. Finning towards a porthole on the exterior, she promptly entered an adjacent doorway. Seconds later, her head popped out the porthole. Right on cue, a red pigfish swam into frame to stare at her, creating one of my favorite images of the entire week. I nearly went into deco, and we reluctantly headed up for our safety stop. It was a superb site to which one dive simply could not do justice. Amazing stuff.

Hole In the Rock at Bay of Islands

Diver in Salisbury wreck (above and right); Common octopus (top right); Yellow moray eel (below)



Hole in the Rock. After lunch and a shore interval on one of the bay's picturesque islands, it was time to head for our second dive location. I was thrilled to discover our second dive would be at one of the Bay's most iconic sites. Situated at the tip of Cape Brett, the Hole in the Rock is one of the area's biggest attractions and a day-cruise staple. Fashioned by centuries of wind and wave erosion, the 18m arch was named Piercy Island by Captain Cook but is known as Motu Kokako in the Māori language. Unlike the Poor Knight's arches, it really was a hole, with its base located well beneath sea level. I hit the jackpot. Not only did we get to see an icon but dive it as well!

Plunging in, the sea floor was strewn with huge boulders, and the constant surge required effort to steer clear of them. Although plant life was virtually nil, the boulders bore astonishing palettes of color. Encrusting sponges of red, orange, purple and yellow adorned every surface while crevices yielded gray and yellow morays and octopuses. Above in the blue, demoiselles swarmed, interspersed with leatherjackets and red moki. Kelpfish, known in New Zealand as hiwihiwi, brandish special pectoral fins enabling them to clasp the reef during strong surge. With so much action, it was difficult to know where to look.

Topside excursion

Craig was kind enough to drop me off right at the hotel jetty, and I had just enough time to change and head to the Treaty Grounds before closing time. It was here in 1840 that the Treaty of Waitangi was signed between the Māori and Europeans, ending a century of conflict and marking the foundation of New Zealand as a nation. On 6 February every year, the site hosts the Waitangi Day Festival to commemorate the event.

The grounds encompass 18.5 hectares, featuring the Museum of Waitangi, Treaty House, Flagstaff and the ceremonial war canoe Ngātokimatawhaorua. Especially impressive was the Meeting House or Te Whare Rūnanga. The interior was especially impressive, an intricately carved masterpiece in red.

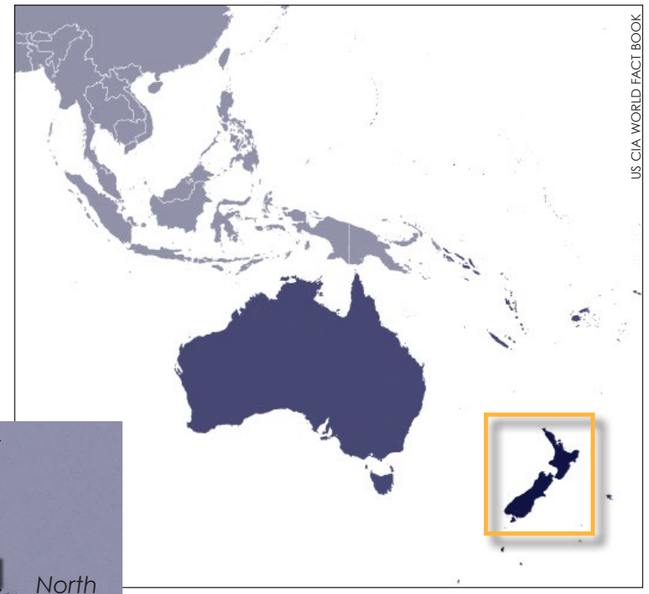
Finally, it was time to return to Auckland. In a mere six days, the volume of marine life combined with the incredible scenery, both under and over the water, was enough to leave one grappling for adjectives. Yet, with relatively few operators in the area, diver numbers remain refreshingly scant. If coral reefs are beginning to look just too familiar, New Zealand's Northland is just what the doctor ordered. I don't think I will wait another 30 years before my next visit. ■

fact file

New Zealand

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

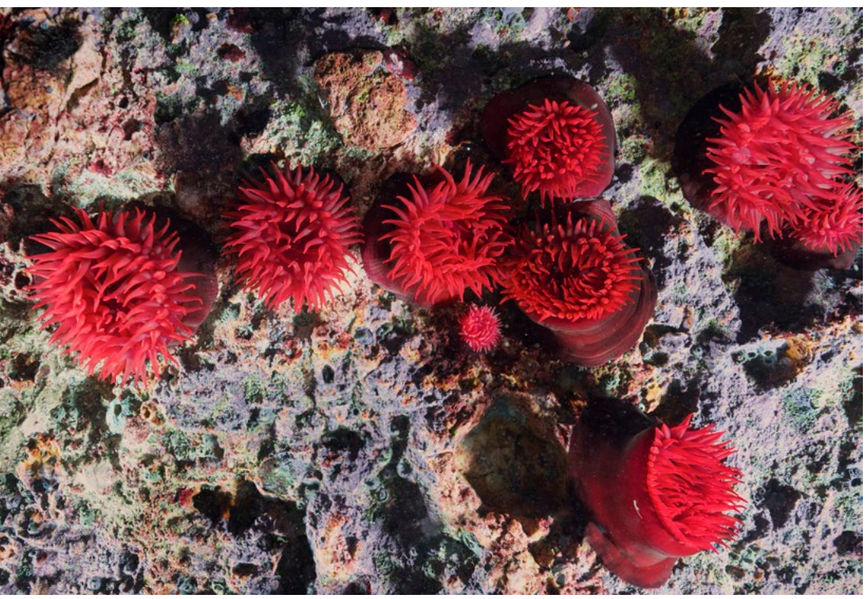
RIGHT: Location of New Zealand on map showing the Oceania region in the South Pacific Ocean. BELOW: Location of Poor Knights Islands on map of New Zealand. FAR LEFT: Sunrise over Poor Knights Islands



US CIA WORLD FACT BOOK

History In about 800 A.D., the Polynesian Maori reached New Zealand. Their chieftains entered the Treaty of Waitangi with Britain in 1840, in which sovereignty was given to Queen Victoria while the native population kept territorial rights. British colonial settlement began that same year. Between 1843 and 1872, a series of land wars ended with the native peoples being defeated. In 1907, the British colony of New Zealand became an independent dominion. In both world wars, New Zealand provided military support to the United Kingdom. By the 1980s, New Zealand's role in a number of defense alliances came to an end. The government has strived to address longstanding Maori grievances in recent years. In 2015-16, New Zealand took a nonpermanent seat on the UN Security Council. Government: a Commonwealth realm with a parliamentary democracy under a constitutional monarchy. Capital: Wellington

Geography New Zealand is made up of several islands located in the South Pacific Ocean, southeast of Australia, in Oceania. Coastline: 15,134km. Terrain is mostly mountainous with vast coastal plains. Lowest point: Pacific Ocean 0m; Highest point: Aoraki-Mount Cook 3,724m.



Waratah anemone

Climate New Zealand's climate is temperate with distinct variations in each region. Natural hazards include volcanic activity and earthquakes, which are frequent but normally not severe.

Economy Over the past four decades, the New Zealand government has taken the country from an agrarian economy, which relied on compromised access to the British market, to a more industrialized, free-market economy, competing in a global market, boosting real incomes, albeit leaving behind some with poorer means. However, the measures did benefit the industrial sector by broadening and deepening technological capabilities. In the decade prior to 2007, per capita income rose in terms of purchasing power parity. But in 2008-09, it fell. A large payments deficit was fuelled by debt-driven consumer spending in the first five years. The central bank raised its key rate steadily from 2004 onward, due to inflationary pressures. In 2007-08, the country's rates were among the OECD's highest, attracting international capital inflows. This strengthened the currency and housing market, but aggravated the current account deficit. Challenges in recent years include rising house prices and declining affordable housing especially in cities such as Auckland. Recession hit in during the global financial crisis with the economy contracting in 2008-09. In response, the government developed fiscal stimulus measures and the central bank aggressively cut interest rates. As a result, growth took place in 2011 to 2016. Current efforts involve expanding export markets, developing capital markets, investing in innovation, raising productivity growth, developing infrastructure, easing fiscal austerity and expanding the countries network of free trade agreements.

Environment Challenges include soil erosion, deforestation and invasive species, which threaten native flora and fauna.

Population 4,510,327 (July 2017 est.) Ethinic groups: European 71.2%, Maori 14.1%, Asian 11.3%, Pacific peoples 7.6%, Middle Eastern, Latin American, African 1.1% (2013 est.) Internet users: 3,958,642, or 88.5% (July 2016 est.)

Language English is the de facto official language at 89.8%, Maori is the de jure official language at 3.5%, Samoan 2%, Hindi 1.6%, French 1.2%, Northern Chinese 1.2%, Yue 1% (2013 est.)

Health & Safety Please check with your country's state and health departments well in advance of your trip for updates on required vaccinations, health and safety advisories.

Currency New Zealand dollars (NZD). Exchange rates: 1USD=1.39NZD; 1EUR=1.68NZD; 1GBP=1.89NZD; 1AUD=1.09NZD; 1SGD=1.05NZD

Decompression Chambers

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Royal New Zealand Naval Hospital
91 Calliope Rd
Devonport, Auckland
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Websites

New Zealand Tourism
www.newzealand.com

French Polynesia's

Tuamotu Archipelago

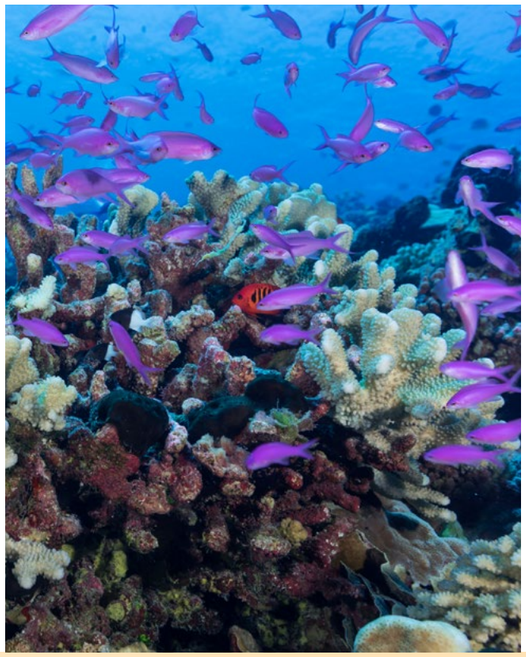
Text and photos by Matthew Meier

Underwater photographer (above) approaches a school of Heller's barracuda; School of purple queen anthias fish (right) swim amongst a colony of branching hard corals

PREVIOUS PAGE: Manta ray swims into a swift current through Tiputa Pass on Rangiroa Atoll

Tuamotu

Situated east of the more widely recognized Society Islands such as Tahiti, Moorea and Bora Bora, the Tuamotu Archipelago comprises around 80 islands and atolls stretching northwest to southeast across the South Pacific Ocean, creating the longest chain of atolls in the world. These sand-covered, coral reef islands rise only a few feet above the waterline and are home to fewer than 20,000 inhabitants, spread out over an area the size of Western Europe. Reminiscent of the southern atolls in the Maldives, divers flock to the Tuamotus to see large schools of fish and pelagics swimming in the swift currents that flow through the passes between islands. Matthew Meier shares highlights from his adventure in Tuamotu, after visiting the archipelago on the only liveaboard operating in the area.

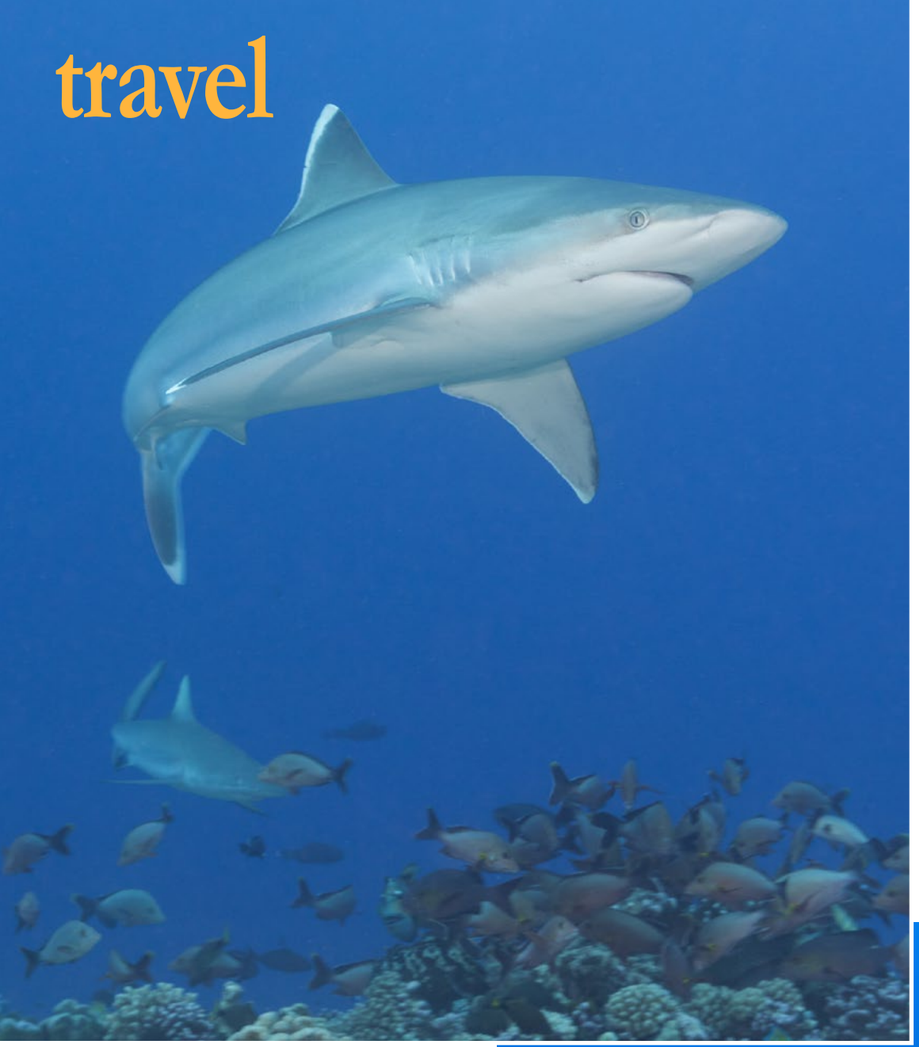


Snorkler in turquoise blue water with coral heads in the shallows off Toau Atoll

After two days of waiting and several failed attempts, Mother Nature finally rewarded us with an incoming current at the famed Tiputa Pass on Rangiroa Atoll. The skiff dropped us in open ocean just outside of the pass and we were now rocketing through the water, 100ft (30m) below the surface. Large schools of fish and gray reef sharks assembled at the mouth of the pass, hovering effortlessly in the current, while a squadron of eagle rays and two great hammerhead sharks circled another 50ft (15m) below.

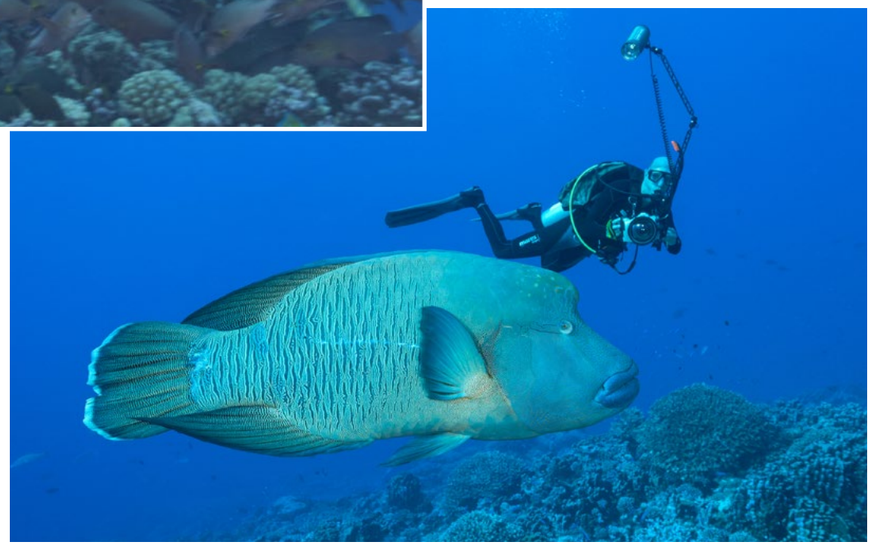
As we entered the pass, the bottom rose to meet us, further heightening the sensation of speed, as we whipped past grooves and channels in the rocky sea floor. In the distance, a large shape loomed and appeared to be moving in our direction. A manta ray was swimming out of the channel, pushing against the intense current with relative ease. Clambering towards the bottom, I managed to secure a reef hook and flatten myself against the rocks in hopes of minimizing my resistance to the fast-flowing water. What happened next was one of the more magical experiences of my diving career.

The manta ray swam up beside me, paused and then slowly moved directly overhead, eventually getting so close that I lost sight of its wingtips through my camera. For what seemed like an eternity, I lay there mesmerized by this incredible creature, gliding effortlessly above me



Tuamotu

Silvertip shark swimming above the coral reef on Rangiroa Atoll (left); Manta ray (above) in swift current through Tiputa Pass on Rangiroa Atoll; *French Polynesia Master* (right), the only liveaboard dive boat operating in Tuamotu Archipelago; Diver with humphead wrasse (below)



and then, as quickly as it appeared, it was gone.

Looking back at my photos, of which there were far fewer than I imagined, the entire encounter had lasted less than a minute. Nevertheless, I was excited when I got to the surface, thinking that nothing could top my dive, only to learn that our other group of divers had experienced a close encounter with a tiger shark while watching the manta ray dance above me. Welcome to the Tuamotus!

This adrenaline-filled destination is easily reached by way of an eight-hour flight from Los Angeles to Tahiti, followed by a one-hour puddle jump to Fakarava or Rangiroa. Land-based resorts exist on both atolls, but to truly experience all of the surrounding area, I suggest an excursion on the French Polynesia Master. Operating since January 2017, she is the only liveaboard dive boat in the Tuamotus and allows for up to four dives per day, on seven- to 10-day expeditions. Built specifically for divers, this brand-new vessel offers an expansive dive deck, multiple camera tables, spacious cabins and plenty of lounge space.

Marine life

Diving in the Tuamotus is dependent on the currents and the creatures they attract, including barracudas, big-eye jacks, several species of sharks, dolphins, manta rays, eagle rays and even the occasional whale shark. The extensive hard coral reefs support immense schools of reef fish as well as solitary animals such as the humphead wrasse, titan triggerfish and multiple species of sea turtles.

Of course, there are also inver-

Gray reef shark (above); Juvenile blacktip reef sharks swim in the shallow waters of Rangiroa's blue lagoon (top left)

Tuamotu

Numerous gray reef sharks swimming in the current form a wall of sharks off Fakarava Atoll (above(and off Toau Atoll (left)

tebrates, crustaceans and other macro critters to see on the reefs. However, except for the relative calm at certain spots inside the lagoon, the currents make it difficult to stay stationary and observe or attempt to photograph the little stuff. This is a wide-angle, pelagic, schooling fish, riding-the-current type of destination, and travelers hoping to spend their time planted in one spot, scouring the reef for interesting critters, should likely head elsewhere.

Sharks. I have heard stories of the famed wall of sharks when I first visited French Polynesia over a decade ago. Thrilling tales of strong currents, wild rides and sharks too numerous to count while diving at places like Fakarava and Rangiroa. I am here to tell you that the walls do exist, and they are not confined to simply those two atolls.

Gray reef sharks gather with the incoming current and use their streamlined bodies to seemingly hover in the water column. We saw this phenomenon at numer-

Aggregation of raccoon butterflyfish at Apataki Atoll (above); Aerial view of the Arutua Atoll while flying south from Rangiroa to Fakarava (right)

ous atolls during our liveaboard adventure; and the stronger the current, the more sharks it seemed to attract. Photographing this spectacle requires patience, a little luck and a reef hook, so you can stay anchored against the racing water. Camera in hand or not, this exhilarating experience is not to be missed.

During the months of May and June, large numbers of hammerhead sharks may be found around Fakarava and Rangiroa. Sharks are revered in French Polynesian culture, and historical lore tells of a shark constellation in the stars. Our local guide told stories from his childhood of swimming with small sharks that had been caught in fish traps by the diminishing tide. He said that sharks are seen as gods, messengers to the spirit world and even as an intermediary between humans and death. They represent the warrior spirit, and he explained that to become a chief, one had to first swim with sharks.

Grouper. As the hammerhead sharks disperse, large numbers of camouflage grouper gather at the south pass on Fakarava Atoll in what may be the largest known spawning aggregation of big reef fish. Often numbering in the tens of thousands, the groupers assemble to spawn with the full moon in late June and early July. During the spawning, the preoccupied fish become oblivious prey for the hundreds of sharks that congregate to take advantage of an easy meal.

Diving conditions

French Polynesia has fairly strict guidelines regulating the number of divers per guide, as well as the allowable depth you may descend based on your certification level. Since many of the dive sites exceed the 60ft (18m) limit for open water divers, an advanced dive certification is recommended, due to the depth and the

School of unicornfish at Apataki Atoll

Aggregation of reef fish and blacktip reef sharks over shallow coral reef

strong currents of the Tuamotus.

Diving is accomplished off small inflatable skiffs in groups of four to six per guide. Typically, there is less than a five-minute ride from the liveaboard to most dive sites, and guests enter the water via a backwards roll on the ocean side of the pass. If there is an incoming current, the group will descend to the mouth of the pass and hook in to stay in place while watching the schools of fish, sharks and other pelagics in the water column. Depth and air supply govern how long divers may stay and watch the show before the guide instructs them to unhook and ride the current through the pass and into the lagoon. Safety stops are typically completed while floating in the blue under the guide's surface marker buoy. Outer reefs

are more easily explored with an outgoing current, as long as divers are careful not to stray too close to the pass and get swept out to sea.

During our 10-day trek across the archipelago, we were often the only boat in sight and nearly always the only divers on a reef. It was easy to envision oneself as a small speck floating on this big blue planet, surrounded by open ocean, with only a small sliver of land serving as protection against the forces of nature.

The remote beauty of the surroundings seemed to have been stolen straight off a postcard at times. There were numerous uninhabited, palm tree-covered islands, surrounded by shallow coral reefs and turquoise waters, with blue skies and puffy white clouds overhead.

In between dives, it was often possible to walk the beaches of these beautiful islands or snorkel in the shallow waters just offshore.

Those of us with a camera did our best to replicate iconic over/under images with the reef below, palm trees above and blacktip reef sharks in the foreground. I was only partially successful in this venture and will simply have to return

Juvenile blacktip reef shark (above) swims in the shallow waters of Rangiroa's blue lagoon; Hawksbill sea turtle (left)

Coral heads in the shallows along the shores of palm tree covered islands of Kauehi Atoll (left); Big-scale soldierfish and humpback snapper hide in a rocky cavern during the day (above); Onespot and humpback snapper fish swimming under the pier at Tetamanu Village on Fakarava Atoll (right)

in an attempt to perfect this shot, among others.

Extra attractions

If vacation time allows, I highly recommend spending extra days in French Polynesia before or after your time on the liveaboard. You can opt to do nothing at all, relaxing in a hammock on a tropical beach, or you can enjoy the numerous activities available on the various islands, designed to keep you entertained.

Rangiroa's blue lagoon. I chose to spend two days on Rangiroa after departing the boat and had an incredible experience exploring the blue lagoon. This shallow body of water is on the western edge of the atoll and is home to dozens of juvenile blacktip reef sharks and stingrays. Local independent operators and select hotels offer day tours to the lagoon, allowing guests to snorkel with the sharks and rays, explore remote palm tree-lined beaches and indulge themselves with a barbeque on the sand.

The sharks swim in packs and come right up to the shoreline, often with their dorsal fins exposed. Wading into the water causes the sharks to initially retreat, but by keeping still, with a little patience, they will be circling your ankles in no time. These interactions create lasting memories and fantastic photo opportunities, both above and below the water's surface.

Tahiti's tiger shark dive. For the truly adventurous, a two-tank tiger shark dive is offered off the island of Tahiti for an up-close look at these magnificent animals. Fish heads are put in the water to attract the tiger sharks and the bait will also often lure in gray reef sharks, blacktip reef sharks, whitetip reef sharks, lemon sharks and nurse sharks, along with a host of reef fish looking for a free meal. This is one of only a few places on this planet where you can reliably interact with tiger sharks. The dives are available year-round but are not conducted daily, so be sure to check the schedule and reserve your space in advance.

Humpback whales. During the months of June through December, with the peak times being mid-August through October, it is also possible to snorkel with humpback

Traditional Polynesian dancers perform for tourists after dinner (left); Tahitian black pearls (above); The inside of an oyster used to produce Tahitian black pearls (right)

whales off Tahiti and Moorea. Half-day tours depart daily in the morning and early afternoon, with drinks and snacks provided. The whales migrate from Antarctica to the warm, shallow waters every year to give birth and raise their young. My visit was in early March, and I regrettably missed the whales, but this is an encounter that is very high up on my bucket list and one for which I hope to return and experience.

