



GLOBAL EDITION
May 2018
Number 85



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Beaked Whales

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Kayak Diving

Tech & Photo
Rebreathers

South Atlantic
St Helena

The Underrated
Nurse Shark

Ecology
Feather Stars

UW Photo
Macro in Anilao

MELANESIA'S

Solomon Islands

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COVER PHOTO: *Hairy Squat Lobster, Anilao, Philippines*
Photo by Kate Jonker (katejonker.com)

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Spider crab on sea fan, Solomon Islands. Photo by Matthew Meier



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Photo by: Larry Cohen

On not jettisoning our legacy of rational thinking

May we have the grown-ups back in charge, please?

More than 2,500 years ago, the Ancient Greeks founded philosophy and formulated scientific principles in an effort to describe the world in a nonreligious manner. Already in the 6th century BC, Athens was a centre of learning for astronomy, cosmology, geometry, political philosophy, ethics, metaphysics, ontology, logic, biology, rhetoric and aesthetics, art and literature. The Athenians also established what is generally held as the first democracy in 508–507 BC.

The Ancient Greeks revered and refined rational thinking, formulated rules of logic and established what makes up the burden of proof. Across the millennia, there are clear unbroken lines of the influence of the Ancient Greeks, which once again came to the fore during the Age of Enlightenment in the 18th century that saw a renewed emphasis on the scientific method and reductionism, along with increased questioning of religious orthodoxy.

The Enlightenment included a range of ideas centered on reason as the primary source of authority and legitimacy, and came to advance ideals like liberty, progress, tolerance, fraternity, constitutional government and separation of church and state. This period is also closely associated with the scientific and industrial revolution. In other words, the achievements which constitute the pillars of modern (Western)

culture and societies as we know of them today, with all their materials goods and benefits, rests on embracing rational thinking.

Inventions such as tablets, dive equipment and digital cameras; passenger jets, which take us to far-flung dive destinations; the Internet; and modern medicine, from hyperbaric chambers to pacemakers, hip replacements and antibiotics—just to name a few that we, as divers, almost take for granted—we can thank the legacy of some of the greatest minds, inventors and scientists for, all of whom worked with the principles once set forth by the Ancient Greeks.

How, may I ask, is it possible to chuck these principles out the window in the span of just an election cycle?

Watching the news these days is simply depressing. While news has always been mostly worrisome, we are now witnessing an ongoing, systematic attack on truth and rationality, during what has already been dubbed the "post-truth era." Matters raised and findings brought to light by hard-working investigative journalists or researchers are brushed aside as "fake news". The scientific community is being denounced and delegitimized on the altar of populism, even accused of being agents of foreign powers. Climate change is denied by high-ranking officials, and environmentalists

are painted as anti-corporate sentimentalists—an so on.

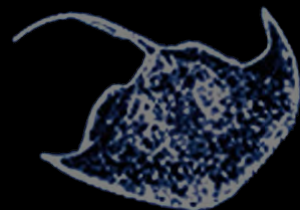
As we have argued many times before, there is no dichotomy between economy and ecology. Natural resources in various forms are the foundation of our economic activities, so they have to be managed *together*. So, who is saying otherwise, and what are their motives, one has to wonder?

Scientific endeavour, smart thinking and clever inventions, along with some forward-thinking entrepreneurs, are what have brought us both wealth and better health, and underlie all the prosperity and progress humanity has undergone throughout history—and will once again, if we embrace sane thinking and reject ignorance.

Going forward, if we are to save this planet—and with it, the aquatic environment that we, as divers, hold so dear—we must, first of all, stop the bashing of the scientific community by populist politicians, as we now need, more than ever, to put humanity's greatest minds to work on clever solutions for the common good and future generations.

— Peter Symes
Publisher & Editor-in-Chief

Rationality: the quality of being based on, or in accordance with, reason or logic.



News edited
by Catherine GS Lim

from the deep NEWS



BALDWIN C. ROBERTSON / CC BY 3.0

A new Haptoclinus blenny (*Teleostei, Labrisomidae*) from deep reefs off Curaçao, southern Caribbean

New ocean zone discovered: The Rhariphotic, full of unknown species

Researchers say the deep "rariphotic zone" around coral reefs could provide a vital refuge for many fish species as shallower regions are threatened by climate change.

About 30 new species identified within an area of just 200 square meters—with such amazing diversi-

ty, it is no wonder that researchers are excited about the new rariphotic ocean zone in the Caribbean.

Occurring between 130 and 309m below the surface—just below the mesophotic (40 to 150m)—this newly defined zone on a southern Caribbean reef system in Curaçao has been the subject of a study by Smithsonian researchers.

They had wanted to find out whether the deteriorating conditions of shallow reefs caused the organisms there to flee to deeper reef areas.

During their research, they discovered such an astounding richness and biodiversity within 130 and 309m below the surface, that they decided to define the area as a new oceanic zone.

80 dives in the sub

In the 80 dives in the Curasub mini-submarine, researchers observed about 4,500 fishes from 71 species. Using the Curasub enabled them to stay underwater for up to eight hours at depths of 309m, while remaining at normal atmospheric pressure.

One in five species new

"About one in every five fish we're finding in the rariphotic of the

Caribbean is a new species," said Dr Ross Robertson, a marine biologist at the Smithsonian Tropical Research Institute. He is the co-author of a paper on the rariphotic, published in the 20 March issue of the journal *Scientific Reports*.

Possible refuge

Despite its great depth and dark surroundings, the fish in the rariphotic are colorful, not unlike those found in coral reefs. As a result, researchers speculate that the rariphotic zone may serve as a refuge for shallow-dwelling reef fishes seeking relief from shallower waters that have warmed up due to climate change. This vast biodiversity within the rariphotic disputes the perception that reef ecosystems just below the mesophotic—which are generally unexplored—transition directly into those of the deep sea.

Diverse ecosystem

According to lead author, Carole Baldwin, curator of fishes at the Smithsonian's National Museum of Natural History and director of the Smithsonian's Deep Reef Observation Project (DROP), "... tropical deep reefs are not barren landscapes on the deep ocean floor; they are highly diverse ecosystems that warrant further study. We hope that by naming the deep-reef rariphotic zone, we'll draw attention to the need to continue to explore deep reefs." ■

SOURCE: SCIENTIFIC REPORTS

Rariphotic (low light): Newly discovered faunal zone from 130–300m (400–1,000ft), below the reef-building coral zone.

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The Bajau have genetically adapted spleens due to their lifestyle.

Genes and spleens underlie freediving prowess in sea nomads

The Bajau are an indigenous people in Indonesia, renowned for their breath-holding ability when diving for food. They have been known to dive up to 70m using nothing more than a set of weights and a pair of wooden goggles.

