Scuba Confidential – New Ideas on Narcosis :: Jens Umbach Portfolio

X-Ray Mag

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Tubbataha Reef

Malta's
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COVER PHOTO BY MATTHEW MEIER

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COVER PHOTO: *Tiger Shark at Tiger Beach, Bahamas*
Photo by Matthew Meier (**MatthewMeierPhoto.com**)

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Whip coral shrimp, Tubbataha, Philippines. Photo by Michael Salvarezza & Christopher P. Weaver

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Mind Safety at Sea

Since we launched this magazine over 15 years ago, it has been my policy not to comment on accidents and tragedies, which seemed to be a bit of a tendency elsewhere. After all, car magazines do not delve into injuries and fatalities as a result of traffic, and travel publications rightly focus upon the experiences, adventures and joys one can get from visiting other countries and cultures.

For the main bulk of divers, diving is statistically a relatively safe pastime. Granted, in our reporting, we often slant towards types of diving—technical, caves and deep wrecks, for example—in which the risk profile is higher, and we go into how these risks can be mitigated for the benefit of all types of divers. We learn from the best, right?

The tragic fire on the *Conception* liveaboard off California last month is an all-together different matter, which left many of us saddened for those who lost their lives and for the families who were affected. But I think many of us also felt that this was something that could have happened to us. We could see ourselves in that situation because we have been on various dive vessels, including those for multi-day trips—the liveaboards.

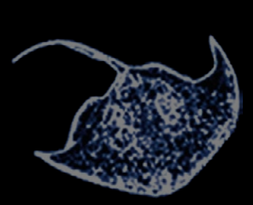
This was not a diving accident. It just so happened that tragedy struck on a vessel carrying divers and not anglers, whale-watchers or birdwatchers.

What exactly caused the fire and why the sequence of events unravelled in the fashion it did has been cause for much speculation. It is only human nature to look for explanations and answers that can hopefully help prevent similar incidences in the future.

These answers and recommendations will come in due time from the official investigators. Until they do, it is important that restraint is shown, and blame is not apportioned before all the facts are known. I have my own theory as to what could have caused this fire, but I will keep it to myself, choosing to discuss it in private for the same reasons. Let the investigators do their job even though it will probably take a long time, and for some, painfully so, before their findings are published.

Meanwhile, we can reflect on what we can do ourselves to always mind safety at sea. On aircraft, we are always being briefed on how to react in various scenarios, where the exits are located and so on. Applying the same mindset on a dive boat is a good start.

— Peter Symes
Publisher & Editor-in-Chief



News edited
by Catherine GS Lim

from the deep

NEWS

AIMS marine scientist Dr Luke Thomas diving during reef surveys in American Samoa

Some coral species are more resilient than others

The coral reefs of Ofu in American Samoa are known for their resilience against elevated temperatures. In 2015 and 2017, the hot summers led to repeated coral bleaching events in American Samoa, affecting many of the corals there. Yet, researchers observed that the bleaching did not affect all the coral species equally; some proved to be more resilient than others.

This became the focus of a study, the findings of which were published in the *Molecular Ecology* journal. In the study, scientists from Australian Institute of Marine Science (AIMS) and Stanford University observed how the bleaching affected two related coral species: *Acropora gemmifera* and *Acropora hyacinthus*. Although they both recovered from the 2015 bleaching, the subsequent bleaching in 2017 affected them differently: *A. gemmifera* recovered, while only 10 percent of *A. hyacinthus* colonies survived.

Differing levels of resilience

The different levels of resilience between the two closely related species was a surprise, as it was normally assumed that all the species in the genus *Acropora* were quite sensitive to heat.

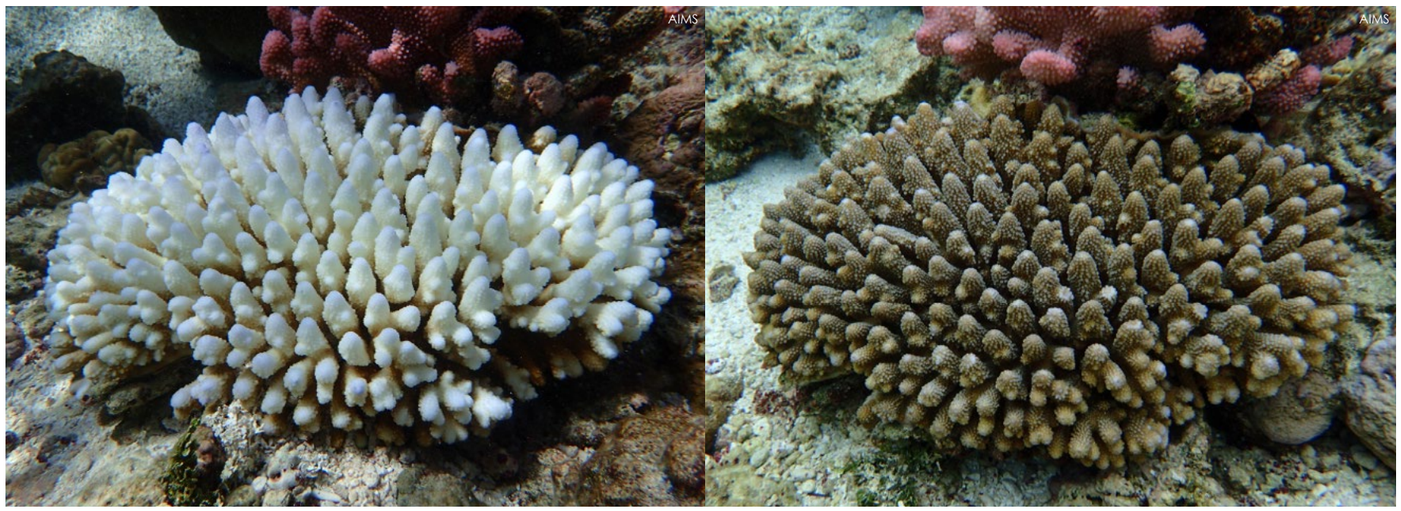
By studying how the corals responded to the bleaching, scientists discovered two differences that affected their survival: the rate at which their gene activity returned to normal after the first bleaching, and the heat resistance of the symbiotic algae the coral associates with.

Commenting on the results, lead author Luke Thomas, an AIMS-UWA Oceans Institute researcher, said they had "found there can be wide variation in resilience to recurrent bleaching between different species, which paints a more optimistic view of their capacity to cope with rapid climate change."

The findings will facilitate further research into which coral species are more naturally resilient, with the hope of targeting them for restoration and conservation purposes.

"We want to work out what corals might survive climate change, and encourage them," said Thomas. ■

SOURCE: AUSTRALIAN INSTITUTE OF MARINE SCIENCE



A colony of the reef-building coral, *Acropora gemmifera*, shown bleached (left) and after recovery from bleaching (right). Unlike other hard corals in the area, this key species survived coral bleaching events in Samoa 2015 and 2017.

news

Edited by Catherine GS Lim

Help Our Kelp campaign aims to restore kelp forests in the UK

The new Help Our Kelp campaign, launched by Sir David Attenborough, aims to restore an underwater kelp forest off the coast of Sussex.

In the past, kelp forests could be found along 40km of the West Sussex coastline. They were so massive that they extended at least four kilometres seaward. According to Alice Tebb, Project Coordinator at the Marine Conservation Society, in the past, the local fishermen had to row their boats away from the beach to get clear of the kelp before they could start their engines. But there is no need to do so anymore, because there is no more kelp around.

Today, what is left is simply some small patches and individual plants, found mostly in shallow water and along the shoreline. This was the result after years of storm damage, increased use of mechanised fishing practices and the dumping of sediment by dredging boats.

Describing the Sussex kelp forests as critical habitat that is key for nursery grounds, for water quality and for storing carbon, Sir David said, "This marine rewilding project, if approved, will ensure the Sussex seas remain healthy for generations to come, and could have far-reaching impact for other parts of the UK coast."

What's more, the underwater kelp forest could play a major role in fighting climate change. Sarah Ward, Living Seas Officer at Sussex Wildlife Trust said: "Kelp forests can absorb and lock up carbon just as effectively as woodland, if not more so, and we're able to create this habitat on a scale that simply couldn't be replicated on land." She added, "This will be a huge step forward in addressing the escalating climate crisis."

Kelp are important nurseries

Kelp forests serve as habitat and nursery grounds for many marine life (like fish, seahorses, cuttlefish, lobster, etc) and serves as a place for them to forage for food and shelter from predators. Due to the absence of the kelp forests along the Sussex coast, fishermen are catching less fish compared to their harvests in the past. Kelp forests are also a natural sea defence against coastal erosion, by reducing the impact of ocean waves and improving water quality.

DAVID BAIRD / KELP FOREST, ARDTOE / WIKIMEDIA COMMONS / CC BY-SA 2.0

Kelp forests are important nurseries for many marine species such as fish, seahorses, lobster and cuttlefish.

Proposed by-law

Led by Sussex Wildlife Trust, Blue Marine Foundation and the Marine Conservation Society, the Sussex Inshore Fisheries and Conservation Authority (IFCA) is proposing a by-law that would implement a trawler exclusion zone that would extend four kilometres outwards from the coastline. Public consultation on the proposed by-law ended on 10th October.

If implemented, this ban on bottom-towed fishing gear would give the kelp habitat some respite from human interference and be the first step in rewilding the marine kelp forest environment.

"If we want healthy seas that are sustainable for wildlife and fishing for generations to come, we urgently need to give our kelp forests a chance to regenerate," said Dr Sean Ashworth, Deputy Chief at Sussex IFCA.

As part of the Help Our Kelp campaign, a film voiced by Sir David and featuring kelp forests, their diverse wildlife and environmental benefits has also been produced.

To see the video, please go to: ***https://youtu.be/JpZ1zkkFsTE*** ■

SOURCES: TELEGRAPH, SUSSEX WILDLIFE

Do reef fish babysit the offspring of other fishes?

Yes, one species of damselfish does, according to a new study. While it is rare that coral reef fish care for their young at all, researchers found that some damselfishes care not only for their own offspring, but also those of other damselfish in the same species, and even some outside the species.

In a phenomenon known as brood parasitism, which commonly occurs in birds, some damselfish, which are brooding their own young, are being taken advantage of by other fishes, which lay their eggs in the same nest or leave their young with the damselfish parent, effectively getting free childcare.

In the Philippines, Giacomo Bernardi and Bruce Lyon, professors of ecology and evolutionary biology at University of California at Santa Cruz, and their team studied two damselfishes of the genus *Altrichthys*, which were known to protect their offspring, and they discovered a third species that also provided parental care.

Genetics

Genetic testing showed that young fish in the broods, which did not look like the others, actually belonged to a different species. The findings, which were published in the journal *Molecular Ecology*, also revealed that many *Altrichthys* parents were caring for mixed broods, including young from the same species but different parents.

"It's kind of a mine field in terms of how to interpret this," said Lyon. "In birds or fish, there are two main ways you can end up with mixed broods—either adoption, where young from outside the family get accepted into the brood, or brood parasitism, where an adult lays eggs in somebody else's nest."

The researchers found evidence of both. By integrating themselves into an *Altrichthys* brood, baby fish of other species gained protection—an important survival strategy for young fish, which often get gobbled up by other fish, according to the researchers' observations. In addition, the mixed broods showed evidence of fish laying eggs in another pair's nest, a sure sign of brood parasitism. ■ SOURCE: SCIENCEDAILY

RICKARD ZERPE / FLICKR / CC BY 2.0

Batuna's damselfish (*Amblyglyphidodon batunai*)

Edited by Catherine GS Lim

The Mimpi Perhentian Resort hosted the Diveheart Malaysia event in September, which gave hearing-impaired children as well as three young, differently-abled women a chance to scuba dive the world-renowned reefs of the Perhentian Islands.

Diveheart event helps hearing-impaired children scuba dive in Malaysia's Perhentian Islands

Text by Majidah Hashim
Photos courtesy of Kids Scuba Malaysia

Who says that people who are differently-abled need to live a life of limitations? A Diveheart Malaysia event in September, the first of its kind to be hosted by a local private island resort, definitely proved otherwise.

Diveheart Malaysia's Adaptive Diver volunteers assisted differently-abled participants during the event.

Nestled on the beautiful Perhentian island of Kecil in Terengganu, Mimpi Perhentian Resort was built not only with comfort, but also accessibility in mind, making it the perfect location for the Diveheart event.

According to Resort Manager Mathew Sangilos, when his team sat down to consider what corporate social responsibility activity to organise this year, it was only natural to play to their strengths and do a dive event. When the idea came of reaching out to the national school of special education, Sekolah Kebangsaan Pendidikan Khas Kuala Besut, the wheels were set in motion for a powerful event set to forever change the lives of children with hearing impairments.

Ten differently-abled children from a local school for the hearing-impaired participated in the event, which included an introduction to scuba diving, quizzes and various beach-related activities. While most of the children appeared shy on the first day when they first arrived at the resort, their shyness quickly disappeared when they got into the water with their Adaptive Scuba buddies.

The children were exposed to basic scuba diving skills such as breathing through a regulator underwater and finning techniques in Mimpi Perhentian Resort's pool, before being introduced to a shore dive by the jetty. After this exciting experience, the difference in the confidence level of the children was like night and day, with a definite confidence boost!

Diveheart & Kids Scuba

Diveheart is an international non-profit organisation founded in 2001 to provide and support educational scuba diving programs that are open to differently-abled children, adults and veterans. By opening up the world of scuba diving to these individuals, Diveheart is on a mission to build confidence, independence and self-esteem through scuba diving, scuba therapy and related activities.

Diveheart Malaysia Ambassador and Kids Scuba Dive Center founder Syed Abdul Rahman Syed Hussain hopes that this event inspires many others to open their doors to this very special community. "I am thrilled to say that events like this not only builds bridges between us, but also reinforces our hope in humanity," he said.

Participants and volunteers of the Diveheart Malaysia event on the Perhentian island of Kecil

A diverse team

The Diveheart Malaysia team spent months training for the event, assembling a diverse team to undertake the responsibility of bringing the experience of scuba to the differently-abled community. They even brought in a "specialist" from the hearing-impaired community. In a heart-melting moment, which caught everyone in awe, Gary Goh—who is deaf, mute and a certified divemaster with over 3,000 logged dives—expertly explained to the children open water scuba techniques in sign language, proving to them that their disability does not stand in the way of them becoming dive professionals someday.

To bring gender balance to the event, three young, differently-abled women were also invited to participate in the event, including Nooraishah Arshad, who is an amputee; Ereen Pasbullah, who is visually impaired; and Nurul Fathiah, who is a paraplegic. All three women undertook several boat dives in which they could enjoy seeing a variety of marine life, for which Perhentian Island is world-renown.

In a world that tends to take people who are differently-abled for granted, often underestimating their capabilities, it is certainly an amazing sight to see them have an "astronaut moment" underwater. The smiling and joyful photos say it all, relaying the wonderful experience participants and even the Diveheart Malaysia volunteers had during the event.

According to Rahman, "If all of us of different abilities can respect each other like this today, then we can really 'imagine the possibilities' for a better tomorrow." ■

For more information, visit: ***diveheart.org*** *or* ***kidsscuba.com****.*

Majidah Hashim is a Diveheart volunteer Adaptive Diver and a PADI Divemaster Trainee based in Malaysia.

Divers on the wreck of the *Polynesian* in Malta

Text by Fatin Iesa
Photos courtesy of Dave Gration, University of Malta, Heritage Malta

Ranging from calm shore dives for beginner divers to technical diving on elusive, unmarked wreck sites, which can only be found via depth sounder—diving in Malta has it all. Just beyond Malta's dramatic underwater landscapes of strange rock formations, chimneys and caves, visitors can discover Malta's intriguing and piquant past. To aid visiting divers, a newly created Underwater Cultural Heritage Unit (UCHU) has been formed within the Heritage Malta agency under the country's cultural ministry to manage the deep historical wreck sites of Malta. The UCHU provides information regarding the history of the wrecks, how to appreciate them and what the proper etiquette is when visiting these war graves.

Malta's Deep-Water Wrecks

& Newly Created Underwater Heritage Unit

Currently rated as the world's tenth smallest and fifth most densely populated country, Malta is the biggest of the three islands of the Maltese Archipelago, which also includes Gozo and Comino islands. This archipelago sits in the middle of the Mediterranean Sea, 93km south of Italy and 288km north of Africa, surrounded by warm clear waters and year-round temperate climate.

Due to its central location in the Mediterranean, this small island has historically had great strategic importance as a naval base in the power struggles between Europe, Africa and the Middle East. In the 19th century, Malta was colonised by the British. During the Second World War, Malta became the headquarters for the British Mediterranean Fleet where many ships and warplanes for the Allied powers were stationed.

Touched by the sands of time, many foreign influences have left their mark on Malta's ancient culture. As the Maltese

Diver on wreck of WWII Royal Navy submarine HMS *Olympus*

was formed under the national agency Heritage Malta, which is responsible for managing Malta's cultural heritage collections, sites and museums.

The UCHU entrusts 12 Maltese dive operators to book and conduct dive tours to the 12 historic dive sites through an online booking system. Regular spot checks of the shipwrecks are done by the UCHU to ensure the protection of the cultural sites. The booking system ensures that dive operators are aware of the basic respect and treatment due to wreck sites

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Historical photo from 1941 of HMS *Olympus* resupplying in Malta

government conducts long-term, systematic, underwater archaeological research off the coasts of the Maltese Islands, it has managed to map out a series of underwater cultural heritage sites. The chronological timeline of the discovered wrecks ranges from a 2,700-year-old Phoenician shipwreck to battleship and aircraft wreck sites from the Second World War.

With the great diversity of nations and cultures represented on the seabed off the Maltese Islands, comes great responsibility. In order to balance the accessibility of information about the wreck sites with the preservation and sanctity of the war graves, the UCHU

THIS PAGE: Scenes from the wreck of ORP *Kujawiak* (L72)

as well as informs them of new information pertaining to underwater cultural heritage sites. Heritage Malta will strive to open three to five new sites in the next two years.

Wreckage that resulted from horrendous acts of war are now teeming with life, from beautiful corals to abundant, colourful fishes and other reef life. Aside from immersing oneself in the history of the wrecks while breathing compressed air and various gas mixtures, divers can enjoy the combination of sheer walls, caves, wrecks, plateaus, and the sandy and rocky seafloor of underwater Malta. Like Malta's vibrant nightlife, the dive sites are beautiful at night too, when the corals glow in wonderful orange to stunning pink hues.

While there are wreck dives in Malta for all levels of recreational divers, here is a look at a few of the deep-water wreck sites for technical divers.

HMS Olympus

Seven miles off the port of Valletta, lies HMS *Olympus*, sitting upright on the seabed, 115m below sea level. While her gun is still intact, aimed upwards, the vessel's posture echoes its failure to fire a shell, which otherwise could have saved the crew.

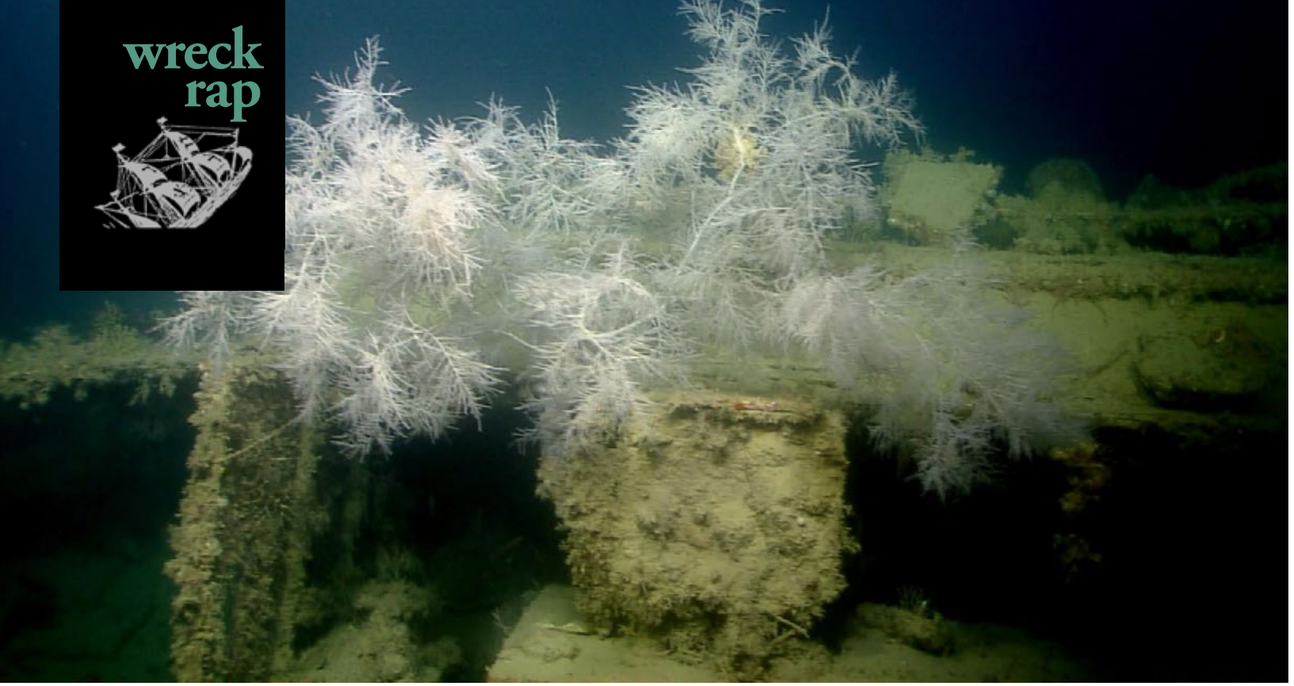
Protecting shipping convoys through the Mediterranean Sea, HMS *Olympus* was a WWII Royal Navy submarine designed for long-distance patrolling. On 8 May 1942, *Olympus* was charged with transporting the surviving crew members of stricken submarines back to England, who were returning to crew replacement submarines built in the United Kingdom. Navigating through 50,000 naval mines deployed by Axis forces in Maltese waters, she was struck by one shortly after leaving port.

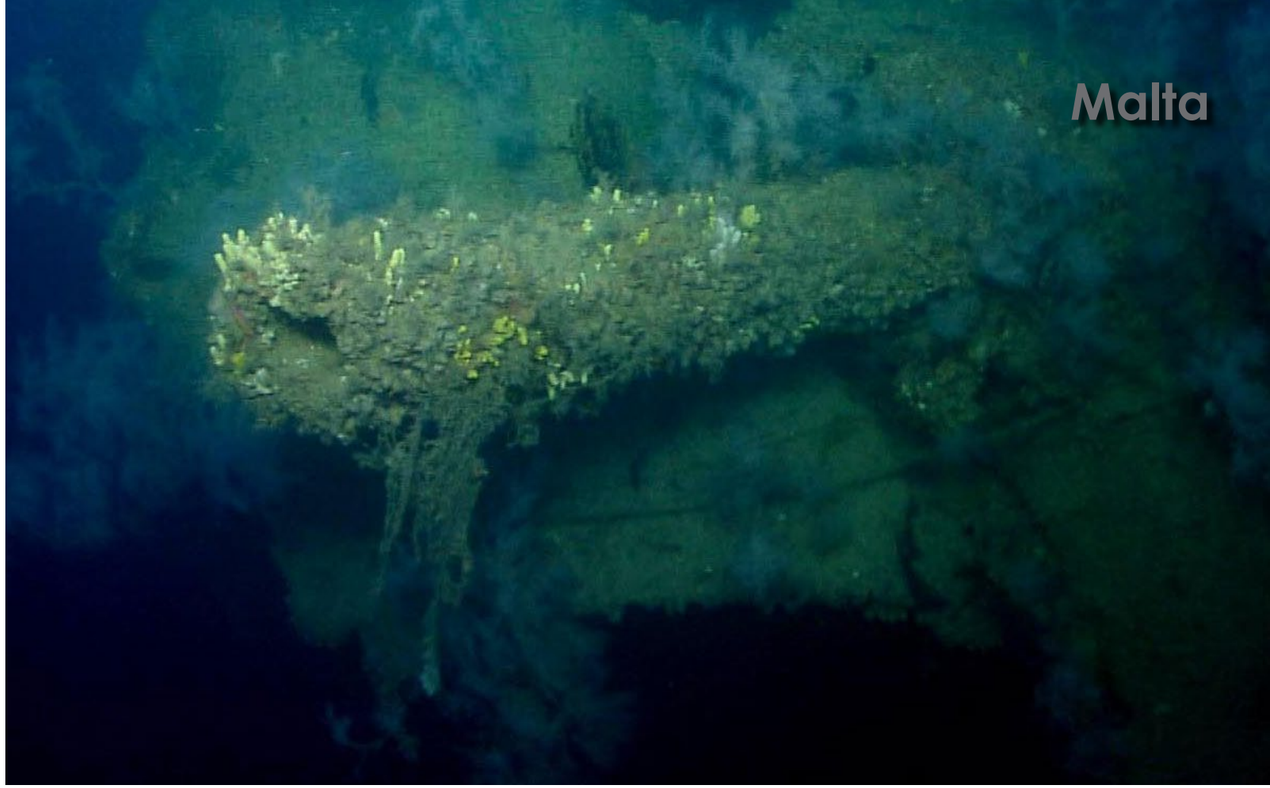
Her hatches lay open, indicating the crew's escape, as *Olympus* slowly sank to her watery grave. Disoriented by the darkness and misjudging the distance to the coast, just nine of the 98 men survived the seven-mile swim to shore. In honour of the fallen men, a memorial plaque has been placed at the base of the wreck.

ORP *Kujawiak* (L72)

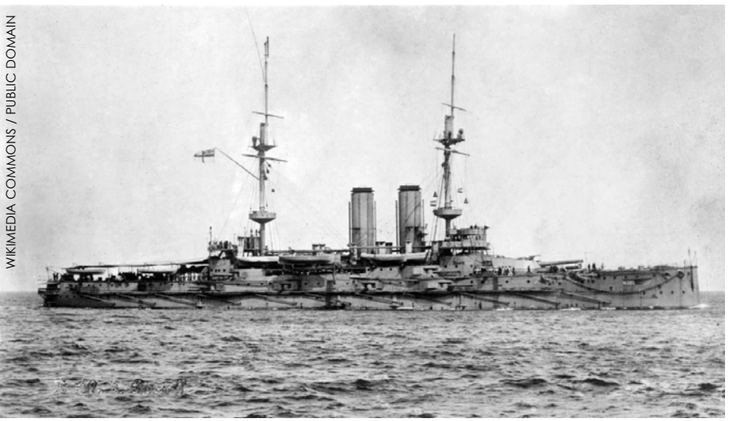
The destroyer *Kujawiak* was given to

Diver on WWII wreck of ORP *Kujawiak* (L72)





Scenes from the wreck (above and right) of the WWI Royal Navy battleship HMS *Russell* (left)



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the Polish Navy by the British Royal Navy in May 1941. Similar to HMS *Olympus*, *Kujawiak* was struck by a mine off the coast of Valletta a month after *Olympus*.

Polish Navy crewmen were part of an armed convoy known as Operation Harpoon. In the middle of WWII, Malta fell short of supplies. Allied powers put together a relief convoy with supplies to Malta from Gibraltar on 12 June 1942. Two days after leaving Gibraltar, the Harpoon convoy was attacked, and *Kujawiak* intercepted strikes by Italian submarines and torpedo planes. After successfully shooting down four Axis planes, *Kujawiak* attempted a dangerous rescue mission while entering Malta's Grand Harbour. She went to rescue another ship in the convoy but ended up hitting a mine herself.

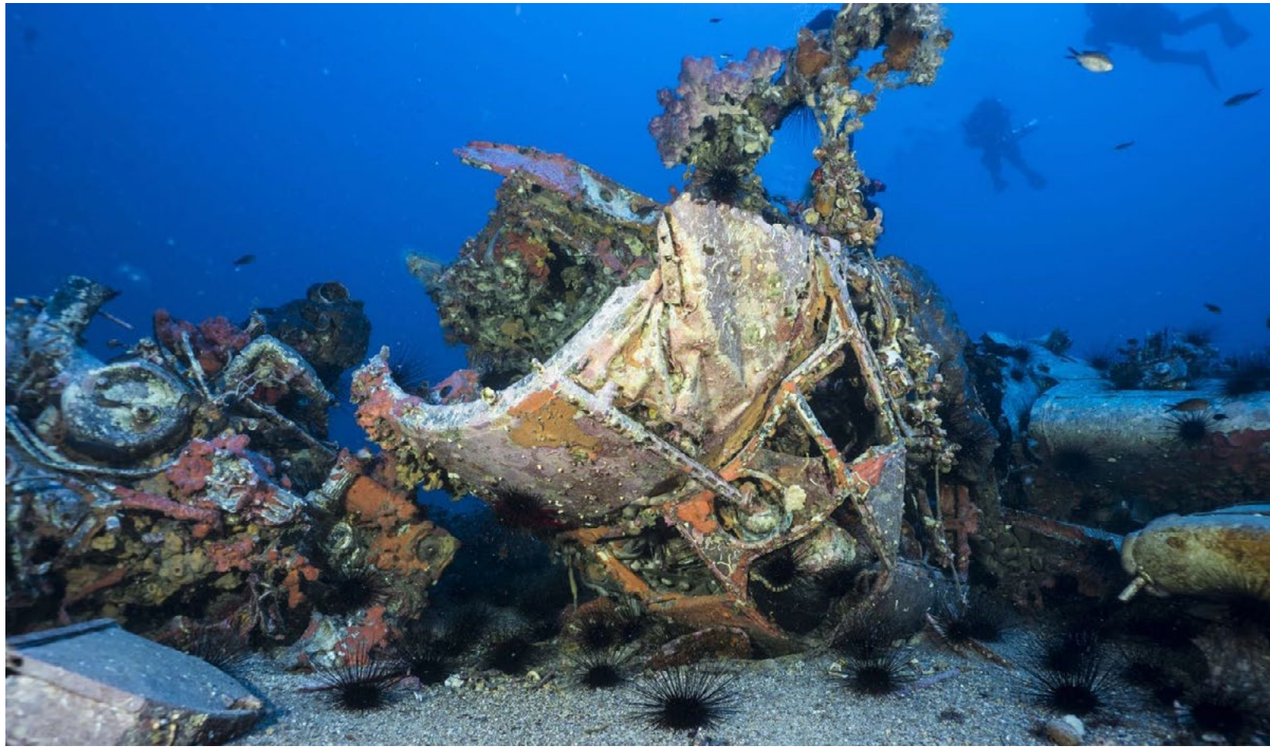
Lying at a depth of 97m, *Kujawiak* is fairly well-preserved except for her stern, which was badly damaged when she hit the seafloor. The ship's bells were recovered in 2017 and are on display at the Maritime Museum of Malta.

HMS Russell

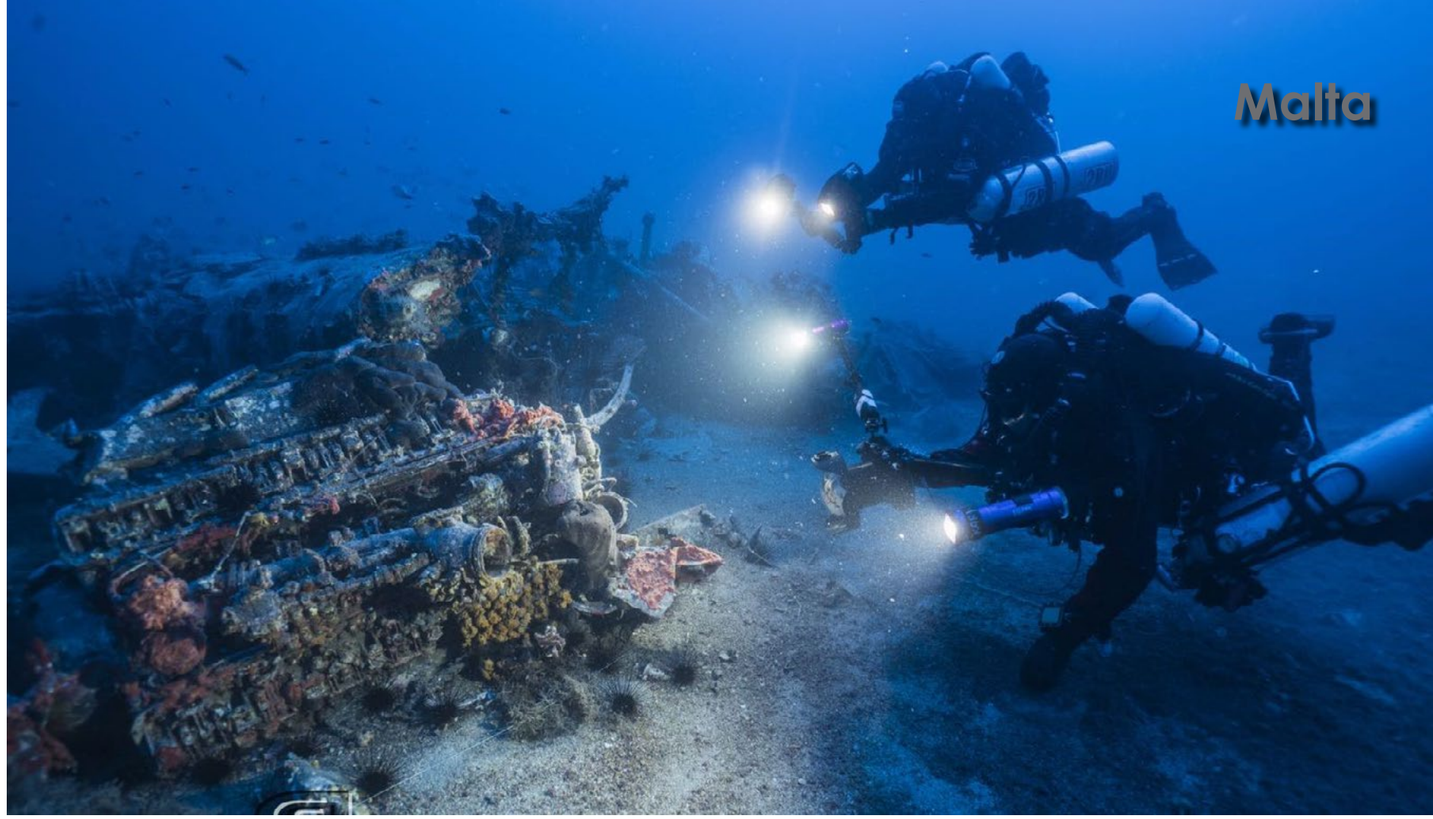
HMS *Russell* was a Duncan-class, pre-Deadnought battleship launched in February 1901 for the British Royal Navy. With a speed of 19 knots, she was one of the fastest warships of her time.

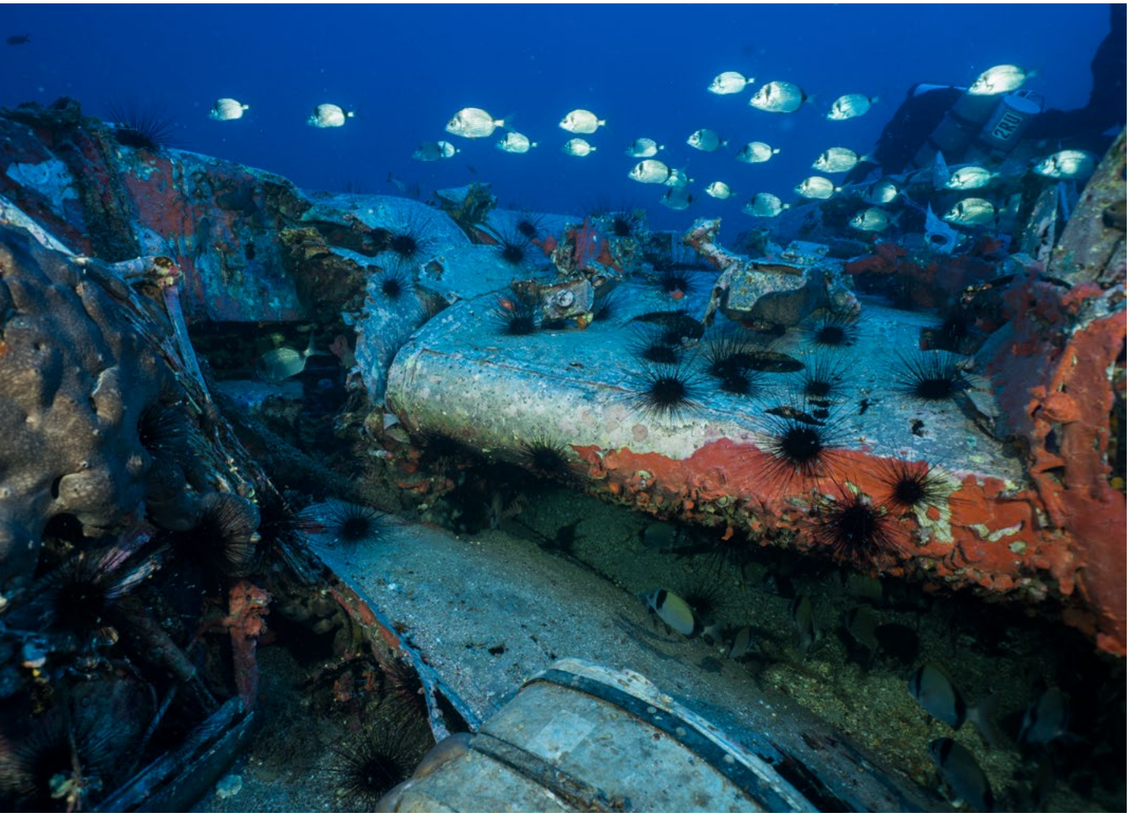
In April 1916, *Russell* was on her way to return to Malta for a fortnight to recuperate and get some minor repairs done, giving her crew some time on land. The Grand Harbour was closed due to boom defence, in which small auxiliary ships laid and maintained steel anti-torpedo nets around the harbour. While manoeuvring outside the harbour, she struck by two naval mines laid by German mine-laying submarine U-*73*. A fire broke out in the aft of the ship, which led to an explosion by one of the turrets, forcing the vessel to list perilously. It took 20 minutes before *Russell* capsized and sank, giving most of the crew enough time to escape.