Polynesian Night. Several resorts offer a glimpse into the native culture with performances of traditional music and dancing. Often called Polynesian Night, these exhibitions take place after an evening feast of local favorite foods. Both men and women dress in traditional costumes while they perform ceremonial dances that have been passed down through generations. Children also participate as they learn the traditions from their elders and perpetuate their heritage. Towards the end of the evening, guests from the audience attempt to dance along with the entertainers as they are invited to join in the festivities. The presentation makes for a fun evening and frequently produces colorful stories to share with loved ones back home.

Tahitian black pearl farms. French Polynesia is famous for its Tahitian black pearls, and a visit to an oyster farm is a must. Several operations offer tours so that guests can witness the production process firsthand and browse their selection of finished pearls.

Grown in shallow lagoons with good water flow, baby oysters are raised in pens for three years until they are large enough to seed for the growth of pearls. The oysters are temporarily removed from the water, and a specially-trained technician carefully seeds each one by hand. A small, perfectly round fragment of shell and the black mantle of a nicely colored oyster are used to seed future pearls, before the oysters are

Tuamotu

Large school of yellowmask surgeonfish swimming into a swift current (left); School of bluestriped snapper fish swimming over the shallow hard coral reef (below)

Overwater bungalows at the Hotel Kia Ora Resort and Spa in late afternoon sunlight (above)

placed back in the ocean.

After 45 days, the seeded oysters are checked to make sure the grafts placed inside have taken. Out of every 100 seeded oysters, roughly 70 are successful, 25 produce usable pearls, but only the remaining five are perfectly round. Once a seed has been accepted, it takes another two years before the pearl is ready to harvest. Oysters that produce a good colored, round pearl are reseeded with larger starter fragments in hopes of creating a larger pearl two more years down the line.

A productive oyster generates a maximum of three pearls in its lifetime; on rare occasions, four pearls are possible. Understandably, due to the limited number produced, the extensive labor involved and the many years required for their creation, large and perfectly round black pearls are a highly-prized and expensive commodity.

Afterthoughts

The Tuamotu Archipelago offers a distinctive blend of remote beauty, rich culture, electrifying diving and sharks, sharks and more sharks. I thoroughly enjoyed my time here and will absolutely return for more unique experiences above and below the waves. Looking for your next dive adventure? Come see the magic of French Polynesia for yourself. ■

*The author would like to thank Master Liveaboards (**masterliveaboards.com**) and the Hotel Kia Ora Resort & Spa (**rangiroalagoon.com**) for their generosity as the gracious hosts on this adventure; Air Tahiti (**airtahiti.com**) and Air Tahiti Nui (**airtahitinui.com**) for their assistance with flights; Fluid Dive Center Tahiti (**fluidtahiti.com**) for their offer of a tiger shark dive; and Scubapro (**scubapro.com**) and Blue Abyss Photo (**blueabyssphoto.com**) for their assistance with underwater dive and photo gear.*

*Matthew Meier is a professional underwater photographer and travel writer based in San Diego, California, USA. To see more of his work and to order photo prints, please visit: **matthewmeierphoto.com**.*

School of bannerfish over reef

Several whitetip reef sharks resting in an underwater cavern during the day (above); Purple jellyfish just below the water's surface (left)

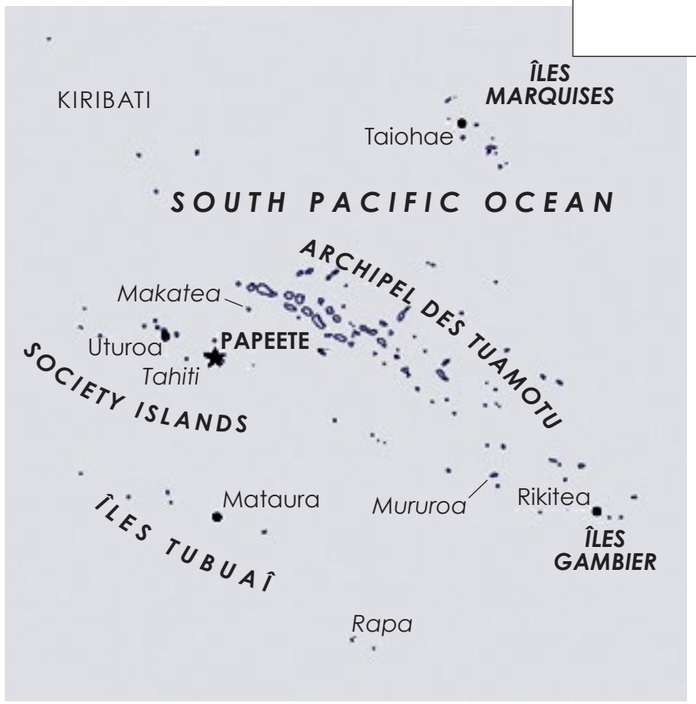
fact file

French Polynesia

SOURCES: US CIA WORLD FACTBOOK, XE.COM, MASTERLIVEABOARDS.COM

RIGHT: Global map with location of French Polynesia
BELOW: Tuamotu Archipelago (Archipel des Tuamotu) on map of French Polynesia
BOTTOM LEFT: Titan triggerfish

US CIA WORLD FACT BOOK



History The islands of French Polynesia were one of the last places on earth to have human settlers. They were discovered in approximately 200 B.C., as part of the Great Polynesian Migration, which began around 1500 B.C. European explorers did not arrive until the 15th century, and it was not until 1889 that the islands were fully declared a French protectorate. Polynesians were granted French citizenship in 1946, and the islands became recognized as an overseas territory of France. The islands' name was officially changed from the French Establishments in Oceania to French Polynesia in 1957. The French government granted partial internal autonomy in 1977, and French Polynesia has acted as an overseas collectivity of France since 2003. Government: parliamentary democracy. Capital: Papeete, Tahiti

Geography French Polynesia is an island nation located in the South Pacific Ocean, roughly half way between South America and Australia, east of Fiji and south of Hawaii. The country is made up of five archipelagos, four of which are volcanic in origin, while the Tuamotu islands consist of coral reef atolls. There are 188 islands and atolls in total, 67 of which are inhabited. The country has a total landmass of 3,827 sq km (1478 sq mi) with the highest point being Mont Orohena at 2,241m (7,352ft) on the island of Tahiti. The terrain is a mix of rugged mountains and low-lying islands, nearly all of which are encircled by coral reefs. Coastline: 2,525km.

Climate The islands are humid and tropical with an average air temperature of 27°C (80°F). In summer, from November to April, the climate is warmer and more humid, while in winter, May to October, it is cooler and less humid. Water temperatures range from 26° to 29°C (79° to 84°F) and a rash guard or 3mm wetsuit is sufficient for most divers. Natural hazards: Cyclonic storms occur occasionally in January.

Economy French Polynesia's economy is largely supported by tourism and pearl farming, which accounted for 54% of their exports in 2015. A smaller portion comes from manufacturing, agriculture and fishing. The country still has only a moderately developed economy and relies on imported goods, along with financial assistance from France.

Environment Challenges include droughts and fresh water scarcity, sea level rise and extreme weather events such as cyclones, storms and tsunamis, which cause erosion, landslides, floods and reef damage.

Population 287,881 (July 2017 est.) Ethinic groups: Polynesian 78%, Chinese 12%, local French 6%, metropolitan French 4%. Religions: Protestant 54%, Roman Catholic 30%. Internet users: 195,275 or 68.4% (July 2016 est.)

Language French is an official language spoken by 70% of the population, with Polynesian, also an official language, spoken by 28.2% (2012 est.) English can be found spoken in most major tourist spots.

Health & Safety Please check with your country's state and health departments well in advance of your trip for required vaccinations, health and safety advisories.

Currency The official currency is the French Pacific franc, or Comptoirs Francais du Pacifique francs (CFP or XPF), which has a fixed exchange rate with the Euro. (1 Euro = 119.3317 CFP) Local currency may be exchanged at the international airport and exchange offices on the main islands, but not at local banks. ATMs will also dispense local currency where available. It is advisable to exchange funds before transferring to the Tuamotus, as exchange facilities are rare. Exchange rates: 1USD=99.45XPF; 1EUR=119.33XPF; 1GBP=134.31XPF; 1AUD=77.71XPF; 1SGD=74.36XPF

Voltage The voltage in French Polynesia is 220V/60Hz and the European style sockets are used. An international multi-prong adaptor is recommended.

Cuisine As you would expect, French is the main cuisine served in the islands. Be prepared for plenty of bread, cheese and ham, along with more traditional Tahitian food including fresh fish, pork, chicken and shellfish with leafy greens and root vegetables and a liberal use of coconut. A wider variety of international dishes are available at tourist destinations and on the liveaboard dive boat.

Tipping Tipping is not traditionally part of the French Polynesian culture. It is not required nor expected. However, if you feel a tip is warranted, it is always appreciated and will be split amongst the crew.

Transportation The only international airport in French Polynesia is located in the capital city of Papeete on the island of Tahiti. There are several air carriers with flights from major cities around the globe including the national carrier Air Tahiti Nui (airtahitinui.com). Locally, Air Tahiti (airtahiti.com) is the main airline for flights between the 54 airports on various islands throughout the archipelago.

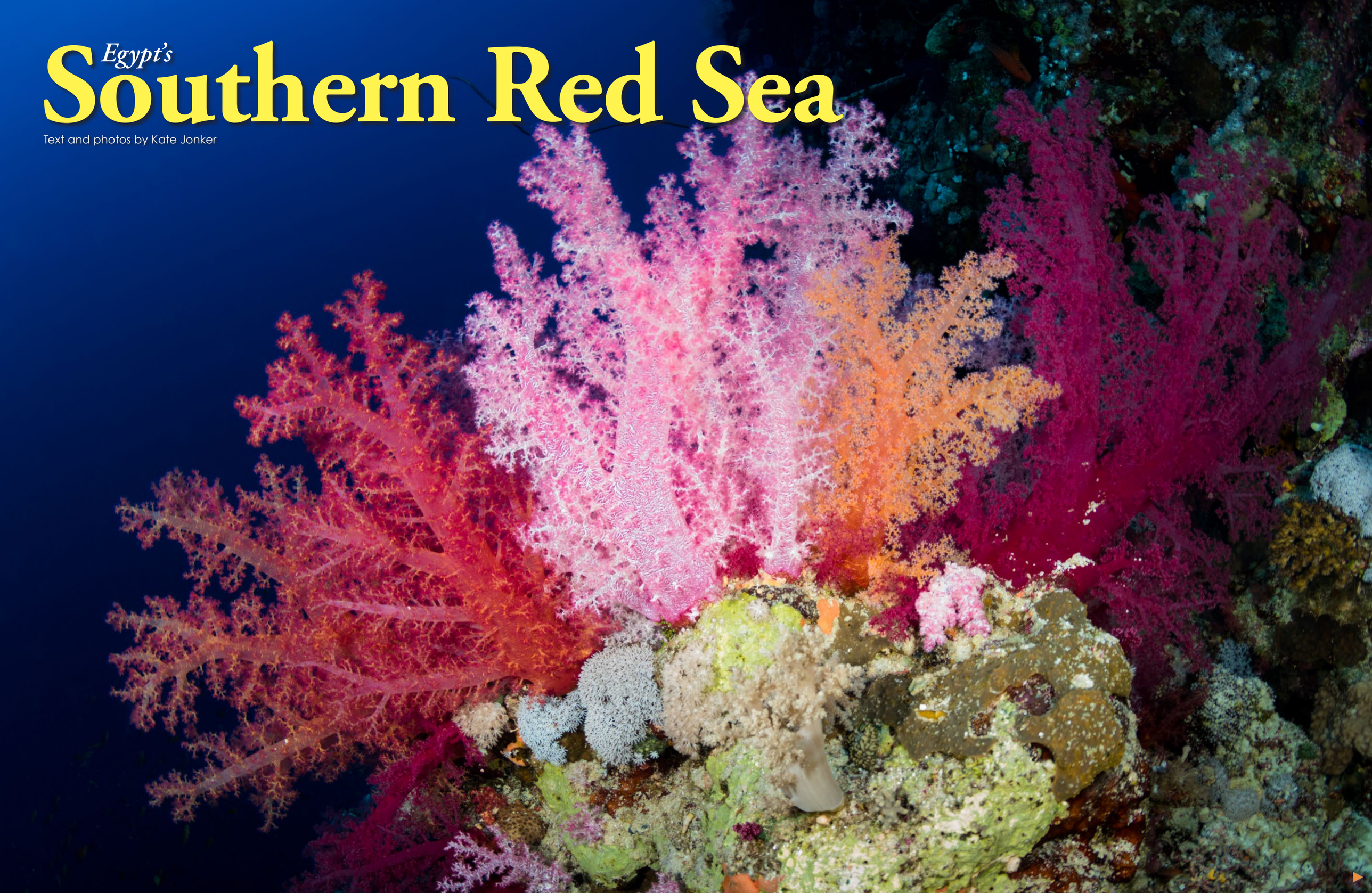
Travel/Visa Travelers from the European Union need only a valid passport for entry, so long as it does not expire for a minimum of three to six months past your stay. Holidays up to 90 days are exempt from visa requirements for most visitors from Western and Asian countries but still require a valid passport.

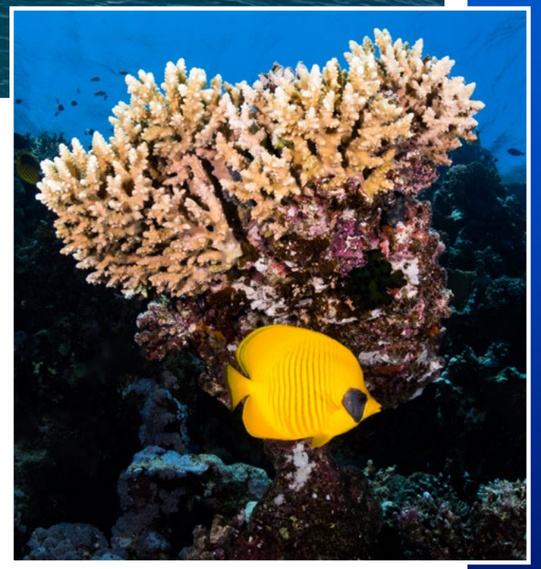
Decompression Chambers There is only one recompression chamber in French Polynesia and it is located at the main hospital in the capital of Papeete on Tahiti.

Websites
French Polynesia Tourism
tahititourisme.com

Egypt's Southern Red Sea

Text and photos by Kate Jonker





Port Ghalib is located 65km north of Marsa Alam along the Red Sea coast of Egypt; Masked butterflyfish shelters under colony of hard corals at Paradise Reef (right)

Having dived in the northern Red Sea almost every year since 2005, I had come to Marsa Alam to join a liveaboard safari that would take me to the Deep South of the Egyptian Red Sea to explore St John's reef and the Fury Shoal, just above the Sudanese border. I had heard rave reviews about the pristine coral reefs and the beautiful cave systems, of the dolphins and sharks and dugongs, and was here to find out for myself whether these claims were true.

The hot, dry desert air took my breath away and the merciless desert wind whipped my hair about my face as I stepped out onto the tarmac. After a one-hour flight from Cairo, I had arrived in Marsa Alam, and it felt good to be back in Egypt.

After being whisked through the airport, I loaded my luggage into the bus in true Egyptian style—through the back window. A short five-minute drive past hotels, apartment blocks and holiday resorts in various stages of development took passengers to the modern marina of Port Ghalib, where guests were to board the boat.

Port Ghalib

Port Ghalib is 65km north of Marsa Alam and, according to its official website, was the brainchild of Kuwaiti billionaire Nasser El Kharafi, who invested two billion dollars into turning this 18km stretch of uninhabited barren coastline into the region's largest tourist area and marina complex. Today, it is home to many modern hotels and holiday resorts, and a palm-lined promenade that runs alongside the international marina hosts a wide

Majestic walls and reefs call for wide-angle lenses in the southern Red Sea.
PREVIOUS PAGE: Soft corals at Habili Gafar—in brilliant colours

Bannerfish and blue-spotted stingray share a table coral at Abu Dabab Talata

Masked butterflyfish at Abu Dabab Talata

selection of restaurants, bars and shops.

Once on board, guests were ushered into the cool, air-conditioned salon and offered a much-needed glass of ice cold juice. After a briefing and paperwork, I was allocated my room and went to unpack, choose my spot on the dive deck and kit up my gear. One of the guests had been on the Internet to check out the dive deck to see which spot was the best: "Not close to the wetsuits so that they flap in your face whilst kitting up and not too close to the main area so that you are swamped by fellow divers," he advised me. He also said he looked at where the dive guides had their gear, as this was usually one of the best places to be.

We spent our first night in the marina waiting for those who were arriving on later flights from different parts of the globe. This is usually the norm, and most liveaboards only depart early the next morning.

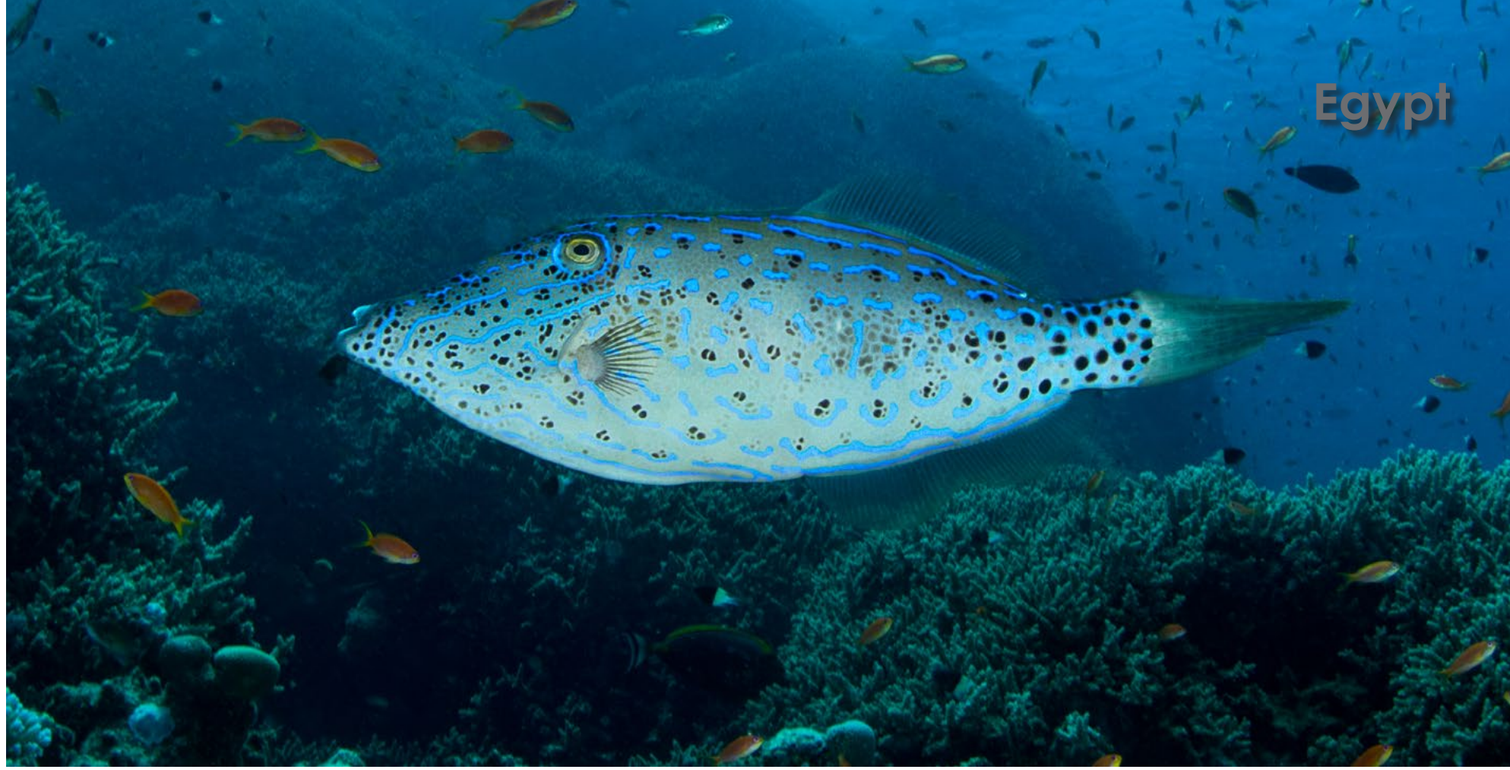
Diving

We left Port Ghalib after an early breakfast and travelled south for two hours to our first destination, Abu Dabab Talata, where we would do our checkout dive to ensure our weighting was correct and our gear was working correctly.

Abu Dabab Talata. I did a giant stride off the back of the boat and was instantly enveloped by the soft, warm 28°C, clear blue water of the Red Sea. The reef was pristine, with huge porite and table corals, pinnacles towering up from a sandy floor dotted with coral bommies, each hosting its own community of banded dascyllus, half and half chromis and blue green chromis. Pairs of masked butterfly and Red Sea bannerfish wound their way slowly amongst the thriving communities. Blue-spotted stingrays rested on the ocean floor and a giant moray eel, accompanied by a bluefin trevally, patrolled the reef, look-

Pristine coral bommies at Abu Dabab Talata

Incredible coral gardens at Shaab Marsa Alam



Egypt

Filefish at Shaab Marsa Alam

ing for breakfast. Picasso triggerfish chased each other around the reef. It was June and mating season in the Red Sea, resulting in a lot of activity and rivalry amongst the fish.

Shaab Marsa Alam. The boat then made its way Shaab Marsa Alam for our last local dive before heading south. As there were 16 divers on the boat, we split ourselves into two groups, with each group having its own zodiac and dive guide.

Our zodiac took us to the far side of the reef. The skipper counted us down and after a backward roll, I descending onto the biggest, most prolific coral garden I have ever seen in my 17 years of diving. Coral-to-coral reef stretched as far as the eye could see, and above this reef hung schools of juvenile barracuda, yellowfin goatfish, blue striped and Ehrenberg's snappers. Smaller reef fish went about their daily chores, flitting in between the branches of their coral homes.

The huge coral garden eventually gave way to sand, littered with coral bommies and large pinnacles, all hosting their own little fish cities. Orange anthias hung around the sunny sides of the pinnacles, and parrot fish and groupers swam amongst them, looking for a quick meal. I could have stayed there forever!

St John's

We started the long trip south to St John's at about 4:00 p.m. With huge swells relentlessly battering the port side of the boat, it was one of the roughest voyages I have ever experienced. At one stage, the sofas and chairs, with their seated occupants, slid from one side of the deck to the other. Fortunately, by about 6:00 p.m., the wind dropped, the sea flattened out and we had a comfortable journey south, finally reaching St John's reef at 6:00 a.m. the following morning.

Scorpionfish at Paradise Reef (left); Domino damselfish and Red Sea anemonefish at Paradise Reef (above); Colourful soft corals at Habili Gafar (right); Crocodilefish at Paradise Reef (lower left)

Paradise Reef. Our first dive at St John's was on Paradise Reef, a beautiful, crescent-shaped reef with a gently sloping sandy bottom, dotted with large pinnacles that were home to many colourful reef fish, including yellowflank and sulphur damselfish, anthias, lionfish, Arabian and emperor angelfish and masked, striped and crown butterflyfish.

The reef wall was intersected by cracks, swim-throughs and gullies where sparkling light rays filtered through from the surface. A huge Napoleon wrasse with his entourage of a smaller Napoleon wrasse and bluefin trevally swaggered onto the reef like a gangster being followed by his minions. Shortly after that, a school of bumphead parrotfish swam lazily amongst the pinnacles in search of an early morning snack, their comical faces making them look like mischievous schoolboys. Sadly, by this stage, I was on my safety stop and had to watch from above—a photo opportunity missed. But such is diving!

Habili Gafar. After breakfast, a short ride took us to Habili Gafar, which simply has to be one of the most beautiful walls I have ever dived. We started our dive on this relatively small, pyramid- shaped reef at 26m and wound our way upwards.

The vibrant pink, orange, red and purple thistle soft corals were astounding, providing a beautiful contrast to the deep blue water, which plunged to depths of over 700m. Orange anthias hung along the entire side of the reef, adding to the riot of colour, and Red Sea bannerfish, broomtail wrasse, masked butterflyfish and rusty parrotfish swam alongside; whilst cornetfish hung silently, watching for a tasty snack. In stark contrast, silvery bluefin and yellowspotted trevallies and great barracudas patrolled the reef, looking for unsuspecting customers that would soon be lunch. We ended our dive at 5m on top of the reef, which was covered with pristine hard corals, before swimming back to the boat.

Divers explore the reefs at Habili Ali (above); Lionfish surrounded by glassfish at Habili Ali (top right)

There's a saying on Red Sea liveaboards—your hair is either wet, or it is dry. If it is wet, it is time to eat and if it is dry, it is time to dive.

To remind you of this, there is a large brass bell on every Red Sea liveaboard. "The Bell" is rung to call divers for a dive briefing or to a meal, and woe betide any diver who does not react promptly to the call of "The Bell." Missing the bell results in a look of disapproval from the dive guide when you arrive late for a dive briefing, or a hurt look from the dining room steward if you are not first in the line for food.

Habili Ali. A very early first dive at Habili Ali the following morning saw us in the search of sharks. A bit ahead of the others, I spotted a grey reef shark, but by the time I had given everyone the point, "Look! Shark!" signal, it had swum out of sight. The other group was more fortunate than ours and sighted a scalloped hammerhead, a thresher shark and a whitetip reef shark.

