X-Ray Mag

GLOBAL EDITION
Sep/Oct 2024
Number 128

Portugal
Porto Santo

Indonesia
Forgotten Islands

Wrecks
HMS Southwold

Ecology
Tuna

Profile
Jonathan Bird

Ecology
Sentience

MELANESIA
Solomon Islands

COVER PHOTO BY KATE JONKER

DIRECTORY

X-RAY MAG is published by AquaScope Media ApS

Copenhagen, Denmark

xray-mag.com

PUBLISHER & EDITOR-IN-CHIEF
Peter Symes
Editor@xray-mag.com

PUBLISHER, MANAGING EDITOR & CREATIVE DIRECTOR
Gunild Symes
Gunild@xray-mag.com

LAYOUT ASSISTANCE
Sine Kristiansen

ASSOCIATE EDITORS
Scott Bennett, Toronto
Scott@xray-mag.com
Catherine GS Lim, Singapore
Cat@xray-mag.com
Matthew Meier, San Diego
Matt@xray-mag.com
Michael Menduno, Berkeley
Michael@xray-mag.com

Russia - Moscow
Andrey Bizyukin, PhD
Andrey@xray-mag.com
Svetlana Murashkina, PhD
Svetlana@xray-mag.com

Sweden
Lelle Malmström
Lelle@xray-mag.com

ASSISTANT EDITORS
Rosemary E. Lunn, London
Roz@xray-mag.com
Don Silcock, Sydney + Bali
Don@xray-mag.com

USA
Larry Cohen, New York City
Larry@xray-mag.com

ADVERTISING
ASIA-PACIFIC
Juliette Myers, Sydney
Juliette@xray-mag.com

UNITED KINGDOM
Rosemary E. Lunn, London
Roz@xray-mag.com

USA & INTERNATIONAL
Matthew Meier, San Diego
Matt@xray-mag.com

Contacts page: Xray-Mag.com

IN MEMORIAM
Michael Symes, M.Sc, Senior Editor
Barb Roy, Associate Editor

SECTION EDITORS
Andrey Bizyukin, PhD – *Features*
Larry Cohen – *Photo & Video*
Mats Gunnarsson – *Equipment*
Catherine GS Lim – *News, Books*
Michael Menduno – *Tech*
Ila France Porcher – *Sharks*

COLUMNISTS
Matt Jevon – *Opinions*
Steve Lewis – *Opinions*
Gareth Lock – *Training*
Ila France Porcher – *Shark Tales*
Mark Powell – *Tech Talk*
Simon Pridmore – *Opinions*
Lawson Wood – *UW Photo*

CONTRIBUTORS THIS ISSUE
John A. Ares
Scott Bennett
Jonathan Bird
Daniel Brinckmann
Sheryl Checkman
Larry Cohen
Lureen Ferretti
Anita George-Ares, PhD
Mats Gunnarsson
Kate Jonker
Kewin Lorenzen
Matthew Meier
Mimo Moqvist
Brandi Mueller
Malcolm Nobbs
Ila France Porcher
Simon Pridmore
Gary Rose, MD
Michael Rothschild, MD
Kurt Storms
Gunild Symes
Peter Symes
Olga Torrey
Claudia Weber-Gebert

SUBSCRIPTION
X-RAY MAG International Edition in English is FREE
To subscribe, go to: **xray-mag.com/Subscription**

COVER PHOTO: Rare ornate klipfish (*Clinus ornatus*), Cape Town, South Africa
Photo by Kate Jonker (**katejonker.com**)

contents

Oval butterflyfish and chromis on reef, Forgotten Islands, Indonesia. Photo by Claudia Weber-Gebert

8 ▶
HMS Southwold
Malta
by Kurt Storms

13 ▶
Porto Santo
Portugal
by Brandi Mueller

23 ▶
Indonesia's Banda Sea
and Forgotten Islands
by Claudia Weber-Gebert

32 ▶
Solomon Islands
Melanesia
by Matthew Meier

43 ▶
Tuna: Too Tasty for
Their Own Good
by Daniel Brinckmann

57 ▶
Profile:
Jonathan Bird
interview by Peter Symes

columns...

53 ▶
It's Probably Not You,
It's the Cylinder
by Simon Pridmore

61 ▶
Ecology: Sentience
or Consciousness?
by Ila France Porcher

70 ▶
UW Photo: Black
as a Design Element
Contributors' Picks

plus...

EDITORIAL 3 ▶
NEWS 4 ▶
WRECK NEWS 6 ▶
EQUIPMENT NEWS 48 ▶
BOOKS & MEDIA 52 ▶
SHARK NEWS 67 ▶

Learn Their Language

Autumn is approaching in our hemisphere. In the forests around our city, the deer are in heat, and the stags can be seen fighting for dominance and the right to mate. It can be a dramatic but entertaining spectacle, provided you understand the need to keep a sensible distance from the animals at this time of year.

The locals who enjoy these forests, going for Sunday walks with family, jogging or bicycling along the many excellent trails, can continue doing so by simply letting the animals get on with their own business. Not that any sensible person would want to go near an agitated stag with big, pointy antlers.

But apparently, not everyone is sensible or educated about wild animals. Sadly, in an unprecedented move, wardens at one of the forest parks have been forced to close the park to the public until the mating season is over.

Some people failed to heed the warnings or were utterly clueless about the animals' behaviour and body language. They got too close, probably to take a selfie or a video to post on TikTok and got into trouble. This kind of behaviour is also what got some people mauled by bison in US national parks.

Others contributed to the closure of parks by feeding the animals, despite clear signs telling the public not to do so because it alters the animals' natural behaviour.

There are always a few ignorant people out there who do things that ruin it for the rest of us.

What does any of this have to do with diving, you may ask?

It is almost always for similar reasons that people get bitten or stung underwater. It should go without saying that you should not climb on a sleeping shark, tug its tail or otherwise provoke it. Yet, some contenders for the Darwin Award seem unable to resist the temptation. But ignorance can get you hurt or worse.

Sharks may not have furrowed brows to signal annoyance with your behaviour or presence, but they do display body language that you can interpret to some degree. For example, lowering the pectoral fins, hunching the back and moving quickly can indicate a dangerous mood.

We cannot know what goes on in the minds of sharks or any other marine creature, for that matter, but we do know that they are intelligent and sentient beings with individual personalities. We also know that they can feel pain and fear, and that they have physiological reactions to stress similar to our own.

The least we can do is err on the side of caution and assume that other beings would also be bothered or hurt by actions or circumstances that would make us uncomfortable.

Leave even the smallest critter in peace and respect other life forms. Observe and enjoy from a respectful distance.

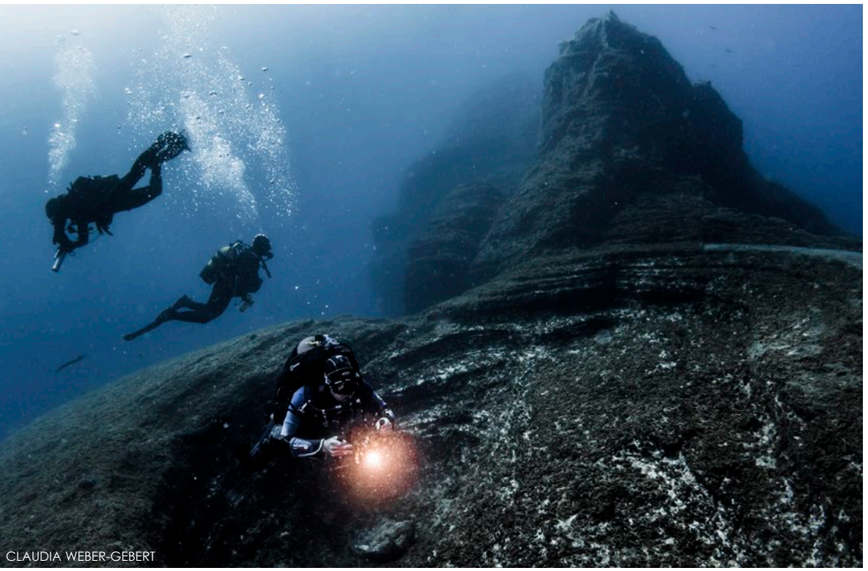
— Peter Symes
Publisher & Editor-in-Chief

Spain Declares First Marine National Park on the Island of El Hierro

The Spanish government has approved the establishment of the country's first marine national park, a move that has been praised by ecologists and the diving community.

The marine reserve is located in the Atlantic Ocean at the southwestern tip of the island of El Hierro, the westernmost of the Canary Islands. The area is known for its exceptional marine biodiversity, including sharks, dolphins, tuna, rays and turtles. The waters are calm because they are sheltered from the trade winds, and its tropical nature is home to species not found in the rest of the archipelago. The almost complete kelp cover and the diversity of the seabed support a high level of biodiversity. The area is also an essential habitat for beaked whales.

In the centre of the park is the famous *El Bajón*, an underwater mountain and a favourite spot for divers. The area has been a Marine Fishing Reserve since 1996, which has helped to preserve its ecological diversity.


CLAUDIA WEBER-GEBERT

Diver at El Bajón, where layers of lava, ash and sand are visible

Approval

On 30 July, the Council of Ministers approved a proposal to grant the Mar de las Calmas the highest level of protection from the Spanish state.

Teresa Ribera, Minister for Ecological Transition, said: "We have started the process of declaring a new National Park. The Mar de las Calmas is a unique place, perhaps the greatest in tropical and subtropical diversity. It will have the highest level of protection."

Ribera highlighted the extensive work that has gone into reconciling maximum protection with traditional activities. Industrial fishing and mineral extraction will be banned within the park, and vessel speeds will be controlled to protect the resident cetaceans.


CLAUDIA WEBER-GEBERT

CLAUDIA WEBER-GEBERT

CLAUDIA WEBER-GEBERT

CLAUDIA WEBER-GEBERT

View of coast at Las Playas (above); *Hypselodoris picta webbi* nudibranch, cuttlefish, parrotfish and wrasse (left to right) at El Hierro

Once fully established, the Mar de las Calmas National Park will protect 24,000 hectares of marine environment, extending several miles offshore. The park's designation will ensure the preservation of unique volcanic reefs, caves and deep sea habitats that support several species, including sperm whales and whale sharks.

Management of the marine park will be the responsibility of the central government, unlike national parks on land. ■

SOURCE: SOCIAL NEWSROOM


CLAUDIA WEBER-GEBERT

Cuvier's beaked whale, El Hierro

Edited by
Peter Symes

NOAA / PUBLIC DOMAIN

Deep seafloor covered with manganese nodules

Oxygen Is Being Produced in Deep Ocean

Recent discoveries reveal deep-sea nodules as unexpected sources of oxygen, reshaping our understanding of marine ecosystems. The findings highlight the potential impact of deep-sea mining on these vital oxygen sources.

In a surprising turn of events, scientists have uncovered that deep-sea nodules are significant sources of oxygen. This discovery challenges previous assumptions about the deep ocean's oxygen levels and has profound implications for marine ecosystems.

Unexpected findings

The discovery resulted from a collaborative research effort. It revealed that manganese nodules found on the ocean floor release oxygen. This was previously unknown, as the deep ocean was thought to be relatively oxygen-poor compared to surface waters. Lead researcher, Dr Emily Roberts from the Oceanographic Institute, commented: "This finding is groundbreaking. It changes our fundamental understanding of deep-sea chemistry and biology."

The presence of oxygen-producing nodules has significant implications for the burgeoning deep-sea mining industry. Mining these nodules could disrupt the delicate balance of deep-sea ecosystems.

Environmental scientist Dr James Whitmore warned: "The extraction of these nodules could deplete oxygen levels in the deep ocean, affecting marine life that relies on these oxygen pockets." This adds a new layer of complexity to the debate on deep-sea mining's environmental impact.

Ecosystem resilience

The presence of oxygen in the deep ocean enhances the resilience of marine ecosystems providing habitats for various organisms. These nodules contribute to a previously unrecognised oxygen cycle in the deep sea. "Understanding this cycle is crucial for marine conservation efforts," noted marine biologist Dr Laura Simmons. The discovery opens up new avenues for research into how these ecosystems function and their ability to adapt to environmental changes.

Implications

Further studies are necessary to fully understand the implications of this discovery. Scientists aim to investigate the extent of oxygen production by these nodules and their distribution across the ocean floor. "This is just the beginning," said Dr Roberts. "We need to explore how widespread this phenomenon is and what it means for global ocean health." The findings could lead to more sustainable practices in marine resource management and conservation strategies. ■

SOURCE: NATURE GEOSCIENCE

IMPERIAL WAR MUSEUMS / WIKIMEDIA / CROWN COPYRIGHT

HMS *Hawke*, launched in 1891, was an Edgar-class protected cruiser.

Wreck of WWI Cruiser HMS Hawke Found in "Amazing" Condition

The wreck of HMS *Hawke*, a British Royal Navy cruiser, which was torpedoed by the German submarine *U*-9 on 15 October 1914 and presumed lost for over a century, has been located off the Scottish coast.

HMS *Hawke* was discovered earlier this week after an extensive search by Lost in Waters Deep—a group that searches for WWI shipwrecks—about 70 miles off the Aberdeenshire coast. It was found to be in "remarkable" condition, lying at a depth of around 110 metres (360ft).

HMS *Hawke* was a cruiser of the Royal Navy known for its involvement in the early naval battles of World War I. Its sinking by *U*-9 marked one of the early successful attacks on British naval vessels by German submarines. The ship's loss had a profound impact on British naval strategy and highlighted the growing threat of submarine warfare. Five hundred and twenty-four officers and men died, including the ship's captain, with only 70 survivors.

Quite intact

"She's lying on her starboard side and under there…seems to be quite intact," Will Schwarz, one of the divers, told CNN in a phone interview on Friday. "The guns look as if they're still active, they're so highly polished it's unbelievable…I've never seen guns like that in such amazing condition, it's absolutely beautiful. But, we're very aware that 524 lads lost their lives on it."

Steve Mortimer, a diver working alongside the Lost in Waters Deep project, told BBC Scotland that finding the location of HMS *Hawke* took a lot of hard work. Schwarz said the team's research to pinpoint a search area included going through the archive records of the ships HMS *Hawke* was with at the time of the attack, as well as studying the German U-boat's logs.

Armed with that information, the team examined the admiralty charts and scanned the seabed in the area in an attempt to find the ship.

Another piece of data was an "obstruction" on the seabed reported by Scottish fisheries in the 1980s. The divers investigated the obstruction site but found nothing. However, just a kilometre away, they found a large shipwreck. ■

SOURCE: LOST IN WATERS DEEP

Ancient Roman Mosaics Discovered Off Naples Coast

Marine archaeologists have uncovered the well-preserved, intricate marble floor of a Roman villa in the submerged ancient spa town of Baiae in the Gulf of Naples.

The mosaics, featuring intricate geometric patterns and vibrant colours, are remarkably well-preserved. The find is considered part of a larger Roman villa or public building that was lost to the sea between the third and fifth centuries as underground magma chambers caused the surrounding terrain to fall.

Unlike mosaic flooring, such as that uncovered at a spa last year, the team of divers from CSR Restauro Beni Culturali and Naumacos Underwater Archaeology and Technology located a rarer and more expensive covering: an opus sectile.

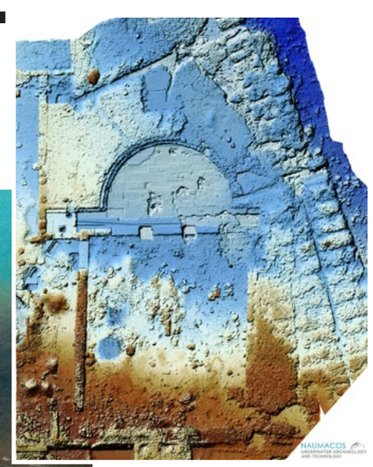
While mosaics use small stone squares, known as tesserae, to create a design, opus sectile demands a higher level of skill and artistry. It involves cutting stones into precise shapes and then forming complicated patterns. The technique encouraged the use of expensive polychrome stones, such as marble, and became increasingly popular beginning in the first century CE.

As such, opus sectile was considerably more expensive than regular mosaic flooring, although in Baiae, archaeologists noted that the owner had used recycled materials. According to the Submerged Archaeological Park of Baiae, this technique was common from the 3rd to the 5th century CE.

Today, the underwater archaeological park is a major attraction, inviting visitors to dive, snorkel or go boating along prescribed routes and view the submerged Roman city. ■

SOURCE: PARCO ARCHEOLOGICO CAMPI FLEGREI

EDOARDO RUSPANTINI / VIA EMAIL



NAUMACOS UNDERWATER ARCHAEOLOGY AND TECHNOLOGY

The survey by Naumacos Underwater Archaeology and Technology provides an overview of the hall of the ancient villa in the Underwater Park of Baia (above). Diver examining the opus sectile underwater in Baiae (left).

The village of Kemer. The discovery of its second ancient port offers new insights into the ancient city's role as an important maritime hub.

Archaeologists Unearth 2,700-Year-Old Roman Port in Parion, Turkey

A significant archaeological discovery sheds light on ancient Roman maritime infrastructure and regional trade networks.

The underwater studies in Parion, a 2,700-year-old port city of the Roman Empire in the village of Kemer in the Biga District of Çanakkale in northwestern Türkiye, have revealed the presence of the second ancient port of the city. This discovery is the second of its kind in the region and emphasises Parion's historical significance in Roman trade and military operations.

Significance

The ancient port, found along the northern coast of the Dardanelles, served as a crucial point for trade and military logistics between Asia and Europe. The archaeological team, led by experts from several Turkish universities, identified structures typical of Roman harbour architecture, including mooring stones and a well-preserved quay. These findings indicate the advanced engineering skills of the Romans and their strategic use of Parion to bolster both economic and military ventures.

Artifacts

During the excavation, archaeologists also discovered numerous artefacts that highlight the daily life and commerce of the time. These include amphorae used for transporting olive oil and wine, coins and pottery, suggesting robust trade links with other parts of the Roman Empire. The design of the port and the artefacts found suggest that it played a vital role in the economic life of the region and was a staging point for naval operations.

Understanding

This discovery significantly enhances our understanding of Roman maritime activities in the region. It provides a clearer picture of how the Romans integrated Parion into their extensive network of trade routes, benefiting from its strategic location to control naval passages between continents.

The uncovering of this ancient Roman port not only highlights the historical richness of Parion but also opens up new avenues for research into the economic and military history of Roman antiquity. As excavations continue, further study of the site will yield more insights into the Roman Empire's maritime capabilities and its influence on regional trade networks. ■

SOURCES: ONDOKUZ MAYIS UNIVERSITY, HURRIYET DAILY NEWS

Diver at the twin Mk XVI guns on the *Southwold* wreck in Malta

HMS Southwold

— WWII British Destroyer in Malta

Text and photos by Kurt Storms

In the waters of Malta, an island nation in the Mediterranean Sea, there are several deep wrecks accessible to technical divers. One is the Second World War British destroyer HMS *Southwold*. Kurt Storms tells us about his dive on the wreck.

Malta, at last. This trip had been planned for some time, but due in part to a lack of time, it had never happened. When I was invited to represent Divesoft at Rebreather Forum 4 in Valetta, it was the perfect opportunity. Together with my dive buddy Willem (Wim) Verreycken, we set off for Malta to dive on some deeper wrecks, including the beautiful WWII wreck of the HMS *Southwold*.

The wreck

The wreck of the *Southwold* came to rest on the seabed in two sections. The bow section is the larger of the two. It is about 40m long and lies at a depth of almost 68m, entirely on its starboard side. The stern section is about 30m long and sits upright on the seabed at a depth of 74m. The stern is about 200m from the bow section, which means one has to do this wreck in two dives.

History

Commissioned on 20 December 1939, HMS *Southwold* was built by J. Samuel White and the Company of East Cowes as part of the British WWII emergency programme. Following the laying of the keel on 18 June 1940, the ship was completed on 9 October 1941 and launched on 25 May 1941.

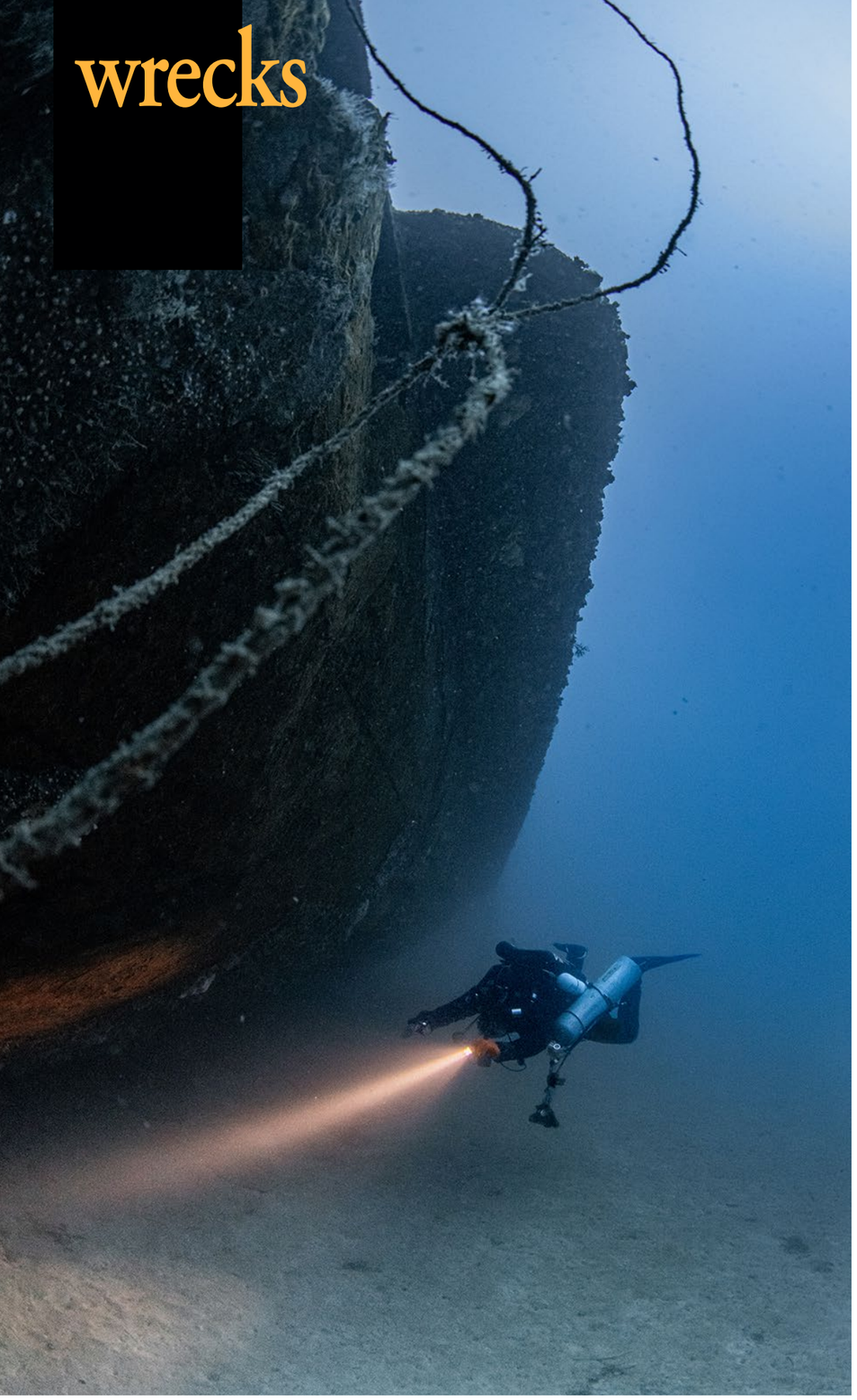
HMS *Southwold* belonged to the Hunt class of destroyers. These destroyers were 86m long with a beam of 9.5m and had a net tonnage of 1,050 tonnes. Used as convoy escorts, they had a top speed of 25 knots. With a crew of 168, *Southwold* carried three 4-inch twin-barrel Mk XVI guns, one at the bow and two aft, as well as anti-aircraft guns and anti-submarine depth charges. On completion, the *Southwold* went to Scapa Flow for trials before joining the Mediterranean Fleet.

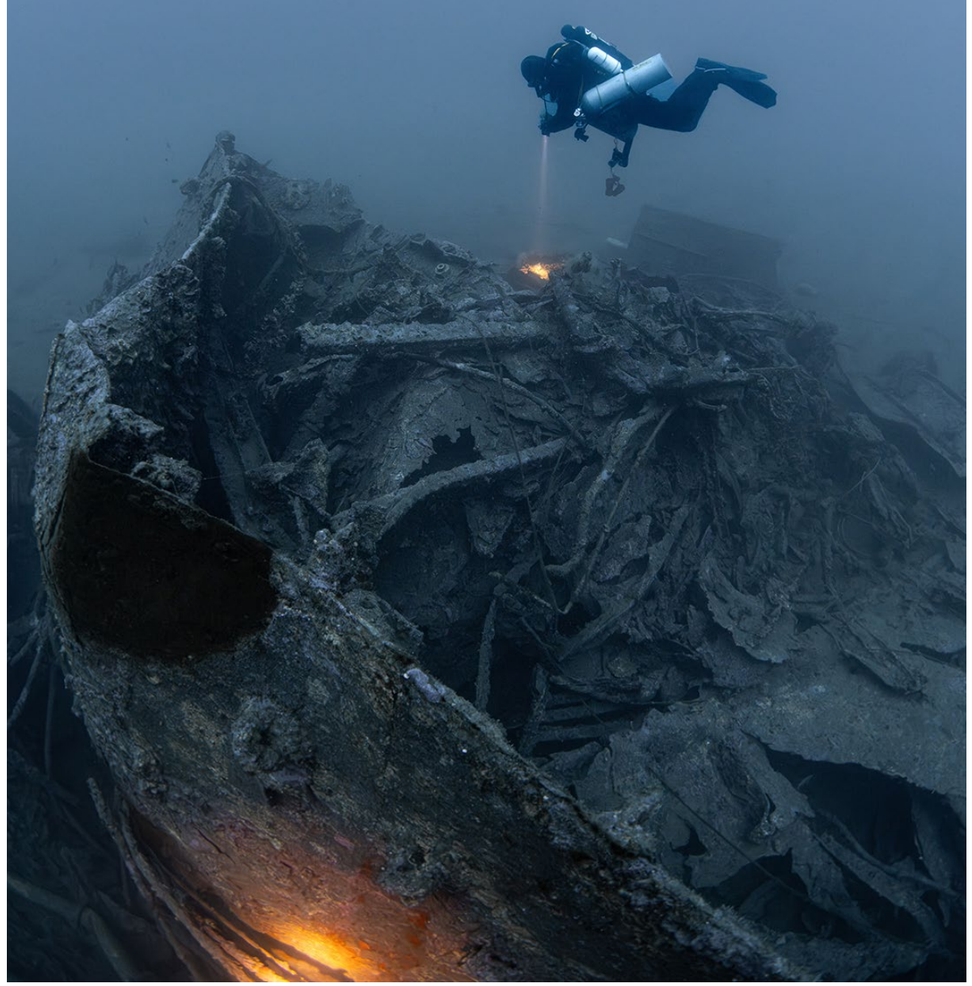
The *Southwold* wreck lies in two sections on the seafloor.

From 12 to 16 February 1942, the *Southwold* was part of an escort for the Malta Convoy MW9B, which never reached its destination. Of the three merchant ships, one was damaged and made it to Tobruk, but the other two sank. The *Southwold* and the other escorts returned to Alexandria, Egypt. On 20 March 1942, the *Southwold* left Alexandria to form part of the Malta relief convoy MW10 under the command of Admiral Sir Philip Vian. During the 820 nautical mile voyage to Malta, *Southwold* came under heavy attack from Italian warships and the Luftwaffe.

Once the enemy had located the *Southwold*, the Italian Navy was alerted and responded on 22 March 1942 by sending ten ships to the Gulf of Sirte (Sidra), 150 miles northwest of Benghazi, to wait for the convoy. When the Italian forces were sighted, Admiral Vian realised immediately that he was not only heavily outnumbered but also sorely outgunned. It was the Italian Admiral Angelo Iachino's 15-inch guns on the battleship *Littorio* and the 8-inch guns on his cruisers against Admiral Vian's 6-inch guns on the *Alexandria* and the 4-inch guns on his destroyers. So, to prevent the Italians from getting into range, the British decided to create a smoke screen. They then stormed in and out of the smoke screen, hitting their superior opponents with damaging salvos and dashing behind the smoke screen before the Italians could take range.

The fight was aborted that





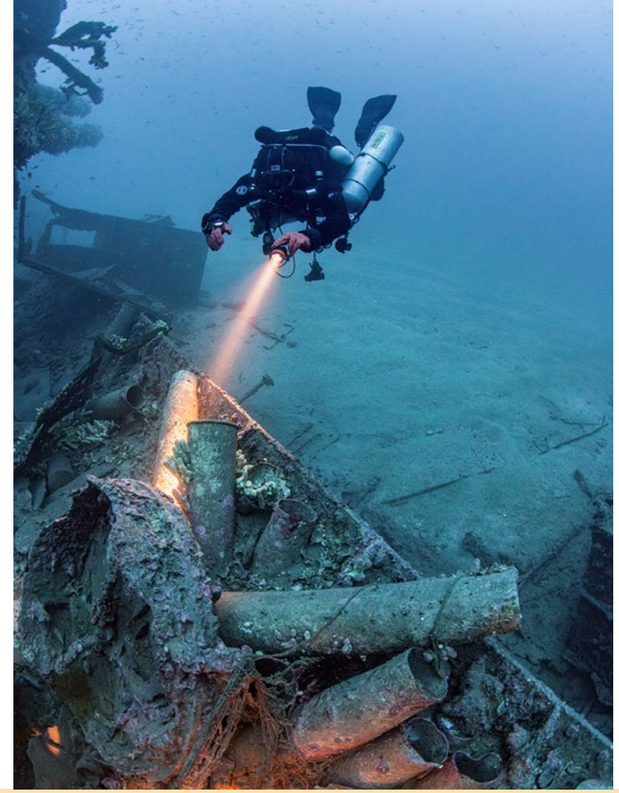
Diver exploring the hull (above), investigating guns in the wreckage (top right) and shining a light on empty shells from a nearby gun (right).

morning, but in the afternoon, the Italian squadron approached again. This time, Admiral Vian closed the range to below 10,000m, driving out of the smoke screen and managing to hit the *Littorio* with a salvo that set the battleship on fire. The Italians returned fire, hitting and severely damaging the British cruiser *Cleopatra*. The British destroyers, including the *Southwold*, quickly counter-attacked, emerging from the blanket of smoke and torpedoing the *Littorio* again, as well as the cruiser *Giovanni delle Bande Nere*, after which the Italians retreated.

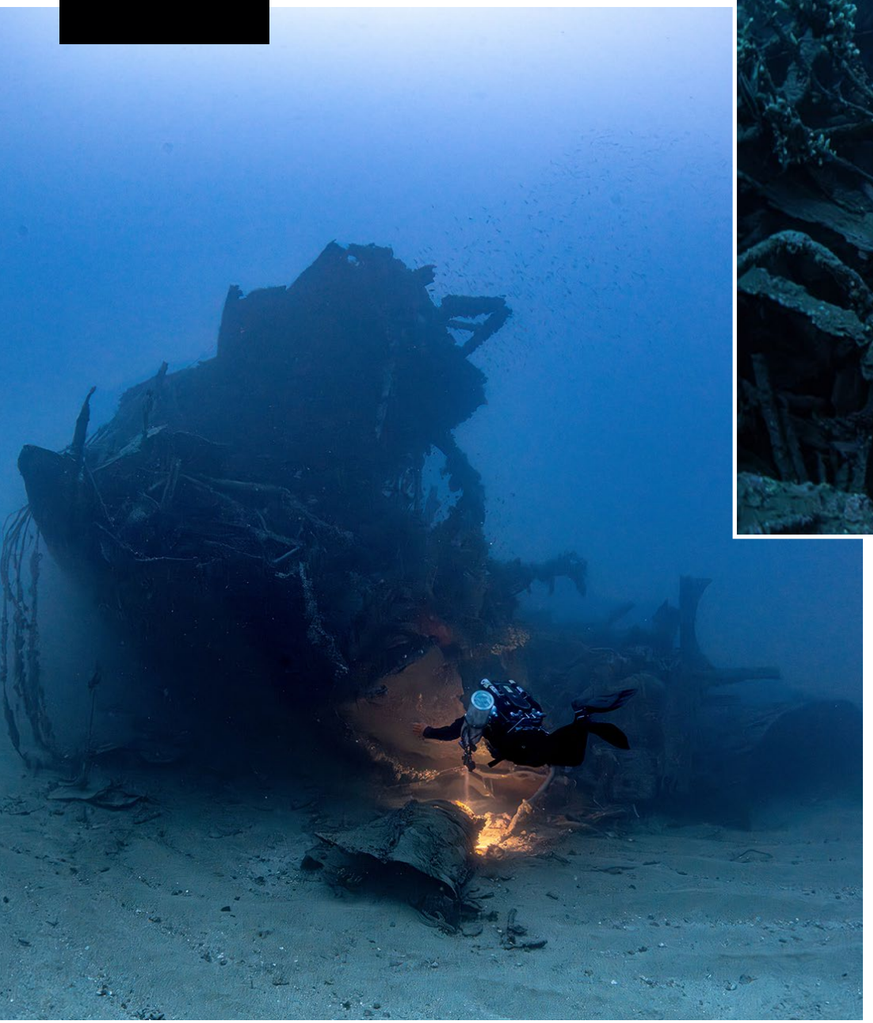
History records this battle as the Second Battle of Sirte. Determined to prevent the convoy from reaching Malta, German aircraft took over the attacks. When the convoy was only 20 miles from Malta, the Germans sank the *Clan Campbell*. However, the convoy was now within range of fighter aircraft from Malta. Hurricanes and Spitfires flew out to protect the remainder of the ships.

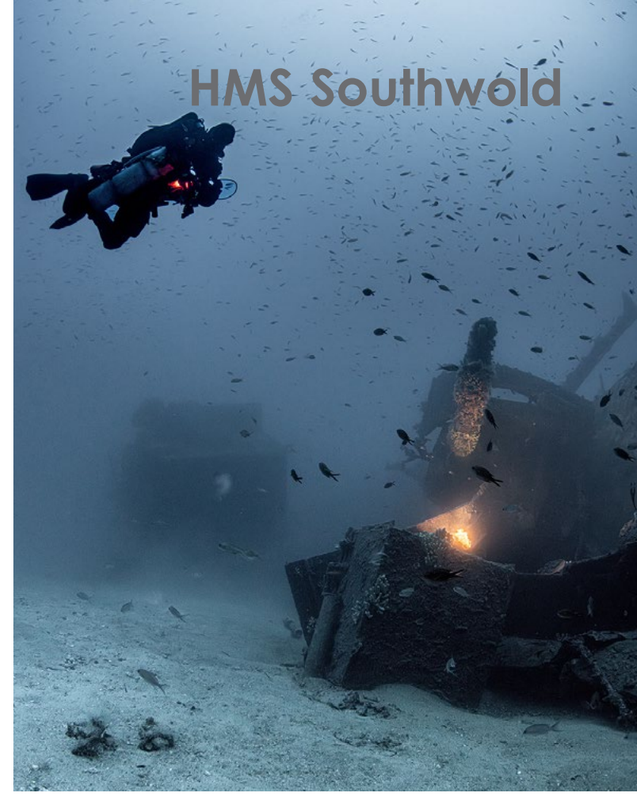
On 23 March 1942, the merchant ship *Breconshire* in the convoy was hit by enemy fire and stopped a few miles off St Thomas Bay. The weather turned rough, and the *Breconshire* drifted helplessly towards the shore, but the crew managed to anchor the ship 1.5 miles off Zonqor Point.