Currently located about 6km east of Fort St. Elmo at a depth of around 115m, the *Russell* wreck site is a boat dive for technical divers on trimix. With its stern section missing, the 132m-long wreck



Divers on the wreck of the Junkers Ju 88, a German WWII Luftwaffe twin-engined multirole combat aircraft





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lies completely upside down on the sandy seafloor.

Junkers Ju 88

Due to Malta's importance as a port for the British in WWII, the strategy of the Axis forces was to bomb the harbours, towns and Allied convoys bringing supplies to Malta in order to destroy the country and starve its citizens. Between 1940 and 1943, the Siege of Malta saw the destruction of many ships and planes of both the Allied and Axis forces. Junkers Ju 88 was a German twin-engine, all-metal bomber, one of the many pawns of the Axis forces in WWII.

Divers who are interested in airplane wrecks will find the Ju 88 wreck in relatively good condition, with her broken tail a short distance away and the cockpit still retaining its forward-facing machine gun. Resting at 57m, it is one of the shallower wreck sites outside Salina Bay.

Fairey Swordfish

The Fairey Swordfish was a British single-engine biplane torpedo bomber, about 11m in length with a 14m wingspan. In 1941, Fairey Swordfish biplanes were utilised to cripple the shipping vessels of Axis forces.

This particular plane experienced engine failure in April 1934, forcing the craft into an early underwater burial. Luckily, off-duty men from the Royal Air Force's air-sea rescue services came to the rescue of the pilot.

Deep-water wreck diving

"It is envisaged that the Maltese Islands will become a market leader in the field of deep-water wreck diving," said Owen Bonnici, Maltese Minister for Justice, Culture and Local Government, in a recent press release announcing the launch of the UCHU.

These sunken heritage wreck sites are more than 40m deep, requiring technical diving certification to be dived and explored. With wreck remains at depths ranging from 55m to 115m, Malta offers some of the best deep-water wreck diving in the region.

Usually at these depths, the type of flora and fauna present is secondary in interest to the wrecks themselves. The sheer size of destruction in the

THIS PAGE: Scenes from the wreck of the Junkers Ju 88; Historical photo of a Junker Ju 88 aircraft (center)

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Diver on wreck of the *Polynesian* (above); Wreck of the *Trusty Star* (right); Diver on wreck of a WWII Fairy Swordfish (top left); Historical photo of Fairy Swordfish, a British WWII torpedo bomber (left); Overview of the Fairy Swordfish wreck (far left)

aftermath of the world wars, combined with the rich history behind each wreck site is overwhelming.

To aid divers in properly exploring the historical wreck sites, Heritage Malta will provide dive schools and clubs with promotional and educational materials such as waterproof cards about each wreck site. Besides adhering to strict rules and regulations for diving the wrecks and maintaining the integrity of the wreck sites, dive operators are also responsible for the health and diving qualifications of the divers diving the sites.

Apart from mapping the wreck sites and making the underwater wrecks public, the UCHU is initiating an outreach programme to inform the public about the importance of Malta's underwater cultural heritage. ■

For more information, please visit: ***visitmalta.com/en/home****.*

Based in Singapore, Fatin Iesa is a science educator and dive writer, certified as a PADI divemaster. She says she must have been reincarnated from a dugong, since she craves diving every other day. Always searching underwater for a pretty octopus in crevices, being surrounded by bubbles and blue is her bliss.

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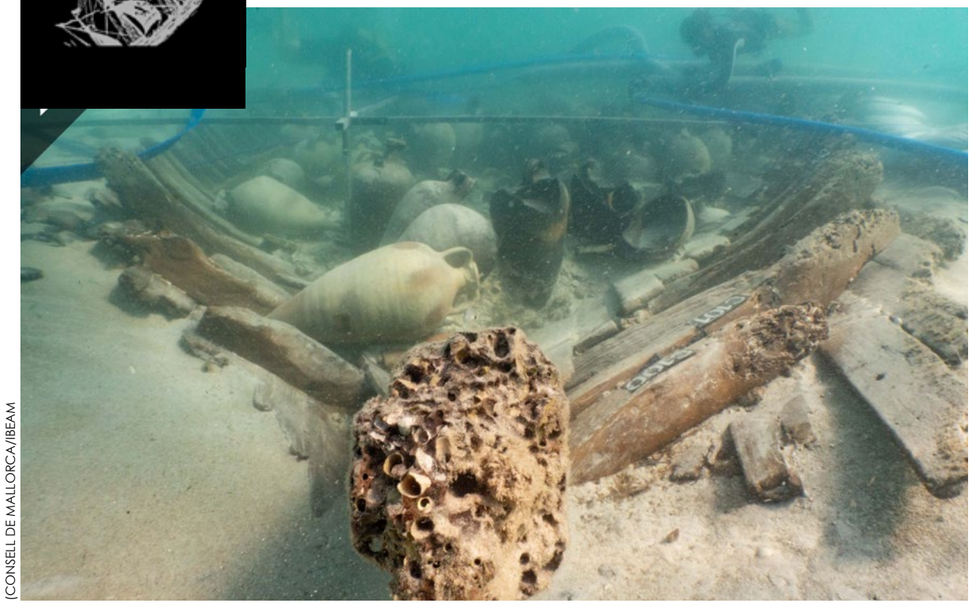
WRECKSITE.EU
WW2DB.COM



(CONSELL DE MALLORCA/IBEAM

Well-preserved Roman shipwreck holding nearly 100 amphoras found off Mallorca

The treasure trove of relics was first discovered in July 2019 in the waters of S'Arenal beach in Palma, according to an announcement from the Council of Majorca.

The vessel—which experts have dated back to around 1,700 years ago—sank mere feet off of the coast of what is today Can Pastilla Beach. According to the archaeologists, the seabed near the beach was dotted with at least 93 amphora, traditional jugs with two handles and a narrow neck used by the Greeks and Romans—many of which remained intact. The wreck is around 10m (33ft) long and five metres (16ft) wide. The merchant ship is thought to have been carrying its wares between Mallorca and the Spanish mainland. Given the excellent preservation of its fragile cargo experts think the shipwreck was likely not the result of a storm.

In a press conference, archaeologist Sebastian Munar of the Balearic Institute of Maritime Archaeology Studies said that the amphorae were perfectly conserved in the ship's hold.

Judging by the ship's route, the age of the wreck and some of the inscriptions on the amphora, the archaeologists suspect it was carrying olive oil, wine and a fermented fish gut sauce called garum—a soy sauce-like condiment that was hugely popular in ancient times.

However, researchers will not be able to open the amphoras to check until they have finished preservation work that will stop the salt in the sea water cracking the jars. ■ SOURCE: BALEARIC INSTITUTE OF STUDIES IN MARITIME ARCHEOLOGY

US NAVY

USS *Eagle 2*, an identical sister ship of *Eagle 56*

Last US warship to be sunk by a German sub during WWII located off the coast of Maine

At noon on 23 April 1945, USS *Eagle PE-56* exploded amidships, and broke into two pieces 3mi (4.8km) off Cape Elizabeth, Maine. The sinking of the USS *Eagle* was originally blamed on a boiler explosion. But in 2001, the US Navy determined it had been sunk by a German submarine, and the ruling was changed to reflect the sinking as a deliberate act of war, perpetuated by German submarine U-*853*, a U-boat belonging to Nazi Germany's Kriegsmarine.

The World War I-era patrol boat split in half, then slipped beneath the surface of the North Atlantic. When it sank, 49 of its 62 crew were killed, and the others had to be rescued from the ocean by a passing Navy boat.

Despite the Navy's effort to clarify the circumstances surrounding the sinking, the *Eagle 56* remained a mystery. The ship had sunk relatively close to shore, but efforts to locate the wreck were futile for decades. No one could find the *Eagle 56*, a small patrol ship that had come so close to making it back home.

The ship's wreckage was located in June 2018, and visited by a civilian dive team later, the same month. It lies five miles (8.0km) off the coast of Maine at a depth of 91m (300ft). A video taken by the divers shows that USS *Eagle 56's* boilers are intact, proving once and for all that they did not explode.

Business Insider spoke to two crew members—Jeff Goodreau and Donald Ferrara—about their discovery. "The *Eagle 56* was always the shipwreck to find. That was the great ghost of New England. A lot of people looked for it. Nobody could find it," Goodreau stated

But the *Eagle 56* was never going to be an easy find. Goodreau described the ocean floor north of Cape Cod as a labyrinth of rocky mountains and canyons. The *Eagle 56* was a "fairly small" boat. And, though the crew did not know this at the time, it was lodged in a trench.

"It's kind of like the equivalent of dropping a soda can into a canyon and putting on a blindfold and going and finding it, because you can't just look down and see it," Goodreau said. "Visibility's 10 feet. It's pitch black."

Even worse, the crew's expensive magnetometer ended up being somewhat of a bust, thanks to the undersea terrain. "It turns out that the rocks off of Maine aren't only big, they're full of iron," Goodreau said.

The exploration of the wreck will be featured in the three-part series "The Hunt for Eagle-56," which premieres on the Smithsonian Channel on September 22.

■ SOURCES: WIKIPEDIA, BUSINESS INSIDER

wreck rap

Edited by G. Symes

More Wreck Beers Brewing

Resurrected, centuries-old beers discovered on shipwrecks by divers have been in the news this year. Let's look at a few of these beers and their backstories…

JAMIE ADAMS VIA AP

New York, USA – Salvaged from the SS *Oregon*, a luxury liner that sank in 1886, a 131-year-old ale has been crafted from yeast found in bottles at the wreck site. The steamship was making its way from Liverpool to New York, when it struck a schooner and sank near Fire Island. From 2015 to 2017, divers led by Jamie Adams of Saint James Brewery in Long Island discovered over 20 bottles with corks intact in the first-class dining room of the ship. With the help of a microbiologist, Adams was able to recreate the beer from yeast, which is thought to have been used in a beer called *King's Ale*, produced over a century ago by Bass Brewers in England. The new ale crafted from the resurrected yeast was named *Deep Ascent*. ■

SOURCE: ABC3340, AP NEWS

ANTONIN HALAS / VVT

Aland, Finland – Divers salvaged five bottles of 170-year-old beer from an early 19th century shipwreck in the Aland archipelago of Finland in 2010. The discovery was one of the world's oldest preserved beers found. Now, after analysis of the yeast in the beer conducted by VVT Technical Research Centre in Espoo, an Åland Islands micro-brewery, Stallhagen, has been able to make an authentic replica of the beer, which is called *Stallhagen Historic Beer 1842*, by using the micro-organisms in the beer found on the wreck. According to Mats Ekholm, master brewer at Stallhagen, it is a Beglian wild-yeast beer. Because wild yeasts have a tendency to spread, they have to be processed in a strictly controlled environment. So, the historic beer was produced at the University of Leuven's beer laboratory in Belgium. ■ SOURCE: HELSINKI TIMES, NEWS18, VVT

JAMES SQUIRE

Tasmania, Australia – A 220-year-old bottle of beer has been recovered from a shipwreck dating back to 1797, located off Preservation Island in Tasmania. To reach Sydney, the 17 survivors of the merchant ship *Sydney Cove*, which sank due to heavy seas and extreme weather, trekked a grueling 600km on foot along the southeastern coastline across dunes, cliffs and rivers. In the end, only three survivors made it. In collaboration with the Australian Wine Research Institute and Queen Victoria Museum & Art Gallery of Launceston, a brewing team from James Squire, one of the oldest breweries in Australia, have extracted yeast from the recovered ale to craft a new beer, which they have called *The Wreck Survivors' Ale*. ■

SOURCE: THEAUREVIEW, WIKIPEDIA

BRITISH LIBRARY / WIKIMEDIA COMMONS / PUBLIC DOMAIN

The barrels found on the wreck of the *Gribshunden* (*Griffen*) may have been used in a similar way to those depicted in this detail from an illustration in *Treatise on the Vices,* which was originally published in Genoa, Italy, in the late 14th century. It shows a cellarer among barrels, handing a glass to drinkers in a chamber above him.

Ronneby, Sweden – A 500-year-old Danish beer may have been discovered by divers during the excavation of the *Gribshunden* (or *Griffen*), the flagship of King John of Denmark, which sank in 1495 off the coast of southeastern Sweden, at Ronneby. The ship, which was on its way to negotiations with Swedish separatist forces when it met its demise, is considered one of the world's best-preserved 15th century vessels, similar to the kind that Christopher Columbus sailed when he discovered America. Sten Sture the Elder, who led the Swedish separatist forces to victory at the Battle of Brunkeberg in 1471, established himself as ruler of Sweden.

In collaboration with the Blekinge County Administrative Board and Ronneby Municipality, the excavation and investigation of the wreck is being done by a team of researchers from Lund University, Södertörn University and the Blekinge Museum, as well as several other international scientists. Researchers found coins, animal bones, tool fragments and a small ring on the wreck, as well as several barrels containing liquid, with holes for aeration and bottling. In those days, water was not considered safe to drink, so sailors drank beer. It is very likely that the barrels found on the wreck contain beer, according to Professor Johan Rönnby at Södertörn University.

"We're taking sediment samples now and hoping we're going to find DNA evidence of hops," Brendan Foley, Rönnby's fellow researcher from Lund University, told The Local. "What we're doing is getting a look at not just what the men on the ship were drinking but what King John was taking to Kalmar to impress Sten Sture the Elder." ■ SOURCE: SPUTNIKNEWS.COM

travel news

Edited by
P. & G. Symes

BRANDI MUELLER

Komodo dragon on Komodo Island, Indonesia

Komodo to stay open, but will cost US$1000 to enter

Famous for its Komodo dragons, Komodo Island, which is a Unesco World Heritage site, will now remain open next year, Indonesian officials announced.

Back in July, a closure for a year had been announced, due to a decline in the Komodo dragon population. The announcement followed a theft of 41 Komodo dragons by alleged smugglers in March.

However, a shift in position by the government appears to have taken place. Instead of closing the park, restrictions on visitor numbers will be put into place alongside the rise in entry fee, which used to be US$10. Now, it is US$1000 for a full-year membership, which will effectively price out many tourists.

"Komodo Island will not be closed," said Luhut Binsar Pandjaitan, coordinating maritime affairs minister, in a statement. "A restriction will be placed on the number of tourists to Komodo Island by rearranging its ticketing system."

BERNARD DUPONT / FLICKR / CC BY-SA 2.0

Komodo National Park, Indonesia

Komodo dragons not affected by overtourism

In addition, officials stated that visiting tourists have not had a negative impact on the Komodo dragon population. Siti Nurbaya Bakar, Indonesia's environment and forestry minister, told *Reuters*, "[The number of] Komodo dragons on Komodo island during 2002 to 2019 observations has been relatively stable . . . There is no threat of a decline."

For tourists, there will be a choice of the premium membership at US$1000, which allows access to Komodo Island itself, or a non-premium membership at a rate yet to be disclosed that allows access to neighboring islands, which are also part of Komodo National Park. Luckily, Komodo dragons are not just found on Komodo Island, but can also be found on Rinca, Gili Dasami and Gili Montang, which are part of the national park, as well as Flores Island. ■ SOURCES: INDEPENDENT, GUARDIAN

How to check if your hotel room safe is really safe

PXHERE

Many safes used in hotel rooms have a code that overrides whatever combination it is set to, in case the guest forgets their own code. Problem is that they are sometimes left to default manufacturer's settings, which are either known or easily guessed.

Most of us will probably assume that leaving spare cash, passports and jewellery in the hotel room safe is the best way to keep it secure on holiday. However, many basic safes used by hotels have a code that overrides whatever combination it is set to. Most hotels either have a master code or a key for when guests happen to forget the code they have set on the hotel room safe. A varying number of hotel employees may have access to the code/key and can easily gain entry to your hotel room. Furthermore, the default override code, left by the manufacturers, is often not changed by the hotel.

In an eye-opening **video** shared on YouTube by "LockPickingLawyer," shows how easy it is for an intruder to break into certain safes once they have gained entry to your room. In the clip, it is quickly demonstrated that would-be thieves do not need to know the real code in order to break in.

In the clip, LockPickingLawyer is seen setting a personal code—just as any guest does when leaving valuables in their room. After checking that the box is locked, the man then enters an incorrect code on purpose but is barred from opening the door as he should be. However, the man then presses the "lock" button, followed by 999999, and the door opens.

In the video, 999999 is mentioned as a default code. It can also be 111111, 123456 or 000000 or 1111,1234, 9999, 0000, depending on the product and manufacturer.

Check the safe

As a result, all guests should check whether their own hotel safe opens after trying out any of these generic master codes before deciding whether or not to leave their own items alone on vacation. Do not use birth dates, room number or check-in date as the pin-code. Also check if the safe is actually mounted to the wall and not just the furniture. ■

Electric airplanes?

Several major and commuter carriers in the Nordic countries of Norway, Sweden, Iceland and Denmark and the territory of Greenland have signed up to support an initiative to develop electric airplanes.

In Oslo, Norway, the Nordic Electric Aviation Network (NEA), whose mission is to accelerate development of electric aviation towards sustainable air travel, now includes SAS, Finnair and Icelandair, as well as Air Greenland, Avinor, Braathens Regional Airlines (a Norwegian-owned Swedish domestic carrier), Heart Aerospace, El Fly (an electric airline startup) and airport operator Swedavia Airports, in partnership with Fossilfritt Flyg 2045 (Fossil Free Flight) and the Research Institutes of Sweden (RISE). The NEA network is hosted and coordinated by an organization under the Nordic Council of Ministers called Nordic Innovation. It promotes cross-border trade and innovation.

"Flight shaming"

Current travel trends are seeing travelers and businesses reconsidering air travel and its carbon footprint. "Flight shaming" and "train bragging," which originated in Sweden, is spreading through Europe and abroad. However, in some regions, especially Norway and Iceland, the terrain is an obstacle for high-speed rail and air travel is the only feasible option for many small towns.

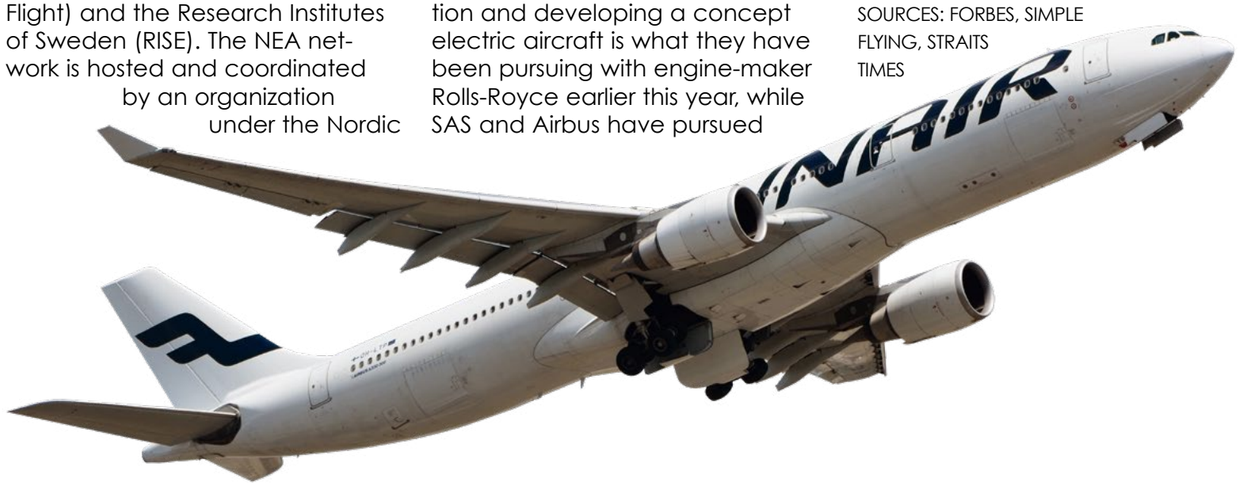
So, when the technology is developed, Norwegian domestic carriers, such as Widerøe, are keen on replacing their old turboprop planes with electric ones for its short-distance regional services. Research into zero-emissions aviation and developing a concept electric aircraft is what they have been pursuing with engine-maker Rolls-Royce earlier this year, while SAS and Airbus have pursued similar deals in hybrid and electric aircraft research.

Working together

Challenges remain in development efforts, but RISE project leader Maria Fiskerud thinks that the aviation industry must work together to realize their common goals. "We believe that the fastest, most affordable and sustainable transportation for regional travel is electric aviation. To achieve that, we need to gather knowledge and people from many different sectors," said Fiskerud.

Indeed, even though the network's main focus centers on standardization of infrastructure and sustainable connectivity in the Nordic region, there will eventually be development of international collaborations to promote the Nordic model to other areas of the world. ■

SOURCES: FORBES, SIMPLE FLYING, STRAITS TIMES



MASAKATSU UKON / WIKIMEDIA COMMONS / CC BY-SA 2.0

Get involved in the Sunset House and Eco Divers Reef Foundation coral collaboration

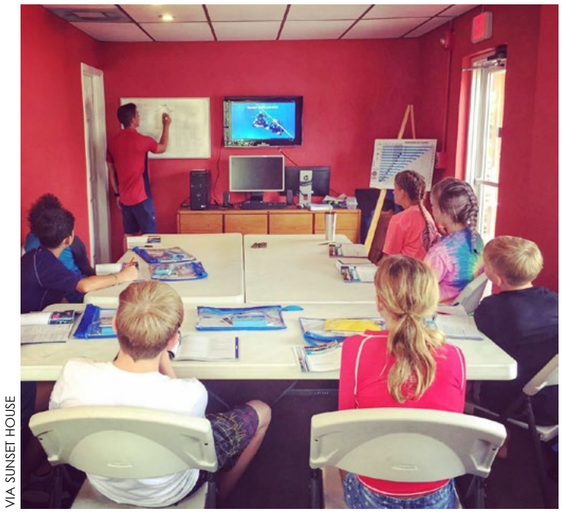
In 2016, the Cayman Islands Department of Environment granted Sunset House a permit to set up a coral nursery, with the aim of growing coral fragments to help replenish Cayman's reefs.

Now, according to Aaron Hunt, coordinator of the Eco Divers Reef Foundation, the project is beginning to bear fruit. "After two years of the coral nursery program, we have an 85 percent survival rate of our transplanted corals," he said.

At present Hunt manages 14 coral nurseries on the island, including the House Reef at Sunset House. His work gives him hope for the future of Cayman's reefs after he recently witnessed transplanted corals in the Sunset House nursery spawning and sending baby corals out in the water to settle somewhere else to grow. "In 2017, we recorded the coral spawning, and now we can see the new corals growing," said Hunt. "It's very exciting and satisfying to see that it works."

In light of this, Sunset House (**sunsethouse.com**) is collaborating with Hunt to give divers the opportunity to access coral conservation and reef renewal courses and dives. These are actually quite special because divers will be able to learn how to properly collect real-time data that is then submitted to CoralWatch. This not-for-profit, citizen-science program works with a global network of volunteers to increase understanding of coral reefs, coral bleaching and climate change.

"We're excited to be working with Aaron on coral conservation education because we are all concerned about our reefs and environment," said dive manager Mike Pinnington. "Not only will Aaron be teaching our guest divers how to clean coral and detach algae, he will also guide them through our coral nursery or include them in reef restoration tasks."



VIA SUNSET HOUSE

Learn about coral conservation and reef renewal.

Special courses and dives

Divers will be able to take part in two distinctive courses—the CoralWatch Distinctive Speciality Course and PADI Reef Renewal Distinctive Speciality Course—as well as three remarkable dives: the guided coral nursery dive, the coral spawn lecture and reef survey, and a reef renewal dive. It will mean that divers will be able to see new corals after spawning events or learn how to remove predators that can damage the corals and affect their growth.

Emma-Jane Fisher, marketing manager at Sunset House, said "We have got a hard-earned reputation for being one of the world's best dive resorts (Scuba Diving Magazine: Readers Choice Awards 2019), perhaps because we notice the small details and take them seriously, and this, of course, includes the environment. For instance, all our dive boats are equipped with skimming nets so that the staff can easily recover trash, plastic or rubbish floating on the sea.

"We are therefore really pleased that Aaron Hunt will be training our instructors too. It is very important to us that our instructors are taught properly, so that they in turn can teach coral restoration correctly. It's a fascinating time for us because Aaron is reporting great success with transplanting staghorn and elkhorn corals. Consequently, this coral restoration and transplantation collaboration is a win-win for everyone who cares about the ocean environment."

To book your place on a coral restoration course at Sunset House, Grand Cayman, simply email reservations@sunsethouse.com or check out www.sunsethouse.com. ■

VIA SUNSET HOUSE

Aaron Hunt is the coordinator of the Eco Divers Reef foundation, which has set up a coral nursery at Sunset House in the Cayman Islands

VIA SUNSET HOUSE

Sunset House's dive boats have skimming nets to pick up rubbish at sea.

VIA BEYOND THE REEF, BVI

An aircraft turned into a shark sculpture by the Beyond the Reef project

British Virgin Islands about to sink one vessel and three aircraft as artificial reefs

After the devastating hurricanes Irma and Maria in 2017, the British Virgin Islands are turning hurricane-destroyed vessels into unique dive sites through the non-profit organization Beyond the Reef.

Members of this group were heavily involved in the sinking of the British Virgin Islands' now famous *Kodiak Queen* "art reef" and are excited to continue with their next project, which involves removing three derelict airplanes from the airport and turning them into half airplane-half sharks. Although a half airplane-half shark sounds unconventional, the two have blended together seamlessly and the group hopes that the "sharkplaneo" will generate positive awareness for the necessity of sharks in our waters, while also making for a fun and interactive new dive site. The site will feature an airplane bull shark, blacktip reef shark and hammerhead shark, along with a coral archway garden made from recycled mooring lines.

Following this, they plan to turn the legendary floating bar and restaurant, the *Willy T*, which was also destroyed in Hurricane Irma, into an underwater pirate ship playground.

In addition to creating new reefs for marine life and new dive sites for tourism, Beyond the Reef is most excited that these wreck sites will go back to benefiting local children through generating donations for children's swimming lessons.

It is currently believed that only one-tenth of children in BVI are able to swim, and Beyond the Reef asks that every diver who enjoys their sites donate US$5 in exchange for a souvenir sticker (one that might even get you free stuff around town), which goes directly into teaching local children to swim. By their predictions, the donation revenue brought in just by scuba divers on these continuing art reefs should be enough to teach every child on island to swim within 10 years. So, come visit BVI, dive the art reefs and know that the diving community is making a massive difference.

■ SOURCE: VIA PRESS RELEASE

Coral disease triggers partial closure of Cozumel Marine Park

Text by Steve Rosenburg
Photos by Larry Cohen
and Olga Torrey

The dive community has been "abuzz" about the partial closure of the southern reefs of the island of Cozumel in Mexico, which started on 7 October 2019. To clarify the situation, a group led by the Cozumel Reefs National Marine Park and several environmental groups, initiated a two-month closure of the reefs from Palancar Pier and southward, from 7 October to 15 December 2019, to give these reefs a bit of a rest.


LARRY COHEN

Over the course of the past year, many of the hard corals around the island have been infected by diseases that were first observed in the Miami area back in 2014. The scientists who have been studying these diseases believe that their source is untreated effluent (or liquid waste) from resorts and/or cruise lines. One of the main reasons for the closure is to bring attention to the seriousness of the problem.

Effective 7 October through 15 December 2019

In a joint action taken by the Secretary of Environment and Natural Resources, the National Commission of Natural Protected Areas (CONANP) and the advisory counsel of the Cozumel Reefs National Marine Park, it was decided that there would be a temporary closure of the southern part of the marine park from the Palancar Pier and southward. It was determined that this closure would take effect on 7 October 2019 and continue through 15 December 2019. The stated reason for the temporary suspension of diving and snorkeling activities in this area was to give the reefs some time to recover.


LARRY COHEN

Background

The background story is that by the end of 2018, Cozumel's coral reefs had seen a huge decline. Hard corals had been infected by diseases called Stony Coral Tissue Loss, SCTL, and White Band Disease. White Band Disease gets its name from the white bands of dead coral tissue that it forms. None of these diseases should be confused with coral bleaching, which is something entirely different.

The suspected bacterial infections spread rapidly killing many species of hard corals. Healthy Reefs, a group that tracks the health of the Mesoamerican Barrier Reef System, states that the effect of the disease is "unprecedented" as mortality rates are very high and around 30 different types of hard corals are susceptible to it, including brain corals, pillar corals, flower corals and star corals, to name a few.

Reef-building corals affected

Among the particularly troubling aspects of this disease outbreak is that the diseases have affected more than half of the reef-building hard coral species. It has also spread quickly and has a high mortality rate among affected hard corals. According to the Florida Disease Advisory Committee and the Florida Department of Environmental Protection, the scientific community seems to believe that the disease is transmitted primarily through the water column, but speculates that it can also be transmitted by contact.

The first sighting of the destruction of these types of corals was in the Miami area in 2014. In Mexico, it was first seen at Puerto Morelos, 45km south of Cancún, and it made its way to the reefs off Cozumel in early 2018. By late 2018 and early 2019, the disease had spread throughout Pompano Beach, Palm Beach, the Upper Florida Keys, and to parts of the Caribbean, including Jamaica, Saint Maarten, the US Virgin Islands, the Mexican Caribbean, the Dominican Republic, Saint Thomas and Honduras.

The exact cause and source of the disease is unknown, but scientists believe that it is linked to pollution and possibly the presence of seaweed such as sargassum in seawater. The phenomenon occurs as a result of pollutants (and possibly rising water temperatures), which cause the coral polyps to expel the algae on which they feed, and that live in their tissues.


LARRY COHEN

LARRY COHEN

The tissues then disconnect from the coral skeleton, the animals die and the reef loses its color.

Solutions

Researchers are still without solutions to the problem, although the state is working on a massive project, replenishing damaged reefs with laboratory-grown coral. In a couple of areas in the western Caribbean (namely along the coastline of the Mexican mainland and in Honduras), there is an effort underway, to replant hundreds of thousands of "lab-grown" corals on the reef. The goal of the project, which began in 2017, is to re-establish healthy corals, hoping that water treatment efforts will minimize the presence of pollution, the probable source of the bacterium.

Causes

The Cozumel Reefs National Marine Park has acknowledged that cruise ships and the mismanagement of waste at coastal hotels in and around the marine park are amongst the most likely causes for the spread of the disease. Although the causal agent of the bacteria is not clear, most scientists think that the bacteria has evolved from pollution (untreated effluent) dumped in the ocean by cruise ships and resorts.

The action taken to close Cozumel's southern reefs to divers was done so for two reasons. First, the Park wanted to slow one potential cause of the spread of the bacteria, which was physical touching of the coral by divers. Studies have shown that during an average four-hour period on any given day of the week, there have been as many as 2,000 touches by divers in the southern reef area.

Second, and perhaps the more important reason, is that the closure will create an awareness of the problems that the reefs in Cozumel are now facing.

Many people want to know why the partial closure was ordered and why the partial closure was only for the southern reefs (Palancar, Columbia, Chun Chacaab, Maracaibo, Punta Sur and Cielo). I have spent quite a bit of time this year diving in Cozumel, as well as other nearby destinations such as the Bay Islands on Honduras. This year, I observed a lot of SCTLD or "White Band" disease in many areas of Cozumel and the Bay Islands of Honduras. The areas of Cozumel that have been affected by the disease are certainly not limited to the southern reefs.

LARRY COHEN

New regulations

New regulations require that hotels and beach clubs install water treatment equipment. This is certainly a good thing. It also reported at this time that regulations require cruise ship lines to treat their effluent (liquid waste) before dumping it in the ocean. This is extremely important because this is the most likely source of the bacterium that has attacked the corals. Obviously, sewage treatment is very expensive, but this step is an integral part of the long-term solution.

Usage and fees

Based on a study that was undertaken at the request of the Mexican authorities by the German Agency for International Cooperation, there were findings that a)the Cozumel Reefs National Marine Park gets 1.8 million foreign visitors per year; and b) that the average visitor would be happy to pay 3,052 Pesos (US$155.00) per person for use of the marine park.

There is some indication that the park is considering the imposition of new use fees on tourists. Most of these visitors to the marine park would include tourists who come to Cozumel off the cruise ships for just a few hours and a lesser number of tourists who come to Cozumel specifically to dive. I would speculate that, in reality, a very small percentage of the cruise ship tourists, if any, who were told that they would have to pay US$155 to dive or snorkel for a few


LARRY COHEN


OLGA TORREY

Cozumel

hours during their one day stay on the island would actually choose to use the park at such a cost.

A more difficult question would be how potential dive tourists would react to a substantial increase of the use fees they are already paying to use the marine park. Cozumel is a wonderful dive destination, which offers incredible encounters with beautiful and unique marine life. However, one of the considerations for many of the divers who come to Cozumel have chosen Cozumel rather than other destinations because it is less expensive.

Dive sites closed

The dive sites that will be closed in Cozumel are all dive sites from the Palancar Pier and southward include:

- All of the Palancar dive sites
- Colombia
- Punta Sur
- El Cielo
- Maracaibo

The good news

The good news for divers coming to Cozumel while the closure is in effect, is that there are many excellent dive sites for divers to visit outside of the closed areas, and they are the ones richest in marine life. The sites that remain open offer excellent opportunities to observe beautiful fish, sea turtles, invertebrates, colorful sponges and healthy corals for which Cozumel is known.


OLGA TORREY

Some of the excellent sites inside the boundaries of the marine park that are not affected by the temporary closure include:

- La Francesa
- Dalila
- Cedral
- Santa Rosa Wall
- San Francisco
- Punta Tunich
- Yucab
- Tormentos
- The C53 wreck dive
- Chancanaab (Park and Bolones)
- Paradise Reef

There are also several excellent sites that are outside of the marine park. These sites will remain open, and they include:

- Las Palmas Wall – Central west side
- Villa Blanca Wall – Central west side
- Miscellaneous shore dives south of San Miguel
- San Juan Reef - Northwest side
- Cantarel Reef – Northwest side
- Barracuda Reef – Northwest side
- El Puente Dos – North end
- Tiburcio – North End
- Hanan - East side
- Cannons – East side

Final thoughts

Multiple meetings have been announced to examine the details of the closure and the effect that the closure has on tour operators, which are concerned about the backlash and economic impacts that the closure will have and the future of the state of Cozumel's coral reefs. There have been discussions that indicate that if the closures extend past the end of the year, there may be a rotation of the closures throughout various areas of the marine park.

Many marine-park business permit holders have asked to have a Federal Attorney for Environmental Protection (PROFEPA) office in Cozumel that can police the marine park and keep out the many illegal dive and snorkel operators as well as illegal fishing, which occurs daily within the marine park. PROFEPA is the institution in charge of formulating and conducting the inspection and surveillance policy on the conservation and protection of aquatic species at risk and of protected natural areas that include coastal and marine ecosystems.

Finally, Cozumel has much to offer for visiting divers. It is an excellent destination, which offers much to see and experience. There are countless groups that are working hard to address the many issues that the world's oceans face from population pressures. I, for one, am confident that Cozumel will remain one of the top destinations in the Caribbean for visiting tourists, and I will not hesitate to bring groups of divers here to experience the beauty and excitement of this great dive destination. ■

The Bahama's Tiger Beach

— Lemons & Tigers & Bulls, Oh My!