Napoleon wrasse on the hunt (above) and whitetip reef shark resting in a cave (lower left) at Big St John's Reef, as rays filter through the cavern (left)

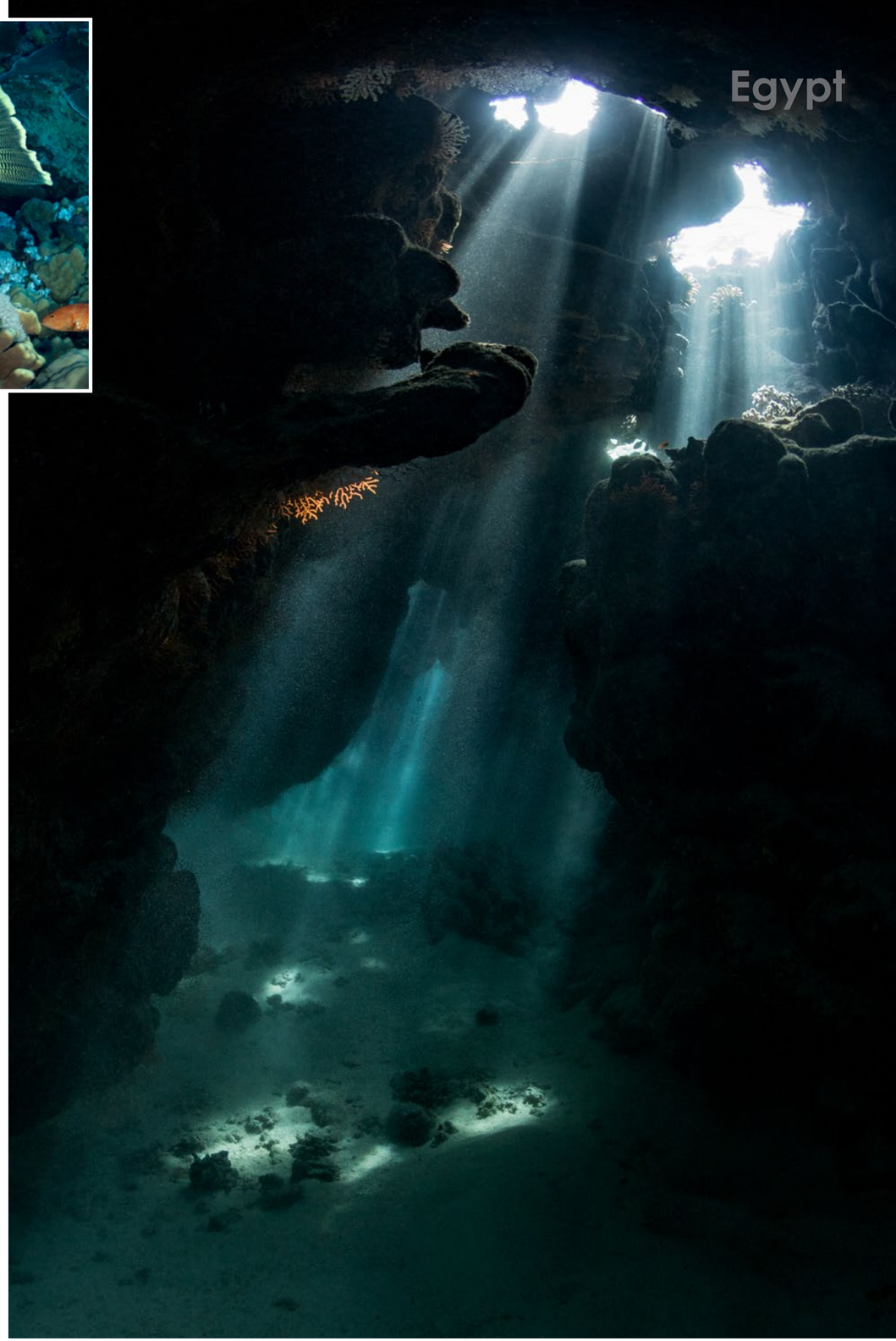
Big St John's Reef. Our next dive was on Big St John's Reef where we were again on the lookout for sharks. We spotted two whitetip reef sharks in a cave as well as a number of medium-sized Napoleon wrasse. These two reefs reminded me very much of the Brothers Islands, with steep walls and lots of paler broccoli soft coral—not the pinks, red and purples of the previous day's reefs.

St John's Caves. Later in the day, we dived St John's Caves. They were one of the reasons I had wanted to come to the southern Red Sea, and the dive exceeded all my expectations. I had seen many beautiful photos of the sun's rays filtering down through cracks in the reef, but nothing prepared me for the breath-taking beauty of the light beams playing on the sandy floor.

This maze-like cave system is extensive, and although it is relatively shallow, giving nice long dives, one dive here is simply not enough. This incredible dive was made even more memorable by the inquisitive dolphins who joined us on our safety stop.

Many of our dives were taken from the back of the boat with an easy, giant stride off the dive platform. We had then either dived with the reef on our right-hand side or on our left-hand side and turned around to go back to the boat, or keep on diving and deploy our surface marker buoys for the zodiac to come and pick us up.

On other dives, the zodiacs took us to strategic spots on the reef. Once we had all put on our masks, the skipper would count us down and we would do a backward roll into the beautiful blue water. To ensure we started our dive at the right place on the reef, we often did negative entries, by taking all the air out of our BCDs before doing our backward rolls. We would then fin away from the



Beautiful light rays filter down into St John's Caves

Huge purple stonefish (top left) and moray eel (above) on night dive at Sataya Reef; Beautiful feather star about to unfurl on night dive at Um Urouk (top right)

Oceanic whitetip shark with entourage of pilot fish at Sataya Reef

boat and meet at 5m before heading to the reef.

Sataya Reef. The next morning, we made our way over to Sataya Reef and had one of the most memorable dives of my life (yes, another). A little way along the reef from the boat, we came across what can only be described as "Parrotfish Heaven." There were parrotfish everywhere we looked—they were foraging for food, chasing each other, fighting for territory and generally, just being busy everywhere. I have never seen such a huge number and variety of parrotfish in one single place. There were Indian longnose parrotfish, ember, bullethead, redbreasted and steephead parrotfish to name just a few.

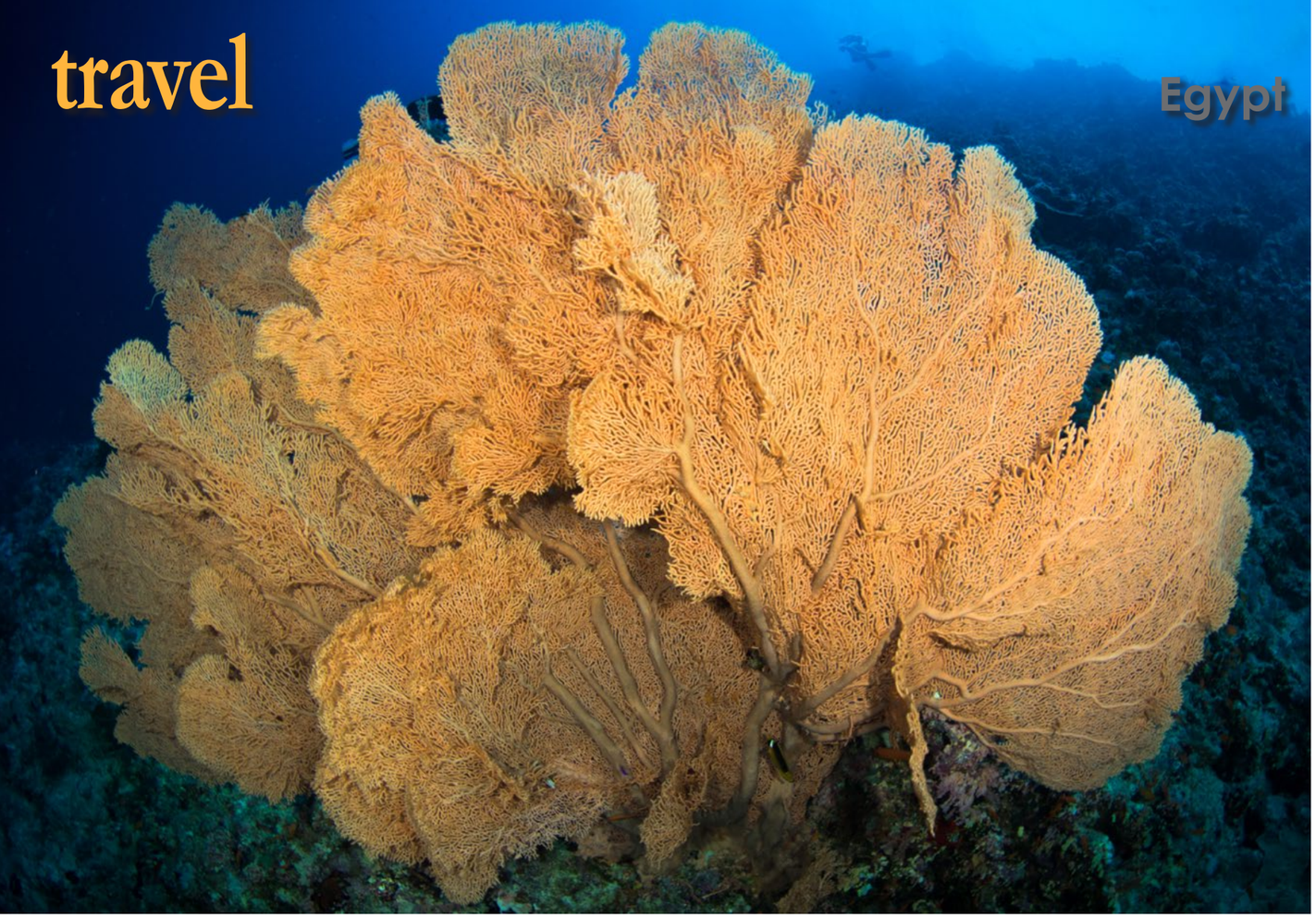
I was in awe. Even more so when my buddy started shouting at me and pointing at a magnificent oceanic whitetip shark that had emerged from the depths with its entourage of black and white striped pilot fish. The shark came to inspect us all and took a bit of a liking to my buddy Esther, circling her a number of times before lazily retreating back to the depths. It was a beautiful, aloof creature, and to have been in its presence was incredibly humbling. We continued with our dive back to the boat, hoping to catch another glimpse of him, but he did not reappear.

Night dives

Night dives were offered every evening and were fascinating. This is when the creatures that lurk in the dark come out into the open. We spotted Spanish dancers, huge stonefish, parrotfish sleeping in their protective mucous cocoons, massive basket stars that extended their arms to catch food in the water column, feather stars in a myriad of colours, strange sea cucumbers with their weird feeler-like mouth parts that crawled across the sand and masked

Diver and coral garden at Sataya Reef

Egypt



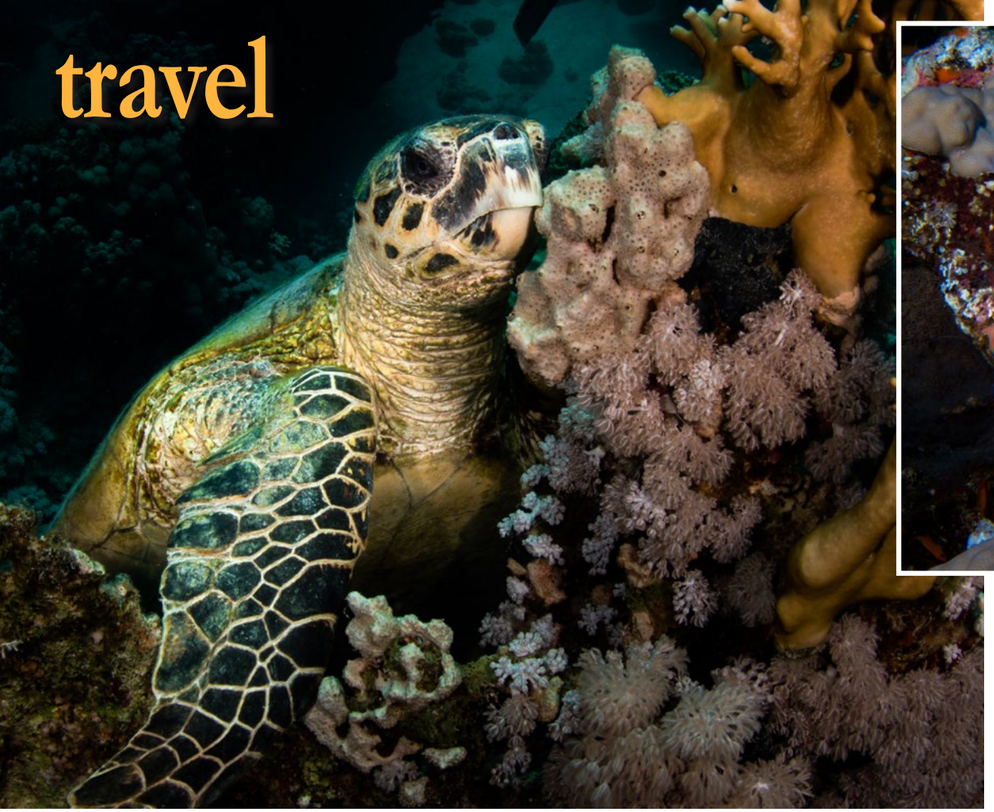
Huge gorgonian sea fans at Shaab Sharm

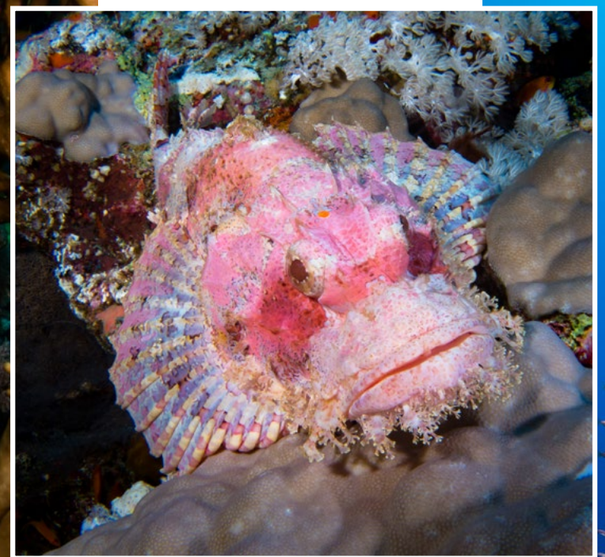
Sea turtle chomps its way through soft coral at Shaab Sharm

puffer fish resting on the tops of rocks. Giant moray eels were seen foraging amongst the coral outcrops, and lion-fish tried to hunt in our torch light. Night diving in the Red Sea is very special and on the southern reefs, it really was fantastic.

Diverse diving and marine life

The following days revolved around "The Bell." We were either diving, eating, resting, sleeping, chatting to fel-low divers or preparing our cameras for the next dive. The captain took us from one beautiful reef to another and our dive guides led us around pristine coral gardens teeming with life and beauti-ful reefs with steep, plunging walls adorned with hard and soft corals and huge gorgo-nian sea fans. We explored cracks and crevasses and even more cave systems and were on the constant look-out for sharks. Marine life continued to be colour-ful and plentiful and we saw more turtles, whitetip reef sharks and Napoleon wrasse. Conditions were perfect with flat sea, no wind and very little current at all.





CLOCKWISE FROM LEFT: Sea turtle enjoys soft corals at Shaab Sharm; Beautiful pink scorpionfish at Small St John's Reef; Lush coral gardens at Shaab Claudia; Bannerfish at Shaab Claudia; Masked pufferfish on a night dive at Sataya

Elphinstone. All too soon it was time to head north again to dive the infamous Elphinstone. Travelling overnight, we had a strong headwind and the sea became quite rough. Lying in my rocking bunk, my over-active mind played tricks on me. I started worrying about reefs hidden just below the surface, only to remind myself that the liveaboard captains came from generations of sea-farers, and that the ocean and its highways were in their blood.

The following morning, we awoke to a howling wind. We anchored up on the leeward side of Elphinstone, and the swells were huge. Massive waves were breaking over the top of the reef, and the boat was bucking against its anchor lines like a wild stallion.

Climbing onto the zodiac was challenging and required careful timing. A bumpy ride took us to the northern tip of the reef, where we did a negative entry and swam down along the plateau at 30m.

Suddenly, we came face to face with magnificent scalloped hammerhead shark, which turned with a flick of its tail and was gone. Sadly, this was the only shark we encountered on our dive.

When we surfaced, the swells had become even larger. Climbing back onto the liveaboard boat involved jumping off the zodiac, swimming to the ladder and clambering up it as quickly as possible. Not an easy task when wearing slippery fins. I had done this many times in the northern Red Sea, but those swells had been tiny in comparison. I was the second person to jump and was really scared—not for the climb up the ladder, which was totally submerged one minute and completely out of the water the next—but for the oceanic white tips that were swimming around the zodiac at the time! Fortunately, I made it back to the boat and up the ladder in one piece.

Due to the adverse conditions, it was agreed that we would skip the second

Two inquisitive dolphins pose for the camera at St John's Caves (left); Diver explores walls at Small St John's Reef (below)

Egypt

dive at Elphinstone and search for dugongs instead. I was really excited as dugongs are at the top of my bucket list, and I had really hoped to see one on this trip.

Marsa Shouna. The captain took us to Marsa Shouna where many other liveaboards and day boats were seeking refuge from the strong wind and swells. Following our dive guide, we swam to the centre of the small bay, swivelling our heads from side to side in the search of dugongs.

The water was only 4m deep and the grassy sea bed was littered with bare patches of sand where, I imagined, dugongs had been grazing. As we swam, I was enthralled by the tiny juvenile fish hiding amongst the blades of grass and the shrimps with their goby partners in their tiny holes in the sand. Sadly, the dugongs did not make an appearance and we finished our final dive of the trip on a rather poignant note.

Afterthoughts

Heading back to Port Ghalib, I reflected on my trip. The Deep South was everything I had read about, and more. The coral gardens were pristine and teeming with reef fish, the walls were majestic with vibrant soft corals, hunting pelagic fish and colourful marine life. The cave systems were plentiful and awe-inspiring, with their dappled light and light beams streaming through cracks in the reef. It was the unexpected visitors—the dolphins, turtles and sharks—that added a sparkle of magic to the trip.

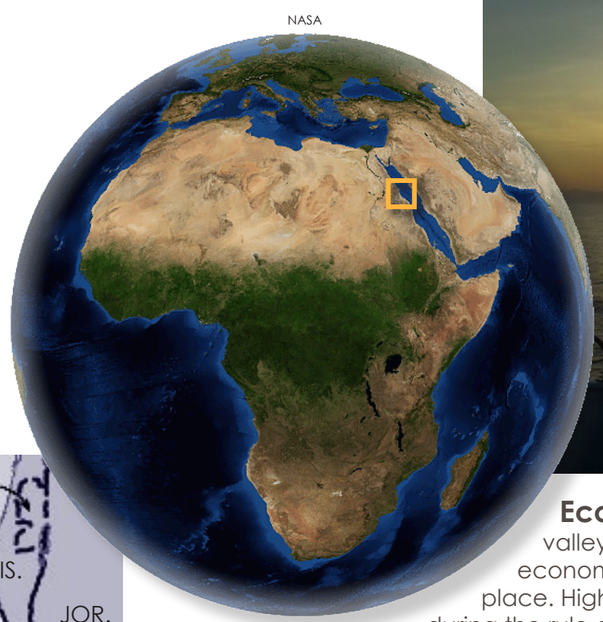
The deep south Red Sea liveaboard routes complement the northern routes by providing a varied and very different diving experience. Those wanting to see mainly sharks though, should consider doing the Brothers, Daedalus and Elphinstone route, and those with a lust for rust would be better off doing a wreck itinerary. Divers wanting a change from the northern region of the Red Sea will not be disappointed with a Deep South itinerary. I certainly look forward to returning again soon—and perhaps I will see the elusive dugong next time! ■

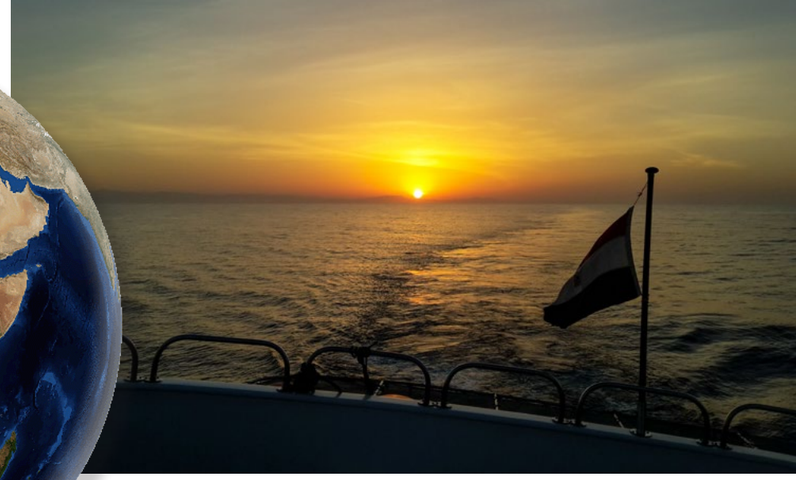
Kate Jonker is an underwater photographer and writer based in South Africa. She teaches underwater photography, is an SSI Dive Control Specialist and dive boat skipper for Indigo Scuba in Gordon's Bay and leads dive trips across the globe. For more information, please visit: ***KateJonker.com****.*

fact file

Egypt

SOURCES: US CIA WORLD FACTBOOK, XE.COM, EDUCATION.STATE.GOV, GOOGLE.COM





RIGHT: Location of Marsa Alam on global map
BELOW: Location of Marsa Alam on map of Egypt
FAR RIGHT: Sunset on the Red Sea

History One of the world's great civilizations developed in Egypt fostered by fertile lands and regularity of the annual Nile River flood, as well as the relative isolation found between the deserts to the east and west. Around 3200 B.C., a unified kingdom evolved, followed by ruling dynasties reigning in Egypt for the next 3,000 years. In 341 B.C., the Persians conquered the last native dynasty. Then came the Greeks, Romans and Byzantines. It was the Arabs who, in the 7th century, introduced Islam and the Arabic language. They reigned over Egypt for the next 600 years. Then, around 1250, the Mamluks, a local military caste, took control and continued to govern after the Ottoman Turks conquered Egypt in 1517. In 1869, Egypt became an important world transportation hub after the Suez Canal was completed, but also accrued a lot of debt. In order to protect its investments, Britain took control of Egypt's government in 1882. However, allegiance to the Ottoman Empire continued, in name only, until 1914. Egypt was partially independent from the United Kingdom by 1922, and in 1952 the country got full sovereignty after the overthrow of the British-backed monarchy. In 1971, the completion of the Aswan High Dam and the creation of Lake Nasser altered the long-held role of the Nile River in the ecology and agriculture of the country. Resources were overtaxed and society stressed as the population experienced rapid growth. In addition, there was limited arable land and continued dependence on the Nile. In order to face these challenges, the government implemented economic reform and major increases in investment in physical and communications infrastructure.

The Tunisian revolution in 2010 inspired demonstrations and labor strikes in Egypt, leading to the ouster of President Hosni Mubarak in 2011. National leadership was assumed by the military until 2012 when a new parliament was put in place. Mohammed Morsi was elected president that same year, but violent protests against his government and the Muslim Brotherhood in 2013 led to the military intervening again, removing Morsi from power, who was then replaced by interim president Adly Mansour. In a referendum, a new constitution was approved by the voters in 2014, and Abdelfattah Elsisi was elected president. In 2015, a new parliament was elected, the first since 2012. Government: republic. Capital: Cairo

Geography Egypt is located in Northern Africa. It borders the Red Sea north of Sudan and the Mediterranean Sea, between Libya and the Gaza Strip. It also includes the Asian Sinai Peninsula. Coastline: 2,450km. Terrain: Cut in half by the Nile valley and delta, Egypt is primarily a vast desert plateau. Lowest point: Qattara Depression -133m. Highest point: Mount Catherine 2,629m. Natural hazards include droughts, earthquakes, flash floods, landslides, dust and sand storms, as well as hot windstorms occuring in spring. Environmental challenges include urbanization and windblown sands decreasing agricultural lands; increased soil salination below Aswan High Dam; desertification; coral reefs, beaches, marine and aquatic habitats threatened by oil pollution, agricultural pesticides, raw sewage, and industrial run-off.

Climate Egypt has a desert climate—hot, dry summers with moderate winters

Economy Nile valley is where most economic activity takes place. Highly centralized during the rule of former President Gamal Abdel Nasser, Egypt's economy opened up significantly under former Presidents Anwar El-Sadat and Mohamed Hosni Mubarak. From 2004 to 2008, Cairo pursued economic reforms aggressively in order to attract foreign investment and foster GDP growth. However, living conditions for the average Egyptian stayed poor and exacerbated public discontent despite the increase of economic growth in recent years. Unrest took place in January 2011 and the Egyptian government dramatically increased social spending to ease public dissatisfaction. However, economic growth slowed significantly due to political uncertainty, which reduced government revenues. The hardest hit sectors were tourism, manufacturing, and construction. Foreign exchange reserves are being used by the government to support the Egyptian pound.