The next morning, the *Breconshire* was found dragging its anchors on the sandy bottom, and the *Southold* was called in to tow it. While attempting to pass a line to the disa-



When a mine hit *Southwold* amidships, it eventually broke in two as it sank (right). Diver with the majestic silhouette of *Southwold* (below). Diver peers inside the wreckage of *Southwold* (bottom right).





bled ship, the *Southwold* struck a mine, which exploded near the engine room, killing an officer and four sailors.

All power and electricity had been cut, so the diesel generator was switched on. The engine room was flooded, but the water gushing into the gearing room was stopped by shoring up the bulkhead and plugging the leaks. The tug *Ancient* towed the *Southold*, but the ship's hull at the engine room split open on both sides up to the upper deck. The ship began to sink, listing to starboard as the injured were transferred to the destroyer *Dulverton*.

Rocked by the swell, it gradually sank further and further amidships. The crew then abandoned the ship as it sagged more deeply, eventually submerging and breaking in two.

Diving

For wreck diving, we would go by boat, employing the services of Jason Fenech of Dolphin Cruises Boat Delfino in Malta. His modernised Luzzu boat, *Delfino*, is a traditional Maltese vessel fully equipped for technical diving. Jason's knowledge of the wrecks is extensive, and he has no difficulty in locating the deeper wrecks and, most importantly, where to drop the shot line in the right place at the right time.

We were well-assisted by deckhand Karsten, who stepped in as a support diver. This job was important. If anything went wrong during the dive, he could jump in the water with extra tanks.

Today, we would be diving the bow of the *Southwold*. Using my Divesoft Liberty SM CCR, I would be doing the dive with my regular dive buddy Wim.

On the captain's signal, Wim and I jumped into the water, and we drifted through the current to the shot line. Once there, we signalled each other to start the descent. I went first, followed by Wim.

After three minutes of descending, we reached the wreck and immediately proceeded to the back of the broken-off section of the vessel. We had a look inside and did our rounds. As agreed before the dive, Wim set up some lights so that this part of the wreck was a bit backlit. Wow, what a tremendously beautiful wreck it was!

We found some empty shells from the gun a few metres away. This double gun immedi-

Diver at the prow of the *Southwold* wreck, resting entirely on its starboardside

ately caught our eye. It stood out, still as proud as it ever was.

Our bottom time was not very long. We only had 35 minutes of bottom time before we had to start our ascent and complete our 90-minute mandatory deco stops.

But before we went back up via the shot line, I took a few more photos of the prow, which was nicely lit on its side. Satisfied with some great photos, we signalled to each other that it was now time to begin our ascent.

In order to fulfil our decompression obligations as well as possible, we used a deco station. The last diver up disconnected the deco station from the shot line so we could all do our deco stops together. This way, Jason only had to keep an eye on the two red buoys instead of several surface marker buoys in different places. Doing decompression at a deco station is also very relaxing for divers. The deco station gave us a reference point to keep track of our depth. It also had spare tanks attached to it in case we had a gas problem.

After completing the deco stops, we emerged satisfied, and Jason approached with the boat. Karsten lowered the lift so that we could get back onto the boat with all our bailout tanks without any problems. Happy, like a couple of kids, we ticked this wreck off our to-do list. ■

A member of the Belgian military, Kurt Storms is an underwater photographer, cave explorer and active technical cave and rebreather diving instructor for IANTD. He began diving in Egypt while on vacation, and his passion for it has never stopped. He is also the founder and CEO of Descent Technical Diving and one of the push-divers who documented the Laplet slate mine in Belgium for national television. For more information, visit: ***kurtstorms.com****.*

SOURCES:
CALYPSOSAC.ORG
HERITAGEMALTA.MT
WIKIPEDIA.ORG

Porto Santo

Relaxation, Great Food & Fantastic Diving

Text and photos by Brandi Mueller

Porto Santo

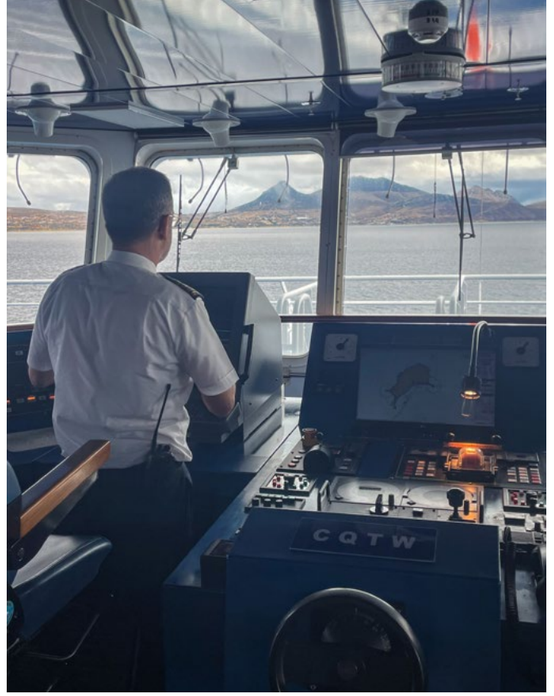
Rocky shore facing an islet, at Porto Santo's beach (above); So many fish on the *Madeirense* wreck, including Atlantic chromis and ornate wrasse (top right); Delicious food in Porto Santo (far right); Drone aerial shot of Porto Santo (previous page)

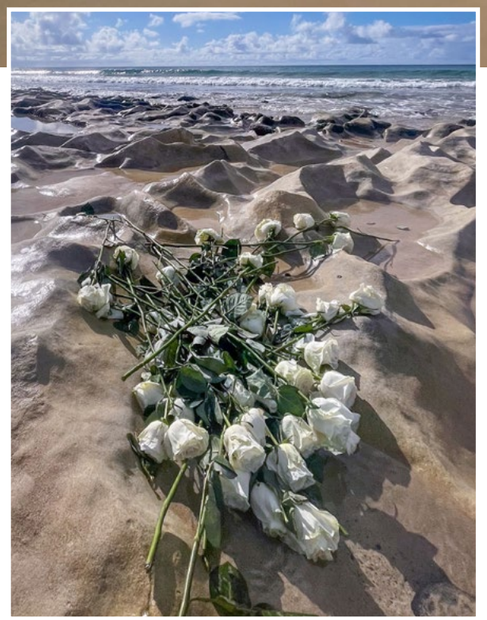
Porto Santo Island, the northern-most island of the Portuguese archipelago of Madeira in the Atlantic Ocean, is known as a golden oasis with turquoise waters. There is a variety of diving to be enjoyed, from wrecks to rocky reefs with diverse marine life, as well as great food and a relaxed atmosphere. Brandi Mueller shares her adventure there.

Rising early to walk Porto Santo's 5.5-mile (9km) golden sand beach, the air was cool and crisp. It was light outside, but the sun had not yet risen over the top of the island, so the beach was still draped in shadow and not too hot. The temperature was perfect for a stroll, and as I looked out over the still waters, the whole island seemed to be at peace.

Closer to Africa than Europe, the small island of Porto Santo is part of the Autonomous Region of Madeira. One of two such areas in Portugal (the other being the Azores), the region is an archipelago that also includes the island of Madeira, the Desertas and the Savage Islands. Less than seven miles (11km) long and four miles (6km) wide, the island of Porto Santo offers relaxation, great food and, most importantly, fantastic diving.

I stayed at the Hotel Torre Praia in the southwestern part of the island, which is mostly flat and where the majority of the population and hotels are located. Although the island has only around 5,000 residents, the island





Early morning walks on the 9km golden sand beach (top left). Captain at the helm of the Porto Santo Line ferry from Madeira to Porto Santo (top right). During one of my morning walks, I found two dozen white roses left behind (left).

population grows significantly during the peak tourist season. But as I walked along the beach, it was mostly empty.

As I continued on my way, drinking in the blue skies, blue waters and golden sands, something caught my eye. There was a white rose on a rock where small waves were rolling in. As I got closer, I could see at least two dozen white roses scattered around the area. I wondered where they had come from, who they were for or if the magic of Porto Santo was perhaps welcoming me with flowers. After snapping some shots of the flowers, it was time to turn around and make my way back to the hotel to meet up with my fellow travelers on this adventure arranged by Portugal Dive. It was almost time to go diving.

Getting there

There are two ways to get to Porto Santo: by plane or by ferry. There is a short 15-minute daily flight from Madeira, and during the high season, there are a few direct flights from Lisbon. Or you can take the Porto Santo Line ferry, a 2.5-hour trip in style and comfort.

When I was told we would be taking a ferry, I pictured a smallish boat with few amenities, just a means of getting from one place to another. So, I was surprised to find something that looked more like a small cruise ship than a regular interisland ferry. Carrying over 1,000 passengers and 145 vehicles, the multi-story ship had several restaurants and bars, a cinema, a children's play area and a lot of outdoor space and seating options. With a Mediterranean monk seal as its mascot, the Porto Santo Line ferry was the most relaxing way to get to Porto Santo. And for divers, it has another advantage: you do not have to worry about your no-fly time on the way back.

We departed in the morning and said goodbye to Madeira just after the sun had come up. The island was still glowing a warm yellow in the dawn light as we pulled away and started the 42-mile (68km) trip northeast. After watching Madeira get smaller and smaller in our wake, I joined my fellow Portugal Dive travelers for coffee in the cafeteria. Just as I was finishing, Arlindo Serrão, our host, let us know that we had a special tour. He had somehow worked his "Arlindo magic" and gotten us a tour of the bridge.

As we made our way past security and offices, the door to the bridge opened for us. We met Captain Batista and his first mate, and they graciously showed us around. As Porto Santo loomed larger in front of us, I figured the captain would kick us out, back to the regular passenger area. Instead, he invited us to the bridge wing to watch him dock the ship. Like a pro, he maneuvered us seamlessly into the pier, and we departed, taking our first steps onto the lovely island of Porto Santo.

The island

There is no record of the discovery of Porto Santo before 1418, when it was accidentally discovered by Portuguese captains blown off course by a storm while explor-

Porto Santo (above), or "Holy Harbor", was named in the 15th century by Portuguese captains blown off course by a storm as they expored the African coast. The marina at Porto Santo (left). Diver on the Corveta wreck, which was intentionally sunk as an artificial reef (top right and right).

ing the African coast, but it is generally thought that the island was known much earlier. "Porto Santo" means "Holy Harbor," so named by the sailors who were saved from the storm by the island's safe harbor.

Soon after its discovery by the Portuguese, Porto Santo and nearby Madeira were settled. Being drier and smaller, Porto Santo had much harsher conditions than Madeira. The settlers quickly exhausted its limited resources and altered much of the original landscape for farming and living. With little water, farming was difficult, and most supplies had to come from Madeira. The ecosystem was further altered by invasive species that took a toll on the endemic and native flora and fauna. Aside from water and food issues, the island was also repeatedly attacked by pirates, French privateers and other bandits, making Porto Santo a rather difficult place to live.

Famously, Christopher Columbus lived on the island for a few years and married the daughter of Bartolomeu Perestrelo, the island's first donatary. A donatary was a noble person who was given a large piece of Portuguese land, in this case, the island, and essentially served as its governor. What is thought to have been Columbus' home during this time is now a museum about his life and time there, including a more comprehensive history of Porto Santo.

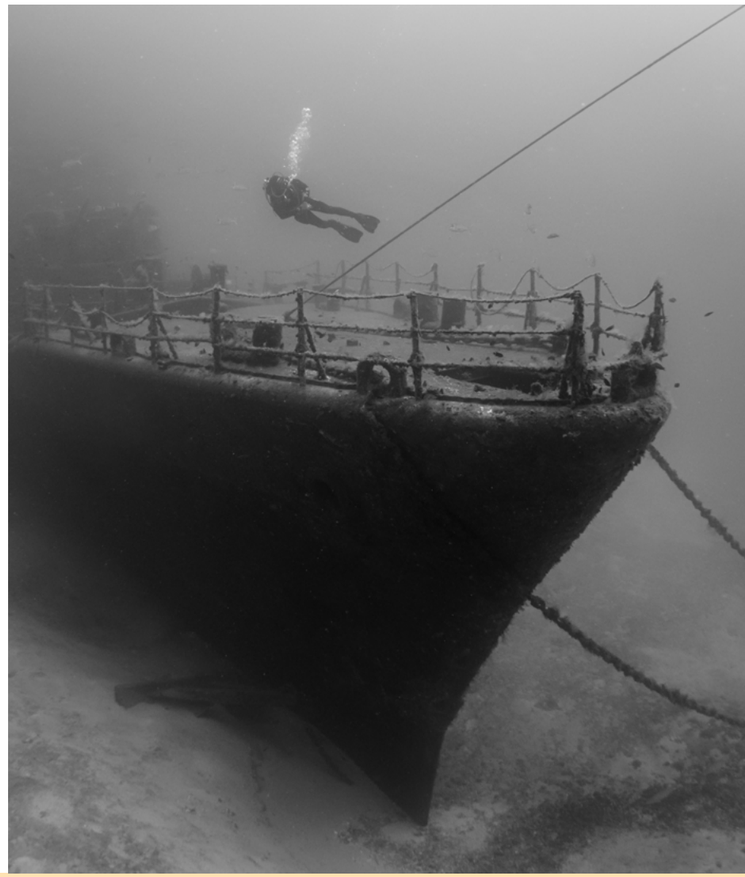
Corveta Pereira D' Eça

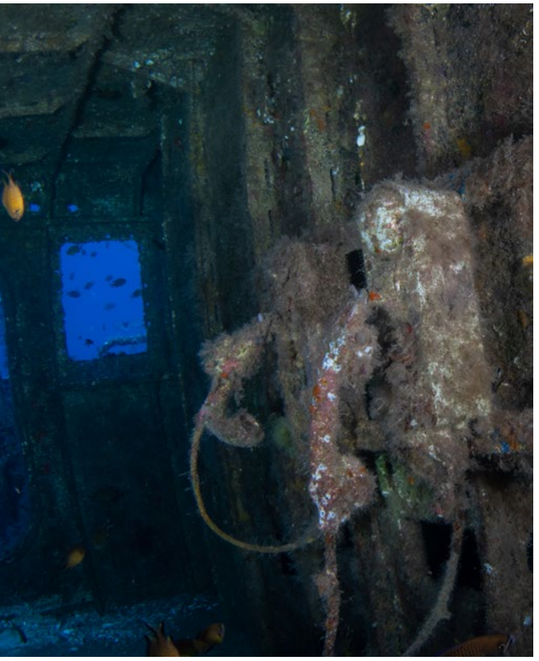
Loading into an inflatable skiff in a picturesque harbor close to the Porto Santo Sub dive shop, we soon headed out to open water and our first dive site, the Corveta wreck. Intentionally sunk in 2016, the Madeira Natural Park Authority coordinated contractors to prepare and sink the ship in hopes of creating an artificial reef to attract marine life and divers.

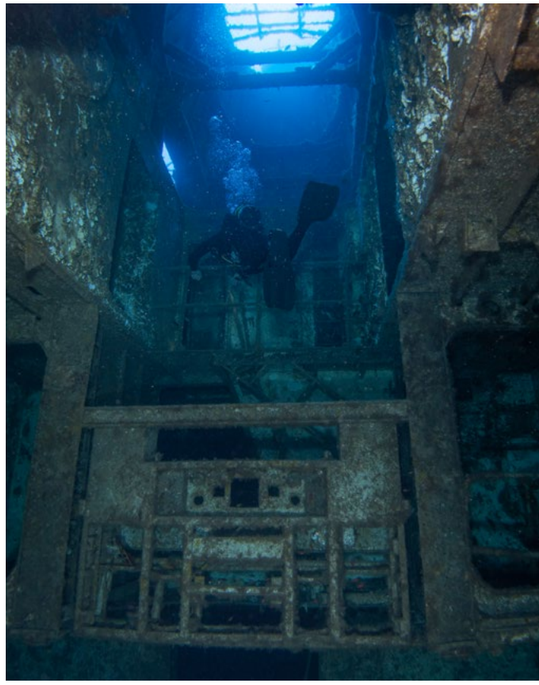
Underwater, we were met with crystal clear conditions and a lovely ship sitting upright in the sand. The water temperature was around 68°F (20°C), and the ship, which was still very much intact, had the anchor chains out in front of it, extending down to the sand with the guns pointing up to the surface. Schools of fish were all around, showing how artificially sunk wrecks make great homes for marine life.

We made our way to the stern, and before we got there, we were met by a resident dusky grouper. It allowed us to get very close for photos. I then followed José Ricardo, our dive guide and one of the owners of Porto Santo Sub, into the interior of the ship.

Having been cleaned up for divers prior to its sinking, this wreck had some great swim-







The Corveta wreck (top left). Diver expores the interior of the Corveta wreck (top right, far right and above right). Diver with grouper on wreck (above left). Phones hang on a wall in the wreck (left).

throughs and penetrations that were far safer to explore than those of a ship that had sunk naturally, with all its hazards. While divers should still have adequate training and experience before entering any overhead environment, the ship had been cleared of stray wires and entanglement hazards, leaving large open spaces.

José showed me the engine room, and we worked our way through the interior of the ship. Phones were still mounted on the walls, and the bridge was easily accessible, with lots of light coming through the openings that used to be windows. It was fun to explore the inside of the wreck, and there were always lots of places with open areas and light where you could swim out if you needed to.

For our second dive, we went closer to the island and jumped in on a shallow rocky area. There was an octopus putting on a show, flashing colors, and it had its entire body out in the open. José pointed out an eel in a rock crevasse, and I positioned my camera to take a shot that I could not see. When I brought my camera back, I looked at the result, and there was not just one, but three eels in the hole. I took a few more shots

Octopus on the reef (above) and stingray buried in the sand (left) at Porto Santo

and continued on, swimming right over a stingray before heading back to the boat.

The whole package

I love diving and am happy to suffer through some pretty dismal conditions in order to get underwater, but Porto Santo was the exact opposite of that. From breakfast all the way to leisurely late-night dinners, there was no going on a diet on this trip. Our resort had an excellent restaurant, but we also ventured into town and found ourselves at Tabua Rasa, a wine bar with a fantastic charcuterie board. We enjoyed local cheeses, meats and other snacks, complemented by cocktails as the sun went down. We had engaging conversations about the wreck we had just dived, the octopus and how great the visibility was.

Europe's best beach

Porto Santo's 5.5-mile (9km) beach has been named the best beach in Europe for many years in a row, and I made a habit of waking up early most mornings, grabbing a coffee and heading out to go for a walk on the beach.

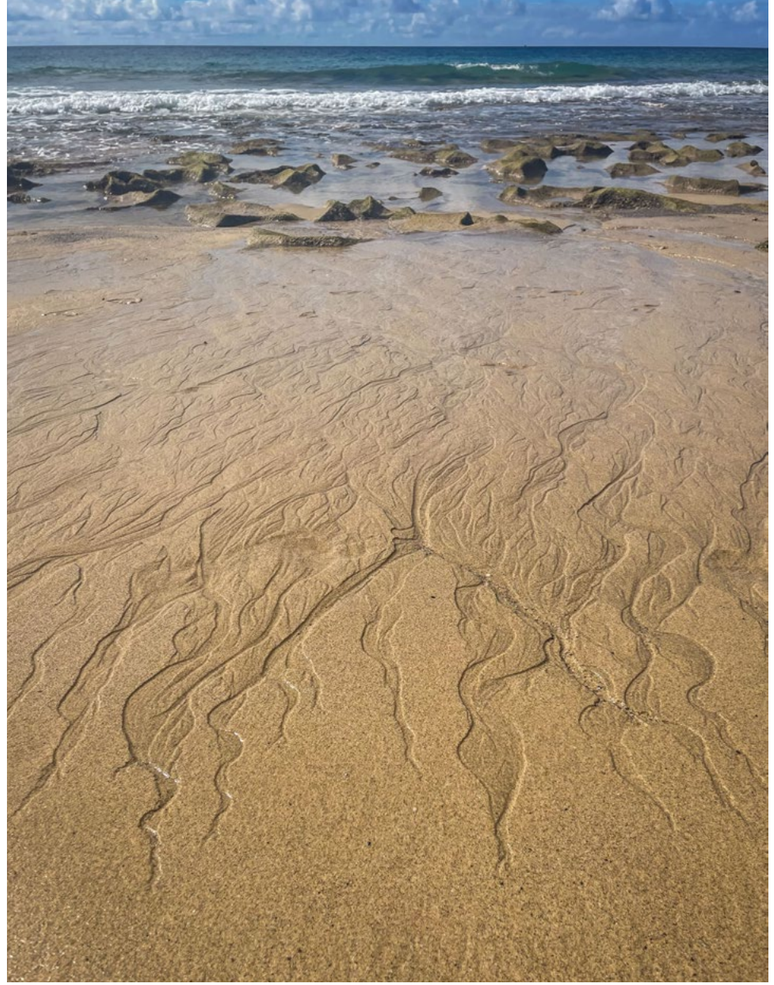
The sand has a unique deep yellow color, almost golden, due to a mineral called calcareous. Formed by ancient coral reefs and marine organisms, this type of limestone has eroded away from the northern parts of the island, creating a stunning soft sand beach that seems to glow in the sunlight. The sand, along with the island's perfect Mediterranean climate, is said to have healing properties and

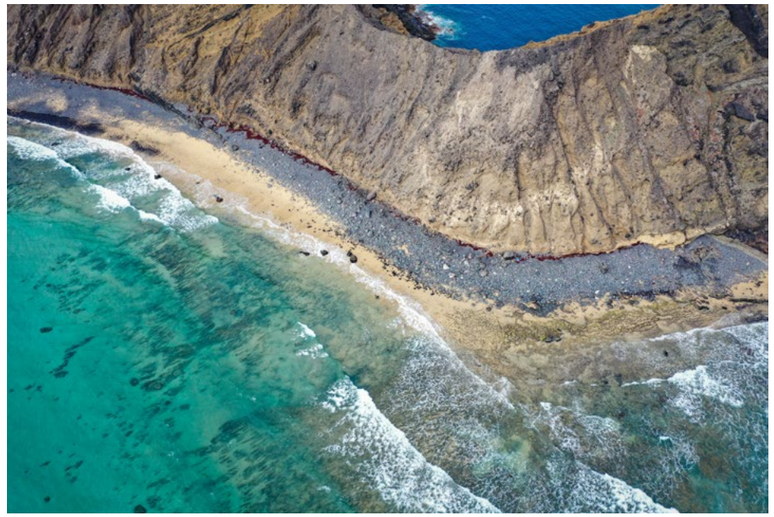
Three eels on the reef off Porto Santo (above)

can alleviate arthritis and rheumatism.

I was still struck by how few others were on the beach. It was May and only the beginning of the tourist season, but I still expected more people. As I walked, there would be groups of people as I got closer to the hotels and resorts, but in between, the beach would empty out again, often as if I were walking on my own private golden sand beach.

One morning, I reached a spot where the beach ended and the sand turned into rocky cliffs. There was a restaurant at the point, and I could not help but have a coffee and look out over the edge of the island. Another islet, Cal, was close by, jutting out of the blue water with a mixture of dark rock and green foliage. To my right, the soft yellow sand abruptly gave way to jagged, dark gray rocky cliffs that would be a proper climb to get around. I wished I had brought my drone but settled for some photos taken from the ground. The walk was so enjoyable that I decided to do it again the next morning with the drone in tow.





Drone aerial shots of Porto Santo's beautiful golden sand beaches (above and left). As the tide goes out, the sand looks like it has veins reaching from the land to the water (top right).

Divers on the *Madeirense* wreck (above and top left)

Arlindo Serrão from Portugal Dive (above), Atlantic chromis and an ornate wrass (right) on the *Madeirense*

Back at the hotel, I prepared my camera and dive gear, had lunch and then met our transport to Porto Santo Sub for more diving that afternoon.

The *Madeirense*

Our next wreck dive was the *Madeirense*. Arlindo had told me that the corvette was a playground for divers, but the *Madeirense* felt like a real shipwreck. Another short and easy skiff ride from the harbor, we were quickly moored and kitted up. The sun was shining, and there was not a cloud in the sky as we back-rolled into the crisp water.

With all divers accounted for and okay signs given, we descended along a line, and it was not long before the shadow of a ship came into focus. The visibility was epic, and soon, I could see the bow all the way to midships. I also noticed that the bow was moving… well, the bow was not moving, but it seemed to be moving, with a cloud of fish. As I got closer, ornate wrasse by the hundreds were crowding around the bow, with Atlantic chromis mixed in.

The ornate wrasse is a beautiful fish that looks like it was painted by a child. Its head is blue with red splotches, its body is green but with a blue and red vertical stripe and its fins are outlined in blue. Around six inches (~15cm) long, these fast-moving wrasses flashed color like a splatter painting, and the copper-gold bodies of the chromis made

Divers on the *Madeirense* wreck (top left). The beautiful church, Paroquias do Porto Santo (Parishes of Porto Santo), in Vila Baleira (top center). Views of the ocean from Porto Santo seen on a jeep tour of the island with Dunas Travel (top right). Rocky landscape on the jeep tour (far right). On the jeep tour, we saw a dugout hole used to hide people and valuables during pirate raids in the 16th to 18th centuries (center).

the ship look like an art installation.

After stopping to photograph the wrasse, we started swimming toward the stern. The ship was about 110ft (34m) in the sand, and we could easily see all the way to the bottom. I was able to swim away from the wreck and shoot big, wide-angle images of huge parts of the ship due to the clear conditions.

Sunk as an artificial reef in 2000, the *Madeirense* is a good example of how artificial reefs provide a place for fish and marine life to aggregate, and a way to generate economic growth for a location by promoting the artificial reef to divers around the world. It is a fantastic dive, and I think a diver could do many dives on it before seeing it all.

Land adventure

On our last day, we took a jeep tour around the island with Dunas Travel. I had been to the beach, and we had dived on the south side of the island, but we had yet to see the rugged cliffs of the north side. First, we headed west to the overlook at Ponta da Canaveira for a stunning view of Liheu de Ferro; it was even clear enough to see the island of Madeira, 65km (~40mi) away.

Driving northeast, the geology of the island changed drastically. Porto Santo is completely different from Madeira in terms of landscape and climate. Even though the islands are so close, Porto Santo is much more arid and home to a small patch of dunes. We went off-roading in an area of sand with sandstone rock formations, and our guide stopped to show us fossils of ancient marine creatures. This sandstone erodes and becomes the glorious yellow sand of Porto Santo's beautiful beach.

We also stopped to see the Organ Pipes—volcanic basalt columns that look as if they were carved by machines. The site reminded me of a spot in Hawaii where lava created the same spectacle millions of years ago.

Our next stop was a quick tour of Quinta das Palmeiras, a mini-zoo and botanical garden in the middle of the desert island. There were many types of birds. One cockatoo even greeted us with an "Ola."

As we continued, the jeep climbed in altitude, giving us stunning views of sheer cliffs and the ocean stretching as far as the eye could see. One interesting stop was at Casa da Serra, a typical settler's house in Porto Santo. With a mini museum set up inside the house, we looked around

Drone shot of Porto Santo

at the antiques and ended the tour by sampling homemade *poncha*, a flavored rum beverage that burned a little bit on the way down.

Funny enough, one of the neatest things I saw was a hole in the ground. In the early days of settlement in Porto Santo, pirates were a serious problem. Holes were often dug and covered to hide goods and even women and children when the pirates attacked. I only hope that someone was left after the attacks to free the children hiding in the holes.

After our tour, the day got even better. José and Joana from Porto Santo Sub kindly offered to cook us lunch before our ferry departed. We arrived at the dive shop to find José with a massive splayed-open tuna, caught just hours before, ready to be cooked in a drum that had been modified into a grill. But this was just the beginning. Inside, a table was set with bread, cheese, olives, salad, vegetables and, shortly after, the absolutely delicious fish. It was such a nice gesture after all their diving hospitality, and we had such a lovely time talking. We heard more about diving around Porto Santo and how José and Joana found their way to owning a dive shop there.

Before we knew it, it was time to catch our ferry. As the sun set, we were underway, with Madeira in the distance and Porto Santo fading away behind us. Sipping drinks, we were all relaxed in that travel-weary manner where you feel like all the conversations have been had and there is nothing left to do but reminisce in silence, each of us scrolling through images taken the previous week, trying to remember all we had seen and done.

I was determined to get to bed early, as my flight was before dawn. But somehow, as we were checking back into the Sé Boutique Hotel on Madeira, I heard that dinner was still being served for another 15 minutes. I knew I would not be around food this good for a while. So, after dropping off my bags, I met some of the group at a table on a cobblestone street, and we enjoyed one last fantastic meal together, paired with local gin and Madeira wine.

Morning came, and it was back to Lisbon and onward to the west for me. As I started to edit photos on the long flight home, I found myself once again in awe of this beautiful island of Portugal and wondering when I might return. ■

Porto Santo

A scenic point on the jeep tour of the island with Dunas Travel (above). Members of the family who own Porto Santo Sub made us the most amazing lunch before we departed the island (top center, center and left).

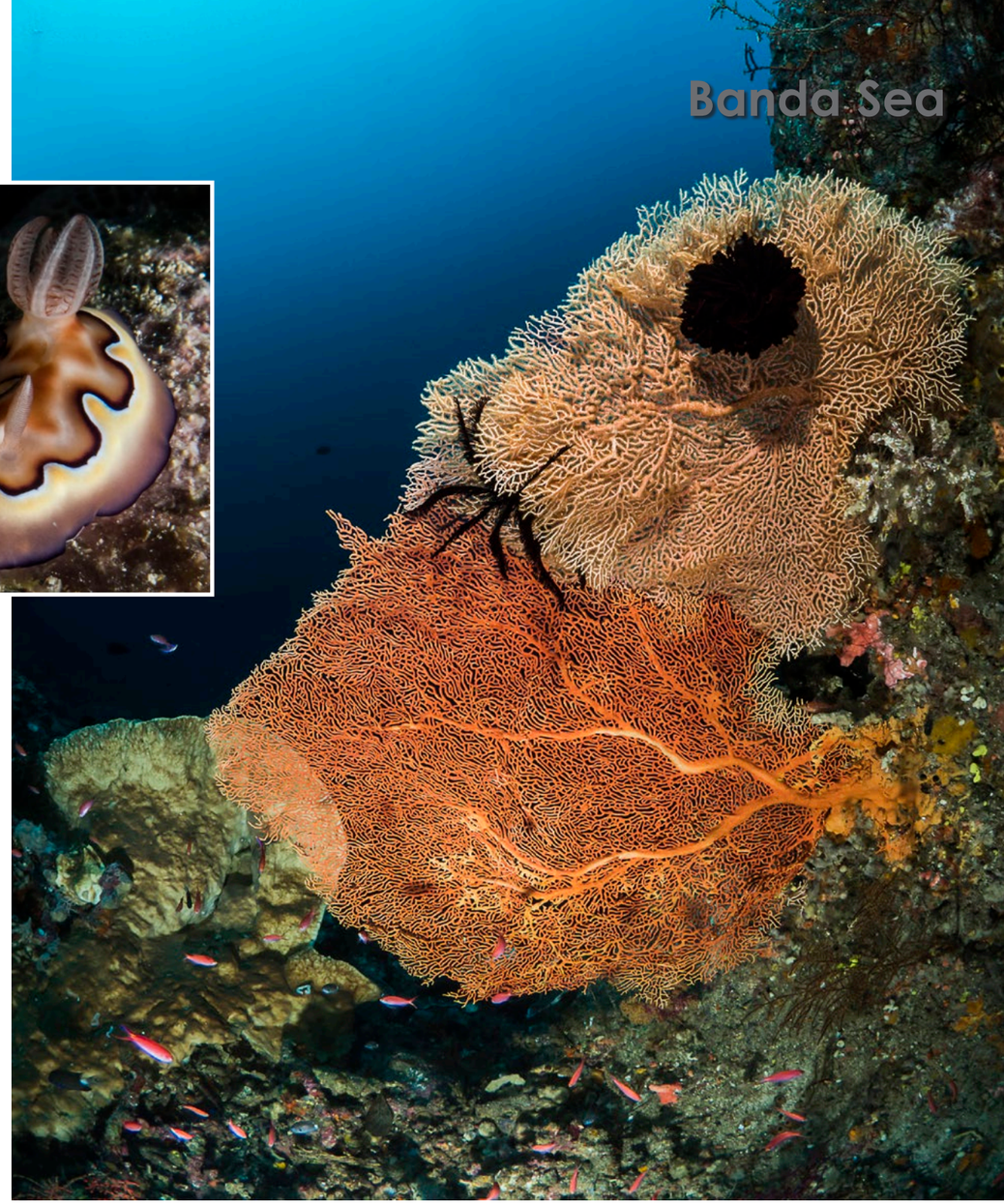
Special thanks go to Portugal Dive, Visit Madeira and Porto Santo Sub.

Brandi Mueller is an American photographer, writer, captain and scuba instructor who is based in Micronesia half the year and traveling the rest. She is the author of The Airplane Graveyard. *You can see more of her work at:* ***brandiunderwater.com***.

REFERENCE: WIKIPEDIA.ORG

Indonesia's Banda Sea *& Forgotten Islands*

Text and photos by
Claudia Weber-Gebert



Divers and huge barrel sponge (above); *Goniobranchus coi* nudibranch (centre inset); Sea fans with black feather stars (right); Pair of large broadclub cuttlefish (left); Leaf scorpionfish on reef with barrel and elephant ear sponges (previous page)

Far away from the stress of everyday life and modern civilisation lies a paradise in the middle of the Coral Triangle, where time has stood still. Claudia Weber-Gebert tells of her adventure to Indonesia's Banda Sea and the Forgotten Islands.

In this part of Indonesia, there are areas completely free of human influence, with no internet or cell phone reception. It is a good opportunity to switch off and enjoy the beautiful nature above and below the water.

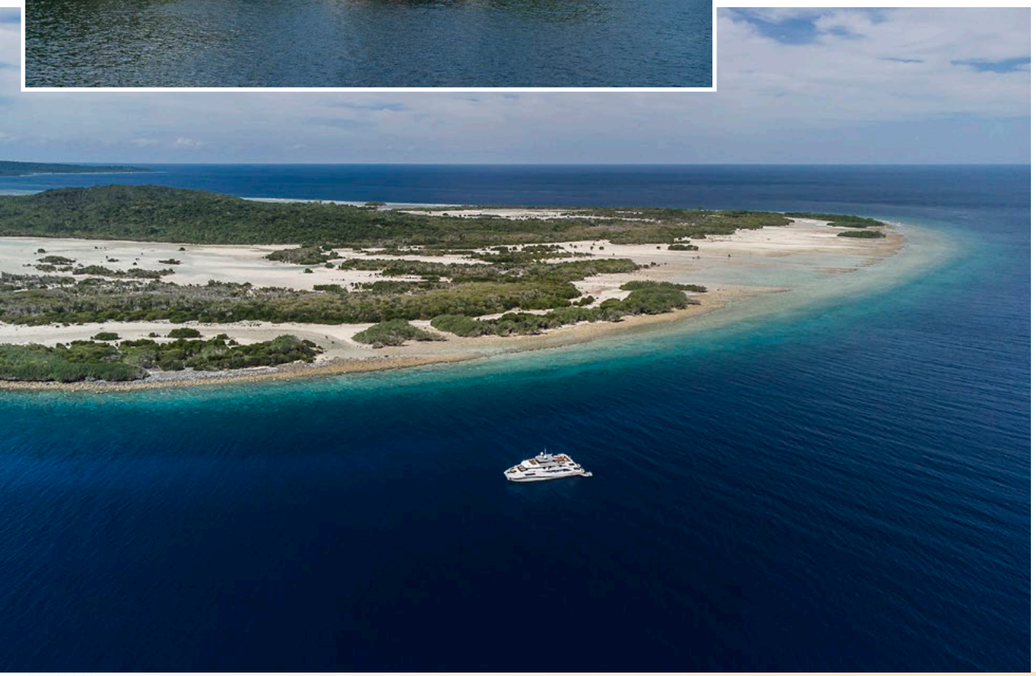
The liveaboard trip began in bustling Ambon. But within a few hours, our boat was far enough away from populated areas to feel remote, and the journey to the unforgettable underwater worlds of the Banda Sea began in earnest.