Text and photos
by Matthew Meier

Three female tiger sharks approaching the feeder (above); A great hammerhead shark swimming over the sandy bottom with sun rays overhead (top right); A great hammerhead shark and a tiger shark swimming past the feeder (previous page)

Standing on the swim step, trying to time my entry with a gap in the dozen or more lemon sharks circling directly below me was a bit daunting the first go around. Of course, the sharks knew this routine well and skillfully avoided my clumsy splash into the water. The reward waiting beneath the surface was an assemblage of sharks that cannot be collectively encountered anywhere else in the world.

As I settled onto the sandy bottom, a mere 20ft below the boat, a curious and very pregnant 13ft tiger shark came over to welcome me to her neighborhood. Soon a second, equally massive tiger shark appeared, then three bull sharks, several Caribbean reef sharks and a few lemon sharks followed along for good measure.

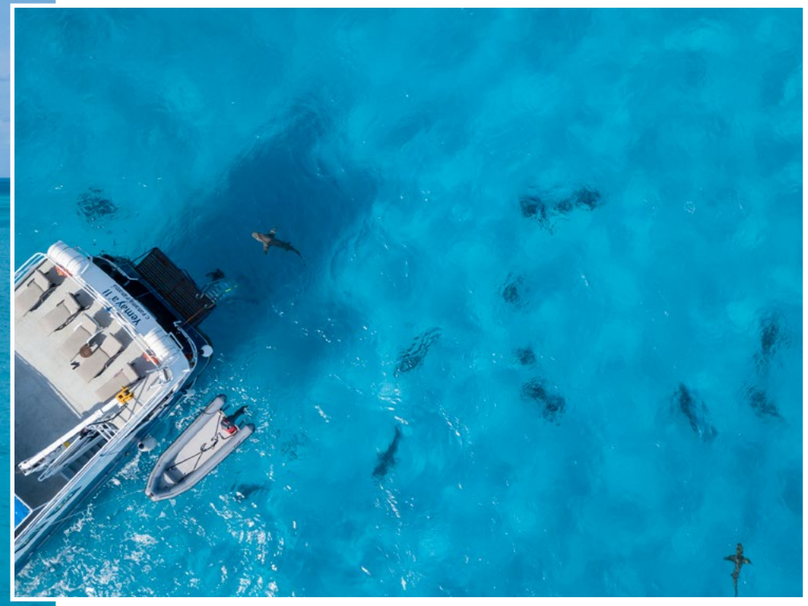
Finally, hovering only a few inches above the sand, a beautifully agile great hammerhead shark drifted past. It was just ten minutes into my checkout dive at Tiger Beach and I had already had close encounters with every shark I had hoped to see on this trip! My heart was pumping, my head was spinning and I could not even imagine how much more thrilling these encounters would become once the divemaster brought fish into the water and we began a proper tiger shark-feeding dive.

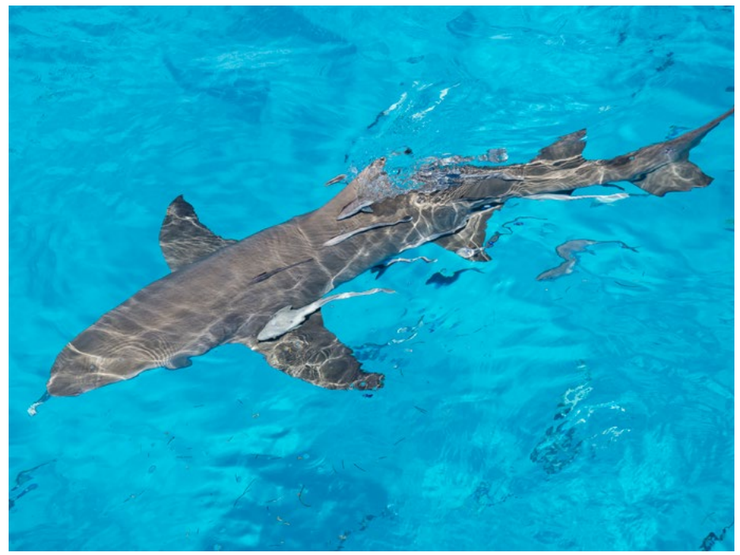
Getting there

Tiger Beach is a shallow sand flat located roughly 26 nautical miles from West End, Grand Bahama, and about equal distance from Fort Lauderdale in the US state of Florida. Divers have been interacting with sharks here for years, getting to this famous site via boats departing from both the United States and Grand Bahama Island. Day trips as well as multi-day liveaboard excursions are available from a range of operators, offering varying dive methods and creature comforts for their guests on board.

The *Bahamas Master* is the newest liveaboard in these waters and she began operations in February 2018, having previously catered to guests in the Pacific Ocean around Malpelo. Boats departing the United States have to cross the Gulf Stream, which can make for a rough journey, while boats from Grand Bahama depart from the towns of either West End or Freeport. The

A female tiger shark turning towards the camera





Aerial view of the *Bahamas Master* liveaboard anchored at Tiger Beach (above) with divers and tiger sharks visible in the water and several lemon sharks swimming on the surface off her stern (top right); A mother, baby and escort Atlantic bottlenose dolphins swimming alongside the boat in pre-dawn light (right); Looking down on a lemon shark swimming at the water's surface (far right)

passage out of Freeport Harbour can only be made at high tide and thus dictates when the captain is able to begin the 93-mile trek to Tiger Beach. Several daily flights are available from both Fort Lauderdale and Miami, in the United States, to the Grand Bahama International Airport in Freeport. A ferry service is also available for those that prefer not to fly.

How it works

My seven-day liveaboard adventure provided nearly unlimited bottom time and unfettered access to the sharks. For the majority of our trip, our divemasters rotated in and out of the water throughout the day, allowing the guests to submerge at their discretion. We visited dive sites such as Classic Tiger and The Pool, with depths of approximately 30ft and 18 ft respectively. I averaged 90 to 120 minutes per tank and spent up to five hours a day underwater.

At such shallow depths, there is not much need for a surface interval between dives, and I would often come up for more air, a quick restroom break, a drink of water and a snack before dropping right back into the water. When immersed with the sharks, divers were over-weighted, so we sank and stayed on the bottom. Traversing from the downline off the back of the boat to the feeding location was done by walking backwards in fins across the sand, as the divemasters did not want us swimming up in the water column.

Each diver was outfitted, head to toe, in dark-colored wetsuits to help eliminate any confusion a bright, contrasting color might create for the sharks, and we were given an extensive safety briefing before our first dive. For our own protection,

each diver was given a "patent-pending" 3ft section of PVC pipe to fend off the sharks. The pipe was meant to be placed vertically in the sand in front of an approaching shark so that the shark would change direction and not swim head on into a diver. Those of us with large dome ports on our underwater housings were instructed to redirect the sharks with our cameras, allowing for countless face-to-face meetings just prior to each shark being turned aside or guided up and over our heads.

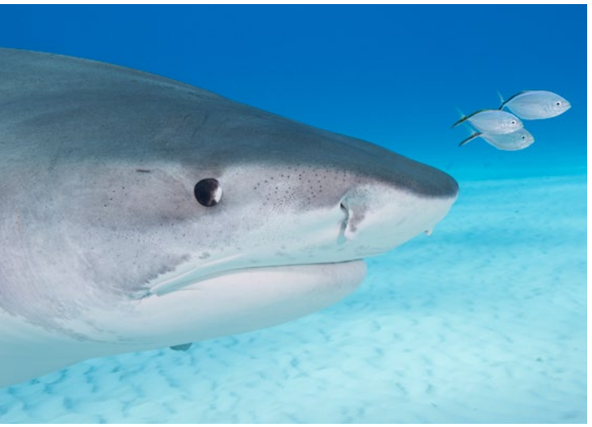
Baited dives

These dives were so-called baited or feeding dives, in which the divemaster/feeder went down with a small, steel crate of fish to attract the sharks, and on occasion, would offer a tiger or great hammerhead shark a hand-fed snack. No fish was intentionally given to the bull or lemon sharks, nor the nurse or Caribbean reef sharks, which also made appearances.

On several stretches throughout the trip, we were able to observe all six shark species on a particular dive. Still, I was only ever able to capture five of the species in a single photo. Divers formed two lines upcurrent in a "V" formation, kneeling on either side of the feeder, allowing the sharks to follow the smell of fish and essentially swim down a runway past the divers to the bait.

Enough space was left to either side of the feeder to permit the sharks to pass between the divemaster and the first guest before circling around for another stroll down the runway. The gap between each subsequent diver was kept at an arm's length to deter the sharks from swimming directly between the divers. When a shark followed this path, it was fairly easy to keep track of them, but there was almost always another shark coming from a different direction, requiring divers

Three female tiger sharks being redirected by the feeder (above); A pair of female tiger sharks approaching the feeder and bumping directly into my camera lens (left); A female tiger shark swimming up in the water column past the feeder, while three additional tiger sharks and a great hammerhead shark circle in the background (top left)



A pregnant tiger shark being hand fed (above); Profile of female tiger shark with three small fish swimming by its nose (left); Fisheye view of a female tiger shark being put into a state of tonic immobility by the feeder (right)

to keep their heads on a swivel and continually watch their backs.

All of the divers in the water worked in a collaborative system, pointing out each shark as they approached, to help give everyone an extra set of eyes on the backs of their heads. The intensity I thought I had experienced on my checkout dive was nothing compared to when six or eight tiger sharks were circling the group, and the top priority shifted from taking pictures to simply keeping the camera in-between myself and the nearest shark.

I was surprised at how sore I was at the end of the day from all of the twisting, turning, kneeling and lunging, which was required to keep an eye on my surroundings and maintain body position on the sand. Not to mention the mental exhaustion such an adrenalin-filled activity inflicts on one's body.

Special attention must be given to the tiger and great hammerhead sharks, while remembering not to ignore the bull or lemon sharks. All can be inquisitive and will suddenly appear behind you if you are not paying attention. The bull sharks especially can be quite brazen as they venture out from beneath the boat while divers are walking to or from the feeding location. Yet, as soon as eye contact was made, they quickly turned to swim back to the safety of the shadows.

Topside

When not in the water, guests were able to relax in the comfy beanbag chairs in the lounge, work on their tans on the back deck or even observe the shark action from up above, while sharing stories from their latest shark encounter—whether that was watching the circling lemon sharks, swimming near the surface, or looking down at the dark shadows of the tiger sharks strutting their way down the runway.

A pregnant tiger shark is redirected by the feeder, while two more tiger sharks swim in the background (left); colorful sunrise silhouettes low clouds on the horizon over the Atlantic Ocean (below)

Tiger Beach

Full meals were served three times daily, with multiple menu items offered to accommodate varying tastes and food restriction requirements. Snacks, sodas, juice, hot coffee or tea and water were always available, as were beer and wine after your dive day was finished.

Photography

I spent a lot of my time in-between dives in the camera room swapping out batteries and memory cards throughout the day. The rapid-fire action down below meant that I shot a ton of photos and quickly wore out my strobe's battery packs. The extensive access to the sharks also allowed me to test several lenses for differing perspectives and shot variety.

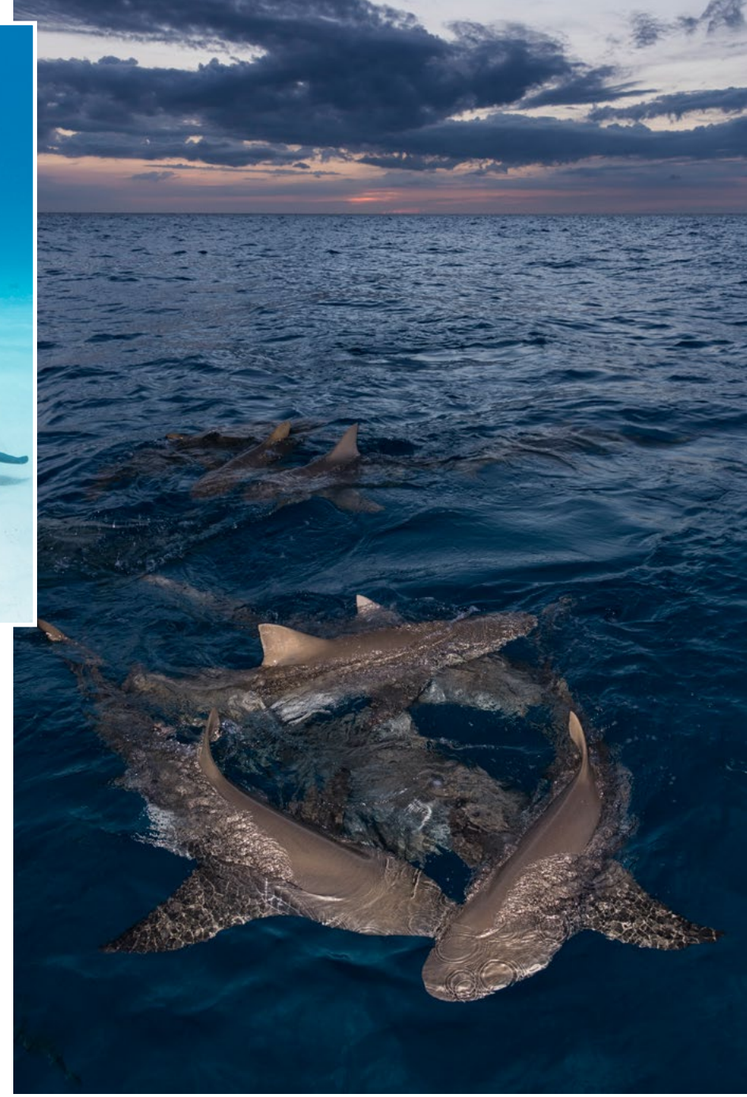
We enjoyed lovely sunrises and sunsets from the top deck and an incredible view of the night sky, with little to no light pollution so far out at sea. Several members of our group screened a different selection from the *Jaws* movies lineup each night, and there was always some sort of shark-related show on the television.

On two of the calmer nights while anchored at Tiger Beach, the divemasters attracted lemon sharks to the back deck for photo opportunities. Conditions were not ideal for sunset split shots, as we had sizeable waves at times, but I managed a couple of lucky photos in spite of being bounced around while laying on the swim step.

Known shark groups and individuals

The crew characterized the tiger sharks that visited us each day as belonging to one of three groups. The "Supermodels" were the most comfortable with the divers and would loop down the runway time and again, even when they were the only sharks in the area. The "Players" were familiar with the routine but would more readily saunter down the runway only if other sharks were present. "Wild sharks" were

Great hammerhead shark approaches the feeder while a tiger shark sniffs the bait box (above); Nurse shark (left)



Over-under view of a pair of lemon sharks swimming at the water's surface at sunset (left); A great hammerhead shark swimming over the sandy bottom (above); Several lemon sharks swimming at the water's surface at sunset (right); A bull shark swimming over the shallow sandy bottom (below)

skittish and would show up on occasion, attracted by the fish, but they stayed on the periphery and infrequently ventured towards the feeder, rarely getting close to the divers.

Many of the Supermodels and Players have been regular visitors over the years and are known by such names as Emma, Tequila, Maui, Maria, Frankie, Freckles and Jitterbug. In total, we saw 10 to 12 different tiger sharks during our expedition, including a couple of unnamed, new faces and one 8ft juvenile that made two brave, relatively close passes on our very last dive.

Nearly all of the tiger sharks that frequent this area are female. A large number of the ones we encountered were pregnant, and the sharks can be found here almost year round. For the past three years, a great hammerhead shark named "Patches" has taken up residency and another, even larger hammerhead named "Queen" has made frequent appearances. Unfortunately, we were not lucky enough to see her on our visit.

Patches was the first great hammerhead to migrate over from Bimini and not return. At 12 to 14ft long, she is an imposing figure, with numerous spots on her underside, for which she is named. The spots darken in color throughout the year as the melatonin in Patches' skin tans from the reflected sunlight off the sand.

Location and conditions

Tiger Beach sits just east of the deep water Gulf Stream and offers little protection from the wind and waves that Mother Nature can generate over the open ocean. Storms and winds from the west can stir up the sand in the shallows with strong waves and swell, reducing visibility and ultimately creating conditions that are not conducive to diving with the sharks.

On those nights when the wind was churning up the sea, our captain ventured farther east of Tiger Beach to anchor and find calmer sleeping conditions. For part of two days during our trip, we were unable to dive with the sharks, but this did not always keep us out of the water entirely. It actually provided us with the opportunity to expand our diving diversity with some reef dives.

There are beautiful, pristine coral reefs, with deep ledges and drop-offs, only a few minutes to the west of Tiger Beach, where the visibility is much less affected by the waves. As long as it is safe to enter and exit off the back of the boat, it is possible to dive the reefs and enjoy a colorful break from the sandy desert.

Tiger Beach

Diver with sponges and sea fans on reef just west of Tiger Beach (top left); Several fish above a reef garden of sponges and sea fans (top right); Large sponges and sea fans decorate a pristine coral reef (right); Caribbean reef shark swimming above sea fans on reef (left)

There are vibrant sea fans, large barrel sponges, beautiful hard and soft corals, several species of grouper, crabs, lobster, schooling reef fish and of course sharks. These were some of the healthiest reefs I have seen in the Bahamas, or even the Caribbean for that matter.

On occasion, the tiger sharks will follow the boat away from the beach, where you can encounter them in a free-swimming environment. Caribbean reef sharks, nurse sharks, bull sharks and lemon sharks can also be found swimming over the reef.

More dives with sharks

The last two days of our trip were near polar opposites as far as wind, waves, visibility and action. We started the second to last day with two dives on the nearby reefs in hopes that the wind would subside and conditions would improve underwater for the sharks.

By midday, we were anchored back at The Pool but the swell was still stirring up the sand and we consequently waited a few more hours before reassessing the situation. The decision was made later in the day to reestablish shark feeding activities and I hopped in the water for most of the next three hours.

The first two hours proved to be an exercise in Zen breathing techniques, as there was little to do at times but stare at the sand. We had a few Caribbean reef sharks, bull sharks and lemon sharks slowly circle the group, but their presence was often short-lived.

By the time I exited the water to refill

Tiger Beach

Pair of pregnant, female tiger sharks (above); Pair of Caribbean reef sharks swim over the sandy bottom (bottom left); Lemon shark resting on the sand with accompanying remora (top left)

my tank, our group had dwindled to the point that there was only one other person still in the water with the feeder. After my airfill, I stayed near the surface at the back of the boat in an attempt to photograph the lemon sharks up in the water column before seeing our first tiger shark of the day approach down below.

Freckles had showed up to pay us a visit and the three of us remaining in the water had her all to ourselves for the next 40 minutes. It was an incredibly peaceful afternoon that made us all appreciate the sheer number of sharks we had been diving with throughout the week.

Our last morning started a bit earlier than previous days, in hopes we could attract more of the sharks to our position and to give ourselves more time in the water before heading for home. The sun was shining, the wind had calmed, and everyone was excited for our last opportunity to get in the water with the sharks.

The early wake-up call seemed to pay off as we had six to eight tiger sharks (plus Patches), swimming amongst us for the next four hours, with beautiful light rays streaming in from above and clear, blue water all around. It was a magical, storybook ending to an extraordinarily memorable experience. I highly recommend this bucket-list, trip-of-a-lifetime-type adventure for anyone interested in a heart-pumping, intimate encounter with these magnificent apex predators. ■

*The author would like to thank Master Liveaboards and the crew of the Bahamas Master (**masterliveaboards.com/bahamas**) for hosting this expedition as well as 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. To see more of his work and to order photo prints, please visit: **matthewmeierphoto.com**.*

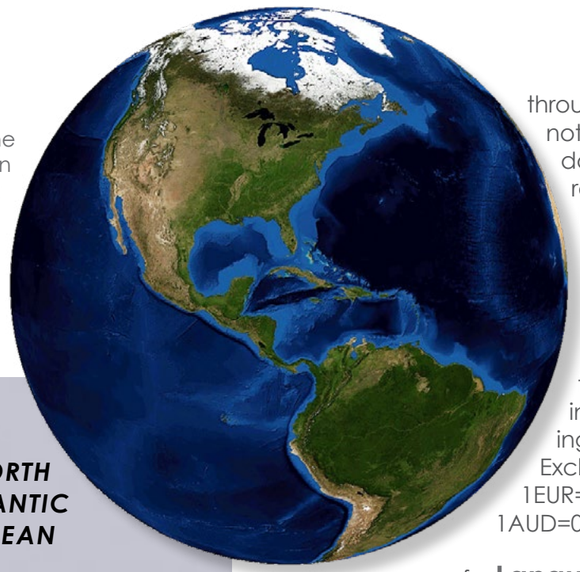
fact file

Grand Bahama Island

SOURCES: BAHAMAS.COM, CDC.GOV, GEOGRAPHY-SITE.ORG, STATE.TRAVEL.US, MASTERLIVEABOARDS.COM, US CIA WORLD FACTBOOK, WIKIPEDIA.ORG, XE.COM

Location of the Bahamas Islands on global map (right); Location of Grand Bahama Island on map of the Bahamas (below); Pregnant, female tiger shark (bottom left)

NASA



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History The name Gran Bajamar, meaning "Great Shallows," was given to the island of Grand Bahama by the Spanish. The eventual name of the Bahama islands as a whole, is derived from this Spanish name. In 1670, the islands were claimed by Great Britain. Up until the mid-19th century, things were relatively quiet on Grand Bahama Island, which had only around 200 to 400 regular inhabitants in its capital city of West End. The island finally gained a stable source of income in 1955 when a Virginian financier named Wallace Groves, in cooperation with the Bahamian government, began redevelopment and built the city of Freeport under the Hawksbill Creek Agreement, creating the Grand Bahama Port Authority. Government: As a Commonwealth realm, the Bahamas is a parliamentary democracy under a constitutional monarchy. Capital: Nassau

Geography Grand Bahama Island is around 153km (95mi) long west to east and 24km (15mi) wide north to south at its widest point. It has an area of 1,400 sq km (530 sq mi) and is the closest major island to the United States, lying 90km (56mi) east of the state of Florida. Tiger Beach is situated 26 miles northwest of West End. The shallow sand flat lies east of the Gulf Stream near deep channels and healthy coral reefs. Coastline: The Bahamas has 3,542km of coastline.

Climate The Bahamas islands are slightly cooler than other Caribbean island groups due to their proximity to the continental North American cold air systems. The subtropical climate sees about 340 sunny days per year. Average air temperatures in the winter and spring from December to May are 18-25°C (65-77°F). From June to August in the summer, temperatures range from 24 to 33°C (75-91°F). Average water temperatures in winter are 24°C (75°F) (December to March), in spring, 27°C (80°F), and in summer (June to August), 31°C (88°F). Average water visibility is 24 to 30m (80-100ft). Natural hazards: Recent hurricanes and other tropical storms have caused extensive flooding and wind damage to some of the islands.

Environment Challenges include coral reef decay and solid waste disposal.

Economy A stable, developing nation, the Bahamas' economy is heavily dependent on tourism and offshore banking. Tourism makes up more than 60% of the GDP and directly or indirectly employs 40% of the archipelago's labor force.

Population The Bahamas population is 332,634 (July 2018 est), with the Grand Bahamas Island population of around 51,756 (as of 2010). Ethnic groups: black 90.6%, white 4.7%, black and white 2.1%, other ethnic groups 1.9% (2010 est). Religions: Protestant 69.9%, Roman Catholic 12%, other Christian religions 13% (2010 est.)

Currency The Bahamian dollar (BSD) is freely interchanged with the American dollar (USD) throughout The Bahamas. It is not necessary to change US dollars into Bahamian currency. Traveler's checks in dollar denominations may be cashed almost anywhere. Credit cards are widely accepted. The Bahamas maintain cordial relations with all international banks and is known internationally for its banking and financial services. Exchanges rates: 1USD=1BSD, 1EUR=1.10BSD, 1GBP=1.24BSD, 1AUD=0.68BSD, 1SGD=0.73BSD.

Language English is the official language, with Creole spoken among Haitian immigrants.

Food Grand Bahama offers a wide variety of international cuisines. The local Bahamian cuisine consists mainly of seafood, poultry or pork, typically fried, steamed, or curried, with various kinds of rice and salads. Meals onboard the liveaboard are served buffet style with multiple options at every sitting.

Tipping The usual tip in the Bahamas is similar to the US practice at 15 percent and is often already factored into the check. Be careful not to tip twice. Tipping on the liveaboard is a recommended 10-15% of the cost of your trip.

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

Voltage Electricity in the Bahamas is the North American standard 120 volts at 60 cycles. Electrical outlets on the *Bahamas Master* liveaboard have universal plugs.

Travel/Visa Daily flights are available from Fort Lauderdale (FLL) and Miami's (MIA) international airports to Grand Bahama International Airport (FPO). A valid passport is required for entry and the expiration date must extend at least six months beyond your departure date.

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

Health Check with your doctor for required vaccinations. There is a risk of Hepatitis A through contaminated food or water in the Bahamas (no matter where you are eating or staying), as well as typhoid through contaminated food or water. Yellow fever vaccination is required if are traveling from a country with a risk of yellow fever virus transmission, including transit (of over 12 hours) in an airport located in a country with risk of yellow fever virus transmission.

Security Check with your state department for travel advisories and updates, as increased caution regarding violent crime is recommended in Freeport, Grand Bahama, (even during the day and in tourist areas) due to Hurricane Dorian.

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

Hyperbaric Chamber
The Bahamas Hyperbaric Centre
The Lyford Cay Hospital
Nassau, Bahamas
24-hour phone: 242 422-2434
Chamber phone: 242 362-5765 ■

Isla Mujeres

— Swimming with Whale Sharks in Mexico

Text and photos
by Don Silcock

Divers with whale shark in vertical "bottle" feeding position (above); Aerial view of Isla Mujeres, off the coast of Yucatán, Mexico (top right); Diver with gaping whale shark (previous page)

Every year, as the summer heat descends on the Yucatan peninsula, an amazing phenomenon takes place in the waters to the northeast of the small holiday island of Isla Mujeres. Local fishermen call it the *Afuera* (Mexican for "outside"), in reference to those deeper waters offshore from the tip of the Yucatan where, come July and August, the largest known gathering of whale sharks (*Rhincodon typus*) takes place.

Long considered as solitary giants roaming the open oceans, aggregations of whale sharks seemed quite rare and, prior to the discovery of the Afuera, a large gathering was thought to comprise 15 to 20 whale sharks. Typically, those aggregations were associated with high seasonal concentrations of zooplankton.

However, it seems that whale sharks are really quite social creatures when something special is on the menu. And the Afuera offers them something really different: an almost unlimited quantity of rich, energy-dense nourishment. Literally hundreds of whale sharks gather to gorge themselves on this all-you-can-eat buffet in nature.

The Afuera: hidden in plain sight

Incredibly, it would seem that this massive aggregation has been taking place for many years, generations possibly—all quite unbeknown to either the scientific or ecotourism communities. But the local fishermen knew, and the first rumours apparently surfaced as early as 2002.

However, at that time, all the attention was on the aggregation of whale sharks and manta rays in the shallow coastal waters between Cabo Catoche and Isla Holbox, on the northern tip of the Yucatan.

The discovery of the Cabo Catoche aggregation, as it is known, led to a number of scientific surveys to quantify the population and dynamics of the whale sharks, which was followed by the eventual establishment of a Whale Shark Biosphere Reserve by the Mexican government in 2009.

The Cabo Catoche aggregation of whale sharks also created a thriving and regulated ecotourism industry on nearby Isla Holbox around whale shark watching. So, it was not until September 2006 that the Afuera was actually investigat-

The whale shark (above) feeds on the eggs of the little tunny fish (right).

ed, when Mexican whale shark scientists led by Rafael de la Parra Venegas managed to organise a series of five aerial surveys.[1] (See Figure 1 on the next page).

What the survey revealed astonished everyone involved. Because not only were the rumours true, but the numbers of whale sharks spotted were almost unbelievable—with a total of 480 sightings recorded in an elliptical area of open ocean of about 18 sq km!

Little tunny

The Cabo Catoche aggregation of whale sharks take place in the shallow coastal waters off the northeastern tip of the Yucatan peninsula. Beginning in May and ending around mid-September, most of the whale sharks are present for a few weeks from late July to the middle of August. They gather to feed on the seasonal spawning of crustaceans (copepods and sergestid shrimp) and the aggregation is known for its turbid waters and poor visibility, which makes any kind of underwater photography quite challenging.

And yet, at the Afuera, just 55 to 65km away, huge numbers of whale sharks were gathering in what, from the air, appeared to be deep and clear blue waters. Subsequent investigations by de la Parra Venegas revealed the presence of huge quantities of fish eggs in the water, which DNA testing identified as eggs from the little tunny (*Euthynnus alletteratus*)—the most common tuna in the Atlantic Ocean.

Illustration of the little tunny fish (*Euthynnus alletteratus*) by Francis Day, 1878

WIKIMEDIA COMMONS / PUBLIC DOMAIN

Little tunny can grow to about 900mm in length and weigh up to 12kg, but the average size is just over half of that—a fraction of the larger species of tuna and most probably how it got its name. But what little tunny lack in overall size they make up for with their prolific ability to breed, which they do by the females releasing massive quantities of eggs into the water column, followed by the males releasing their sperm.

Pair of feeding whale sharks

The female little tunny are incredibly fertile creatures and can release 1.75 million eggs over the course of a mating season. Those eggs are circular and transparent, plus they are buoyant because they contain a droplet of oil—so they are pelagic and able to float in the current.

In the Atlantic Ocean, those mating seasons occur from around the middle of April when the water temperature reaches about 25°C (77°F) and can last until mid-September, with the most intense spawning taking place in July and August. The main spawning areas are in offshore waters that are typically 30 to 40m deep—all of which perfectly describes the location and timing of the Afuera

Isla Mujeres and Cancun

Just as a significant whale shark watching industry has been established around the Cabo Catoche aggregation from Isla Holbox, a similar but bigger one has grown around the Afuera and is serviced from both Cancun and nearby Isla Mujeres. The big difference between the two is that Cabo Catoche occurs within the Whale Shark Biosphere Reserve and is therefore regulated. Unfortunately, for now at least, the Afuera

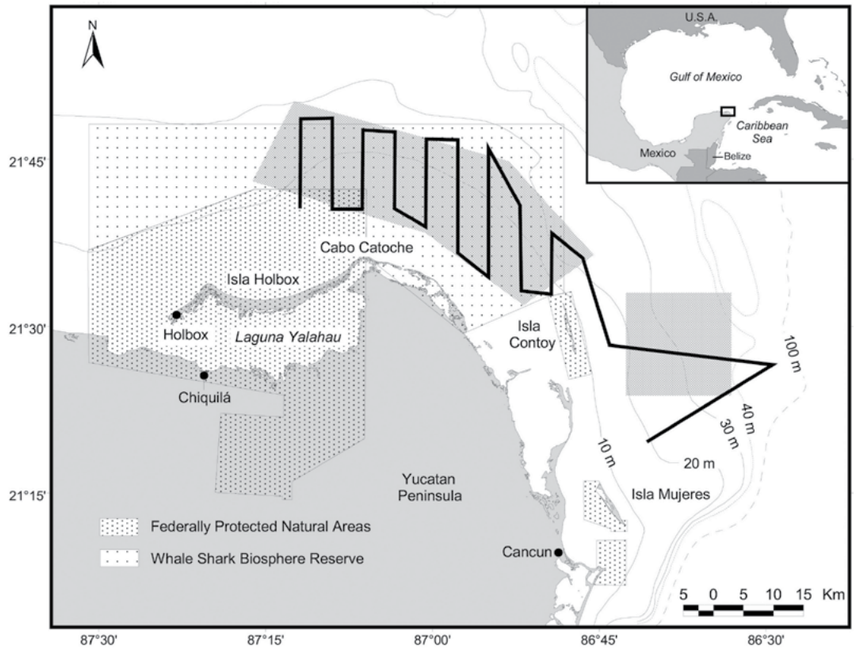


Figure 1. The flight path of the aerial surveys by Rafael de la Parra Venegas et al. of whale sharks off the coast of Quintana Roo, México. The triangular leg on the east side covers the newly-discovered Afuera whale shark aggregation.

Golf carts are the mode of transport on Isla Mujeres (top right); Souvenirs for sale in Isla Mujeres (center); Gaping mouth of a whale shark (right)

is neither protected nor regulated.

There is a lot you could say about both Cancun and Isla Mujeres—both positive and negative—and I can only offer my personal opinion. Cancun is not my cup of tea, as I found it far too touristy and over-developed, while Isla Mujeres is also somewhat over-developed but has a much more laidback and slightly rustic charm. Plus, the principal form of transport there are golf carts!

The estimated two million tourists who visit Cancun every year have a wide array of entertainment options available to them, and in the Afuera season, this also includes "guaranteed" whale shark swimming. A similar mechanism occurs on Isla Mujeres. What this means is that every morning, a veritable armada of whale-shark-swimming boats leave from both locations. The "guaranteed" part means that the tourists will be in the water with the whale sharks twice. Basically, they will get their turn as the people on board each get immersed.

It is hardly a quality experience, but in all probability, it is all most of the tourists want. And what appears to be happening is that the operators bring the tourists out, give them two immersions with the whale sharks and then it is time to get them back to Cancun or Isla Mujeres.

Quality time

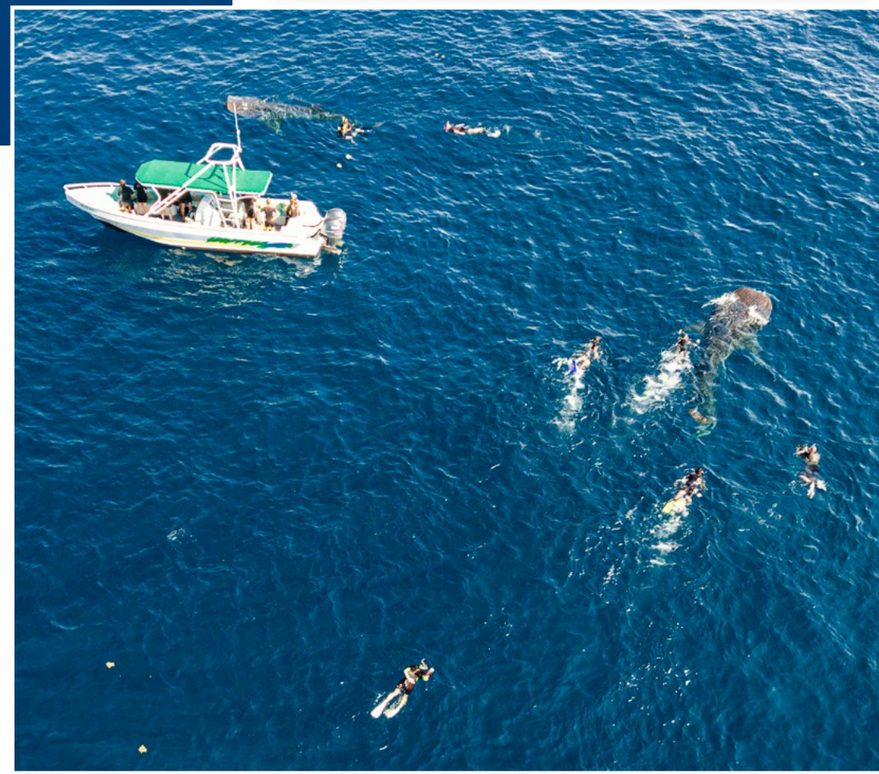
To have any kind of quality time with the whale sharks, you need to sign up for a private tour. Which means that somebody organises all the logistics for you, so you can simply turn up with your camera, mask and fins to enjoy the experience. That is exactly what I did, and I was pleased with the overall outcome, which involved five full days out on the water.

Being in a private boat means that you stand a good chance of getting to the whale sharks before the tourist armada arrives and have some good encounters before it all turns into a zoo. Then, it is just a question of finding a good spot to continue swimming with the whale sharks. But be ready to be surrounded by a bunch of tourists dropped in beside you!

However, the "zoo" part does not last that long, as the boats want to get back as soon as they have fulfilled their two-encounter guarantee. Typically, that is about two hours or so, and then the number of boats starts to decline rapidly and calm returns. Interestingly, none of this seems to bother the whale sharks, who just get on with what they are there for—feasting on the little tunny eggs.

In the water

Personally, prior to my trip to Isla Mujeres, I had very limited experience of in-water encounters with whale sharks. Those that I had, in places like Mozambique, Papua New Guinea and Socorro in Mexico, are probably best described



Whale sharks do not seem to mind the snorkellers. They are too busy feeding!

Underwater photographer with feeding whale shark

Cruising whale shark (above); Face-to-face with a whale shark (right)

as fleeting.

Surface encounters in Mozambique revolved around cruising whale sharks looking for food, and the best chance of a quality encounter was if a shark found a large quantity of floating plankton and hung around until it was all consumed.