Previously, scientists have speculated on whether dive capacity is related to spleen size. Although there was limited information available about the human spleen in terms of physiology and genetics, deep-diving seals were known to have disproportionately large spleens, which led researchers to suspect the Bajau had genetically adapted spleens due to their lifestyle.

Human dive response

According to the press release issued by St John's College, Cambridge: "The spleen plays a central role in prolonging free diving time as it forms part of what is known as the human dive response. When the human body is submerged under cold water, even for brief amounts of time, this response is triggered as a method

of assisting the body to survive in an oxygen-deprived environment. The heart rate slows down, blood vessels in the extremities shrink to preserve blood for vital organs, and the spleen contracts.

"This contraction of the spleen creates an oxygen boost by ejecting oxygenated red blood cells into circulation and has been found to provide up to a 9% increase in oxygen, thereby prolonging dive time."

Genetic basis

The spleens of the Bajau and their land-dwelling neighbours, the Saluan, were scanned by ultrasound and samples taken. The results showed that the Bajau have a median spleen size that was 50 percent larger than the Saluan. And this was true even for non-diving Bajau. It was also discovered that the Bajau possessed a gene called PDE10A, which the Saluan did not. This gene is believed to control levels of the thyroid hormone and in turn spleen size as thyroid hormones and spleen size are connected.

The discovery of this genetic adaptation has implications in

the medical field, particularly in the study of acute hypoxia. This is because the human dive response simulates this medical condition, in which body tissue experiences a rapid depletion of oxygen.

Professor Rasmus Nielsen who holds dual positions at the University of Copenhagen and the University of California, Berkeley, said, "This is the first time that we really have a system like that in humans to study. It will help us make the link between the genetics and the physiological response to acute hypoxia. It's a hypoxia experiment that nature has made for us and allows us to study humans in a way that we can't in a laboratory."

The findings have opened up the possibility of investigating other sea nomadic populations like the Moken in Thailand and the Haenyeo women of Jeju, South Korea. Doing so can shed more light on the relationship between human physiology and genetic adaptations to extreme lifestyles, and clarify whether such adaptations have developed separately. ■ SOURCE: CELL

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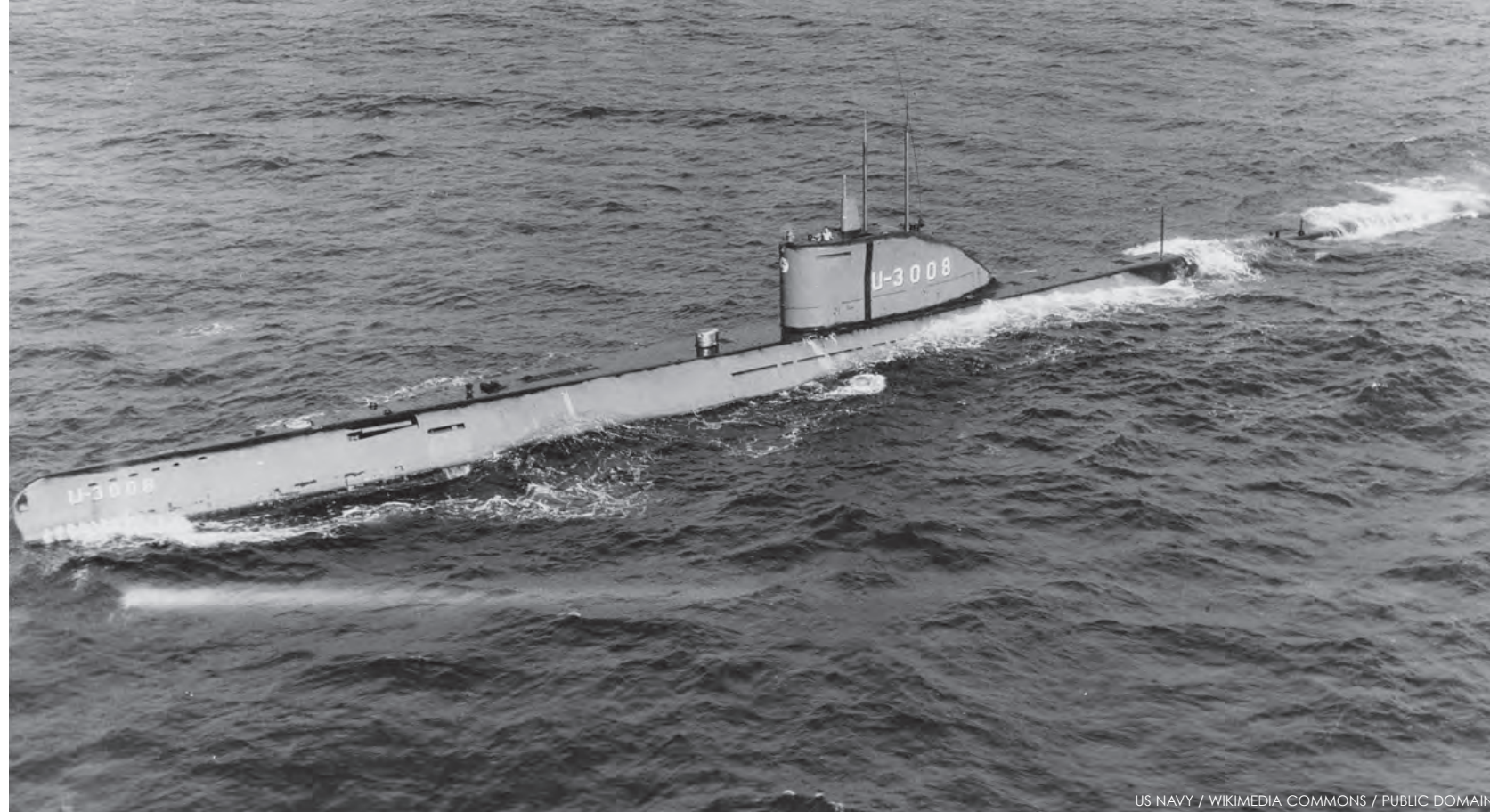
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File photo of a submarine similar to the one now located in the North Sea. The ex-German submarine U-3008 of Type XXI was taken over by the US Navy after 1945 and used as a test vessel. Photo from 15 April 1948.



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Rare WWII German submarine located in the North Sea

Sea War Museum Jutland in Thyborøn, Denmark finds wreck of unique WWII German U-boat during its ongoing registration of shipwrecks in the North Sea and in the Skagerrak.

The U-3523 was of the new and highly advanced type XXI U-boats that could have revolutionized the submarine war if enough boats had been completed in due time. One hundred and eighteen boats were laid down, but only two entered active service, and none ever saw battle.