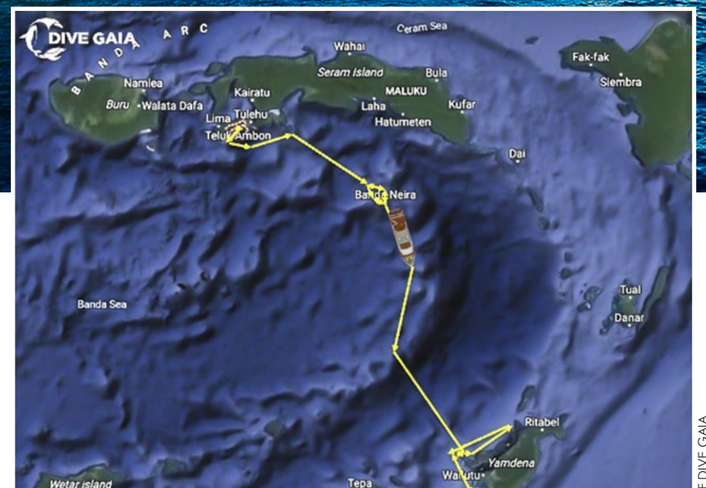
We were in the so-called Coral Triangle, where the Indian and Pacific Oceans meet. The water is warm around the equator, and underwater life literally explodes in this region. Here, you can find the greatest variety of hard corals, soft corals and sponges—not to mention fish and all kinds of marine life. Biodiversity here seems to burst forth like colourful fireworks.

Getting there

Our journey took us from Ambon via Nusa Laut to the Forgotten Islands, including the outer Banda Islands, Banda Neira, and the volcanic cone of Manuk, on towards Yamdena, and finally to the port of Saumlaki, where our journey ended. Aboard the *Gaia Love* liveaboard, we covered around 1,000km (~620mi) as we crossed the Banda Sea from north to south.

The open sea can be a bit bumpy at times. Luckily, the *Gaia Love*, which has been recognised by the 2024 Reader's Choice awards, is a steel vessel that sits very calmly in the water, making it suitable for divers who are prone to seasickness. To cover the long distances across the open sea, our boat sailed at night, and we arrived at a reef near an island in the morning for our first dive.





COURTESY OF DIVE GAIA

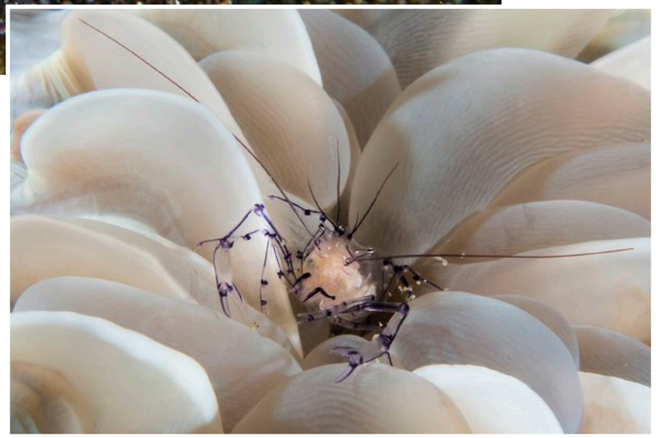
The *Gaia Love* liveaboard in the Forgotten Islands (bottom left); Glimpses of small fishing villages can be seen in the dense tropical forest (left); Banda Neira panorama (above); Cruise route of the *Gaia Love* liveaboard through the Banda Sea and Forgotten Islands (right)

Reefscapes

The reefs are located where small volcanic islands have risen from the depths of the Banda Sea. If you look at the map, you can see a semicircular ridge with volcanic islands protruding above the water's surface on either side. We came across reefs that were nearly untouched and still intact. The small, isolated islands in the Banda Sea were sometimes sparsely populated or uninhabited. Most were just small fishing villages with a few huts peeking through the vegetation. Only in the outer Banda Islands and Banda Neira could larger towns be found.

The underwater landscapes were very varied. Sometimes, there were flat, sandy coral gardens, and sometimes, there were steep drop-offs with huge coral fans—an El Dorado for underwater photographers. These sites were particularly good for wide-angle photography of colourful reefs. But, of course, there were also lots of small creatures sitting on and between many of these colourful corals and sponges, ideal for macro photography. With their trained eyes, the dive guides found even the tiniest of critters.

All the landscapes during the dives were dotted with giant barrel sponges populating the reefs. Schools of fish, moving like ribbons through the clear water, grouped in and around these barrel sponges. Visibility varied. In some places, there was a little more plankton in the water, brought in by the ocean currents. But most of the



Scorpionfish (top left); Hairy squat lobster (top right); Hawksbill sea turtle and large colony of staghorn coral (right); Bubble coral shrimp in bubble coral (above); Clark's anemonefish in anemone (left)

time, you could still see other divers, even from 30m (~98ft) away. And at some dive sites, if you looked down, the entire bottom was often covered with corals and sponges of all kinds. There were hardly any gaps in the reef, with huge corals and an almost indescribable variety of sea life.

Nusa Laut

At the start of our trip, the dive sites around Nusa Laut, still part of the Moluccas, had the most visible traces of human civilisation and the destruction that came with it. On the rocks at one of the dive sites, we saw a huge, discarded net, overgrown with reef life and as still as a memorial. Fishing lines could be seen here and there, but they posed little threat. But the further we travelled away from civilisation, the more beautiful the dives became, with intact and colourful coral reefs and lots of fish.

Banda Islands

Next, the outer Banda Islands came into view, with their green volcanic craters and lots of seabirds. The birds sat in the trees like big fruits. The frigate birds were particularly noticeable, harassing seabirds returning from a hunt until they vomited up their prey and

The Lava Flow dive site at Gunung Api (above). A giant barrel sponge at the Lava Flow dive site is a shelter for corals, chromis and damselfish (right).

dropped it in desperation—a clever tactic by these pirates of the skies.

Although we dived on many beautiful and breathtaking reefs on our trip, one site in particular impressed us: the Lava Flow dive site at Gunung Api. This island volcano erupted in 1988, and a wide stream of lava flowed into the sea and over the existing reef. A broad strip of this reef was completely covered in lava and destroyed—a tragedy, some might think, but nature knows better.

A short time later, new corals formed on the lava and grew at a rate that amazed even scientists. You can see the marks the researchers made on the corals to measure their growth. It is very interesting because today, the staghorn corals are so densely packed in this exact spot that it is impossible to put a finger on the ground anywhere. Nobody expected this after the destruction. Above the water, you can see how the ribbon of lava flowed from the top of the crater down to the water. But below the water's surface, nothing of it is visible today. It is a very special and wonderful dive site with the densest corals I have ever seen.

On the way back from the dive site, we were surprised by a large pod of melon-headed whales (also known as electra dolphins)—an incredible sight. Around 300 to 400 individuals circled the liveaboard, and some happily played in the bow wave of the skiffs. It was as if these beautiful cetaceans had come especially to greet us. They were resting in the calm waters around the islands before returning to hunt in the open sea and at great depths. These animals can grow up to three metres (~9ft) long. Unfortunately, little is known about this species of cetaceans.

We saw a huge pod of 300 to 400 melon-headed whales (aka electra dolphins)

During our dives, we also saw the occasional hammerhead shark, especially on the steep walls. The area was known for this, but it was not the right season for hammerheads. So, we only saw the occasional hammerhead from a distance. In September, hundreds of hammerhead sharks gather here in a truly amazing sight. But okay, you cannot have everything in a single trip!

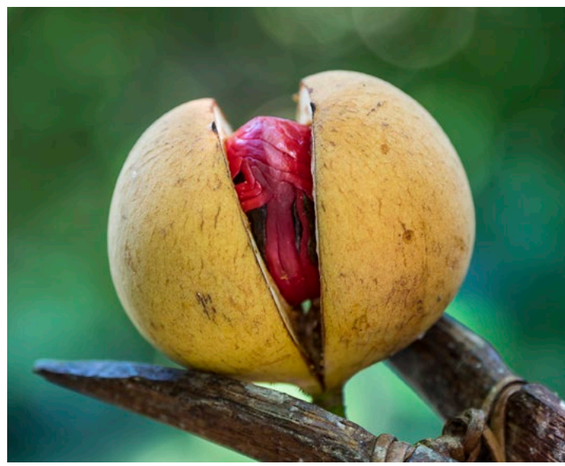
Banda Neira

On Banda Neira, we took a shore excursion to the plantations.

At Banda Neira, the colorful mandarinfish were not shy like they can be elsewhere in the world (above, left, bottom left).

Banda Sea

Nutmeg fruit (below) is used in local dishes, as well as the seed and red aril, or seed casing, which can be seen when the fruit splits open (bottom right).



Nutmeg and cinnamon are still grown and exported here. These plantations once belonged to the Dutch East India Company, and in the small museum in town, our guide told us the terrible history of the enslavement of the local population as the trade in valuable spices such as nutmeg and cinnamon developed. Today, the plantations earn a small additional income from visitors.

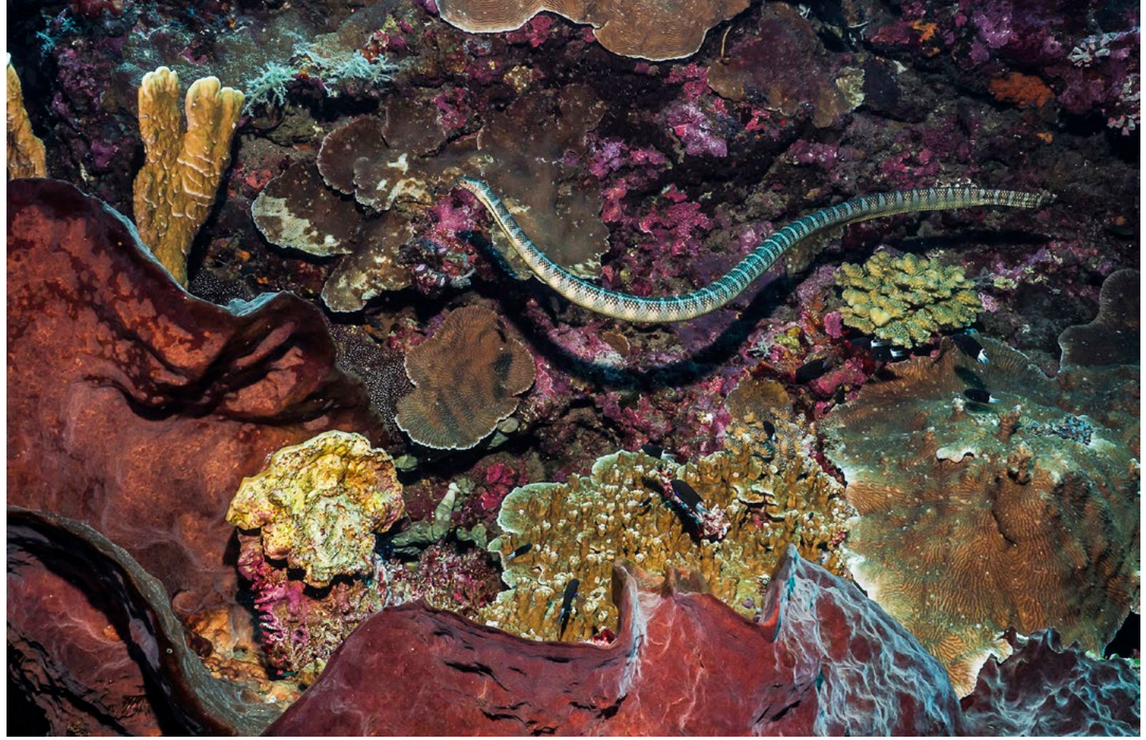
Homemade bread with nutmeg jam was served with nutmeg cake and tea. In Europe, only the dried seeds of the nutmeg fruit are known as a spice. However, the yellow fruit around the seed is sweet and is used in many local dishes. The red aril, or seed covering, around the core, which is visible when the ripe fruit bursts open, is particularly valuable. This is also dried and sold as mace, a spice with a similar but more delicate flavour to nutmeg.

After returning from the shore excursion and a little refreshment on board, a special night dive was scheduled to see the colourful mandarinfish that can be seen in the town harbour in the evenings. Just in time for dusk, they emerge from their hiding places in large numbers, while above the surface, local children jump from the harbour wall into the water, almost on top of the divers' heads. While mandarinfish are often rather shy elsewhere, they were not shy here at Banda Neira.

The plastic problem

The beauty of the reefs in the region can make it easy to forget a significant problem in the area. It was only when we visited the islands on land that we realised that single-use plastic had no place in this society. Vegetables were grown, and fishing was commonplace among the locals. Almost everyone had a few chickens in the garden. But the islands were also supplied with food and goods by boat once a week.

Like in our supermarkets, modern goods and electronics come in plastic packaging. However, there was no way to dispose of this plastic on the islands—let alone recycle it. There was no garbage collection and no yellow bags. So, where did the plastic waste go? We saw it piled up on street corners, behind walls and at the edge of the forest. Here, it was either burned or simply left



lying around, eventually to be overgrown with plants. And the piles got bigger every day.

Fortunately, the reefs are currently spared from this plastic waste. The dive sites were beautiful, with lots of corals of all kinds and, of course, beautiful barrel sponges of all sizes. And there was something else in abundance—snakes!

Water snakes

Water snakes dive to search for prey between the corals. These highly venemous animals are peaceful as long as you leave them alone. Do not harass them, especially as they ascend to the surface for air. If you remain still, you may also be able to see them up close.

As a diver's view to the sides is restricted by a dive mask, there can often be moments of surprise when a snake suddenly crosses your line of vision, very close. We also cannot see what is happening behind us. It is, therefore, advisable to look around calmly from time to time and give the snakes plenty of space.

On to Manuk

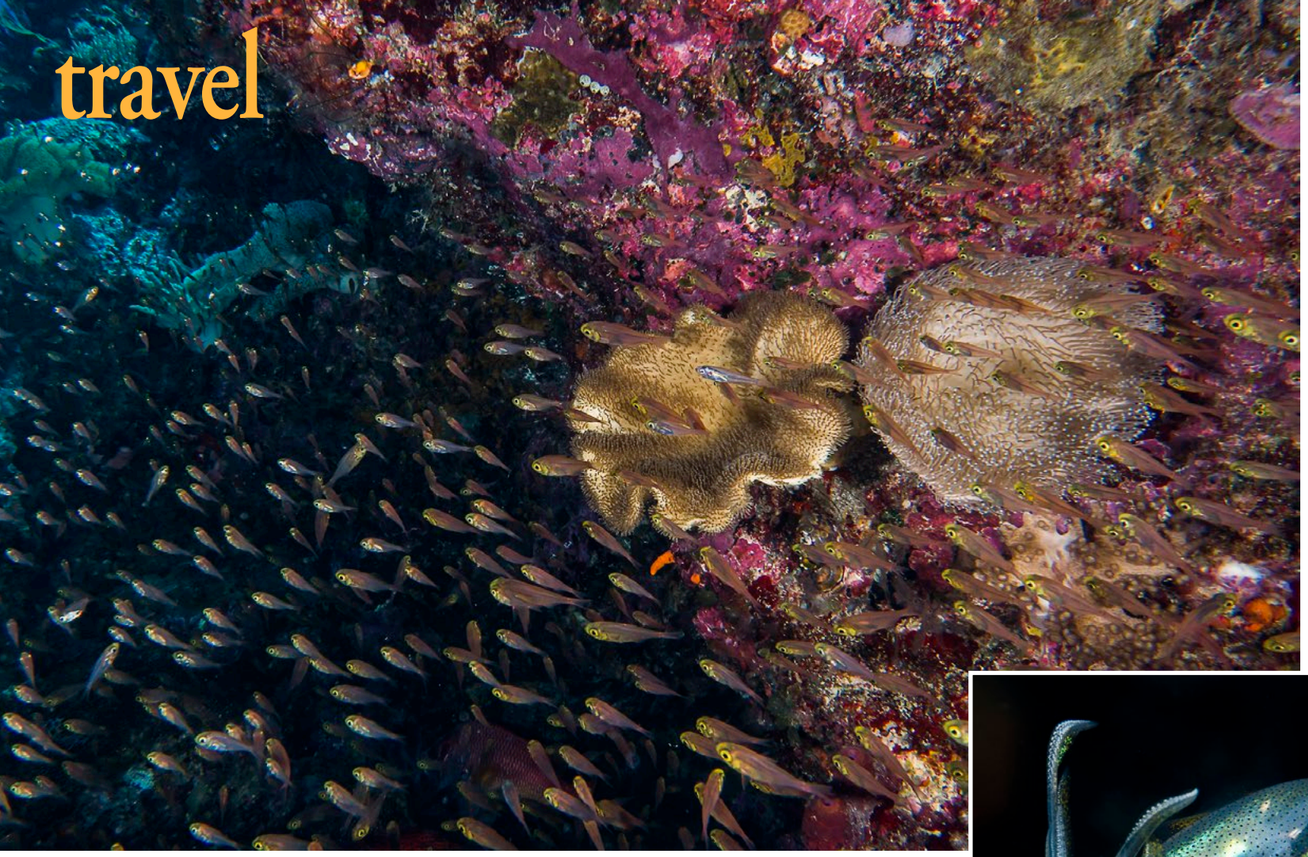
We sailed through the night to reach another volcanic island 100km (~62mi) away in the middle of open water, with no land in sight. This was Manuk, or Snake Island. The top of its volcano juts out of the water, and clouds of sulphurous steam still rise—evidence that volcanic activity is still omnipresent. The lush green of the island disguises this activity. However, the sulphurous smell that sometimes hangs in the air does not. Underwater, you can also see yellow areas with sulphur deposits in the black sand.

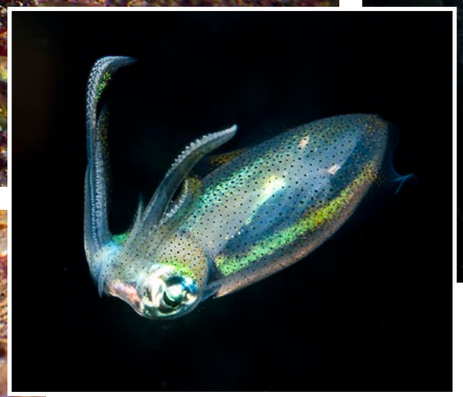
Once again, we came across a lot of water snakes. Their venom is stronger than that of the king cobra. Our dive guides had a healthy respect for them. They said dive suits should fit tightly all over the body so that a snake does not accidentally get caught somewhere in the suit and bite you in a panic. That would be fatal as we were far from any hospital. There was no cell phone reception, not even via satellite. We were far from civilisation, so calling for help was not an option.

But we kept calm and enjoyed our dives on the beautiful reefs around Manuk, which were intact, healthy and simply beautiful to look at. Fishing boats rarely came here, so the amount of marine life and biodiversity was very high. The volcanic island was an oasis in the middle of the open sea.

It was also clear why there were so many snakes. Water snakes need land. They do not

Sea snake swimming over reef (above); Coral grouper and chromis shelter under large cabbage corals (top left); Reef scene with leather corals (left)





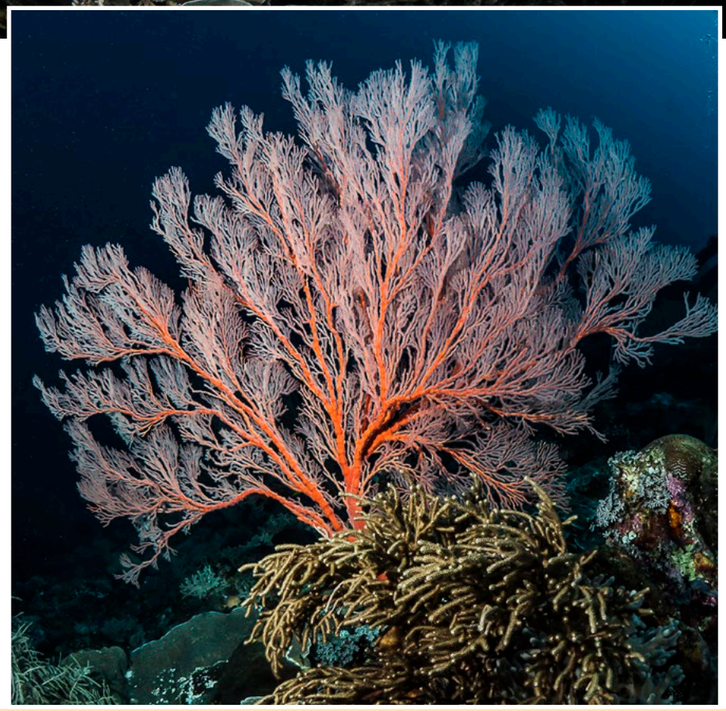
Large colony of cabbage coral (above); Large sea fan on reef (right); Squid on night dive (centre)

Banded coral shrimp with brood of eggs under its abdomen (above); Swarm of glassfish on colorful wall with leather corals (top left)

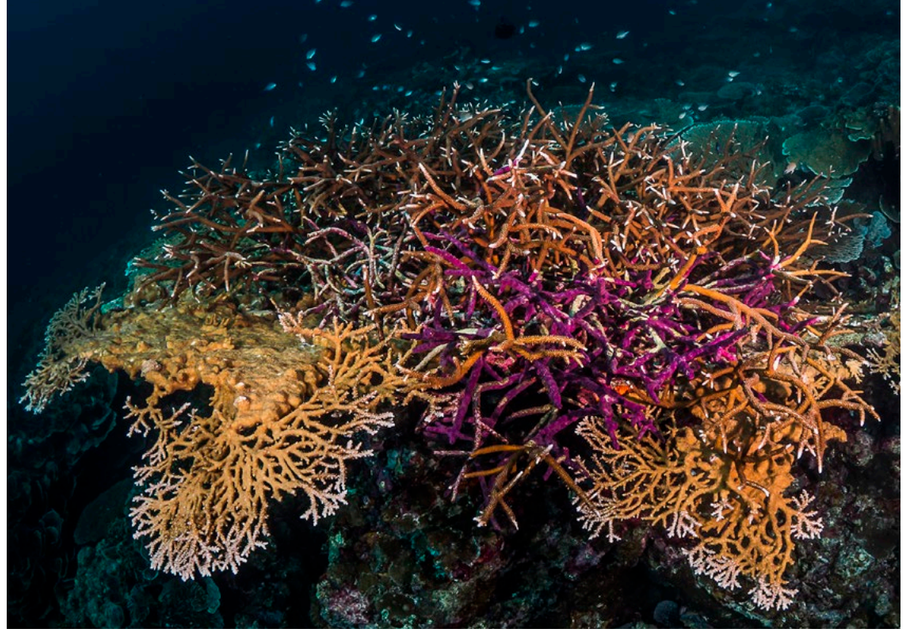
live exclusively in the water. They usually spend the day in caves and crevices on land, curled up with many of their own kind. At night, they go out to hunt. And they lay their eggs on land.

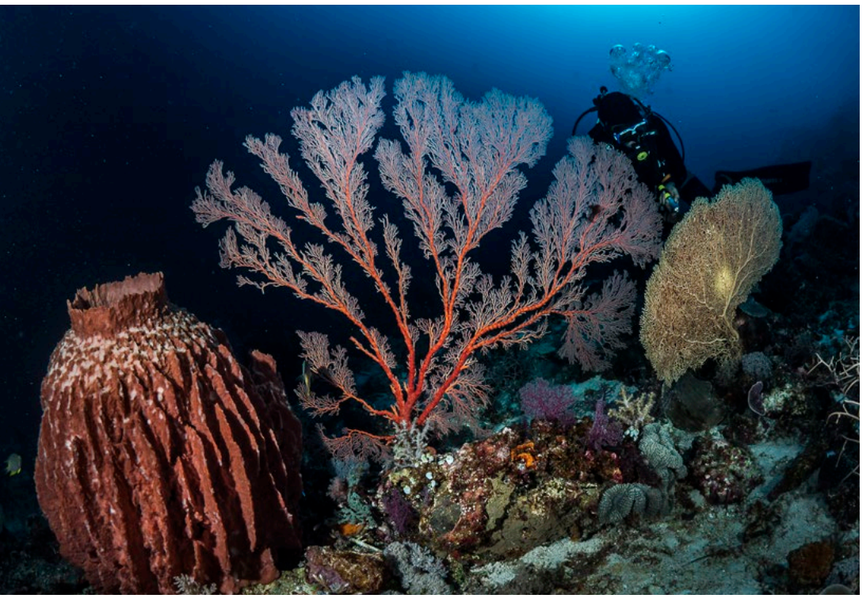
Nevertheless, many snakes also go out in the water during the day to search for prey. But this is only because there are fewer birds of prey on the remote islands in the Banda Sea, which are the snakes' only threat. However, you can sometimes see birds of prey diving to catch a water snake and carry it away.

Over the course of evolution, the bodies of water snakes have become increasingly flattened, and a real fin has developed at the end of the tail, making it easier to swim in the water. Interestingly, water snakes often work with large mackerels as they hunt together. The snakes drive the prey fish out of their burrows, and their reward is a few pieces of fish left over by the mackerels, which cannot hunt in the narrow cervices themselves.



Chromis and damselfish on staghorn corals (right). Dense schools of glassfish on reef with sponges and leather corals (far right). Broadclub cuttlefish (bottom right). *Hypselodoris tryoni* nudibranch (centre). Diver with sea fans and giant barrel sponge at Yamdena (below).





Yamdena

Our journey continued south to the coast of Yamdena. Strips of coral reefs have formed on the edges of shallow lagoons with mangroves. The water was flooded with sunlight that shone through large sea fans and hard corals. We still had two more days of diving ahead of us, and we had not seen another dive boat the whole time. Like everywhere else on our trip, we had the dive sites all to ourselves. With the divers divided into four small groups, each with a dive guide, the dives were relaxed, and there was a lot to see. Individual dives without a group were the hallmark of this trip, which could not have been better.

After 12 days of diving, with three to four dives a day, we entered the port of Saumlaki with our camera memory cards full to the brim of wonderful impressions of the Banda Sea—both above and below the water. The coral reefs here were unique and in no way inferior to those in well-known places like Raja Ampat.

Overwhelmed by the beauty of the Banda Sea and the peace and isolation of the Forgotten Islands, it was hard to say goodbye. The crew and our tour managers had grown on us, and we had made new friends and acquaintances with the other guests. Indonesia has so many wonderful places to visit, and we look forward to our next trip on the *Gaia Love*. ■

REFERENCE: WIKIPEDIA.ORG

For more information, visit: ***divegaia.com***

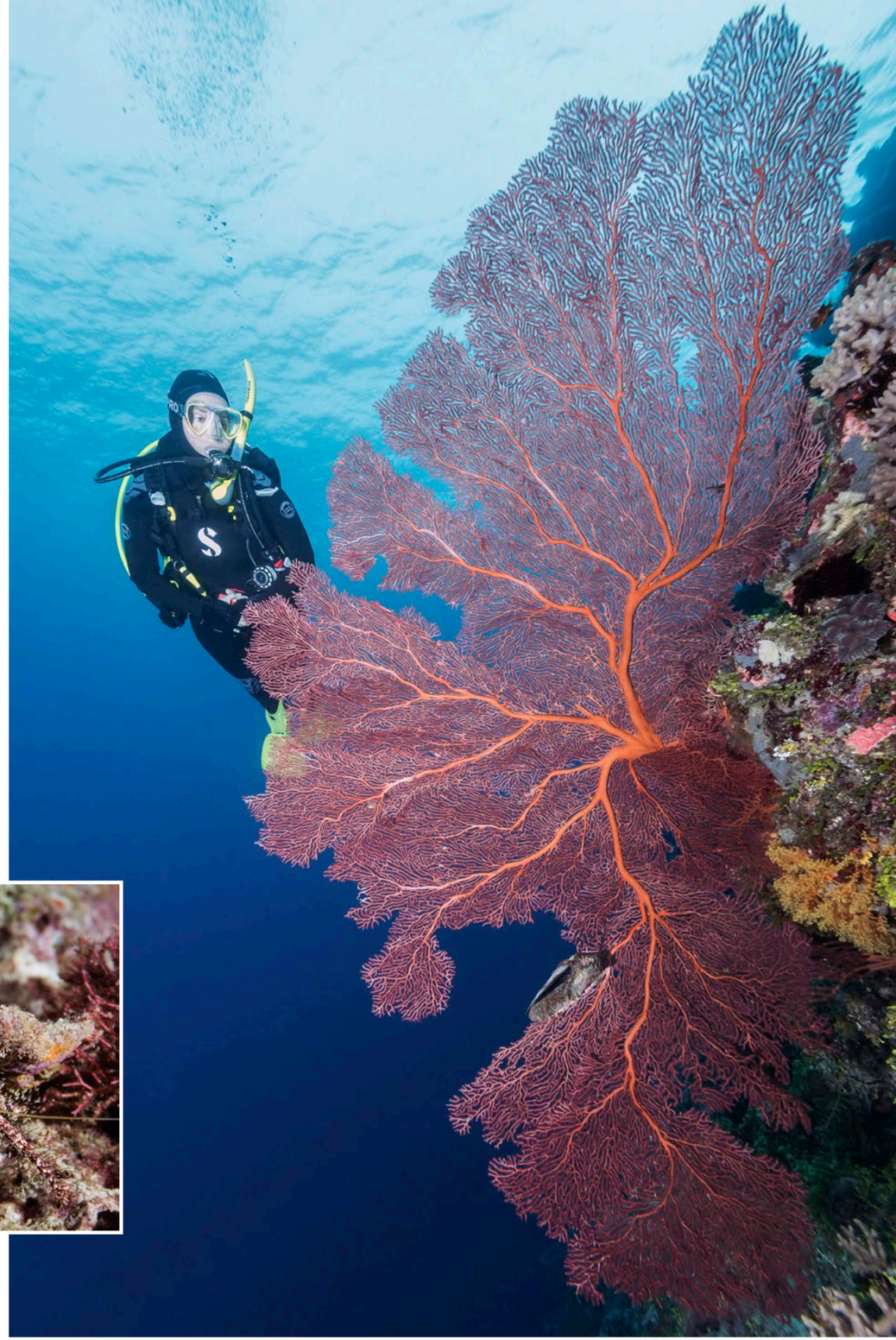
Watch Dive Gaia videos:
youtube.com/watch?v=gK0WnO_517o
youtube.com/watch?v=qKWDvNeiFrQ&t=64s
youtube.com/watch?v=K2jgTpEfEw4

Claudia Weber-Gebert is an advanced diver, underwater photographer and dive writer based in Germany. Her latest book, Maare, Quellen, Wasserfälle: Die faszinierende Unterwasserwelt der Vulkaneifel (Maars, Springs, Waterfalls: The Fascinating Underwater World of the Volcanic Eifel), *is available at* ***eifelbildverlag.de****. For more information, please visit:* ***design-buero.org/Unterwasser-Fotografie****.*

Solomon Islands

Pristine Reefs & WWII Wrecks

Text and photos by
Matthew Meier



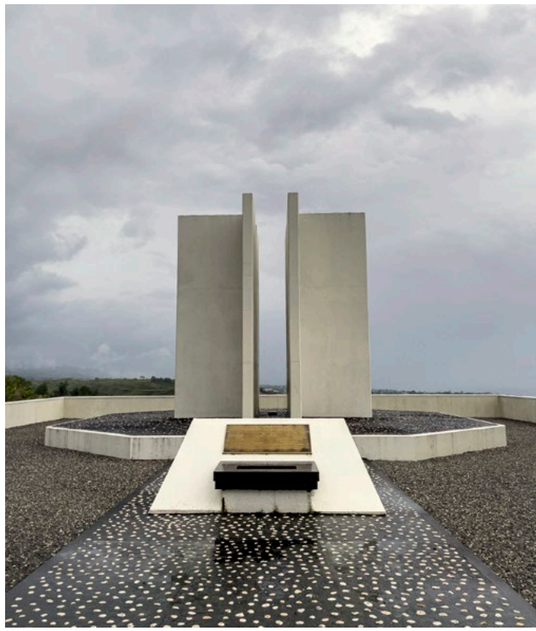
A massive purple elephant ear sponge (previous page) and large orange elephant ear sponge covered in white sea cucumbers, *Synaptula* sp. (above), at the Florida Islands in the Soloman Islands

The Solomon Islands, located in the southwestern Pacific region of Melanesia, offer divers a plethora of underwater experiences, from pristine coral reefs to World War II wrecks. Matthew Meier tells of his return to this island oasis, where remnants of the islands' military history can be viewed on land and under the sea.

I had the privilege of visiting the Solomon Islands in the summer of 2017, 75 years after Allied troops came ashore to launch the Battle of Guadalcanal on 7 August 1942. After nearly three weeks of amazing experiences, I reluctantly departed and vowed to return. In February 2024, I was finally able to do so, and this time, I was excited to introduce my wife to the remote beauty of the Solomons' pristine coral reefs and the islands' vast WWII history on display both above and below the water's surface.

Returning to the Solomon Islands, I was curious to see what had changed, how the reefs had fared and what impact the COVID-19 pandemic might have had on the country. Like other Pacific island nations, the Solomons closed its borders to outside travel in early 2020 and was one

Diver with huge, red gorgonian sea fan on a reef wall (above) and a purple and red hermit crab on a night dive (center) at the Russell Islands in the Solomon Islands



At Guadalcanal Island: Panoramic view from the hilltop of the Battle of Bloody Ridge (top right); Wreckage from a Grumman F4F Wildcat fighter plane that crashed onto the island during WWII (top left) and a Japanese Type 96, 15cm howitzer cannon left on the island after WWII (bottom left) at Vilu War Museum; Monument to the Battle of Bloody Ridge, which took place during WWII on a hill overlooking the airport in Honiara (above left), plaque (above right) at the Japanese War Memorial (right) for the Japanese soldiers that fought and died in the Solomon Islands during WWII.

of the last countries to reopen over 800 days later. Since then, the number of tourists has steadily increased, and for the first time ever, Guadalcanal even hosted the Pacific Games in the fall of 2023. The newly completed Honiara Sports City Complex was the venue for this athletic competition, which was a precursor to the 2024 Summer Olympics, featuring 24 teams from the region's 22 countries and territories, plus a contingent of athletes from Australia and New Zealand.

Historical tours

Our adventure began with two days of land tours on Guadalcanal, visiting WWII museums, memorials and battlefields before boarding our live-aboard for ten days on the water. We had hoped to incorporate a couple of shore dives on local shipwrecks, but plans had to change when heavy rains created silty runoff from nearby rivers and creeks, drastically diminishing visibility.