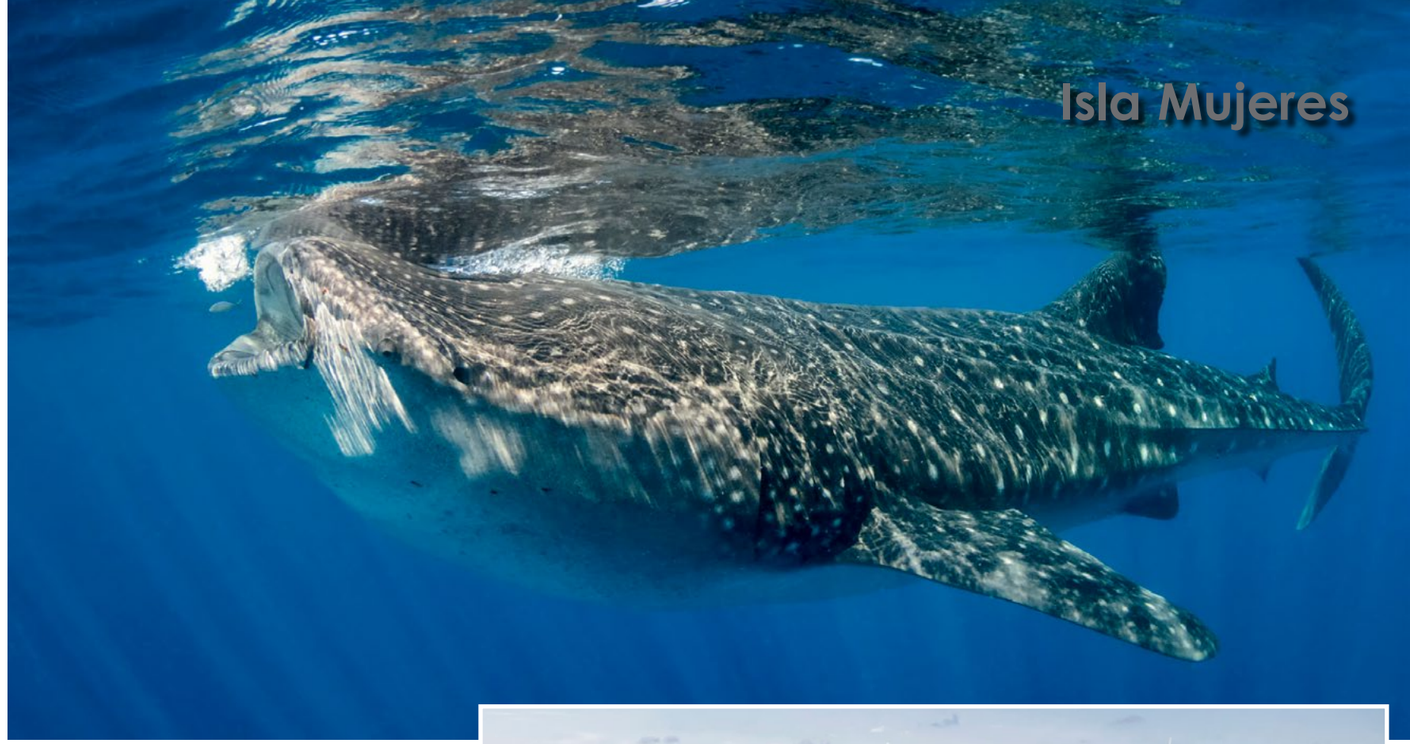
Otherwise, it was basically a "drive-by," in which you are dropped in front of an approaching whale shark and it swims towards and past you. There is very little chance of staying with a whale shark when it is swimming, as they move decidedly quicker than they look like they are. Often though, the whale shark would see you and the other snorkellers and then resort to "banking"—a defensive mechanism whereby it dives down and turns its back, with its really thick hide, on you.

While underwater on scuba in Papua New Guinea and Socorro, the encounters are even more fleeting, as it is more of a three-dimensional meeting with the two-dimensional divers at the surface. The time spent with the animals seems like milliseconds, as they move past so quickly!

But at Isla Mujeres, the whale sharks are so focused on feeding that they basically ignore you, which means you can have some very close encounters. The buoyant little tunny eggs keep the whale sharks at the surface, and they are simply feeding to their hearts' content. To these whale sharks, you and all the tourists seem to be nothing more than a minor annoyance, which is quickly forgotten as they continue to feed.

How it works

Whale sharks and their migratory patterns are a source of great mystery, and nobody really knows where they come from and go to. However, from a very layman-like and non-technical perspective,



Isla Mujeres

Whale sharks feed on little tunny eggs at Isla Mujeres (left and above); Dive boats and divers gather to observe the whale sharks (right); Snorkeller with whale shark at the surface (lower left)

it would seem that they have a routine that they follow, with key way-points where they can feed as they grow.

For example, at Tofo in Mozambique, the whale sharks that gather there are of a certain size, as are the ones at Isla Mujeres and Cabo Catoche. While in the Galapagos, some really big ones are seen during the season.

Well-known whale shark scientist Simon Pierce made a back-of-the-envelope calculation that while at the Afuera, the animals consume about 143kg of little tunny eggs during an 11-hour feeding period, which seems a lot taken by itself. But this needs to be taken into the overall context, because the whale sharks are gorging while they can, and long periods can follow where the whale sharks may not find food at all. It also explains why it is believed that many of the whale sharks tagged and identified at both Cabo Catoche and the Afuera stay in the overall area for up to six months at a time. Plus, while you and the tourists are ignored, these guys are focused on the food!

Feeding time

Knowing this basic fact allows the whale sharks' in-water behaviour also to be understood—something that took me a couple of days to rationalise when I was there in the thick of it all.

Think of the whale sharks as totally focused on the food supply. While they are swimming forward at the surface, they can ingest what is immediately in front of them. For a whale shark, that is a good thing, as they might go for considerable periods in which there is no food in front of them. So, when they eventually swim out of the area where the tunny eggs are, they stop. And, it would seem, they simply turn around and go back.

What that means for you is that if you have been dropped in where the tunny eggs are, there will be an endless procession of whale sharks making their way back and forth through their personal little tunny-egg corridor. And all you have to do is stay where you are and look for the next one.

In practical terms, this means that as soon as you have finished one encounter, you need to be looking for the next approaching whale shark. So, you need to try and fin up a bit and spot the next approaching fin and get in position.

Bottle feeding

For me, the most spectacular encounter possible during the

Feeding whale shark (above); Tourists on a whale shark tour (left)

Afuera is the "Botello," or "bottle" feeding position. This appears to occur when the whale shark happens upon a large patch of food. That can be little tunny eggs at the Afuera, crustaceans at Cabo Catoche or just plain old zooplankton elsewhere.

The whale sharks seem absolutely determined to consume every piece of that patch of food and to make sure they do so, they assume a vertical position and basically hoover up every last piece. And as they do this, they seem totally fixated on the task at hand, which allows you to have a terrific, really close encounter.

Although, it has to be said, the size of a whale shark's gaping mouth does bring thoughts of "Jonah and the whale" to mind when one gets really close!

In conclusion

The annual Afuera aggregation is a must-do if you are into seeing and photographing "big animals." Whale sharks are after all the biggest fish in the sea, and the encounters with them to the north of Isla Mujures are very special.

Simply stated, being in the water with so many whale sharks, where all you have to really do is wait for the next one to appear, simply does not happen anywhere else—at this point in time at least. The aggregation is so special and clearly of profound importance to whale sharks in general, we have to hope that Rafael de la Parra Venegas and his wife Beatriz, together with people like Simon Pierce, can convince the Mexican government to extend the current biosphere at Cabo Catoche to cover the Afuera. ■

Asia correspondent Don Silcock is based in Bali, Indonesia. For extensive location guides, articles and images on some of the best dive locations in the Indo-Pacific region, please visit his website at: ***indopacificimages.com****.*

SOURCES:

[1] DE LA PARRA VENEGAS R, HUETER R, GONZÁLEZ CANO J, TYMINSKI J, GREGORIO REMOLINA J, MASLANKA M, ET AL. (2011) AN UNPRECEDENTED AGGREGATION OF WHALE SHARKS, RHINCODON TYPUS, IN MEXICAN COASTAL WATERS OF THE CARIBBEAN SEA. *PLOS ONE* 6(4): E18994. HTTPS://DOI.ORG/10.1371/JOURNAL.PONE.0018994

The most spectacular sight is the "Botello" (or "bottle"), when a whale shark assumes a vertical position (like a bottle) in order to consume a large patch of tunny eggs.

DON SILCOCK

Whale sharks eat plants too, a new study reveals

As the world's largest fish, it is likely that whale sharks (*Rhincodon typus*) suffer long periods of starvation and may resort to eating more plants than previously thought.

A research team led by Alex Wyatt at the Atmosphere and Ocean Research Institute are using a powerful, yet simple tool developed at the University of Tokyo to find out what whale sharks eat.

While studying three whale sharks in an aquarium and two in ocean net cages, researchers normally took samples of various body tissues to analyze isotopes of carbon and nitrogen inside them. To interpret the isotope levels correctly, the scientists also needed to know a whale shark's growth rate and diet history. However, it was impractical to track growth and diet in wild whale sharks, so a blood test was used in combination with the tissue isotope analyses.

"Similar to blood tests performed when you visit the doctor, we are able to assess the health of whale sharks based on the contents of their blood," Wyatt said. "We combine blood tests and tissue isotope analyses to create an accurate health check for the animals."

In the wild

This combination of tests was done on eight wild whale sharks along the coast of Okinawa, Japan. According to the test results, several of them may not have eaten for weeks or even months. The findings, which were published in the journal *Ecological Monographs*, showed that all the whale sharks tested had eaten significant amounts of algae and plants.

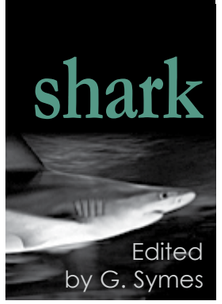
"This is a somewhat surprising and controversial finding, since whale sharks are generally assumed to feed strictly on higher levels of the food chain," said Wyatt. "However, some whale sharks have been found with seaweed in their stomachs and eating plants might make sense if feeding opportunities can become as limited as our blood tests suggest."

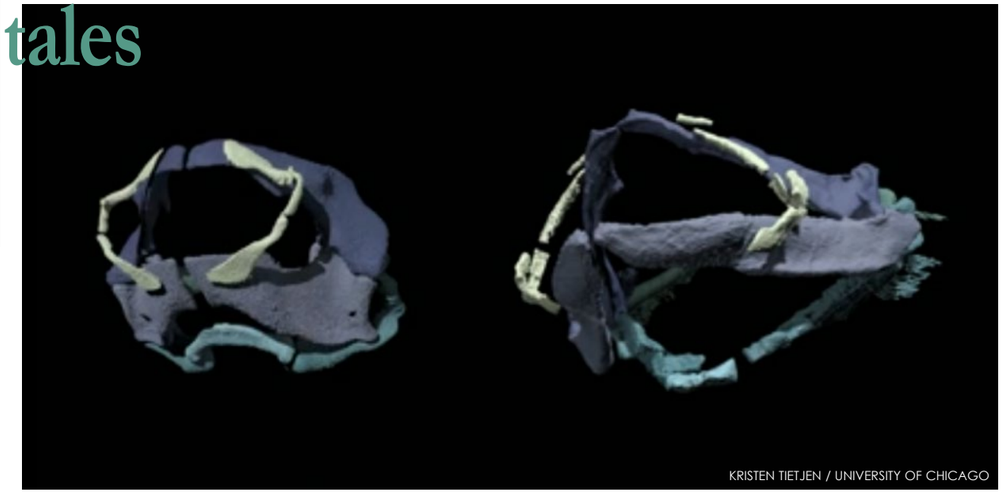
An endangered enigma

Whale sharks, which are an endangered species, can grow up to 12m (39ft) in length and weigh up to 21 tons (over 46,000lbs). They are soft-bodied filter feeders that normally prey on microscopic organisms in tropical seas, such as tiny krill, fish eggs and even small fish and squid. Even though 183 years have passed since their discovery, details of how these gentle giants live still remain a mystery.

While the findings about the diet of wild Okinawan whale sharks may not be the same for other populations, Wyatt hopes that the new health check approach will be employed in investigations of a variety of other threatened marine animals to learn more about their foraging specialization, unexpected food choices and possible starvation.

■ SOURCE: EUREKALERT





Researchers from the University of Chicago used CT scans of a *Tristychius arcuatus* fossil (on the right) while it was still encased in a nodule of ironstone rock. Three-dimensional modeling software was then used to reconstruct the skull and jaws to understand how they fit together and moved. For comparison, the jaws of a modern-day bamboo shark are shown on the left.

Sharks were first to suck in prey

Long before other fish figured it out, ancient sharks found another way to feed—by sucking in their prey. For the first time, researchers at the University of Chicago have made 3D reconstructions of a 335-million-year-old shark fossil, showing how suction feeding evolved in sharks 50 million years ahead of bony fish.

Tools to explore the mechanics of modern-day fish jaws were combined with CT imaging technology, which captured images of a *Tristychius arcuatus* fossil—a two-foot long shark similar to a dogfish—still encased in ironstone rock. The results showed the ancient shark had sophisticated jaws, which were capable of suction feeding similar to that of bony fishes such as carp, perch, bass and modern-day nurse sharks.

Evolutionary versatility

Fifty million years older than the earliest fossil record of similar jaws adapted to suction feeding in bony fishes, these ancient shark jaws reveal the evolutionary versatility of sharks. They also show sharks' quick response to new ecological opportunities, which arose after one of the five massive extinctions in our planet's history.

"Among today's aquatic vertebrates, suction feeding is widespread, and is often cited as a key factor contributing to the spectacular evolutionary success of ray-finned fishes," said Michael Coates, PhD, professor of organismal biology and anatomy at the University of Chicago and lead author of the study, which was published in the journal *Science Advances*. "But here we show that high-performance aquatic suction feeding first appeared in one of the earliest known sharks."

Trend-setters

To catch elusive prey, such as worms, crustaceans and other invertebrates off the sea floor, suction-feeding requires fish to suck water in through the mouth, and then funnel the water through the gills, rather than back out of the mouth. Flexible arches and joints, which expand the fish's cheeks, increases suction and volume inside the mouth. Many of today's fish have perfected this process, but *Tristychius* could also do it with its similar feeding apparatus. Other sharks at the time had typical snapping jaws, but with *Tristychius*' expanding cheeks and circular mouth, it could access more difficult-to-catch prey.

Coates said, "These particular sharks were doing something sophisticated and new. Here we have the earliest evidence of this key innovation that's been so important for multiple groups of fishes and has evolved repeatedly." ■ SOURCE: EUREKALERT

Tubbataha

— *Pristine Diving in the Philippines*

Text and photos by Michael Salvarezza
and Christopher P. Weaver

Diver with large school of trevally (above); Large marble ray (right)

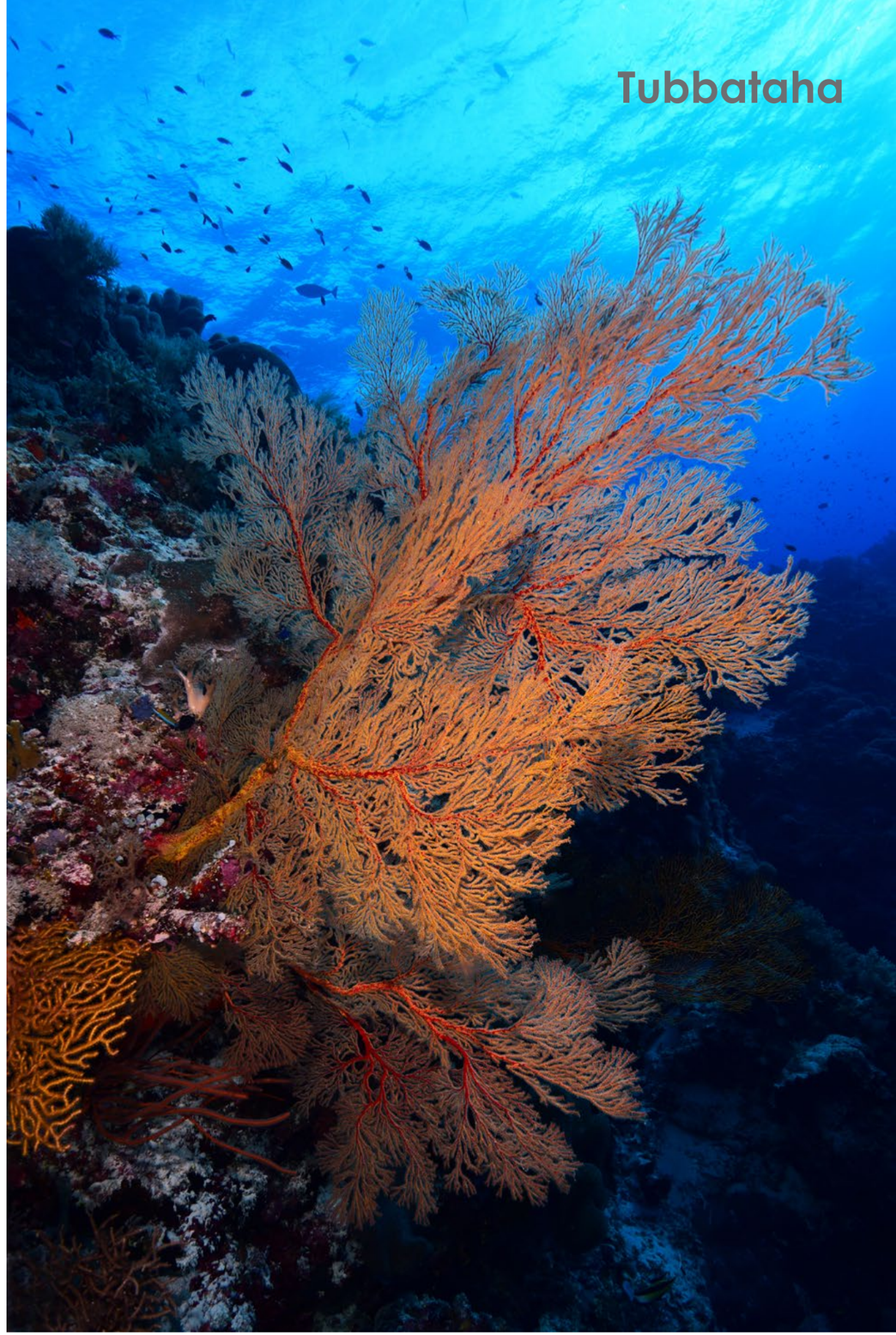
We came up over a coral ridge and yet another vista of beautiful hard and soft corals met our eyes. It was late in the day and the diminished sunlight was quickly turning the dive into a dusk adventure. After four dives in the day, we were both tired and exhilarated, and it was time to begin our ascent and head to the boat for a well-earned dinner.

Suddenly, a large section of the seafloor appeared to move. In the fading light, we could barely make out what was happening… until we got a bit closer and spotted the largest marble ray we had ever seen lifting off the bottom and flapping away into the darkness of the deep. With sandy "contrails" behind it, the smart car-sized ray lazily swam beneath us and over the ridge leading to the drop-off before disappearing completely. Reluctantly, we agreed it was time for the safety stop.

Tubbataha is a reef system lying 177km (110 miles) from the city of Puerto Princesa on the island of Palawan in the Philippines. Divers come here with the hopes of seeing large animals; whale sharks, tiger sharks, manta rays and marble rays are often encountered, along with massive schools of trevally and striped barracuda. Herds of bumphead parrotfish patrol the reefs, while tuna and silvertip sharks hunt along the walls. The parade of marine life usually does not disappoint.

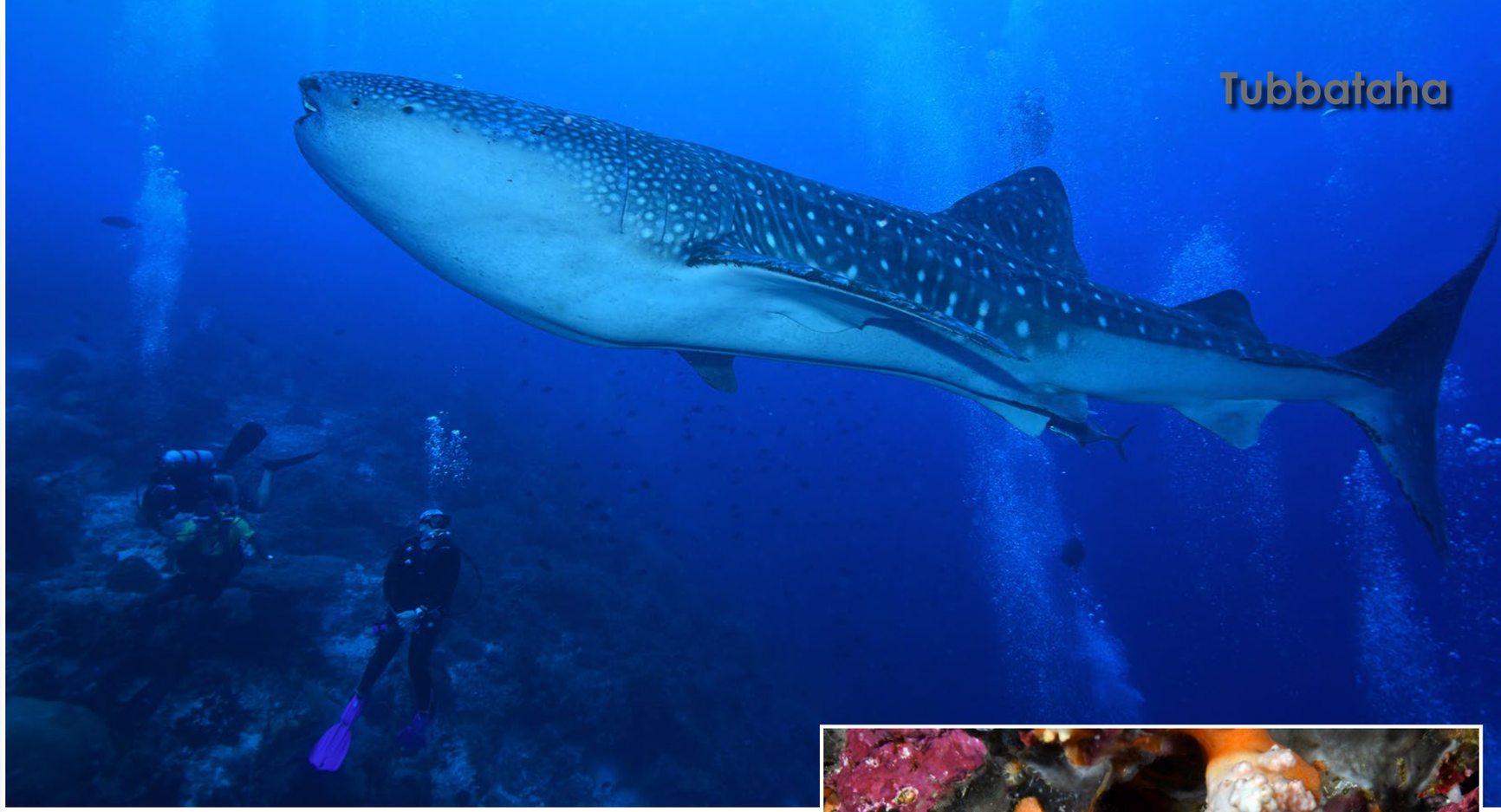
What a reef should look like

But the real treasure that is Tubbataha lies in its pristine reefs and healthy marine ecosystem. For every encounter



Tubbataha

The reefs drop off into the depths and are adorned with marine life (above); The healthy reefs of Tubbataha (previous page)



Divers with whale shark, the gentle giant of the sea (above); An oyster snaps its shell closed when divers approach (right)

with a whale shark, there are innumerable opportunities to witness life in the sea as nature designed it. Tubbataha is, in fact, a living example of what coral reefs systems around the world should look like.

What enables this system of atolls in the Sulu Sea to thrive is a mix of isolation, weather patterns and aggressive protection from the Philippines government. What continues to threaten it, though, remains beyond their control.

The three atolls of Tubbataha (the North and South Atolls, and the Jessie Beazley Reef— an emergent coral cay) were formed millions of years ago when volcanic eruptions created small islands, which eventually collapsed back into the sea. The fringing coral reefs around these islands are the atolls we see today.

The name "Tubbataha" comes from the Samal language meaning "long reef exposed at low tide."

Over-fishing

For generations, local fishermen were barely able to reach these reefs because of the distance from land and the capriciousness of the weather. Without motorized boats, fisherman rarely braved the frequent monsoons, typhoons and rough seas to get here. But, as inshore reefs became exhausted and better boats became available, the reefs at Tubbataha soon became a target.

As word began to spread about the productivity of these reefs, dynamite and cyanide fishing began in earnest as well as more traditional forms of fishing. The reefs were under siege.

Marine protected area

Thankfully, in 1988, President Corazon Aquino, in response to a strong campaign by scuba divers and environmentalists, and with the support of the Provincial Government of Palawan, declared Tubbataha a 97,030-hectare (970 sq km) Marine Protected Area, the first of its kind in the Philippines.

School of striped barracuda (above); Lionfish (right)

What is unique about Tubbataha is the management and conservation model that was subsequently put in place. In 1999, the Tubbataha Protected Area Management Board (TPAMB) was formed as the policy-making body for the Tubbataha reefs. It is comprised of 20 members of national and local government, academia and the private sector. Some examples of the membership include the Office of the Governor of Palawan, the Philippine Navy, the Philippine Coast Guard, the Philippine Commission on Sports and Scuba Diving, the Bureau of Fisheries and Aquatic Resources, and Palawan State University, among others. All of these members are considered important stakeholders in the future of the reefs at Tubbataha.

This body has implemented strict controls over access to the reefs. In addition, the season to visit Tubbataha is largely dictated by the monsoons and typhoons, with the general window extending from March through June. This short season gives the marine life and the reefs time to regenerate and refresh during the off season.

Divers are among the most frequent visitors and their actions are very carefully monitored. Indeed, dive guides can be heavily fined or even prohibited from working in the park if the divers they escort as much as touch the coral or harass any of the marine life. For divers, this is a very strict "no-touch" environment and good buoyancy skills are essential. We personally witnessed dive guides from a neighboring

The ranger station at Tubbataha Reef (above); Our expedition group arrives at the ranger station island (right); Meeting the rangers is a special opportunity to learn more about the protection of the reefs (left).

boat scolding a diver who came too close to the reefs and the ramifications can be severe: A dive guide whose divers touch the reefs or harass the marine life can be fined and prohibited from working in Tubbataha for a lengthy period of time.

The ranger station

Besides the diving, one of the highlights of any trip to Tubbataha is a visit to the ranger station located on the North Atoll. A stop here gives a glimpse into what life is like for the dedicated individuals who reside here for two months at a time protecting Tubbataha. Usually, a team of between 10 to 12 men from the Philippine Navy, the Philippine Coast Guard, the Municipality of Cagayancillo and the Tubbataha Management Office is on duty, living in a relatively spartan shelter on a small spit of sand virtually unprotected from severe weather or high seas. They are equipped with radar, motor boats and other equipment and regularly patrol the park in an attempt to thwart illegal activities.

This is an essential component of the overall management plan for Tubbataha.

Our visit coincided with a visit by Angelique Songco, known locally as "Mama Ranger." Since 2001, she has been Tubbataha's park manager, and she works tirelessly to protect this very special place.

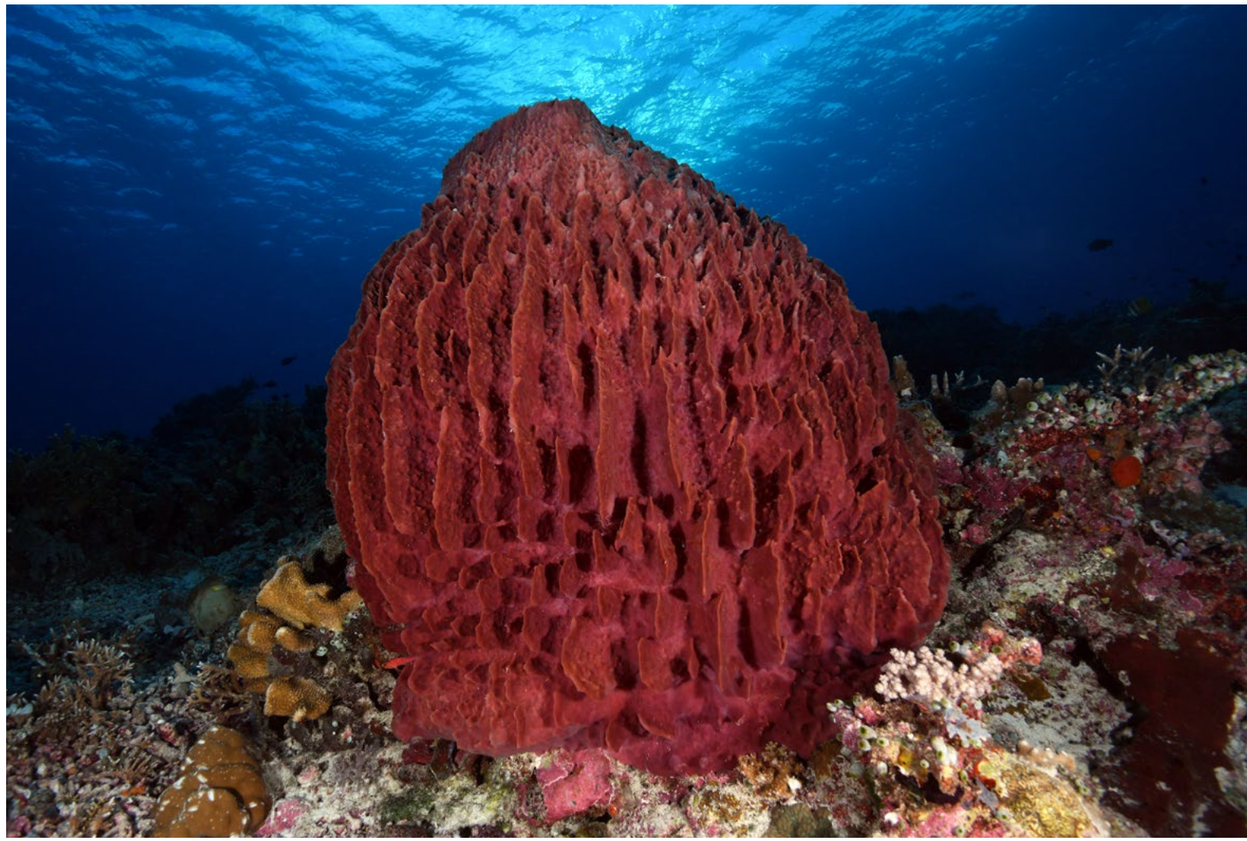
For visiting scuba divers, a visit to the ranger station gives grateful divers an opportunity to personally thank those who are working so hard to keep these reefs so healthy and protected.

Challenging access

Because of the distance from land, Tubbataha is only accessible by liveaboard dive vessels. While the diving is off-the-charts spectacular, this type of expedition is not for all divers. Indeed, the crossing from Puerto Princesa can take as long as 15 hours and can be rough. If there are typhoons in the region, it is not unusual to experience mountainous seas and rough diving conditions. In addition, strong currents wash over the drop-offs of the atolls and can be confusingly inconsistent. Divers should be accustomed to open water diving in conditions such as these, while being aware that Tubbataha affords very little protection from the surrounding ocean in bad weather.

Tubbataha

Bubble anemone are favorite macro subjects (left); The reefs are a healthy mix of hard and soft corals (far left); Barrel sponges dominate the reefs (below); The eggs of a Spanish Dancer nudibranch (bottom center); Sabre squirrelfish often are found in cervices and under ledges (bottom left).



Diverse reef life

Despite these caveats, diving Tubbataha is an almost ethereal experience. From the moment we peered underwater at the reefs, we were enthralled. Gardens of hard and soft corals stretched from the shallows to the deep drop-offs. Sheer walls festooned with soft corals in rainbow colors were the domain of the big animals while clouds of anthias and butterflyfish flitted amongst the coral structures.

We watched transfixed as titan triggerfish scoured their nests in broken coral plains while Napoleon wrasse poked around looking for an easy meal. We swam by whitetip reef sharks and loggerhead sea turtles resting in plain sight, and we even searched for tiny shrimp and gobies amongst the whip corals.

Diving

We traveled to Tubbataha aboard the *Discovery Adventure* liveaboard on an expedition organized by the Marco Vincent Dive Resort located in Puerto Galera. The daily routine was quite simple: wake to a very light breakfast, dive, enjoy a heartier breakfast, dive,

A funeral Jorunna nudibranch accompanies a small goby.

There are a few small wrecks in shallow water (above); The *Discovery Adventure* liveaboard (right)

lunch, dive, snack and then dive again!

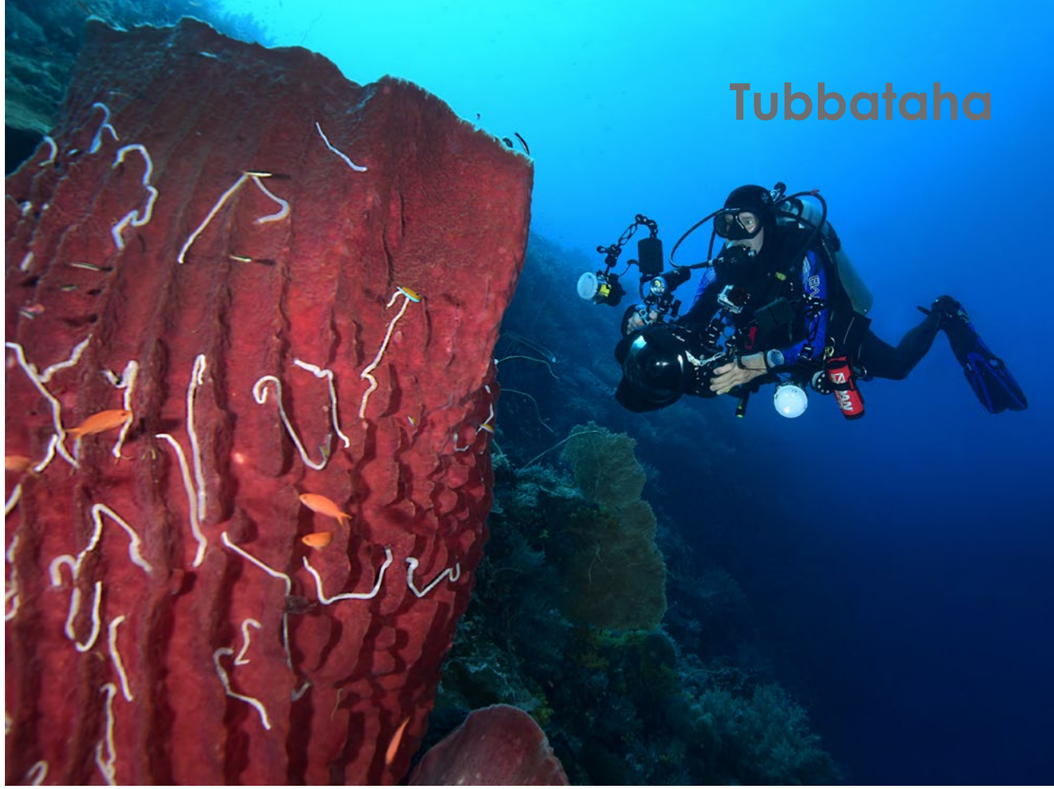
For divers looking for five-star accommodations and gourmet meals, this adventure might disappoint. Nonetheless, the cabins were comfortable and clean, each with their own air conditioning units, and the food was a tasty mix of Filipino cuisine and western-style offerings. Meals were served buffet-style and this was generally a time to find divers excitedly talking about the just-completed dive and the wonders they had encountered!

All of the diving took place from zodiac-style RIBs. Teams of four to five divers would set out from the main ship to the dive sites, usually ten minutes (or less) away. On board, nitrox was available, and all the dives were preceded by a detailed dive briefing in the main cabin. We never went into the water unprepared.

Healthy coral reefs and marine life

In the end, our expedition was a resounding success. We counted nine different whale sharks over the course of the journey, along with encounters with manta rays and numerous schools of hunting trevally and barracuda. Tubbataha is a very special place in the ocean world. It is a real example of how our oceans can be protected and what healthy coral reefs really look like.

For now, the protections are in place with a strong commitment from the Philippine government. But threats remain. Some, like climate change, rising ocean temperatures and increasing acidification are beyond the ability of the rangers on-site to prevent.