U-3523 was sunk on 6 May 1945, by depth charges, northeast of Skagen Horn, in the Skagerrak. U-3523 was attacked by a British B-24 Liberator of 86 Squadron/G RAF. All 58 crewmen were lost. Only the day before, the German forces in Denmark, Northwest Germany and the Netherlands had surrendered. Hence the U-boat was not on a war patrol, but prob-

ably on the run.

In April 2018, the museum found the wreck of the German U-boat, U-3523, sunk in May 1945.

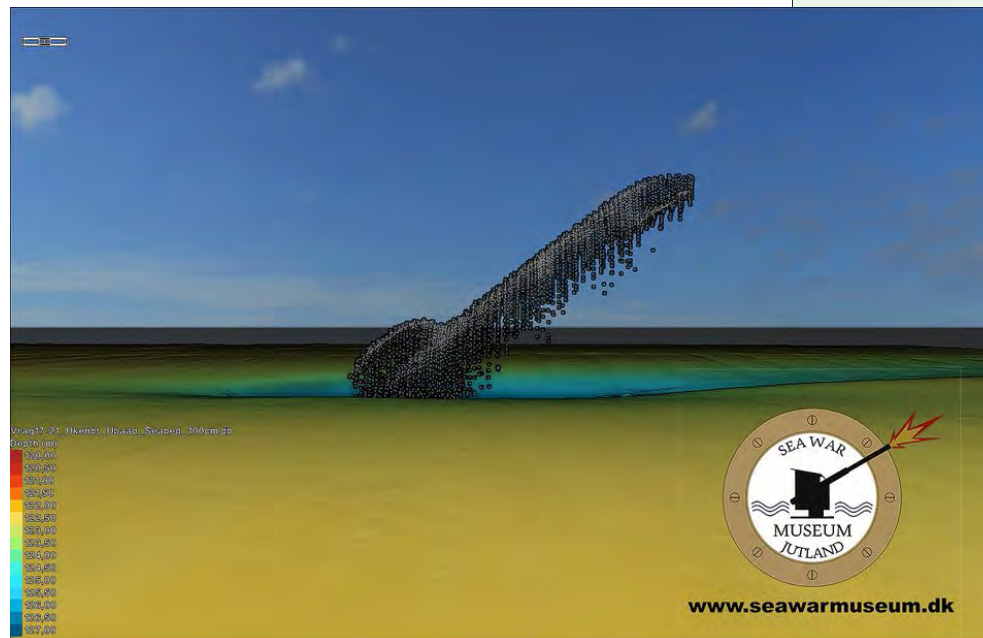
Nazi gold rumors

After the war, there were many rumors that top Nazis fled in U-boats and brought Nazi gold to safety, say in South America. The Type XXI U-3523 had the range that would have allowed it to sail non-stop all the way to South America. But it is not known what was the U-boat's destination, and nobody knows whether the U-boat had any valuables or passengers aboard in addition to the 58 crew.

Resting at 123m

U-3523 appeared on the screen during the museum's scan of the seabed ten nautical miles north of

Skagen, and the picture was very surprising. Most unusual was that the whole fore section of the U-boat lies buried in the seabed, while the stern is standing 20m above the bottom. The wreck lies at 123m of water, making it very difficult to access. ■ SOURCE: SEA WAR MUSEUM JUTLAND IN THYBORØN, DENMARK



FACT FILE:

Type XXI U-boats, also known as "Elektroboote" (German for "electric boat"), were a class of German diesel-electric submarines designed during the Second World War.

They were the first submarines designed to operate primarily submerged, rather than spending most of their time as surface ships that could submerge for brief periods as a means to escape detection or to attack. They incorporated a large number of batteries to improve the time they could spend underwater, to as much as several days, and they only needed to surface to periscope depth for recharging via a snorkel. ■

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The wreck of the "Lady Lex", as she was known, was discovered by the crew of Allen's research vessel, RV *Petrel*, on 4 March 2018 at a depth of 3,000m.



US NAVY / WIKIMEDIA COMMONS / PUBLIC DOMAIN

In less than two weeks, Paul Allen's search team finds two historic WWII wrecks

First, wreckage from the USS *Lexington* was found in Coral Sea by a search team led by the billionaire co-founder of Microsoft, Paul Allen. Aircraft from the ship appeared remarkably well-preserved, with squadron insignia and visible kill markings. Three weeks later, the team also located the cruiser USS *Juneau* off Solomon Islands.

The USS *Lexington* was scuttled about 800km (500mi) off the eastern coast of Australia in May 1942 after sustaining serious damage from Japanese aircraft. A series of secondary explosions, after the Japanese attack, sealed the ship's fate, and one of her own escorting destroyers was ordered to finish off the crippled carrier.

The wreck of the "Lady Lex", as she was known, was discovered by the crew of Allen's research vessel, RV *Petrel*, on 4 March at a depth of 3,000m and was positively identified when her nameplate was found on the remains of the ship's stern. The team shared photos of the carrier taken by the RV *Petrel*, which also showed aircraft that appeared remarkably well-preserved.

The USS *Lexington* was originally commissioned as a battlecruiser but was launched as an aircraft carrier in 1925. She took part in the Battle of the Coral Sea (4-8 May 1942) along with the USS *Yorktown* against three Japanese carriers. This was the first carrier-versus-

carrier battle in history, and was the first time Japanese forces suffered a permanent setback in its advances on New Guinea and Australia. However, the United States lost the *Lexington* and more than 200 of its crew members.

Scuttled

The *Lexington* had been hit by multiple torpedoes and bombs on 8 May, but it was a secondary explosion causing uncontrolled fires that finally warranted the call to abandon ship. The USS *Phelps* delivered the final torpedoes that sank the crippled Lady Lex, making it the first American aircraft carrier casualty in history. With other US ships standing by, 2,770 crewmen and officers were rescued.

The *Petrel* crew had been planning to hunt for the *Lexington* for six months after successfully locating several

historic wrecks including the Japanese battleship *Musashi* and the USS *Indianapolis* last year. "Lexington was on our priority list because she was one of the capital ships that was lost during WWII," Robert Kraft, director of subsea operations, said in a statement.

USS Juneau

The Atlanta-class light cruiser was finally found 4,200m (about 2.6mi)

below the surface, 76 years after it was sunk by a Japanese torpedo during the battle of Guadalcanal. The *Petrel's* autonomous underwater vehicle (AUV) first identified the ship in its side scan sonar on 17 March. Upon analysis of the sonar data, the *Petrel* crew deployed its remotely operated underwater vehicle (ROV) on 18 March to verify the wreckage through its video capabilities.

During WWII, the cruiser departed for the Pacific Theater on 22 August. On 8 November, *Juneau* departed Noumea, New Caledonia, as a unit of Task Force 67 under the command of Rear Admiral R. K. Turner to escort reinforcements to Guadalcanal. The force arrived there early morning 12 November, and *Juneau* took up her station in the protective screen around the transports and cargo vessels.