Flights to Honiara via Fiji, the most direct route from the United States, currently land only three days per week, so divers will likely have a couple of days on the front and/or tail end of their dive trip to explore the area. I highly recommend scheduling flights to arrive early just in case there are any issues with delays or lost luggage.

Situated 15 miles (24.5km) west of the capital city of Honiara is the Vilu Military Museum. This jungle-esque, open-air facility is run by a local family who charges a nominal fee to walk among the numerous remnants collected after the war. The grounds are lined with Japanese anti-aircraft guns, cannons, machine guns, ammunition, the wreckage of several airplanes and multiple granite memorial monuments dedicated to the souls lost during the war. The experience is a fascinating glimpse into the island's military history and well worth the bumpy, hour-long drive and the necessity for bug spray.

Near the museum is the final resting place of a WWII US B-17 (Flying Fortress) bomber, one of the wrecks we had hoped to dive. The wings, fuselage and cockpit remain nearly intact and lie just offshore in less than 60ft (18m) of water, where it came to rest after being damaged by Japanese fighters during a bombing raid on 24 September 1942. The tail section was removed and recovered in January 1944 by members of the 61st US Navy Seabees, and no human remains were discovered. Official records indicate that two of the eight crewmembers on board made it to shore after the crash, though neither survived long enough to tell their tale, and the fate of the six remaining crewmembers is unknown.

Wrecks and monuments

Continuing east, back toward Honiara, there are three shore-dive-accessible Japanese shipwrecks. They were all bombed by US aircraft on 15 October 1942. Closest to the B-17 is the *Kyusyu Maru*, a 466ft (142m) cargo vessel that ran aground after being bombarded. Initially, its bow stuck far out of the water, but over the years, it has succumbed to the depths, having withstood various salvage operations and possibly being the subject of target practice by US bombers after the war. The wreck is now completely submerged and lies at a 45-degree angle to the shore, from a depth of 10ft (3m) down to 148ft (45m). The

Diver and pink anemonefish in large, green and purple carpet anemone on top of a sea mount (above), lionfish (right), and speed boat heading to Fonagho Point to pick up divers (far right) in the Russell Islands.

Hirokawa Maru and *Kinugawa Maru* rest a short drive farther east, just offshore of Bonege Beach, with a small portion of the *Kinugawa* still protruding from the water.

On a hill west of Honiara and close to the current international airport (Henderson Field) is a monument to the Battle of Bloody Ridge, which took place 12-14 September 1942. Over the course of those two days, over 800 US Marines, under the command of Lt. Col. Merritt Edson, successfully repelled Japanese forces in a battle that was critical to maintaining control of two airfields, Henderson Field and Fighter One Airstrip, and with them the entire island of Guadalcanal. During the battle, the Marines suffered 57 casualties, and another 232 were wounded, while at least 1,214 Japanese soldiers perished. It is hard to put into words the somber feeling I had standing on that hill over 80 years later, with shallow foxholes still evident, trying to fathom what it must have been like to experience that kind of fear, devastation and loss of life.

The last site we were able to visit was the Japanese War Memorial, also known as the Solomon Peace Memorial Park. This simple yet elegant stone edifice and garden, located on a hill overlooking Honiara's harbor, was dedicated in 1980 as a place of repose for all those who sacrificed their lives during WWII on Guadalcanal and throughout the Pacific Theater. If you know just where to look, it is possible to see the American War Memorial from the Japanese Memorial on a distant neighboring hilltop. We had hoped to tour the American Memorial the morning after our dive trip but had to postpone due to a torrential downpour.

Variable conditions

January and February are traditionally the rainy season in the Solomon Islands, and while climate change has made weather patterns less predictable around the globe, rain, wind and sea conditions forced altered plans several times during our trip—all part of the adventure and an important reminder to be flexible and curb expectations when traveling. Mother Nature is always going to win.

We boarded our floating home for the next ten days late in the afternoon on 30 January and proceeded with the usual introductions, paperwork, boat safety briefings and room assignments before reconvening for our first dinner together while still tied to the dock. The captain departed around 11 p.m. and attempted the open ocean crossing to the Russell Islands against a 9-13ft (3-4m) swell. For the next few hours, we drove west into the pounding waves before the decision was made to change course and head for the Nggela Islands, commonly known as the Florida Islands, in hopes of calmer seas. We were going to get a taste of WWII wrecks earlier than expected on this trip.

Florida Islands

H6K Mavis seaplanes. North and slightly east of Honiara, across the Iron Bottom Sound, are the Florida Islands. During the war, the Japanese had multiple strategic bases here,

Ternate chromis and lemon damsels on coral bommie at the Russell Islands (right)

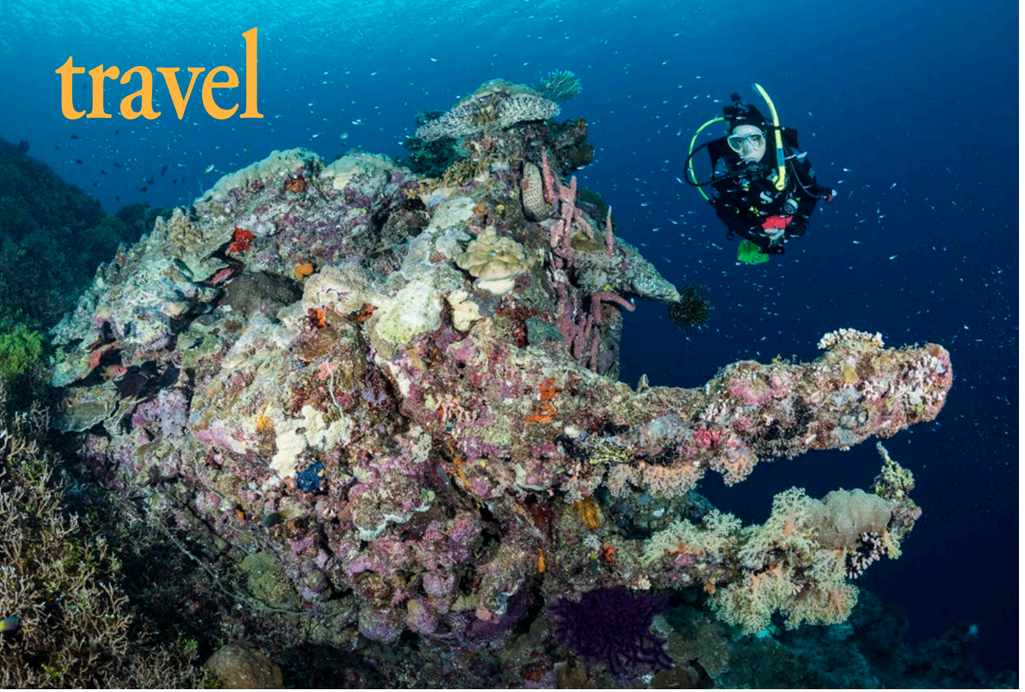
At Tulagi, Florida Islands: Diver at the nose of a WWII US PBY-5A Catalina seaplane (top left); The attached underwing pontoon, sitting upside down (above), and the fuselage and cockpit (top right) of a WWII Japanese Mavis airplane that sank on 7 August 1942 at the Tulagi Seaplane Base.

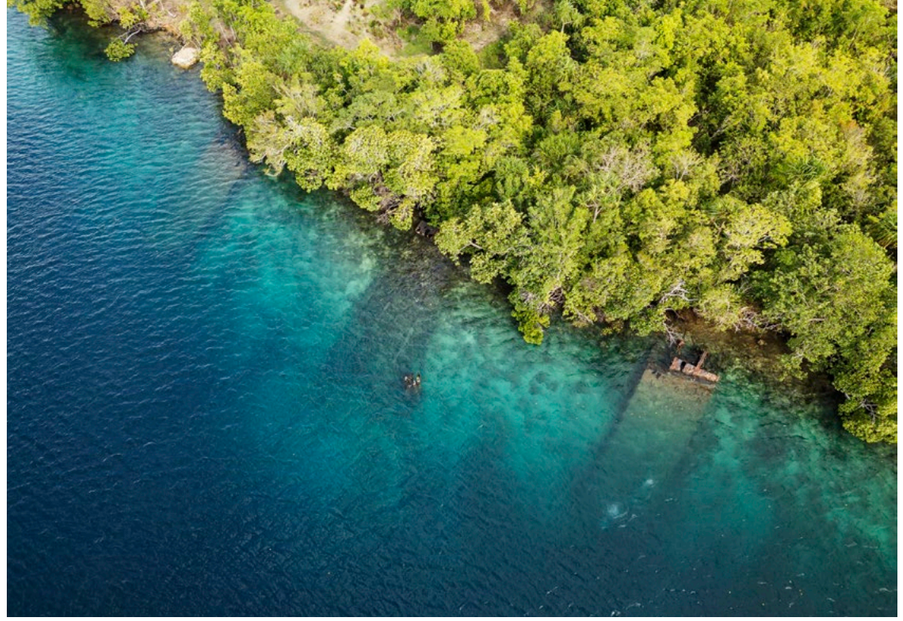
including one with over a dozen seaplanes, all of which were sunk as part of the secondary prong of the initial Allied invasion on 7 August 1942. Several of these H6K Mavis seaplanes have been discovered in subsequent years, and we had the opportunity to dive on wrecks numbered 5 and 6. Both planes rested in over 100ft (30m) of water and were amazingly well preserved after more than 80 years below the surface. I am happy to report that I did not see any major changes to either wreck since my last visit.

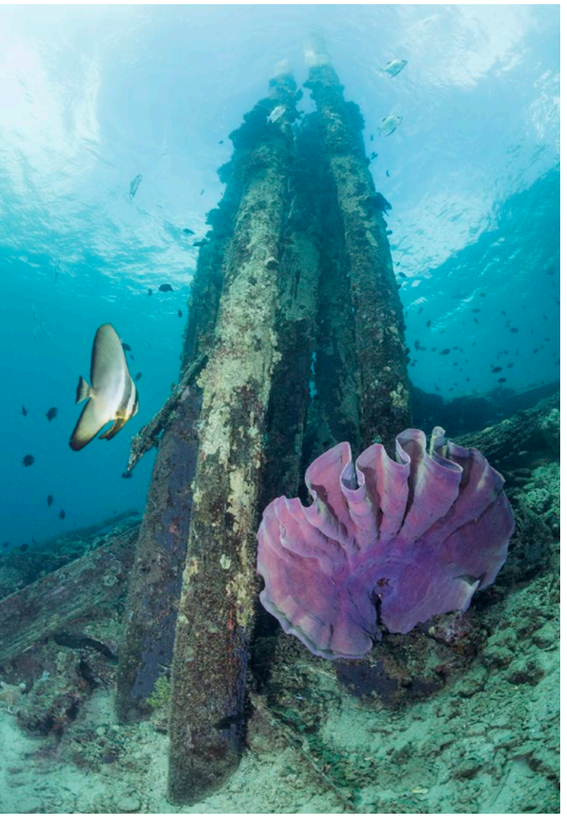
The huge wings of Mavis 6 were twisted on top of one another, tearing a hole in the fuselage behind the cockpit, allowing divers a peek inside at the intact gauges and the pilot's yoke and seat. The float that once supported the right wing was now inverted and covered with soft corals, sponges and a huge school of glassfish. The nose cone of Mavis 5 was pushed upward, presumably from the impact with the sandy bottom, although the left wing was still attached with both engines in their mounts. The tail section had two impressive vertical stabilizers that were also intact; however, with the recent rains, our visibility did not allow us to see both at the same time.

Near the Mavis wrecks, we dived on the remains of a US PBY-5A Catalina seaplane that was sitting upright on the seafloor at 108ft (33m). Its wings were attached and resting on their floats, and the left engine had fallen off its mount and was propped up in the sand on two of its three propellers. Machine gun bullets were still visible along the rear fuselage, and the left wing was missing the same number of panels as it had seven years ago.

Garbage Patch. The Garbage Patch dive site in Tulagi Har-







Longfin spadefish, diamondfish, purple elephant ear sponge and wooden pier pilings from WWII at White Beach

At White Beach: Diver and glassfish at a forklift from WWII, encrusted with colorful corals and sponges (top left); Three piers that were sunk by the US military after WWII (top right); Diver and glassfish above a truck cab from WWII (right)

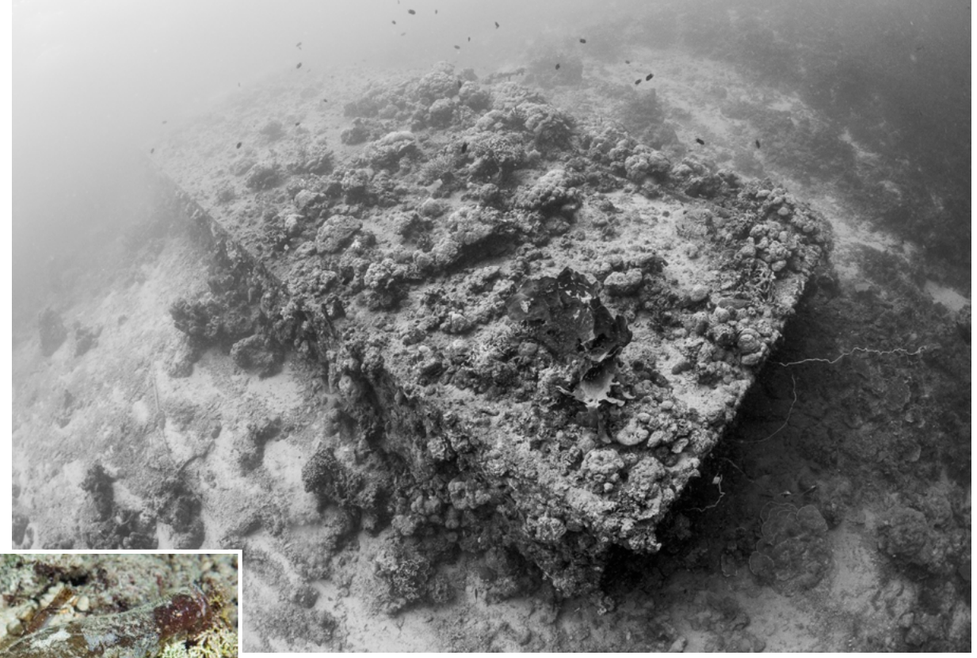
bor was another captivating spot to see wreckage. Here, the bottom was littered with discarded tires, ammunition, scrap metal, oil barrels, anchors, entire ships and the bow of the USS *Minneapolis*, a WWII New Orleans-class cruiser. The port was used as a ship repair dock for many years, and what could not be salvaged was apparently just thrown into the water or intentionally sunk.

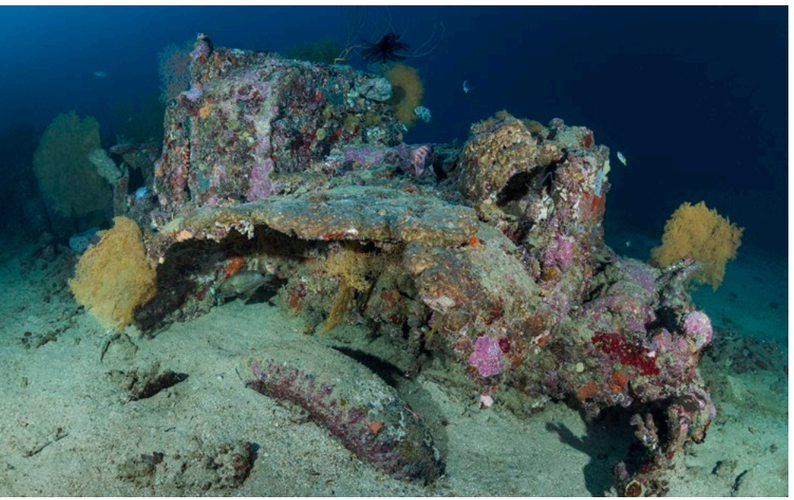
We made several reef dives to supplement the wreck diving around the Florida Islands, and I am pleased to report that the corals remain in excellent shape. The Solomons have some of the largest elephant ear sponges I have encountered, and they come in a brilliant purple color, as well as an orange and green variety. A number of them were easily over 10ft (3m) across, and we found a few that were inundated with a horde of white sea cucumbers. There were also large sea fans, huge domes of encrusting corals, a multitude of colorful soft corals and the always crowd-pleasing energetic baby sweetlips.

Russell Islands

After two days of diving, we made the overnight crossing to the Russell Islands through a series of scattered thunderstorms. Thankfully, the seas were a little calmer than on our first attempt, and the captain slowed our transit to allow for a slightly smoother crossing.

Located roughly 30 miles (48km) northwest of Guadalcanal, the Russell Islands consist of two small main islands surrounded by dozens of islets, all of which are volcanic. In 1943, as part of American mili-





At White Beach: Diver with tractor encrusted with colorful corals, sponges and sea grapes (top left), glass Coke bottle (above), and submerged floating pier (top right) from WWII; Diver with purple elephant ear sponge, staghorn corals, ternate chromis and endemic goldhead damsels, with wooden pier pilings from WWII in the background (right); Jeep from WWII buried in the sand at 120ft (left)

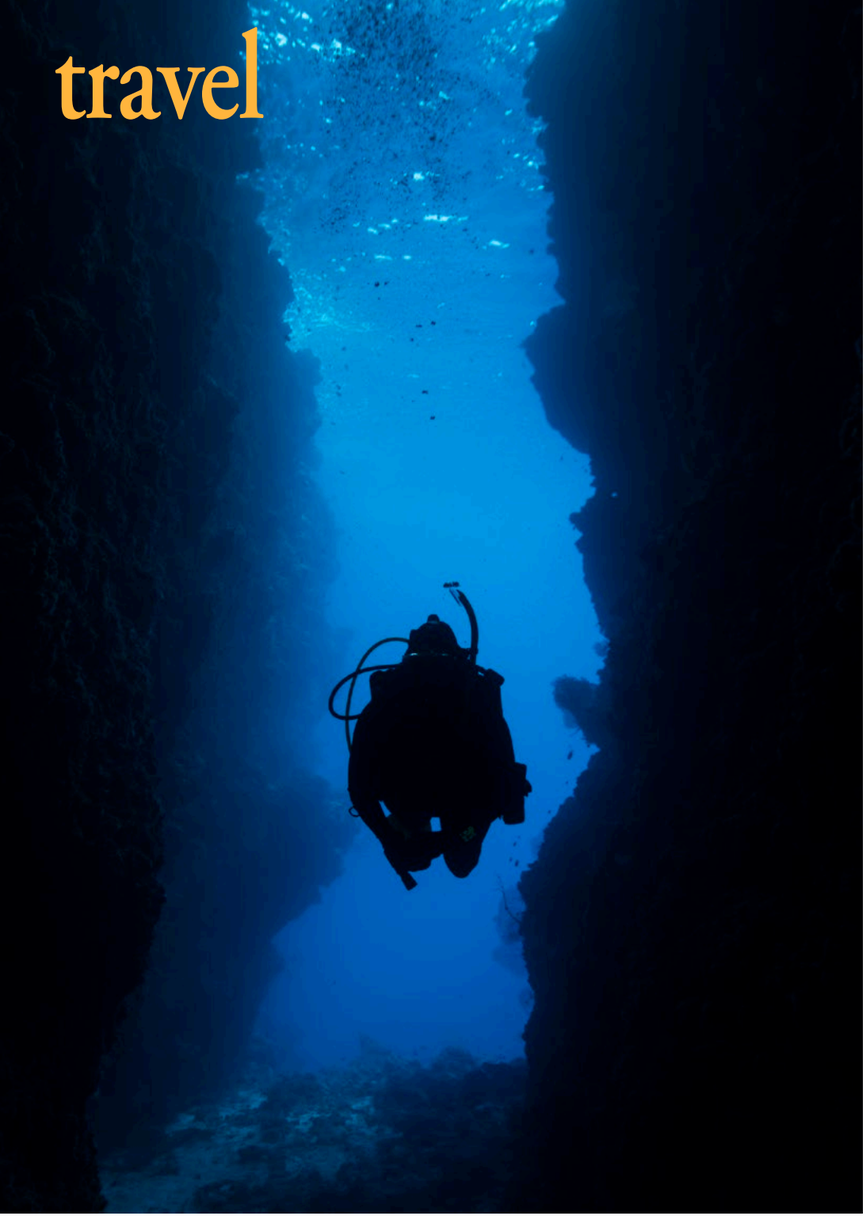
tary operations during WWII, the US Navy erected a large base in the Russells on the island of Mbanika and also established a supply base on the islet of Hai, code-named White Beach.

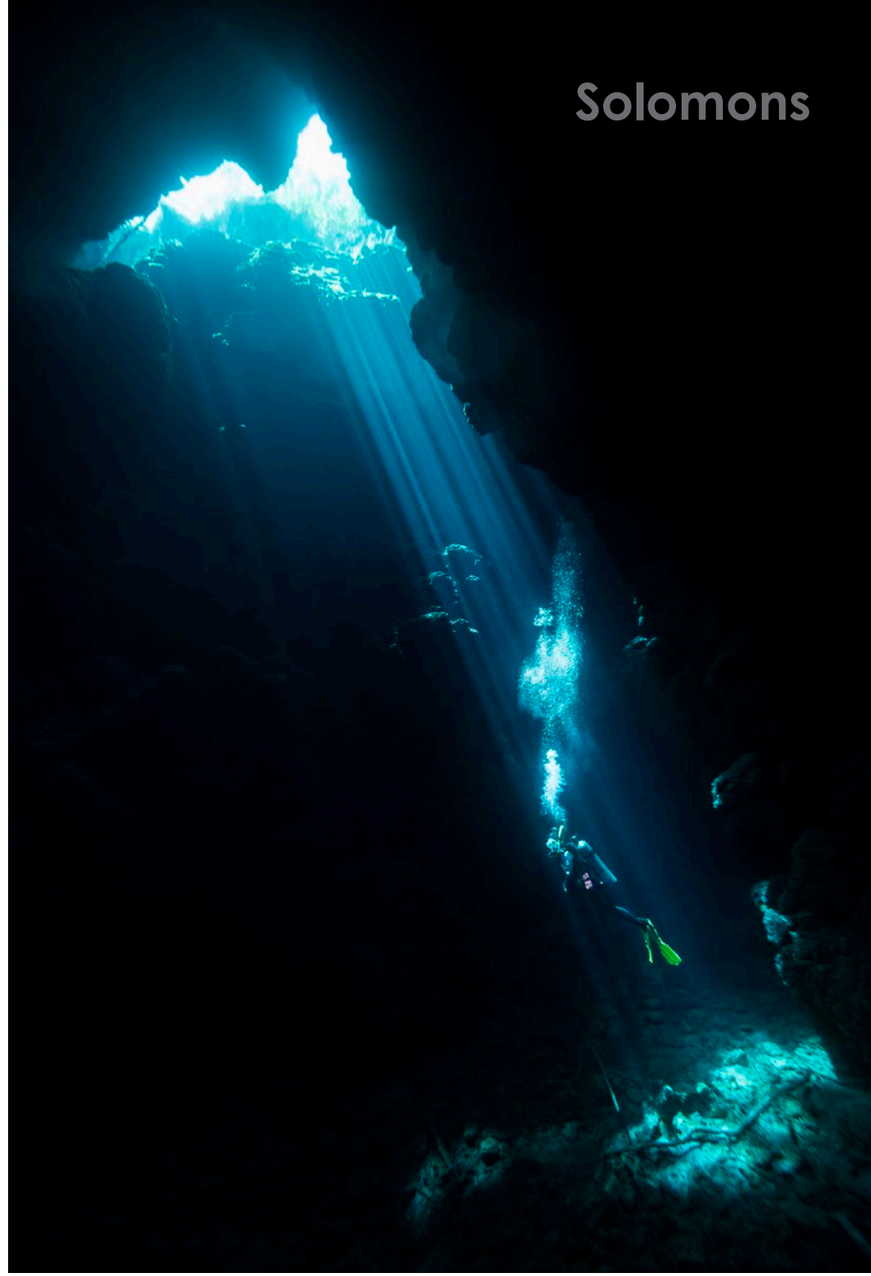
White Beach. One of three main supply depots used during WWII (Red, White and Blue), White Beach has become a dive site famous for the assorted equipment and floating piers that were dumped into the water at the war's end. Here, divers will find trucks, jeeps, tractors, forklifts, bulldozers, ammunition and 80-year-old glass coke bottles, all encrusted with multicolored corals and sponges.

A few of the pier pilings were still intact, rising above the water's surface, and the three submerged piers stretching out from the shoreline were clearly visible from the air. These unintentional artificial reefs appeared to be in similar condition after my seven-year absence, although a few had previously unseen colonies of green sea grapes growing across their structures.

Due to the sheltered nature of this site, we moored overnight and made a series of dives here over several days as the crew had to get creative with dive site selection due to weather restrictions. With repetitive dives, I was able to photograph a jeep resting upright at 120ft (36.5m), which we had not been able to locate on my first trip. Along the shoreline, archerfish could be found hunting among the mangrove roots, as well as a large school of diamondfish hovering in the shallow water column.

Another highlight for me was a night dive in search of flashlightfish. These deep-sea residents migrate to the shallows at night and are known to congregate inside one of the submerged piers. The dive produced at least four different species of crabs, numerous lionfish hunting among the rubble and a yet-to-be-identified octopus camouflaged against the substrate, but sadly, no flashlightfish.





At Russel Islands: Diver in Leru Cut (left), in the opening of a small cavern (above), and with sun rays penetrating the main cavern of Kastum Cave (far right). Local village children sold fruits and vegetables in dugout canoes (right and lower right).

Topography

Carved into the various islands and islets are an array of spectacular caves, caverns, inland ponds and cuts that have become some of the Solomons' most iconic dive sites and are the result of the islands' volcanic origins.

Leru Cut is perhaps the most well-known, consisting of a knife-edge gap in the rock of Leru Island, 10 to 15ft (3 to 5m) across, 30 to 40ft (9 to 12m) deep and extending 300 to 400ft (92 to 122m) into the island, with a canopy of trees overhead. The resulting thin vertical profile of blue water between black rock walls with a diver in silhouette is instantly recognizable. On a sunny day, there is a brief window of one to two hours when one can also see fabulous rays of light streaming down into the opening, although I have yet to witness that phenomenon in person.

Mirror Pond. Time of day is also key for light rays at Mirror Pond. This underwater cavern has a circular opening to the jungle overhead, which can produce fantastic images when conditions are optimal. It is a must-see during your visit. On my previous trip, our guide made a pre-dive check for "geckos" (aka saltwater crocodiles), which the current crew promised had not been seen of late.

Kastum Cave features a downward sloping underwater tunnel that opens into a 50 to 60ft (15 to 18m) high cavern with a small unobstructed view of the sky above, producing impressive floor-to-ceiling light rays when timing and Mother Nature cooperate.

Intervals and interactions

During surface intervals, life on the boat consisted of sharing dive stories and experiences with fellow passengers, rinsing gear, getting scuba tanks refilled, working on underwater cameras, occasional naps, reading books or playing card games, replenishing fluids and an abundance of good food. Most of the provisions were loaded on board before departing Honiara, but the chef was able to enhance the ship's selection of fresh fruit, vegetables and fish by purchasing supplies from local villagers, who paddled out from shore in wooden dugout canoes in what

Diver (left) and superstructure at stern (above) on Wreck of Ann, Russell Islands

Pair of whitetip reef sharks mating among the corals and rubble on top of a sea mount in the Russell Islands (above)

is always a special encounter.

On one particular occasion, we had half a dozen canoes around the back of the boat, filled primarily with blond-haired children selling their wares. Solomon Islanders and other inhabitants of Oceania have a gene in their DNA that produces blond hair in roughly 5 to 10 percent of the population, similar to the percentage of blondes in the rest of the world; however, researchers have determined that the characteristic arose completely independently of European influences. It is a fascinating and beautiful trait.

Our original 10-day itinerary was to include a visit to Marovo Lagoon, which involved a lengthy overnight open-ocean transit to the west of the Russell Islands. The lagoon has fabulous coral gardens, including many species I had only encountered in this area, not to mention some of the largest sea fans I have ever seen. I had hoped to revisit a local village to spend time with and photograph the locals, learn more about their way of life and potentially augment my collection of ocean-themed wood carvings, as Marovo Lagoon has some of the best wood carvers in the world. Sadly, the sea conditions did not allow us to make the crossing safely. So, we spent a few extra days sampling the remarkable diving in the Russells, and the crew was also able to coordinate a local village tour. We were treated to a performance of traditional song and dance, and one lucky guest had an adorable child follow along, holding hands with them for the entire visit.

Bonus diving

We investigated dive sites that we would not have had the chance to see on the normal route, finding stunning coral gardens teeming with reef fish, huge sea fans, numerous species of clown fish, including the endemic white bonnet anemonefish, a large congregation of spawning surgeonfish and even a pair of mating whitetip reef sharks thrashing around on the seafloor. The reefs were very healthy, with only minimal signs of brown algae growth in a few select spots, and while I was unable to make comparisons from my previous visit, I would say that they had fared quite well during our absence.

Wreck of Ann. I was also introduced to a new shipwreck called the Wreck of Ann. It was an old freighter deliberately sunk as an artificial reef, stretching stern to bow from 30ft (9m) down to 100ft (30m) in the sand. The vessel's cargo hold was cavernous, and there were lots of little critters hiding among the colorful coral and sponge growth on the superstructure, making for a fun dive.

Back to the Florida Islands

In an effort to shorten our final crossing home to Honiara, and hoping to get ahead of the worsening sea conditions, we made an overnight crossing back to the Florida Islands for one last day of diving.

Large, dark green crocodile flathead fish lying in a patch of red algae on the reef, Florida Islands

Baby Cakes. Our first site was at a pinnacle called Baby Cakes, which I had navigated in a strong current during a night dive seven years ago. As luck would have it, we were in for a similar experience, as the dive guides explained that we would need to use the mooring line to pull ourselves from top to bottom.

Once down, we swam toward the point, into the current, in search of schooling fish, but along the way, I found one of my favorite photo subjects and never ventured further. Below me, perfectly nestled in a bed of red algae, was a gorgeous dark green crocodilefish. These ambush predators are prevalent in the Solomon Islands, and I saw four on my previous trip, but apparently, this time, I had to wait until our last day to be rewarded with this beauty. The struggles of pushing a large dome port into the current melted away as the opportunity to photograph this fabulous scene made it all worthwhile.

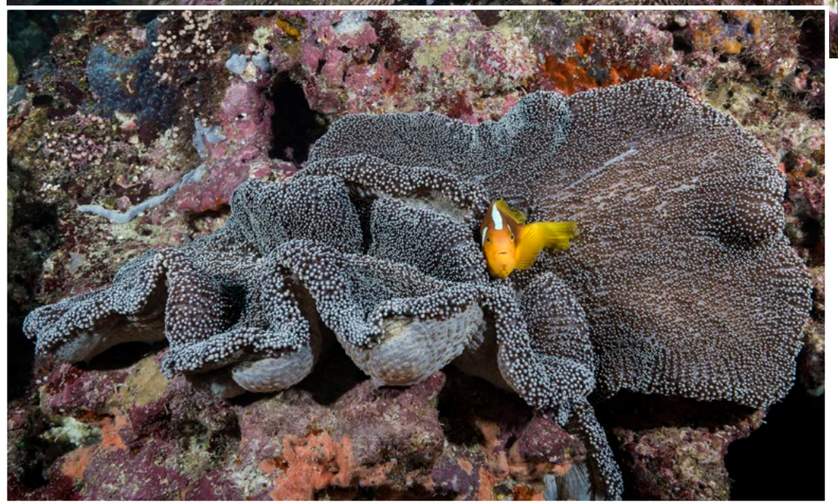
On the way back

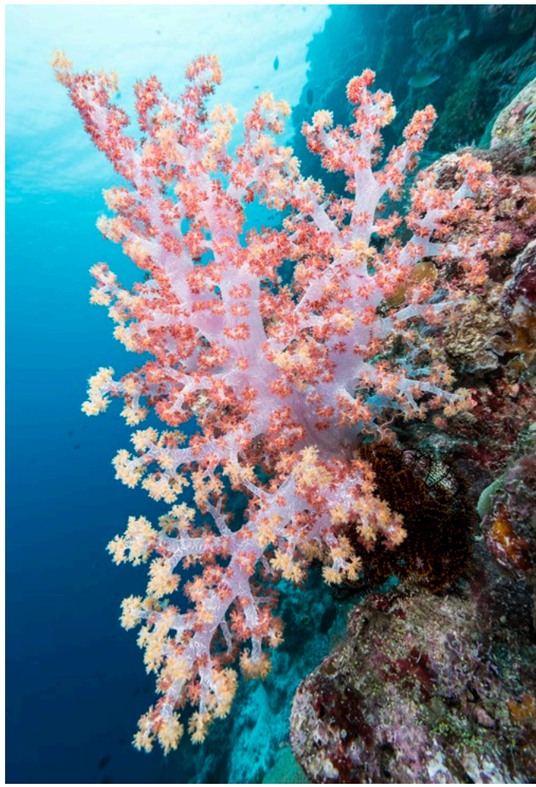
After our last dive, the captain needed to move the boat into Tulagi Harbor so we could tie up safely for the night. The shortest distance was to the west into unprotected waters, which was initially attempted but quickly proved to be too rough. Thus, the decision was made to circle around the northern and eastern sides of the island before cutting through a long channel not typically utilized by vessels of this size.

We sailed slowly down the narrow passage, past small, secluded villages and children waving from the shoreline as the sky lit up in pink and orange hues as part of a fabulous sunset. This once-in-a-lifetime opportunity was so rare that the entire crew assembled on the decks to soak in the experience. It was an evening that none of us will soon forget.

Lasting impressions

The following morning, we were back in Honiara, saying our goodbyes to guests and crew before heading to our hotel for one last night before our flight home. As always, the trip was





Diver near entrance to Bat Cave (above), sunset over the Pacific Ocean (top left), and ternate chromis over coral bommie (top right) at Russell Islands

At the Russell Islands: An octopus lying on the sea floor on a night dive (above left) and an endemic white-bonnet anemonefish, found only in the Solomon Islands and Papua New Guinea, on a large carpet anemone (above right).

Soft coral (*Dendronephthya* sp.) collecting nutrients in the current, Russell Islands

over far too soon, and despite the challenges, we thoroughly enjoyed our time in the Solomon Islands. I was glad to see that the reefs were still incredibly healthy, vibrant and isolated enough to keep them from being over-loved. Plus, I was relieved to know that the Solomon Islanders were able to endure the pandemic and were making a strong recovery.

My wife and I look forward to a return visit and highly recommend that you explore the Solomons' fascinating culture, rich WWII history and underwater wonders for yourself. ■

*Thanks go to Master Liveaboards (**masterliveaboards.com**) for hosting this adventure, Tourism Solomons (**visitsolomons.com.sb**) for their help on the ground, arranging land tours and shore diving, and Scubapro (**scubapro.com**) for their assistance with underwater dive 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, visit: **matthewmeierphoto.com**.*

Text and photos by
Daniel Brinckmann

Tuna: Majestic oceanic wanderers, renowned for their muscularity, speed and elegance, now often end up in cans sold with "dolphin-safe" labels. It is crucial to look beyond these labels and ensure sustainable fishing practices have been applied and the species in question is not endangered. Daniel Brinckmann reports.