Tubbataha

CLOCKWISE FROM TOP LEFT: Giant school of trevally; Barrel sponges grow to very impressive sizes; Divers return from a dive in a RIB; Philippines blenny; The smile of an oyster

We left Tubbataha under a full moon, with flashes of lightning from a distant thunderstorm behind us. The water was calm, and our crossing was quiet and serene. Tubbataha had cast a spell on us, and we were now forever in its grasp. Aware of the threats that this special place faces, but equally confident that every effort is being made to keep Tubbataha protected, we retired for the night. Tomorrow, we would begin our trek home, but our hearts would remain here, in the Sulu Sea. ■

TUBBATAHA

Getting there
The only way to dive Tubbataha is by liveaboard, and most depart from the port city of Puerta Princesa on the island of Palawan. Philippines Air Express flies domestic routes from Manila Airport.

Diving and accommodation
The authors dived with the *Discovery Adventure* liveaboard of Discovery Fleet, on a chartered expedition by Marco Vincent Dive Resort. For more information, visit: **marcovincent.com**

When to go
The dive season at Tubbataha runs from March through June only.

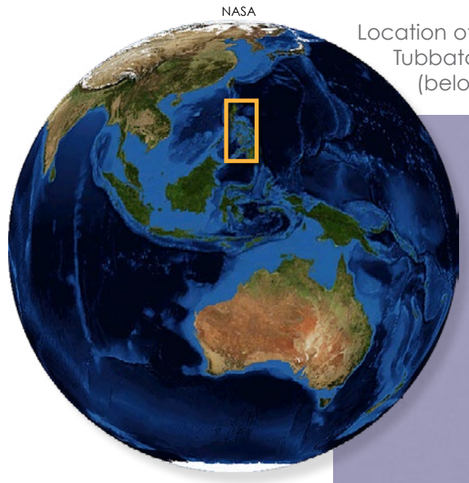
Michael Salvarezza and Christopher P. Weaver are underwater photographers based in New York. For more information about this and other expeditions, visit: ***ecophotoexplorers.com****.*

fact file

Philippines

SOURCES: ATLANTISHOTEL.COM, CIA.GOV, CDC.GOV, STATE.TRAVEL.US, WIKIPEDIA.ORG, XE.COM

Text by Walt Stearns



NASA

Location of the Philippines on global map and Tubbataha Reef on map of the Philippines (below); Yellowfin surgeonfish (lower left)

US CIA WORLD FACTBOOK

History The Philippines have been inhabited for tens of thousands of years but it was not until 1543 that the country was named Las Islas Filipinas in honor of King Phillip II of Spain by the explorer Ruy Lopez de Villalobos. The islands were colonized and remained part of the Spanish empire for more than 300 years. Following the Spanish-American war in 1898, the Philippines were relinquished to the United States and in 1935 became a self-governing commonwealth. During World War II, the islands fell under Japanese control but on 4 July 1946, after the United States helped the Filipino people reclaim control, the Republic of the Philippines was granted its independence. Numerous presidents and varying degrees of political and economic stability have followed, but the country remains independent to this day. The Philippines are a founding member of the United Nations and the World Trade Organization. Government: presidential republic. Capital: Manila

Geography The Philippines are located east of Vietnam in Southeast Asia, between the Philippine Sea and the South China Sea. The country consists of an archipelago of 7,107 islands, spread out over nearly 300,000 sq km. The terrain consists of volcanic mountains and coastal lowlands, ranging from sea level to the highest peak, Mount Apo, at 2,954m. The Philippines are situated at the northern tip of the coral triangle, the epicenter for global marine biodiversity. Coastline: 36,289km. Terrain consists primarily of mountains with coastal lowlands varying from narrow to extensive. Natural hazards include typhoons, landslides, volcanoes, earthquakes and tsunamis.

Climate The climate in the Philippines is tropical, and the heat and humidity is greatly influenced by the Amihan ("dry" northeast monsoon that typically blows mid-November to April) and the Habagat ("wet" southwest monsoon in May to October). The monsoons roughly create three seasons: the hot, dry summer from March to May; the rainy season from June to November; and the cool dry season from December to February. The air temperature averages 80°F (27°C) and ranges between 70-90°F (21-32°C) depending on the season and location. Water temperatures fluctuate between 78-84°F (26-29°C).

Environmental issues Challenges include air and water pollution in major urban areas, deforestation in watershed areas, soil erosion, degradation of coral reefs, and pollution of coastal mangroves, which are important breeding grounds for fish.

Economy The Philippines boasts an emerging economy, as it transitions from agriculture to the service and manufacturing industries. Primary exports include semiconductors and electronic products, transport equipment, copper, petroleum, coconut oil, fruits and garments. Roughly 47% of the population is employed in the service industry, which accounts for 56% of the country's GDP.

Currency Philippine Peso (PHP) Currency may be exchanged at the Manila airport, local banks and resorts. Credit cards are widely accepted at tourist destinations. Exchange rates: 1USD=52.13PHP; 1EUR =57.04PHP; 1GBP=64.31PHP; 1AUD=35.25PHP; 1SGD=37.73PHP

Population 105,893,381 (July 2018 est), with over 12 million living in the capital city of Manila. Ethnic groups: Tagalog 28.1%, Bisaya/Binisaya 11.4%, Cebuano 9.9%, Ilocano 8.8%, Hiligaynon/ Ilonggo 8.4%, Bikol/ Bicol 6.8%, Waray 4% (2010 est.). Religions: Roman Catholic 80.6%, Protestant 8.2% (includes Philippine Council of Evangelical Churches 2.7%, National Council of Churches in the Philippines 1.2%, other Protestant 4.3%), Muslim 5.6%, tribal religions .2% (2010 est.). Internet users: 56,956,436, or 55.5% (July 2016 est.)

Language The official language is Filipino, with eight major dialects, but English is widely spoken at most resorts.

Voltage The voltage in the Philippines is 220/240 AC at 50 cycles and several socket types are utilized. An international multi-prong adaptor is recommended.

Cuisine Philippine cuisine has a mixture of influences from Hispanic, Chinese, American and other Asian cultures. The food tends to have full-bodied flavors but is not as spicy as that of neighboring countries. Rice, fish, coconut, mangoes and plantains are staple ingredients. Filipinos do not eat with chopsticks but prefer western cutlery or the traditional method of eating with a just-washed right hand.

Transportation The gateway into the Philippines is through Ninoy Aquino International Airport (MNL) in Manila. Most international flights into Manila arrive between 9:00 pm and 3:00 am. As part of their services,

Travel/Visa A valid passport with at least six months left before its expiration date along return ticket is required for the entry into the Philippines. US and European nationals automatically receive a 21-day tourist visas on arrival. Guests staying longer, or those with passports of another nationality, will need to either contact the resort or see: immigration.gov.ph.

Health & Security Mosquito-borne illnesses are a problem, and there are cases of malaria, dengue and Zika. Avoid mosquito bites by using mosquito repellent and covering up during times when mosquitos are out. Water and food-borne illnesses can also be a problem, so be sure to drink only bottled or filtered water, and only eat food that is cooked thoroughly. Check with your state department for current travel advisories before your trip.

Decompression chambers Chambers can be found on various islands across the country, in cities such as Manila, Cebu, Batangas City, Cavite, Makati City, Quezon City and Subic.

Websites
Philippines Tourism
experiencephilippines.org

Edited by
Rosemary E. Lunn

POINT & CLICK ON BOLD LINKS

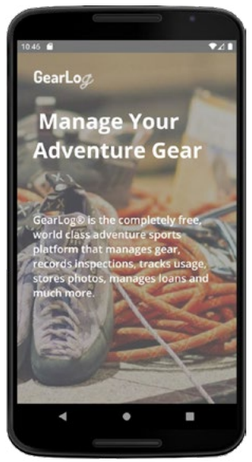
Equipment

Kubi Red Gloves

The award-winning Slovakian dry glove system now has added a 100 percent latex red rubber outer glove to its range. KUBI has been selling black, textured, heavyweight outer gloves for approximately four year, and it is well-liked by wreck divers who want a thicker glove than the standard 1.6mm latex glove. Recently, divers have asked KUBI for a brighter glove colour, hence this red, dexterous 2.4mm glove has been launched. KUBI states the red should show up better underwater (when compared to black) when the diver is using a light or torch. These textured gloves are very generously sized (with five sizes: Small, Medium, Large, Extra Large, XX Large). So, it is worth visiting your local dealer to make ensure you buy the correct size.

Kubistore.com

Gearlog App



An ardent diver is a real kit monster. We love our gear and consider a kit fondling session time well spent—cleaning it, maintaining it or playing with an alternative gear configuration. We are less keen about completing the relevant paperwork. When did we buy it? Who from? How much did it cost? What is the serial number? Now GearLog—a totally free "society contribution" app—looks as though it will take the pain out of looking after managing our kit. Once you have entered your equipment details, GearLog will apparently make it simple for you to track your gear, set up inspection regimes, record usage and let you know when it needs servicing. GearLog has also been designed to allow users to produce audit reports for compliance, and share equipment logs with other staff or club members. **Gearlog.org**

Fourth Element Poncho

One of the first pieces of diving advice you are taught is to get out of the water and seek warmth if you are cold. One way you can do this is to snuggle into a poncho. The latest version is from Fourth Element. Its OceanPositive unisex poncho is UV resistant and quick drying (200 percent faster than cotton). It is made from S.Café technology: a low-temperature, high-pressure, energy-saving process that produces a recycled yarn from coffee grounds. The resulting fabric is soft, light and flexible. The material has been impregnated with "activated" carbon, derived from coconut, which binds to sweat to eliminate unpleasant odours. The Storm Poncho has an adjustable, peaked hood, comes in six sizes (XXS, XS, S, M, L, XL) and two colours: burgundy and black. **Fourthelement.com**

Ocean Reef GSM Mercury

Ocean Reef has launched a new ultrasonic digital communication unit—the GSM Mercury. It has a 40m (131ft) depth rating, a range of 250m (820ft) and it is compatible with all previous Ocean Reef and competitor units on the same frequency. It comes with a rechargeable battery via a standard micro USB, with a 30-hour operating time. Apparently, the unit has a dynamic microphone that removes unnecessary noise such as bubbles being exhaled from the mask. Other features include hands-free operation, two earphones for a stereo like experience, and two channels for separate teams or conversations.

Oceanreefgroup.com

Otovent

As part of your elementary scuba training, you must learn how to clear your ears early and often, and you can do this by swallowing or using the "Valsalva" or the "Toynbee" manoeuvres. All of these actions increase pressure in the middle ear, effectively equalising the pressure when the surrounding (or ambient pressure) has increased. But whatever you do, you must ALWAYS clear your ears in a very gentle manner, so that you do not cause mechanical damage to parts of your ear. As a new diver, how can you learn "what is gentle?" You could play with a medical device called Otovent Dive. This non-surgical, drug-free method is used by ENT consultants to help relieve the symptoms of "Glue Ear" in children. Because this gently opens up the Eustachian tubes, it can also be used by non-divers and new divers to learn what gentle middle ear equalisation feels like.

Otovent.co.uk

As Brexit looms, UK manufacturers adjust

Text by Peter Symes

PIXABAY

How will a no-deal Brexit affect prices, supplies and aftermarket services of UK-based dive equipment manufacturers?

"We just have to be prepared to be nimble," said Jim Standing of Fourth Element. "We have such good relationships in Europe that I feel confident that nothing is insurmountable, other than macroeconomic factors like exchange risk, etc, and there's nothing we can do to influence it, except to invent a time machine."


Halo 3D thermal undersuit by Fourth Element

Assuming that the United Kingdom leaves the EU without a deal on October 31, some manufacturers have made contingency plans to mitigate possible disruptions or cushion an economic impact.

Fourth Element has looked at establishing short-term warehousing within the EU, which will mitigate some impact until the end of the year, and are also considering longer term storage in the EU.

Weezle is constructed in the United Kingdom, so their import worries only relate to importing from the United States, from which they purchase one of the fibres that they use. The company stated it has many good customers in Europe, whom they have reassured they will be able to support and supply whatever the outcome. "We have been developing other markets within the United Kingdom and outside the EU to assist us over the turmoil that Brexit is likely to cause us," wrote Hilary Child of Weezle.

AP Diving, manufacturer of the Inspiration rebreather and Buddy BCD ranges, stated that since it already exports its products all over the world and its staff are well experienced in shipping to non-EU countries, it expects exports to EU countries to become slightly different but "still easy enough".

AP has nonetheless made arrangements in the areas of CE product certification and EU Export Control licensing, explained Martin Parker, Managing Director of AP Diving. As the UK-notified bodies for CE approvals will lose their notified body status when the United Kingdom leaves the EU, CE approvals of AP products have been transferred from SGS United Kingdom to SGS Finland. This means that CE numbers have been changed on all products and their certification is ready for Brexit.

Regarding AP Diving's range of rebreathers, they are "dual use" products with military as well as non-military applications. As such, they have restricted destinations, except when accompanied by their owners. AP Diving is licensed by the UK Export Control Organisation (ECO) to sell products to many destinations with appropriate declarations on the paperwork and appropriate and auditable records.


Weezle Extreme Plus Undersuit – One Piece

While the United Kingdom is a member of the EU, no export license is required to sell products within the EU. But once Britain comes out of the EU, an export license will be required. The ECO has been very proactive in creating the new license and processing applications, and this license was already granted to AP Diving in February 2019; it comes into force in the event of a no-deal Brexit.

Will Brexit affect consumer prices?

"Yes, it will affect pricing," wrote Standing at Fourth Element. "Every barrier to trade increases costs, but we have worked very hard to keep the changes to a minimum. To be honest, we still don't know the likely conditions, but we are determined to keep the costs down."

Until the trade negotiations are complete, the current tariffs stand for two years. "What happens, we will watch with interest to see the effects," wrote Child at Weezle. "As we already have good trade with countries outside the EU, we have the necessary company, HMRC, export paperwork and accounting systems set up."

"It is clear, most manufacturers desire tariff-free trading," wrote Parker at AP Diving. "If tariffs are applied, I would expect them to be in the region of two to seven percent, but this is just guesswork on my part. But tariffs of this order are easily off-set by the devaluation of the pound. The devaluation of the pound, of course, has resulted in a surge in demand, and most customers want the delivery before the Brexit deadlines."

Will repairs, returns and other aftermarket services be affected?

"It's possible, but we have repair facilities across Europe and further afield," wrote Standing at Fourth Element. "It may delay some returns being processed, but we have a pretty good relationship with our dealers, and we will work with them to ensure that these delays do not affect the consumers, or at least do so as little as possible. Fortunately, everyone in the industry is in a similar situation, and as an industry, I think we are pretty good at working these things out together. I'm sure there will be challenges, but we have many years of trust built up with our partners in Europe—we are all motivated to work it out."

Child at Weezle wrote: "Not in the least. We will still offer repairs, if and when required. The Weezle goods have always had to come back to us here in Yorkshire, for any alterations or a '1000 dive service,' as they need to be done, by our seamstresses—that won't change."

Inspiration rebreathers by AP Diving

Parker at AP Diving wrote: "To start with, I think delays at the border will be inevitable, but there has been a lot of contingency planning to reduce delays. Our export license for returning serviced items is already in place and will become active in the event of a no-deal Brexit." ■

New Ideas on Narcosis

ILLUSTRATION COMPILED WITH IMAGES FROM PIXABAY

Text by Simon Pridmore

Researchers have raised some eye-opening thoughts on nitrogen narcosis, showing that it is something that most divers THINK they understand but few actually do.

This issue's column is adapted from a chapter in my book *Scuba Physiological: Think you know all about Scuba Medicine? Think Again!* 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). My (self-appointed) task was to rewrite their sometimes-complex research in a form accessible to all divers.

What is nitrogen narcosis?

Nitrogen narcosis is a condition affecting the physical and mental state of people who breathe air or mixtures containing nitrogen (or other inert gases) at pressures greater than 3 to 4 ATA.

Conventional scuba diving theory holds that narcosis occurs when molecules of a narcotic gas expand the volume of a hydrophobic membrane—an idea referred to as the "lipid theory." However, recent studies have discredited this concept and revealed that, in fact, nitrogen narcosis occurs via the production, release and uptake of some brain neurotransmitters.

Everyone is affected by narcosis to some extent when they dive deep. Responsiveness can differ from person to person, but it is commonly accepted that the effects begin at around 30m (100ft), although some people may experience effects of narcosis from 21m (70ft). The signs and symptoms cover a wide range of severity, from mild performance impairment to hallucinations and general anaesthesia. The deeper you go, and the longer you stay, the more severe the symptoms become.

Nitrogen narcosis is a more serious con-

ILLUSTRATION COMPILED FROM IMAGES FROM PIXABAY

Narcosis

One of the most remarkable findings from these studies was . . . the actual cerebral impairment caused by nitrogen narcosis persists for at least 30 minutes AFTER SURFACING. So, don't dive and drive—not immediately anyway.

cern than many divers believe. In order to operate effectively underwater, a diver has to master a considerable number of different skills that rely on manual dexterity, motor coordination and both short-term and long-term memory. These skills are essential to staying safe in situations where precise actions and accurate judgement are required. And these skills are the ones adversely affected by nitrogen narcosis.

What causes nitrogen narcosis?

As the underwater environment in which divers operate is markedly different from the surface environment, it seems logical that environmental factors should influence performance and, over the years, the diving community has cited a number of these as contributing to the onset and severity of narcosis, albeit without much scientific evidence. For example, increased partial pressures of CO_2 from hard work or heavy swimming are believed to enlarge cerebral vessels, leading to a higher nitrogen presence in the brain. Other supposed environmental risk factors include alcohol use, being hungover, fatigue, anxiety or apprehension, the effects of motion sickness medication, rate of descent, task loading and time pressure stress.

From a scientific point of view, the evidence for most of this is not strong. Claims about whether something exacerbates or reduces narcosis have often been based on fuzzy criteria, and this has led to divers being given some dubious advice. The science shows that all you can really be sure of is that ethanol exacerbates the signs and symptoms of narcosis and amphetamines alleviate them.

There are two ways to try and quantify the effects of nitrogen narcosis. The first is a behavioural approach, measuring task performance such as mental arithmetic, memory, reaction time and manual dexterity. Although these behavioural studies have confirmed progressive deterioration as the surrounding pressure increases, many of the tests are unreliable because motivation, experience and learning can influence the results.

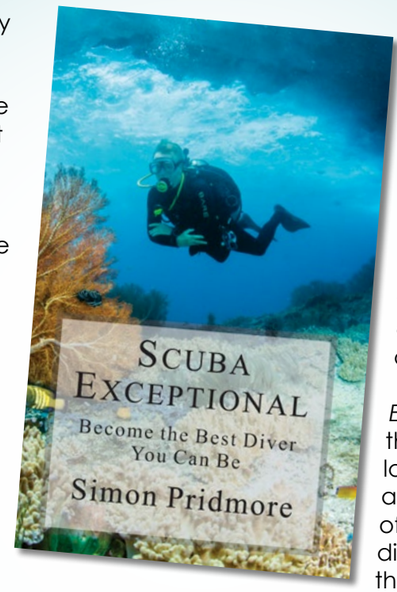
The second approach relies on observing changes in objective, measurable neurological parameters, using electroencephalographic (EEG) recordings and the like. Several recent such studies have been conducted. These were the first to measure the effects of nitrogen narcosis during an entire dive AND for a period of time after the diver surfaces. Based on lipid theory, diver-training programmes have always advised divers that, in the event of nitrogen narcosis, all they have to do to make the effects go away is ascend to a shallower depth. One of the most remarkable findings from these studies was not only is this not the case, but the actual cerebral impairment caused by nitrogen narcosis persists for at least 30 minutes AFTER SURFACING. So, don't dive and drive—not immediately anyway.

The studies also provided significant evidence that, when objectively meas-

A New Book for Scuba Divers!

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

The philosophy of safer diving through the acquisition of knowledge and skills is the same, although this time the themes are different. As before, Pridmore provides us with a whole host of extremely useful advice and techniques, illustrated by real-life experiences and cautionary tales. The focus this time, though, is more on issues that experienced divers face. There is more technical diving content, and Pridmore covers some relatively complex issues in his usual clear and easy-to-read style. In many cases, the issues that concern technical divers reflect those that affect scuba divers at every level. After all, as Pridmore writes, technical diving is on the same spectrum as conventional sport diving:



It is just a different frequency.

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

While most of *Scuba Exceptional* focuses on the diver, it also takes a look at the wider picture and highlights a number of areas where scuba diving professionals and the "industry" as a whole are letting divers down. As always, Pridmore is realistic in his assessments. He may shine a little light on the dark side of the scuba diving world, but he does this in order to illuminate bad practices and encourage change, while offering solutions.

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

ured, nitrogen narcosis may simply be influenced by pressure and the gas being breathed—nothing else. It seems that the environmental factors I referred to earlier have little or no impact.

Adaptation or tolerance?

The diving community generally believes that divers can adapt to the signs and symptoms of nitrogen narcosis. This belief is based on experiments that reported an initial deterioration in task performance followed by significant improvement. However, on the contrary, scientific tests have generally been unable to confirm any habituation, and researchers have concluded that sport divers do not develop tolerance to nitrogen narcosis.

Instead, it is more likely to be the case that divers who perform the same tasks over and over again gradually find them easier to do, and this may lead them to feel that they have developed narcosis tolerance. They think that they are adapting to narcosis when, in fact, they are just learning to cope with it. A good analogy is habitual drunks who learn to cope with their impaired reflexes, cognitive functions and motor skills. The problem, of course, is that even though they may be able to deal with things better, they are still just as drunk.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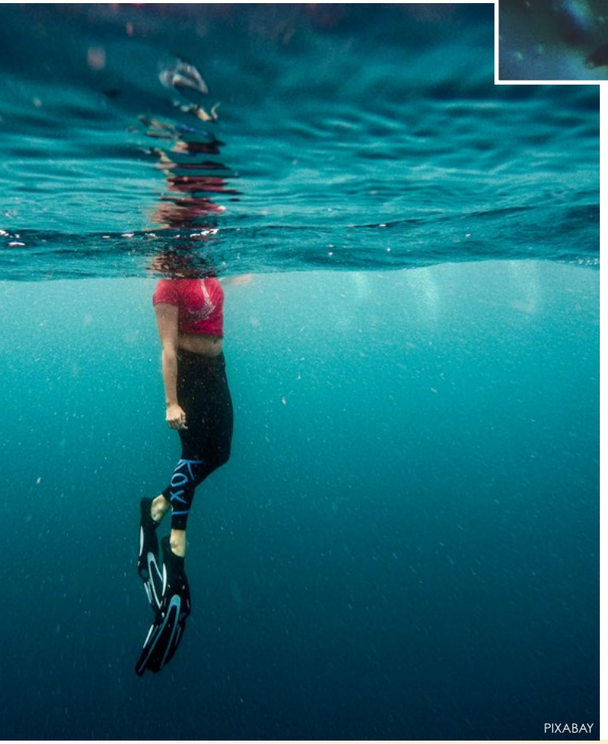
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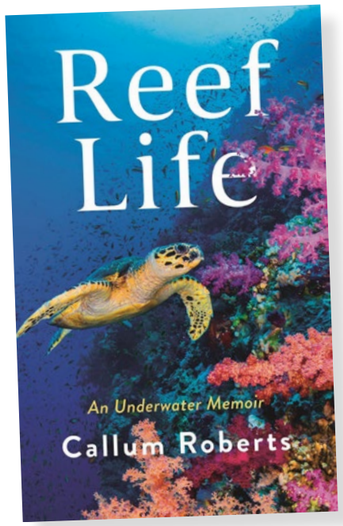
Take-home messages

- Nitrogen narcosis can impair a diver's ability to function effectively or even survive.
- Nitrogen narcosis alters the higher functions of the nervous system.
- Cerebral impairment from nitrogen narcosis persists for at least 30 minutes after surfacing.
- Divers cannot develop tolerance to nitrogen narcosis, but they can learn to cope with it.
- You may feel less "narked" when you ascend from depth, but, objectively, you are still just as "narked." ■

Simon Pridmore is the author of the international bestsellers Scuba Confidential: An Insider's Guide to Becoming a Better Diver, Scuba Professional: Insights into Sport Diver Training & Operations *and* Scuba Fundamental: Start Diving the Right Way. *He is also the co-author of* Diving & Snorkeling Guide to Bali *and* Diving & Snorkeling Guide to Raja Ampat & Northeast Indonesia, *and a new adventure travelogue called* Under the Flight Path. *His recently published books include* Scuba Exceptional: Become the Best Diver You Can Be, Scuba Physiological: Think You Know All About Scuba Medicine? Think Again! *and* Dining with Divers: Tales from the Kitchen Table. *For more information, please visit his website at:* ***SimonPridmore.com***.

media

Marine Conservation

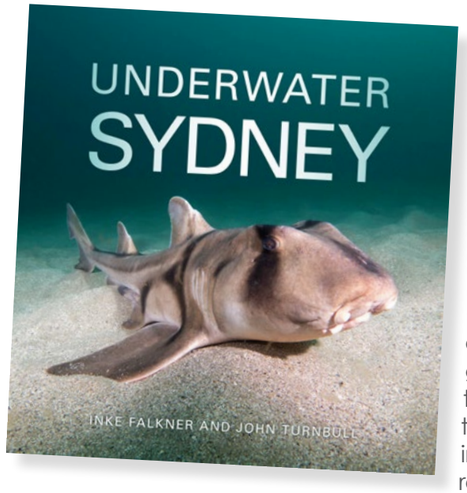


Reef Life: An underwater memoir, by Callum Roberts

This book presents the life of marine conservation biologist and oceanographer Callum Roberts, whose eminent 30-year career started amongst the reefs of Saudi Arabia. Since then, he has dived and researched the world's oceans, as well as the Great Barrier Reef and the reefs of the Caribbean. Laced with wry humour, his stories are both astonishing and lyrical, penned in a bid to raise the reader's understanding of the science of the oceans and reefs.

Hardcover: 384 pages
Publisher: Profile Books
Date: 7 November 2019
ISBN-10: 1788162153
ISBN-13: 978-1788162159

Underwater Photography

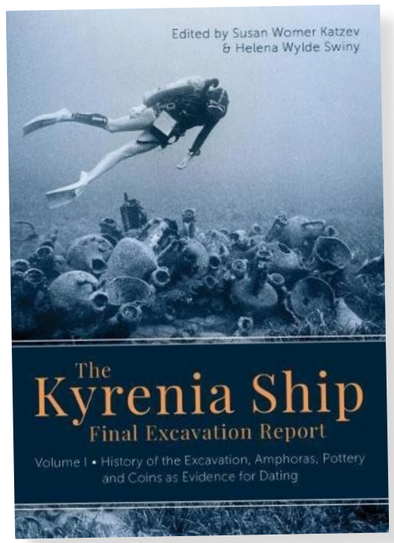


Underwater Sydney, by Inke Falkner and John Turnbull

This book takes the reader into the world beneath the waves of Sydney Harbour. Learn about the harbour's marine life through engaging, eclectic stories and colour photographs featuring many diverse fish and invertebrate species. There is also an overview of the Sydney Harbour environment, covering intertidal rocky shores, submerged sandstone reefs, sponge gardens, beaches sandy bays and mangroves. The challenges faced by the harbour after more than two centuries of coastal development and the role of marine science in maintaining the harbour's health is also explored.

Paperback: 168 pages
Publisher: CSIRO Publishing
Date: 27 August 2019
ISBN-10: 1486311180
ISBN-13: 978-1486311187

Shipwreck



The Kyrenia Ship Final Excavation Report, Volume I: History of the Excavation, Amphoras, Pottery and Coins as Evidence for Dating, by Susan W. Katsev and Laina W. Swiney

This is the first of a planned multi-volume publication on The Kyrenia ship, a Greek merchantman that sunk off the coast of Cyprus around 294-291 BC. The hull's extraordinary state of preservation has allowed us great insights into ancient shipbuilding. This book presents a detailed history of the ship's excavation, together with the most important items used to determine when it sank, as well as the possible trade route of the ship's final voyage.

Hardcover: 464 pages
Publisher: Oxbow Books
Date: 30 September 2019
ISBN-10: 1785707523
ISBN-13: 978-1785707520

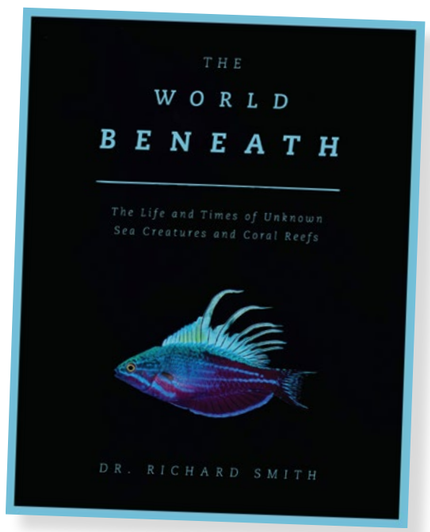
Cave Diving

Into the Planet: My Life as a Cave Diver, by Jill Heinerth

Read hair-raising, firsthand accounts about pioneering cave exploration from one of the world's most renowned cave divers, Jill Heinerth. One of the few women in the field, the first person in history to dive deep into an Antarctic iceberg and leader of a team that discovered submerged remains of ancient Mayan civilization, Heinerth blends science, adventure and memoir to bring us close to the terror and beauty found in earth's remaining unknown depths while pressing the extremes of human capability. The first book to deliver an intimate account of cave diving, *Into the Planet* offers insights into split-second, life-saving decisions, recovery of a fallen friend's body and the obstacles women face, pursuing careers underwater, as well as Heinerth's collaboration with scientists discovering new species, tracking climate change and finite freshwater reserves.

Hardcover: 288 pages
Publisher: Ecco
Date: 20 August 2019
ISBN-10: 0062691546
ISBN-13: 978-0062691545

Marine life



The World Beneath: The Life and Times of Unknown Sea Creatures and Coral Reefs, by Dr. Richard Smith

This book is packed with information about those fascinating sea creatures and coral reefs in our oceans. More than 300 colour photos within give you a peek into this mysterious underwater world. Travelling to places like the Coral Triangle, Triton Bay, the Atlantic, Pacific and Indian Oceans, you will meet unique creatures like the pygmy seahorse, Cenderawasih fairy wrasse, polka-dot longnose filefish, multicoloured seadragon, as well as scarlet-coloured corals, baby-blue sponges, daffodil crinoids—to name just a few.

Hardcover: 312 pages
Publisher: Apollo Publishers
Date: 10 September 2019
ISBN-10: 1948062224
ISBN-13: 978-1948062220

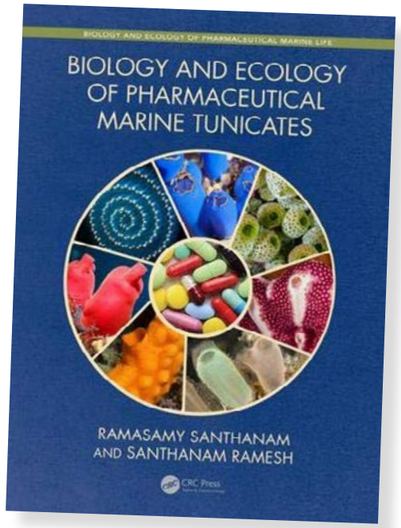
Marine Invertebrates

Guido Mocafico: Leopold & Rudolf Blaschka: The Marine Invertebrates, by Alexandra Baudelot, Isabelle Pirotte and Emmanuel G. Reynaud, edited by Patrick Remy, with photography by Guido Mocafico

This book showcases the work of Leopold Blaschka (1822–95) and his son Rudolf (1857–1939), who created masterpiece glass models of marine invertebrates and plants, photographed by Guido Mocafico. Based in Dresden, the Blaschkas were originally from Bohemia, and worked from the mid-1800s to the 1930s. They handcrafted their intricate models of invertebrates such as jellyfish, starfish, sea cucumbers and sea anemones, from clear, coloured and painted glass, which are now held in museum collections at Harvard University, Corning Museum of Glass and the Natural History Museums in London and Dublin. It was a challenge to get permission to photograph these exceptionally delicate and fragile models, most of which are not on display, but Mocafico persevered and eventually gained access to capture images of these beautiful treasures hidden from view.

Hardcover: 320 pages
Publisher: Steidl
Date: 23 April 2019
ISBN-10: 3958293980
ISBN-13: 978-3958293984

Tunicates



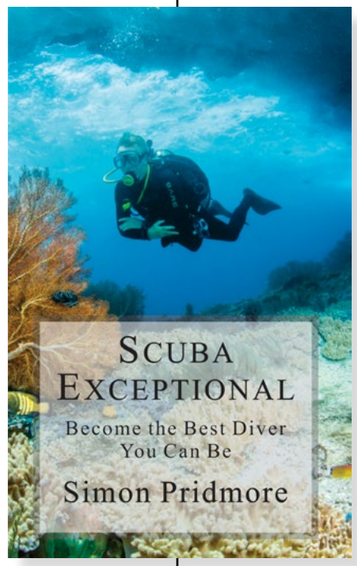
Biology and Ecology of Pharmaceutical Marine Tunicates by Ramasamy Santhanam and Santhanam Ramesh

The ocean is full of living organisms that may be a source of bioactive compounds for life-saving medicines, including discoveries of alkaloids isolated from tunicates and sea squirts, which have led to the development of anti-tumour and anti-cancer drugs. This book aims to provide information about the biology and identification of high-potential, yet under-studied species of tunicates and sea squirts, of which there are around 4,000. High-quality illustrations accompany taxonomy, common name, habitat, global distribution, pharmaceutical compounds and diagnostic features of 165 key species. It is a guide that can be used as a reference by researchers, teachers and students in various scientific and medical fields.

Hardcover: 188 pages
Publisher: CRC Press
Date: 1 November 2019
ISBN-10: 0367337657
ISBN-13: 978-0367337650

REVIEW

Scuba Exceptional



By Simon Pridmore

Paperback: 305 pages
Kindle
Publisher: Sandsmedia Publishing
Date: 27 October 2018
ISBN-10: 172919415X
ISBN-13: 978-1729194157

Simon Pridmore needs no introduction. He has been a household name among regular readers and followers of his regular column, which has been a mainstay in our magazine for many years—and for a good reason. He always brings up relevant topics and makes salient points meant for the reader to reflect upon, and as result, become a better diver. It therefore can come at no surprise that his latest opus is entitled, *Scuba Exceptional: Become the Best Diver You Can Be*.

Steve Lewis, another of our resourceful, regular pundits, comments: "Scuba diving is exciting, arresting, stimulating; the list goes on. But of course, without the appropriate training, the proper mindset and applied knowledge, it can be risky too. A great way to manage the risk and damp down the danger is to have a mentor—someone with more experience that you can dive with and who can help keep you on the straight and narrow. In his latest book, *Scuba Exceptional*, acclaimed author Simon Pridmore is that mentor. You may not be able to have Simon as an actual dive buddy, but his book—crammed with relevant advice, tips and explanations about how and how not to approach the sport we love— is the next best thing. Well written and easy to read, put a copy of *Scuba Exceptional* on your shopping list and read it before your next dive trip."

I'll second that and would like to add that I am particularly pleased, and impressed actually, with the ease and clarity with which Simon handles the many and varied topics he covers across 32 chapters. Two out of five main sections are about the heavier subject matters of physiology and technical diving. As Simon himself puts it, without getting "too geekily idiosyncratic" and to balance the material so that it is of interest to technical divers yet still accessible to non-technical divers, he sets out, in his own words, "to shine a little light on the dark side of the scuba diving world, in an effort to illuminate bad practices and encourage change (...) Sweeping problems under the carpet, or pretending that they do not exist, benefits nobody."

I would say: mission accomplished. This book is a keeper. ■

River Treasures

— Freshwater Biodiversity in Italy

Text and photos by Marco Colombo

Diver explores the rocky underwater landscape of a freshwater lake in Italy; Alpine newt (*Ichtyosaura alpestris*) in a freshwater pond in Italy (previous page)

From mountains to caves, freshwater environments and creatures can be found in Italy's ponds, lakes, rivers and streams.

When considering underwater photography, we usually think about images of wonderful coral reefs, colourful fish, clear waters and undersea landscapes. In fact, 70 percent of our planet is covered by water on its surface, and, even though 97 percent of this is saltwater, the remaining three percent is freshwater in rivers, streams, lakes, ponds, marshes and groundwater. This is a tiny percentage, but it is very important: Freshwater allows for life on land and is strictly connected with human survival.

Moreover, these often turbid and turbulent freshwater bodies host a huge variety of species, many of them as big and colourful as their marine counterparts. For this reason, we should be protecting freshwater environments, which are endangered by pollution, poaching, water withdrawal, climate changes and many other threats.

Italy is a very anthropised country, which has thousands of kilometres of rivers, and lots of big and small lakes. During my fieldwork, I decided to explore these delicate environments in order to shed light on the diversity of their inhabitants. I took underwater photographs while scuba diving, snorkelling or simply walking in the water, as sometimes the depths of these freshwater areas were not very deep. The main challenge though was backscatter, due to silty bottoms and strong currents, often experienced together with very low water temperatures.