As the *Juneau* tried to leave the area, it was hit by a second torpedo in the same location. Following a huge explosion, the ship broke in two and sank within 20 to 30 seconds.

The Sullivans

The discovery, described in a statement by Vulcan Inc. representatives, marks the watery grave of the Sullivan brothers — George, Francis, Joseph, Madison and Albert.

The Sullivans refused to serve in the US Navy unless they could serve together, and they were granted permission to do so despite a Navy policy that prohibited assignment of family members to the same ship, according to the Naval History and Heritage Command (NHHHC) website. ■

SOURCES: PAULALLEN.COM

At 1:48 a.m. on 13 November, Rear Admiral Daniel J. Callaghan's relatively small Landing Support Group engaged the enemy. The Japanese force consisted of two battleships, one light cruiser, and nine destroyers. The *Juneau* was hit on the port side by a torpedo and subsequently withdrew alongside the other damaged ships, the *Helena* and the *San Francisco*.

USS *Juneau* afloat just after being launched at the Federal Shipbuilding Company yard, Kearny, New Jersey, 25 October 1941. The *Petrel* team first identified the ship in its side scan sonar on 17 March 2018.



US NAVY / WIKIMEDIA COMMONS / PUBLIC DOMAIN



Edited by
Peter Symes

This unrelated file photo shows a hyperbaric facility in a hospital used for both hyperbaric therapy of various illnesses, such as wound care, and for treating hapless divers for decompression sickness.



PETER SYMES

Lack of deco chamber in Pensacola, Florida, has local dive operators and tourism promotion authority on edge

The closest decompression chambers to the popular *Oriskany* wreck dive site and the Florida Panhandle Shipwreck Trail in the United States are in Mobile, Alabama, which is out of state—or in Fort Myers, more than 600mi away.

Although Visit Pensacola promotes the *Oriskany* dive site and Florida Panhandle Shipwreck Trail, it has not been made aware of the safety concerns over the region's lack of hyperbaric chambers to treat decompression sickness, Nicole Stacey, spokeswoman for Visit Pensacola, told *Pensacola News Journal*.

She said Visit Pensacola was not involved in any effort to try to improve

emergency treatment options for divers and would rely on the diving industry and those professionals in the area to remedy the situation.

Closest facilities

The closest hospital to Pensacola that offers hyperbaric chambers for use in dive emergency is Springhill Medical Center in Mobile, Alabama, about 60mi (100km) away. Within the state of Florida, however, the closest hospital that provides the services is in Fort Myers, more than 600 mi(1,000km) away.

Julio Garcia, director of the Hyperbaric Medicine Program at Springhill Medical Center in Mobile, Alabama, has long warned about the risk Panhandle divers face because they cannot receive timely treatment for decompression sickness, commonly known as the bends.

Divers "too expensive" to treat

Many hospitals, including some in Pensacola that actually operate hyperbaric chambers, limit their use of their facilities to outpatient wound care and other noncritical treatments stating it is too expensive to have chambers, physicians and staff available 24 hours a day, seven days a week for rare dive injuries.

Careful planning urged

The Florida Fish and Wildlife Conservation Commission website urges divers to carefully plan for an *Oriskany* dive.

"Due to its depth, distance from shore, and potential currents, all divers should gain appropriate training equipment, fitness and experience before diving the *Oriskany*," the website states. ■

Meanwhile, new hyperbaric facilities serving divers are opening up elsewhere

Philippines

In a bid to boost the Davao Region's position as a premier diving destination in the Philippines, a new hyperbaric chamber facility was inaugurated at the Southern Philippine Medical Center in Manila, which will treat divers and other patients who suffer decompression sickness. The facility, whose construction was started on October 2016, has two hyperbaric chamber systems. One is funded by the Philippines Tourism Infrastructure and Enterprise Zone Authority (Tieza), and the other is donated by the Office of the President through the Manila Economic and Cultural Office.

Antigua

On Antigua in the West Indies, a new hyperbaric chamber, funded by the Calvin Ayre Foundation, has been set up at the Mount St John's Medical Center. The death of a local fisherman and diver, Andy Samuel, in 2017 spurred friends of the deceased to convince the foundation's chairman, Calvin Ayre, who is also the Special Economic Envoy for the Government of Antigua and Barbuda, of the need for a hyperbaric chamber on the island to treat divers who suffer from decompression illness.

"Clearly this project is humanitarian, especially with respect to local fishers," said Ayre. "The loss of just one person can be so devastating and so unnecessary and we hope that having this new hyperbaric chamber will make decompression sickness a thing of the past."

According to the Health and Environment Minister, Molwyn Joseph, the hyperbaric chamber will not only be used for the treating divers with the bends, but also patients with diabetic sores and wounds. ■ SOURCES: ANTIGUA NEWS ROOM, MINDANAO TIMES

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Buddy Dive closes branch on Dominica following hurricane destruction

After two years of successfully running Buddy Dive on Dominica, it will officially be closing its doors at the Fort Young Hotel. As difficult as it is, Buddy Dive has come to terms with the end of an era. "After the devastating effect of Hurricane Maria, the decision was unavoidable," CEO Martien van der Valk stated in a press release.

In the face of all that has happened over the last couple of months, Buddy Dive has been looking into the opportunities to rebuild what was lost. "The way the numbers added up and the way the future looked to us, we have come to the unavoidable decision to close down our business at the Fort Young Hotel. This is an emotional time for us and our employees, who have been such a big part of what has made Buddy Dive on Dominica successful," Van der Valk said. ■



Boracay's closure was ordered by President Duterte after he was outraged by environmental violations.

Boracay Island closed to tourists for six months for clean-up

The Philippines has announced a six-month closure of the popular tourist destination of Boracay over concerns the island's famous beaches and clear blue waters have been transformed into a "cesspool", due to sustained environmental damage.

The tourism boom that Boracay has seen over the past decade or two has brought jobs and investment but strained the island's water and rubbish disposal systems and its sewer system.

Among the problems caused by the island's long-running tourism boom is unregulated development and pipes carrying raw effluence directly into the sea. In a survey of the island's sewerage facili-

ties, the vast majority—716 of 834 residential and business properties—were found to have no discharge permit and were presumed to be draining waste water directly into the sea, according to a report by the official Philippines News Agency.

Off-limits to visitors

President Rodrigo Duterte — who has said that inadequate sewage treatment on the island of Boracay has turned

its beaches into a "cesspool", directed that it be closed to tourism starting on 26 April, his spokesman, Harry Roque, said on Wednesday. The government says the overhaul is necessary to save the tiny island, which generated over US\$1 billion last year but cannot cope under the strain of two million tourists a year. The island, whose revenue makes up 20 percent of the country's total tourism industry, will be off-limits to visitors during the clean-up.