Population 97,041,072 (July 2017 est.) Ethnic groups: Egyptian 99.6%. Religions: Muslim (mostly Sunni) 90%, Coptic 9%, other Christians 1%. Internet users: 37,122,537 (2016)

Currency Egyptian pounds (EGP). Exchange rates: 1USD=17.71EGP; 1EUR=21.34EGP; 1GBP=24.00EGP; 1AUD=13.90EGP; 1SGD=13.34EGP

Language Arabic (official), English and French

Health & Safety The US State Department has issued an Egypt Travel Warning for US citizens due to threats from terrorist and violent political opposition groups. Please check with your country's state and health departments well in advance of your trip for updates on required vaccinations, health and safety advisories.

There is an intermediate degree of risk for food or waterborne diseases such as bacterial diarrhea, hepatitis A, and typhoid fever; vectorborne disease such as Rift Valley fever; and water contact disease such as schistosomiasis. H5N1 avian influenza has been identified in the country but poses low risk to tourists.

Decompression Chambers
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Web sites
Egypt Tourism
www.egypt.travel ■

Edited by
Rosemary E. Lunn
and Peter Symes

POINT & CLICK ON BOLD LINKS

Equipment

Divesangha bag

Too much plastic finds its way into our oceans, threatening marine life and ecosystems. Divesangha has launched a unique, robust, reusable bag to help wean everyone off one-time-use plastic carrier bags. This lightweight, sturdy, fashionable "Turtle" bag neatly packs down into an integrated pouch, allowing you to stash it in a coat pocket, rucksack, or laptop bag. When you reach the checkout till, simply pull it out and fill it up. The 100 percent white polyester fabric is machine washable and the bag itself is constructed to conveniently handle more weight than its littering plastic carrier bag cousin. **Divesangha.com**

AquaLung Rogue

Aqua Lung unveiled the "Rogue" at DEMA.2017 and stated its lightweight BCD is easy-to-assemble and should make a great travel buoyancy control device. Firstly, the Rogue weighs in at less than 2.2kg (5 lbs) Secondly, the diver can strip down the modular unit and pack the backpack, interchangeable shoulders straps, weight pockets and air cell in the best manner possible, rather than having to resort to ingenious methods to make everything fit in a gear bag. The back inflated BCD has 15 lt (35 lbs) of lift capacity and the ability to come in 27 different sizes. **Aqualung.com**

Stealth

The latest edition to the HECS Stealth suit range is a semi dry suit. These suits utilise the Faraday cage principle by containing a mesh of conductive carbon fibre, which neutralises the human body's electrical fields. A Faraday cage is an enclosure made of a conductive grid that attenuates electrical fields. This should allow the diver to get much closer to the many marine creatures that can sense electrical energy. The new semi-dry suit incorporates 2mm neoprene inner neck and shoulder sleeve, acting as an insulated layer between chest zip and body. Glued and blind-stitch seaming. Reinforced knee and elbow pads. **Hecsaquatic.com**

Tusa Paragon

It looks as though TUSA has thrown down the gauntlet by debuting their top-of-the-line 'Paragon' mask at DEMA.2017. This two-lens mask has a reinforced 'tri-mix' frame. Apparently, the silicone, stainless steel and polyurethane combination has been designed to absorb impact shocks. (Is this a real diving problem?) What is interesting is the investment that TUSA has put into their new 'AR / UV420' lenses. These are not mirrored lenses, but clear lenses that have a special coating on the surface that reflects light and provides UV protection. (This is an expensive process.) Divers that need corrective lenses have also been remembered - UV lenses that provide minus corrections will be available. This probably makes the Paragon the first top-of-the-range mask that comes with off-the-shelf corrective lenses. **Tusa.com**

Watoom Cyano

Korean manufacturer Watoom has launched a watch style nitrox computer that is compact, sleek and pretty darn sexy. But are we looking at style over substance? The wireless rechargable "Cyano" appears to have a battery life on par with a typical mobile device. (And just how often have you been caught out by your cell going flat?) The user will probably need to establish a meticulous daily charging regime. The Cyano uses the Bühlmann ZH-L16C decompression model. Features include a stopwatch, compass and gauge mode and it is water resistant "up to" 100 mt (328ft). This computer stores 100+ dives, and divers can manage their data via the Cyano mobile app. Choice of four colours: white, black, mint and pink. **i-cyano.com**

Scuba Confidential:

The Concept of Failure Points

PIXABAY

Text by Simon Pridmore

Failure points is a very important concept in the technical diving world, which is highly relevant to every form and level of scuba diving, but it is rarely addressed and often neglected.

Let me begin, as I often do, with a short story.

Andrew was a relatively experienced technical diver. One warm spring day, he back-rolled off a tender boat into the exciting, fish-filled, current-strewn waters of northeast Bali, deflated his wing and descended. As he was rolling around onto his front to get his bearings, his world exploded. Suddenly he had no regulator in his mouth and he was surrounded by a thousand Jacuzzis-worth of bubbles. As he was only at a depth of 6m (20ft) or so, he decided to ascend to the surface first and then see what had happened, rather than try and sort everything out under the water. So, exhaling continuously, he rose up and emerged to the sunlight, surrounded by the chaos of a frothing ocean.

He made himself buoyant, then inspected the damage. Reaching for his regulator hose, which was whipping around him like an angry snake, he found that his second stage was completely gone and air was pouring out of the open hose-end. That was the source of all the bubbles then! He reached behind his head and turned his valve off. As he flipped onto his back and started to kick back towards the dive boat, he realised that he had also somehow managed to lose a fin. He climbed on board, a little shocked but otherwise fine. His diving day was done, however.

An hour or so later, the rest of the group returned bringing with them Andrew's missing second stage and his lost fin, which they had found on the bottom under the boat. The second stage still had the hose swivel attached, while the fin was missing part of the plastic buckle on one side and the strap was hanging loose.

PIXABAY

Failure Points

What had gone wrong?

Afterwards, Andrew tried to analyse what had happened. Everything had been fine on the boat but, once he started descending, the second stage had sheared off at the point where the hose swivel had been screwed into the low-pressure hose. He concluded that, when he had fitted the swivel to his regulator the previous week, he must either have failed to tighten it, or cross-threaded it without noticing, and either increased pressure in the hose or the shock as he entered the water, or a combination of both, had caused it to break off. When the hose started whipping around freely, the jet of compressed air spurting out of it must have hit his ankle right where the fin buckle was, snapped the connection and knocked the buckle off.

He had bought the hose swivel because his jaw would ache after long dives, and he had read that a swivel might be the solution. His fins were quite new too. He had bought them because they had stainless steel heel straps and he was planning on doing some cave diver training. He had heard that normal floppy rubber fin straps represented an extra hazard in a cave environment and that stainless steel straps were safer.

Not just bad luck

Andrew initially put the accident down to bad luck, but, of course, bad luck is never the only cause of accidents. Andrew had made a couple of mistakes and one of these was to neglect to consider the concept of failure points.

A second stage swivel can indeed relieve jaw fatigue but it also introduces another o-ring into your air supply path. It adds a further thing that can go wrong to a survival system that already has plenty of things (mainly o-rings) that can go wrong. So, the number of points where the system can fail is increased.

The primary rule behind the concept is that you aim to reduce, rather than increase, the number of failure points in your gear. You only add a failure point when there is a fundamental need that is more important and justifies adding risk. And I am afraid, in the game of chance we call scuba diving, a gas supply failure trumps an aching jaw every time.

As for Andrew's fins, yes, they had stainless steel straps, and these are indeed preferred for cave diving, but the straps he had bought were attached to the fins with normal plastic fittings. The idea behind using coiled springs instead of rubber thongs is not just so that you do not have loose bits of rubber flapping around your ankles, where they can get caught up in your guide line, it is so that you remove the failure points that flimsy plastic buckles represent and, by so doing, you make it less likely that you will lose a fin on a cave dive. So, to be fit for purpose, stainless steel straps need to be permanently bolted into the body of the fin.


PIXABAY

Misconceptions

Since mainstream diving equipment manufacturers first noticed that technical diving was attracting more divers and was not just going to be a passing fad, they have been trying to make equipment to sell to technical divers. But, there are aspects of technical diving that many of them just do not understand.

For example, producing wings and harnesses with fixed D-rings that cannot be moved around shows that they are completely ignorant of the idea of configuration and making fins with stainless steel straps, AND plastic buckles shows that they have no idea of the concept of failure points. They are like many local restaurants in my home island of Bali that sell pizza. What they serve to customers looks like a pizza, but it sure does not taste like pizza. It is as if they once saw pictures of a pizza, but without a list of ingredients, and just guessed what should go in it.

What can you do?

There are potential failure points in every piece of gear you dive with. Recognize that they are there, eliminate them when you can and, where you cannot eliminate them, make sure you have a plan for what to do when the failure happens—a plan that works and that you have tested in a pool or shallow water.

There are potential failure points in every piece of gear you dive with. Recognise that they are there, eliminate them when you can and, where you cannot eliminate them, make sure you have a plan for what to do when the failure happens...

When you are planning to buy equipment, compare options with the concept of failure points in mind. For example, BCDs all have multiple potential failure points, some more than others. Have the manufacturers considered the concept when they built the product? Do they use double cable ties on the corrugated hose, so that if one breaks, the hose still holds? Is there an internal air cell to keep the wing functional if the external casing gets torn?

Finally, if, like Andrew, you are buying gear with technical diving in mind, buy products made by specialist technical diving equipment manufacturers who know what they are doing. ■

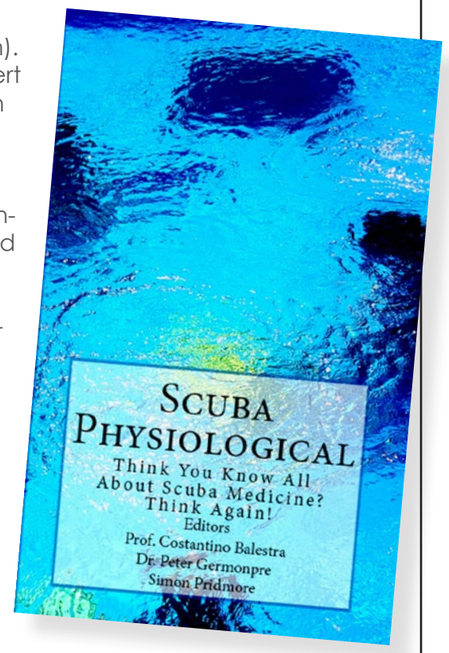
Simon Pridmore is the author of the international bestsellers, Scuba Confidential: An Insider's Guide to Becoming a Better Diver, Scuba Professional: Insights into Sport Diver Training and Operations and Scuba Fundamental: Start Diving the Right Way. He is also the co-author of the Diving and Snorkeling Guide to Bali and Raja Ampat and the Diving and Snorkeling Guide to Northeast Indonesia, as well as a new adventure travelogue called Under the Flight Path. His new e-book, Scuba Physiological: Think You Know all About Scuba Medicine? Think Again! is now available on: Amazon.com. For more information, please visit the author's website at: ***SimonPridmore.com****.*

A New Book for Scuba Divers!

If you are a diver, much of what you learnt about topics such as decompression sickness and narcosis in your scuba diving class is over-simplified and some of it is just plain wrong, as diver training agency texts have not kept pace with the science. Despite 170 years of research, the nature of decompression sickness and decompression stress remains unknown. Great advances have been made to make diving safer, but there are still glaring gaps in our knowledge. *Scuba Physiological* provides us with a good summary of what we know, a glimpse of where current science is taking us, and some good tips to make us all safer divers now.

The chapters in *Scuba Physiological* were originally written by scientists in the field of decompression research as part of a three-year project called PHYPODE (Physiology of Decompression). Simon Pridmore is not an expert on diving medicine but, when he came across the material, he knew that many people in scuba diving beyond the scientific community would be interested in it. So, he contacted the original authors and proposed an abridged, edited, simplified and re-formatted e-book, which would make the information more accessible to the general population of divers. They thought it was a great idea and *Scuba Physiological* is the result.

Scuba Physiological: Think You Know all About Scuba Medicine? Think Again! by Simon Pridmore is available on: **Amazon.com**.




PIXABAY

Text and photos by Don Silcock

Great Hammerhead Sharks

of South Bimini

Great hammerhead shark on night dive (right) and day dives (below and previous page) off Bimimni Island in the Bahamas

Hammerheads

Like a fashion model up on the catwalk, great hammerhead sharks sashay into one's field of vision, and, if they were human, you would probably say they have just "made an entrance". Their strange mallet-like head, robust body girth and tall sickle-shaped dorsal fin make them well-nigh instantly recognisable, and most other sharks in the immediate area spot that too and give them a wide berth.

The great hammerhead shark has a unique and distinguished presence in the water, cautious but confident, and seemingly in control of its environment. As it approaches, its distinctive head sweeps from side to side, causing the rest of its body to move in an almost snake-like manner.

My first close encounter with a great hammerhead shark was in the Solomon Islands. Although it was fleeting, the shark's demeanour reminded me of how a Jamaican mate of mine used to walk into a pub back in England—dressed in his best suit, cigar in hand and scanning the room in search of a date for the evening.

But like all sharks, these magnificent animals have been impacted dramatically by the seemingly insatiable demand for shark fin soup in China, the status dish of choice at the ubiquitous celebratory banquets. That large dorsal fin, which makes hammerheads so distinguishable, is very highly prized in the Hong Kong markets that cater to the Chinese shark fin trade.

So, encounters with the great hammerhead shark are particularly rare these days—everywhere that is, except in South Bimini where, come winter, a sizeable number of these elusive sharks aggregate in the island's waters.

South Bimini—great hammerhead central

The islands of North and South Bimini are located on the western edge of the Bahamas archipelago, just 53 miles to the east of Florida, making them very popular with well-heeled, large-boat owners from America's Sunshine State. Bimini is known for a few things: it was a favourite haunt of the famous American writer Ernest Hemingway and it was also from where a great deal of rum was smuggled over to Florida during Prohibition in the 1920s. But perhaps it is most renowned for its sport fishing, being often referred to as the "big-game fishing capital of the world."

Less well known though is that South Bimini is the location of Dr Samuel Gruber's Shark Lab where, for over 25 years, significant research has been conducted into the sharks and rays of this part of the Bahamas. "Doc" Gruber is an enigmatic and charismatic individual who, as he approaches his 80th year, has few peers in the field of elasmobranch study and research. His story is truly inspiring and is told extremely well in Jeremy Stafford-Deitsch's book, Shark Doc, Shark Lab. (Read more about Doc Guber in *X-Ray Mag* #64 **here >>>**)

Doc Gruber picked Bimini because of its large resident population of lemon sharks that use the large, mangrove-fringed, lagoon system to the east of the north island as a nursery for its young, making it almost the perfect spot for research. Many academic papers have been produced from the extensive field research conducted by Gruber and

NASA / PUBLIC DOMAIN

his team, but what they did not tell the world was that just off the beach, to the west of South Bimini Island, is probably the best place in the world to see the great hammerhead sharks.

The Shark Lab first became aware of the reliable presence of great hammerheads back in 2002, but managed to keep the news to themselves for over 10 years. Word did eventually get out, and without doubt, South Bimini is now firmly established as Great Hammerhead Central!

But why South Bimini?

The Bahamas are said to take their name from Baja Mar—the Spanish term for "shallow 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. 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.

The small islands of North and South Bimini sit at the northwestern tip of the Great Bahama Bank, isolated from the rest of the archipelago and physically closer to Miami than the nearest Bahamian city of Freeport. Their location means that to the north, south and east is the shallow waters of the Great Bahama Bank, which is typically some 10 to 15m in depth. While to the west is shallow water that slopes down to about 50m before plunging down into the 2,000m deep channel between Miami and Bimini, through which the rich waters of the Gulf Stream current flows north towards the Atlantic Ocean.

The Gulf Stream is a profoundly important force of nature, and in many ways, can be thought of as almost a conveyor belt of warm, nutrient-rich water bringing life to

NASA / PUBLIC DOMAIN

Great hammerhead shark with snapper and jacks; Map of the Bahamas (above); Bimini (top right) and on map (right)

A ferry (above) travels between North and South Bimini; Great hammerhead shark on night dive (right)

the areas it touches. The current is rich with larvae swept up as the Gulf Stream flows up from the Gulf of Mexico. Those larvae thrive in the current and are deposited at landfalls along the way, with the islands of Bimini being the first major way-point.

Bimini is uniquely placed to benefit from that life flow as they are the only islands in the area big enough to sustain a significant, large area of mangroves and seagrass, which provide a nursery that those larvae need in order to grow into crabs, lobsters and conch. The larvae, in turn, provide a source of food for the animals higher in the marine trophic food chain, such as stingrays and sharks. Basically, Bimini can be thought of as a rich, self-contained ecosystem that has benefited greatly, overall, from the protection the government of the Bahamas has enacted over the years.

The role of government

The Bahamas was one of the first countries to understand the importance of sharks to their seas and fish stocks, plus the growth of shark tourism means that live ones are immensely more valuable than the dead and de-finned variety. That said, the country has never been at the leading edge of the conservation movement and has suffered from over-exploitation of its fish stocks over the years, as well as periodic over-development of tourist resorts in ecologically sensitive areas.

But there is no major industry in the country, and its people generally have a deep and visceral understanding of how important the health of their surrounding waters is to their long-term prosperity. Therefore, the establishment of the Bahamas National Trust in 1959 to manage the world's first marine protected area—the 112,640 acre Exuma Cays Land and Sea Park—can now be viewed 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 environmental legislation, including making Exuma Cays a no-take marine reserve. Then in 2011, the government went one step further and became the fourth country in the world to establish a shark sanctuary by formally protecting all sharks in Bahamian waters.

Face to face

Any encounter with a large animal underwater arouses an incredible mixture of fear and excitement that is at its most intense just prior to entering the water for the first time. Sure, you have read about the animal from those that went before you, and the pre-dive briefings are almost always excellent. But when push comes to shove and it's time to get in the water, I can tell you that this heart of mine was beating at an increased tempo, and you could say I was "focused."

Hammerheads are known to be aggressive hunters that feed on smaller fish, octopus, squid, and crustaceans but are not known to attack humans unless they are provoked. In Bimini, they are tempted to swim close to divers, by feeding them, and the whole thing is carefully organised to give the participants maximum exposure to the animals. That is done by limiting the number of people in the water at any time to six participants, one "feeder" and a safety diver watching our backs.

The feeder is in the middle with an aluminum bait box (to keep the sharks from getting over excited), and there are three participants on either side who rotate positions after 15 minutes, so everybody gets a turn next to the bait box where it can get very exciting. There are usually 12 people on a trip, so after 45 minutes, you get a tap on the shoulder as it is time to give up your place and return to the boat. The safety diver is there, not because of the hammerheads who often roam around behind you, but because of the bull sharks that are also quite common in Bimini. The reality is that any real danger in Bimini comes from those bull sharks rather than the great hammerheads—hence the safety diver.

All this occurs in about 12m of water, so air consumption is minimal. Decompression is not really an issue, so the show goes on all day. But interestingly, the first hammerheads only show up about ten in the morning, so it is a leisurely start every day.

During the day, it is very easy to become lulled into a false sense of security, as the hammerheads appear out of the distant blue, sashay in towards the bait box where they basically take the offered bait and then exit to the

Divers photograph hammerheads as they approach the feeder; Staff prepares chum for shark-feeding dive (top right)

Great hammerhead shark exits the feeding area on day dive (left)

Hammerheads

After dark

On one particular day, we kept up the rotations till late afternoon. Then, after a break and change of tanks, all 12 participants entered the water together for the dusk night dive. This time, there were two feeders, but we followed the same routine of rotating positions, so that everybody got a turn next to the bait box.

There were two very noticeable differences from the daytime petting zoo to which we had all become accustomed. First, the hammerheads were much more active and far more aggressive at night. Instead of the slow sashay along the bottom towards the bait box, if you are next to the bait box, the shark is chomping away right in front or on top of you—at which point, you are sincerely grateful that your camera housing is made of aluminum.

Nine times out of ten, the feeder flicks the bait upwards, and the shark gets it with the first chomp. But things can get a bit hectic around the bait box, and when they do, you really do know it was the right decision to bring that big DSLR.

left or right. After the first day or so, and the initial excitement has dissipated somewhat, it all seems very predictable and seems a bit like a petting zoo—and then you do the night dive.

Feeding time

The job of distributing the pieces of fish on any shark feed is clearly somewhat of a fairly high-risk endeavour, but with the great hammerheads, it takes on quite another dimension. As the shark approaches the feeder, it can see the offered bait, and at the last minute, the feeder flicks the bait slightly to the left or the right so that the participant at that side will get an up-close and very personal photo opportunity.

The shark sees where the bait goes and turns, but at that point the bait usually disappears under its mallet-shaped head, so it instinctively chomps away till it bites on the bait. The issue is then that

Hammerheads approach the feeder on a night dive (above, left and top right)

Divers photograph a great hammerhead shark as it turns after being fed (right) and exits the feeding area (lower right); A hammerhead approaches the feeding area (below)

they came in quite fast and at chest height. Their body language was completely different, and I have to say, it was all a bit intimidating. The experience reinforced the fact that we were interacting with wild animals and we were completely in their space.

Secondly, while we had been repeatedly warned about bull sharks, I do not think any of us actually saw any during the day. That changed completely as dusk fell and we could see them cruising the feeding zone in the distance, but ominously coming closer each time.

The feeders would bang on the bait box to scare them away, but within minutes they would be back doing the same thing. However, as night fell, it became harder and harder to see where the bull sharks were, and then it dawned on me that if they were sneaking towards us from the front, there was a distinct possibility they were doing the same behind us.

As you can probably tell, I am not a great fan of bull sharks, and I personally consider them the most dangerous and unpredictable of all sharks. So, it was a case of being glad when our group had had enough, we got the signal that the feed was over, and it was time to head back under the boat.

We had been given very strict instructions that only two people at a time were to be at the surface behind the boat at any time, and we were to get out of the water as quickly as possible because of the presence of bull sharks. It was with great relief when my turn came, and I produced an Olympic-like performance to get out of the water in record time.

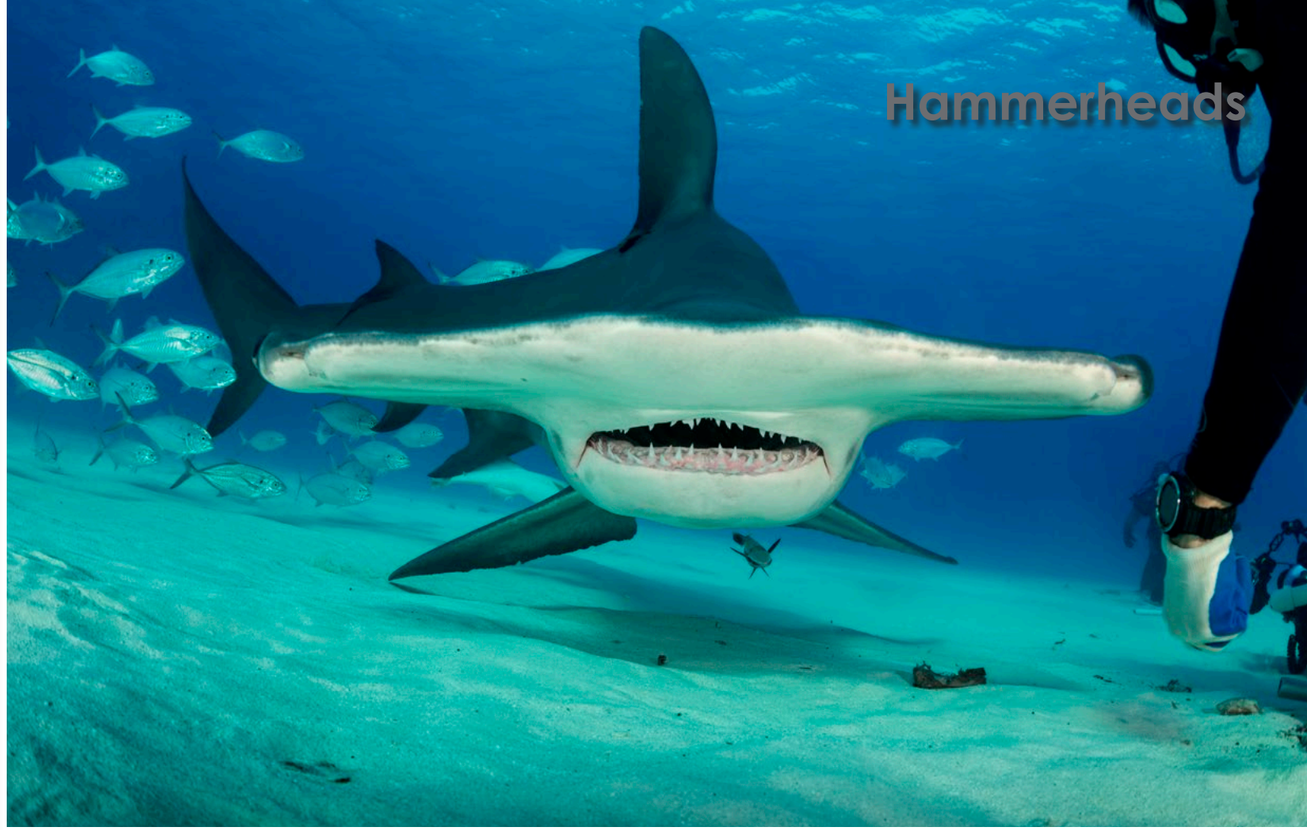
The ethics of it all

Feeding sharks as a tourist attraction is a contentious subject, and there are two basic schools of thought about its overall wisdom. The naysayers are adamant that it induces dangerous behavioural changes in the sharks by conditioning them to approach humans for food and therefore promoting the same (potentially) dangerous behaviour that occurs when bears, lion or crocodiles are fed.