Diverse aquatic life

From mountain peaks to caves, every corner of Italy offers surprises to the prepared naturalist and photographer. The important thing is to study the

The trench (above) and trout (right) live in freshwater lakes and streams.

behaviour of one's photographic subjects, in order to find them easily (more or less) and not disturb them while photographing them. Here are some of the species found:

Trout. The brown trout (*Salmo trutta*) lives in many streams and rivers, preying upon invertebrates, fish and frogs. Sometimes, in very cold waters, it is possible to photograph it very closely, with a wide-angle lens, in order to capture its image within its beautiful environment.

Tench. The tench (*Tinca tinca*) is a beautiful and clever fish, which lives in lakes and ponds. Its body has big rounded fins, giving the fish an elegant appearance. Preferring turbid waters with slow current, these fish feed upon worms, snails and other invertebrates on the lake bottom. It is not uncommon to meet them under fallen trees near the shore, where it is possible to approach them if one moves very slowly.

Sea lampreys (*Petromyzon marinus*) travel from the sea to the rivers to spawn and build nests.

Crayfish live in clear streams in the hills and mountains (above); River crabs can be found in streams in the central and southern regions of Italy's peninsula (top right).

Sea lamprey. Sea lampreys (*Petromyzon marinus*) migrate from the sea to the rivers in order to spawn and build nests for their eggs, removing up to 10kg of pebbles with their sucker-like mouths. They are endangered in Italy by dam construction, while in North America, they are an invasive species, due to environmental alteration of the flow of rivers.

Crayfish. The white-clawed crayfish (*Austropotamobius pallipes*) often thrive in very clear and protected little streams on hills and in the mountains. A nocturnal species, they can be found in the open or along the steam bed during bad weather, looking for food (including invertebrates).

River crab. Usually, when people think of where crabs can be found, they think of the beach, but some species of crab can be found in tropical jungles too! In Italy, the river crab (*Potamon fluviatile*) colonises little streams in the central and southern regions of the Italian peninsula. Active during the night and early morning hours, these crabs can be found exiting the water and heading into the woodlands on rainy days, catching frogs, small snakes and insects as prey. Strangely, a population of river crabs can be found living in the centre of Rome!

Non-aquatic species

Freshwater is also very important to animals that are not strictly aquatic, including birds (such as mallards like the *Anas platyrhynchos*), reptiles and mammals. These animals live near freshwater habitats in order to feed, drink and cool down during the heat of the summer, or find vegetation in which to shelter and feed during the winter.

Dice snake. Snakes are feared by people but, in fact, the Italian species of snakes are not dangerous. In particular, aquatic snakes are harmless and just hunt fish, using their tongues to find them on the lake bottom. The dice snake (*Natrix tessellata*) shown (see photo on next page) has just caught a barbel fish and is trying to bring it out of the

Dice snake, *Natrix tessellata* (above), with barbel fish in its jaws, which can open very wide to swallow prey; Mallard duck, *Anas platyrhynchos* (left); Apennine yellow-bellied toad, *Bombina pachypus* (top right), displays a bright yellow belly to warn predators that it is poisonous.

water, where it will begin swallowing the prey, thanks to its ability to greatly widen its jaws.

Pond turtles. Pond turtles (*Emys orbicularis*) are shy and difficult to photograph underwater. Luckily, they often live in beautiful settings, where wide-angle shots are the best way of capturing the light found in these areas. This species moves along the bottom of river pools during the summer, looking for little animals to eat.

Toads. Not all the frog-like creatures are frogs. The Apennine yellow-bellied toad (*Bombina pachypus*) is a small toad, warning possible predators of its toxicity with its vivid yellow belly. It is endangered by the spread of a fungal disease, which can be found on amphibian skin, killing and depleting entire populations.

Newts & salamanders. Italian crested newts (*Triturus carnifex*) and alpine newts (*Ichthyosaura alpestris*) enter ponds in the spring, courting and laying eggs, and remain there until autumn, when they exit to go into hibernation. Salamanders, like the northern spectacled salamander (*Salamandrina perspicillata*), only enter streams to lay eggs, and then go back to the forest, where they are active during heavy rains.

Olm. Another amphibian that lives in underground lakes and rivers in

Pond turtle, *Emys orbicularis* (above), are shy creatures, which find small animals to eat at the bottom of rivers.

The crested newt, *Triturus carnifex* (left), and the spectacled salamander, *Salamandrina perspicillata* (top center), enter freshwater ponds to lay eggs in the spring; The 40cm long olm, *Proteus anguinus* (above) is blind, can self-amputate its own arms and fast for up to eight years—an adaptation gained by living in dark caves where prey is hard to come by; An invasive species, the coypu, *Myocastor coypus* (top right), is a large, herbivorous, semiaquatic rodent also known as the nutria; Rivers are delicate freshwater ecosystems that should be conserved, kept free of trash and not used as landfill (right).

northeastern Italy, the 40cm-long olm (*Proteus anguinus*) has extraordinary features. It is sightless, white and elongated. It can practise autotomy (self-amputation of its own limbs), live up to a century and fast for eight years (which is a huge adaptation to living in dark caves that are poor in prey), What's more, it breathes thanks to cutaneous respiration. This species, which is endangered by pollution, is very difficult to find and photograph, because it is very hard to reach the pools where it lives.

Invasive species

A very big problem for biodiversity worldwide is the introduction of invasive species.

Coypu. One example is the coypu (*Myocastor coypus*), which comes from South America and was released in Italy where it damages shores, vegetation and birds' nests.

Jellyfish. Curiously, another invasive species is the freshwater jellyfish (*Craspedacusta sowerbii*). The environmental consequences of this invasive species are unknown, but this jellyfish originally comes from China; it was first discovered in England, and is now widespread worldwide.

The conservation of freshwater habitats is crucial for life, even for humans. Rivers and lakes are not landfills, but treasures to protect and respect. ■

Italian naturalist and scuba instructor Marco Colombo is an award-winning photographer and science writer who is also a co-author of photographic and species identification books. His images, papers and articles have been published in several scientific and nature periodicals. In 2007, he discovered a new spider species on Sardinia. He has been hosted on television broadcasts such as Linea Blu and Geo, and his photography has won awards and recognition in international competitions such as Asferico, GDT European Wildlife Photographer of the Year, Festival Mondial de l'Image Sous-Marine and, most importantly, Wildlife Photographer of the Year in which his work was chosen as category winner three times (2011, 2016, 2018). In addition, his work has been shown in exhibitions and private collections of Italian wildlife. He has also served as a judge in several competitions, including Asferico, Nature Photographer of the Year, See in the Sea, Abissi Città di Venezia and In&Out. For more information, visit: ***calosoma.it****.*

MONTEREYDIVER / FLICKR / CC BY 2.0

Humpback whales from different regions share their distinct songs as they congregate at feeding grounds or along migratory routes.

Where has a humpback whale been? Listen to its song!

The songs of humpback whales can change and evolve, influenced by where they have been traveling and whom they have met. Features within their songs can tell us where they came from. In fact, just as we do when listening to music on a radio, the whales pick up new tunes from other whales they have encountered along the way.

Indeed, it is a type of cultural transmission, when the whales share their songs, providing us with clues about where a whale originally came from and where it has traveled during its migration.

"Our best analogy is to human fashion and pop songs," said Ellen Garland at the University of St Andrews in the United Kingdom. "We can pinpoint a population a whale has likely come from by what they are singing."

To gather data, Garland and fellow researchers made recordings of humpback whale songs near the Kermadec islands in the South Pacific from September to October 2015. Additional recordings were made where whales come together to mate and feed in locations throughout the western and central regions of the South Pacific as well as areas in eastern and western Australia.

Three song types

By analyzing the units or themes in the songs of 52 whales, such as the combination and repetition of notes and phrases, the research team found three different distinct whale song types, each specific to a certain area. Song type 1 was heard primarily in the central Pacific, which included French Polynesia and the Cook Islands. Song type 2 was heard mostly in the western Pacific, which included Tonga, New Caledonia, and Niue. Song type 3 was heard only in eastern Australia.

These humpback whale song types were then compared to song types heard at a migratory stopover near the Kermadec islands. Here, there were two: song type 1a and 1b. As whales share their songs, they morph, as some whales may had a few notes or a riff.

Pinpointing where the whales at the Kermadec islands originally came from was based on the percentage of similarity between recorded song types. Genetic and photographic identification of the singing whales confirmed the findings, which were published in *Royal Society Open Science* journal. There was no match between the song types from western Australia and the Kermadec islands. While there were very few similar song types between eastern Australia and French Polynesia, most songs came from the Cook Islands, Niue and New Caledonia.

According to Garland, it is possible that there are other places in the world, similar to the Kermadec islands, in feeding grounds or along migratory routes, where whales from different regions gather and share their songs. ■ SOURCE: NEW SCIENTIST

Dolphin swimming is banned in New Zealand

Tourists are no longer allowed to swim with bottlenose dolphins in New Zealand due to the impact it has had on the marine mammals.

According to new research, people are loving the dolphins far "too much." The department of conservation said that the interactions with the dolphins has had a "significant impact" on the animals' ability to feed and to rest.

Indeed, since 1999, the number of dolphins visiting the Bay of Islands in New Zealand, where dolphin swimming had been permitted, has dropped by 66 percent. Now only 19 individuals are seen to return frequently.

In addition, researchers have found that there was a 75 percent calf mortality rate in the bay, which is higher in number of deaths than anywhere else in the world, whether in captivity or in the wild.

New rules, which came into effect this past July, not only ban swimming with dolphins, but limit tour operators, who are licensed to take people out on the water, to make visits only in the morning or the afternoon. The regulation will allow dolphins to have break from human interaction in the middle of the day. While there were some restrictions in place to protect the dolphins, researchers found that they were not as effective as they needed to be.

Other locations, such as Hawaii, are also planning to ban dolphin swimming, with spinner dolphins in this case. However, officials admit that the restrictions would not stop the dolphins themselves from approaching boats or swimmers. ■ SOURCE: BBC

PIXABAY

DAN Safety

DCS Risk Factors

Sponsored content by DAN

Decompression sickness (DCS) is often covered in open-water courses but then mentioned only briefly in continuing education. While it is true that our understanding of the condition has been mostly stagnant for the past two decades, that is beginning to change, and it is time to start updating divers and students as researchers discover new information. A recent big-data study performed by a DAN research team used modern statistical analysis techniques to dig into a sample of nearly 40,000 open-circuit recreation dives and look for patterns and clues about DCS risk factors in real-world cases. Some of what they have found confirms our previous knowledge and opens entirely new avenues for research into the factors that contribute to DCS risk. Here is what we have learned.

The good news

Most divers are safe and well trained. Bulk analysis of the data set showed that the average dive had a depth of approximately 89ft (27.1m), a run time of 46.4 minutes and a maximum gradient factor of 0.66—a gradient factor of 1 represents pure Buhlmann (zero conservatism). Ultrasound bubble counts confirmed previous research showing that bubble formation peaked 30 to 45 minutes post-dive, although prior issues with directly linking bubble count and DCS symptoms did arise.

Workload

Work at depth has long been one of the primary risk factors on which technical and advanced divers alike have focused. Whether that work is due to current at depth or significant exercise (scalloping, artifact removal, etc.), it is going to stay on the list of likely but unproven risk factors. Researchers theorized that work at depth could increase stress in divers, which could increase risk, but workload alone does not correlate directly to DCS risk.

Stress and hormones

While many specific factors (like workload at depth) did not correlate directly with DCS risk, researchers theorized that stress and the resulting hormone release could affect bubble formation. This theory brings to light some interesting concepts and has been the focal point of a new study focusing on hormone production and DCS risk. Some studies have shown that women may be at slightly greater risk for DCS despite the few physiological differences between the sexes, and a small number of studies have linked menstrual cycle peaks with higher DCS risk (and, conversely, the use of oral contraceptives with decreased risk). These factors combined seem to indicate a connection between both exogenous and naturally-produced hormones and DCS. This potential link will require further investigation in the coming year.

Visibility

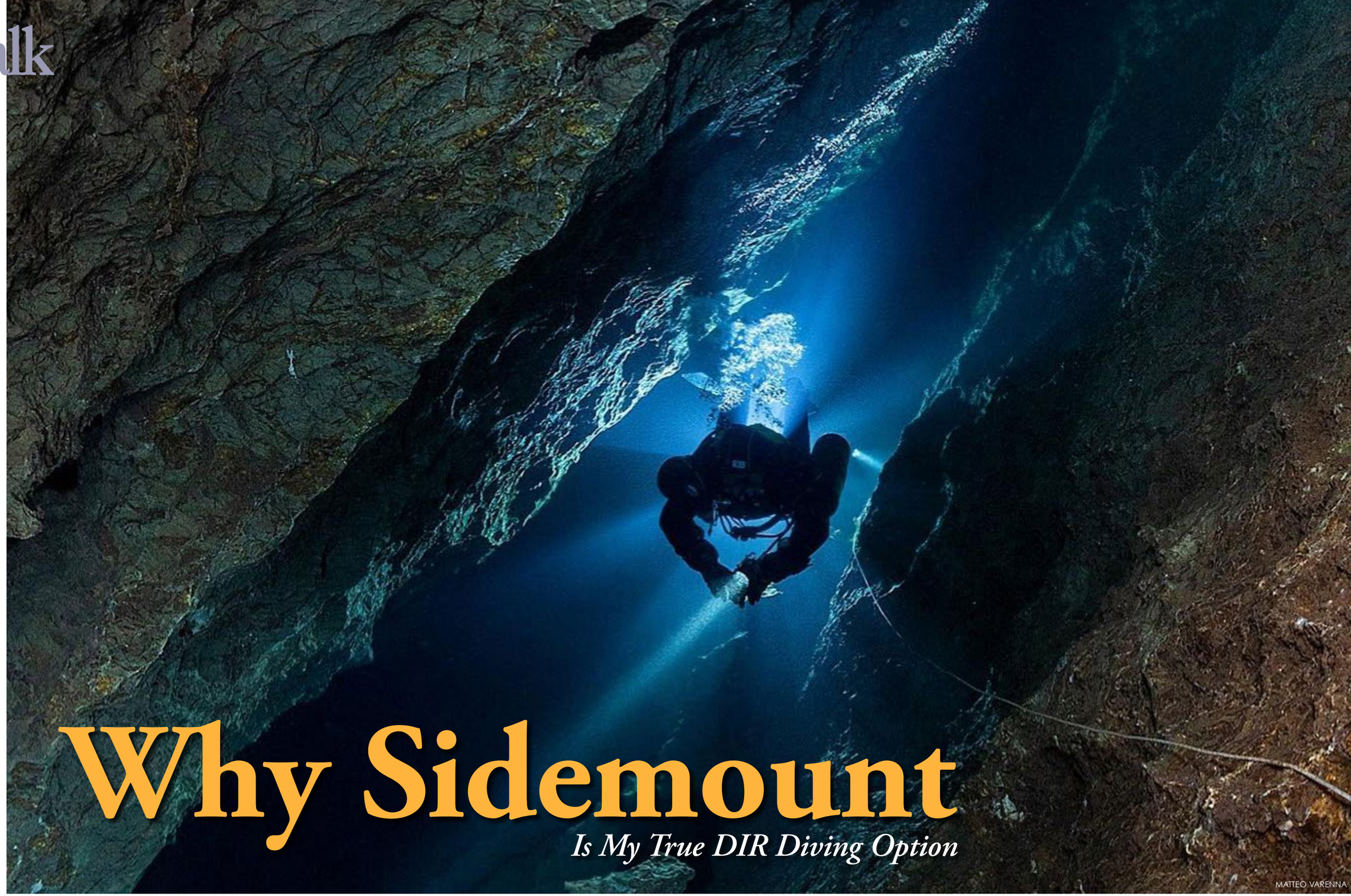
The beauty of working with huge data sets and modern statistical analysis techniques is the ability to reveal results you would previously never consider. Analysis of the DAN database seems to show that DCS prevalence increases as visibility decreases. This relates to the study of stress and hormone production mentioned above, but it is interesting to see that even with significant data, more concrete risk factors like workload do not correlate with DCS risk.

Age and BMI

BMI and age have long been theorized to increase DCS risk; this study confirmed the increased risk. Both factors appeared to contribute directly to increased bubble formation, while physiological metrics like height and weight individually could not be correlated (indicating that BMI, rather than a direct function of height or weight, increases the risk of DCS). Analysis of diver fat mass, which also correlated with DCS risk, further confirmed the results.

The study is ongoing, and this work and the offshoot studies will continue in 2020 and the years to come. Keep an eye out here and at DAN.org for more information. Contact the DAN medical department directly with any questions about how these risk factors may pertain to your diving. ■

For more information, go to: ***dan.org***.



Diver in Sinji Cave, Arkadia, Greece

Why Sidemount

Is My True DIR Diving Option

MATTEO VARENNA

Text by Stratis Kas
Photos by Stratis Kas, Nata Kas and Matteo Varenna
Edited by Michael Menduno

Doing something right has never been more important that being ready—and even eager—to change for the better. What was considered great a few years ago is not always great today. All we need is to find a better option, since what was right yesterday, may not be right anymore. Doing It Right (DIR) is about doing it better than it was done before. For me, that is the only right thing to do.

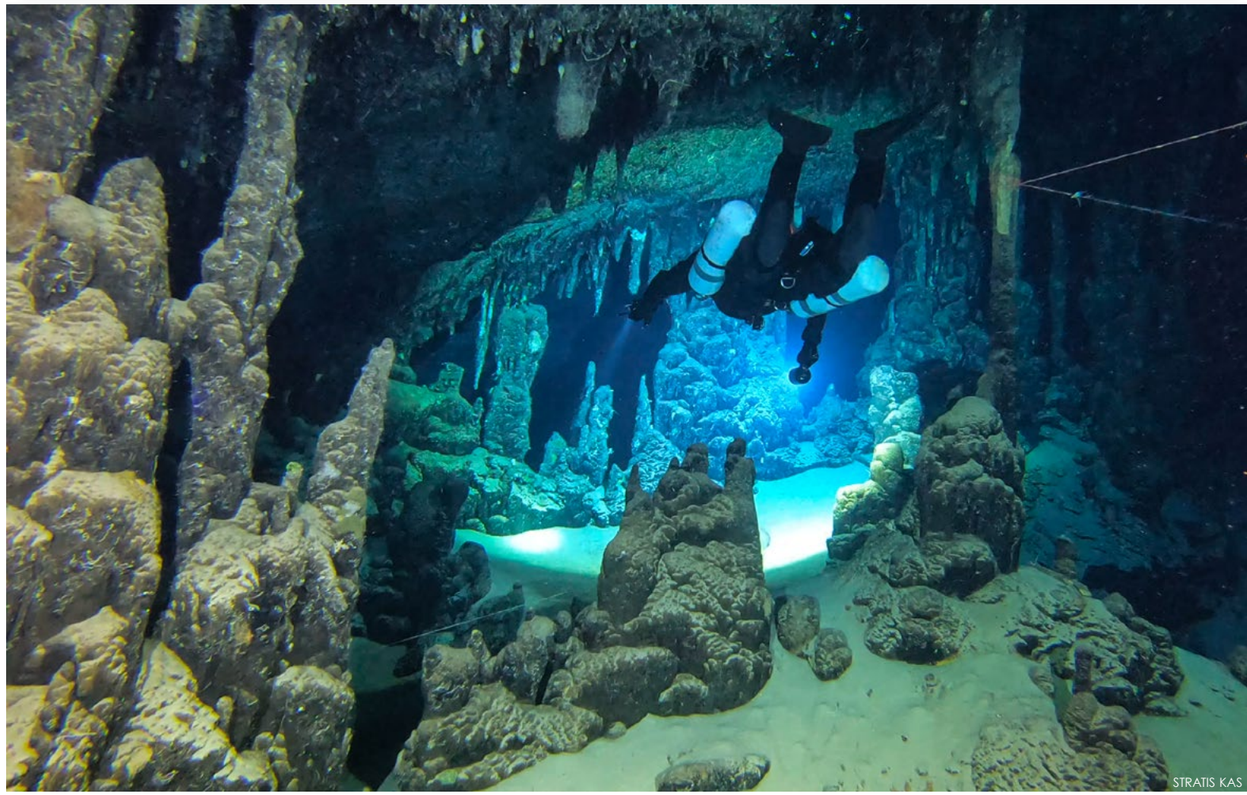
Ever since I can remember, two distinct parameters have pretty much ruled my entire learning life: common sense, and justifying anything that was being "fed" to me. These two "rules" basically determined my personal opinion on all things considered, whether it was diving or not.

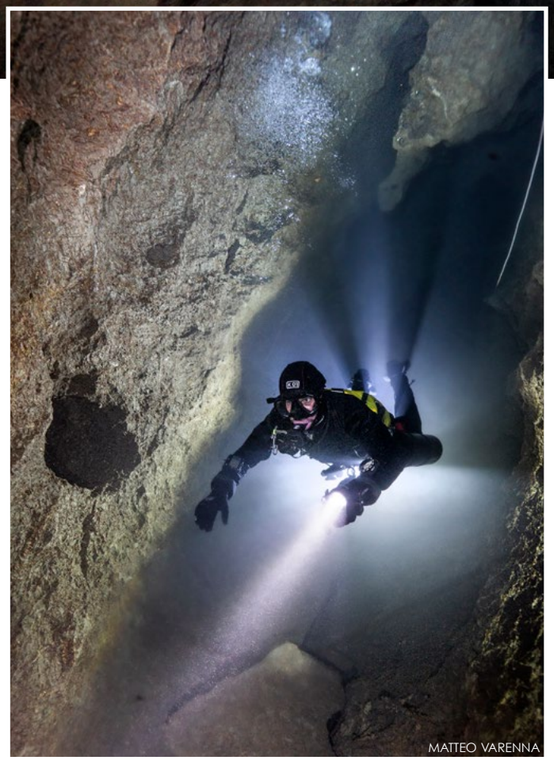
Common sense began as my own "inner voice," which helped me to understand and decide between a choice of two or more options at hand, even in the absence of history, experience and/or training. Eventually, it became the last check prior to making any decision—great or small.

Complex or basic, common sense has the ability to clear up the "silt" that confuses people when they simply do not know what to do. We are, for the most part, thinking beings, so as this is our primary tool, we should use it. Our brains work as a result of the synergy of two distinct stimuli: a) knowledge and experience, and b) common sense. These are the two factors behind our everyday decisions.

Justification is also crucial, not because I am a well-known reactionary person, but because I am also well known as a


MATTEO VARENNA


STRATIS KAS


MATTEO VARENNA

Divers in Sinji Cave, Arkadia, Greece (above and left); Sidemount diver in Amphitrite Cave, Cyclades, Greece (right)

questioning person. Try to convince me that "your way" is right, and you will be bombarded with "why's." My main goal has always been to learn from any encounter. I do not argue, I do not disagree, I simply want to understand the reasoning of your proposed option. Questioning things is proven to create better learning, as through questioning, knowledge becomes not just a bunch of simply stated and accepted facts, but a familiar foundation, which is easier to remember and make one's own. As you may have guessed, I was not meant for a military career.

This brings us to my actual career: diving.

History

In the 1990s, we saw the birth and rise of the "Doing it Right" DIR methodology in diving. A lot of good stuff came from it. However, the thought behind it basically "prohibited" any personal interpretation, making it inflexible but also non-evolving. The equipment that went with it, stemmed from its rigid mentality but was accepted because the system worked. It's true; it did. But anything that works can evolve and work better. If nothing else, it is worth trying.

In the years that followed, two kinds of divers emerged: the ones who followed DIR, and the ones who almost purposely did things differently, just to make sure they were properly "outside" the DIR circle. The result was that neither of them evolved as much as they could have, given the years and number of practitioners involved.

The entire idea of DIR was amazing: Take only what you need, use these protocols and dive this way to be safe. It is true, a proper DIR diver is probably safer than the average diver when following DIR diving rules. The problem was that most DIR divers almost always just practiced their skills in order to be better, to be ready. Ready for what? I thought diving was supposed to be fun, too.

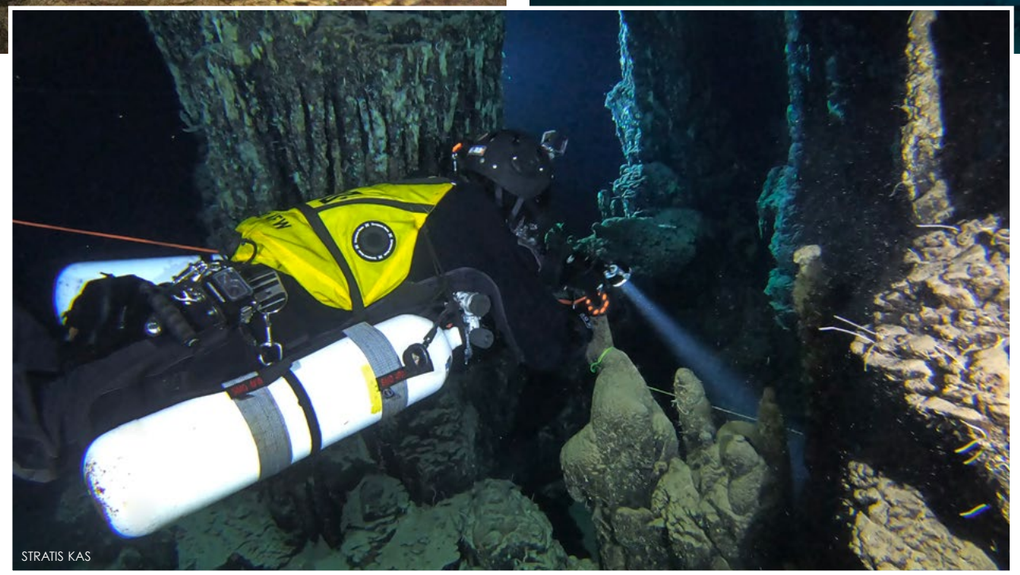
My journey through DIR diving was long, and exciting. That was probably when I also became a safe and aware diver. Just as the ad said: "Nothing was just because." There was a justification for all of what we did. Except, there was one big issue for me: Years of boxing, as well as my shorter arms-to-torso ratio, made valve drills not only a pain, but straight up impossible with heavy undergarments. Of course, turning cylinders upside down or adding tools

MATTEO VARENNA

Divers in Sinji Cave, Arkadia, Greece (above)

STRATIS KAS

Sidemount diver in Amphitrite Cave, Cyclades, Greece (above and left)



STRATIS KAS

to help was a non-DIR process, and therefore prohibited.

Sidemount

Transitioning to sidemount came next, but not out of a trendy choice. There was no common sense for me to say NO to cylinders that were not connected by a manifold, but then need to basically un-gear in order to shut down my valves. Nowadays, out of pure personal challenge and some stretching, I have perfected back-mounted valve drills to my own level of perfection—though not suitable for a GUE training video. Still, I prefer to reach them easily, identify leaks faster and feel safer overall.

Once I started diving sidemount, I quickly saw a lot that DIR diving could have used from that system while remaining faithful to its holistic thinking and evolving. Though some great ideas like "donate what your breath" could stand in the way of progress.

DIR diving has a series of basic rules: Donate what you breathe, use a minimalistic approach, and dive as a team, are probably the cornerstones. Donating what you breathe is probably the only rule that sidemount actually fails to achieve on 50 percent of the dive. In real life, how many times have you actually had a need to share gas? I expect your answer to be (close to) "never," if you are a proper and well-trained technical diver.

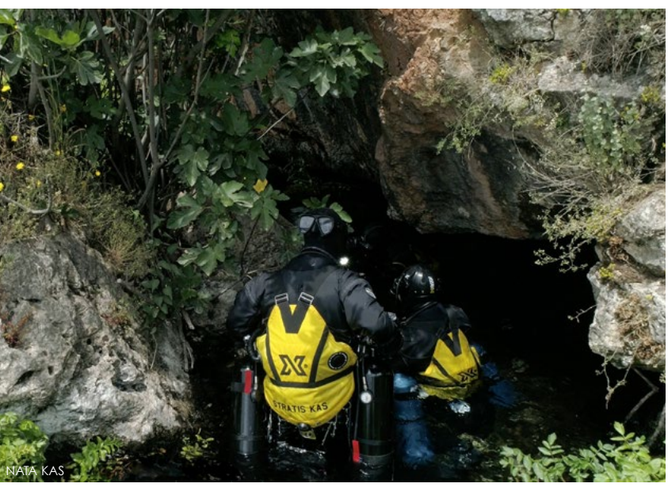
In sidemount, the chances that the regulator that I was breathing minutes ago will suddenly fail, or that the cylinder that is attached to it will be empty, are so small that it can be considered almost irrelevant. Not having to exit a cave "attached" to another diver when I can simply donate a cylinder, is more important.

Advantages

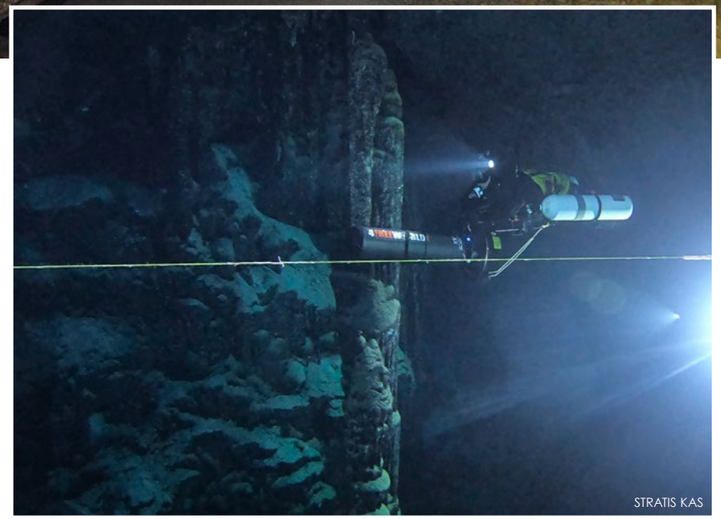
Sidemount is more trimmed than a back-mounted configuration. That is a fact when divers use just two cylinders, but it is even more obvious when additional cylinders are used. With all the focus on keeping everything from hanging so as not to create an entanglement issue, seeing experienced back-mounted divers, myself included, was not pretty, and often made no sense. Having hanging or floating cylinders when empty, is now something I have a hard time comprehending. Why not look towards sidemount when rigging and preparing stage cylinders? What was the downside of that? Nothing. It was simply the rejection of progress, especially when it came from the "other" (non-DIR) side of diving.

Sidemount is a more personalized configuration than backmount. Does it make sense for someone like me who measures 170cm of height to use the same setup and rigging distances that a two-meter giant uses? Why was this never considered? At the end of the day, as technical divers, we all have our own equipment. The problem is that we are not all the same size.

When it came to stage cylinders, for example, I do not recall anyone considering the distance to the back clip. Why didn't we learn from sidemount, which relatively early on produced a very nice, tidy and yes, a "right" position for their side-mounted cylinders? Why didn't we think we could do that for our stage cylinders? Why didn't organizations



Divers in Sinji Cave, Arkadia, Greece (above, right and left); Diver in Amphitrite Cave, Cyclades, Greece (lower right)



that teach both DIR (or Hogarthian) style technical diving and sidemount think of merging the good from both sides?

Approach

I still believe that the DIR approach is an awesome way to conduct technical diving. Learning the fundamentals is paramount prior to moving in the direction of technical diving. Be in control. Plan your dive with knowledge and execute it with ease and awareness.

But you should also consider your own uniqueness, your own highs and lows. With these in mind, create your own "DIR" version. What is "right" for me may be impossible or simply challenging to you.

And regarding team diving, as long as we all know what we have to do if an emergency occurs, and we have practiced it together, then we are a team. Reducing response options has proven to reduce stress and reaction time when solving a problem. But making the selected options easy is important too. I know divers who avoid difficult-to-do exercises. As a result, once they get certified, they never practice those emergency scenarios again. Even if there is only one option, it is as far as it can be from being a comfortable and effective one.

Personally, I was one of those divers who avoided skills that reminded me of the difficulty in reaching my valves. Not anymore. I practice valve drills prior to any serious dive, on all cylinders (sometimes up to five in a single dive). Yes, in sidemount, it takes time and commitment when it comes to rigging equipment properly. It is far more personalized, and a 3cm distance longer or shorter can dramatically change how you feel. However, once I am done, it is truly done "right" for me. Everything is tight, close by and has a reason. It has a justification. It has common sense.

I think sidemount is the future of the true DIR diving. Most of its practitioners develop their own adaptations on established standards and share them openly. Most importantly, equipment companies often listen to and adapt their next products for these real needs and/or solutions. They listen to real divers. They evolve.

A sidemount diver is not necessarily a more evolved diver, but the holistic minimalism and safe practice of the DIR principles, which we all loved, are still there. Each year they become better. ■

Stratis Kas is a professional award-winning photographer, filmmaker, trimix, cave and DPV instructor and is the co-author of cave diving manuals, exams and related materials. Widely published in international magazines like Vogue *(Italy, Russia, Greece) and* GQ *(UK), his images have been exhibited in London, New York and Paris, and have been used by brands such Christian Dior and Levi's. Diving since 2001, Kas has truly global experience in diving, from South America to Hawaii, from high-altitude lakes and Florida caves in the United States to the Red Sea and beyond. Since 2016, Kas has led the Top2bottom cave-filming team, which specializes in adventure film. In 2017, he finished his first film,* Amphitrite, *which won a finalist place in the SHORT to the Point international short film festival in 2018. Currently, he is filming his first full-feature film,* Echoes of Silence, *produced by Because I Can, Ltd., and FilmO2 Paris.*

Why I Dive Sidemount

Text by Olgo Torrey
Photo by Peter Symes

"Long dives, no pain" was the main reason for me to learn this configuration. I have been using sidemount for nine years now, and I still think it is the best approach to prevent the deterioration of one's neck, shoulders and back.

As divers age, it is important to prevent injuries and dive without pain. Diving off a boat is different than from diving in caves. Bad weather, limited space, small entry and exit doors, the crew's knowledge of sidemount and poorly designed ladders are the challenges sidemount divers face. Caves do not have these issues. Nowadays, dive boats on the US northeast coast let more sidemount divers on board and are not as hesitant about it as when I started.

In other parts of the world, sidemount is still new to boat diving. Last year, I was diving off a liveaboard, and I was not allowed to dive sidemount, despite my nine years of experience and certification card. The main reason is that these boats cater to single-tank, no-decompression divers and lack understanding of the sidemount configuration.

Also, some captains feel sidemount has no place on boats. They think that if the seas pick up while sidemount divers are underwater, using an equipment line or handing tanks up could be dangerous. In this situation, a sidemount diver does have to be ready to climb the ladder wearing their tanks. Despite this, I think the sidemount configuration is safer due to the close proximity of tank valves, hoses and regulators.

Click on the image above to read the "Sidemount Workshop" article by Olga Torrey.

Photography

Underwater photography with sidemount has its challenges. Once, I tried to take a photo of a seabird sitting on the water's surface, and the bird was looking down. Being underwater, it was not easy to turn on my back because the tanks prevented me from easily rolling over. Backmount is better suited for getting into this position. Otherwise, sidemount does not affect the way I shoot, but it does allow me to fit into tight spaces to get different compositions.

Advantages and logistics

Trim and swimming are more comfortable while using sidemount. Transporting single tanks used for sidemount is less weight to carry than banded, double-backmounted tanks. After diving, coming back on the boat, tanks can be hung on an equipment line and pulled up onto the boat. Also, tanks can be removed from the harness, when coming up the ladder and then handed up to a crewmember.

All in all, the benefits of using sidemount outweigh the challenges, and I will continue to use this configuration on my dives as an underwater photographer. ■

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

Sidemount Tanks

Getting Sidemount Tanks to Behave Themselves & Sit Where They Should

LARRY COHEN

Text and illustrations courtesy of Steve Lewis. Underwater photos by Larry Cohen and Olga Torrey

One of the least mysterious things about sidemount diving is how to rig a set of steel primary cylinders so they hang at diver's sides as they are supposed to, rather than hanging pendulum-like below them. However, some still struggle to get it anywhere close to right. Perhaps this article will help.

There may be several variations on the basic theme, but I have found the simple way to rig steel cylinders to hang this way is to break the process of rigging them into a series of simple steps. Now, before explaining things in detail, there are a few assumptions that apply to this method.

Firstly, the primary cylinders are fitted with left and right DIN type valves. Secondly, whatever SM harness you use, it is fitted with loop bungees. Some folks refer to these as "old school" bungees, some call them "Armadillo" bungees because the original Armadillo SM harness used them as standard, and some call them loop bungees. These tips may not work with ring bungees or straight bungees: Frankly, I have no idea since I use loop bungees exclusively. The third assumption is that you want the orientation of your cylinders to look something like the illustration (Figure 1, left).