The decision ended weeks of speculation on the fate of the popular tourist destination, after President Duterte complained about the state of the island in February. Duterte has said that Boracay must be cleaned up, but officials have given only vague indications that there is a plan to do so. The Philippines will tear down illegal structures, build a bypass to unclog traffic, convert tricycle taxis into electric vehicles and build a modern waste-to-energy plant to rescue its premier tourist island, the government said on Friday.

Outcry from residents

The closure has triggered an outcry from island residents that the Philippine government is sacrificing the local interests to keep Chinese investments and tourists coming. The island is home to around 500 tourism-related businesses, which drew in annual revenue of \$1.07bn in 2017. Boracay's Chamber

of Commerce and Industry requested Duterte to reconsider the closure, arguing that not all businesses were violators and that only those found to be polluting should be shut down.

Officials, however, also reminded the media that Boracay would be closed for a maximum of six months. Epimaco Denising, assistant secretary for the Department

of the Interior and Local Government, expressed that there was a possibility of a "soft opening" of the resort island "in three to four months."

NGOs approve

"Several environmentalists praised Duterte's actions, saying that what they want right now is to ensure the issue of sustainability is at the forefront of the discussion when it comes to environmental concerns," said Al Jazeera's Jamela Alindogan who was reporting from the capital city of Manila. ■

"...we wish to upgrade the services. We must swallow the bitter pill, and see this solution as one step backward and two steps forward. We want to continue to promote the Philippines as a beautiful destination—and want to add that our destinations are environmentally compliant."

— Ricky Alegre
Assistant Secretary
Department of Tourism

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75 Years After World War II

Solomon Islands

Text and photos
by Matthew Meier



Diver with massive red sea fan at Russell Islands. PREVIOUS PAGE: A school of glassfish swimming in silhouette under the left wing of a US PBV-5A Catalina seaplane, which was sunk during WWII just outside of Tulagi Harbor, Florida Islands



Diver on the wreck of a F4U Corsair fighter plane, which crashed into the sea during WWII, Munda

My journey to the Solomon Islands began with an exciting dive experience and an unforgettable taste of history. Passing 100ft (30m) on my way down to 170ft (52m), I began to question the intelligence of this decision. I was in a very remote corner of the globe, with minimal surface support, dropping to a very deep depth and all on a single tank of air.

The plan was simple, descend down the sloping coral reef until we hit the seabed, spend six to seven minutes on the bottom

and then begin the slow ascent back to the surface, punctuated by 25-plus minutes of decompression stops. The temptation drawing me to the ocean floor was a somewhat newly discovered and nearly fully intact WWII Corsair fighter plane sitting upright in the sand. Circling her with my camera, I concentrated on controlling my breathing and composing photos, all the while contemplating the ill-fated young US pilot who likely perished when this plane went down.

The Corsair had been found just 15 years earlier when freedivers, spearfishing off the point, spotted the plane on the bottom. Due to the exposed nature of the dive site, the depth at which she sits, and the level of experience needed to dive her, only a handful of people



Munda Airport runway, constructed by the Japanese during WWII from October to December 1942; the United States captured the airfield in 1943.



Solomons



Shallow coral reef and tropical trees (above) and red whip corals (top right) at Russell Islands; Anemone hermit crab (left) and Papuan scorpionfish at night (right) at Florida Islands; Large school of bigeye jacks, Solomon Islands (far right)

since I was a teenager. I spent my adolescent years researching book reports on the Pacific Theater during the Second World War and knew of the Battle of Guadalcanal and John F. Kennedy's ordeal on PT-109 long before I fully grasped that they occurred in the Solomons. It took the prospect of my recent trip to bring all of the puzzle pieces together and rekindle my enthusiasm to see these childhood curiosities in person.

The year 2017 marked the 75th anniversary of the 7 August 1942 invasion that started the Battle of Guadalcanal, the first major allied offensive against the Empire of Japan during World War II. Codenamed Operation Watchtower, the campaign

began with attacks against Japanese-held installations on Guadalcanal, Tulagi and Florida islands. The objective was to keep the Japanese from using these bases and airfields to threaten communication and supply routes between the United States, New Zealand and Australia. Over the course of six months, the allied and Japanese forces squared off in three key land battles, seven extensive naval battles and near continual aerial assaults, leading to the eventual withdrawal of the remaining Japanese forces in February 1943. Tens of thousands of men were killed or wounded,



have had the privilege to visit the Corsair each year since her discovery. Back on dry land, I marveled at the wreckage left behind after the war and contemplated the fact that even now, 75 years later, hundreds of planes are still waiting to be discovered.

History

I should probably start off with a confession: The Solomon Islands have held a fascination for me

dozens of ships destroyed and hundreds of planes lost during the struggle to retake the Solomon Islands.

Allied troops eventually seized the seaplane base at Tulagi, along with the Japanese built airstrip on Guadalcanal, which later became known as Henderson Field, and currently serves as the nation's principal international

airport, plus the Japanese-built airstrip at Munda, which now welcomes daily interisland flights from Honiara and Gizo. Control of these airstrips was essential in

stopping the Japanese advancement across the Pacific and I was fortunate to explore all of these places and more during my visit.



Orange-finned anemonefish on carpet anemone (left), blue-green chromis on branching corals (above) and diver with large sea fan (lower left) at Munda

Diving

The diving around Munda offers a wide variety of exceptional options including colorful coral reefs, sheer walls, schooling pelagics and WWII wrecks. The remote nature of this area equates to a limited number of divers, zero competition for dive sites and healthy, pristine reefs. Visibility can vary within the bays and shallow lagoons but is often in the 60 to 100ft (18

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Munda

New Georgia Island and the settlement of Munda was the first stop on my tour of the Solomon Islands. Located in the Western Province, at the edge of Roviana Lagoon, this quaint waterside town is walking distance from the contested air-strip that brought allied troops here 75 years ago.

Consisting of a few storefronts, a couple of hotels, a nightclub, a dive shop and the town pier, life passes relatively slowly here. The restaurant at my hotel had views of the ocean from every table and provided an assortment of delectable cuisine, as well as my new favorite drink, bush lime juice. Hand squeezed from tiny limes, the resulting beverage is tart, sweet and refreshingly indulgent.

Munda is a bit rustic by typical American travelers' standards and definitely off the beaten path; however,



for those looking for a little adventure, especially divers wanting to experience untouched wilderness, mixed with amazing WWII history, this is the place to be.