The argument goes that sharks will be unable to differentiate between an encounter where they will be fed and one where they will not—thereby greatly increasing the risk to humans. The counterargument being the benefits that flow to the local communities from the tourism revenue and the lack of any substantial evidence of behavioural change. There is no real data to support either case, so we are firmly in the realm of anecdotes and opinions.

However, given that his life's work has been the study of sharks, the opinion of Doc Gruber deserves to be heard, and like most things from him, it is very clear. "The relative risks are nil, and the relative benefits are great" is how he describes it, while conceding that there is "some alteration of the shark's behaviour, but it is not significant, and normal patterns of migration are not impacted."

In other words, the availability of food in South Bimini during the main great hammerhead dive-tourism season does not change the way that the sharks behave



A great hammerhead shark turns after being fed

overall. They turn up at the feeding stations for a snack, but continue to do all the other things they normally do. Plus, there is no evidence at all of increased aggression towards humans from the feeding of the great hammerhead sharks.

All that said, perhaps the biggest impact from these unique in-water encounters is that virtually all of the participants leave the Bahamas as confirmed shark ambassadors, which has to be a good thing, given the ridiculous and irresponsible media coverage given to sharks generally.

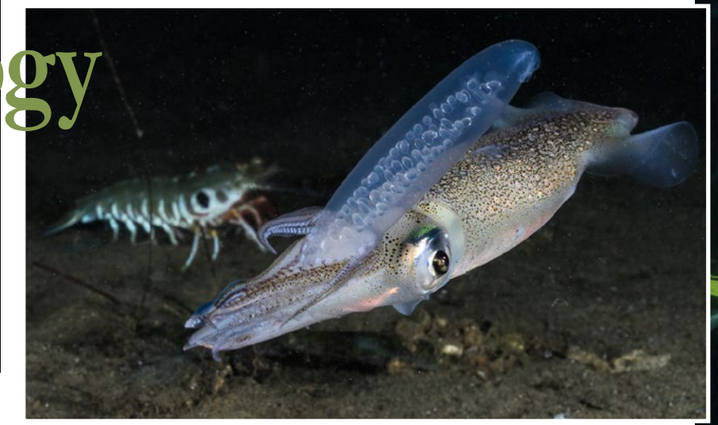
Sharks have an incredibly significant role to play in the ocean. Without them, the dead, the dying, the diseased and the dumb of the oceans can pollute and degrade the health of those ecosystems and the genetic quality of its inhabitants. The many species of sharks are there for a reason, and they have 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. The impact of shark finning in the Caribbean illustrates the impact of such cascades extremely well, for when the shark population declined, it removed one of the natural limitations on the number of groupers in those waters.

Groupers have voracious appetites and also breed rapidly, but a healthy shark population would keep overall numbers in check and maintain that fine balance. But as the number of sharks declined, it allowed the number of groupers to increase, which subsequently consumed a disproportionate number of reef fish. This meant that the naturally occurring algae was no longer being consumed, and so the reefs started to die.

There is no quick fix for these events, because sharks grow slowly, mate intermittently, have long gestation periods and do not mass produce their young. But all that gets lost in the hype that sharks generate, and the only way to really put it back in perspective is to see them in their own space. Simply stated, South Bimini is the best place to do that, with the very special creature that is the great hammerhead! ■

*Asia correspondent Don Silcock is based in Bali, Indonesia. His website, **Indopacificimages.com**, has extensive location guides, articles and images on some of the best diving locations in the Indo-Pacific region.*



Portrait of a female squid ready to attach her egg case to the substrate

Southern California's

Market Squid Run

Text and photos by Brent Durand

Most years, Southern California on the US west coast is the site of a special marine life aggregation, treating locals to one of the most unique dives in the world. Hundreds of thousands of market squid (*Doryteuthis opalescens*) swim into recreational dive depths to mate and lay an expansive canvas of egg baskets (collections of eggs) across the sandy substrate. Because so many squid can be present, and because they are attracted to divers' torches, the dive is spent immersed in a cloud of these small, excited squid.

The excitement of the squid run is apparent in the frenzied mating behavior of the species, which is just one of the highlights of this night dive.

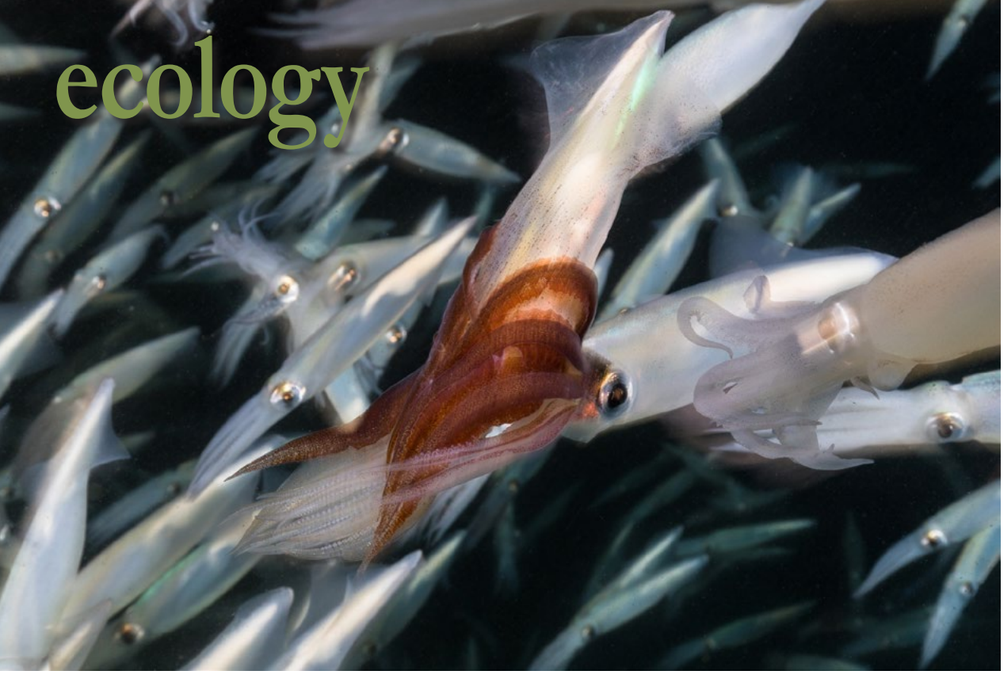
Scuba diving the market squid run is an incredibly unique dive experience.

The squid run is hard to predict but usually occurs in December. Avid divers surveying the canyons will see indicators of a pending squid run: a lone squid or two during a night dive, solitary egg cases attached to the substrate here and there, and moon phase clues. The most popular area for divers to experience the event is the submarine canyon of Redondo Beach in Los Angeles, as it is a very accessible night beach dive.

The market squid are a nearshore species that live six to nine months and spend most of their time at deep depths, migrating vertically at night to hunt. The eggs will hatch anywhere between two to four weeks after being laid. Since the long cases are attached to the sand (in groups called baskets), the surge from ocean swell will oxygenate the eggs naturally.

Diving the squid run

A squid dive begins like any other night beach dive in Redondo—gearing up in a parking lot. The difference is that there is an electric excitement in the air, more divers are present, and you are sure to encounter friends preparing for their dive. Squid fishing boats sit offshore over 60m of water—beyond the reach of divers (market squid fishing is a major commercial fishery in California). Only a gentle staircase and 30m of sand separate divers from the ocean.



THIS PAGE: In the mating aggregation, male squids lunge after female squids—often three or four per female. The male's tentacles turn crimson red when it has successfully paired with a female, in order to warn other males to stay away. A stingray hunts squid in the swarm (right)

The squid lay eggs up to about 20m, so divers get a chance to enjoy a descent down the steep sandy slope of the submarine canyon before starting to spot the white egg baskets. At first, a few squid approach, but before long, divers will become engulfed in a pulsating cloud of white market squid. But this is a mating aggregation; the male squid are constantly lunging after female squid—sometimes three or four at a time. When a male squid successfully pairs with a female, his tentacles will turn crimson red to warn other males to stay away.

This cloud of squid is the highlight of the dive, but there is so much more action during the squid run. Female squid streak low across the sand while trying to lay and place their egg cases into an egg basket. Shrimp, crabs, rays, and even small sharks join the party, becoming so full of food they are lethargic. Divers who venture off the sand into more open water may even hear the sound of hunting dolphins, and with that, rapidly passing shoals of squid that dart one way and then the other. It is spectacular.

Photographing squid

Photographing the squid run is deceptively challenging. Strobes must be positioned to avoid thick backscatter, and oftentimes the density of squid bodies blocks strobe light from reaching the subject. The fast movement of the squid and the layers of subjects make one want to point and shoot; however, this technique often renders the subject squid out of focus. Shooting macro views of the eggs also proves challenging, as the cases can sway back and forth by 10-20cm in the surge, making focus and composition a very fluid exercise.

Before long, it is time to ascend up the canyon slope into shallower water. The squid will follow dive torches to a point, but then turn around and go back to their business. Crabs run across the sand, rays watch carefully, and divers chimp through photos as they off-gas on the way to the surface and the lights of the Redondo Beach Pier. ■

Brent Durand is a freelance underwater adventure photographer and writer. His work is published in print worldwide, in advertising and across the web in a variety of outdoor industries. Durand presents regularly on photography technique and has a reputation for writing insightful yet simple camera gear reviews. He leads several photo workshops every year and writes a newsletter containing underwater photo tips and tutorials. Durand is also the creator of We All Roam, an adventure travel concierge providing expert advice and local knowledge to help you plan and book the perfect dive trip. See more of his work at: ***BrentDurand.com****.*

DAN Safety

Lessons Learned

Sponsored content by DAN

Hindsight is 20/20, but it rarely helps to predict the future—except in the world of incident analysis. Introspective analysis is one of the strongest tools that we have as a community to improve dive safety. By analyzing the incidents that occur to divers, we can effectively tend to dive injuries and respond to real incidents occurring across the globe. For three decades the researchers at DAN have monitored, tracked and analyzed diving incidents and fatalities worldwide. One of the best sources of this incident data is you, the diver. When you self-report an injury or incident that you experienced or witnessed via the DAN Incident Reporting System, you offer a valuable look at real world diving incidents and injuries.

For this issue of *X-Ray Mag*, we wanted to share this incident from an extremely experienced CCR diver who developed immersion pulmonary edema (IPE) at nearly 300 FSW. While we may not all be able to perform that dive ourselves, it is entirely possible that we could suffer similar symptoms at much shallower depths, and we can prepare ourselves to respond to symptoms of IPE by learning how she handled her incident. Read this divers story, and use it to keep yourself safe in the water this winter.

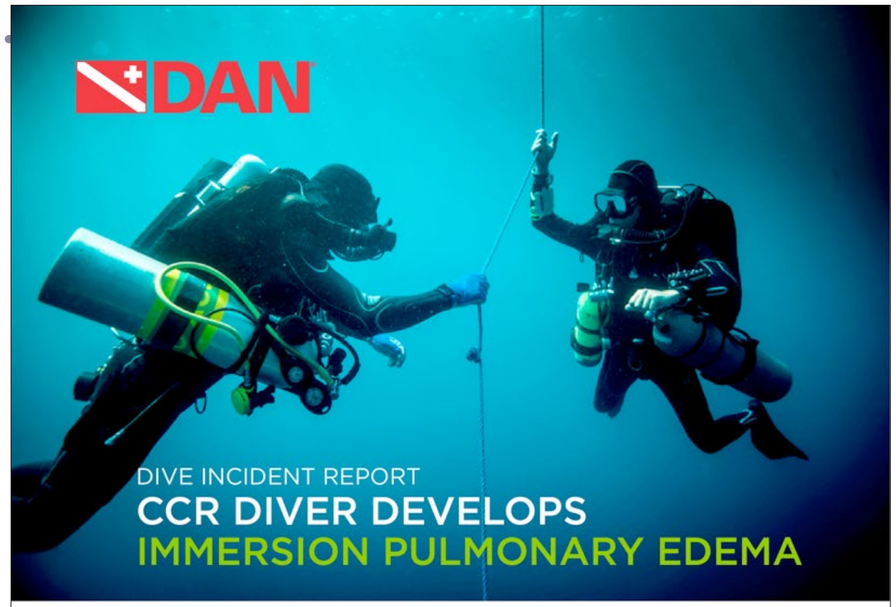
Diver Incident Report Synopsis:
With cold conditions reported on the bottom, this diver borrowed a 5mm wetsuit and hood to replace the 3mm wetsuit she had initially intended to use. Her buddy wore a drysuit. Both divers were using closed circuit rebreathers, and carry two open circuit bailouts containing 15/50, and 50/10. The planned dive was a 10-15 minute bottom time at 291 FSW with a direct descent, and free ascent.

The initial descent was uneventful, with a thermocline noted at 186 FSW, and a bottom temperature of 52ºF. The dive plan was to swim along the bottom until one diver became too cold, and then ascend. After a few minutes at depth, this diver reported feeling a tickle in her throat and coughing a few times. The diver then coughed once or twice a minute for about ten minutes. Coughing is abnormal for this individual, who is an endurance triathlete and in excellent physical shape. After approximately 10 minutes, coughing worsened and the diver reported feeling like she was working and breathing hard. At this point, the diver also began to feel cold and signaled her buddy to ascend.

During the ascent, at approximately 200 FSW, the diver experienced a gurgling noise upon inhalation, and reported that it felt like she was gargling water right behind her Adam's apple. In addition, the coughing continued. At this point in the dive, both the diver and her buddy had 52 minutes of decompression remaining, and the diver decided to minimize exercise and finish as much of that decompression as possible before symptoms could worsen and force an ascent.
At their first decompression stop around 90 FSW, the divers ascended into warmer 86°F water. The coughing and gurgling symptoms continued, and by the time the diver had reached her 70 FSW stop she was having a difficult time breathing and felt like she was overheated. Too task-loaded to take it off, the diver cut off her hood with scissors to remedy the situation, and continued to minimize movement and focus on her ability to breathe.

At 30 FSW, it became apparent that the diver's buddy did not know she was in trouble, and so the diver signaled that she was "badly bent" on a slate, and had the buddy deploy a yellow surface market buoy, a predetermined emergency signal that had been discussed with the charter boat crew. The crew responded by sending a safety diver into the water with a bottle of oxygen, which the diver refused for fear of compromising her buoyancy and making her exercise more.

The diver did manage to complete her decompression despite the coughing, and spent an additional 10 minutes at her last stop depth. Upon surfacing, the diver was removed from the water, stripped of her equipment, and placed on emergency oxygen while being transported in a waiting ambulance, and then to a local hospital. Symptoms did begin to improve upon surfacing, although they did not abate entirely. X-rays confirmed pulmonary edema, and the diver was kept for observation in the hospital overnight, and released the next day. The diver reports that the outcome was good, and there are no lingering issues. To read the diver's full report, visit: **DAN.org/diving-incidents**



DAN Expert Analysis:
This diver was experienced but improperly prepared for the thermal stress of the dive. The equipment improvisation may or may not have contributed to the event, but fit issues did add some discomfort as evidenced by actions taken during ascent. The diver was generally cool-headed and exercised good judgment in what would undoubtedly be a stressful situation. With the support of her buddy, she likely avoided a much more complicated outcome that would have arisen following an abbreviated or aborted decompression.

The key weakness in this case was likely communication, with contradictory messages leading to confusion for both the buddy and the surface team. Expecting some degree of confusion in any evolving case, the need for clear, ongoing and flexible communication is clear. Divers often focus on decompression stress, but it is important to remember that a variety of problems may arise.

Immersion pulmonary edema results from a combined effect of increased central blood volume and increased work of breathing. Central blood volume is increased by immersion, cold stress and possibly high levels of fluid intake. Work of breathing is increased by the breathing circuit, body position, gas density and physical exercise and stress. Problems are more likely to arise when multiple factors, possibly each modest individually, act together.

To report a diving incident, visit **DAN.org/research/IncidentReport.** For more information on IPE and diving, visit **DAN.org/Health**.

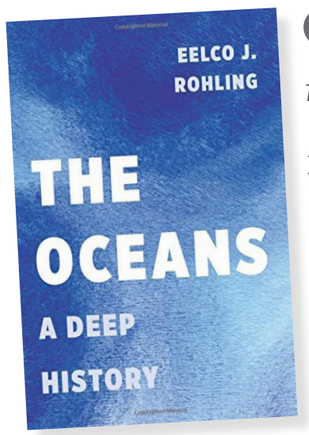
media

Indian Ocean

Indian Ocean, by Stefan Loiperdinger

With key information about six destinations in the Indian Ocean, author Stefan Loiperdinger has compiled a new, carefully researched and curated, magnificently-illustrated coffee table book covering the beautiful islands and 46 luxury resorts and hotels in the region. Available at: **Indianocean.de**.

Hardcover 480 pages
Language: English and German
Publisher: Travel Publishing GmbH
Date: 26 October 2017

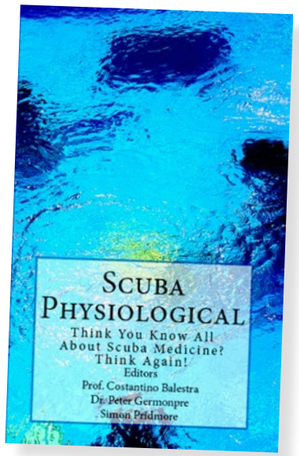


Our Oceans

The Oceans: A Deep History, by Eelco J. Rohling

Author Eelco J. Rohling takes readers on a 4.4-billion-year journey of Earth's oceans, beginning with the formation of primeval Earth and the earliest appearance of oceans, through the oceans' evolutionary history to the breakup of the Pangaea supercontinent and today's changing climate. By exploring the inter-relationships of the oceans, climate, solid Earth processes and life, he provides perspective on our impact on the health and habitability of our planet and what the future may hold. As an introduction to the science of paleoceanography, this book enables readers to form their own opinions about the current environmental challenges faced by humanity.

Hardcover: 272 pages
Publisher: Princeton University Press
Date: 5 December 2017
ISBN-10: 0691168911
ISBN-13: 978-0691168913



Dive Medicine

Scuba Physiological: Think You Know all About Scuba Medicine? Think Again!
by Simon Pridmore

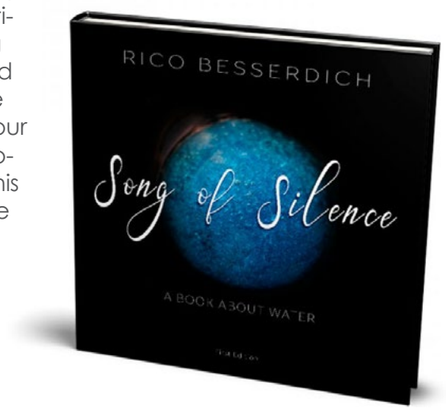
Even after 170 years of research, decompression sickness and decompression stress is still a mystery, and much of what is taught about it in dive training agencies' textbooks is over-simplified and outdated. This must-have book presents the new science in the field of decompression research in a more accessible format for divers. *Scuba Physiological* provides divers with a good summary of what is known and where the current science is taking us, as well as some good tips on how to make us all safer divers today. Available on **Amazon**.

E-Book File Size: 2136 KB
Print Length: 189 pages
Publisher: Sandsmedia
Date: 1 December 2017
ASIN: B07859DVJF

Underwater Realm

Song of Silence, by Rico Besserdich

Song of Silence is an art book that will take you on a journey into the essential, ineffable beauty of the mighty element, water. Combining arts, science and philosophy, this unique art book takes readers on a journey, exploring the relationship between humankind and water. Its vision of global unity is personified through the voices of 97 individuals from 47 countries, from all walks of life, who have contributed their personal thoughts about the beauty and significance of water. In the author's own words: "Mother Nature is the greatest artist and water is one of her favourite brushes. The element of water alters our vision and impressions. Known forms transition into new, unique and often startling creations, often beyond our expectations." *Song of Silence* was officially released at the Nobel Museum, Stockholm, Sweden, in November 2017. It is available for purchase at: **songofsilence.com.**



Hardcover: 132 pages
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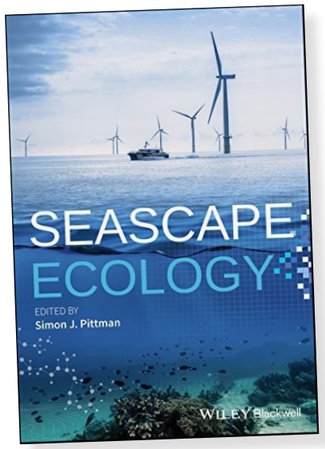


Seascape Ecology

Seascape Ecology,
edited by Simon J. Pittman

This book explores the science in the application of landscape ecology to the seas. It presents the principles, concepts, methodology and techniques informing seascape ecology and reports on the latest developments in the application of the approach to marine ecology and management. Comprising contributions from researchers at the forefront of seascape ecology, it is a useful reference for researchers, professionals and students in related disciplines like marine biology, environmental science, geosciences, marine and coastal management, and environmental protection.

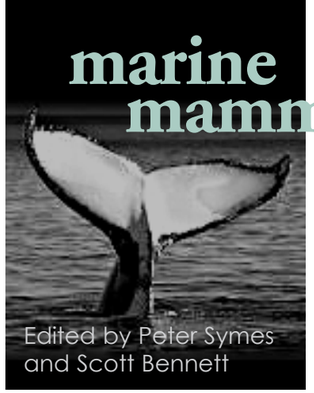
Paperback: 528 pages
Publisher: Wiley-Blackwell
Date: 8 December 2017
ISBN-10: 1119084431
ISBN-13: 978-1119084433

Macro Life

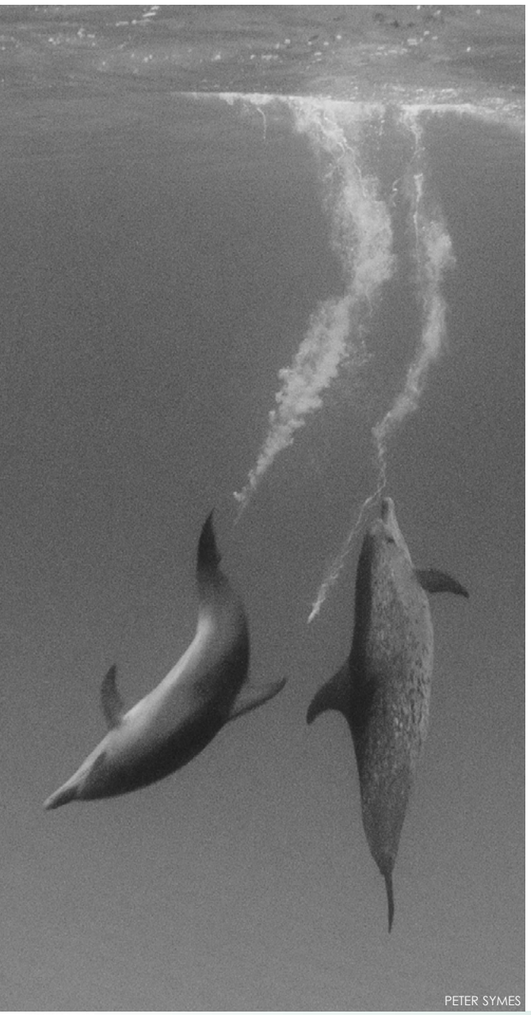
Evolutionary Ecology of Marine Invertebrate Larvae, edited by Tyler Carrier Adam Reitzel, Andreas Heyland

Many of the organisms in the ocean reside in pelagic form, and marine invertebrate larvae comprise an integral part of this pelagic diversity. Researchers have studied these organisms for centuries, and this book provides an essential modern update on larval ecology, integrating it with life history theory, evolutionary developmental biology, and modern genomics research. The content is divided into four areas: evolutionary origins and transitions in developmental mode; functional morphology and ecology of larval forms; larval transport, settlement and metamorphosis; and climate change and larval ecology at the extremes.

Hardcover: 352 pages
Publisher: OUP Oxford
Date: 7 December 2017
ISBN-10: 0198786964
ISBN-13: 978-0198786962



Whales and dolphins can naturally muffle loud sounds


PETER SYMES

Researchers have discovered four whale species and dolphins that seem able to dial down the sensitivity of their ears. This could potentially shield the animals from navy sonar and oil drilling, linked to at least 500 deaths since 1963.

Many species of whales and dolphins have supersensitive hearing because they use sound to navigate, a process known as echolocation. They make clicks that they are able to hear bounce off objects as small as a ping pong ball 20m away. Some hear high-pitch frequencies up to 100 kilohertz (kHz), which is about 80 kHz higher than the upper limit of human hearing.This makes them particularly susceptible to loud blasts of sound in the ocean.

In 2008, researchers at the University of Hawaii began to suspect some marine mammals could protect their hearing naturally. The team used suction cup electrodes to study marine mammal brain activity during echolocation. Their captive false killer whale heard her outgoing clicks at a quieter level than equivalent signals presented right in front of her, indicating she could adjust her hearing sensitivity when she knew the impending sound would be loud. Her hearing sensitivity increased when her trainers asked her to find something far away.