In it, the diver is able to hold good horizontal trim with her or his cylinders parallel with an imaginary line drawn through the centre of the diver's body.

The fourth and final assumption is that the bottom of the cylinders (the part nearest the diver's bum) are going to be clipped to hardware on the back of the SM harness or

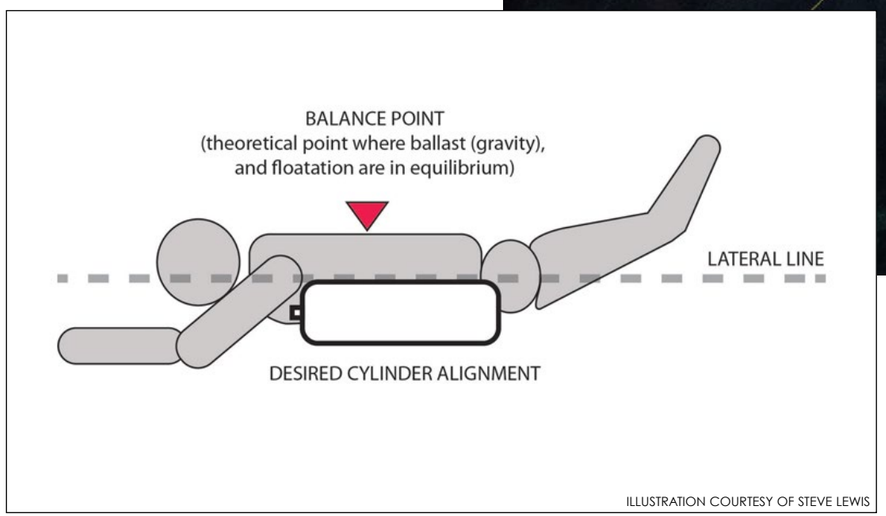
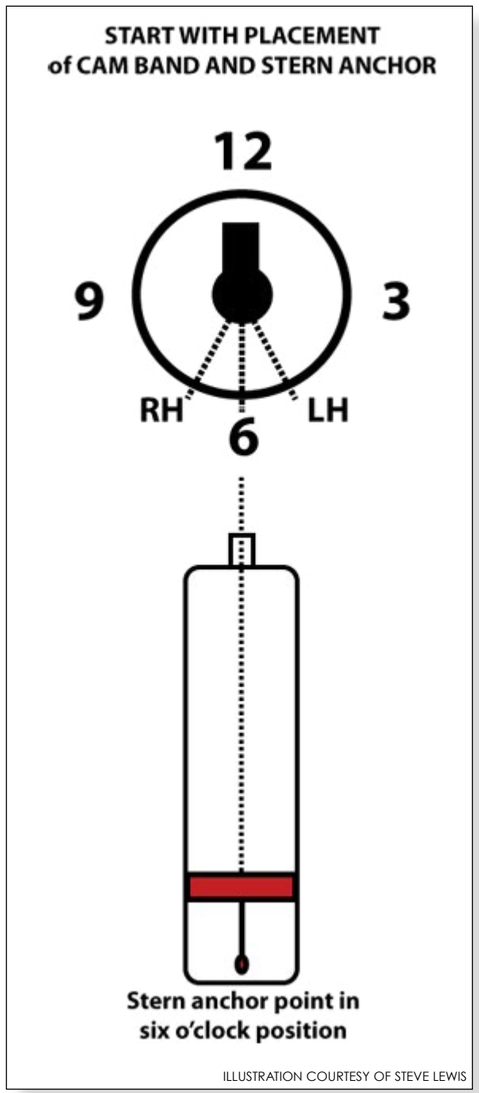


Figure 1. Desired sidemount cylinder alignment and balance point

Figure 2. CAM band and stern achor



somewhere close to the diver's hip.

A fifth point, not really an assumption, is that as long as tanks with opposing valves are used (i.e. left and right-hand valves), whether or not the first stages are worn pointing in towards the diver or pointing out to the environment, is immaterial.

A simple way to approach tank rigging

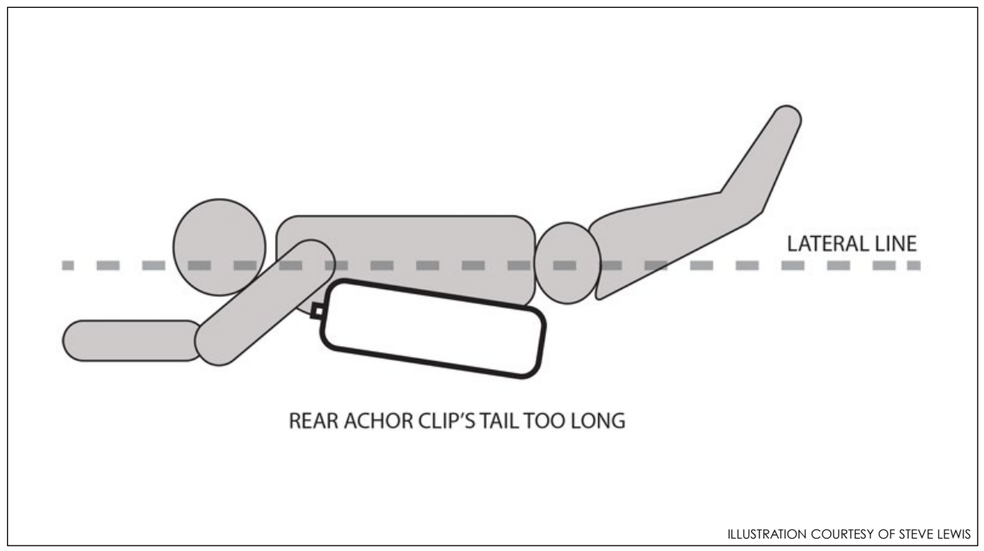
Start with the notion that there are several things that will affect a tank's orientation, and therefore, the diver's orientation also. I find it easiest to get all of these things (let's call them variables) approximately squared away on dryland and then resolve them one at a time, working in shallow water with an observant buddy or one with a GoPro and time to spare.

The first thing to get sorted is the rigging on both tanks. The clip or boltsnap on the neck of the tank is simply tied onto a small loop of equipment line (3mm braided poly works fine). The loop needs to be long enough to allow it to fit over the valve and handwheel. This clip is a backup for the loop bungee, so its setup and configuration are probably the simplest things about rigging sidemount.

It is the placement of the stern (rear) anchor point in relation to the position of the valve—well, the handwheel on the valve, that is a little more complex. I guess we could start anywhere, but I seem to have the best luck, and the shortest gear-tweaking sessions, starting at this point.

First of all, it helps if we understand what challenge we are trying to "fix" with each variable—or what each affects at least.

When we dive sidemount, we want our primary cylinders at our sides, with the handwheels pointing away from our bodies, and pointing very slightly down towards the seabed, lake bottom, cave floor, etc. We want the handwheels oriented this way to make it possible for loop bungees to wrap around the handwheel and stay in place. We can do this by manipulating the location of where the cord with a bolt snap on it is connected to the body of the primary cylinder, in such a way that the natural resting position of the handwheel "knob" is out and down.



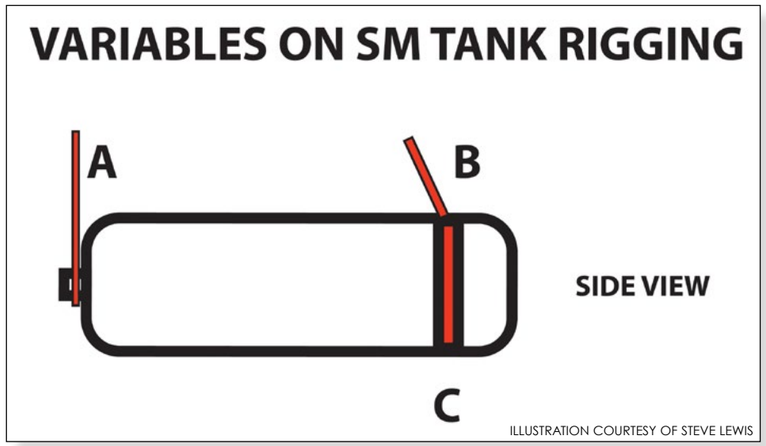
Start off by looking at the cylinder from directly above. Think of the handwheel pointing to 12 o'clock on an imaginary (and analog) clock face. Six o'clock is opposite and at 180 degrees away from it, and we want to mark this line. So, take a straight-edge and a marker and draw a line about 20cm or eight inches long from the bottom of the tank along this six o'clock meridian along the side of each cylinder.

The illustration (Figure 2, left) should make this clearer. It shows a dotted line running along the cylinder at 180 degrees from and opposite to the handwheel. The CAM band is shown in red, and the tail (a piece of nylon equipment chord) and the bolt snap or butterfly clip is shown as a solid black line with a small black and red oval at the end of it.

For the vast majority of divers, fixing the stern anchor point at six o'clock (or slightly to the left or right, let's say, five-thirty to seven-thirty) will greatly help orient the bottle and handwheel correctly. In fact, the best option is to start off with the anchor point at six o'clock for both the left and right-hand cylinders. Fix them in this way, and let's move on.

Now, note well a couple of provisos. The distance of the CAM band from the bottom of the cylinder is another variable and something we will discuss in a few paragraphs. At this point and as a first step, all we need to do is to find the optimal spot on the clock face to fix the spot where the stern anchor is attached

Figure 3. Variables on sidemount tank rigging



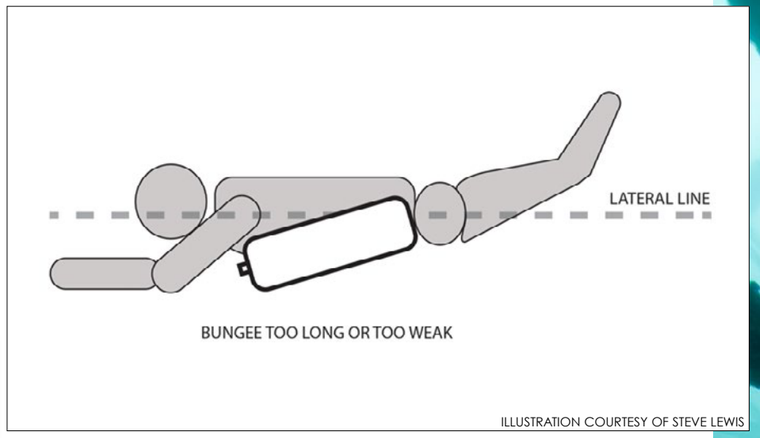
to the cylinder.

For the time-being, we can put the CAM bands three or four fingers width from the bottom shoulder of our cylinder.

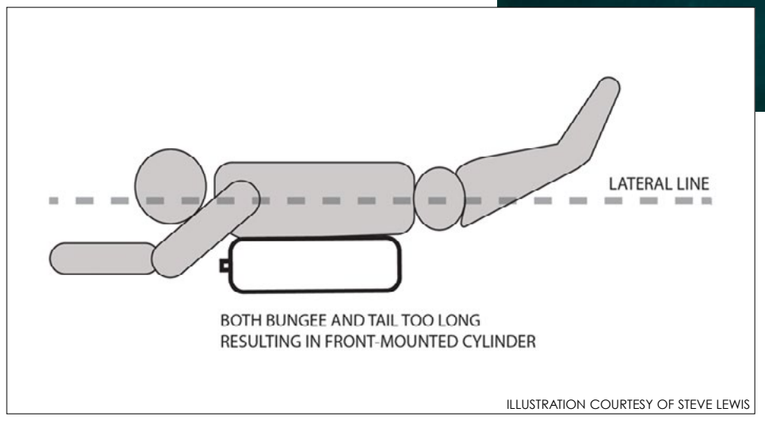
Point A is the length of the loop bungee that wraps around the cylinder's handwheel, keeping the top of the tank attached to and aligned with the diver's shoulder. Making it longer or shorter allows a diver to adjust the position of the valve and cylinder's top with the diver's chest and armpit.

If the loop bungee is too long, the result will be a bottle hanging low in the front and higher in the back. If the bungee is too short, the diver will be unable to reach the tank handwheel, and there is a good chance the valve will dig into his or her armpit. This is both uncomfortable, and potentially hazardous since he or she will most likely not to have the mobility to doff or don the cylinder without help.

Most manufacturers of loop bungees use 6-7mm (1/4-inch) thick shock cord. This thickness is strong enough not to stretch much in water. Bearing this in mind, adjust the length of your loop bungee so that with your arms by your side, and without any tension in it, the end of the loop just pokes out past your bicep. This will need to be fine-tuned for some individuals but it is an okay starting point.



Okay, with that done, we are ready to work on the rest of our tank rigging. The illustration above (Figure 3) shows three more primary variables.



Point B is the length of the tail attaching the cylinder's bottom to the stern anchor point (either a Dring or "door handle" on the diver's harness, or on the diver's waistband). We have already oriented the anchor point to align the handwheels, which is controlled by making this the cylinder to hang parallel to our lateral line. If the tail is too long, the cylinder will be oriented tail down. Too short and it will be difficult to handle, and the tank will sit with its bum pointing up instead of

straight back.

The length of this tail WILL need to be adjusted! Do not cut it too short when you first attach it to your CAM band.

Point C is the location of the CAM band or clamp attaching the stern anchor to the cylinder. This is one of the factors influencing the diver's trim! Moving the CAM band closer to the top of the cylinder will shift weight towards the diver's bum, while moving it closer to the bottom will shift weight towards the diver's shoulders and head. So moving the CAM band helps to trim the diver who is either head or bum down—you move the CAM band towards whichever end of the diver is sinking.

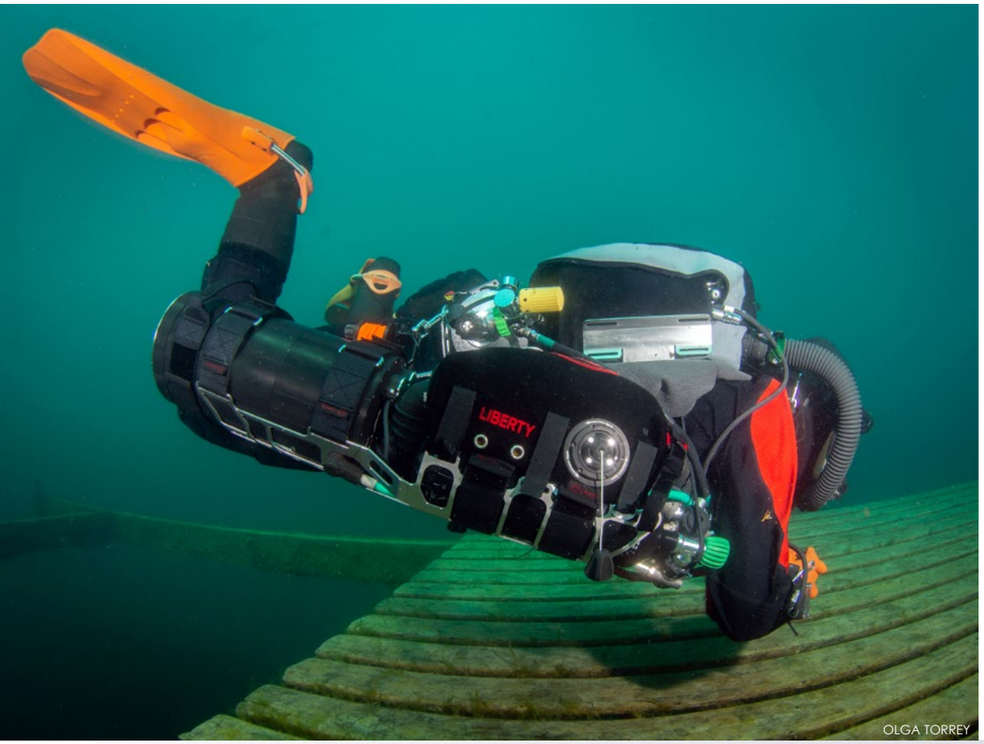
I find it much better and quicker to make small adjustments to one variable at a time, and to get it "right" before moving on. Your mileage may vary, but this method works for me.

A few centimetres of adjustment (an inch or so) can radically alter the trim of a tank or the diver. When you move something, make a note of what you did. I also mark the "six o'clock line" on my primary cylinders with hash marks every centimetre or so from the bottom of the tank up to about 10cm. This makes fine-tuning my trim easier when I wear thicker or thinner drysuit undies.

There are more subtle issues with getting your sidemount self-squared away (hose routing, for example), but this should help you improve the way you look and feel in the water.

The value of a buddy with a camera who can photograph you underwater, so that you can see exactly what you and your gear look like in the water, cannot be over-stated—make it happen.

Good luck. ■



OLGA TORREY

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

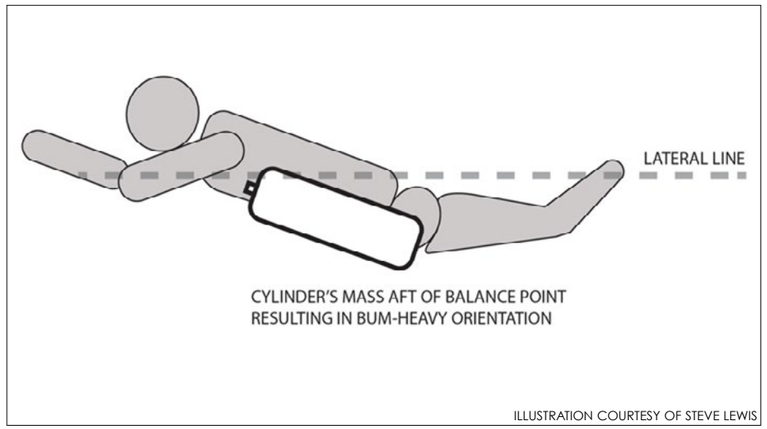

ILLUSTRATION COURTESY OF STEVE LEWIS

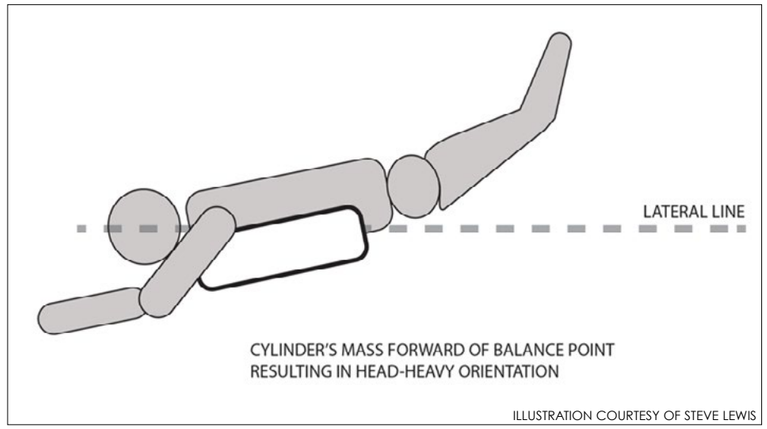

ILLUSTRATION COURTESY OF STEVE LEWIS

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If you ever have the chance to work with a professional freediver, grab it! Models without scuba gear do look so much better. Model: Didem Kara

Underwater Model Photography

Text and photos
by Rico Besserdich

Whether or not we find something to shoot during our dives with a camera, there is always one photogenic subject that is always with us: the dive buddy. This allows us to explore an interesting category of underwater imaging: model photography. There is hardly any underwater photographer who has not recently taken photos of his or her dive buddy as souvenirs of a dive, for practice purposes, or simply because nothing else could be found as a photographic subject. Here is an excellent opportunity to consider how people can be photographed in interesting ways as models underwater.

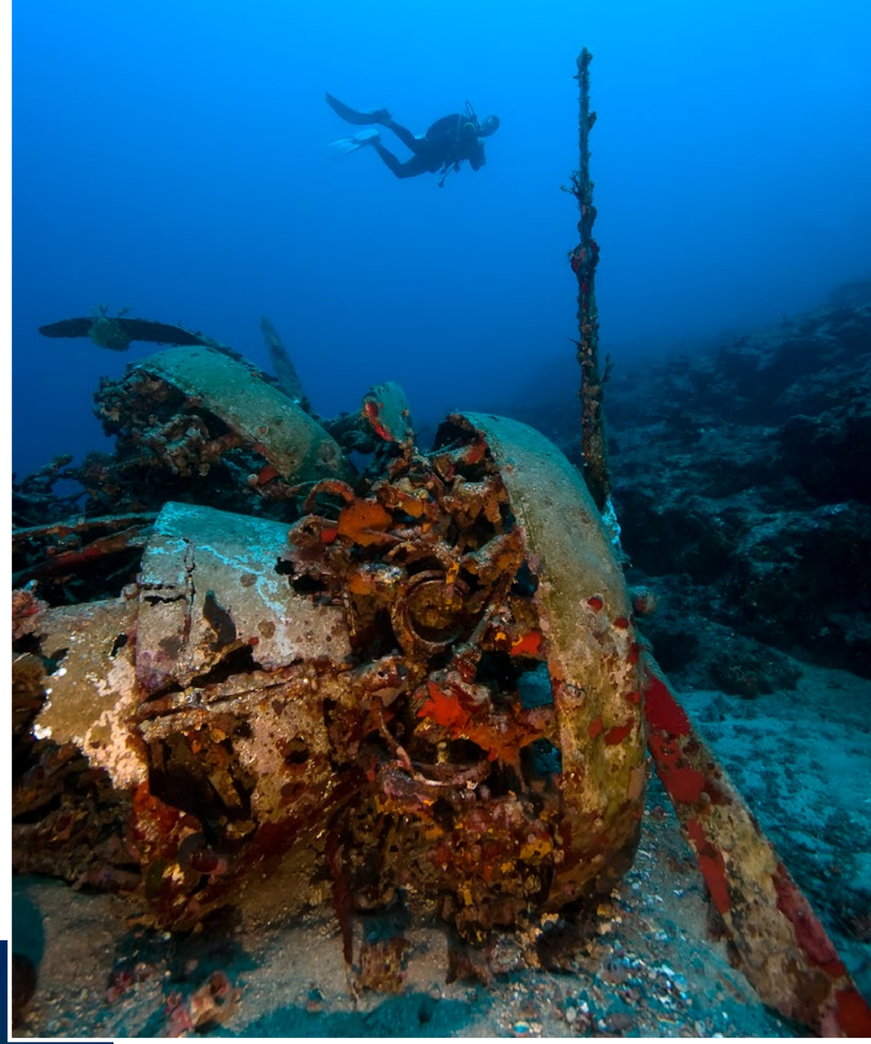
Some may wonder where the sense is in making a human being the main subject of an underwater image, whilst the underwater flora and fauna have so much beauty to offer. This is a legitimate question, which can, in a sense, be answered by human psychology. Human beings are "land animals," and whether or not they are equipped with a diving apparatus, they are generally not designed for a life underwater. Thus, a photo of a human being underwater always creates a certain tension in the composition, especially for viewers who are not divers. That ancient instinct for survival, the necessity to breathe air, is photographically quite useful and something we can use to our advantage in arousing the viewer's attention.

In addition, a human model underwater conveys to the viewer a natural sense of scale in many shooting situations. How imposingly tall (or how small and puny) a wreck is, becomes clear in most underwater photographs when a human is visible in the image. In photos of corals, reefs, underwater landscapes, marine plants and animals of all kinds, when a human being (a diver) is included in the image, an underwater shot often appears to be more interesting and compelling.

Although we as underwater photographers consider the dive itself, the under-

The size of wrecks will become understandable if a human model is part of the image composition. Model: Thorsten Gregor

A scuba diving "model" adds nicely to the blue background and also gives the viewer a sense of scale of a wreck or wreck debris. Model: Mark Sapsford



water world and the other divers in the water as relatively "normal," this is not the case for many non-divers. To them, the world of the oceans is a miraculous and mysterious unknown realm, and diving is an activity for risk-seeking adventurers. With our photography, however, we can make the beauty of the underwater world accessible to a huge range of people. This air of mystery can give our underwater images an extra sense of drama in which underwater models can come in handy as well.

Working underwater with a model can be time-consuming and complicated, but it does not have to be so. There are different forms and imaging concepts that can be explored; some of them can even be realised in a swimming pool. Whether with a dive buddy, freedivers or children in a lake, the sea or the local swimming pool, the "basic pillars" of underwater model photography consist of the following:

- Planning
- Cooperation
- Communication
- Pose
- Buoyancy

Let's now move towards well-planned and executed photos with a model.

Planning

The beginning of the creative process is the idea. Advanced photographers, as well as professionals, first develop an idea; then they make a plan as to how the idea can be realised; and then, as the last and final step, the actual execution of the plan underwater follows.

Developing an idea depends on imagination, creativity, local possibilities (the type of water) and available equipment. Every person has ideas and finding or developing an idea is an important part of the photographic design process. The "creation" of a special image starts long before the actual click of the shutter button. Sources of inspiration for a good idea can be found in dive magazines as well as on the Internet, where many outstanding underwater photographers present equally outstanding underwater model photos.

Once there is an idea, planning follows:

- What do I need to realise my idea?
- How do I configure my underwater camera equipment and settings?
- When, where and with whom should the photo shoot take place?
- What are the local conditions?
- Are there certain (extra) security aspects to consider, and if so, how can they best be realised?
- What should the model do, and what should I do?
- How do I communicate with the model, and how do I explain the idea or concept to the model?

Underwater photographers, while doing the stuff they do, can be quite photogenic underwater models as well. Model: Isabella Maffei

It is helpful to jot down some notes. Some photographers outline the planned image in advance. No artistic skills in drawing are required here; a very simple sketch will help the process of visualisation immensely.

Cooperation

A good photograph with an underwater model is the result of excellent teamwork between the photographer and the model. The performance of the model has the same importance as

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Shoots in shallow pools allow the use of ambient light. Even the smallest accessories such as sunglasses are fun and helpful, not to mention the smile of a happy model. Model: Seda Karadeniz (right); For the model to feel comfortable and relaxed in and under the water is crucial for successful underwater model photography. Model: unknown Turkish girl (far right)

the performance of the photographer. Therefore, the model deserves 50 percent of the "credit," at least! Good cooperation between the photographer and the model almost always results in a good image.

It would be unwise to simply use the model as an "object." Let the model participate in your idea and also in the planning. You will find valuable input that certainly will benefit the planned images.

It is (in my humble opinion) also the photographer's duty to ensure a positive and relaxed atmosphere. Idea exchange, conversation and respect for the model and his or her performance are important factors. It is a simple principle: Relaxed and happy models perform better! No one feels good being "pushed around," criticised or even bossed around. This applies to the dive buddy from a dive club as well as the professional model. Your (underwater) models can be the keys to your success—treat them with respect.

Let your model participate in your vision and understand that the realisation of your idea is a team effort of equal team members. Be ready for and open to cooperation, as well as to (positive) surprises—sometimes with a complete rethinking of your initial idea.

Reflections at the water's surface help relay the image's message. Such shots are ideally done in the evening or at night. Model: Seda Karadeniz

Communication

Many of you probably know the frustrating feeling that arises when you are trying to photograph a model properly underwater, and your well-intentioned (and what you thought were completely clear) instructions by means of hand signals (which may grow into energetic arm waving, accompanied by curses shouted into your regulator), often receive only glances of incomprehension or shrugs from the model, or, in the worst case scenario, result in an exasperated model swimming away. The model is confused, the photographer is frustrated, and the hoped-for image is not in the can—another frustration! Often, this is due to the (not-so-ideal) communication between model and photographer.

Communication is also a question of the right arrangement. Such an agreement should, of course, take place before the actual photo dive. Our communication options underwater are limited. The solution lies in the briefing, or preliminary discussion, just before the dive.

Agree with your model, ahead of time, on just a few (!) hand signals to use to communicate during the actual shooting. Please note: The model does not see what you see. He or she usually has no idea of how the scene in your camera viewfinder looks, and therefore (if the model is good and willing) relies on clear "instructions" by means of hand signals.

Limit communication to just a few hand signals that you have previously agreed upon. Too many hand signals will confuse the model. The commands: "Forward," "Back," "Up," "Down," "Stop" and "Again" are often sufficient here. Plus, a hand signal meaning: "One moment, please" (e.g. in case you want or need to change settings on your camera) is a good signal to include as well.

Also plan and discuss underwater hand signals with which the model can communicate with you. You may have your problems with camera settings, lighting and composition, but even models may have their own problems or desires and need to be able to communicate them to you. "Okay?" "One moment," "I am ready" and "I want to cancel" are standard signals that should be discussed before the dive to ensure a good shooting session as well as safety.

Only a few underwater photographers have the advantage of an exclusive model who does nothing but pose patiently and indefinitely. What is more common is that dive buddies act as underwater models. This then

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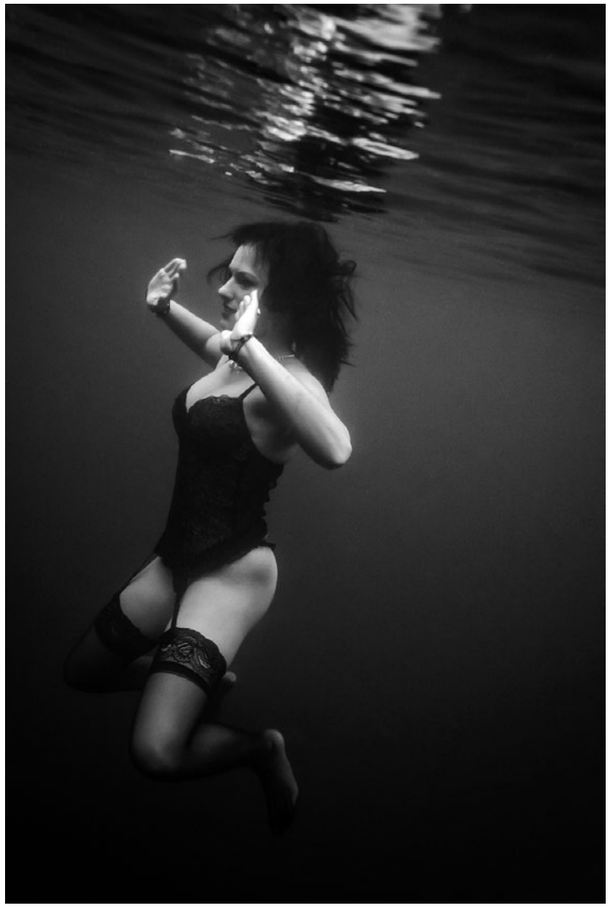
Sexy clothes always work when combined with a happy and playful model. What the image does not show is that the water was just 11°C. It is not easy to stay happy in such cold water. The entire shoot lasted 12 minutes. Model: Chris Mo (right); Shoots just below the surface at sunset or at night allow for nice reflection effects, helping the viewer to understand that the image was taken underwater. Model: Olivia Schiessl (far right)



often happens on a shared dive. If this is the case, then the patience of the model should not be overstrained. If all agree to the plan for the shoot, then a specific time and period of the dive for the model photography can be arranged. With appropriate preparation, a lot of photographic work can be done in just five to ten minutes. This leaves enough time for your model, or dive buddy, to enjoy the rest of the dive for himself or herself.

From the point of view of an underwater model, the photographer is usually hidden behind the camera, performing mysterious things. It is hard for models to know exactly when the image is being taken and when exactly a particular pose, facial expression or position is to be presented. If the flash ignites, then it is already too late.

It is always fun and rewarding if models enjoy the shoot and are playful. Even the simplest accessories such as an anchor chain can add something to an image. Model: Olivia Schiessl

Here is a suggestion: In most underwater cameras, the trigger is operated with the index finger of the right hand, and the index finger of the photographer rests almost constantly on the release button. Pressing the release button is only a very small movement, which is often not noticeable to the model. As a visual aid for the model, the photographer's forefinger can be used as a "signalling device." An extended forefinger can signal "Attention, recording." The model then knows that the image will be taken within the next few seconds and can set up accordingly.

In a way, that is also part of the communication. If you think you have managed to take a very special photo, take a very short break to show the image to the model. Share your enthusiasm! This motivates the model and creates a nice atmosphere. You will see that your model will be even more enthusiastic about subsequent recordings. Motivation is important. Encouraging this motivation and creating a relaxed work environment for the model is the task of the photographer. So, communicate with the model if you are particularly pleased with a shot.

Pose

The pose of the model is often crucial for a successful image. A scuba diver as an underwater model should, of course, be an "ideal diver." A straight back, straight legs and arms, with hands close to the body is the classic pose. There are as many exceptions as there are creative possibilities. But in general, the model should look good. Period.

There are lots of poses and what is best suited for the planned image is something that should be considered and agreed upon beforehand. For experienced photographer-and-model teams, the model knows the classic poses, or the photographer's favourites, and plays them through for several shots. For beginner teams, however, it is recommended that they keep to a maximum of two to three (previously agreed upon) poses.

Buoyancy

Perfect buoyancy is another important key factor in successful underwater model photography, and this applies

Professional freedivers without scuba gear look so much better than models laden with tanks. Model: Didem Kara (below); Model and safety diver on their way back to shore after a shoot in around 14m of depth. The model was not supposed to carry the weight belt, but she wanted to help. Safety diver: Hanne Van Liere; Model: Chris Mo (bottom right)

equally to the photographer and the model. Many beautiful "classic" underwater images show a model in close proximity to coral—sometimes, just centimetres away. In these cases, even the photographer is very close to the action, no matter how "wide-angle" the image may look like later.

Careful buoyancy is important for the protection of marine animals and plants, but also for self-protection. Only a perfectly balanced model can pause at the right moment in the desired pose, and only a perfectly balanced underwater photographer can reach the ideal shooting position... and stay there for a while.

Protecting nature and the safety of those involved (photographer and model) should always take precedence over anything else in an underwater photo shoot. If the underwater world (coral reef, for example) is endangered or directly threatened by our presence and circumstances (current, for example), the photograph will be a failure. There is no photo in the world that justifies broken coral, agitated sediment, stressed animals or other "damage." The same applies to "self-protection," as in the case of currents, waves or other "hindering factors." To ensure the 100 percent safety of all participants, it would be better to abort the shoot or try to move to a safer place. For such cases, it is good to have a "Plan B" (i.e., what to do in case a shoot at the originally planned location is, for safety reasons, not possible).

Shooting situations and scenes

There are a variety of possible shooting situations in which a human model underwater can play an important role or even be the sole protagonist. Here are some examples:

- **The human as a diver in the context of the underwater world**
This is the variant that is most frequently used. Often, the model is the dive buddy, who happens to be in the vicinity, and thus, is "basically available," assuming there has been an appropriate prior agreement and briefing. Photographer and model are both (in most cases) equipped with scuba gear.

- **The visual statement: A human exploring the underwater world**
As previously mentioned, this theme offers the viewer a relationship to the event, complements the understanding of the image, awakens especially positive associations or feelings (e.g. "I would like to dive there too"), and to non-divers, offers an impression of the exotic and adventurous. The attention of the viewer is assured. In addition, a comprehensible sense of scale regarding the dimensions of an object or subject matter underwater is achieved when a human model is visible in the image. The size of a shipwreck, for instance, or the (comparatively) fragile minuteness of a nudibranch, become evident to the viewer almost automatically when a human being (a diver) is part of the image composition. Applications and subjects of this theme include:

a) **Diver exploring a shipwreck**
When it comes to photographing the size of a wreck, the model is usually completely visible in the image, sometimes even just as a silhouette.

b) **Diver looking at underwater flora and fauna**

c) **Divers exploring imposing underwater landscapes**
Whether in tropical seas or in a lake, if the visibility is good, a diver (as a model) adds that "special something" to an underwater landscape shot.

Safety aspects

Assuming that both model and photographer are underwater as fully equipped scuba divers, the known safety protocols include buddy checks, control of depth, no-stop time, air consumption, as well as consideration and planning for special local conditions such as visibility, current, waves and other safety-related factors. These are safety procedures that also count for underwater photography activities.

It is important to strive for a certain discipline. Often, in the "heat of battle" and

Behind the scenes of a classic model shoot underwater in the ocean. The model poses, the photographer shoots, and the safety diver is very close to the model (but not in the image frame of the camera), observing the model carefully, with air support (octopus) ready at hand. Image credit: Seda Karadeniz; Model: Chris Mo; Photographer: Thomas Preiss; Safety diver: Rico Besserdich (right)

What might look so simple and basic here was, however, the result of a team of six people working half a day, including the model, the photographer, the safety diver and three more people providing surface support. Model: Chris Mo

especially in underwater photography, dive depth, remaining no-stop time and air consumption are not controlled as well as they would be when diving without underwater photographic equipment.

Indeed, some underwater photographers have found themselves after "just taking a few shots" with a remaining pressure of 60 bars at a depth of 25m! Despite all the passion one may have for underwater photography, such high-risk incidents should be avoided, and the fact that more air is consumed during underwater photography dives (due to more movements made in changing position while photographing as well as perhaps sheer excitement) should be well considered in dive planning. This applies equally to photographer and model.