Large colonies of mushroom leather corals growing near the water's surface on the reef at Munda



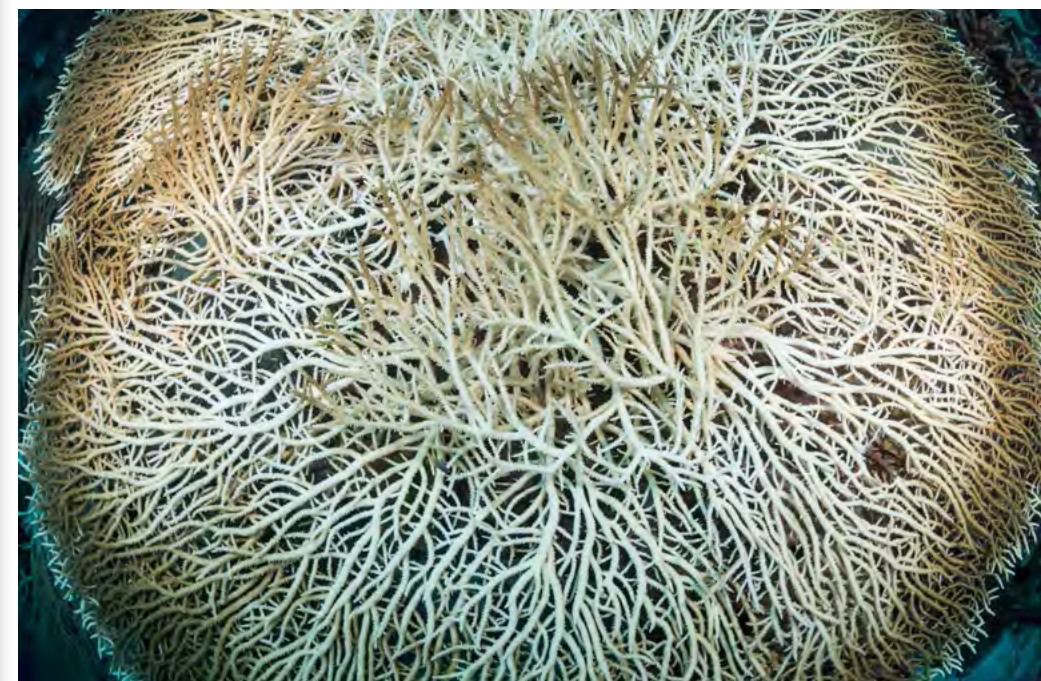
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Solomons



Grumman F4F Wildcat fighter plane, which crashed into the sea during WWII, rests upside down on the sea floor, encrusted in corals and sponges and surrounded by schools of glassfish (above); Massive, circular plate coral colony on reef (left)

across an expanse of the largest plate corals I have ever seen. Measuring 10 to 15ft (3 to 5m) across, the sea floor was literally covered with these massive disks. The scale of these formations was simply astounding, as is the notion that it likely took well over a hundred years for each of these coral colonies to amass their enormity.

to 30m) range on the outer reefs and most dive sites are only a 10- to 20-minute boat ride from shore.

Alice in Wonderland. I thoroughly enjoyed diving on the

reefs amongst fields of mushroom leather corals, enormous carpet anemones and shallow hard coral gardens. Although my favorite find was at a dive site called Alice in Wonderland, where we came

Grumman F4F Wildcat. Next to Alice in Wonderland is a Grumman F4F Wildcat fighter plane resting upside down in 40ft (12m) of water. Shot down on 4 August 1943, the Wildcat is now fully entwined with the surrounding





Propeller, engine and cockpit of a Douglas A-24 Banshee Dive Bomber / Reconnaissance Aircraft, which crashed during WWII, Munda (above); Bell P-39 Airacobra fighter plane (left), with one wing and its propeller still intact

Friendly locals

In between dives on the Airacobra and the Douglas bomber, I was fortunate to photograph and interact with a group of local children playing along the shoreline. Several young boys were using an arching palm tree as a make shift trampoline, grasping on to the trunk as they bounced up and down before



Local boys from a nearby village playing, Munda

reef. Schools of glassfish and golden sweepers call it home, as they dance around the fuselage and landing gear encrusted with colorful corals and sponges.

I dived on four different plane wrecks while in Munda but this was the only one that had been reclaimed by the reef. The other three, including the Corsair, a Bell P-39 Airacobra and a Douglas A-24 Banshee dive-bomber landed upright in the sand and are still easily identified as their former selves.

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Photo by Kim Jong Mun





Bow of a Japanese supply ship, the *Kashi Maru*, which was sunk in Mbaeroko Bay by a US B25 bomber during WWII while unloading equipment and fuel (above and far right); One of four Japanese anti-aircraft guns (right) stationed along the shoreline to protect the landing site for supply ships like the *Kashi Maru*

catapulting themselves into the shallow water.

The children were hesitant when I first approached but as soon as I was able to convey my intentions, by showing them photos on the back of the camera, playtime resumed. It was such a fun and memorable experience to be accepted into their midst and share in the universal joys of childhood.

Lumbaria

Nearby to the final resting place of the Airacobra is the island of Lumbaria, where John F. Kennedy and the US Navy's Patrol Torpedo (PT) boats were stationed during the war. Though different from the

now famously named Kennedy Island, where JFK was stranded after a Japanese destroyer struck and eventually sank his PT-109 boat, I was still thrilled to witness yet another small part of the history I had studied in my youth.

Kashi Maru. Mbaeroko Bay is situated on the northern coast of New Georgia Island, nearly opposite of Munda, and is home to the wreck of a Japanese supply ship named *Kashi Maru*. A US B-25



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bomber sank her on July 2, 1943, while she was offloading fuel and vehicles under an artificial canopy of palm trees, constructed to camouflage the ships existence. The wreck now rests upright, leaning slightly to port, in 40ft (12m) of water alongside the sandy, sloping bank, with remnants of the cargo still in the hold. Truck axles, tires, ammunition

and spools of wire can be seen through the gaping hole in the port side that was peeled open by the bomb responsible for her demise. The engine room, just aft of the cargo hold, is fully intact and well preserved for those with the experience and skill to penetrate the small space. This beautiful shallow wreck can provide hours of fascinating discoveries,

though the brackish water in the bay can at times lead to challenging visibility.

Topside war relics

No visit to the *Kashi Maru* is complete without a boat ride along the nearby shoreline to view the four Japanese anti-aircraft guns once used to protect this supply depot. These massive cannons



Machine guns and ammunition (above) and hand grenades (right) at the Peter Joseph World War II Museum; A functioning 1942 Jeep Willy, with Japanese anti-aircraft guns in the backgrounds, is parked on one of the original jungle roads used by US troops during World War II (top center)

now sit idle, in rusting disrepair, slowly being reclaimed by the surrounding jungle.