The team collaborated with scientists from Russia and the Netherlands to study this effect in a bottlenose dolphin, a harbor porpoise, and a beluga whale, in addition to extending the study on the false killer whale. The animals' brain activity was measured while hearing sounds loud enough to evoke a response, but below the threshold of causing temporary hearing loss. Each of the captive animals learned to reduce its hearing sensitivity by 10 to 20 decibels when the scientists played a warning signal before producing the loud sound. ■

SOURCE: SCIENCE MAGAZINE


PXHERE.COM / CC0 PUBLIC DOMAIN

(File photo) Bottlenose dolphins are the most common members of the family Delphinidae,

First resident pod of bottlenose dolphins discovered off England

Although England's South West is regarded as a cetacean hotspot, little was known about the bottlenose dolphins glimpsed off the coast. New research has revealed the region is home to a resident population of bottlenose dolphins, the first and only such community identified in English waters.

The study was conducted by Rebecca Dudley, currently pursuing an MRes at the University of Plymouth, who has been analyzing sightings and photographs of dolphins in the region.

From thousands of records, Dudley identified 98 individuals and defined a distinct social group of 28 resident dolphins, present throughout the year in shallow coastal waters around the South West. This discovery could have significant implications for the conservation of these animals, which currently receive no specific protection in their home range.

More research needed

"This research is proof that we have a resident population and is incredibly exciting. Further work is needed but this is a huge step forward and I am proud of what our partnership between Cornwall Wildlife Trust, scientists and boat operators has achieved," said Ruth Williams, Marine Conservation Manager at Cornwall Wildlife Trust. "The future of these iconic animals is in our hands and we need to make sure the few we currently have in the South West are given the protection not just to survive, but to thrive."

As dolphins are wide-ranging, strong evidence is needed to show that an area is important before protection can even be considered. The United Kingdom's two other resident bottlenose dolphin populations (in the Moray Firth, Scotland, and in Cardigan Bay, Wales) have both received protection. Bottlenose dolphins in the South West face several threats, including pollution from plastics and chemicals, injury by fishing nets, and disturbance from recreational activities. ■

SOURCE: UNIVERSITY OF PLYMOUTH

Seal whiskers have been found to have a peculiar three-dimensional structure that minimizes vibration and drag.

Seal whiskers inpire high tech

Studying nature's engineering solutions can not only improve existing technologies but provide us with brand new ones. Research published by Cleveland engineers in the US state of Ohio has revealed how a seal's whiskers could teach us how to build bridge struts and oil wells that last longer underwater.

Detecting devices

"There's a lot that we can learn if we just take a moment to look at nature," said Aidan Rinehart, an author of the Cleveland University paper and a classically trained engineer. Rinehart is figuring out how seals manage to detect predators and prey with their whiskers while avoiding the difficulties that plague our underwater technology. When water flows around an irregular structure, it forms a zigzag wake that makes the structure rattle. These vibrations damage almost everything we put in the water, from the columns of wind turbines to the risers on oil rigs. British Petroleum estimates that countering the damage gobbles up 10 percent of their multi-billion-dollar budget for deep-sea projects.

Steady does it

A seal's underwater acrobatics should cause its whiskers to vibrate so intensely that outside disturbances would be undetectable, but they do not. If we understood why, we might be able to build underwater structures that work better and last longer.

By holding its whiskers perfectly steady, the seal can detect tiny swirls of turbulence that would otherwise be invisible. As a fish swims, a defined current unfolds in its wake, undulating through the water like a cracked whip. To a seal, this trail is as easy to follow as the track a snake leaves in the dust. "It's like a signature," said MIT's Michael Triantafyllou. "They can tell what it is at a distance."

Undulating structure

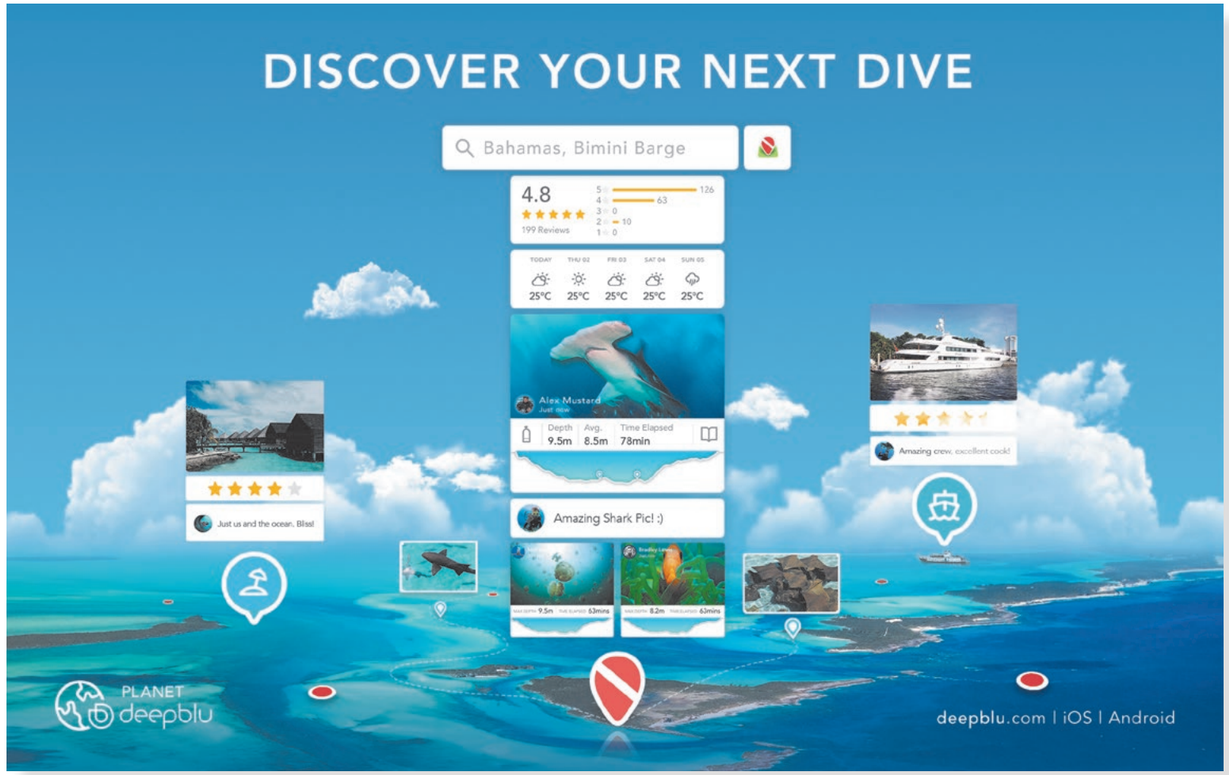
It is the undulations in seal whiskers, which is the key to their remarkable stability. Rinehart's recent paper focuses on finding the exact parameters of the whisker, so they can be applied to human technologies.

Learning from nature

The result of millions of years of natural selection, a whisker's proportions are precisely what several different groups of engineers had calculated to be ideal for reducing vibration. It seems evolution and human problem solving had the same solution.

"There's this small aspect of this really complex geometry that's found in nature, and it just so happens to match—it's dumbfounding," Rinehart said. "There's some really amazing things happening in nature, and we don't even really know most of the time." ■

SOURCE: INTEGRATIVE ZOOLOGY.



Sea lions are equipped with a highly sensitive array of whiskers that, while not having quite the complex structure found in seals, also allows them to detect disturbances from afar or zero in on the wake of their next meal. The follicle of each whisker is connected to many nerves, allowing an animal to "feel" its surroundings by picking up tiny vibrations in air or water.

PETER SYMES

Tiger shark and bed of seagrass, Grand Bahama

Why tiger sharks are good for seagrass and the environment

Scientists have discovered that tiger sharks are aiding in the regrowth of seagrass beds by scaring off grazers such as dugongs.

When factors such as heat waves destroy seagrasses, sharks become critical for ecosystem health. Where tiger sharks rove seagrass beds, dugongs and other shark prey steer clear. That keeps seagrasses—which these grazing prey like to eat—from being completely eaten away.

Seagrass is essential to the fishing industry. Found in salty and brackish waters worldwide (except Antarctica), seagrass generally grow at depths of one to three meters where there is sufficient light. They provide shelter for marine animals. By providing a three-dimensional structure in an otherwise barren sea, seagrasses provide the perfect hiding place for fish and invertebrates such as crabs, shrimp and clams. "In developing countries, this is of major significance for food supply and livelihoods, where everything can be caught, eaten or sold. In developed countries, seagrass fisheries are exploited more for recreational purposes or are highly species specific—for example, clams," said Dr Leanne Cullen-Unsworth, from Cardiff University's Sustainable Places Research Institute.

Carbon sink

Seagrass beds also store vast amounts of carbon—known as blue carbon—and help to offset greenhouse gas emissions and climate change. Although seagrass meadows occupy less than 0.2 percent of the world's oceans, they are responsible for more than 10 percent of all carbon buried annually in the sea. Per unit area, seagrass meadows can store up to twice as much carbon as the world's temperate and tropical forests. Coastal seagrass beds hold up to 83,000 metric tons of carbon per square kilometer, mostly in the soils. beneath them. ■

Form and function: Why are not all sharks streamlined?

After studying the body composition of 32 shark species, a team of researchers has concluded that sharks have managed to evolved different physical attributes based on the ecosystems they live in.

Large livers, bulky bodies

For instance, sharks that live in dark, cold and nutrient-poor oceans (like the bramble sharks or birdbeak dogfish) have big fatty livers that make up more than a quarter of their bodies. As a result, they are bulkier and less hydrodynamic. Nevertheless, they are able to survive because in their part of the world, slow swimming is the order of the day—for both the predator and the prey.

"They are the zeppelins of the shark world, cruising near effortlessly at low speeds to save energy," said biologist Adrian Gleiss, PhD at Murdoch University Centre for Fish and Fisheries Research. He is the lead author of a paper describing the findings of his team's study, which was recently published in the *Proceedings of the Royal Society B* journal.

Small livers, fast swimmers

At the other end of the scale are sharks with smaller livers—they are negatively buoyant and therefore have to swim fast so that their fins can provide sufficient lift. Such species had evolved a more efficient body that could maximise their energy expenditure.

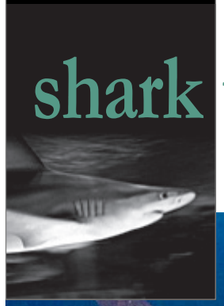
Jean Potvin, PhD, professor of physics at Saint Louis University, elaborated: "As with the sharks inhabiting shallow waters, trying to fly zeppelins at the speeds and accelerations common to fixed wing aircraft of same the weight class would require significantly more energy, unless that is, it is reshaped into a more javelin-like body."

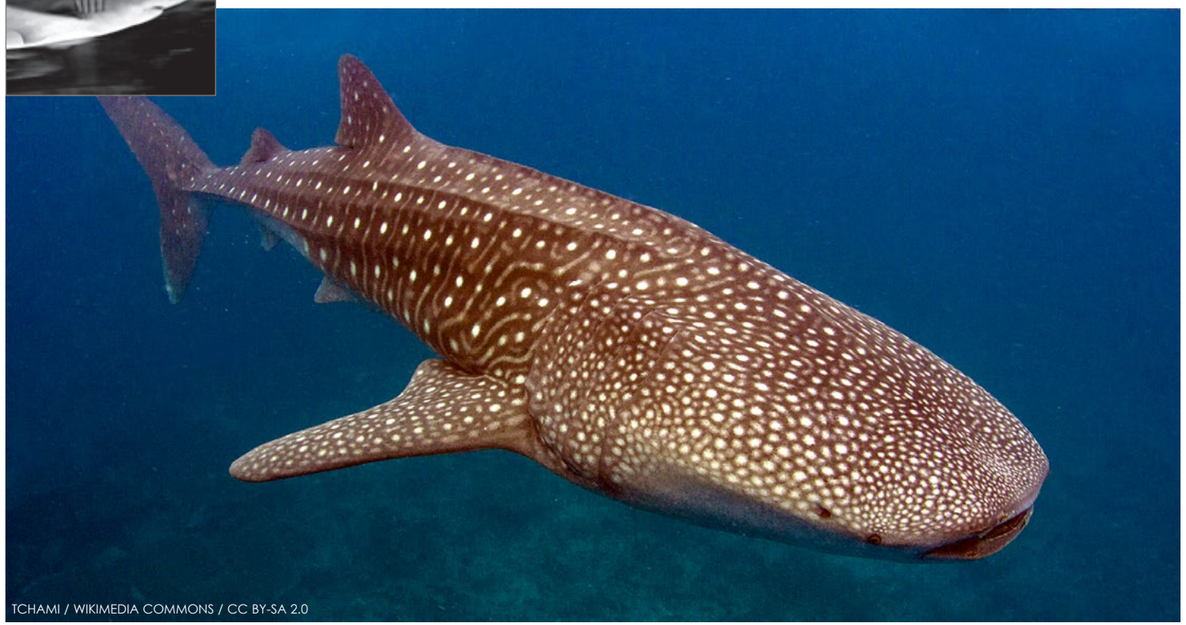
"It would follow that slimmer, and thus more hydrodynamic sharks will require less energy for swimming at the high speeds necessary to catch agile prey, especially in environments where fast swimming is common," she added.

This study has shed light on how the environment has shaped the evolution of marine fish from bottom-dwelling to those capable of swimming at a range of depths. "It is incredible to think that many hundreds of million years ago, the early ancestors of fish only lived near the sea bed, sporting heavy armour that prevented them from swimming in mid-water," said Gleiss.

"Sharks represent a relic of this time and were probably among the first fish to exploit most depths of the ocean. Our study contributes to our understanding of the evolutionary processes that led to them being such a successful group." ■ SOURCE: PROCEEDINGS OF THE ROYAL SOCIETY B

The shortfin mako is on record as the fastest-swimming shark, capable of bursts of speed up to 68 km/h (42 mph).





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Each whale shark has a unique pattern of lines and spots.

Astronomy software used to track whale sharks

Spots on whale sharks are being used to identify and track individual whale sharks worldwide, thanks to an algorithm developed by NASA that was originally used to track star patterns.

An algorithm developed by NASA to study star patterns in the night skies is being used to track whale sharks in the oceans in a bid to learn more about them.

It relies on citizen science: Divers who encounter whale sharks when diving would send in photos of the animals to the Wildbook for Whale Sharks website. The algorithm then tries to match the whale shark in the submitted footage with previously submitted photos in the database, compiled over the years.

Whether or not a match is found, the new image will be added in the database for future reference. This system, called the Wildbook for Whale Sharks, is a visual database of whale shark encounters and individually catalogued whale sharks.

How does the match occur?

Well, according to its website: "The Wildbook uses photographs of the skin patterning behind the gills of each shark, and any scars, to distinguish between individual animals. Cutting-edge software supports rapid identification using pattern recognition and photo management tools."

"That pattern is like a fingerprint, it's unique to each individual, so we're actually tagging the whale sharks without touching them," said Bradley Norman, a marine conservation biologist. He is the lead author of a paper in the 29 November issue of the *BioScience* journal, which focused on how the algorithm has been used to track whale sharks all these years.

To date, almost 30,000 whale shark encounter reports from 1992 to 2014 have been recorded, with more than 6,000 individuals identified from 54 countries. ■

SOURCE: WILDBOOK FOR WHALE SHARKS

Nova Scotia's great white shark mating hot spot

Great white sharks recently tracked in Nova Scotia waters may offer insight into the elusive mating habits of these majestic creatures. Based on the research group Ocearch's findings, shark migration patterns in Nova Scotia's southern waters are consistent with there being a breeding site in the area, according to Ocearch founder Chris Fischer, which could mark an important step towards unravelling the mysterious mating habits of great white sharks.

For scientists like Fred Whoriskey, executive director of Dalhousie University's Ocean Tracking Network, the fact that great whites come to Nova Scotia may be an indication it is a place for males and females to mingle. Fischer said the great whites are the "balance keepers" of a range reaching from Newfoundland to Florida. If the white sharks are not there, the seals can just go out and scavenge the entire region at their leisure and tend to wipe out shellfish populations and a lot of fish we count on as food sources. ■

Western Australia is Australia's great white shark hot spot

According to Australia's Commonwealth Scientific and Industrial Research Organisation (CSIRO), there are no reliable estimates of white shark population sizes or trends in Australian waters, but genetic evidence suggests there are two populations of white sharks in Australia: an eastern population, ranging along the eastern coast from Tasmania to central Queensland; and a western population, ranging from western Victoria to northwestern Western Australia (WA).

The local abundance of white sharks in shelf and coastal waters varies from season to season and year to year due to variations in shark distribution and movement patterns.

Monitoring by CSIRO of acoustically tagged white sharks off Western Australia indicated that white sharks may be present off most of the southern and lower western coasts of WA throughout the year, although they are more likely to be encountered during spring and early summer and are least likely to be present during late summer and autumn.

The study also suggests there may be twice the number of adult great white sharks off WA's coast. ■

SOURCE: MARINE AND FRESHWATER RESEARCH

ANDREY BIZYUKIN

Great white shark

Training vs Experience

Text by Matt Jevon
Photos by Andrey Bizyukin

“Experience is what you get when you don’t get what you want.” It is an old and well-worn phrase, but is it true?

One of the most popular battles for arm-chair divers and Internet warriors is that of training versus experience. You hear it all the time: “I don’t need a certification card for that dive. I’ve been doing dives like that for years.”

The other popular assertion is that all those pioneers in diving got it all through experience: “No one was doing certification cards back then, and if it was good enough for them, well, then it is surely good enough for me!”

Finally, you hear the counter argument: “Yes, they may have all the badges, but I wouldn’t dive with them.”

There is a reason these debates go on and on, because frankly, what people are talking about is so vague, it staggers belief. Experience is not in itself meaningful, nor is it able to be measured in time or frequency (years or numbers). Here’s why.

Experience is of no use unless it has been developmental and you have learned from it. If the lesson kills you, then you were not ready to change and adapt to it. Remember, Darwin said it is not the survival of the fittest, but those most adaptable to change. It is badly, though not incompletely, related to time.

For example, 20 years diving is of no use if it has all been in the same patch of ocean and/or doing the same dives. You have one year’s experience repeated 20 times. Similarly, 100 dives that are all the same and that have gone well, even as an instructor, is not 100 dives worth of experience. It is one dive’s worth of experience repeated 100 times.

Being lucky and getting away with dives beyond training and experience based on ignorance or bravado is not big and not clever. We also know so much more about what works and does not these days, and training curriculums reflect the

Training vs Experience

hard and, in some cases, very final lessons that some of the early pioneers taught us. So, in today's world, experience without training is arrogant irresponsible, reckless and ignorant.

Training is no use unless it has been with the right instructor, and again, has been a learning and developmental experience. Simply muddling through a tick box exercise and a series of PowerPoint presentations on diving is not being trained. Nor is being bullied and beasted by the pseudo-military wannabees. (See the article on why training with some instructors might be a waste of time).

If you claim to have the training and show off all the badges but have no experience, then my first reaction is to question the quality and value of your training and to assume you are naive and impatient.

So, quality training and meaningful, relevant experience need to be combined, if you want a positive character assessment from me. Not that everyone would be too bothered, I suppose, by my opinion.

Regarding training agencies

So, let us look at the agency-bashing exercise the guy doing deco on his couch loves. Well, using generic definitions of training and experience, you can pick a standpoint and have an easy pop at most of them.

Effectively, the agencies have set themselves up to be shot at. They publish standards, both on training skills and competencies, as well as setting qualifying experiential criteria. Brave, but they are right—a line has to be drawn somewhere. But, as always, the devil is in the details.

Take the example of becoming a technical instructor, for instance. One agency is happy you start with only 25 deep dives and finish with 60; another wants over 100; others, more. The lower numbers might be okay if the dives were all meaningful, learning-experience dives—but they will not be in 95 percent of cases.

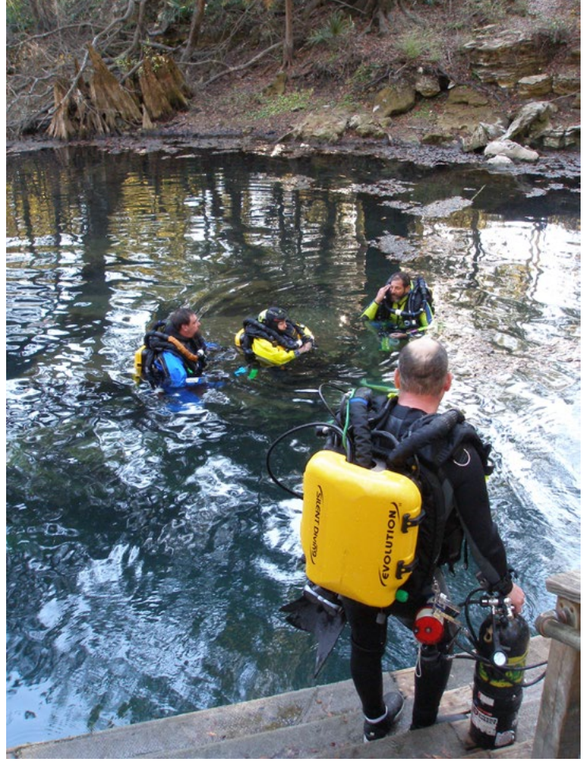
Past recreational dives are counted. Make sure the experience is not only meaningful but relevant. Recreational experience as an instructor is not relevant to technical teaching, even if you have been a recreational instructor for 20 years or more. Bear in mind, the largest group of deaths in cave diving is recreational instructors with no cave training or cave experience.

To me, qualifying experience dives to become a technical instructor should be signed off, dive by dive, with another technical instructor, or at the very least, a technical divemaster. They should be properly logged, with what was learnt from the dive, and any incidents recorded, including how they were managed.

What level can you teach?

I also believe you should not be able to teach to the level at which you are a diver. You should only be able to teach one below. So, for example you would not teach normoxic trimix if you were not hypoxic qualified. In this way, the qualifying number of dives could reasonably be, say, around the 100 mark. But they can all be assessed by an instructor trainer as to how meaningful they were. If the candidate did have the same dive repeated 100 times, then off they must go to get 99 more meaningful experience dives.

In this way, all divers—even if not aiming to become a technical instructor—can also get guidance and input on what training would be most meaningful for them. Technical training does follow a meaningful pathway with gradually increasing depths, gas and deco mixtures. But for some divers, the steps between each level can still be too big, depending on the level and quality of experience they have built up since



their last training, and depending on the quality of that training.

In recreational diving, the development is more ad hoc, with almost any agency programme. Divers jump onto specialties, like nitrox and wreck courses, before competency in the essentials of buoyancy, trim and propulsion have been mastered.

Experience acquisition

So, we are now faced with a conundrum. If experience is to be meaningful, it must expose the person to a learning experience, but ideally one that does not injure or kill them. To achieve this, the diver must take responsibility for and must plan their experience acquisition to at least the same detail as they plan their training progression. They should invest in the process of gaining experience, probably to the point where they spend more time, effort and money on gaining experience than they need to invest in their training.

Training courses can be anything from one to six days, typically. Between course experience in recreational diving, I would say a minimum 25 "meaningful" dives, and in technical diving, a minimum of 50 "meaningful" dives, should occur between diver level courses. This will, of course, take a lot longer than both agencies and divers themselves want, but it is, I feel, well-advised.

Quality inputs

You should also look for quality inputs into your diving, whilst the experience is being gained. How can you do this?

Firstly, mentors. Whether you chose your last instructor, or ideally, you choose your next planned instructor, ask them for help and advice on the dives you should do, whom you should do them with, and what conditions you should operate in. If not an instructor, then find divers who have both your respect and the respect of their peers, as well as a reputable agency for their dive certifications. Good sense suggests that you try to regularly use more than one mentor. When you find good mentors, keep them close, and keep asking them to help you develop meaningful experiences.

Secondly, teammates. Dive and dive often with people who are at a level or two above you, but are where you want to go. Watch them—from their preparation the night before to their routines, checks and preparation on the day, before and after the dive. Observe them in the water, and try to emulate what you think to be good practice. Ask them to explain different or unusual configuration

choices, and talk about planned responses to the unexpected. In short, soak up their experience and training. Log what you learned and note what you want to try out next.

Thirdly, variety. Within your current limits, and only at the edge of your comfort zone, get as much variety of diving as you can: warm to cold, current to calm, shore, boat and all varieties of scenic and wreck. Reflect on how you prepared for the dive and what skills, kit and configurations worked best or let you down. Reflection is the very best way of gaining meaningful experience (check out my past articles for some tips).

Fourthly, get some coaching. Do not think all development has to be independent experience or formal training. Work with a good mentor or instructor and take a day's coaching. Talk to your mentor about appropriate content. Share notes and reflections from your experience dives, so you can agree on what you will work on. It is a lot more fun than training, as there does not have to be formal assessment.