In order to avoid or at least reduce this additional stress and risk factor, it is advisable to conduct underwater model photo shoots in rather shallower (3m to 15m) depths, if possible. Some underwater photographers (such as Dr Alex Mustard) mount the dive computer directly on the underwater housing or on the strobe arm to have both the camera and dive data in view at the same time.

Brief tips

Streamlining. A scuba diver as an underwater model should have his or her dive equipment well-configured and mounted. "Close to the body" is the motto; hanging brackets, dangling regulators or other equipment should be avoided, if possible. Dive equipment should be kept as simple as possible; models decked out like "diving Christmas trees" are usually not very photogenic.

Pointers. A scene such as "a diver looking at a coral" implies that the model really looks at the coral and does not look straight into the camera. If the model uses a dive light as a pointer (which is quite popular in such situations), the dive light should be aimed at the object of exploration (e.g. coral) and not indiscriminately into the blue, or even at the photographer's face.

Bubbles. Pay attention to the breathing rhythm of the model! Air bubbles, especially when they are close to the model's face, often disturb the image. Therefore, it is important to signal the model just before you take the shot, using a hand signal that conveys the message: "Attention, recording" (see description above). If this is not possible, then the photographer's observation skills are required. Observe the inhalation and exhalation frequency of your model and adjust accordingly.

How the model inhales and exhales is, first of all, the model's job alone. Influencing or even controlling the breathing frequency of the model creates a rather unpleasant atmosphere. This is to be avoided. Experienced (and sometimes paid) underwater models know about this issue and can control their respiratory rate accordingly.

A few exhaled air bubbles in the image and then far above the model (perpendicular to the water's surface) are not necessarily disturbing; they can, in some cases, even contribute positively to the image's composition, since the "bubbles" act nicely as the scuba diver's "signature." Especially with wide-angle shots (wreck shots with divers, for example), images without "bubbles" (well, not in front of the model's face!) sometimes seem static, even unrealistic.

Swimming position. If the model is completely visible in the image, an appealing as well as understandable swimming position is recommended: spine and legs stretched out, arms close to the body, and fins in a natural swimming motion (not at right-angles to the shins). It is also important that the dive model can be recognised as a diver in the image, especially in silhouette photos where the dive model just appears as a dark shape. If the model is not swimming, but just floating above or near a wreck for example, presenting the model in an upright position in the water, with a dive light (if carried) in the middle of the body, can give certain wreck photos a special flair.

Masks. While most underwater photographers prefer donning black silicone dive masks because they provide easier viewing in camera viewfinders while avoiding light reflections from the mask, submerged underwater models are more likely to opt for translucent dive masks with large lenses and transparent silicone. This makes it easier for the photographer to illuminate the eyes of the model. Some specialists still use the very large aperture masks from the early dive pioneer days, as these are still excellent, despite being contrary to all modern trends, for the purpose of ideally illuminating the face of the model. The sense (or nonsense) of using "old" diving equipment in modern underwater photography remains, of course, a personal matter of taste.

If your chosen model is an underwater photographer and you depict him or her photographing the underwater flora and fauna, such a scene could work nicely

The model signals: "I need air" (right). Not visible in the image was the safety diver who was just 1.5 meters away. After the signal was given, it took only two to three seconds until the model had air to breathe. This procedure, however, was briefed and rehearsed many times in very shallow waters before the shoot. Safety first; Actually, an underwater model can wear anything she wants. It is fun to play with different clothing and accessories. Model: Isabella Maffei (below)

as a photogenic and compelling image statement. In such cases, it is important that the model photographer and the subject matter targeted (by the photographer) are equally reflected in the image.

Freediving underwater models

This refers to models posing underwater without scuba equipment, whether as the classic freediver equipped with dive mask, snorkel and fins; or just as a human being underwater without any diving equipment. Here, things get creative, but in some cases, more involved, regarding preparation, implementation and safety.

The freediver. Freed from bulky scuba diving equipment, the freediver symbolises diving in its most natural form, representing the feeling and experience of the underwater world on only one breath or the human at one with nature and the element of water in which there are no "earth-bound" constraints (gravity), just peace and silence. In a sense, the subject is almost philosophical in significance, even in an image.

The freediver as a model in an underwater image "turbo-charges" the senses of the viewer. For experienced and ambitious freedivers, it is nearly "normal" to be in this environment. For some well-trained scuba divers, it may also seem sort of normal. But for the rest of humanity, it is a mystery how someone can dive "without air" and look so good.

Applications. Whether a freediver is ascending, descending or just floating in the blue open water, exploring a wreck or an interesting underwater landscape, just observing underwater flora and fauna, or even just lying on the ocean floor, they (almost) always look good in underwater images. Freediving models have the body coordination and elegance to hold their positions in the photographic foreground.

All this does not have to happen in deep water. A few metres of depth is usually enough; even positions just below the water's surface will create beautiful images.

In such model shoots, good results often occur when the underwater photographer, equipped with scuba, floats in shallow water (2-5m) while the freediver ascends and descends, presenting his or her poses in a previously marked area and in a fashion that has been previously rehearsed. When working with professional or semi-professional freedivers as models, one might think that a few metres more depth may be required. However, extra depth is not necessary, as the visual sense of "depth" is realised by photographic technique rather than actual depth of immersion.

The classic freediver model is often equipped with a neoprene wetsuit, dive mask and fins (sometimes special, extra-long freediving fins). Some use snorkels, but many do not. From a photographic point of view, both situations are okay, but photos without a snorkel have slight advantages, as it frees up the mouth, which is also an important part of facial expression.

Safety aspects. Ideally, you have another safety diver or swimmer on hand, watching and supporting the model, if necessary, at the surface of the water. If this possibility does not exist or cannot be realised, you should operate only in shallow water (2-3m) and be attentive and willing to put your camera aside at any time to provide assistance to the model if needed.

The freediving model, not the photographer, determines the rhythm of diving, posing and surfacing.

A buoy secured by a rope, or any other floating device with sufficient buoyancy, allows the model to take breaks (without effort) at the water's surface between shoots. Breaks are chosen by the model, according to personal needs.

An emergency plan must be made, one which is clearly understood and agreed upon by all (!) participants. It should be easy, efficient and feasible.

This type of model shoot should not go into overtime. The main effort here lies with the model (despite how effortless the model may look in the resulting images), so the descent and ascent cycles should be kept within a manageable framework. If the shoot is well-prepared, just 10 to 15 minutes will suffice for five to seven descents and ascents by the model. This will also spare the ears of the model, as it will limit the time the model has to do repetitive pressure equalisation.

Shooting with a model right below the water's surface can have a pleasing outcome, plus there is less "safety hassle." But not everyone has the gift to look great underwater. Model: Chris Mo (right); Humans who feel comfortable and happy underwater, and furthermore, have at least basic freediving skills, simply make great models. Model: Chris Mo (below)

If the possibilities at the location permit, then it is a good idea to schedule several short shoots, with appropriate rest periods in between (which are also good opportunities for brief discussions), spread out over half a day. Water and other drinks for hydration as well as fortifying snacks should be available to models between shoots. This should also be included in the planning.

The model has the right to premature termination of the shoot at any time, for whatever reason.

The human underwater

In the previous part of this article, we talked about divers who have freediving skills or at least experiences with snorkelling, so the following is dedicated to the human being as a model underwater. At least now, the model is the star of the scene and as such, preparations for the shoot must be adjusted accordingly. From the specific surroundings, backdrops, sets and lighting to the model's poses, clothing, accessories, make-up and props—all are primarily selected exclusively to translate photographically, the beauty of humans in an unfamiliar and exotic environment.

It often gets very artistic here, as specialised underwater model photographers access a variety of ideas, equipment and props. It is also not uncommon to work with several models simultaneously underwater. The effort is often great, but the results are breathtaking. Cal Mero, Todd Essick, Zena Holloway, Cheryl Walsh, Ken Kiefer, and Rafal Makiela (and many others) are renowned photographers, whose underwater model photos show inspiration and creativity.

This type of photography sometimes takes place in the sea, but more often in swimming pools, which then serve as underwater photo studios, so to speak.

Image statement. It can be whatever you want! In this case, the element of water becomes an "exquisite location," and there are no limits to the imagination. When the model is finally the sole subject, one can and should play and experiment with different ideas. Humans floating in the weightlessness of water, facial expressions, gestures, clothes, accessories and gadgets—each offers a wide range of possibilities for artistic images, which will certainly attract the attention of the viewer. If you want to "enchant" the viewer, it is worthwhile thinking in this way.

Ocean shoots. Only very few photographers practise artistic underwater model photography in the sea, especially in depths where it is not possible for a model to comfortably stand on the seafloor. Shooting in open water is still possible, but requires more effort, and sometimes also carries higher risk. In this type of photography, the model dons no dive equipment, sometimes not even a dive mask. Rather, the model is dressed in photogenic costuming (or sometimes, not at all), wears make-up and is decorated overall as if it were a "topside" photo shoot.

So, how does one photograph such a model in open water while still ensuring the best possible safety? Here is a possible solution: First of all, you need to find a model who is not just "watery" and fluid, but rather a "fish" herself. In such shooting concepts, models with very good knowledge and experience in freediving have real advantages, including knowledge of self-protection. It is important that the model feels very natural and "free" underwater, even without any dive equipment.

You will also need a backup diver, who is also responsible for the transport of, and the air supply for, the model. This safety diver is a fully equipped scuba diver, who, in the best-case scenario, has his or her octopus mounted on an extra-long hose.

Of course, the location of the shoot should be clearly defined during the preparations and be known to all participants involved. If it is possible to swim along the surface of the water, the model sticks to the safety diver, who, in turn, acts as a "taxi," as it were. The model wears a dive mask. If the location of the shoot has to be dived, the model sticks to the back-up or safety diver (who also secures the model by holding on to the model's arm or hand, for example) and breathes out of the back-up diver's secondary regulator. Together, they (photographer, model and back-up diver) will go to the agreed place of action. Long distances are to be avoided.

Once there, the following happens: The model and back-up divers take their previously planned positions. The model also has a dive mask on and breathes from the second regulator of the safety

Usually, air bubbles near the face of the model should be avoided. But sometimes, a very few bubbles can illustrate the message: "This was done underwater" (right); Never forget to enjoy the process, have fun, keep your models happy, and be happy yourself. Selfie with the models Seda Karadeniz and Istem Guten (below)

diver. The photographer also takes his or her previously planned position. Then, the photographer takes a few test shots to adjust exposure and other camera settings. Meanwhile, the model continues to breathe out of the secondary regulator.

Once this is done and everyone is ready, the model removes the dive mask, transfers it to the back-up diver and takes the second regulator out of her or his mouth, which is then picked up and secured by the back-up diver. The back-up diver now swims out of the field of view of the camera; usually, one to two metres away is far enough. The photographer gives the safety diver the corresponding signal ("free field").

The model then takes the previously planned pose, and the photographer takes several shots of the scene. At no point does the back-up diver take his or her eyes off the model, for safety reasons, keeping the second regulator ready to hand it to the model at any moment.

If the model feels the need for air, the model places the right hand to the mouth—a signal that was, of course, also previously agreed upon. If the back-up diver sees the "I need air" signal, he or she immediately swims quickly to the model, secures the model with one hand on the arm and offers air via the octopus to the model with the other hand, placing the regulator on the mouth of the model (as the model has no dive mask on, so cannot see very clearly).

If the model feels ready for a second round after a few (or more) breaths, the model takes the second regulator out of the mouth and poses again. The back-up diver picks up the octopus, swims out of the camera's field of vision and never lets the model out of sight, always ready to offer air or other assistance if requested.

When the shoot is finished, the back-up diver first provides the air supply to the model, securing the model by holding her or him, and then hands over the dive mask. The model puts on the mask, blows it out and after a general "OK" signal, everyone swims back to shore or to the boat.

Safety aspects. This technique is generally considered an example of how some professionals realise such photos and is by no means recommended without adequate training and serious practice in a pool, for example. Procedures, signals and emergency procedures must be strictly agreed upon and adhered to by all involved, and they must be practised first in very shallow water (at a depth in which one can still stand on the bottom) until everyone feels safe and comfortable.

Even if only one of the participants feels unwell (also mentally), it is a clear sign to abort the shoot. Keep such shooting sessions as short as possible. If concept, plan, preparation and teamwork are correct, the desired image should be in the can after 10 to 15 minutes.

Never forget that the model is not protected from the cold by a neoprene wetsuit like you are. This also calls for a speedy shoot. Hot drinks and warm, dry clothes must be ready for the model upon return aboard a boat or to land. Take into account in your photo dive that two people (the model and safety diver) are breathing from the same scuba tank; available air will be depleted faster.

Pool shoots. For underwater model photography, swimming pools offer the advantage of a more or less configurable underwater studio—a versatile and usable playground for the model and the photographer, so to speak.

Almost everyone is familiar with swimming pools, and nearly everyone has refreshed themselves in a swimming pool at some point or another. A pool is ultimately a (water-filled) space with clear boundaries, unlike the sea. Especially underwater models who are not so experienced will feel safer and therefore more comfortable in a pool. Despite having open water in the deep end, the pool is usually perceived as a "familiar environment," and in any case of doubt or feelings of discomfort, the safe edge of the pool is reached quickly, or if in the shallow end of the pool, one can just stand up to get air at the surface. These factors immensely support a relaxed as well as safe working atmosphere.

Dry clothes, towels, drinks and refreshments, as well as quiet areas should be within easy reach. Music can even be played in the pool area to promote relaxation or a "good mood." In that sense, the often-spurned swimming pool has its good points.

On the other hand, even a clean and beautiful pool is not necessarily photo-

In case your model wears a dive mask, transparent ones always work best to capture the eyes. Model: Chris Mo (below); One underwater model is always available to you: your dive buddy. Model: Erol Öztunali (bottom)

genic, with its tiles, ladders, and sometimes pool lane dividers. So, it often makes sense to have a few basic accessories at hand.

General sets and props. Fabrics, and lots of them. Black, white and red are colours that always work well. Have some larger pieces (3m x 3m) ready to serve as backgrounds. Umbrellas, chairs, mirrors… basically any item of everyday use will make an excellent decoration, assuming you have the pool owner's consent, which, of course, should be obtained beforehand.

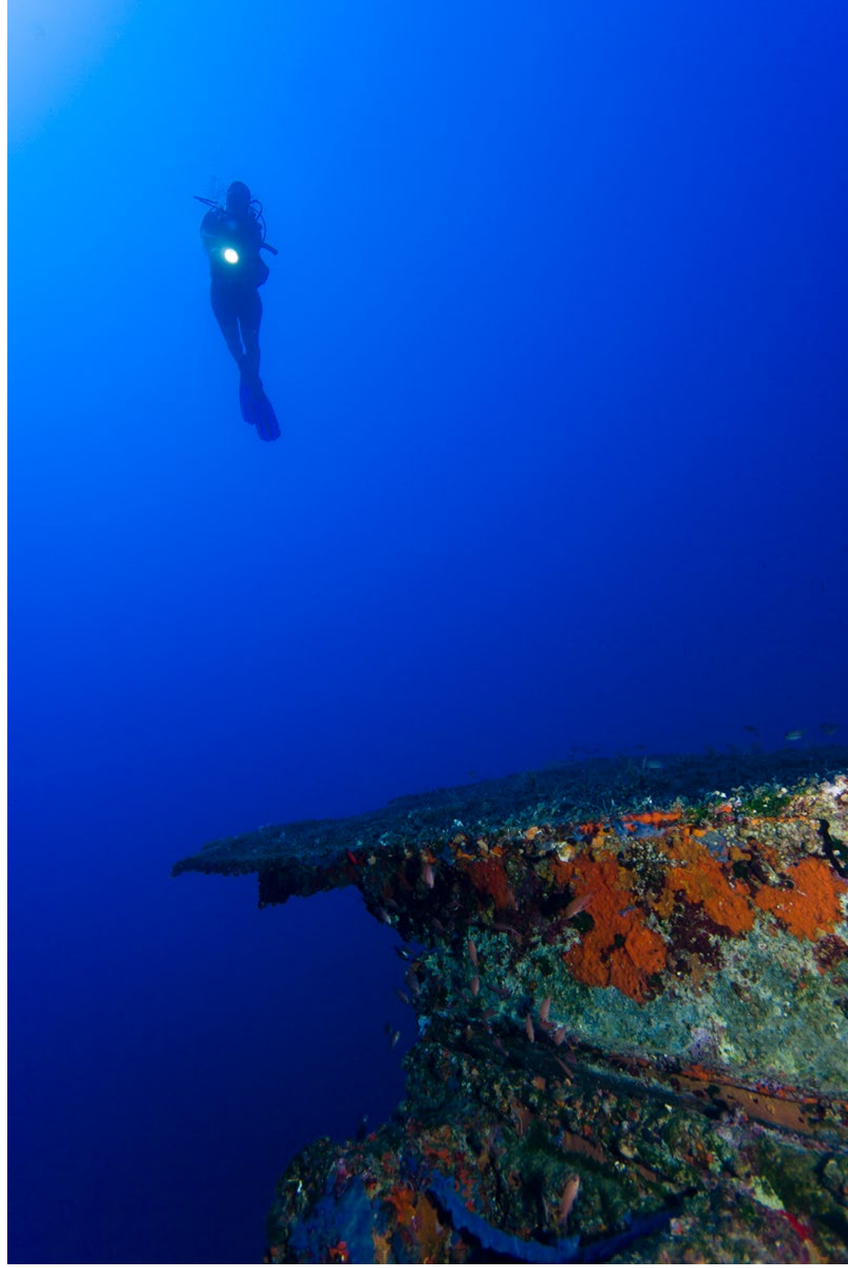
Costume. From basic swimwear to elegant evening attire, the possibilities are endless. Gone are the days of the underwater model in neoprene (which is often not very photogenic). Now, it is time to get fashionable and creative! Whether models are in business attire, a red evening dress (red always goes well!), a tux or a "little black dress," trouser suits or just draped with a few (almost) transparent pieces of cloth from the prop box—anything goes, and everything is allowed. Once the photographer and the model get caught up in the "play instinct," there is no stopping them and things get fun! Great photos, then, almost create themselves.

Makeup. Mascara, lipstick, nail polish, highlights, glitter, and in some cases, also artificial eyelashes, are standard. In general, make-up for underwater models may be "a little bit more" heavy or theatrical than so-called "discreet make-up," which will simply disappear in an underwater shooting situation. Make-up colours should be tailored to the skin and eye colour of the model, as well as the colour of the clothing, hair and the water itself (which is usually turquoise in pools).

It is important to use only waterproof make-up products. It is better to use gel or cream-based products instead of powder. However, cosmetic products in powder form can be mixed with a neutral gel to become water-resistant. Especially for the eye area, lighter colours are often recommended. Too dark make-up on the eyes can often make them look "fatigued" in the resultant photo, and complicate things for the photographer trying to achieve an appealing illumination. Make-up can have a supporting effect here, highlighting the facial features and eyes of the model or even providing artistic flair. It simply depends on how the photographer imagines the photo. Some glitter (silver or gold) can provide beautiful colour and light accents.

With fake eyelashes, one should remember that the glue does not last very long. Waterproof make-up products often lose their water resistance when the pool is over-chlorinated. So, the less chlorine, the better. This also applies to the eyes of the model, which in chlorinated water, become irritated and turn red relatively quickly. Eye drops are a great help during breaks between shoots. It is also good to have someone available

Makeup and fancy clothes are not always required. Sometimes, a scuba diver in silhouette works just perfectly as an underwater model, adding something to the blue. Model: Seda Karadeniz



who takes care of the make-up of the model.

Professional underwater models recommend make-up products by She Laq, MAC (its "SudioFix" product line), Temptu (its "Dura Skin" product line), Make Up Forever and Yabi Pearl Paints. However, all this is not mandatory. Of course, you can also photograph your model in his or her natural, unadorned beauty.

Accessories. Jewellery, sunglasses, long ribbons (braided into the hair), fancy belts, bracelets, toe rings or even body paint can provide interesting accents in an image.

Poses and facial expressions. There are no limits. Floating natu-

The key to being a good underwater model is to look natural. Model: Chris Mo (left)

rally or floating spherically, sitting on the ground, standing, lying down or performing ballet-like dance movements—the possibilities are endless. When in doubt, a smile always works wonders.

Brief tips and safety

- If the pool is too deep to stand in, the shoot should take place as close to the edge of the pool as possible, so that the model can emerge at any time at the edge of the pool to rest.

- Some freediving training for the model works wonders. Instead of struggling with inflated lungs and cheeks while submerged underwater, it is better that the model exhale before diving.

- Keep the individual shooting sequences as short as possible. Usually, a model can hold a pose underwater for only 10 to 20 seconds. Depending on the well-being of the model, a 10 to 15-minute break should be taken after ten of these kinds of sequences.

- Try to schedule at least half a day for a pool shoot (including preparation, photography, breaks and wrap-up).

- Plan rest breaks for models to recover, warm up, touch up make-up and for interim meetings. It is advisable to have another person on hand, stationed at the edge of the pool, to provide help and support when needed.

- The pool should be clean and not overly chlorinated.

- When photographing in outdoor pools with sunlight exposure, it is also possible to work with the natural ambient light as the light source.
- High-intensity wide-angle lenses with an effective focal range of 16-20mm are used mostly in this type of photography.

- In addition to underwater strobes, other light sources such as underwater photo lamps or slave flashes can be used to achieve special lighting effects as well as to lighten shadows.

- Very special photos can be obtained by shooting sessions in the dark (during the evening or at night).

- Try to make sure your pool images do not lose the relationship with the element of water. It often helps to have the water's surface at least partially visible in the image. Reflections of the model on the water's surface are always welcome classics. If the viewers do not understand an image was made underwater, all your efforts were for naught.

And never ever forget: Happy model = Great resulting images! Always keep your model happy, share the joy and share the success. ■

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

Sometimes, just a few accessories and a playful (and happy) model can result in interesting underwater model shots. The key is to share the fun. Model: Isabella Maffei (right)

photo & video

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Ikelite Novus Polish Set

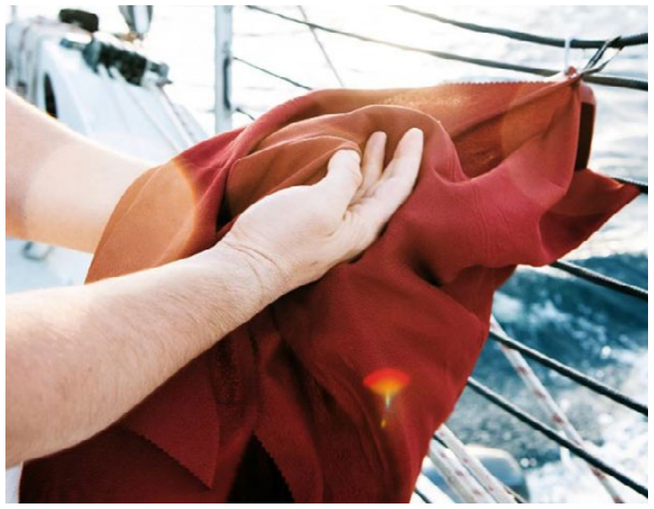
Underwater dome ports made out of acrylic do have their advantages but are prone to scratches, which then might affect images in a negative way. The Novus Plastic Polish Set from Ikelite is designed to remove scratches and abrasions from acrylic dome ports. The kit comes with three different cleaning and polishing solutions for light scratches, heavy scratches, and for general cleaning. A cleaning cloth is included in the package. **ikelite.com**

Dive Label

To clearly identify your own underwater photo gear, especially on crowded dive boats or in dive centres highly frequented by underwater photographers, labelling your photography or videography gear comes in handy. The 100% waterproof Dive Label stickers are customizable (adding your own name and/or logo), are made from reflective sticker material and Ritrama brand vinyl, with added lamination to prevent scratching and damage. The labels are available in different colours and sizes. **divinglabels.com**

Matador NanoDry Towel

Whether you plan to "hitchhike the galaxy" or dive with your underwater camera gear, it won't do to go without a towel. This shower-sized, 47 x 24 inch (120 x 60cm), packable towel made of antimicrobial nanofiber material is very lightweight at 5 oz (142 g), highly absorbent (it absorbs two to three times its own weight), and quick drying. It is suitable for drying and protecting underwater housings and related gear, replacing the average shower towel, and even serves well as a warming wrap after a dive. The machine washable towel has a snap loop hanger and comes with a silicone travel case with carabiner. **matadorup.com**



Retra Flash PRO

After a long period of development, the new underwater strobe "Flash PRO" from manufacturer Retra is now in serial production and ready for pre-order. The strobe runs with four rechargeable AA-size batteries, has a maximum light power output of 150W, is made of machined aluminium, and has a built-in leak detector and 13 power settings, plus various user-programmable settings. Its beam angle is 130 degrees, and its colour temperature is 4900K. With a set of fully charged batteries, the Retra Flash PRO provides 150 flashes on 100 percent light output. A standard feature: The strobe can be triggered by optical cables, which are compatible with INON and Sea&Sea housings. Furthermore, an additional converter allows the usage of standard sync cables. Other optional accessories include snoots, dome diffusers and protective covers. **retra-uwt.com**

Lacie Rugged BOSS SSD

Designed for image-makers who work extensively in the field and who do not want to always carry a laptop as storage device with them, Lacie has come up with the BOSS drive, which lets you back-up files directly from SD cards (integrated SD card reader included) and other USB devices. Transfer progress, capacity, and remaining energy of the built-in battery can be monitored via the built-in status screen. To view and organise footage on set, Lacie offers its own BOSS app, which connects the mobile hard drive with iOS or Android mobile devices. The shock and waterproof SSD has a capacity of 1 TB, USB 3.1 connection, and a transfer speed of 430MB/s. **lacie.com**

Transcend WiFi SD

While many newer cameras now come with built-in Wi-Fi connectivity for wireless sharing and transferring of captured images, those owning cameras without such a feature can add Wifi support by using a WiFi SD card. Transcend offers a Wi-Fi SD memory card that adds wireless capabilities to SDHC-compatible digital cameras. It comes with an app for iOS and Android devices, which allows users to browse the content of the card, instantly view images on their mobile device, and even share content online. The Wi-Fi SD memory cards from Transcend feature a SDHC Class 10-speed rating and are available in 16 or 32GB capacities. **transcend-info.com**

Jens Umbach

P O R T F O L I O

portfolio

Clownfish, by Jens Umbach. Acrylic on canvas, 50 x 60cm. PREVIOUS PAGE: *Homesick Blues*, by Jens Umbach. Acrylic on canvas, 70 x 100cm

German artist and illustrator Jens Umbach creates surreal paintings of marine life floating in pastoral landscapes and deep-sea creatures in otherworldly seascapes with underwater moons. With a new children's book soon to be published, *X-Ray Mag* interviewed the artist to learn more about what inspires his fantastical and imaginative imagery.

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

JU: I am a painter and illustrator, living in Germany near the city of Kassel. This is the area where the Brothers Grimm found many of the stories for their fairy tale collection and it really is a nice little corner of the world, very rural with lots of woods all around and all kinds of natural habitats. Growing up in these surroundings, I always had a close and direct connection to nature. I think this is the reason why I mostly paint landscapes and animals.

When I think about it, it is hard to say how I became an artist, because ever since I was a child, I just always kept doing what I loved—drawing and painting. It all became a bit more professional in the 1990s when I started to publish illustrations in magazines, and on book and CD covers. Then, around 2005, I started painting in larger formats with acrylic paint on canvas.

I think that I am influenced by the surrealist painters, especially Max Ernst and René Magritte, but I also love the works of Vincent van Gogh and other impressionists. In my paintings, I try to combine these two different things—the surreal and the natural world.

Manatees, by Jens Umbach. Acrylic on canvas, 60 x 80cm

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

JU: My fascination with marine life is founded in its overwhelming beauty and diversity. I am especially fascinated by coral reefs and their seemingly endless riches of shapes and colours.

But I am also very interested in the deep sea. This is the place where a surrealistic painter's dreams (or nightmares?) come true. It is hard to imagine more bizarre and impressive life forms. The deep-sea anglerfish or the vampire squid, for example, are really incredible, and every deep-sea expedition discovers new wonderful and strange creatures. We know more about the dark side of the moon than we know about the depths of the oceans, and so it is a perfect hunting ground for one's imagination.

I think I developed my style of painting just by practice. You have got your influences from the work of other artists you admire and then you have got so many impressions from everywhere, gathered in your

Octopus´Garden, by Jens Umbach. Acrylic on canvas, 70 x 100cm

Jens Umbach

mind over the years. And somehow it all comes together at one point, and maybe, what comes out is one's own unique style.

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

JU: Sometimes I use the "decalcomania" technique to create a picture. In this technique, you cover up the canvas with liquid paint and then it gets pressed against a pane of glass or a board. When you take it off the canvas, the paint leaves a fascinating, natural-looking pattern that often looks like ancient weathered rocks, moss or corals.

Then, you have got to figure out what you see in these structures and make it recognisable for the viewer. In this way, you can create all kinds of landscapes, animals or zoomorphic creatures. This method was often used by Max Ernst.

At other times, I just find an animal that I really like, or that fascinates me in some way, and I let it float over a field of wheat, for example, placing it somewhere it cannot exist in reality. I love to imagine a sea turtle or a manatee taking a little holiday trip out of the water and spending some time floating through the country skies. In this way, I am just combining different things that I like. The place where I live was an ocean in prehistoric times, and sometimes, I wonder how it must have been.

X-RAY MAG: What is your relationship to the underwater world and coral reefs? Are you a scuba diver or snorkeller? If so, how have your experiences underwater influenced your art? In your relationship with reefs and the sea, where have you had your favourite experiences?

JU: No, I am not a diver or snorkeller, but I remember having a snorkelling mask when I was a child, which I used to explore small areas of the ocean floor near the shores of the North Sea, where I spent the holidays with my family. Because I am not a diver, I can only explore the coral reefs at shallow depths. For all other places underwater, I refer to books and documentaries,

Rock Bottom, by Jens Umbach. Acrylic on canvas, 80 x 60cm

Manatee, by Jens Umbach. Acrylic on canvas, 70 x 60cm (right)

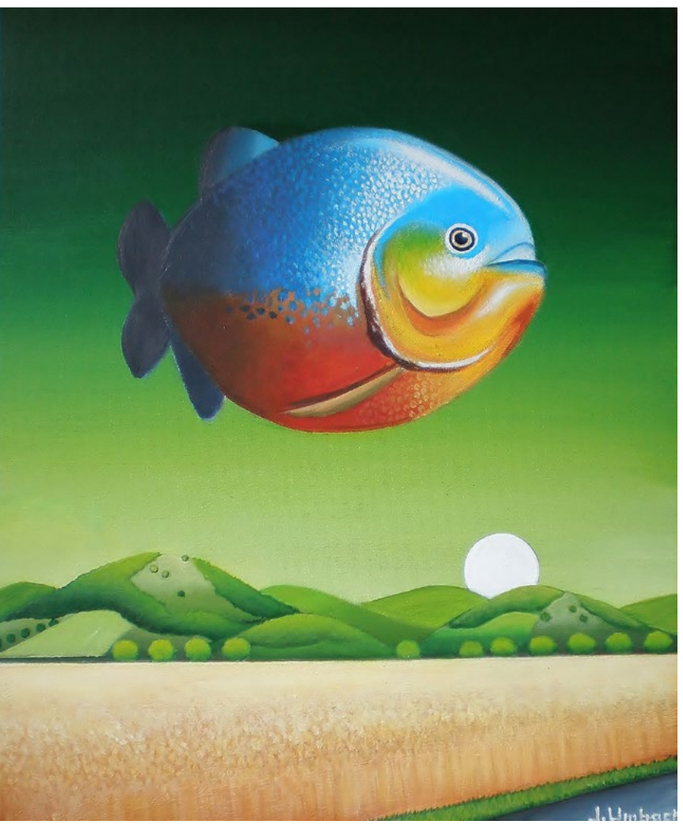
Sea Turtle, by Jens Umbach. Acrylic on canvas, 60 x 80cm (below)

or articles and images on the Internet.

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

JU: When I am looking at the situation of the oceans and the world as a whole these days, it can be really distressing. Recently, I saw a documentary about some scientists growing corals in their laboratories, trying to save almost dead coral reefs by replacing the bleached and dead corals with the ones grown in their tanks.

I admire those scientists for their work, but somehow, it seems to me a bit like fighting against windmills, because global warming will not stop anytime soon. But I am really no expert, so I hope that I may be wrong with my rather pessimistic view on these things.



Piranha, by Jens Umbach. Acrylic on canvas, 60 x 50cm

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

JU: I think the greatest achievement for me would be to let the viewer experience a bit of calm and peace, even just for a moment. In this world, which seems to move faster and get crazier every day, this would be the greatest thing for me to give the viewer—a little peace of mind.

A second thing I hope for is that maybe the viewer gets a little bit more aware of ocean life, and natural life in general. It is all a wonder, and we are on the way to destroying it all, if we do not change our behaviour radically.

X-RAY MAG: What are the challenges or benefits of being artists in the world today?

JU: One of the great benefits for the artist today is clearly the Internet. The ability to reach almost everybody in this world with one's art is something that was completely unimaginable for artists of the past.

But the negative aspect of it is the overwhelming and endless flood of pictures the digital world generates every day. So, it is hard to gain attention for one's own work in this crowd.

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

JU: Up until now, I have never seen children react to my paintings. But it just so happens that I am going to publish a children's picture book, and I am eager to see if they will like it. It is made in a different, more basic style than my paintings.

One memorable interaction happened during a small exhibition of my paintings at a café. Somebody asked me why all the animals in the pictures were so huge, and I just could not explain it, because I just really did not know.

There is no rational reason for the way I paint—it just turns out this way. Rationality and logic do not seem to have a lot to do with it, I think.

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

Underwater Moon, by Jens Umbach. Acrylic on canvas, 60 x 80cm

Jens Umbach

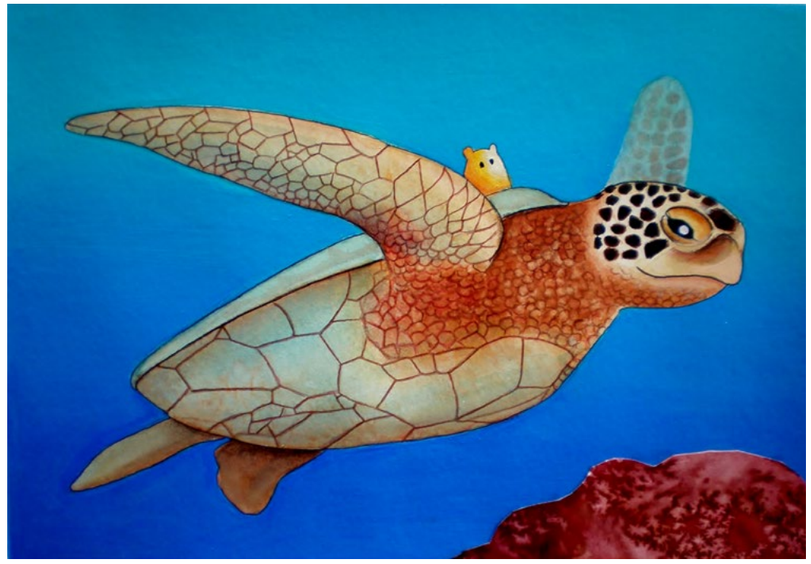


Illustration (above) from Jens Umbach's new children's book, *Grimpy*, about the adventures of a cute little dumbo octopus searching for his hermit crab friend, soon to be published in Berlin, Germany. For more information, please visit: **startnext.com/grimpy**

Ocean Sunfish (Mola mola), by Jens Umbach. Acrylic on canvas, 60 x 50cm

JU: As I mentioned before, I am very happy to be publishing a marine life-related children's book this fall. It is about the adventurous journey of a little dumbo octopus called Grimpy. It has been in the making for some time, but now, it is finally ready for printing. I am really looking forward to it.

I have always wanted to make a picture book for children. So, when I learnt about the dumbo octopus some years ago, it was clear to me that it should be the hero of the story. When I completed the pictures and the story of this book three years ago, I showed it to Tanja, a friend, who has a little publishing agency for art exhibition catalogues and similar publications in Berlin, and she wanted to publish it. Her husband, Lars, helped especially with all the things on the financial side, like setting up a crowdfunding project to raise funds for publishing the book. (See: **https://www.startnext.com/grimpy/blog#p.nav**).

At the moment, there are no plans for editions in other languages, because there is simply no money for that yet. In this first edition, 500 hardcover books will be printed in German, but I always had in mind to include a text sheet for English-speaking readers. It would be great to reach more people with a translation in English or maybe even other languages. ■

*For more information or to purchase artwork and prints, please visit the artist's website at: **kunstnet.de/habakuk** or his Facebook page at: **facebook.com/Jens-Umbach-Malerei-Painting-563873427105970/***