Similar relics from the war exist in other places on the island, including mass dumping grounds where departing troops, both Japanese and American, buried everything from weapons and ammunition to trucks and airplane parts. Up in the hills overlooking Munda, one man has organized thousands of found objects into the town's only museum. The artifacts are neatly displayed in a covered open-air facility, on rows of tables with supporting documentation, labels and historic photos. The Peter Joseph WWII Museum is named after the US soldier whose dog tag first started the collection. It has now grown to include hand grenades, knives, bullets, shells, mortars, guns, helmets, canteens, lighters, buckles, cups, bowls, bottles, silverware,

rotary telephones, engines, propellers and much, much more.

On my way to the museum, I was lucky to ride in an almost fully restored 1942 Jeep Willy as we toured the surrounding hillsides, utilizing roads originally cut through the jungle by allied troops. Believed to be the only functioning WWII jeep in the Solomons, should you get the opportunity, this once-in-a-lifetime brush with history is not to be missed.

Skull Island

Across the lagoon to the west of Munda sits a small palm tree covered patch of land called Skull Island. Locals have built a shrine on this sacred spot to honor their past chiefs and many still journey to the alter asking for their blessings. The skulls

of former chiefs adorn the shrine, along with shell money and other offerings for good fortune. While still in use today, the last chief laid to rest here died in 1932.

Tetepare Island

There are many places around the islands for the non-diver and outdoor enthusiast to explore this tropical wonderland. For avian fans, the Solomon Islands also offer world-class birding opportunities. Several islands provide hiking or trekking tours, including Kolombangara and Tetepare, which are within a one- to two-

hour boat ride from Munda.

Tetepare is the largest uninhabited island in the South Pacific and is home to several endemic species of birds and bats, plus monitor lizards, tree snakes, dugongs, sea turtles, saltwater crocodiles and a resident pod of dolphins. Over 230 species of birds have been documented on Tetepare, 24 distinct reptiles, 4 frogs and 13 species of mammals.

The island is maintained as a conser-

vation sanctuary with an eco-lodge and several rangers on staff to patrol the area. School groups, researchers, scientists and birders use the lodge to facilitate extended stays on the island, but only 13 guests may visit at any given time. During my short stint on the island, I photographed over a dozen different species of birds as well as a monitor lizard sunning itself on the curved trunk of a palm tree. (Learn more at: tetepare.org)

Skulls on the shrine (above) built on Skull Island—the island is sacred to the locals and the shrine was built with the skulls of their past chiefs; Western Pacific monitor lizard (right) and a female olive-backed sunbird (top right) at Tetepare Island



CLOCKWISE FROM LEFT: Cab of a truck from WWII, encrusted with corals, sponges and algae; Colorful coral bommie; Longfin spadefish swimming in formation in blue water; Blue-spotted puffer fish on a large, purple elephant ear, White Beach, Russell Islands

divemasters for saltwater crocodiles. In areas where they are known to linger our guide carried out recon missions ahead of our dives to be sure none were laying in wait. Sadly, none of the missions were successful and I did not get to see any geckos on our trip.

Bat Cave. However, upon surfacing inside a cavern at a dive site named Bat Cave, I did get to see hundreds of bats roosting on tree branches overhead. Just outside the cave entrance, I photographed the smallest critter found on this trip: a Denise's pigmy seahorse.



facts remain, scattered down a sloping coral wall.

As in Munda, large amounts of supplies and gear were left behind at the end of the war and in this instance nearly all of it was pushed into the sea. The floating barges used to offload supplies were intentionally sunk, as were tanks, trucks, tractors, forklifts, ammunition, provisions and more. The resulting wreckage still echoes its previous life form, though it is far more colorful today, thanks to years of coral and sponge growth.

Russell Islands

After a week-long stay in Munda, I took a short one-hour flight back to Honiara, the capital city on Guadalcanal Island, before boarding a new liveaboard dive boat for a 10-day cruise dubbed the Best of the Solomons. The first stop on the itinerary, after an overnight transit, was a place called White Beach in the Russell Islands. Once home to a supply depot for allied troops during WWII, evidence of its topside existence has largely been erased over time; however, under the water, a huge collection of arti-

White Beach. White Beach was the only site where I encountered WWII relics in the Russell Islands, though I am certain more exist. Our remaining three days of diving in the area focused on shallow hard coral gardens, sheer walls, coral bommies, schooling fish, incredible caverns and huge sea fans. Here, I also learned to be on the lookout for geckos, the name affectionately used by the local



Blue Wall. Contrast the half-inch (1cm) long seahorse to the massive 15+ ft (5m) wide sea fans at a dive site called Blue Wall, and the Russell Islands delivered the biggest span of life I encountered underwater.

Mirror Pond. Should Mother Nature and the dive schedule cooperate, there are spectacular photo opportunities at two world-renowned dive sites in the Russell Islands. Both require bright sunshine throughout a small window of time during which light rays may stream into cavernous



Dually truck tires from WWII, encrusted with corals, sponges and algae, White Beach



Diver swimming through the Leru Cut, Russell Islands

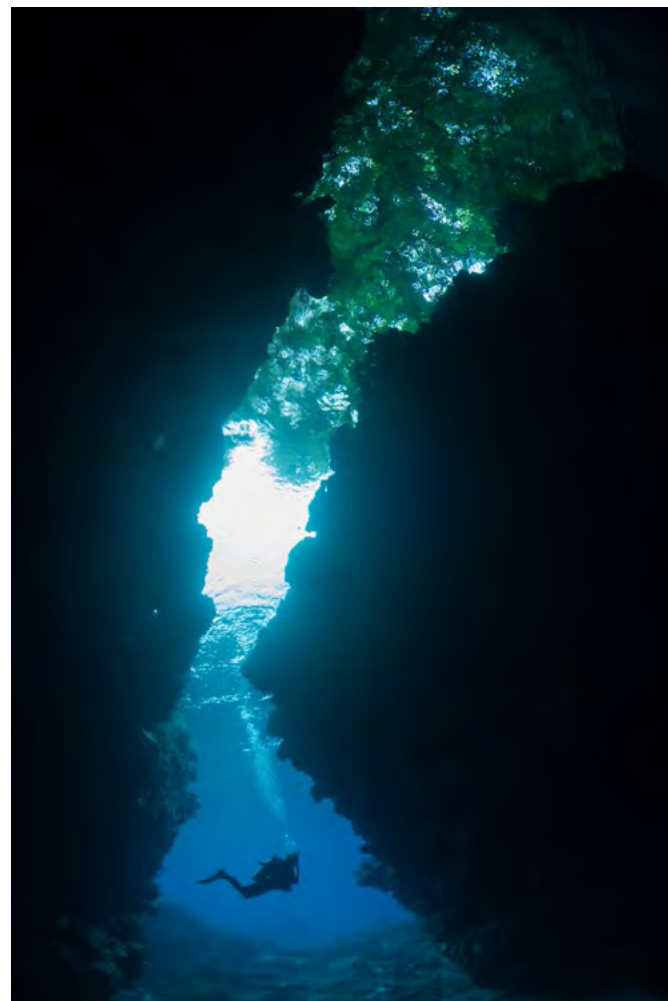
spaces. The first is called Mirror Pond and this actual pond of seawater lies in the jungle surrounded by trees. Divers enter from below, through an underwater cavern, to see a mirror like reflection in the water's surface with sun-

rays streaking in from above. Exhalation bubbles quickly ripple the mirror effect, so photographically, it is best to be the first one inside or wait for everyone else to pass and try your luck at the back of the pack.