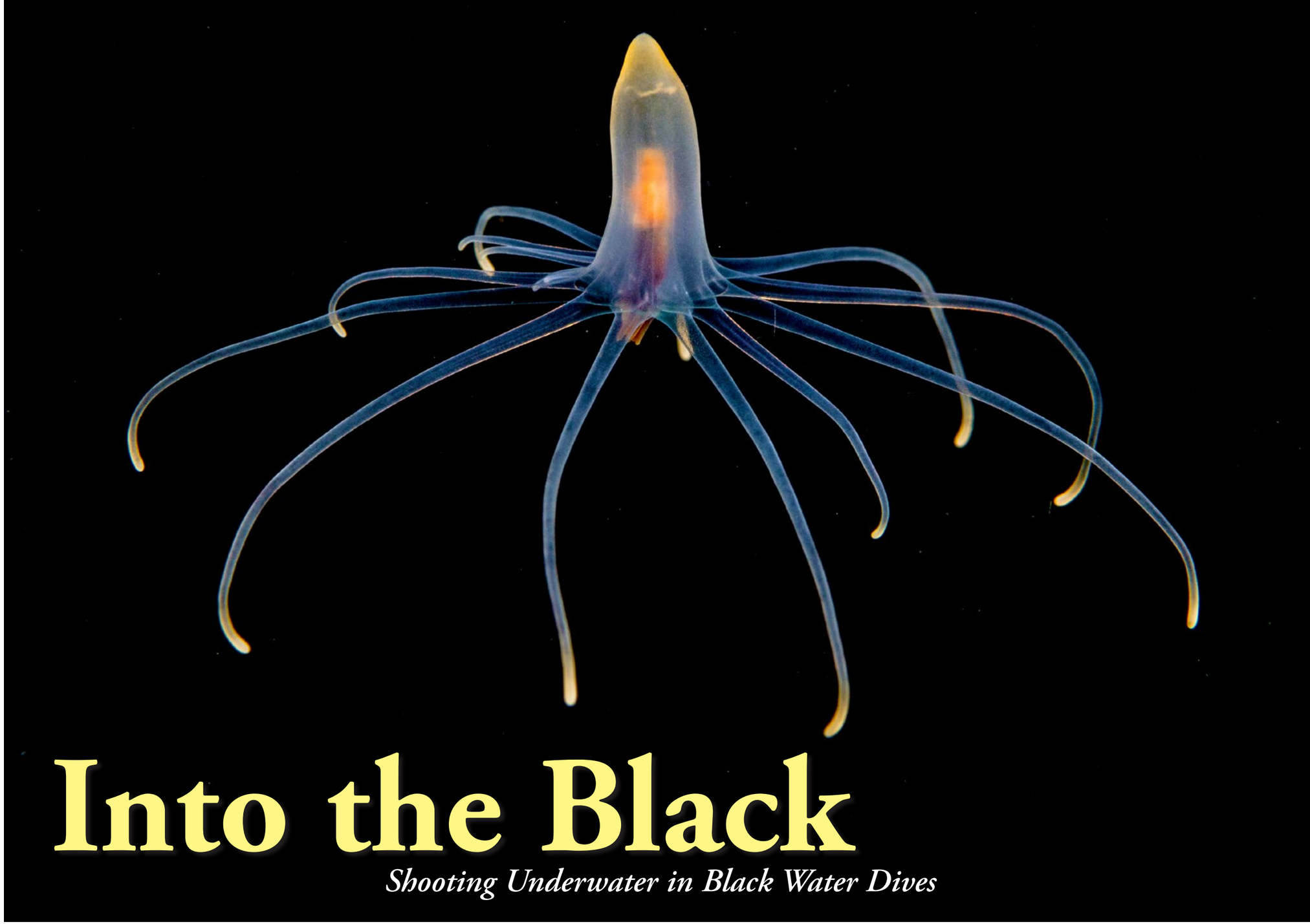
Your time with a mentor can be used to explore your capabilities, not just what the training course expects to be delivered. It is usually of great value, especially for what you get out of it. Finally, it is a brilliant way of checking out potential instructors for future courses. Ask yourself: Do you enjoy their teaching style? Do you respect their approach and in-water skills? Did they improve your diving in the time you spent with them?

Summing it up

So, is experience what you get when you do not get what you want? Well, that is certainly how it was for the pioneers of diving. Nowadays, though, it does not need to be. Relevant and meaningful experience should be what you want, and what all agencies and instructors or instructor trainers demand, before you take the next courses up the diving ladder. You can plan it so it is safe and developmental—you learn from every dive. It is the cement between the bricks of the training you take, which should definitely be of the highest quality.

Be honest. If you go for a 12m, 45-minute bimble on your local dive site, or cruise the reef on a warm holiday fun trip, it is a cool and fun dive. It is not experience. ■

Technical trimix and cave diver, Matt Jevon, is a technical and CCR instructor with TDI, IANTD and PADI. He is also the JJ-CCR instructor and dealer for Ireland. Jevon has held accreditations as an interdisciplinary sports scientist, sports psychologist and was a British Olympic registered strength and conditioning coach.



Larval anemone photographed on black water dive in Anilao, Philippines

Into the Black

Shooting Underwater in Black Water Dives

Text and photos by Mike Bartick

Many would look across the ocean at night and feel a tinge of fear. I guess that is normal—fear of the unknown, fear of the dark, fear that something out there is coming to get you. But for those that have embarked on diving in the open ocean at night, it can bring on a feeling of curiosity, excitement and discovery.

Jumping off a boat and into the black ocean at night, far away from any landmass, is not for everyone, but more and more divers are quenching their fears and venturing out to experience this "not-so-new" form of black water diving first hand.

Origins

The term "blue water diving," coined by William Hammer and company, happened as a need for effective research. While attempting to study planktons, they discovered that the fine mesh nets they were using to collect them were actually destroying some of them. Curiosity drove them to dive down to observe and record them in their natural habitat—open ocean.

David Attenborough eloquently describes the movement of planktons as the "greatest migration of animals on the planet that happens every night, just offshore". Millions of planktons migrate vertically from the depths. They disperse, feed and then return to the depths, all under the cover of darkness, when most filter-feeding marine mammals are resting.

The term "black water diving" was coined by a Japanese award-winning photographer named Ryo Minemuzo. His stunning images were actually captured by placing as many as 20 torches into the sand, facing upwards at night, which in turn, attracted inshore planktons and the subjects that feed on them. We now call

Smoking squid. These smaller pencil squids will dart in to feed on the small subjects attracted by the lights, occasionally running right into us. Most of the time, they will leave small ink trails, which tip us off to their presence, without ever seeing them.

this method "bonfire," which is conducted in the shallow waters over sand or rubble and near, or over, a reef. While bonfire diving is a great way to study larval subjects in the shallow waters, the real black water experience only happens in open ocean.

For the real black water diving experience, open ocean is your destination, over very deep water, away from any reefs and the sea bottom. The differences between these two habitats are quite significant, and both are just as interesting, fun and as surprising as the other. In fact, you are most assured to say, "What is that thing?" repeatedly, both on the dive and while processing your images in post.

Personal experience

My first experiences began much like the scientists above, when a group of friends in the United States invited me along to join them in hopes of photographing jellyfish off the Southern California coastline. The continental shelf approaches the coast near Dana Point, approximately five miles from shore where the substrate drops off to abysmal depths. Here, the currents push up and bring with them giant salp chains, comb jelly and a myriad of other horizontal drifters.

A few years later and after seeing a friend's images of black water subjects, my interest churned again, which compelled me to get out there and see it for myself. I have always been curious by nature, and this next step seemed like the most logical one for me, jumping into the open ocean at night.

Dangers and safety measures

There are several ways to get set up for a safe black water experience. Some divers prefer to tether themselves to a downline while others, like myself, prefer the freedom of not being tethered at all. As one could imagine, this style of diving has an inherent exposure to danger, so a few precautions should be taken to mitigate it. It is not what is in the water that poses the real danger—the real danger in black water diving is complacency.

In the beginning, our dive team would simply tie off a rope with a light on it to the balancer of our banca boat. More than once the surface wind picked up, and the boat began dragging the line faster than we could kick. Watching a line that is attached to a boat while drifting and searching for small subjects in open ocean at night, does not exactly make for a relaxing experience.

After some time of doing this and many more black water dives under the belt, our system has been improved to create a safer and more conducive dive experience. The latest version of our rig has a lit buoy attached to the top of our 30m downline.

Our downline is equipped with video lights pushing 35,000 lumens of inviting warmth out into the dark night waters. The buoy line drifts free from the boat, with the current, this style of black water diving is like being suspended in space with nothing moving around you. The boat follows closely behind as we drift, sometimes several kilometers on a single dive, without even knowing it. This technique is by far the best method we have used so far.

A couple of things that I like the most about black water diving is that it is impossible to set up a shot. There is just no way to stop something or to get a second chance

Japanese snake blenny. There is no telling what will be attracted by the lights as you drift on the current. Most of the time, you will only get a few chances to shoot a subject. On this occasion, this snake blenny made several approaches, allowing me to get a few extra shots of it.

Juvenile Moorish idol in settling phase photographed on black water dive in Anilao, Philippines (left)

Flying fish (right). Black water diving is not always about going deep. In fact, some of the coolest stuff can be right on the surface. I always leave a little gas in my tank to search just below the surface for subjects like flying fish. These are what I would call a "high value target."

if you missed it the first time. It is all about hunting, drifting and shooting your subject as best as you possibly can at that moment. The other thing I like and probably the most, is the opportunity to see something that is truly unique.

Safety tips

Drifting in the dark of night in open ocean should be taken seriously and prepared for properly so that you may enjoy the experience enough to repeat it over and over. Keep safety first and secure yourself physically and mentally with proper preparation:

- Discuss a bail-out plan or measures to take if a diver should drift out of sight from the line.
- Do an emergency recall from the boat.
- Limit the amount of people to small groups.
- Turn on focus lights.
- Never let your ego, or anyone else's, override common sense.

Larval mantis shrimp photographed on black water dive in Anilao, Philippines

Polish your dive skills

Your diving technique is almost as critical as your shooting technique while drifting and will take some practice. The more times you do this style of diving, the better you will become at both recognizing subjects and how to approach them. Give yourself three or four attempts before the magic begins to happen.

In this new black world, transparency rules the night. As you drift along, your torch will become your best friend for finding and tracking your subjects. Slowly move around with the current and search for your subject. Once a subject is spotted, advance slowly. Try to use its momentum in your favor. Remember that your personal pressure wave can

Lionfish larvae (left) and jelly with driftfish (below) on black water dives in the Mimpi Channel, Bali, Indonesia

cause the delicate little drifters to close up or get spooked. Try to let them come to you and use as little movement as possible. The idea is to find a subject and calmly drift along with it and photograph it as best as you can. Being quick on the shutter release and timing your shot are important. Keep your eye in the viewfinder, and your head in the game.

Some black water locations

Bali. I recently indoctrinated several new divers to black water diving while hosting a work-shop on Bali in Indonesia. Black water diving was just a side dish to the workshop, but it quickly became the hot topic and everyone wanted to join. I am certain we were the first in that area, if not the entire island, to do black water diving, and it was well worth it.

We ventured out into the open ocean from the Mimpi Channel until it felt deep. Judging by the proximity to a local island and, of course, the local knowledge of the dive guides and boatmen. The dive started out well and finished even better, with many unique finds and many happy divers. In fact, the chattering on the boat after the dive was a stark contrast to how it sounded on the way out to do the dive. Nerves were a bit tense amongst the newbies as the boat puttered out further and further.

Philippines. In my dive courses at Anilao, Philippines, we do a lot of black water dives using a map of the depths of the local bay and channel. This helps us to figure out the best places to jump in and for what reasons. I can say, confidently, where we can find one kind of subject like jellyfish versus subjects like fish larvae, but the truth of the matter is, one cannot really predict what will be seen.

Another way to attract planktons can be done on any night dive. Simply use a torch that is at least 2,000 lumens positioned in the sand and facing deeper water. We call this style "bonfire" diving. This style is more inclusive of divers learning buoyancy, or those that are not comfortable with open water diving. I use two or three torches but have had just as much luck with a single torch. I have even dangled a light from a boat over deeper water, while tied off to a mooring ball. There really are many ways to experiment, and again, there is no way to tell what will show up.

United States. Black water diving is gaining popularity and in many different areas, making it possible to plan for it as a part of your next dive trip. The dive operations in Kona, in the US state of Hawaii, have been doing this for many years and are probably the first operations to do it commercially, when they introduced the "Pelagic Magic" experience. Funny as this seems, with all of my diving in Hawaii, I have not done it there yet.

Another really active US location is West Palm Beach, Florida. Approximately five miles from the coast, the gulf stream approaches the shoreline, and the locals have been finding some very special subjects. The dive operations offer black water diving several times a week, and you will most certainly have several locals on the boat to help with any questions.

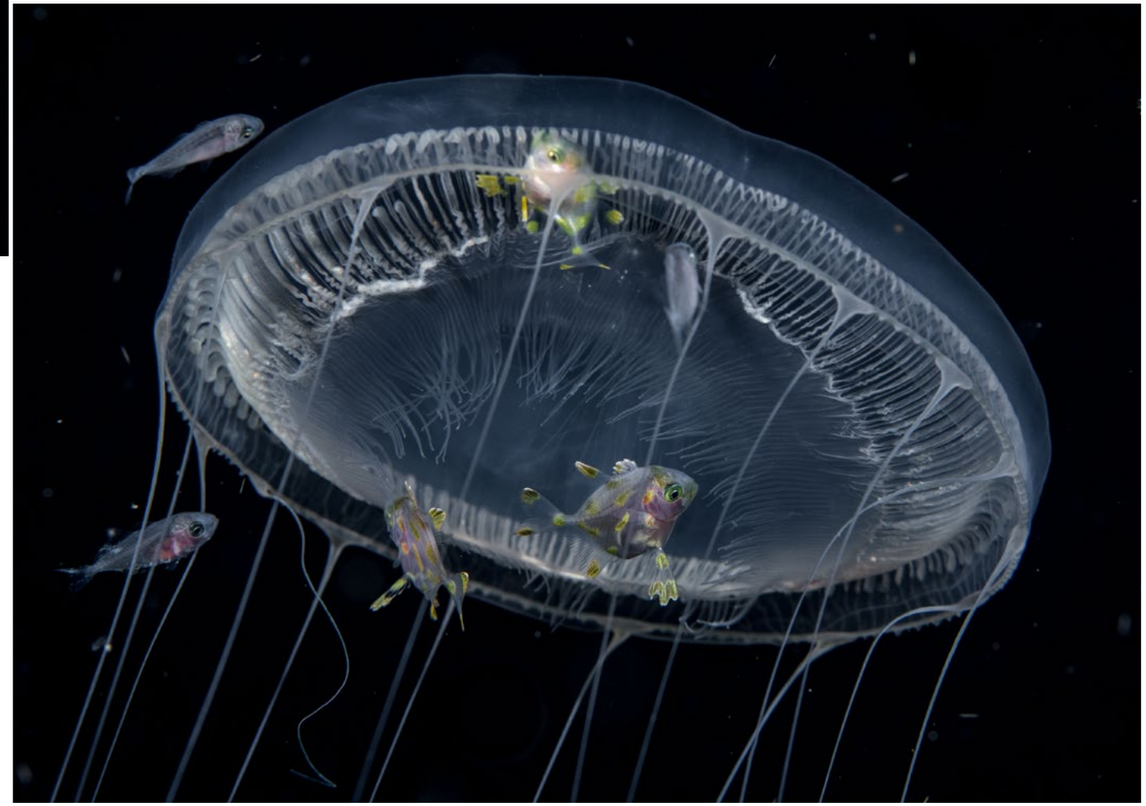
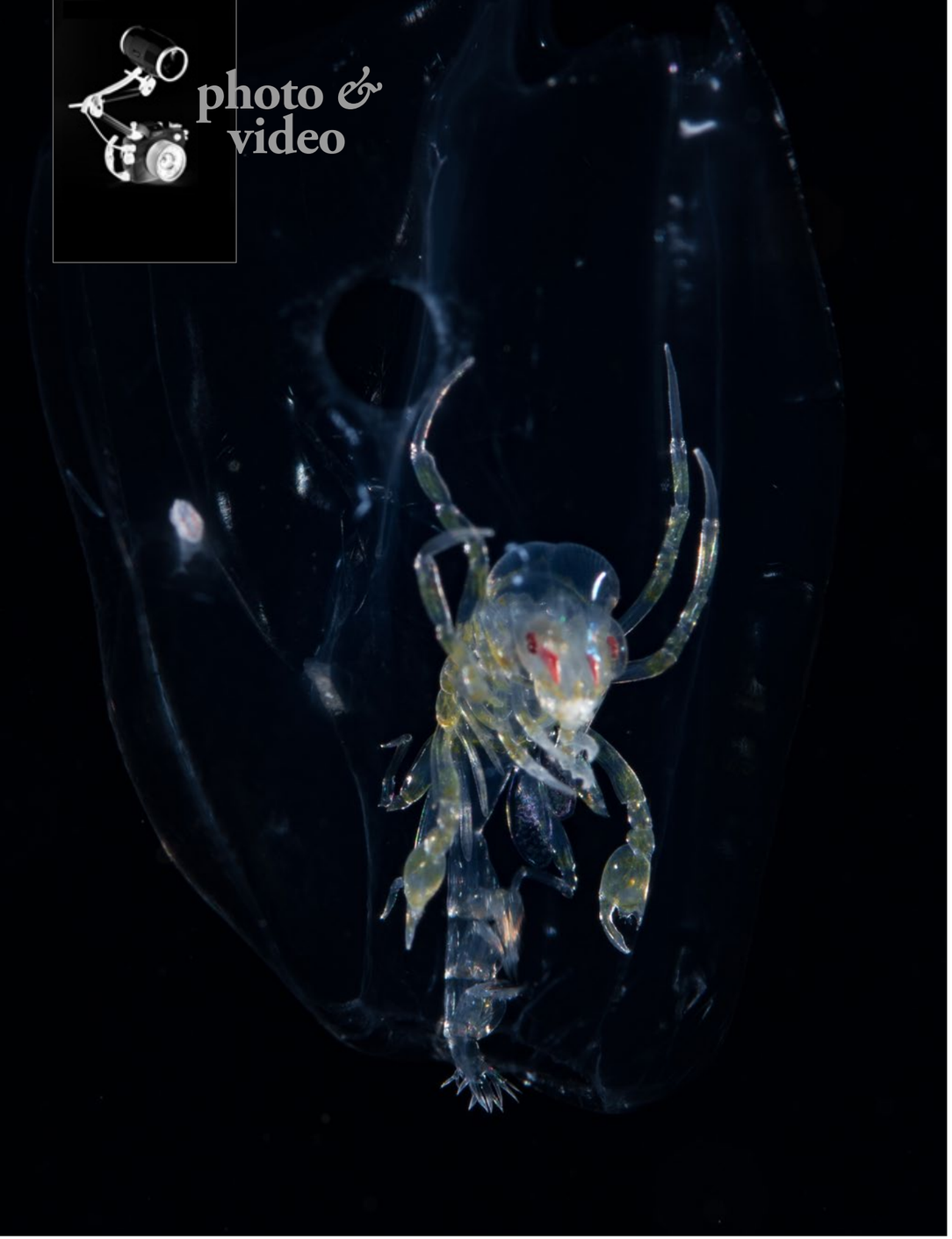


Photo technique

Be ready for the shot by gearing up properly. The best lens for an Advanced Photo System type-C (APS-C) framed SLR is hands down



Phronima sp., also known as a pram bug, is an aggressive little amphipod that can be found in every ocean throughout the world, with the exception of the polar regions. They are thought to be either parasitoid or parasitic, but cannot be thoroughly studied unless you are in their environment. Similar to crabs, Phronimas leave the safety of the sea bed to take up residence in salps. The Phronima will settle on a single salp, eat the interior guts, lay their eggs and use them to raise their young, moving around with ease in their protected, hydro-dynamic nursery, and saving their energy for momma duties.

A juvenile pelagic octopus riding a *Pelagia nocturna* jellyfish photographed on black water dive in Bali, Indonesia

the 60mm lens. I have used the 105 but ended up missing several great opportunities. For full-frame (FF) camera rigs, I suggest the Nikon in DX mode and a 60mm lens, or for Canon FF, a 50mm macro lens.

Strobe position is important too, and water clarity must be judged often to determine the best ways to light your subject. Remember the subjects are small, for the most part, palm-sized at best, barring the occasional squadron of squids that might come in to investigate.

For the close work, my strobes are usually turned in, facing the 8 and 4 o'clock positions on the opposing strobes. For shooting further away, I will swing my strobes back to an outward position. Backscatter is a big issue for black water diving, but it is not such a bad thing. Open water is the habitat of the subjects we are shooting, and as long as the backscatter is not critical, then do not worry about it. Just try to limit the amount of backscatter in the frame, think fast and work those strobes.

What you will see

Depending on the depth of the water, time of night and luck, much can be seen. You do not need to go deep, though, so stay with the hunt all through the dive. (See the images and captions for examples of marine life seen on black water dives.)

Anilao is set on a peninsula with two bays, one on either side. My team of divers has been exploring the depths now for a couple of years. Recently, we have acquired a map of the sea floor, which has helped us to determine the areas to target. Drifting in the "deep end of the Verde Island Pass" has been a long-time goal of mine. With the construction of our new downline, we plan to do a lot more of it.

Black water diving is an exciting way to add a new dimension to your portfolio, guaranteed to re-ignite your curiosity for the ocean. Once accomplished, you will soon find yourself counting down the hours of daylight before getting out to do it again.

Now get out there and have an adventure! ■

Mike Bartick is a widely published underwater photographer and dive writer based in Anilao, Philippines. A small animal expert, he leads groups of photographers into Asia's underwater realm to seek out that special critter. For more information, visit: ***Saltwaterphoto.com****.*

User Review: The Olympus Tough TG-5

Text and underwater photos by Lawson Wood

OLYMPUS.COM

I was sent recently a new small compact camera by Olympus to test on home grounds as opposed to taking it away to perfectly warm, perfectly clear, overseas destinations. Considering that most new compact cameras are aimed at a local market, it made sense to try this one out at home. The new little compact is the Olympus Tough TG-5.

This review is NOT a scientific test, nor is it a blow-by-blow account of how every setting works. This is a user review written after taking the camera into the water for the first time and exploring its capabilities as I went along on the dive.

Features

Maybe it is just me, but when I first get my hands on a new camera, I kind of explore it before I even look at an instruction manual. Speaking of which, you really have to download the BIG and expanded manual (free) to get the most out of this amazing little device. (See: http://cs.olympus-imaging.jp/en/support/imsg/digicamera/download/manual/tg/man_tg5_e.pdf).

Settings. So, checking out the dials on the back, there are a couple of new settings. Undoubtedly this is the King of the macro compact cameras as there is not only an "Underwater" setting (more on that later) there is also a microscope mode, also with three settings. By far this is the greatest magnification ratio available on any compact cameras in the market today. I was able to zoom in to a small cowrie and even smaller nudibranchs. Thank goodness, I had the camera to be able to see the subject!

Sensors. This hand-held compact also has a 12MP CMOS backlit sensor. It is the same as the sensor in the top-of-the-range Olympus OMD E-M1, which makes for massive sharp images, high speed writing to the memory card and allows a maximum of 20 fps. The raw buffer is 14fps, but in only JPEG mode, it is almost like a slow-motion movie. Speaking of which, this Olympus TG-5 is able to shoot at 4K high speed and a full 1080 120p, which can be slowed down in post-production to only 30p for some amazing slow action shots.

The camera also includes full image stabilization, so video and stills are always sharp. There is a dedicated movie button for the full 4K, but one can operate recording in any other modes, including the microscope setting, but at 60p.

The 12-megapixel image sensor gives the best image quality, with

OLYMPUS.COM

25-100mm zoom telephoto. With an F:2 setting at maximum aperture, it is perfect for low-light shots.

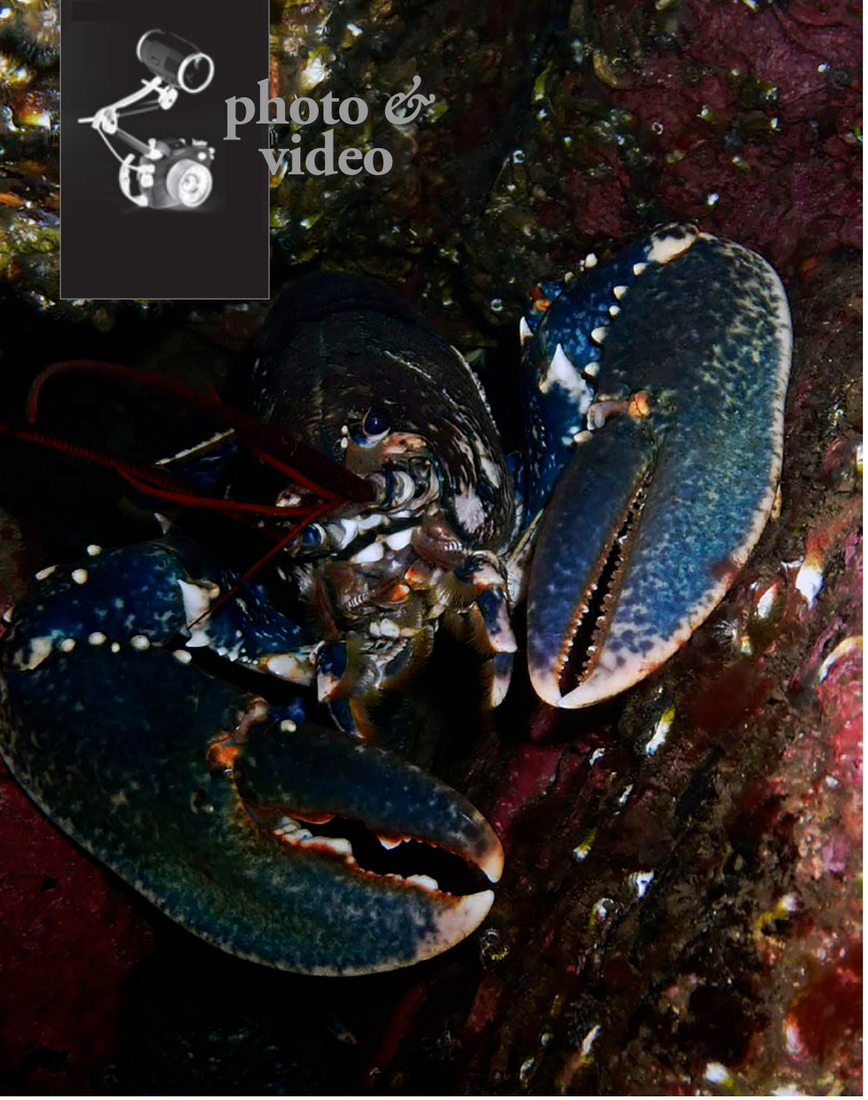
Modes. For underwater photographers, there are special modes incorporated: Underwater Wide, Underwater Macro, Underwater HDR or Underwater Snapshot. And for all us fans of macro, the TG 5 has an advanced, four mode variable macro system, with microscope, microscope control, focus bracketing and focus stacking modes.