Tuna filets at a market

Simply Too Tasty

Tuna

for Their Own Good!

Tunas are oceanic creatures that travel thousands of kilometres across the oceans in shoals. They are packs of muscle with the ability to keep their body temperature above that of the water. Unfortunately, they are so popular as food that a simple Google search for their species will inevitably return their average nutritional value, even on the main page. Whether canned, grilled, fried or served as sushi, sashimi or tartare, tunas are highly prized around the world for their firm flesh. In fact, they account for almost half of the biomass of all seafood caught worldwide.

According to estimates from the UN Food and Agriculture Organization (FAO), the global tuna catches increased fourfold from approximately 400,000 tonnes in 1955 to over two million tonnes in 1997. This level has been consistently maintained with little fluctuation ever since. It is not surprising that tuna, among other

Tuna fish in Malta (top left); Albacore tuna in the Maldives (above); Dogtooth tuna in the Maldives (left)

species, have seen their populations plummet to a tenth of their original size over the past 70 years.

If the remaining giant females had not released millions of larvae in their spawning grounds off the coasts of Africa, Mexico and the Mediterranean, the bluefin tuna species would probably have been driven to regional extinction long ago due to the desirability of its meat. Archaeologists have found evidence of chamber net systems dating back more than 2,000 years in North Africa. Additionally, in the 18th century, traders from Tyrol not only brought lemons but also salted tuna from Italy across the Alps to Central Europe.

Misleading labels?

The average consumer reaching for the usual canned food in the supermarket may only take a brief look at the "caught dolphin-safe" label but not give any thought to who the actual supplier is. The label typically depicts an inconspicuous silver fish with widely spread fins, far from the endearing image of a character like Nemo. But just because the fishing industry puts sustainability labels on its products does not necessarily mean it aligns with marine conservation efforts.

Imagine witnessing these massive swimmers, which can weigh up to half a ton and grow up to four metres long, in their natural habitat. If more people had the chance to see them in the water, they might think twice before reaching for tuna at the supermarket. Anyone who has snorkelled or dived among a school of tuna will never forget the experience. Swimming among a living wall of enormous, gleaming metallic bodies with eyes the size of fists feels like being in the midst of a tornado. It is a synchronized ballet, where each fish is much stronger than a human and can noticeably affect the water pressure with just a small

School of skipjacks in the Maldives (top left); School of bonitos in the Azores (top right)

Amberjacks, not tuna, in the Azores

change in direction.

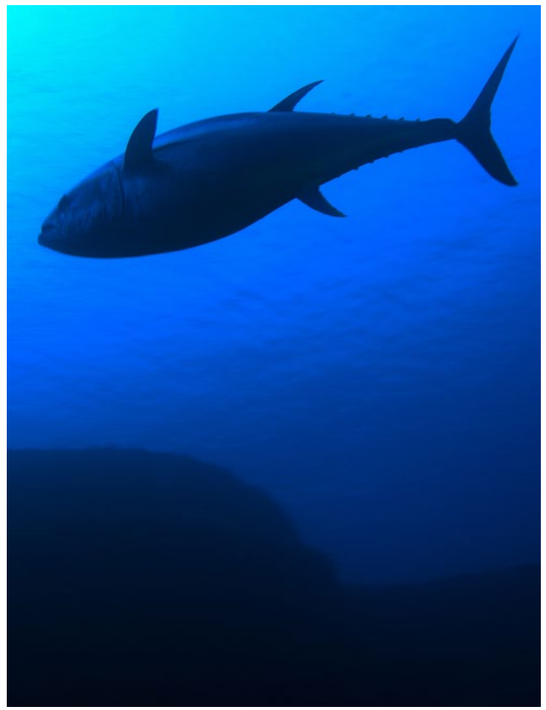
This ancient ritual, which has occurred in every ocean for countless years, has become increasingly uncommon. Up until the end of the post-war era, tuna was even spotted off the coast of the Danish North Sea and occasionally in the western Baltic Sea. However, due to the rapid rise in marine pollution and a few record years of industrial fishing, the tuna population was nearly wiped out in the 1960s. Less than two decades later, the first stocks in the inland seas, particularly in the Mediterranean, also collapsed.

Tourist attraction

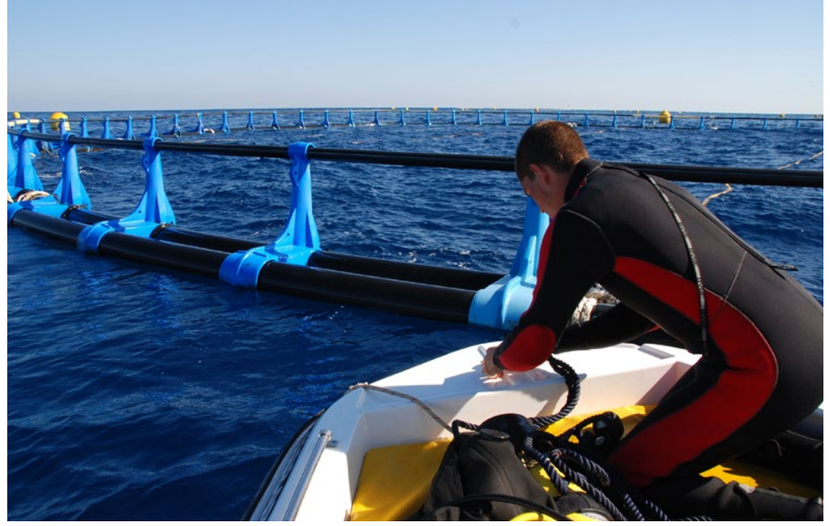
The last commercially operated tuna traps off Western Sardinia were maintained as a tourist attraction until the early 2000s despite declining fish populations. In 1954, there was a significant migration of tuna into the fjord-like bays of the northern Adriatic near Trieste, which led fishermen from various communities to quickly take to their boats for a major fishing trip. The few remaining photo and film documents from this time appear to be relics from a long-forgotten era when "tourists" were still a new phenomenon and were protected from sharks, as well as humans, by shark nets at seaside resorts such as Opatija.

When people refer to "the" tuna, they are usually talking about the bluefin tuna—a massive fish found in the temperate Atlantic. Its habitat ranges from Canada and Mexico in the west to Norway and West Africa in the east and even extends into tropical waters. During spawning, some of the population migrates to the Mediterranean, while others migrate to the Gulf of Mexico.

In subtropical marine regions with temperatures above 21°C, the largest and most sought-after species, which is considered critically endangered, can be found alongside the second larg-



Bluefin tuna in Lampedusa, Sicily, in Italy



Fishing boats with large tuna (top left) and monitoring of a tuna pen (top right) in Malta; Cans of tuna in a factory warehouse (above); Tuna market in Okinawa, Japan (left); Tuna sashimi for sale in the market (far left)

est representative of the family, the yellowfin tuna (potentially endangered), the albacore (or white tuna, potentially endangered) and the bigeye tuna, which is currently on the verge of being classified as critically endangered by the International Commission for the Conservation of Atlantic Tunas (ICCAT).

The economic relevance of the remaining five species, apart from the larger tuna and the smaller bonito (or "skipjack"), has been inadequately researched. This lack of attention is due in part to the fact that these smaller tropical species have become increasingly rare, as the industry has prioritized them less than the larger ones.

Easily spotted

The visibility of tuna has been a major factor contributing to their decline. Shoals of these large fish can be easily seen from exposed capes, even without binoculars, when they swim in shallow waters. Their hunting behaviour also makes them easy to track, as it causes a visible disturbance on the sea surface.

The Phoenicians developed a cage-like system of net chambers to catch tuna as they spawned in the Mediterranean Sea, beyond the Strait of Gibraltar. This fishing method has survived for an incredible 2,000 years. During their migration to the Mediterranean in May and June, tunas were lured into the "death chamber" at bottlenecks in their migration routes along net walls. The net was then pulled to the surface on command by the "mestre" (master or leader overseeing the fishing operation – ed.) for the final catch at the end of the season when no more fish arrive.

At the turn of the millennium,

Young tuna fish, which are caught in the Mediterranean and fattened up to become fat-rich, are known for their high quality and sold at high prices in the gourmet wholesale markets of Japan.

these almadrabas (Spain) and mattanzas (Italy) were increasingly replaced by several hundred tuna-fattening farms between the coasts of Andalusia and Cyprus. This approach makes sense from an economic perspective. Fewer animals need to be utilised more efficiently. After all, the almost complete collapse of the Mediterranean bluefin tuna around ten years ago could only be averted at the last minute with rigorously reduced catch quotas and strict controls.

Monitoring

EU fisheries observers have been monitoring every trawler and farm to ensure compliance with fishing quotas. Severe penalties are imposed whenever the specified number of fish is exceeded by a double-digit percentage. Both fisheries inspectors and fishing co-operatives are familiar with the laws and loopholes, resulting in a daily battle at sea between economic interests and environmental sustainability. As a result, fattening farms operate legally with young wild-caught tuna, which are not recorded in any statistics as live animals. These tunas are then sold at high prices through middlemen, starting at a varying minimum size.

The Mediterranean tuna, especially the ones that are exported to Japan, are known for their high quality. In gourmet wholesale markets like those in Tokyo, these tunas, which are caught as young fish and then fattened to become fat-rich, command astronomical prices in the millions.

Extensive bycatch

In the Western Pacific and the southern Indian Ocean, as well as anywhere with dense shoals that justify the operating and maintenance costs of trawler fleets, tunas are caught using drift and purse seine nets. Unfortunately, this method leads to the unintentional capture of fish, marine mammals and reptiles, including manta rays, sharks, swordfish and turtles. This unintentional capture, known as "bycatch," is so extensive that it poses a serious threat to the survival of some species due to the impact of tuna fishing.

Sustainable practices are crucial. If destructive practices go unnoticed or are concealed to keep prices low, stocks are depleted until wild catches are significantly reduced, and farmed animals become luxury items. Even the organic sections of Michelin-starred chefs and self-proclaimed soul-food icons often only highlight the evolutionary traits that give tuna its firm, deep red flesh.

No information is mentioned about the endangered status of fish and the need for moderation. There is also no reference to the significant contamination of meat with heavy metals like mercury, microplastics and other toxins, particularly in tinned tuna. While the health benefits of fish oil, proteins and omega-3 fatty acids are not in question, the current reality is that the higher a fish is in the food chain, the more detrimental it is to health.

If you are looking forward to enjoying a delicious tuna fillet, it is important to know that the fish may contain harmful microplastics and substances that it accumulated while growing up, eating other fish and so on. *Enjoy your meal!* ■

Daniel Brinckmann is a German travel journalist, photographer, and tour leader based in Neuss, who has had several hundred travel reports published in Europe. Follow him on ***Facebook*** *or* ***Instagram****.*

When you buy the Tern TX, you get two wristbands, a wireless charger and a good box to store it in (right). The two different length wristbands are easily changed without any tools (bottom right).

Review of the Shearwater Tern TX

Text and photos by Mats Gunnarsson

The Tern TX is the middle model in Shearwater's "watch series" of dive computers. The series includes the little brother Tern and the big brother Teric. Tern TX is a dive computer for more advanced sport diving, up to advanced nitrox.

It has five different modes/dive methods plus an everyday clock:

- Air: For regular sport diving with air.
- Nitrox: For regular sport diving with a nitrox mix.
- 3 Gas Nitrox: Decompression diving with three different gas mixes of air and nitrox.
- Gauge: A bottom timer that only records time and depth.
- Freediving: For snorkelling and freediving.

The computer is approved for depths up to 120m, which should be sufficient.

The dive computer/clock

The computer has an outer dimension of 53mm, including the buttons, with a 1.3-inch (33mm) AMOLED colour display. In my opinion, it is a very clear and easy-to-read display, although I usually dive with a larger one. The package includes two different lengths of wristbands, which can be easily changed without tools (Remora Quick Release System). Unfortunately, the longer wristband did not quite fit around my drysuit arm, so I would have preferred a slightly longer one. However, there is another type of wristband available to buy, specifically made for drysuits, which is longer and more elastic. It is also available to order in different colours.

When you buy a Tern TX, it comes in a handy box that you can store the computer in when it is in your dive bag or on the slopes.

The computer has a rechargeable lithium-ion battery that is charged wirelessly with a supplied charger. According to the manufacturer, the computer should last six months on a single charge in standby mode. I used the computer daily as a "normal" watch for five months without having to charge it, as I was diving with another computer during that time. This may be because the display is off, and you have to press one of the buttons to see, for example, what time it is, which saves battery power. According to the manufacturer, one charge should last for 20 hours of diving. When I dived with the computer, it consumed about 3 to 4% of the charge on a regular 40-minute dive.

It has a clear and easy-to-understand screen, despite the size.

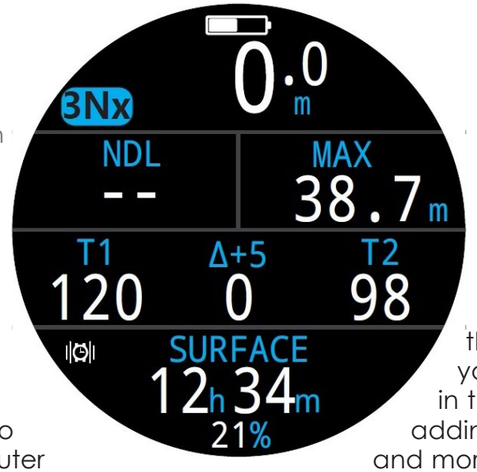
Here, you can clearly see that the ascent is a little too fast.

Easy-to-understand display

I have dived with quite a few different dive computers but found this one very easy to understand. It has small symbols by the four buttons, so you can easily understand how to use them. Shearwater (the manufacturer) has also used standardised language in the menus, which helps you understand the different functions. Some manufacturers come up with their own terms for certain functions, which can make it a bit difficult to understand. The Tern TX is both easy to read and easy to understand. I did my first dives without reading the manual to see if I could understand the computer anyway, and I was fine! Of course, I had another computer as a backup.

When it comes to dive computers today, there are many things you can customise to your own taste and the information you want to see during your dives. This, of course, also applies to the Tern TX. You can start by choosing the colour and size of the text on the display and, to a large extent, what information to show. You can also decide what you want to see when you press the top right button, so you can easily access the information you want. You can also choose from four different brightness settings.

Another logical way to use the colours is that if the computer warns you about something, this is indicated by a yellow background behind the information. If the background turns yellow, you can dive on without action. If, on the other hand, the background turns red and starts flashing, you, as a diver, must take some type of action. If you are colour-blind, you can distin-



Here, you can see that in the tank named T1, there is 120 bar, and in the tank named T2, there is 98 bar.

When using the compass, a green dot shows that you are slightly off course.

guish between the two warnings by the severe flashing one. To make the computer even safer, the Tern TX has a built-in vibration function, so if you are not looking at the computer, you will clearly feel a vibration on your arm when it warns you.

Take the ascent rate, for example. During an ascent, you get a stack of arrows that gets higher the higher the ascent rate you have. Up to 9m/min, the arrows are white. If you increase the speed to between 9-18m/min, the whole bar turns yellow. If you exceed 18m/min, the bar turns red and starts flashing. And, of course, the computer starts to vibrate too.

Built-in compass

The in-built compass can be hidden and only displayed when needed at the touch of a button, or it can be shown as a discreet little north arrow or as a 90-degree arc on the screen. A very nice feature is that you can take out the direction before or during the dive, and a small green dot appears at the outer edge without covering other information. If you are swimming in the correct direction, the green dot appears at the top of the screen (equivalent to 12 o'clock on an analogue watch). If the dot moves in any direction, simply adjust the direction so that it is back at the top. The computer is also equipped with tilt compensation, which means that you do not have to hold the computer completely flat as with a regular compass. What has happened to me is that the computer lost the calibration of the compass at some point, and I did not discover this until the dive... However, it is easy to calibrate the computer when you discover it on land.

Logbook

According to the manufacturer, the Tern TX is able to log up to 500 hours of diving in the log. When you look at a log in the computer, you get a lot of information about the dive, such as times, depth, temperature, settings and a diagram of the dive, as well as a lot of other information. If you connect your computer to your PC or mobile phone via Bluetooth using Shearwater's free Shearwater Cloud software, you can see even more information about the dive. Of course, you can keep a log in the programme by adding location, buddy and more.

If you use Shearwater Cloud, you can make "notes" in your computer during the dive. For example, if you find a location or a particular animal, you can make a mark there. You can then select what you want to mark in the computer, such as animal, navigation point, hazard, etc., in a list. This way you do not have to remember the depth at which you found the animal/location.

Air Integration (AI) wireless pressure sensors

The Tern TX can be connected to four different wireless pressure sensors, which means you can see the tank pressure of up to four tanks directly on your computer. This is done by mounting a sensor on the regulator first stage and then connecting it wirelessly to the computer, and the tank pressure will appear on the display. The range is about one metre, so you can only see the pressure in your own tanks.

Here, you can see the size difference between the Tern TX and the Shearwater Perdix.

On the computer, you can set whether you want to see the pressure in one or more tanks at the same time, and you can also put different labels on the different pressure sensors/bottles. The available options are the letters B, S, O, T and D and the numbers 1 to 4. For example, if you dive with a nitrox tank on your back and an oxygen tank decompressing, you can name the two pressure sensors B1 for the bottom gas (nitrox) and the oxygen tank O1 (O as in oxygen). If you dive sidemount instead, you might name the tanks S1 and S2.

You can also add a warning pressure to each pressure sensor. Let's say you set a warning pressure of 50 bar; then the computer will warn (yellow) at that pressure, but if the pressure drops more, to half the specified value or about 20 bar, the computer will switch to red warning.

Another feature is that if you dive with a sidemount, you can set the computer to warn you when it is time to change the tanks, either on time or when the pressure in the cylinders differs more than you have set them to do.

As the computer detects the pressure drop, it can also provide you with other important information, such as GTR (Gas Time Remaining). This tells the computer how long the gas will last at the current depth—or SAC (Surface Air Consumption), where the computer shows how many bars per minute you are consuming from the tank you are currently breathing from. You can also multiply the bar by the size of the tank to get the number of litres you are consuming per minute at the current depth. So, if the SAC increases, the GTR will decrease.

On the display, you can, of course, decide in advance whether you want to see SAC, GTR or both and on which tanks if you are diving with several.

Calculation model ZHL-16

Tern TX uses probably the world's most common calculation model for sport diving, namely Bühlmann ZHL-16.

The Shearwater Tern TX with its storage case

It is the calculation model that determines how long you can stay at a specific depth or the length of the stops you need to make when decompression diving. The fact that the Tern TX uses the ZHL-16 means that you will most likely get the same dive times as divers using other types of dive computers.

For those more familiar with dive computer modelling, the Tern TX is equipped with adjustable gradient factors (GF/conservatism). The default setting is 30/80, and there are two values for quick selection (40/85 and 35/75). You can also set whatever values you want, but this requires you to know what it means. If you do not know the gradient factors, leave it at 30/80, which is an accepted practice.

Tern TX obviously supports decompression diving with nitrox and air (as nitrox 21%) in the 3 Gas Nitrox mode, but not with trimix.

Safety stop

When diving deeper than 11m (36ft), a reminder will appear to make a safety stop of 3 to 6 minutes (you can set the time you want). The safety stop starts counting down when you get above 6m (~19.7ft) and continues to count down as long as you stay within 8.3 to 2.4m (~27.2 to ~7.8ft). If, for any reason, you need to surface without having completed the safety stop, you will not be penalised by the computer in any way (it is a voluntary stop, but it is recommended).

In Freediving Mode

When the computer is set to Freediving Mode, it is a very good support, as the vibrations mean you do not have to waste time looking at the computer during the dive. For example, you can set it to vibrate every two metres or when you reach the preset maximum depth. After each dive, you can instantly read the maximum depth and time of the dive on the screen.

If you are practising breath-holding, you can set it to vibrate every 30 seconds, for example, or use the stopwatch.

As a regular wristwatch

The Tern TX is not a smartwatch (hence the lower price), but it is a dive computer in watch format and a good-looking one (in my personal opinion). Of course, there are some functions such as an alarm, timer, timer clock and flashlight. If you activate the flashlight, the entire screen turns white at maximum brightness. It will not be like turning on the flashlight on your mobile phone, but it is bright enough to find the keyhole at night.

The Tern TX is very well thought out and easy to use, both as a watch and as a dive computer. The price is reasonable for such a good dive computer/watch with an easy-to-read screen that also looks good on land. I would only have bought the longer bracelet. ■

Dynamic Nord TR-80 DIN Regulator Review

Text by Mats Gunnarsson
Photos by Mats Gunnarsson and Mimo Moqvist

Sometimes, you can get a feeling for a product just by holding it in your hand, and that was the case here. And the feeling was good...

Dynamic Nord's TR-80 regulator is the "top of the line" in Dynamic Nord's regulator series of three different models. Dynamic Nord's regulators are fairly new to the diving market, and I have never dived with them before. When I unpacked them from the box, I got a sense of quality from how they were made and the choice of materials.

I usually dive in cold water, where one appreciates a little weight in the first stage, as it increases the possibility for the first stage to be "heated" by the surrounding water, which reduces the risk of freezing. A large surface area of the first stage is also an advantage. This first stage was equipped with cooling fins, which, together with the weight/mass of the first stage, gave me the feeling that this was a regulator that would work even in cold water. The second stage was also equipped with two cooling fins right where the pressure drop occurs, and the risk of freezing is greatest.

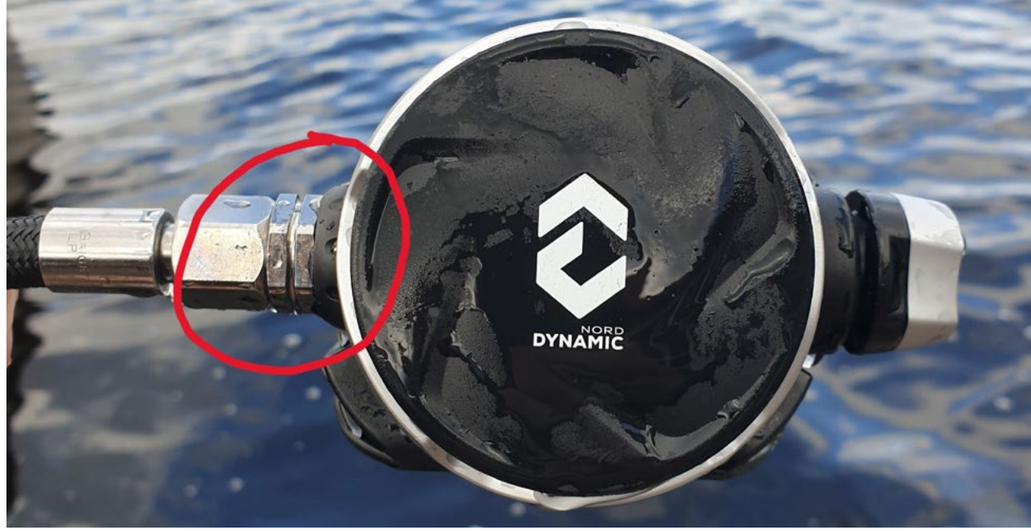
This weight can be a negative for those who travel a lot and need a light regulator for warm water. Then, you should probably look at the CS-30 model instead.

Dry sealing and balanced

Another detail that makes me think this will be a reliable regulator (even in cold water) is that it is made with a so-called "dry sealing/permanent anti-freeze" construction. You can tell this by the black rubber membrane at the top of the first stage. It prevents water from reaching the spring inside. This is good because ice crystals can form around the spring when diving in cold water, which can cause it to seize up. This can happen even at 10°C above zero (50°F) or at high flows through the regulator, for example, if you accidentally free-flow with the purge button.

So, this diaphragm prevents ambient water from reaching the spring but allows the ambient pressure to affect the attachment of the spring, which is necessary because the first stage is a so-called balanced first stage. A balanced first stage adjusts the gas flow

The Dynamic Nord TR-80 DIN regulator



The hose routing is good, with no protruding hoses that might get caught or stuck during wreck and cave diving (above). The black membrane and the cooling/heating flanges show that the first stage is made for cold water. This particular first stage has a DIN connection approved for up to 300 bar, which is used in some northern countries (top centre). Two low-pressure outlets and one high-pressure outlet on each side of the first stage make it work just as well on a single tank as on a double set of tanks (centre). Cooling/heating fins reduce the risk of freezing (circled in red), and on the right is the knob for adjusting the breathing resistance (top right).

so that it is the same regardless of the dive depth. A first stage of this high quality should be balanced to provide plenty of air even at greater depths.

The first stage

It is equipped with a high-pressure gauge port and two low-pressure ports (inflator and second stage) on each side of the first stage. This makes it suitable for both single and double cylinders. I have dived with the RT-80 in both single-cylinder and double-pack configurations, and the hose pull worked well in both configurations. The first stage is available with two different connection options: either with a yoke, which can handle cylinders up to 232 bar, or a DIN connection, which can handle cylinders up to 300 bar.

Second stage

It is available in yellow and black, like most other brands. With the yellow one, which is intended for use as a secondary second stage, the "octopus" is fitted with a 92cm long hose and lacks the personalised adjustment facility. Otherwise, it is equipped just like the primary second stage.

These second stages are, of course, also balanced and equipped with a Venturi knob. The Venturi knob means that by turning the knob on the second stage towards you, you can make it easier to breathe, i.e., the second stage has a lower breathing resistance. If you have the knob in the position away from you, as you should have, for example, on the octopus when you are not using it, it is, of course, possible to breathe in it (I know many people who have dived whole dives in this way), but it is perceived as having a slightly higher breathing resistance. The advantage is that the second stage does not free-flow as easily, for example, when you step into the water, scoot or accidentally hit it with your arm.

Adjustment breathing resistance

The second stage also has a knob for adjusting the breathing resistance. Every diver has a personal opinion about the "optimal" breathing resistance. Using the knob, you can easily find the best-personalised setting and thus get maximum breathing comfort without the second stage free-flowing.

The special design of the front prevents free floating of the second stage when diving in strong currents or when scooting (DPV).

The increased pressure (due to current or speed) cannot affect the inhalation diaphragm because the front has no openings at the front. The necessary inlets are located on the side, which makes the second stage insensitive to currents and the like. I have tried really hard to provoke a free-flow when snowmobiling, but I have not succeeded, which is good!

The design of the lid of the second stage makes it suitable for diving with a scooter.

Note the holes on the sides of the second stage and on the left of the venturi knob, which is in the "dive" position.

Comfort

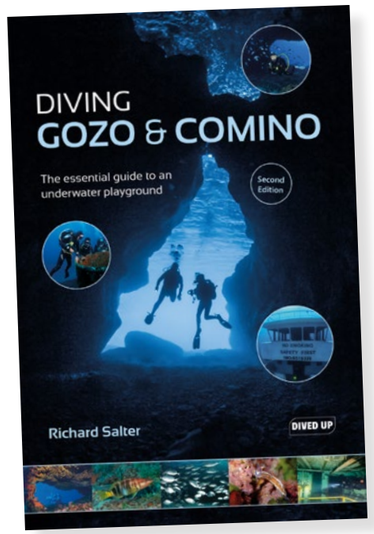
The mouthpiece is made of anti-allergic silicone, and I found it sat well in my mouth even on longer dives. Then, it is individual what you think is a comfortable mouthpiece. The weight of the second stage was not something I noticed, so it should be quite neutrally balanced, and the hose pull from the first stage was good.

I found the breathing resistance, which is adjustable (see above), to be very easy to breathe. I had to increase the resistance a little because I found the resistance a little too light for my taste. It should be noted that I did not dive deeper than 40m with the regulator and only with air as breathing gas.

I find the Dynamic Nord TR-80 to be a stable and robust regulator that I think will make many divers happy in the future. As I wrote earlier, if you are looking for a lightweight and not freeze-protected regulator, you should probably not choose a TR-80 but look at the CS-30 instead. ■

books &media

Edited by
Peter Symes

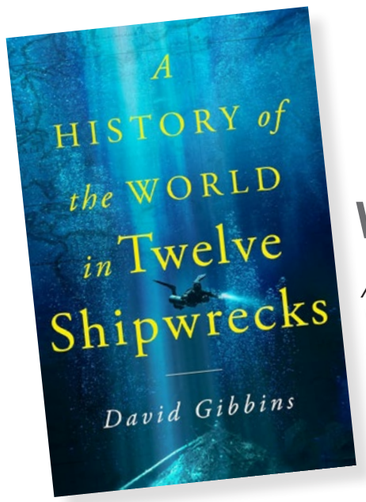


Gozo & Comino

Diving Gozo & Comino, by Richard Salter

Diving Gozo & Comino, the expanded second edition by local expert Richard Salter, offers an unmatched exploration of 72 dive sites in the enchanting waters of Gozo and Comino. This comprehensive guide not only updates you on new sites and significant changes such as the transformation of the Azure Window, but also enhances navigation and aesthetics for a superior user experience. Beyond the dive sites, Salter's guide delves into the cultural tapestry of Gozo, offering insights into its rich history, charming villages and vibrant festivals. This added dimension ensures that your experience is not just about diving, but also about embracing the full spirit of the island.

Publisher: Dived Up Publications
Date: 9 July 2024
Paperback: 184 pages
ISBN: 978-1-909455-58-0

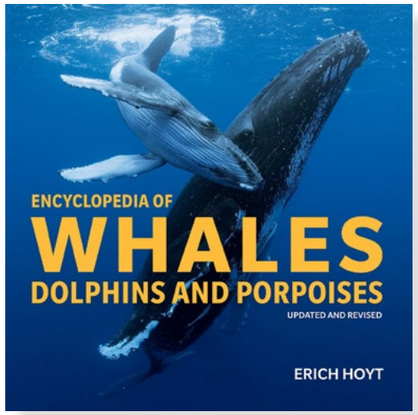


Wrecks

A History of the World in Twelve Shipwrecks, by David Gibbins

David Gibbins's *A History of the World in Twelve Shipwrecks* takes readers on a captivating journey through time, uncovering how pivotal shipwrecks have changed not only seafaring, but also the world. Each chapter reveals a different wreck and its broader implications, making history accessible and engaging. The book weaves a rich tapestry of historical narratives, economic impacts and human stories behind each shipwreck. From the sinking of the Spanish Armada to lesser-known disasters that triggered significant technological, political and cultural shifts, Gibbins provides both broad historical contexts and intimate details of life aboard these doomed vessels.

Publisher: St. Martin's Press
Date: 4 February 2024
Hardcover: 304 pages
ISBN: 978-1250325372

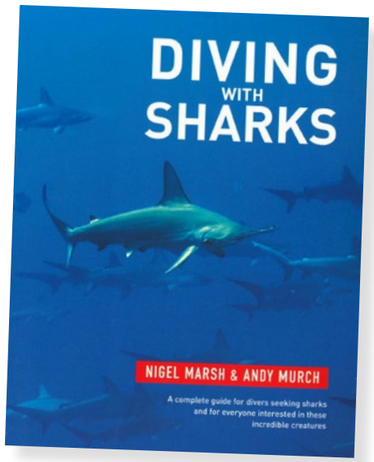


Whales

Encyclopedia of Whales, Dolphins, and Porpoises, by Erich Hoyt

This immersive guide offers a window into the world of these fascinating marine mammals. Erich Hoyt combines detailed scientific insights with captivating images, making this a must-have book for anyone passionate about the ocean's most charismatic inhabitants. The book meticulously details over 90 species of cetaceans, from the well-known blue whale to the elusive beaked whales. The book is rich with information on each species' habitat, social structures and challenges in the wild. Hoyt's passion for marine conservation shines through as he discusses the threats to these magnificent creatures and the efforts needed to protect them.

Publisher: Firefly Books
Date: 23 September 2023
Hardcover: 300 pages
ISBN: 978-0228104351



Sharks Diving

Diving with Sharks, by *X-Ray Mag* contributors Nigel Marsh and Andy Murch

Written by *X-Ray Mag* contributors Nigel Marsh and Andy Murch, this book delves into the fascinating world of sharks, offering readers expert advice on how to safely engage with these magnificent creatures. The book covers a wide range of topics, from understanding shark behaviour and biology to selecting the best gear and locations for shark diving. Marsh and Murch bring their extensive field experience to the pages, detailing encounters with various shark species around the world. They emphasise conservation and respect for shark habitats, aiming to educate divers about the importance of preserving these creatures and their environments. The guide is packed with stunning photographs and practical tips that promise to enhance any shark diver's experience.

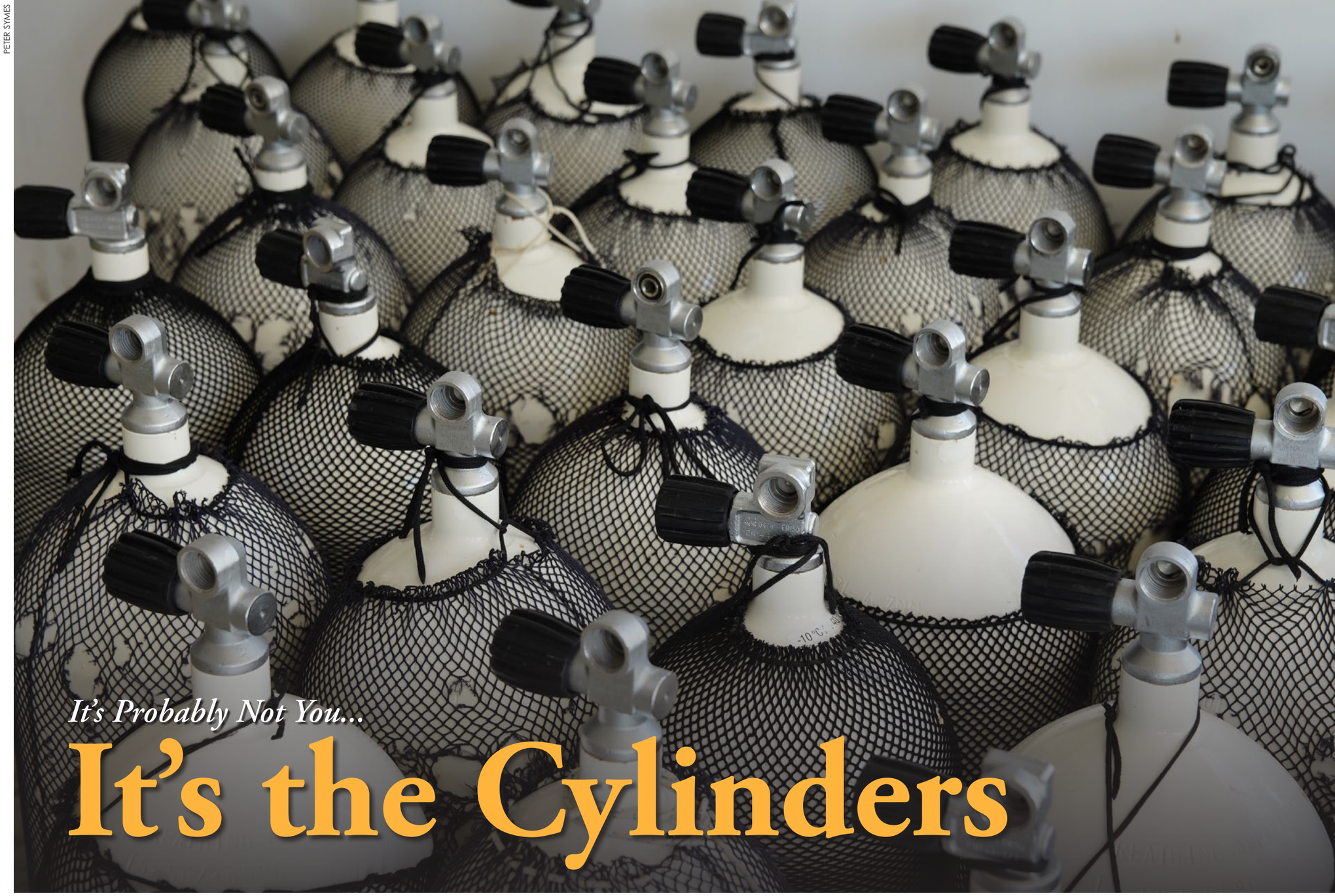
Publisher: New Holland Publishers
Date: 30 September 2022
Paperback: 208 pages
ISBN: 978-1925546965

Shark Facts

1,000 Facts About Sharks, by Sarah Wassner Flynn

The author brings together a treasure trove of insights in this captivating book designed to intrigue and educate young readers aged 8-12. With each fact, she dispels myths and sheds light on the misunderstood world of sharks, highlighting their critical role in marine ecosystems and their varied, often misunderstood behaviours. This guide goes beyond typical shark tales, offering facts about shark biology, behaviour and conservation efforts. It provides an in-depth look at different species, their unique traits and the challenges they face in the wild. The book aims to foster a greater appreciation and understanding of these magnificent creatures, emphasising the importance of their preservation.