Internal flash. The camera's internal flash is easily accessible through the rear control wheel, allowing you to change settings to suit the subject and situation, whether you want it at full power, fill-in only or off—you can do this as you go. Similarly, you can adjust the resolution of the photograph the same way.

Underwater settings. The underwater settings on the camera can also be changed as you go, with Underwater Snapshot—in which there is a compensation filter added when close to the

increased image detail and much less noise than anything else out there of this size and style of camera. The TruePic VIII image processor is able to deliver high resolution photographs, especially when shooting in low ISO. This image processor, taken from the Olympus Pro flagship system camera OM-D E-M1 Mark II, has an improved image processing algorithm, which is even more powerful, delivering higher image resolution in low-contrast areas especially when shooting at low ISO sensitivity, which can go to 12,800.

Zoom lens. There is also a 4x zoom lens, which is standard, giving the 35mm equivalent of



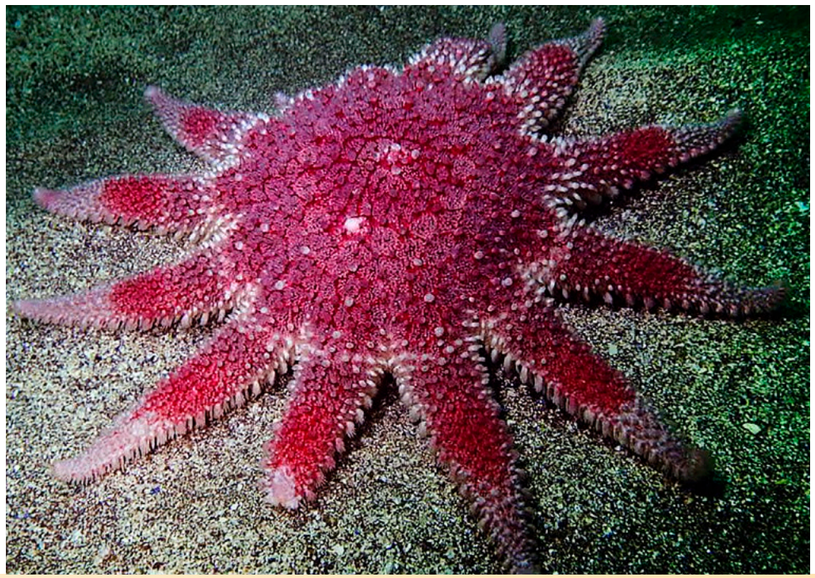
surface (perfect for snorkelling); Underwater Wide; Underwater Macro; and Underwater HDR, in which the camera takes a series of images simultaneously and combines them in-camera to get the best colour saturation, best light and most optimum conditions of the picture, creating a more pleasing image overall.

Pro Capture Mode. Another exciting feature is the Pro Capture Mode, carried down from the Olympus flagship cameras. This basically involves the camera storing data as you start to focus on your action photograph of a subject. Each time you partly depress the shutter, the camera will buffer the image to your memory card. When you finally take the photograph you are after, all of the pre-stored images will also be written to the camera, allowing you to choose the optimum photograph of that crucial action moment.

Depth sensor. Clearly, the 15m (50ft) depth rating is a massive plus, and the camera has a built-in depth sensor. At around 12m (40ft), a small banner is illuminated across the screen warning you of the depth. At 15m (50ft), this warning is a much more obvious signal, with a large red triangle and depth warning. I am sure that if it could make noises, it would!

Housing. Should you wish to extend your depth range, there is an underwater housing also made by Olympus. All the camera's functions are accessible, and this case is waterproof depth rated to 45m (150ft). There is a fibre-optic connector to connect an external flash, such as the UFL-3. This is in effect operated as a slave flash by the firing of the camera's internal flash when taking a photograph. The housing is also neutrally buoyant underwater.

Flash diffuser. The one item that I really love with this camera is the flash diffuser—the FD-1. As we all know, using the integral flash with a compact camera is often a challenge, particularly in macro, as the flash is located in the top left portion of the camera with a light output that may be cut off by the position of the lens in relation to the flash—particularly in macro or close focus/wide angle shots.

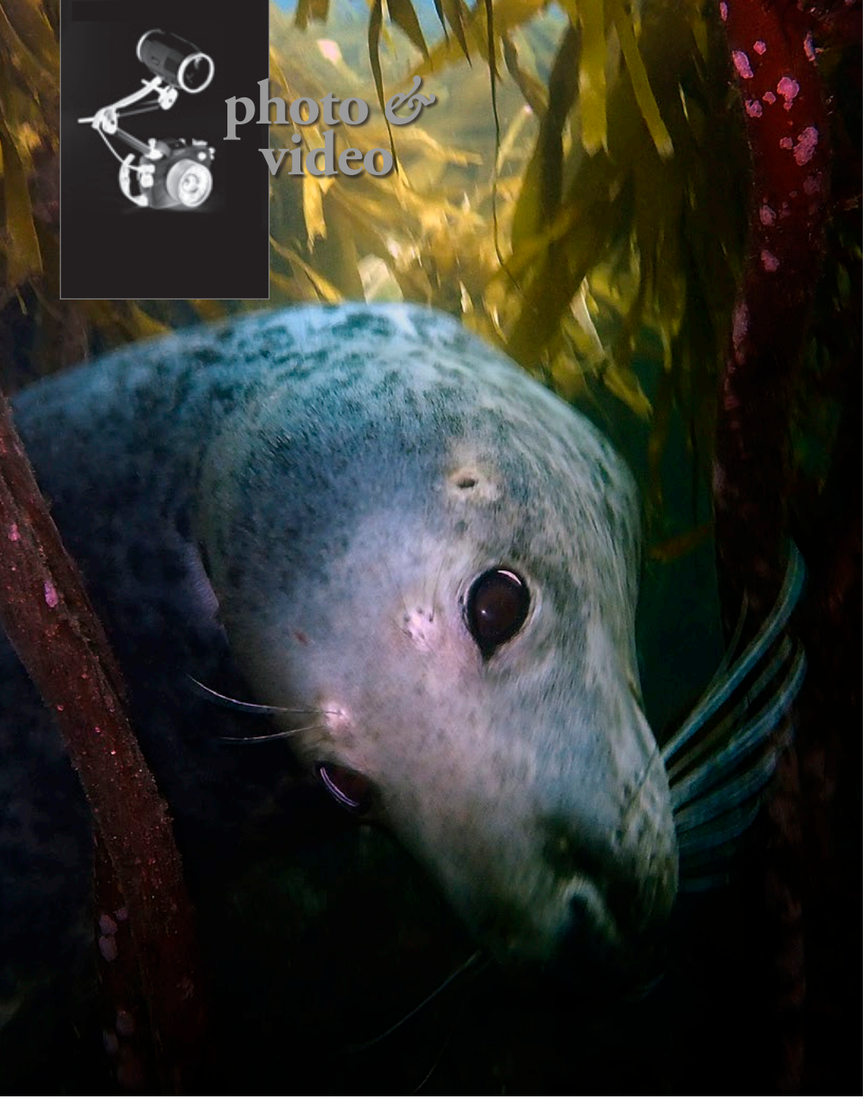


Well, Olympus has designed the flash diffuser to fit directly around the lens, creating a ring flash—something which many underwater photographers would love to use for macro and extreme close up photography. This allows an even output of light to illuminate a subject. The diffuser even incorporates a lever for adjusting the strength of the flash. By controlling the exposure of the subject in the foreground, one can darken the background and make the subject stand out—to spectacular effect.

Although you cannot use this flash diffuser with the fisheye converter, this wide-angle lens can be connected whilst underwater or removed at your whim, fitting the flash diffuser as usual, to greatly expand your versatility underwater. Unlike other compact cameras of this type, you can attach waterproof converters and 45mm lens filters, using the conversion lens adapter. This fisheye lens allows for full wide-angle shooting, without sacrificing the brightness of the TG-5's F:2 lens. The angle of coverage is 130-degrees and has an extended focal length of 19mm.

Tele-converter lens. Last, but not least, is the tele-converter lens, which is able to extend your actual focal length from 100 to 170mm. With its incredible, super-resolution zoom, it will reach a maximum of 13.6x magnification and still at the F:2-rated lens.

Flash. Olympus does have its own flash and it recycles at two seconds, has a respectable guide number of 22 and is depth-rated to 75m. But the camera will, of course, accept any proprietary flash that is fired by slave through an optical lead.



Sharing. The last interesting point is the GPS, location compass, and, of course, WiFi, allowing one to send instant photographs anywhere on one's smart phone.

Maintenance and cleaning

There are two waterproofed compartments. One underneath the camera, which holds the battery and memory SD card; the other is on the left-hand side, protecting the charging ports (USB & HDMI). Both have a double-lock mechanism, so please make sure that there are no hairs or dust anywhere near the silicone gasket before closing the camera.

After a dive, remove any attachments and place all of the bits into warm water for ten minutes or so to allow any salt particles to dissipate. Allow the camera and accessories to dry naturally, and wipe with a dry, lint-free cloth. Then you are ready to go again!

So, the questions are:

Am I impressed? Yes absolutely! The Olympus Tough TG-5 is small and lightweight, with lenses that are interchangeable underwater; it is waterproof to 15m and has the best macro and micro facility of any waterproof underwater camera on the market.

Does it do what it says on the packet? Much more than that! I was totally blown away by how versatile the camera is and how easily adaptable it is for changing lenses underwater without any loss of clarity or quality of photograph. The ring-flash gizmo is superb!

How does it handle underwater? It is quite small and compact, but that is the nature of the beast. It would be nigh on impossible to operate the camera with thick neoprene gloves on, but for adventure sports; any wet or muddy work and yes, even an hour underwater off the St. Abbs and Eyemouth Marine Reserve in Scotland's North Sea, did not leave me undeterred.

There is one point though. I tend to use a small movie light by LUME CUBE [see my next review], which I fix onto the handle of a small bracket via the accessory screw on the bottom of the camera. Working in micro close-up, the variable output from this little light negated the effect of needing flash. The camera responded extremely well for "natural" light, even in wide-angle mode. It handled this type of light on the Automatic setting, allowing the camera to do the thinking for me, and it worked amazingly well.

Would I own one? Certainly! This would be an easy add-on to my other Olympus equipment, as I currently use the OMD EM-1. The price for many can be prohibitive, particularly if you want all of the must-haves that go with it. But overall, I feel that the innovations are well worth the price tag.

Would I recommend the camera and accessories to others? Much more difficult to answer, as I have also to think of others and perhaps what their uses would be. You should never just look at a camera as a single entity; rather it is the start of a comprehensive and versatile system. The Olympus Tough TG-5 fits that bill admirably, as the supplementary lenses and flash diffuser raise this little waterproof camera to a much greater level of status.

Final thoughts

Overall, I have no hesitation in recommending this BIG, little camera for everyone. I am constantly amazed at how technology is advancing. I look forward to the next generation of underwater cameras, which are becoming more and more like the old Nikonos film cameras. These new, digital compact cameras just need a better depth-rating, and we will have moved full circle.

The Olympus Tough TG-5 is a joy to use, and I am learning more about its excellent capabilities every time I enter the water with it. ■

THE COSTS *

Olympus TG-5 digital camera
US$ 449.00* / GB£ 399.00

Underwater case PT-058
US$ 299.99* / GB£ 259.00

External flash UFL-3
US$ 499.00* / GB£ 319.00

Flash diffuser FD-1
US$ 47.95* / GB£ 49.99

Wide-angle fisheye converter FCON-T01
US$ 169.00* / GB£ 120.00

Tele-converter TCON-T01
US$ 129.00* / GB£ 129.99

Conversion lens adapter CLA-T01
US$ 19.00* / GB£ 20.00

Silicone protective cover TG-5
US$ 26.95* / GB£ 29.99

(Additional arms, brackets, connecting shoes and optical lead will cost extra, but all are made by a variety of companies, and all are a standard fit and design). ■

* Prices listed are approximate.

Lawson Wood is a widely published underwater photographer and author of many dive guides and books. For more information, visit: ***lawsonwood.com****.*

THIS PAGE: First place winners in the Open Class;

RIGHT: Open Class, Cephalopod, 1st Place: Lilian Koh of Singapore. Koh also won the DOT-PAL Photographer of the Year Award for this image.

Fifth Anilao Underwater Shootout winners announced

Anilao in the Philippines is home to some of the rarest underwater species on the planet. This location was also the base of the 5th Anilao Underwater Shootout, presented by the Department of Tourism (DOT) and co-organized by Philippine Airlines (PAL), in Mabini, Batangas.

Dubbed the "World Cup of Photo Competitions," the Anilao Underwater Shootout drew 173 divers and underwater photographers from Asia, Europe and North America. The awards night and closing ceremonies at Camp Netanya were officiated by DOT Undersecretary Benito Bengzon Jr., with a keynote address by Secretary Wanda Corazon Tulfo-Teo.

Open Class

Macro/Supermacro category, winners included: Wu Yung Sen of Taiwan, 1st place; Hongchao Yao of China, 2nd place; and Navapan Janjarasskul of Thailand, 3rd place. Marine Behavior category winners included: Cem Gazivekili of Turkey, 1st place; Seungchul Yang of South Korea, 2nd place; and Wen Chih Yen of Taiwan, 3rd place. Nudibranch category winners included: Cem Gazivekili of Turkey, 1st place; Songda Cai of China, 2nd place; and Hakan Basar of Turkey, 3rd place. Fish Portrait category winners included: Wen Chih Yen of Taiwan, 1st place; Wayne Jones of Austria, 2nd place; and Dennis Corpuz of the Philippines, 3rd place. Winners of the new Cephalopod category included: Lilian Koh of Singapore, 1st place; Wen Chih Yen of Taiwan, 2nd place; and Peichi Chiang of Taiwan, 3rd place.

Open Class, Marine Behavior, 1st Place: Cem Gazivekili of Turkey

Open Class, Fish Portrait, 1st Place: Wen Chih Yen of Taiwan

Open Class, Macro/Supermacro, 1st Place: Wu Yung Sen of Taiwan

Open Class, Nudibranch, 1st Place: Cem Gazivekili of Turkey

Compact Class

All the Macro/Supermacro category winners were from the Philippines: PJ Aristorenas, 1st place; Penn De Los Santos, 2nd place; and Ma. Nerissa Fajardo, 3rd place. Marine Behavior category winners included: PJ Aristorenas of the Philippines, 1st place; Penn De Los Santos of the Philippines 2nd place; and Virginie Barfuss-Gofart of France, 3rd place. All the Nudibranch category winners were from the Philippines: Ronald Dalawampu,

1st place; East Pardillo, 2nd place; and Jonathan Christopher Veridiano, 3rd place. Fish Portrait category winners included: Jorge Ida of the Philippines, 1st place; Nancy Berg of the United States, 2nd place; and PJ Aristorenas of the Philippines, 3rd place. All the Cephalopod category winners were were from the Philippines: Ian Amboy, 1st place; PJ Aristorenas, 2nd place; and Eric Yee, 3rd place.

Honorable mention

Special prizes were awarded to Ryan Berg of the United States in the Special Beginners category, and Yung Sen Wu of Taiwan in the Blackwater/Bonfire category.

DOT-PAL Photographer of the Year

Two photographers were awarded the DOT-PAL Photographers of the Year Award, sponsored by The Department of Tourism (DOT) and Philippine Airlines (PAL): Singapore's Lilian Koh for her Open-Cephalopod image, and the Philippines' PJ Aristorenas for his Compact-Macro photo.

During the awards ceremony at Camp Netanya in Mabini, Batangas, Tourism Undersecretary Benito Bengzon Jr. said: "As the event grows and evolves, so does our goal in recognizing and highlighting the importance of Anilao as a dive destination with a unique and critical ecosystem."

Judges

This year's panel of judges included renown names in underwater photography, such as veteran National Geographic photographer David Doubilet; photojournalist and aquatic biologist Jennifer Hayes; William Tan of Singapore; Tobias Friedrich of Germany; Cannes Palme d'Or winning photographer Scott "Gutsy" Tuason; and Cebu-based Japanese marine researcher Yoshi Hirata.

Compact Class, Nudibranch, 1st Place: Ronald Dalawampu of the Philippines

THIS PAGE: First place winners in the Compact Class. RIGHT: Compact Class, Macro/Supermacro, 1st Place: PJ Aristorenas of the Philippines. Aristorenas also won the DOT-PAL Photographer of the Year Award for this image. BELOW: Compact Class, Fish Portrait, 1st Place: Jorge Ida of the Philippines. BOTTOM CENTER: Compact Class, Marine Behavior, 1st Place: PJ Aristorenas of the Philippines

Compact Class, Cephalopod, 1st Place: Ian Amboy of the Philippines

Sponsors

The 5th Anilao Underwater Shootout took place in partnership with Nauticam and ScubaLamp Underwater Photography Equipment (SUPE), and was sponsored by Aiyanar Beach and Dive Resort, Azure Dive Resort, Balicasag Island Dive Resort, Buceo Anilao Beach and Dive Resort, Camp Netanya Resort and Spa, Fun In Taiwan (FIT), Pacifica Dive, Pier Uno Resort and Dive Center, RGBlue and Weefine. ■

Darina Denali

P O R T F O L I O

PREVIOUS PAGE: *Sisters of the Stars,* by Darina Denali. Oil on canvas, 45 x 92cm

LEFT: *Turtle´s Journey,* by Darina Denali Oil on canvas, 100 x 50cm

Darina Denali

Queen of Camouflage, oil on canvas, 45.5 x 45.5cm (above), and *In Love*, oil on canvas, 60 x 50cm (left), by Darina Denali

Text edited by Gunild Symes
All artwork by and photos courtesy of Darina Denali

Czech artist Darina Denali, now based in New Zealand, creates glorious, vibrant and dynamic paintings of marine life, capturing the curious behaviors of animals and sublime nature of the underwater realm. *X-Ray Mag* interviewed the artist to gain insights into her artistry and creative process.

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

DD: I am a professional artist based in a little town called Russell in the middle of the beautiful Bay of Islands in New Zealand. I live with my husband and my 10-month-old son. I originally come from the Czech Republic. I have always specialized in painting with oils, but after my son was born, I changed medium and started to use watercolors instead, as it better suits my new lifestyle. I also paint with acrylics when I work on murals.

My grandfather was an artist, and my mother enjoyed painting too. So I have always been encouraged to paint and draw as well. Ever since I can remember, I was the weird kid sitting in the corner of the day care center and drawing for the whole day. It was my most favorite thing to do then, and it still is now. Nobody was surprised when I made the choice to study art in college. I then graduated from a private school of design in Prague, where I studied oil painting for four years.

After graduation, I decided to fulfill my dream of traveling and living by the ocean. I moved to Cyprus, where I met my husband, and also painted my first marine life painting.

We lived in Iceland for two years, and later on, moved to New Zealand, where we finally permanently settled in one of the most beautiful diving spots ever, surrounded by stunning nature, diverse wildlife and always smiling people.

I feel a deep connection to nature, the ocean and all living creatures. They inspire me every day, and I just wish to have four hands to give me more time to paint everything I would like to. I am grateful that I can express myself through my art and share it with like-minded people.

My artwork is represented by galler-

Little Seal, by Darina Denali. Oil on canvas, 60 x 50cm

ies throughout the country, and many of my paintings are held in private collections around the world.

X-RAY MAG: Why marine life? How did you come to this subject matter and how did you develop your style of painting?

DD: Since I was a child, I have dreamed about the ocean. I kept saying to my family that one day I would live by the sea and swim with different ocean creatures. Of course, they laughed at me, as we lived in a land-locked country and my parents only knew of the sea from photographs. But I always had this strong calling. And now, just the fresh smell of the ocean in the air calms me down and brings me a strange feeling of happiness.

I find underwater life very mysterious and fascinating. It is a different, almost surreal world, parallel to ours, full of incredible

Rainbow Seals, by Darina Denali Watercolor on Fabriano 300g paper, 29.7 x 42cm

Darina Denali

creatures. Once you start to learn more about them, the more admiration you will have for them. I find it impossible not to paint marine life.

My oil paintings, watercolors and murals featuring marine life are very colorful, with realistic detail. I found that reading and learning about each creature was very interesting. I always try to learn as much as I can about everything I am going to paint. I want to better understand what these animals are, by learning more about their anatomy, life cycle and behavior.

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

DD: It depends on whether I paint with oils on canvas, acrylics on a wall (mural) or watercolors on paper, but once I am inspired and have a vision, I use Photoshop to create a mock-up, which most closely matches my idea. Then I sketch it on canvas or paper or on a wall. I sort of need to know what I am doing and what I am aiming for, but I still find lots of surprises in the final result.

X-RAY MAG: What is your relationship to the underwater world and coral reefs? How have your experiences underwater influenced your art? Where have you had your favorite experiences?

Pink Mao Mao, oil on canvas (above), and *Soul Mates*, watercolor on Fabriano 300g paper, 29.7 x 42cm (left), by Darina Daneli

Just Curious? by Darina Denali. Oil on canvas, 100 x 40cm

DD: I am snorkeler. I am just too impatient to spend time with gear preparation to become a scuba diver. My husband is a very keen freediver, and we share our love for ocean.

I think that the most incredible experience with marine life that I have had was while snorkeling in Poor Knights. It is a marine reserve here in New Zealand, and I just could not believe how many beautiful, fully grown, very friendly and curious fish we could see there. It was literally a paradise. After this experience, I painted a painting called "Underwater Cathedral" (on next page).

X-RAY MAG: What are your thoughts on ocean and freshwater conservation, and how does your artwork relate to these issues?

DD: I am a big fan of marine reserves, and I hope that there will be many more of them in the near future. I have seen what a difference they can make, keeping the ocean free of human beings as predators in places like Poor Knights Islands or Goat Island in New Zealand. There, fish and crayfish have finally a chance to reproduce and fully grow. From others, I often hear the opinion that there is enough fish for everyone, and that we can just keep taking. I wish that there would be a less selfish approach. Otherwise, there is not going to be many fish left when our children grow up.

Shark finning, global warming, dumping of chemicals and debris in the ocean, overfishing, greediness... all this makes me angry and sad, and this is not the sentiment from which my art comes. With my paintings, I focus on the positive, with the hope of fostering positive change. I intend to depict the true beauty and richness of the ocean through my art, and I hope that it will lead people to respect and converse about marine life. I do donate originals or reproductions to different organizations to help save the oceans and rivers.

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

DD: I find it wonderful when people can relate to my art—when it reminds them of their own personal experience, or takes them on a virtual trip under the water's surface.

X-RAY MAG: What are the challenges and benefits of being an artist in the world today?

Face To Face
by Darina Denali
Oil on canvas
30.5 x 30.5cm

Darina Denali

DD: Benefit? Definitely, social media. I love when people can see my art in person in galleries, but it is incredible how many people you can share your art with on social media, in a very limited time. And I really enjoy interacting on social media with people who are interested in my art. I can learn about who they are and hear their own life stories, too. I am very grateful for every person who takes the time just to look at my paintings, and I am happy that my paintings bring them joy. Some people purchase my art via social media and it always feels very personal. When people purchase your art through a gallery, most of the time, you do not know who bought it.

I think that the challenges artists have today are the same as they have always been. It can be quite tricky to make a living as an artist, as many people still see this profession as just a hobby. But being an artist is like running a small business, offering items people do not necessarily need.

Once clients start to take you seriously, and you gain some recognition, life gets much easier.

I absolutely love being an artist and my lifestyle. I think about new paintings and ideas all the time. I dream about them. I feel very excited and alive when working on each piece. I am very grateful for being able to make a living by just being myself, and doing what I love the most. This lifestyle can be very unpredictable at times, but I am happy to take the risk.

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

DD: People, and especially children, usually like that I use bright colors. I have not met many children commenting on my oil or watercolor paintings. But I talk to children when they watch me create murals on the street. They love all the ocean creatures I paint. It is amazing to see such excitement in their eyes and their love for the ocean and the animals.

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

DD: Currently, I am working on series called "People of Nature," which are futuristic portraits of people blended with different ocean creatures, birds or trees. These paintings represent our connection to the natural world, the living breathing ecosystem of which we are a part. ■

For more information or to purchase artworks, fine art prints and gifts, visit the artist's website at: ***Darinadenali.co.nz****.*

Underwater Cathedral
by Darina Denali
Oil on canvas, 100 x 40cm

Tranquility, by Darina Denali. Watercolor on Fabriano 300g paper, 35 x 56cm