Publisher: National Geographic Kids
Date: 4 June 2024
Paperback: 96 pages
ISBN: 978-1426371745



PETER SYMES

It's Probably Not You...

It's the Cylinders

Text by Simon Pridmore

Ever wonder why the number of weights you need to wear changes from dive to dive or why there is a significant difference in the air left in your cylinder on similar dives? Simon Pridmore investigates these mysteries and offers insights and advice on how to deal with them.

Friends Phil and Donna passed this tale on to me, and it is an excellent topic for a Scuba Confidential column. They were living in Florida at the time and heard that one of the local boats had a couple of spare slots. So, they threw their equipment into the truck, drove down to the dock and jumped on board.

Phil takes up the story…

The dive day

It was a beautiful morning. The sea was flat and calm, and the dive deck was a hive of activity, typical of the first day of a long holiday weekend, with visiting groups getting themselves back into a diving frame of mind after too many weeks spent out of the water. We watched while they busied about putting their gear together, choosing their weights and setting up their dive computers. They looked like a competent bunch, and we were looking forward to a nice, relaxing day on the ocean.

We were having a lovely time, but as the morning progressed, we overheard several remarks that, individually, might have seemed insignificant, but together, they set a train of thought rolling through our minds.

The problems

Here are a few examples of the sort of thing we were hearing.

"On dive one, I used the same amount of weight I usually wear, but I was way too heavy. So, I took a couple of pounds off. Then, on dive two, I couldn't even get down, and the divemaster had to give me one of his weights. I was so embarrassed. It was

PETER SYMES

like I'd forgotten how to dive."

"For me, it was the opposite. I was too light on dive one, so I bobbed to the surface during my safety stop. I couldn't stay down. Talk about embarrassing! Then, before dive two, I added another weight to my belt, and I was way too heavy all the way through the dive."

"I had to adjust my cylinder band to put the BCD on my dive-two cylinder. It had fitted just fine on dive one. I must have done something to it when I took it off."

"It's strange. I must have been breathing harder than usual. My tank had 3000psi in it when I started, but after half an hour I was already low on air."

"Really? I came up with way more air than usual on the last dive. And it wasn't because I was relaxed. Quite the opposite: I felt clumsy and unbalanced throughout."

The investigation

A few other comments ran along similar lines, and our suspicions were aroused. After we docked, all the dive gear was unloaded, and we had a closer look at the cylinders the divers had been using.

Individually, all the cylinders looked identical, but when viewed together we could see that a few were fatter than others. When we examined them more closely, we saw that physical size was not the only thing that differentiated them. There were four types:

1. Luxfer S80 cylinders,
2. Catalina S80 cylinders,
3. Catalina C80 cylinders, and
4. Luxfer S100 cylinders.

One of the groups of divers invited us to join them for lunch nearby, and they started talking about the various issues they'd had to deal with on the dives that morning. Their general response was to blame themselves for everything that had gone wrong. It was the first day of the trip; these were just teething problems; it had been a while since they had been diving; the following day would be easier—etc, etc.

There was a lull in the conversation, so we asked if they might be interested in what we thought was behind the problems they had encountered.

They were, so we told them: "It's probably not you. It's the cylinders."

The cylinders

We explained that the dive operation was using four types of dive cylinders, all of which had been mixed up on the boat. Although they looked similar, the different cylinders had very different properties, which was why the divers had been having difficulties.

We walked over to the compressor room, where the cylinders were all lined up outside, waiting to be filled. We picked out one example of each type.

When the divers saw the four together, it was clear that one was significantly larger than the others,

NIKLAS MORBERG / FLICKR / CC BY-SA 2.0

although, as one of the divers mentioned, it was not so much bigger that it would stand out as unusual if you saw it on its own.

This, we told them, was a Luxfer S100 cylinder, containing about 100 cu ft (2,832 litres) of air when filled to its rated pressure of 3300 psi (228 bar). It was just over 26 inches (66cm) high and 8 inches (20cm) in diameter. It was 4.8 lbs (2.2kg) negatively buoyant when full of air and 2.8 lbs (1.3kg) negatively buoyant when empty.

We then drew their attention to the other three cylinders, all approximately the same height as the S100 but noticeably thinner at 7.25 inches (18.4cm) wide.

The first of these, we explained, was the Catalina C80 cylinder, which holds 77.4 cu ft (2,192 litres) of air at its rated pressure of 3300 psi. It is about 6 lbs negatively buoyant when full and almost neutral when empty.

The second, Luxfer's S080 cylinder, looks almost identical to the Catalina C80 but contains 77.4 cu ft (2,192 litres) of air at its rated pressure of 3000 psi. When full, it is just under 2 lbs (0.9kg) negatively buoyant. When empty, it is over 4 lbs (1.8kg) positively buoyant.

The fourth cylinder, another Catalina model, the S80, has very similar characteristics to the Luxfer S080.

The issues

The main issue was that some of the divers had been switching from one type of cylinder to another, from dive one to dive two, without noticing, or they had prepared their weights for one type of cylinder and then inadvertently gone diving with a different type.

Another issue was that all the cylinders had been filled to 3000 psi (207 bar), notwithstanding their different rated pressures.

The consequences

If a diver was correctly weighted for an S080 or S80 cylinder (the most common type of scuba cylinder), they would be wearing way too much weight if they were diving with an S100 or a C80.

Conversely, if the diver was properly weighted for a C80 or S100 and then dived with an S080 or S80, they may not be able to stay down at the end of the dive and float to the surface on their safety stop.

The S100 is fatter than other cylinders, so a diver needs to adjust the cylinder band on their BCD if they switch to it from an S80, S080 or C80. The extra bulk of the S100 can also make a diver feel unstable in the water if they are not used to it.

Other points to note

If you are diving with an S080 or S80 cylinder and your pressure gauge reads 3000 psi or 207 bar, the cylinder is full. However, if you are diving with a C80 at 3000 psi (207 bar), it is only 90% full, so you have less air (70 cu ft instead of 77 cu ft or about 1,980 litres instead of 2,180).

At 3000 psi, the S100 cylinder contains only 90 cu ft (2,548 litres).

Just seeing the Luxfer or Catalina brand on the shoulder of the cylinder is not enough to tell you what type of cylinder you are diving. You need to look at the type of cylinder you are using—in this case S080/C80/S80 or S100. This information is marked on the shoulder of the cylinder, too, as is the rated pressure.

The recommendation

We recommended that the following day, the divers should decide which type of cylinder they wanted to use and make sure they would be diving with two cylinders of the same type by identifying the cylinders with a piece of tape. We contacted them afterwards, and they reported that they had all had a very successful day's diving, with no repetition of the problems that had plagued their first day. Mission accomplished!

PETER SYMES

ADAPTED FROM IMAGE BY NOAH KATZ / CC BY-NC-SA 2.0

To sum up

Phil and Donna's story shows how important it is, especially if you are diving with an operator with whom you are not familiar, to double-check what type of cylinders you are diving with, what the rated pressure is, how much air they hold and what their buoyancy characteristics are. And make sure you get the same type of cylinder on every dive so that your weighting is consistent.

Not all dive cylinders are the same. With more space, of course, this article could be expanded to cover aluminium cylinders made by other manufacturers, as well as steel cylinders and composite cylinders, all of which have very different weights, volumes and buoyancy characteristics. Perhaps that should be a chapter in the next book in my *Scuba* series? ■

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

Bird filming a tiger shark in the Bahamas

DAVID FLEETHAM

Jonathan Bird

— Content is King

Interview by Peter Symes
Photos courtesy of Jonathan Bird

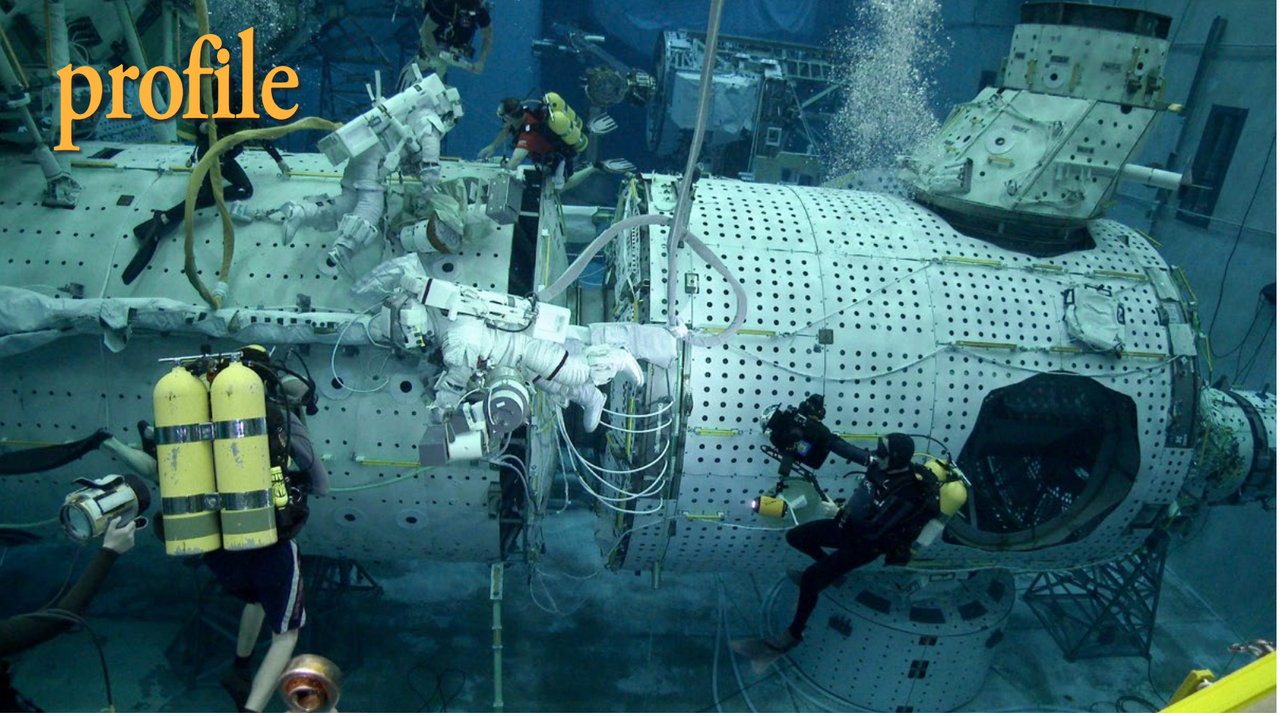
What does it take to create a YouTube channel about the underwater realm with more than a million subscribers? BlueWorldTV is arguably one of the most visited channels on YouTube for divers and anyone interested in what lies below the surface. *X-Ray Mag* editor Peter Symes sat down with founder and principal content creator Jonathan Bird to discuss content creation, creativity and connecting with an audience.

Filmmaker and content creator Jonathan Bird, founder of BlueWorldTV

Let's start with the humble beginnings. Do you recall the moment you wanted to become a diver?

When I was a kid, I watched Jacques Cousteau on television and thought scuba divers were more like astronauts or superheroes than ordinary people. I would go to the local lake and spend as much time with my mask as possible, looking underwater. I never imagined that "normal" people could become divers. I used to "swim" under my bed and pretend I was exploring a sunken shipwreck. It wasn't until I was in college (and scuba diving was offered as a physical education credit) that I got certified. My dad had gotten certified on vacation the year before, and he encouraged me to go for it.

On my open-water checkout dives, I was definitely hooked. I still remember watching a lobster walk by and thinking it was the most exciting thing I had ever



Bird on assignment filming astronauts for NASA (left and center)

Jonathan Bird

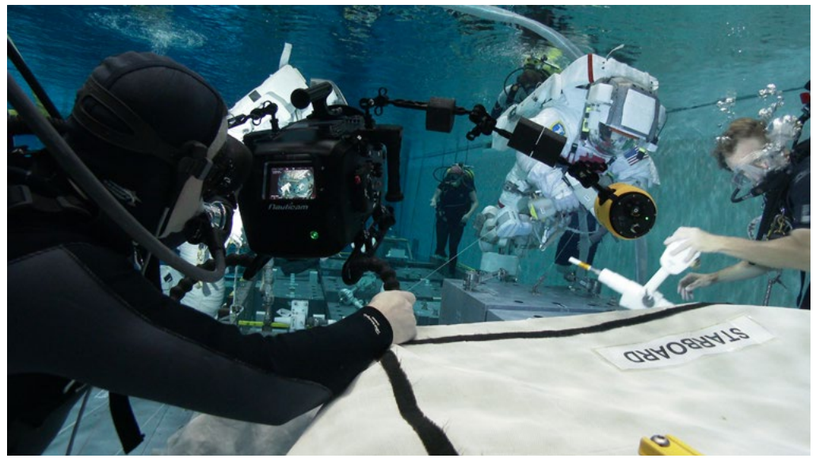
seen. And that class ruined my intended career in electrical engineering!

I met my wife, Christine, at a dive club. My kids really had no idea how amazing it was to me that they could get certified at age 10, which they both did. We are a scuba diving family.

How did you end up doing underwater videography for a living?

My interest in filmmaking came from diving. My first camera was a Nikonos V, so I started with still photography.

I got certified in 1988. A big influence was Howard Hall's *Shadows in a Desert Sea*, which aired in 1992. I started shooting segments with an underwater angle for local Boston TV in 1993. In 1995, I had the opportunity to go to Kwajalein Atoll, where I shot my first full-length film about sharks.



There was a large population of sharks because foreign fishing vessels weren't allowed in those waters because of military installations.

I came back to Kwajalein in 2000 to do a full-length feature for TV. We made a pilot in 2001. It was in a magazine format with two to three stories modeled after a show called *Chronicles*. We shopped it around to several channels. Discovery said it was too educational, but in 2003, we got a two-year contract with *National Geographic*. The pilot was turned into webisodes on the internet.

We started on YouTube in 2007. It looked bad, as it was crude and had low bandwidth. It was just 360p on our own website. We started doing segments as I retained the rights to put episodes on BlueWorldTV.

PCMag did a piece about stuff to watch during the Hollywood strike (2007-2008 Writers Guild of America strike – ed.). After that, we did four seasons on PBS. In 2012, it became harder to raise money for PBS. Meanwhile, YouTube took off and started doing revenue sharing. We were able to put up a couple of segments a month for 12 years.

What made you switch from still photography to video?

The storytelling aspect is more interesting, and I find filmmaking to be more creative. In the days when we were shooting on film, it was quite challenging, but the digital format has made it easier, as you get instant feedback, and you can reshoot.

I am cognizant of the fact that I am lucky.

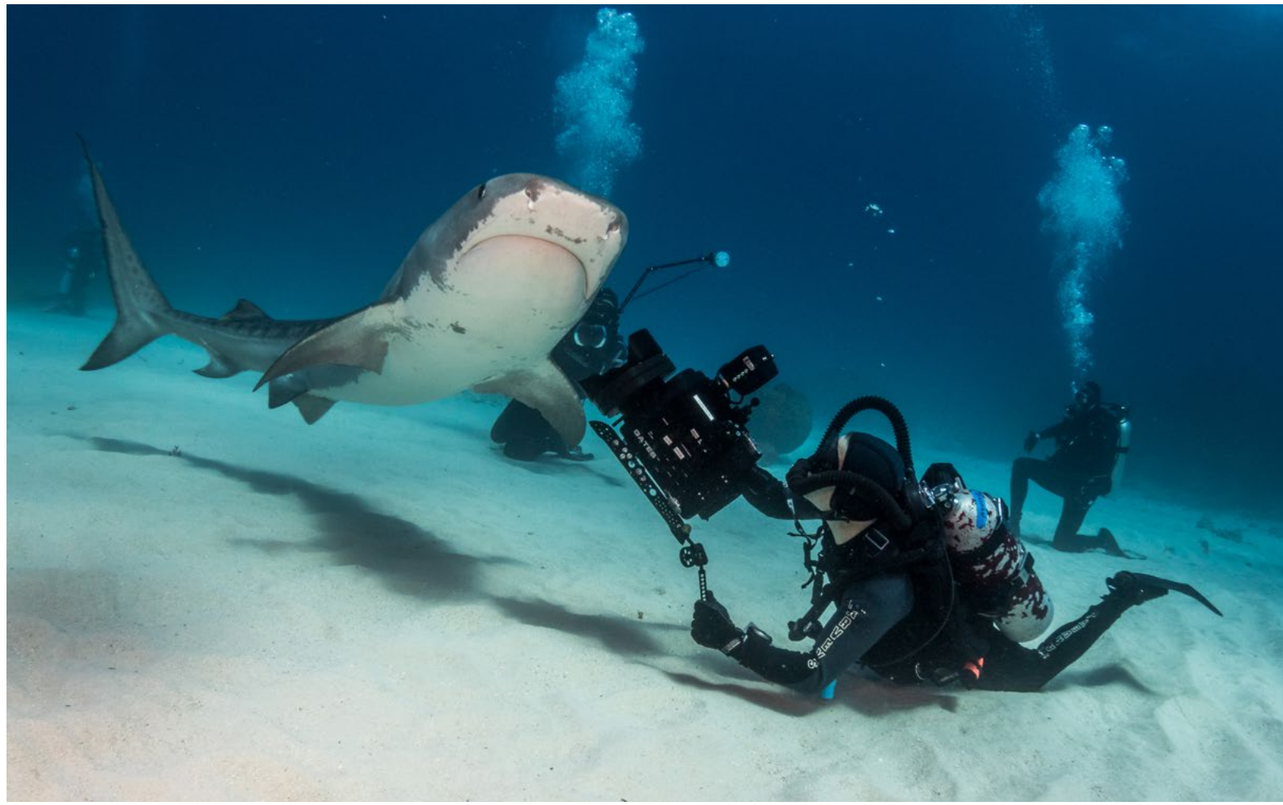
A lot of still photographers are just collectors of images, shots of this animal or that place and other stuff considered "cool." Still photographers are looking for a money shot, and that is different from being a photojournalist. When you do video, you need to document everything.

When you shoot video, you have to try to capture behavior with sequences and think about what shots you need to make the sequence work. It is short form. It is easy to tell a 15-minute story. A full-length feature is a completely different challenge.

It has become a bit of a thing in my life, and I enjoy doing it. I don't care about clicks. I pursue topics that are interesting to me. I just like to know why a video does very well or very badly. I won't stoop to do clickbait.

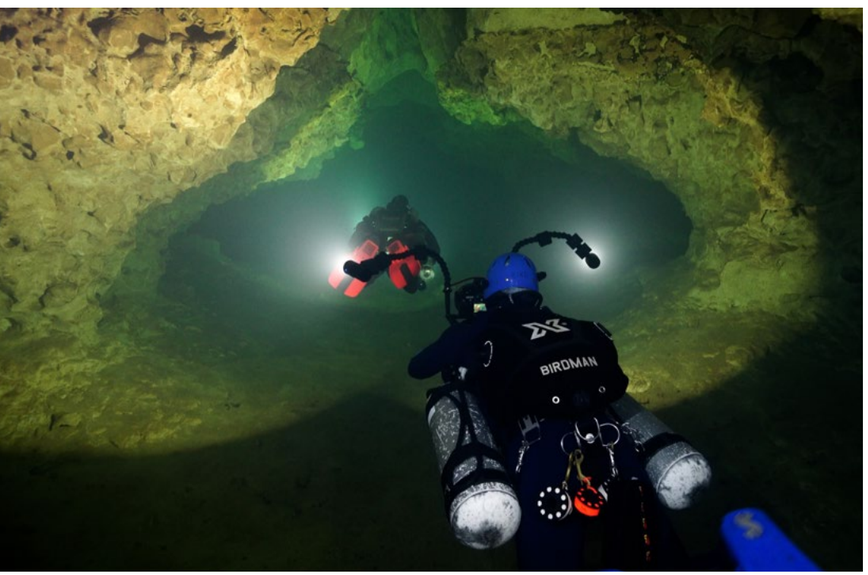
Have you dialed in your procedure?

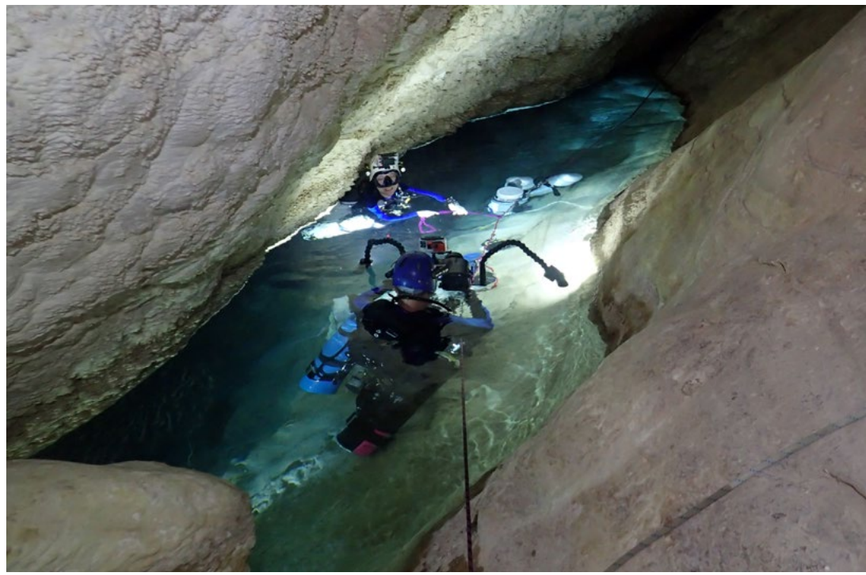
The process is similar, but the stories are different.



Bird filming a tiger shark in the Bahamas

Bird shooting on location with an IMAX camera (left) and with an underwater camera in caves (above, right and bottom left)





Do you have to wait for opportunities or offers to present themselves?

We are a bit budget-constrained, so we have to work around that. For some segments, we get invited, such as the segment on NASA. We get unique opportunities out of the blue. It is hard to do something new. Some locations are worked to death.

How do you envisage or get a sense of your audience and their frame of reference?

I don't make a show for divers but for the general audience. It is a show for anyone who likes the oceans. Our target audience is 12-year-olds. The vast part of our audience was probably under 18. BlueWorldTV is about underwater stuff. The bottom line is to tell a good story.

Which of your YouTube episodes is your favorite and why?

The next one is always my favorite. BlueWorldTV has given me the opportunity to travel the world with dear friends and have amazing adventures. When I go back and watch an older episode, it brings back so many great memories of the adventures we had making it, the people I met and the things I learned. So much fun! There is always another adventure to have, another place to go and another thing to see. So, I always look forward, not back.

What destination or location has been your best positive surprise or experience?

I find great joy in any place I've never been, whether it's a place lots of other people have been or something way off the beaten track. There certainly is a great satisfaction in doing something that not many other people have done, but any place new to me is still new. That being said, coral reef destinations are really popular with the mainstream diving crowd, but I have grown a little tired of that kind of thing. I seek something a little more special—bigger animals, colder water, rarer behaviors—just for the additional challenge and to produce something new and different.

Jonathan Bird

Unexpected guest? A frogfish attaches itself to Bird's rig (top left). Bird in action, shooting scenes for BlueWorldTV (top right).

Bird's work has taken him all over the world to shoot film and video of dive adventures, including cave diving and diving with sharks.

What places or destinations remain on your bucket list?

The sardine run in South Africa, southern right whales in Patagonia.

With the benefit of hindsight, what advice would you give to your 20-year-old self?

Don't waste 20 years trying to figure out how to do it yourself. Find a mentor and make yourself useful.

If someone wanted to get into doing video reports for YouTube or another venue, what advice would you give them?

Find your voice, do it for fun and don't do it expecting to make a living at it because that takes a long, long time. Don't give up in six months if you don't have a million subscribers. Underwater videos are not that popular, so if it is clicks you care about, make cat videos. Learn video production and spend time on production value. If you don't take it seriously, nobody else will. Learn to tell stories. Get a real camera. Learn to edit. Don't spend too much time and effort on social media; it is largely worthless.

Who has inspired you the most? Who has provided you with the lessons or insights you value most?

I've had an evolution of inspirations and mentors in my career arc. My grandfather, who was an avid photographer, inspired my love of photography. I was the photo editor of my high school yearbook and president of my college photography club for a couple of years. Jacques Cousteau inspired me to dive and explore the underwater world. Once I was doing that, I became interested in underwater photography, and I was inspired primarily by photographers whose work I saw a lot in books and magazines—in particular, Marty Snyderman, Doug Perrine, David Doubilet and Chris Newbert.

When I became interested in underwater cinematography, I became a student of Howard Hall's work. There is simply nobody else in his league. But as a filmmaker, I also learned a lot from the people I worked with locally, particularly my friends Art Cohen and Tim Geers, who worked at a local ABC affiliate. Working with them on news and local TV shows in Boston, I learned the art of telling a story, from the camera to the edit. I'm delighted to report that over time, I have been fortunate enough to become friends with all of my heroes, mentors and inspirations.

What are your three favorite books?

Let's go with movies: *Star Wars* (the original), *Love Actually* and *Back to the Future*. ■

For more information, visit: ***blueworldtv.com*** *or* ***youtube.com/@BlueWorldTV***

In 2019, Jonathan Bird was inducted into the International Scuba Diving Hall of Fame.

Blue-ringed octopus

Sentience or Consciousness?

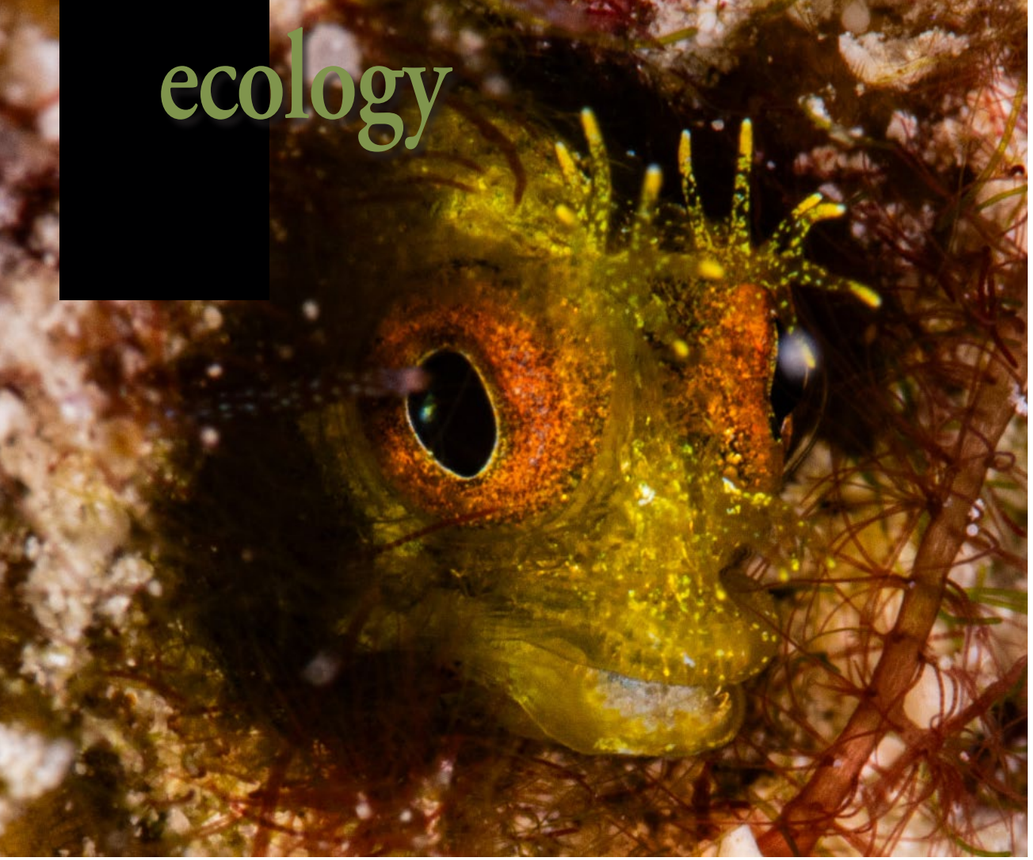
Text by Ila France Porcher
Photos by Kewin Lorenzen

An article recently published by the BBC discusses the latest scientific findings on consciousness in animals. It states that not only do the "higher" animals, such as birds and mammals, appear to experience consciousness, but likely all vertebrates do. The cephalopod molluscs, including octopuses, insects and at least some crustaceans, are also mentioned as having shown evidence of consciousness. Ila France Porcher takes a closer look and provides insights into the cognitive lives of marine life.

But this is hardly new news. The evidence of intelligent awareness in animals has been steadily accumulating for decades. In particular, it was Donald Griffin's work in the 1980s, followed by his book *Animal Minds* in 1992, that finally broke through the bias of mainstream science with the declaration that some actions performed by animals cannot be done without thinking (called cognition in animals). His book provides a fascinating array of examples of cognitive behaviour from species across the animal kingdom. He and his colleagues considered that cognition must require an overseer who is doing the thinking. Therefore, already at that time, some degree of conscious awareness was felt to be a necessary part of the mental life of animals using cognition.

Griffin's work was met with virulent opposition from traditional scientists, for behaviourism dominated the field then. But I was greatly relieved to find my own observations backed up by his views. Watching from the sidelines, I had been appalled that scientists denied consciousness to animals while at the same time conjecturing that their computers would soon be conscious. Indeed, Daniel Dennett pronounced his thermostat to be conscious (in an intentional state) in 1978! His ideas were taken seriously by leading advocates of artificial intelligence (AI), including John McCarthy, who echoed his ideas in later writings.

However, their hopeful idea that complexity automatically produces consciousness, as in the human brain and complex computers, has been



Roughhead blenny

debunked for various reasons. For one thing, it forecasted that consciousness should spring up in places where most people would not expect it, such as in your CDs. Further, it excludes all other living things, as if complexity is more important than life. The quality of life, which is not yet understood, should not be so easily dismissed.

Reading down the page, the BBC article gives some interesting examples of intelligent animal behaviour, but then the word "consciousness" is suddenly dubbed a weasel word and replaced with the word "sentience".

That struck a discord with me, for sentience and consciousness are two different things. The sentience of an animal (the capability to feel and to suffer) should undoubtedly be acknowledged and taken into account in establishing guidelines for animal welfare laws governing, for example, fishing, agribusiness and laboratory experiments. But "sentience" is not interchangeable with "consciousness".

Many of the points made in the article come from the position of behaviourism, which has dominated thinking about animal mental states since 1924 when John B. Watson introduced methodological behaviourism, a technique that sought to understand behaviour by measuring observable actions. Behaviourists consider that no one can know what mental states animals might have, so each is considered a "black box". But this human-centred position fails to consider the way all life evolved together on this unusual planet.

Behaviourism

In ignoring evolution, it smacks of Creationism. Indeed, behaviourism grew out of mechanical philosophy, which appeared in the 1600s and included the Christian belief that the human is divine and that God put the rest of nature here for us to use. Animals were classified as being mechanical in nature. This opened the door to vivisection, and within a short time William Harvey had discovered the circulation of the blood by cutting up animals alive. The trend continued.

The mechanical philosophy's view of nature as being mechanical, and thus reducible to its parts, laid the groundwork for behaviourism's reduction of psychological phenomena to observable actions while avoiding introspection or subjective analysis. Behaviourism therefore focused on behaviour that could be easily measured in laboratory experiments. An animal's behaviour was reduced to simple stimulus-response associations termed "conditioning".

What this all boils down to is that if a creature lacks a human brain, then whatever it might think or feel is irrelevant. This is the argument used to claim that fish cannot feel pain despite the vast wealth of evidence that they do. It is also used by various industries to perpetuate their control over the use of animals for profit.

Animals' true nature

One gets a very different idea about animal behaviour by observing wildlife in their natural habitats. Watching from a distance, ethologists see what wild animals are actually doing and how they respond in different situations. Thus, they witness their true nature in action. Ethology also emphasises the role of evolution, environment and innate behaviours, or instincts. It acknowledges that each individual is different.

As a wildlife artist, I have observed a wide range of species in nature—reef sharks most extensively. All the wild animals I have known have shown evidence of being able to reason and hold an idea in mind while working towards a planned

Pygmy seahorse

MENTAL QUALITIES AND MACHINES

American computer scientist John McCarthy (1927-2011), one of the founders of the discipline of AI, wrote:

"To ascribe certain beliefs, knowledge, free will, intentions, consciousness, abilities or wants to a machine or computer program is legitimate when such an ascription expresses the same information about the machine that it expresses about a person. It is useful when the ascription helps us understand the structure of the machine, its past or future behaviour, or how to repair or improve it. It is perhaps never logically required even for humans, but expressing reasonably briefly what is actually known about the state of a machine in a particular situation may require ascribing mental qualities or qualities isomorphic to them."

McCarthy (1979) considers systems with very limited beliefs. For example, a thermostat may usefully be ascribed one of exactly three beliefs—that the room is too cold, that it is too warm or that its temperature is okay. This is sometimes worth doing, even though the thermostat may be completely understood as a physical system. ■

SOURCE:
MCCARTHY J. 1979. ASCRIBING MENTAL QUALITIES TO MACHINES. IN RINGLE M (ED.), PHILOSOPHICAL PERSPECTIVES IN ARTIFICIAL INTELLIGENCE. HARVESTER PRESS.

Ornate ghost pipefish

outcome. Such goal-oriented behaviour—assuming a future in the making and demonstrating learning from the past—suggests the presence of an overseeing, self-serving awareness doing the thinking. That is, there is a "self" or "I" that is considering what is happening, making moment-to-moment decisions and keeping his or her purposes in mind as (s)he pursues his or her life.

Though individual variations among animals are ignored in lab experiments, the essence of the evolutionary process is the natural behaviour of individuals. A community of a given species adapts to changes in its environment through the ingenuity and resilience of each member. For it is each one's efforts and choices that drive evolution, as each succeeds or fails to reproduce and pass on its unique set of genes to its descendants.

It is self-evident that for an animal to survive, it must be able to understand reality accurately enough to respond to it appropriately, or it will go straight into evolution's garbage can. And no brain is simple, as anyone who has observed the actions of a spider will appreciate.

Are they conscious? Has anyone ever produced any remotely convincing evidence that an animal can win the evolutionary fight without being conscious? No.

Candy crab on soft coral

Consciousness

Consciousness, far from being a weasel word, is currently being studied by scientists from diverse fields. Though neglected for many decades while behaviourism dominated psychology, since 1994, interest in this "last frontier of science" has exploded. The science of consciousness emphasises broad and rigorous approaches to all aspects of the study and understanding of conscious awareness.

Sir Roger Penrose, a professor of mathematics at the University of Oxford, is one of the pioneers in consciousness science. In his first book on the subject, *The Emperor's New Mind: Concerning Computers, Minds and The Laws of Physics* (1989), he presented a beautifully crafted argument that computers would never be conscious because consciousness is not computable. He pointed out that many other things in nature are not computable either, including simple and evident things. For example, the sun and moon are visible to any creature on this planet—they appear circle-shaped. The ratio of the circumference of a circle to its diameter is pi, a number that a computer cannot represent.

Penrose theorised that consciousness is fundamentally a quantum-mechanical phenomenon. This came at a time when AI advocates were at the height of their hype about their soon-to-be-conscious machines, so he attracted a lot of attention. But so far, he seems to be right. By the early 1990s, most of the large AI labs had shut down because vast efforts to program the basic cognitive tasks by the most brilliant people on the planet had failed. No one could figure out how to present information to a machine and have it understood. Advances since then have been based on increased speed and complexity rath-

Lionfish on reef

er than new algorithms permitting machines to perform cognition.

Penrose's approach to consciousness echoes that of the Athenian philosopher Plato, who first described a world we can access only through our consciousness. Only through reflection can we understand reality. Ideas unfold when we reflect upon them, and mathematical ideas have been found to underlie the actions of the physical universe. For example, anyone can reflect upon a circle, measure the circumference and diameter and try to figure out the number pi. More mysteriously, the universal constants, which include the speed of light, Planck's constant and the speed of expansion of the universe (plus only a few others), are each extremely precise. These remarkable numbers underlie the reality that we know. And through reflection, many different scientists figured them out.

Three worlds

Penrose describes three realms: consciousness, the physical universe and Plato's world. He calls the relationships between them the three profound mysteries. In the physical world, consciousness appears, reflecting and finding Plato's world, the truths of which lie behind the manifestation of the physical world (Penrose, R. 2007. *The Road to Reality*. Vintage).

Music also leads us into Plato's world, and some birds sing using scales defined by our own musicians. When played at one-quarter speed, a hermit thrush's song is like a human composition, with between 45 to 100 notes and 25 to 50 pitch changes. It approximates a pentatonic scale with all the harmonic intervals. Many other species, too, compose their own songs and perfect them single-mindedly, apparently trying to match some inner concept of the musically beautiful, which they perceive in their minds—in Plato's world.

The creations of bower birds, which in every way resemble art, provide another example of the recognition of the beautiful by an animal.

The lionfish presents an extraordinary loveliness that is thought to have evolved under the influence of its prey, crustaceans. What would that tell us about crustaceans?

Then there is the peacock. In its quest to become beautiful, it did not just grow a radiant plume to attract the gaze—it evolved a fabulous fan of intricately designed feathers, each detailed to the microscopic level, all fitting together to produce a breath-taking overall design.

The intricate and precise colouration of many marine invertebrates is spectacular. Their flamboyant patterns tell us something about the minds of these ephemeral life forms who, through aeons of evolution, have chosen their dress.

The delicacy and beauty of the biosphere convey something of the underlying quality of the consciousness behind it. Indeed, the appreciation of beauty could be widespread in living things yet unperceived by us. So much of nature is beautiful that one could postulate that beauty was selected for. That is, animals chose beautiful mates, and therefore, the most beautiful individuals had the most offspring. The appreciation of beauty is an indicator of consciousness.

Awareness and thinking in animals and plants

Paramecia are one-celled animals, so they have neither brains nor nerves, yet they can learn, remember and make decisions based on whether they were in a place before and

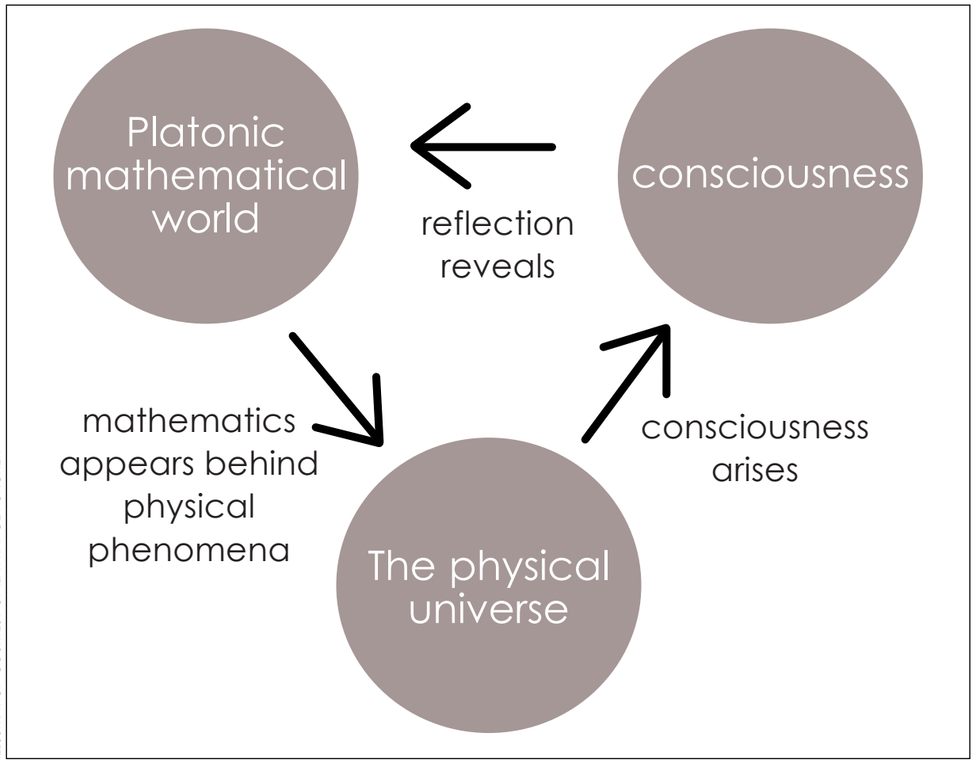


ILLUSTRATION COURTESY OF ILA FRANCE PORCHER

Diagram of Sir Roger Penrose's three worlds philosophy

Mimic octopus (left); Eye of a hammerhead shark (below)

whether they had a good time when they were there. There is now evidence of rational behaviour in bacteria too.

The vast gulf that was thought to separate humans from animals does not exist.

The sensitivities of plants have also been well documented. Films of them in motion look uncannily animal-like when sped up. Researchers have found that plants show many of the same types of awareness and thinking found in animals. They are aware of their environments, including the location of other plants and, in the case of climbing vines, objects that they can use as they climb upwards. The Asian dancing plant will learn to dance to music if it is exposed to music repeatedly, and individuals improve with practice, suggesting learning and memory.

The modern view of plants is that they are a completely different form of life that evolved in another direction from the one taken by animals. Though plants lack organs, they send messages through their systems in the same way that nerves transmit information in animals. They are just as evolved as animals, and apparently they are aware of reality in other ways.

Research into the inner workings of forest ecosystems has revealed that, far from standing alone, each tree networks with others through fungi, slime moulds and other species to share water and nutrients as needed. The slime mould (*Physarum polycephalum*) is neither plant, animal nor fungus but an amoeba and an underground inhabitant of temperate forests. Slime moulds connect with trees and distribute nutrients, showing that living things are not necessarily devoted exclusively to their own survival. The slime mould has cognitive abilities that have been assumed to depend on brain circuitry, and its intelligent behaviour is one of the unexplained mysteries of science. There are likely to be similar examples in the marine environment, so far unrevealed by science.

These findings suggest that intelligent awareness, or consciousness in some form, may be an intrinsic aspect of life—a comprehension of reality in which the creature, simple as it might be, understands its environment as it functions within it. This shared understanding becomes the ground for interaction among the vast and diverse network of living things that covers our planet from pole to pole.

Evolution

Reflection on life's processes suggests other curious facts. While science holds that consciousness evolved from matter, religion holds that matter evolved from consciousness.

Let us consider how evolution works. The flight capabilities of birds have been documented through the fossil record to have evolved slowly as their ancestors tried to stay in the air for longer and longer spans of time. At first, just the ability to hop higher, with the forelimbs reaching up, must have begun the transition as the creature fled from increasingly nimble predators. Gradually, gliding developed, as only those who were able to leap the highest reproduced. At last, over aeons of strife by each individual trying to survive, wings evolved.

Thus, the behaviour came before the structure; birds have wings because they fly. Here, it is consciousness that gives rise to matter. Following this line of reasoning leads to a picture in which the species have created themselves, each being a manifestation of all the efforts of all its forebearers down through the abyss of time since life appeared. It was consciousness that created matter!

Thus, from many perspectives, there is evidence that we live on a planet full of conscious, thinking life forms.

However, so far, researchers have made very little progress in discovering what conscious awareness is. It has even been suggested that, from our limited perspectives, we are simply

Closeup of the rhinophores on the head of a nudibranch

unable to understand it, just as fish cannot do mathematics. And consciousness is not the only enigma that remains. Life itself and how it appeared here on Earth is another deep mystery.

Therefore, with the source and nature of consciousness so elusive to science, there is absolutely no scientific basis for denying it to any living thing. ■

Ethologist Ila France Porcher, author of The Shark Sessions *and* The True Nature of Sharks*, conducted a seven-year study of a four-species reef shark community in Tahiti and has studied sharks in Florida with shark-encounter pioneer Jim Abernethy. Her observations, which are the first of their kind, have yielded valuable details about sharks' reproductive cycles, social biology, population structure, daily behaviour patterns, roaming tendencies and cognitive abilities. Please visit:* ***ilafranceporcher.wixsite.com/author****.*

FURTHER READING:
DENNETT D. 1978. BRAINSTORMS: PHILOSOPHICAL ESSAYS ON MIND AND PSYCHOLOGY. CAMBRIDGE: BRADFORD BOOKS/MIT PRESS.
GHOSH P. 2024. ARE ANIMALS CONSCIOUS? HOW NEW RESEARCH IS CHANGING MINDS. BBC.
GRIFFIN DR. 2001. ANIMAL MINDS: BEYOND COGNITION TO CONSCIOUSNESS. UNIVERSITY OF CHICAGO PRESS.
PENROSE R. 1989. THE EMPEROR'S NEW MIND: CONCERNING COMPUTERS, MINDS AND THE LAWS OF PHYSICS. OXFORD, ENGLAND: OXFORD UNIVERSITY PRESS.
PENROSE R. 1995. SHADOWS OF THE MIND: A SEARCH FOR THE MISSING SCIENCE OF CONSCIOUSNESS. OXFORD, ENGLAND: OXFORD UNIVERSITY PRESS.
PORCHER IF. 2017. THE TRUE NATURE OF SHARKS. INDEPENDENTLY PUBLISHED.

By Ila France Porcher

PETER SYMES

Tiger shark off the Bahamas (right). Sharks occupy a wide variety of niches and are essential to ecosystem functioning.

Ecological Importance of Big Sharks

The largest shark species, such as tiger sharks and great whites, have a strong ecological role in healthy oceans, but they have been the most severely affected by fisheries. Seven decades of industrial over-fishing has so depleted them that in vast regions they no longer fulfil their ecological functions.

A new **study** has shed light on the surprising ways in which large sharks contribute to their ecosystems. They help transport nutrients across marine ecosystems, which involve a variety of marine life forms. As the climate warms and human activities continue to alter ocean conditions, their roles are shifting. Some species are expanding their ranges into cooler waters, affecting new areas and interactions. Changes in their distribution can disrupt local ecosystems because, as apex predators, they play a crucial role in maintaining the balance of marine ecosystems and can take different roles in different environments.

By controlling the populations of other species, the large sharks indirectly help to maintain habitat quality and boost carbon sequestration, making such ecosystems more resilient to climate change. Their hunting practices can influence the entire food web. The tiger shark, for example, has been shown to have a significant impact on coastal seagrass and kelp forests.

Researchers are exploring how restoring the populations of large sharks could help restore ecological balance in diverse marine environments and even enhance the ocean's ability to absorb carbon dioxide.

Complex interactions

However, understanding the full extent of their ecological roles remains a challenge. The complexities of their interactions with various species and habitats often make it difficult to grasp their true impact. While some shark species have been well studied, others—particularly those in deep waters—remain poorly understood.

To protect and restore these vital predators, conservation efforts must focus not just on increasing shark populations but also on preserving their ecological functions. The main challenge is eliminating their take by industrial fisheries, which continues to devastate them. Balancing commercial interests with ecological health will be key to ensuring they continue to thrive and support healthy, resilient marine ecosystems.

As scientists and policymakers work to address these challenges, the message is clear: Safeguarding shark populations is not just about protecting a species but also the health of our planet's oceans and climate. ■ SOURCE: SCIENCE (JOURNAL)

shark news

Edited by Peter Symes & Ila France Porcher

MATTHEW T RADER, MATTHEWTRADER.COM / CC-BY-SA

Whale sharks, known for their long-range migrations, interbreed across global populations, necessitating international conservation efforts.

The World's Whale Shark Populations Are Closely Related

Whale sharks are long-range travellers and interbreed with different populations around the world. Therefore, conservation efforts have to be global.

Whale sharks are a declining species, and there is limited biological data available about them. Although these animals are protected in many areas, they are still being legally and illegally fished in some countries. It is important to gather baseline biological and ecological data in order to develop an effective conservation plan for whale sharks.

It is not known, for example, whether the whale shark is represented by a single worldwide panmictic population (characterised by random mating within a breeding population) or by numerous reproductively isolated populations.

The analysis of genetic population structure is a crucial element in establishing the fundamental data needed for the conservation of whale sharks. Studies have demonstrated minimal genetic variation between whale shark populations in different geographical areas. Satellite tracking data has shown that whale sharks migrate both regionally and over long distances across their range, validating the existence of genetic exchange between populations.

Whale sharks cross geographical and political boundaries throughout their lifetimes, breeding with animals from distant populations. Therefore, conservation efforts should focus on international protection for this species. ■

SOURCE: PLOS ONE

Tiger Sharks Seen at Easter Island

For the first time, tiger sharks have been photographed near Easter Island, in the south-east Pacific. While there have been anecdotal reports of tiger sharks in this region before, this is the first time such sightings have been documented scientifically.

The sightings, documented in a study by Amy Rose Coghlan and Naiti Morales, took place during a period of unusually warm sea surface temperatures, a condition that has been linked to the expansion of tiger shark habitats in other parts of the world.

These new records, along with historical data, are crucial for understanding and predicting how species like the tiger shark adapt to their environment, including their migratory patterns and the limits of their range. This is especially important in light of the swift changes taking place due to global warming.

Migration

Tiger sharks are highly migratory and can travel vast distances across oceans. Some individuals have been tracked moving thousands of kilometres from one region to another. Their migrations are typically influenced by water temperature and prey availability.

In some regions, tiger sharks migrate seasonally. During the winter, they migrate from cooler temperate waters to warmer tropical and subtropical waters. Their appearance in the vicinity of Easter Island may, therefore, be due to global warming and the expansion of warm seas.

Ecology

Tiger sharks often travel between coastal areas and the open ocean. They are commonly found near coral reefs, estuaries, and bays. Female tiger sharks frequently use shallow coastal areas as nursery grounds where their young can grow with less risk of predation. But tiger sharks have also been spotted far offshore, sometimes in deep waters.

As apex predators, tiger sharks play a crucial role in maintaining the balance of marine ecosystems. They are generally solitary and hunt alone, especially at night when they are most active. They use their keen sense of smell and electroreception to locate a wide variety of prey, including fish, sea turtles, seabirds, and seals. They sometimes consume inedible objects like license plates and tyres.

As is also true of other shark species, they are curious animals. They often investigate objects or animals in their environment, and this curiosity sometimes leads them to approach boats or divers.

Threats to tiger sharks

The International Union for Conservation of Nature (IUCN) lists tiger sharks as Near Threatened. They face threats from industrial and recreational fishing, both of which are now strongly influenced by the lucrative shark fin trade and habitat loss.

Understanding tiger sharks' migratory patterns and habits is vital for their conservation, as it helps scientists predict their movements and identify critical habitats that need protection. The sighting at Easter Island provides more information about their ranges and the effect of the expansion of warming seas. ■

SOURCE: JOURNAL OF FISH BIOLOGY

MARION KRASCHL / WIKIPEDIA / CC BY 3.0

Tiger shark

shark news

Edited by Peter Symes & Ila France Porcher

MALCOLM NOBBS

Broadnose sevengill sharks are found in temperate kelp forests around the world, except in the North Atlantic.

New Shark Species Showing up in Puget Sound

Oregon State University researchers have confirmed the presence of the broadnose sevengill shark and the endangered soupfin shark in Puget Sound, marking a significant development in the region's marine biodiversity.

During ten days of fieldwork in 2022 and 2023, the researchers caught ten sharks from the broadnose sevengill and the endangered soupfin species.

The Salish Sea separates northwest Washington from British Columbia's Vancouver Island. The 6,500 sq mi body of water stretches into Washington as Puget Sound, and the sharks were caught close to Olympia, near the sound's southernmost point.

For decades, only one broadnose sevengill shark had been found in the Salish Sea, but Oregon State University scientists have found nine in South Puget Sound in recent years. They have also found a soupfin shark.

On the brink of extinction

Once abundant in these coastal waters, soupfin sharks are now critically endangered due to overfishing. The high demand for their fins and livers, particularly for the eponymous shark fin soup, has driven them to the brink of extinction.

Despite reduced fishing pressure, the species has not recovered, underscoring the urgent need for conservation efforts and federal protection under the Endangered Species Act.

Like the broadnosed sevengill shark, the soupfin shark is found in temperate waters around the globe and is a top predator in any ecosystem it inhabits. It eats cephalopods and a variety of fish. Soupfin sharks are known as strong swimmers whose migrations can exceed 1,000 miles.

The study's lead author, Ethan Personius, said the Salish Sea has experienced pervasive shifts in species abundance and composition, industrialisation, and significant habitat degradation. The appearance of soupfin sharks may be a result from climate change and changes in prey availability. ■

SOURCE: FRONTIERS IN MARINE SCIENCE

Great White Sharks Separated Into Three Population Groups

A new global study has shed light on the genetic diversity of the great white shark, an apex predator found in oceans worldwide.

Having been subject to extreme fishing pressure by industrial fishing fleets as well as recreational fishermen, the species is currently classified as Vulnerable on a global scale and Critically Endangered in Europe.

The **study**, led by researcher Isabel Wagner, used a groundbreaking approach. They combined advanced genetic techniques (including target gene capture sequencing and whole-genome re-sequencing), to analyse the DNA of white sharks from across their global range. Eighty-nine individual sharks were examined through target gene capture sequencing, and 17 sharks were studied through whole-genome re-sequencing.

Three distinct populations

The results revealed three genetically distinct lineages of white sharks: one in the North Atlantic, another in the Indo-Pacific, and a third in the North Pacific. These lineages diverged between 100,000 and 200,000 years ago, likely due to environmental changes during the penultimate glaciation.

During this period, low sea levels, shifting ocean currents and varying water temperatures created barriers that led to the separation of these populations. These lineages rarely interbreed, and there is evidence of only a few very recent hybrids.

Importance of the method

This study highlights the importance of using high-resolution genomic analyses to fully understand the diversity within species like the white shark. Without such comprehensive research, the true extent of their genetic diversity, the barriers to inter-breeding, and the potential for local adaptation could remain unknown.

Conservation efforts needed

This knowledge is essential for informed conservation strategies aimed at protecting these remarkable predators. This new knowledge shows that conservation efforts for white sharks require a deeper understanding and management of these distinct populations. This is crucial for the survival of the species. ■

SOURCE: CURRENT BIOLOGY

SCOTT BENNETT

Great white shark

Black *As a Design Element*

Contributors' Picks

Text and photos by John A. Ares, Sheryl Checkman, Larry Cohen, Lureen Ferretti, Anita George-Ares, Kate Jonker, Brandi Mueller, Matthew Meier, Gary Rose, Michael Rothschild and Olga Torrey

We asked our contributors to share their favorite underwater images that use black as a design element, and they came back with a dynamic selection of macro and wide-angle shots featuring a diverse range of marine life, haunting wreck scenes, dramatic underwater topography, and even divers. Here, *X-Ray Mag* contributors share their selected images from the tropical waters of Fiji, the Solomon Islands, Chuuk, Papua New Guinea, the Philippines, Indonesia, the Maldives, the Red Sea, the Turks and Caicos Islands, Mexico and Hawaii to the subtropical and temperate waters of Florida, the US East Coast, Canada and South Africa.

LUREEN FERRETTI

Spotlighting Subjects

Text and photos by Lureen Ferretti

Black, the result of the absence of light, is often used in underwater photography to draw the viewer's attention to the primary subject, in the same way a spotlight is used on key characters in Broadway performances. Often, we find the most beautiful subjects blending in well with their cluttered, busy backgrounds, making it difficult to make the subject stand out.

Clever photographers have learned to isolate their subjects by using snoots. Snoots are special strobes or strobes with attachments to adjust the light beam. Snoots are quite possibly one of the most frustrating gadgets to learn how to use efficiently and effectively to change the size and shape of the light beam to blacken the background with just the lighting—often referred to as making the subject "pop." Visit: **instagram.com/lureenferrettiphotography**

Photo 1. (above) Snooted photo of a *Nembrotha kubaryana* nudibranch, Nggela Islands (previously known as the Florida Islands), Solomon Islands. Gear: Canon EOS 70D camera, Canon 100mm macro lens, Nauticam housing, Backscatter Mini Flash 2 and Snoot. Exposure: ISO 250, f/18, 1/200s.

Photo 2. (previous page) Snooted photo of just the eye of a crocodilefish, *Cymbacephalus beauforti*, Marovo Lagoon, Solomon Islands. Gear: Canon EOS 70D camera, Canon 100mm macro lens, Nauticam housing, Backscatter Mini Flash 2 and Snoot. Exposure: ISO 200, f/16, 1/160s.

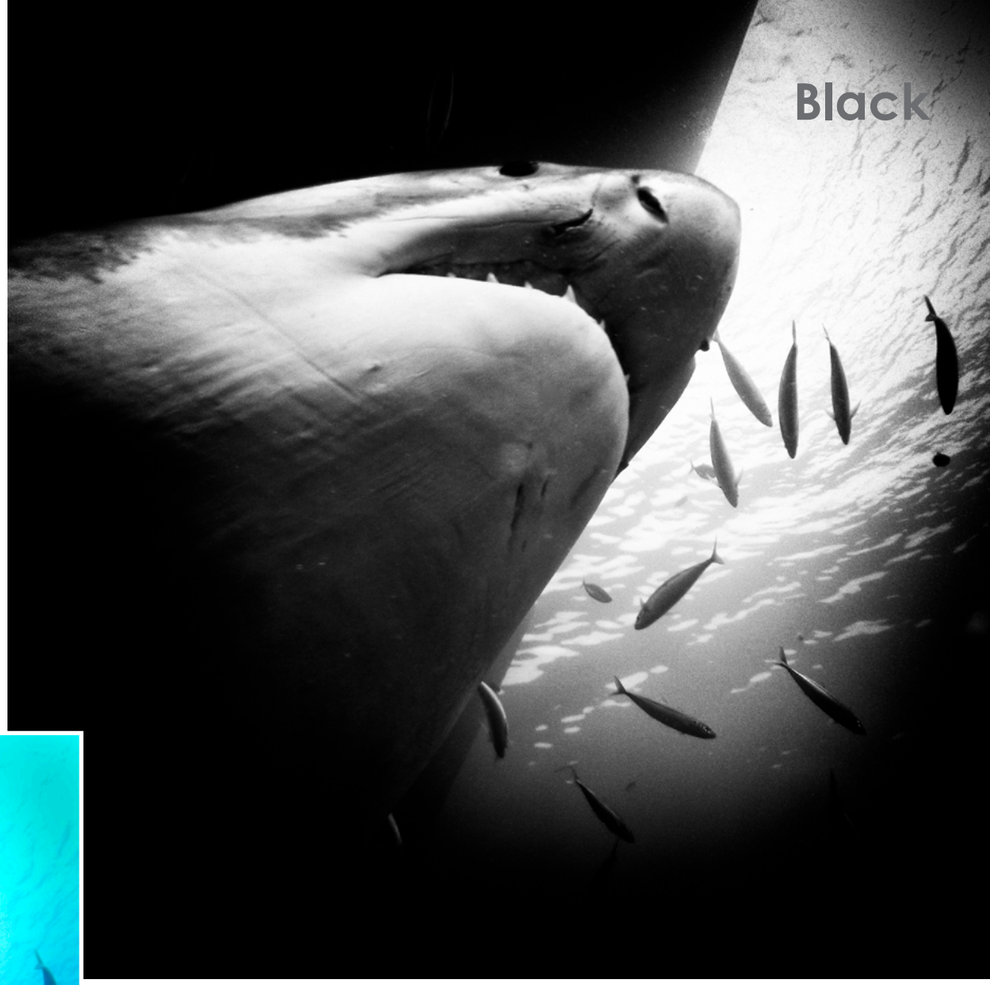
Photo 3 (left). Warty frogfish, *Antennarius maculatus*, snooted with a wide beam of light to include some surrounding background, Tulamben, Indonesia. Gear: Canon EOS 70D camera, Canon 100mm macro lens, Nauticam housing, Backscatter Mini Flash 2 and Snoot. Exposure: ISO 200, f/13, 1/80s.

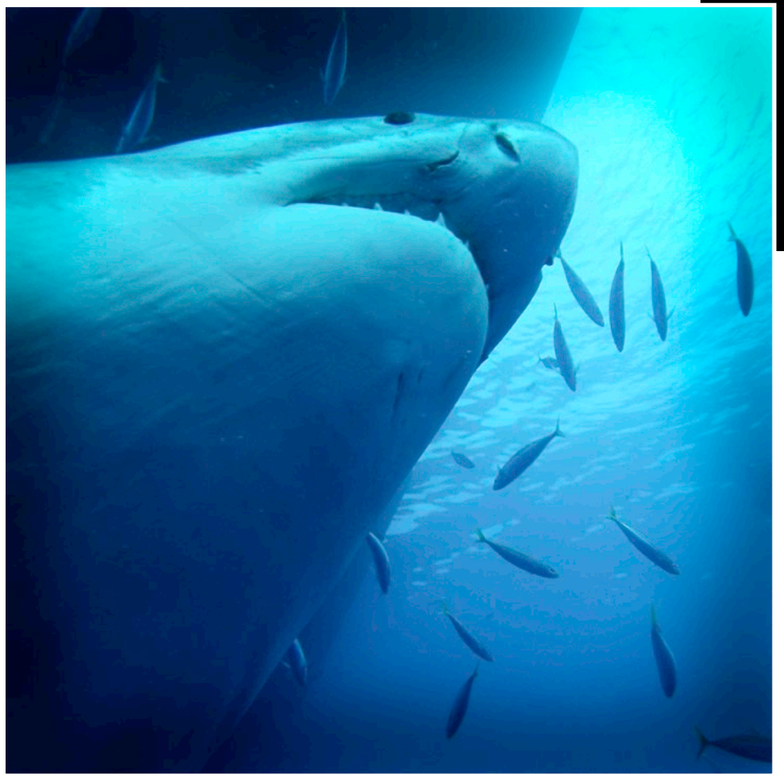
Photo 4. (above) Warty frogfish, *Antennarius maculatus*, snooted with a narrow beam of light, using darkness to draw attention to the frogfish and exclude the surrounding background, Tulamben, Indonesia. Gear: Canon EOS 70D camera, Canon 100mm macro lens, Nauticam housing, Backscatter Mini Flash 2 and Snoot. Exposure: ISO 200, f/13, 1/80s.

Photo 1. Apo Island cavern and drop-off, Negros Island, Philippines. Gear: Canon EOS Rebel SL1 camera, Canon EF-S 60mm macro USM lens, twin Ikelite 161 strobes. Exposure: ISO 1600, f/10, 1/160s.

Photo 2. *Jorunna funebris* nudibranch, Dumaguete, Philippines. Gear: Canon EOS 10D camera, Canon EF 100mm f/2.8 macro lens, twin Ikelite 161 strobes. Exposure: ISO 400, f/16, 1/160s.

Photo 3 and 4. Great white shark, Guadalupe, Mexico. Gear: Canon EOS Rebel T1i camera, Sigma 11-18mm f/2.8 lens, available light. Exposure: ISO 800, f/4.2, 1/125s.





Black Composition

Text and photos by John A. Ares

Black is a feature that helps frame divers. The dive site in Photo 1 is a famous drop-off at Apo Island. The image is a happy accident because as I was photographing the diver with the camera, the others just happened to swim into the frame.

Black can be significant as negative space, but here in Photo 2, the black color is a key component of the nudibranch. *Jorunna funebris* is a species of nudibranch that can grow quite large.

The theme for this feature was the use of black as a key component in a color photo. While the original blue version of the great white shark in Photo 3 makes for a strong image, I believe the pure black and white version of it in Photo 4 is stronger.

I used Nik Silver Efex Pro to convert the full-color photo to black and white. Photos can become more artistic by removing some of the reality. The black can be made darker without looking artificial, making the image more dramatic. Visit: **JohnAres.com**

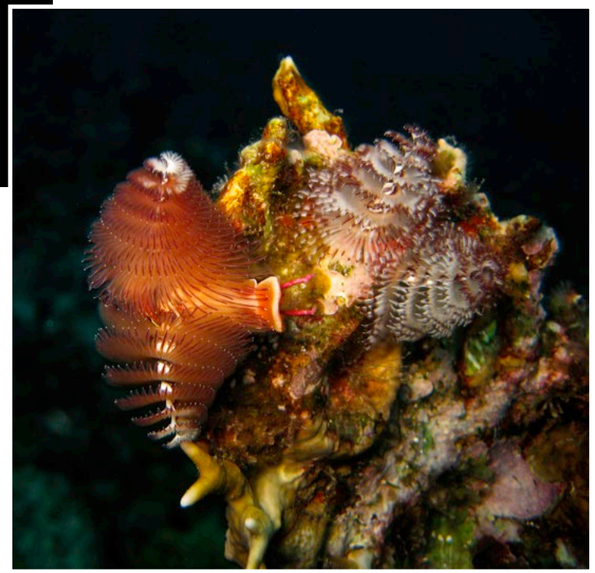
RESOURCE: HANLON RT, MESSENGER JB. 1996. CEPHALOPOD BEHAVIOR. CAMBRIDGE UNIVERSITY PRESS.

Photo 1. (bottom left) Spadefish, Blue Heron Bridge, West Palm Beach, Florida, USA. Gear: Olympus OMD EM5 Mark II camera, Olympus M.60mm f/2.8 Macro at 60mm, Olympus PT-EP13 housing, Sea&Sea YS D-1 strobe. Exposure: ISO 200, f/18, 1/125s.

Photo 2. (left) Brittle star on a yellow gorgonian, French Cay, Fifi, Turks and Caicos Islands. Gear: Canon Powershot SD700 camera at 5.8mm, Canon WP-DC5 housing with one strobe. Exposure: ISO 75, f/5.6, 1/60s.

Photo 3. (below) Silhouette of Christmas tree worms on coral, Aquarium, Turks and Caicos Islands. Gear: Canon Powershot SD700 camera at 5.8mm, Canon WP-DC5 housing with one strobe. Exposure: ISO unknown, f/5.6, 1/60s.

Photo 4. (right) Bubble coral, House Reef, Alor, Indonesia. Gear: Olympus OMD EM5 Mark II camera, Olympus M.60mm f/2.8 Macro at 60mm, Olympus PT-EP13 housing, Sea&Sea YS D-1 strobe. Exposure: ISO 200, f/18, 1/125s.



Making Subjects Stand Out

Text and photos by
Sheryl Checkman

Black, when used to isolate a subject, can make for a very dramatic photograph. In each of the four photos I chose for this theme, the subject stands out from the background simply because the background has been rendered black, making the color pop. I chose to silhouette a close-up of a spadefish at Blue Heron Bridge in Florida (Photo 1) by making the background black. Had I not done so, the fish's mostly silvery white body would have been lost against the sandy bottom.

In Photo 2, the black background behind an orange brittle star spread out on a yellow gorgonian at Fifi, off French Cay in Turks and Caicos, nicely isolates the gorgonian and lets the eye focus on the bright orange brittle star. The Christmas tree worms clinging to a coral head in Turks and Caicos in Photo 3 also stand out against the black background.

On a night dive in Alor, Indonesia, I photographed bubble coral, also known as *Plerogyra sinuosa*, a stony coral species (Photo 4). During the day they appear soft, with fleshy membranes (vesicles), but at night they pull in their vesicles to reveal their hard calcareous skeleton. Since this was a night dive, there was no ambient light to add color to the surrounding background. So, by using only my single strobe on the subject, I got a nice black background, highlighting the bone-like structure of the coral and revealing the tentacles it uses to capture plankton and small prey in the passing currents. The resulting image is more like an abstract work of art, with the dark negative space creating a sculptural effect. Visit: **Instagram.com/SherylCheckman**

All photos were taken in Chuuk Lagoon with a Olympus E-330 camera, Olympus 7-14mm lens, Olympus housing and Sea&Sea YS-03 strobes.

Porcelain inside the *San Francisco Maru* (right). Exposure: ISO 400, f/16, 1/125s.

Truck inside the *San Francisco Maru* (far right). Exposure: ISO 400, f/8.0, 1/60s.

Gas mask inside the *Fujikawa Maru* (bottom right). Exposure: ISO 400, f/11, 1/125s.

Truck parts inside the *Hoki Maru* (center). Exposure: ISO 400, f/8.0, 1/125s.

Creating Dramatic Images

Text and photos by Larry Cohen

When shooting underwater, I often opt for a slow shutter speed. This technique allows me to capture a vibrant and colorful background. To enhance the details inside wrecks and caves, I occasionally use an additional strobe or LED light. However, the artifacts and machinery inside a shipwreck can take on a mysterious quality when set against a black background. The shipwrecks of Chuuk Lagoon, in particular, offer a stunning backdrop for such photography.

The interiors of wrecks are often dark, making it challenging to capture the details of the subject. To overcome this, I employ two strobes to effectively light the subject while a fast shutter speed ensures a black background. This setup also prevents my focus light from showing up in the photograph. I used this lighting scheme inside the *Fujikawa Maru* to photograph a gas mask on some machinery, creating a dramatic image.

Many of the ships sunk in Chuuk are freighters. Their cargo, once intended to help the Japanese war effort, now rests permanently on the bottom of the lagoon inside the wrecks. In the cargo holds of the *Hoki Maru*, there are truck parts that never made it to their destination. Photographing the front grills from a low angle gives them a majestic appearance, underscoring the importance of preserving the history of these shipwrecks.

Inside the *San Francisco Maru*, there are many intact trucks. Photographing one of the trucks from a low angle, I used a shutter speed of 1/60th of a second to capture a hint of blue light from the wreck's openings. I also found porcelain tableware used by the crew inside the *San Francisco*.

I used side lighting to highlight the details and to keep the background black, emphasizing the awe-inspiring presence of these intact artifacts. Visit: **liquidimagesuw.com**

ANITA GEORGE-ARES

Photo 1. (right) Spotted porcelain crab, Solomon Islands. Gear: Canon EOS Rebel XTi camera, Canon EF 50mm f/2.5 compact macro lens, Ikelite housing, two Ikelite DS161 strobes. Exposure: ISO 200, f/11, 1/200s.

Photo 2. (left) Scalefin anthias and soft coral, Red Sea. Gear: Canon EOS Rebel SL1 camera, Canon EF-S 18-55mm f/3.5-5.6 IS STM lens (at 55 mm), Ikelite housing, two Ikelite DS161 strobes. Exposure: ISO 200, f/11, 1/125s.

Photo 3. (below) Hawksbill sea turtle, Maldives. Gear: Canon EOS Rebel SL1 camera, Canon EF-S 10-18mm f/4.5-5.6 IS STM lens (at 10 mm), Ikelite housing, two Ikelite DS161 strobes. Exposure: ISO 200, f/11, 1/160s.

ANITA GEORGE-ARES

ANITA GEORGE-ARES

Black Magic in a Color Image

Text and photos by Anita George-Ares, PhD

In Photo 1, a porcelain crab is resting at the base of an anemone. Porcelain crabs have a pair of appendages covered with long bristles. The black negative space highlights the long bristles used for filtering plankton.

Soft corals are abundant in the Red Sea and come in a variety of colors. The black negative space in Photo 2 intensifies the orange and pink colors of the soft corals and the anthias.

I was making a late afternoon dive at Ali Thila in the Maldives when it began to get dark underwater. I encountered a juvenile hawksbill sea turtle as it slowly ascended toward the surface (Photo 3). The black background isolates the turtle and highlights the scale patterns on its head and flippers. Some of the beautiful shell pattern shows through the encrustations.

During a night dive at Alimatha in the Maldives, I captured the image of a tawny nurse shark (Photo 4). The black background and the white sand highlight the pinkish-brown shark. Alimatha is known for its abundance of tawny nurse sharks. Bait that is routinely placed in the area attracts the sharks. Visit: **facebook.com/profile.php?id=100016947967639**

ANITA GEORGE-ARES

Photo 4. (above) Tawny nurse shark, Maldives. Gear: Canon EOS Rebel SL1 camera, Canon EF-S 10-18mm f/4.5-5.6 IS STM lens (at 10 mm), Ikelite housing, two Ikelite DS161 strobes. Exposure: ISO 200, f/11, 1/200s.

Moonwalker—ornate amphipod photographed using a snoot torch to create a black background (above). Gear: Olympus TG-6 camera, Marelux housing, Minigear torch. Exposure: ISO400, f/18, 1/1000s.

The Strategic Use of Black

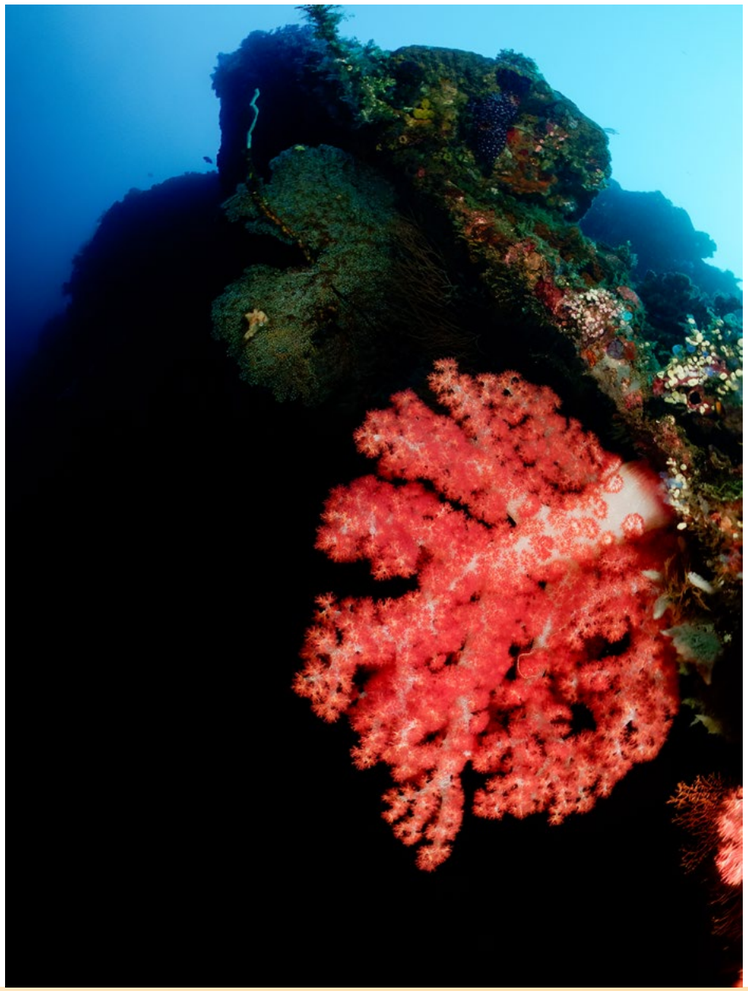
Text and photos by Kate Jonker

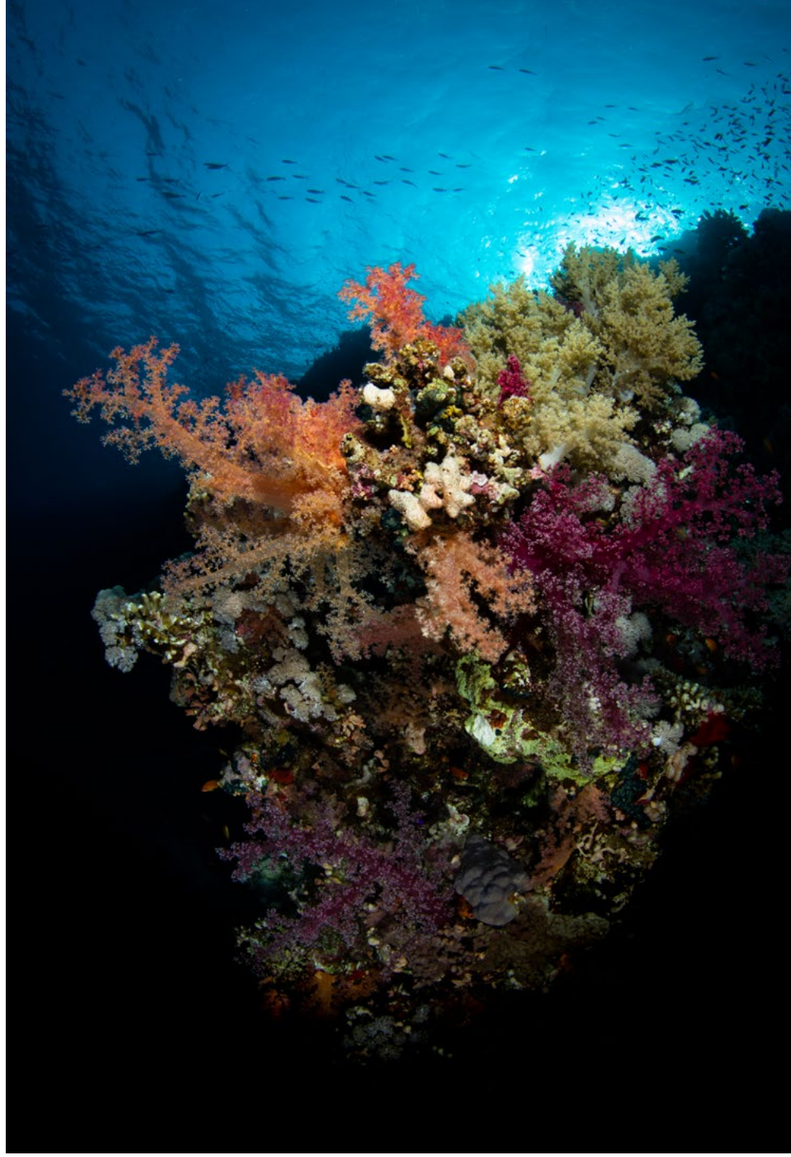
Incorporating black in underwater photography can dramatically enhance and emphasise the colours, details and textures of your subjects. The contrast created by black not only makes vibrant colours pop but also adds depth and dimension to your images. For instance, using the silhouette of a reef or wreck against brightly coloured soft corals on the reef can create a striking visual impact. This method not only highlights the vivid hues but also brings out the intricate textures and details of marine life.

Another effective technique is inward lighting with strobes or torches, which allows you to spotlight your subject against a dark water column. This approach isolates the subject, making it stand out against a black background, thus drawing the viewer's attention to the subject's colours and details. Similarly, using a snoot can create a focused pool of light on a vibrant subject, separating it from a potentially distracting background. This targeted lighting enhances the subject's natural beauty, making the colours more vivid and the textures more pronounced.

In my own work, I have found that the strategic use of black can transform an ordinary photo into an extraordinary one. By carefully balancing light and shadow and using black as a contrasting element, the true beauty of the underwater world is revealed in stunning detail and vibrant colour. This technique not only showcases the splendour of marine life but also adds a professional touch to underwater photography. Visit: **katejonker.com**

Orange gasflame nudibranch, *Bonisa nakaza*, lit using inward torch lighting to create a black background (above). Gear: Canon EOS 7D Mark II camera, Canon 60mm macro lens, Sea&Sea housing, OrcaTorch D900V. Exposure: ISO 320, f/7.1, 1/125s.

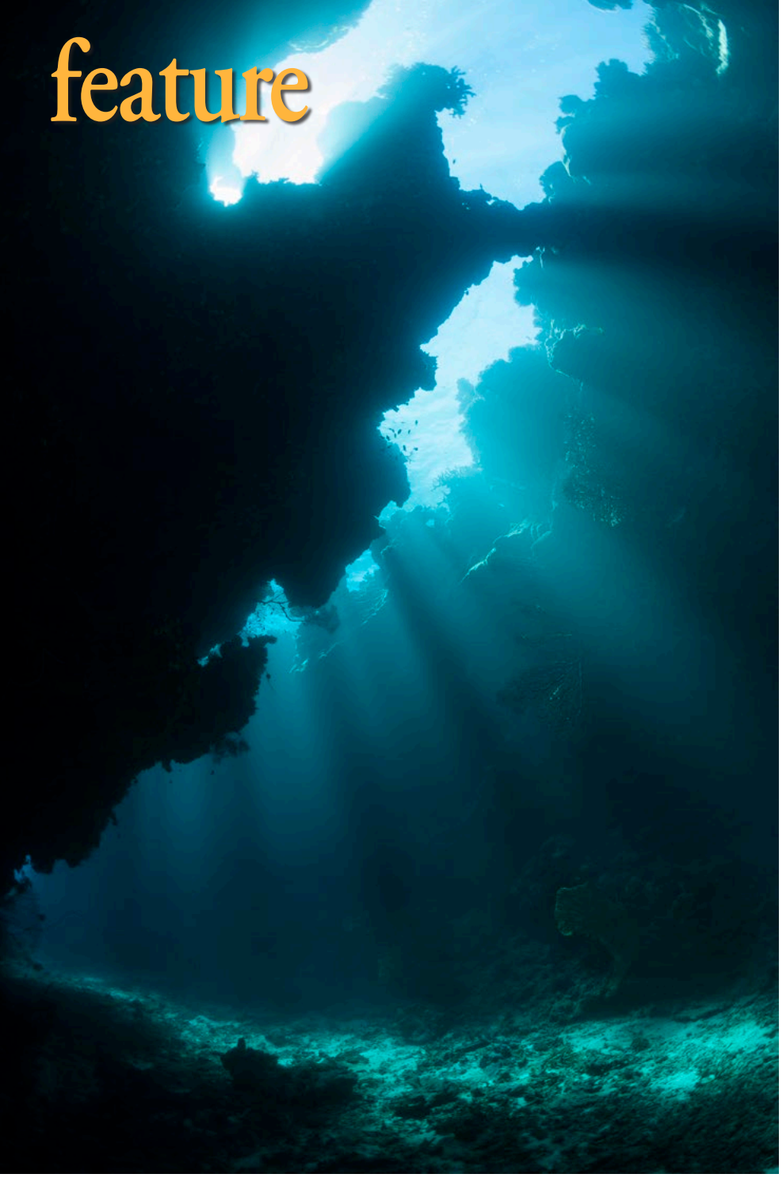




Red Sea soft corals in the Straits of Tiran, with the black silhouette of the reef to highlight the vibrant colours of the soft corals (above). Gear: Canon EOS 7D Mark II camera, Canon 60mm macro lens, Sea&Sea housing, two Inon Z-240 strobes. Exposure: ISO 160, f/11, 1/250s.

Soft corals on the USAT *Liberty* Wreck in Tulamben, Bali, Indonesia (left). Gear: Olympus TG-6 camera, Marelux housing, two Backscatter MF-2 flashes. Exposure: ISO 400, f/5.6, 1/125s.

Caught in the headlights— a rare ornate klipfish, *Clinus ornatus* (on this issue's cover) photographed near Cape Town, South Africa, using inward strobe lighting to create a black background. Gear: Canon EOS 7D Mark II camera, Canon 60mm macro lens, Sea&Sea housing, two Inon Z-240 strobes. Exposure: ISO 320, f/18, 1/250s.



The Many Uses of Black

Text and photos by Matthew Meier

Black can be used to isolate a colorful subject, eliminate a distracting background, provide an additional point of interest and scale with a diver silhouette, and also define an underwater structure. The first two examples involve lighting techniques that use snoots and/or strobe positioning to keep light from hitting the area behind what is being photographed. In combination with low ISO levels, fast shutter speeds and typically small apertures, the resulting effect, when done properly, is a colorful critter in front of a black canvas.

A diver in silhouette above a colorful scene helps move the viewer's eye around the frame. Our eyes are drawn to the contrast of the black human form against the negative space. The diver's silhouette also adds a known proportion to assess the scope of the setting.

Underwater formations—whether hard coral arrangements, old lava tubes or caverns—often have fabulous shapes that can be emphasized by exposing for the light that shines through their openings while providing no additional lighting. This allows the walls to go black, defining their parameters. While I am certain there are many other creative ways to use black in color images, these photos illustrate each of the above techniques.

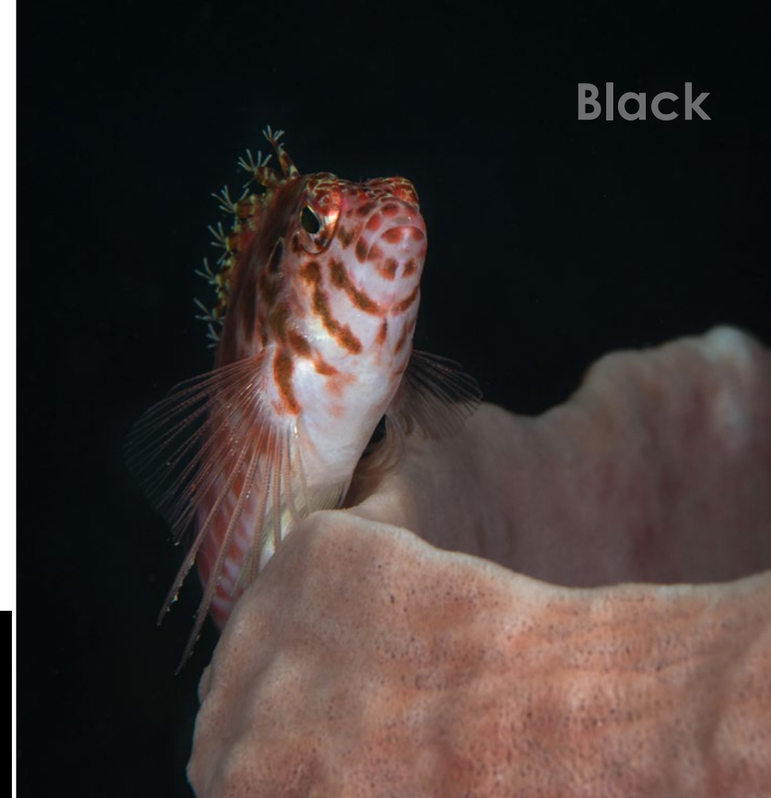
Visit: **MatthewMeierPhoto.com**.

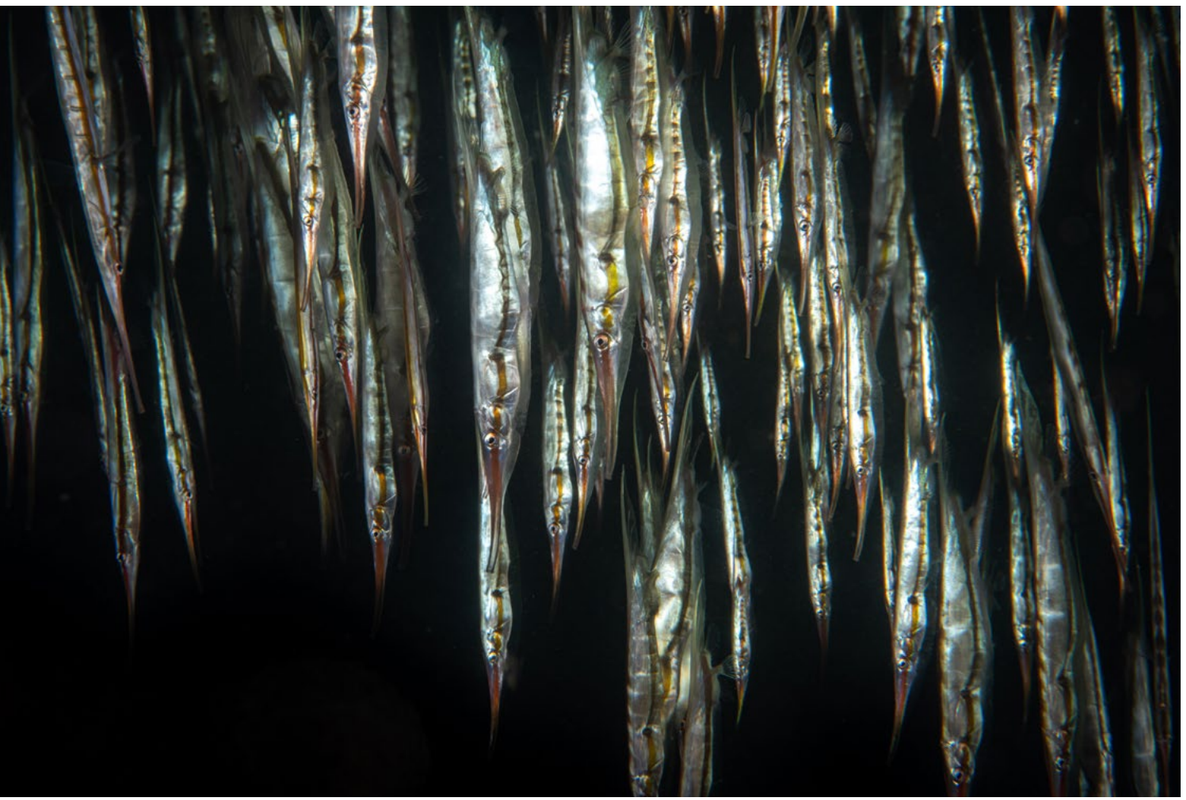
Scuba diver and dive boat floating in silhouette above a large, red gorgonian sea fan attached to the wall of a sea cave, Bligh Waters, Fiji (right). Gear: Nikon D3 camera, Nikon 16mm fisheye lens, Subal housing, Sea&Sea YS-250 strobes. Exposure: ISO 200, f/6.3, 1/250s.

Light rays streaming in from above the cathedral at the E6 dive site, Bligh Waters, Fiji (left). Gear: Nikon D3 camera, Nikon 16mm fisheye lens, Subal housing, ambient light. Exposure: ISO 400, f/5.6, 1/250s.

Squid eating a small fish against a black background, Lembeh Strait, Indonesia (below). Gear: Nikon D810 camera, Nikon 105mm macro lens, Subal housing, Sea&Sea YS-250 strobes. Gear: ISO 200, f/20, 1/125s.

Black saddle snake eel emerging from the black muck sand bottom with a magnificent anemone shrimp climbing on its nose, Lembeh Strait, Indonesia. Gear: Nikon D810 camera, Nikon 105mm macro lens, Subal housing, Sea&Sea YS-250 strobes. Exposure: ISO 200, f/22, 1/125s.





All images were taken with a Nikon D850 camera, Nikon 105mm lens, Ikelite housing, and dual Ikelite DS230 strobes.

School of shrimpfish, Dumaguete, Philippines (above). Exposure: ISO 200, f/18, 1/200s.
Anemonefish with cleaner wrasse, Puerto Galera, Philippines (top left). Exposure: ISO 200, f/20, 1/200s.
Goby on barrel sponge, Puerto Galera, Philippines (top center). Exposure: ISO 200, f/18, 1/200s.

Hawkfish on barrel sponge, Puerto Galera, Philippines (above). Exposure: ISO 200, f/16, 1/200s.

Golden damselfish, Anilao, Philippines (left). Exposure: ISO 250, f/18, 1/200s.

Fish in Black

Text and photos by Brandi Mueller

I love using black backgrounds to accentuate fish. Removing all or most of the distractions of the reef behind them helps the fish stand out. It also shows the fish in a slightly different manner than with the blue background of the water they live in. By underexposing the image and using strobes positioned in different ways to light only certain parts of the subject, it is fun and challenging to make an image with a black background.

The Philippines has an abundance of fish life, so it is a great location to try different techniques when shooting fish. A goby sits on an outer ridge of a barrel sponge, allowing the light to only fall on those parts of the sponge, leaving the crevasses black. A hawkfish also perches on a barrel sponge. A golden damselfish tries to look ferocious while guarding its eggs, and an ameonefish opens its mouth to be cleaned by a wrasse. Visit: **brandiunderwater.com**

All photos were taken with a Nikon D500 camera, Tokina 10-17mm lens, Nauticam housing, Inon Z-330 strobes.

Photo 1. (right) The black silhouette of the great white shark emphasizes the ethereal warmth of the oceanic sunset. Exposure: ISO 200, f/14, 1/125s, FL 17.

Photo 2. (below) These lemon sharks, against a black background, emphasize depth of field and shades of color. Exposure: ISO 200, f/11, 1/125s, FL 10.

Photo 3. (far right) Lemon shark with jaws wide open evokes primal fear, especially against a black background. Exposure: ISO 320, f/11, 1/160s, FL 10.

Photo 4. (top right) The very subtle coloring of this tiger shark is accentuated by the black background. Exposure: ISO 200, f/11, 1/125s, FL 17.

A Splash of Black — A Splash of Color

Text and photos by Gary Rose, MD

I often enjoy using subtle coloring to emphasize the feelings I experience when I witness the beauty and majesty within the sea. I have also found that on many occasions, when I combine muted coloring with black, I am able to add an additional layer of visual information that augments the successful capture of the emotion I felt at the exact moment I witnessed the scene. Later, when viewing my photos, the nuances of color and black evoke the same feelings and responses I experienced when I originally took the photo.

I utilize soft colors to magnify what I feel at the very instant I capture a silhouette. In Photo 1, the entire photo tells a story. The soft greens merging into soft blues, a little bit of copper reflection on the baitfish and the cathedral lighting demonstrate the ethereal warmth of an oceanic sunset. The black silhouette of the great white shark slowly disappearing into the curtain of subtle color adds to the feeling of witnessing a very special moment.

One of the pleasures of diving off Jupiter in Florida is the opportunity to dive with the resident community of lemon sharks. I love watching them cavort and play as I ascend to my safety stop. By experimenting with my settings (depending on the lighting conditions of the day), I have captured some wondrous moments. In Photo 2, the inky black background serves as a backdrop that emphasizes the subtle shade gradient in the coloring of these energetic lemon sharks, creating an X-Y-Z dimensionality—a depth of field. When I took this photo and when I look at it today, I still feel myself pulled into the game these "puppy dogs" were playing.

One of the bucket list items for underwater photographers is to capture the wide-open jaws of a shark. Lemon sharks are particularly excellent for photographs with their jaws wide open. Their numerous sharp, needle-like teeth add an extra layer of excitement. In Photo 3, the black negative space (empty background) offers a canvas that immediately draws the viewer's attention to this "dental dream". In addition, the very pale pink of the shark's gums and the light beige of her gullet evoke a primal fear of terror in the night.

Speaking of primal fear, there is another shark that many people associate with human-shark interactions, and unfortunately not in a positive manner. Tiger sharks are beautiful, intelligent and curious. It is their inquisitiveness that initiates most human-tiger shark encounters. Photo 4 demonstrates the beauty of the bars and bands on a large female tiger shark. To feature and accentuate the very subtle pinks and blues of her otherwise metallic silver skin, I dusted her with my strobe lights (on a very low setting) against a very dark black background.

I was once told that to become a reasonably good photographer, all that it took was to push the shutter release, push again and keep pushing. I would add to that advice: Be willing to experiment, using subtle coloring and black, and let the light guide you… Click away. Please visit: **garyrosephotos.com**

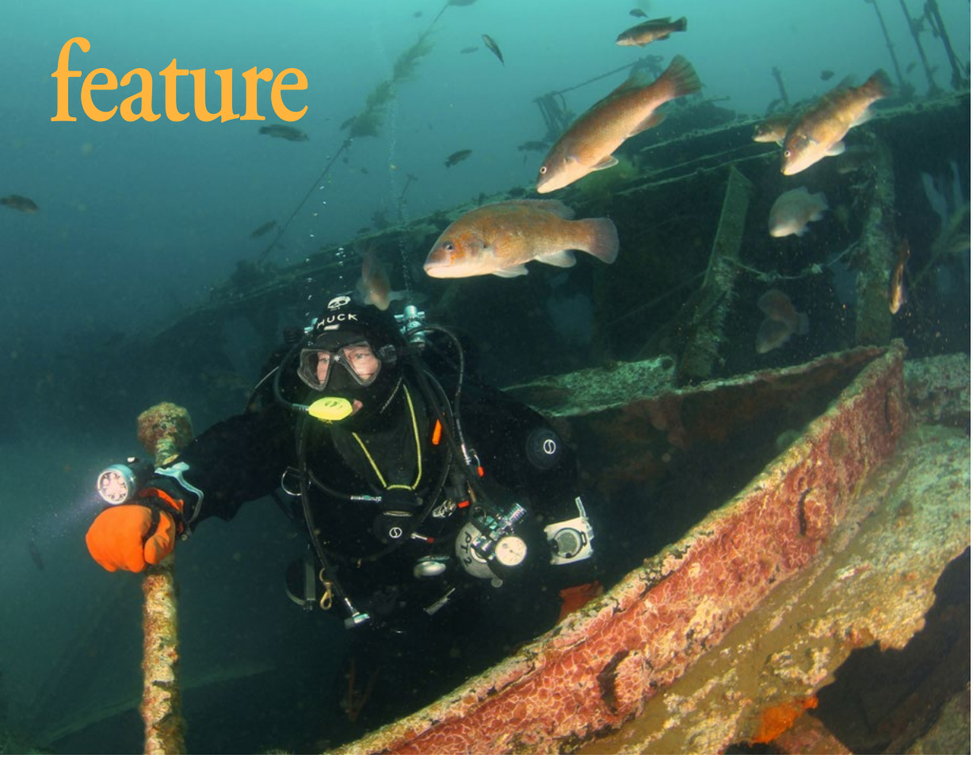


Photo 1. (above) Diver in Truk Lagoon, Micronesia. Gear: Canon EOS 7D Mark II camera, Tokina 10-17mm fisheye lens (at 10 mm), Nauticam housing, dual Inon Z-240 strobes. Exposure: ISO 160, f/13, 1/80s.

Black in Color Images

Text & photos by Michael Rothschild, MD

As automaker Henry Ford may or may not have said about his cars, "You can have any color you want as long as it's black." Divers—especially technical divers—have long had a similar choice. And while manufacturers are now throwing splashes of color into their gear, black still dominates the market. This presents a challenge for photographers hoping to show some of the detail in their models' kit, ever battling the tonal range on the left side of the histogram.

In Photo 1, the diver's gaze is fixed on the photographer as he finishes his decompression stop, perfectly poised in the water column. His suit and rebreather are all in technical black, but both AP Diving and Fourth Element have thrown a bit of yellow into the scene, which contrasts nicely with the rich blue of the shallow Pacific in the background. Photo 2 also shows a technical diver, this time in the frigid waters of Newfoundland. In his black gear with yellow accents, he drifts up out of the black void of the hold below. In Photo 3, the jet-black pupil of the clownfish lurks behind the venomous tentacles of its symbiotic friend, the sea anemone, like a portal to another dimension. And Photo 4 shows another diver in Canada, again wearing black with yellow accents, surfacing in the cool green of the St. Lawrence Seaway. Visit: **dive.rothschilddesign.com**

Black

Photo 2. (top left) Diver in Newfoundland, Canada. Gear: Canon EOS 7D camera, Tokina 10-17mm fisheye lens (at 10 mm), Nauticam housing, dual Inon Z-240 strobes. Exposure: ISO 200, f/8, 1/250s.

Photo 3. (left) Clownfish and anemone, Truk Lagoon, Micronesia. Gear: Canon EOS 7D Mark II camera, Tamron 60mm macro lens, Nauticam housing, dual Inon Z-240 strobes. Exposure: ISO 160, f/13, 1/250s.

Photo 4. (below) Diver in the St. Lawrence Seaway, Canada. Gear: Canon EOS 7D camera, Tokina 10-17mm fisheye lens (at 10 mm), Nauticam housing, dual Inon Z-240 strobes. Exposure: ISO 125, f/9, 1/250s.

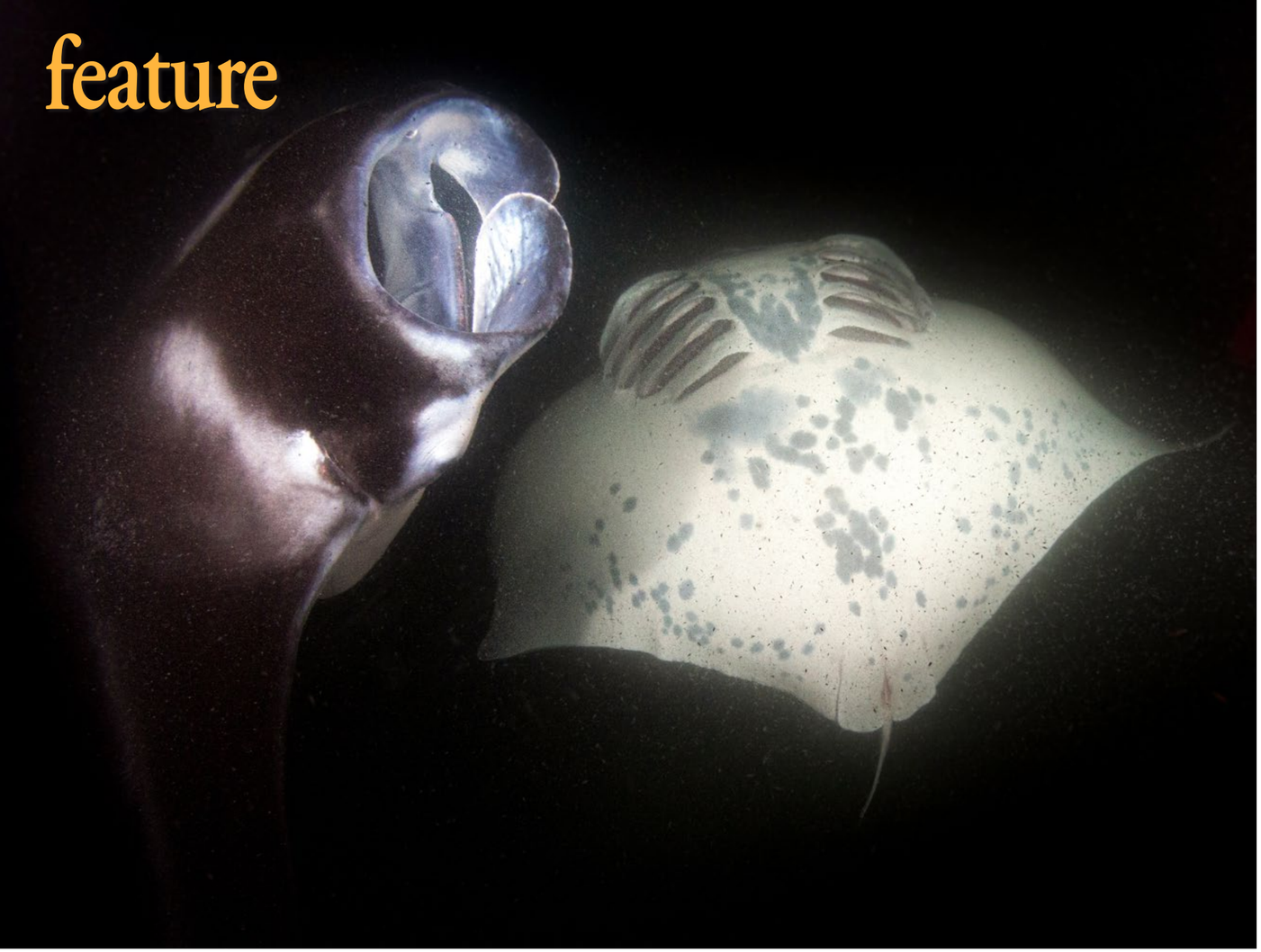


Photo 1. (right) Ornate leaf slug, *Elysia ornata*, Tufi House Reef, Papua New Guinea. Gear: Olympus OM-D E-M5 camera, Olympus M.Zuiko 60mm f/2.8 macro lens, Nauticam housing, Sea&Sea strobes. Exposure: ISO 250, f/22, 1/160s.

Photo 2. (above) Red coral, Papua New Guinea. Gear: Olympus OM-D E-M5 camera, Olympus M.Zuiko 60mm f/2.8 macro lens, Nauticam housing, Sea&Sea strobes. Exposure: ISO 400, f/16, 1/80s.

Photo 3. (top left) Giant oceanic manta ray, Kailua-Kona, Hawaii, USA. Gear: Olympus OM-D E-M5 camera, Panasonic 8mm fisheye lens, Nauticam housing, Sea&Sea strobes. Exposure: ISO 1600, f/11, 1/250s.

Elements of Black

Text and photos by Olga Torrey

The elegant black and white-edged ruffled mantle of the ornate leaf slug defines its aesthetic beauty in Photo 1. Black and white, used together, create a stark contrast that is visually compelling, defining black as the color of sophistication and white as the color of purity, emphasizing exciting shapes and forms. This sea slug is a sacoglossan, which feeds on green algae.

In Photo 2, the red color of the coral pops with vibrant intensity, and the black background intensifies the depth. These two colors attract attention by creating a visual dynamism with a bold and dramatic atmosphere. Red corals feed on zooplankton or derive their nutrition from zooxanthellae.

My visit to Kailua-Kona, Hawaii, was the adventure of a lifetime. I embarked on a thrilling night-snorkeling experience with giant oceanic manta rays.

To focus on the vivid details of the mantas' black skin and the white patches on their bodies floating against the solid black background of the water, I used lights to attract plankton and spotlight the manta rays (Photo 3). The use of video lights as an essential tool helped my artistic vision to show the strength, power and mystery of the manta rays while leaving the rest aside. The animals were hungry and active, giving me plenty of opportunities to capture them in action with their graceful, acrobatic movements. The giant oceanic manta ray feeds on small fish, crustaceans and zooplankton. Visit: **fitimage.nyc**

REFERENCE: WIKIPEDIA.ORG