Leru Cut. Leru Cut is the other site, and it consists of a natural gash in the rock at the edge of Leru Island that is 10 to 15ft (3 to 5m) wide, 30 to 40ft (9 to 12m) deep and stretches 300 to 400ft (92 to 122m) into the island, with trees forming a canopy overhead. Here again, it is best to

be first in line with a camera, so you can swim inside and look back out the opening to silhouette incoming divers against the blue water and streaks of light. I did not have great luck at either of these sites with conditions or time of day and look forward to improving my images the next go around.



Marovo Lagoon

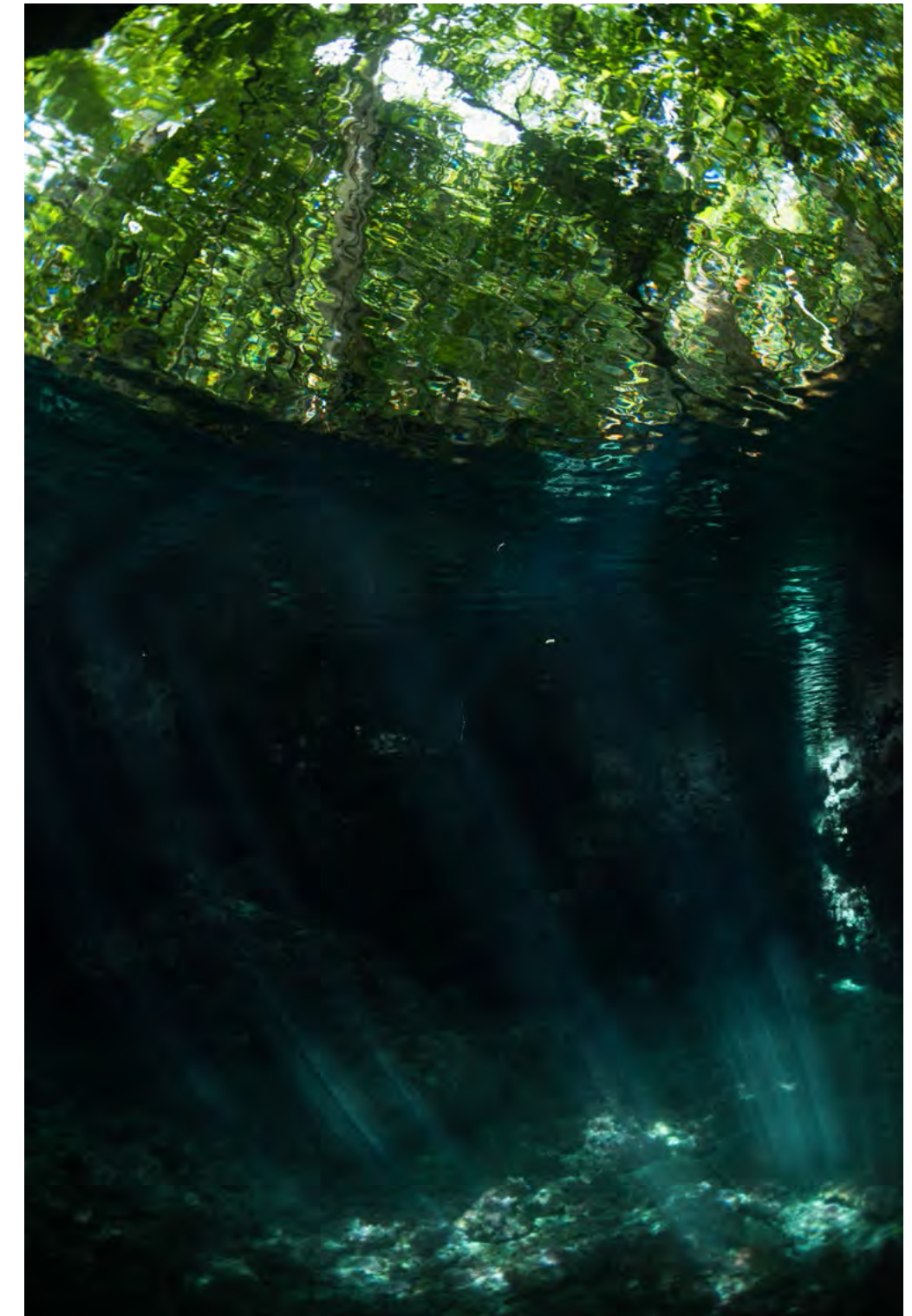
From the Russell Islands, I took a northwesterly heading on a long overnight transit to Marovo Lagoon. The next morning, I discovered that this saltwater lagoon is absolutely massive, encompassing 270 sq mi (700 sq km), and is protected by an impressive double barrier reef. Skilled fishermen inhabit numerous islands within the lagoon, as do some of the most talented wood carvers I have encountered during my travels.

Several members of our boat crew grew up in this area, and

Local children (left) sang songs for visiting tourists, Marovo Lagoon, Peava Village, Gatokae Island; Diver silhouetted in the blue water of an underwater cavern with overhanging trees at Marovo Lagoon (lower left)

we were fortunate to visit one of their homes while on a tour of Peava Village on Gatokae Island. The resident children lined the beach awaiting our arrival and excitedly led us on a procession

to tour their schoolhouse. Once inside, the kids welcomed us with a series of songs before we presented their teacher with a collection of school supplies and made lots of new friends when a bag of



Underwater view of green trees and sun beams, Mirror Pond, Russell Islands





A massive school of glassfish (left) on coral bommie, Florida Islands; Green, elkhorn-shaped hard corals (right) and an endemic white-bonnet anemonefish (above) in anemone at Marovo Lagoon—this species can only be found in the Solomons Islands and Papua New Guinea



lollipops materialized. A few of the kids posed for portraits for me and I loved seeing their smiling faces light up upon observing themselves in the camera.

Back down along the shoreline several artists had laid out their woodcarvings in a makeshift market, and we were left with the difficult task of choosing between all of their magnificent work. With zero space or weight left in my

bags, I was lucky the large pockets in my jacket allowed me to bring home stunning carvings of both an octopus and a cuttlefish to add to my collection.

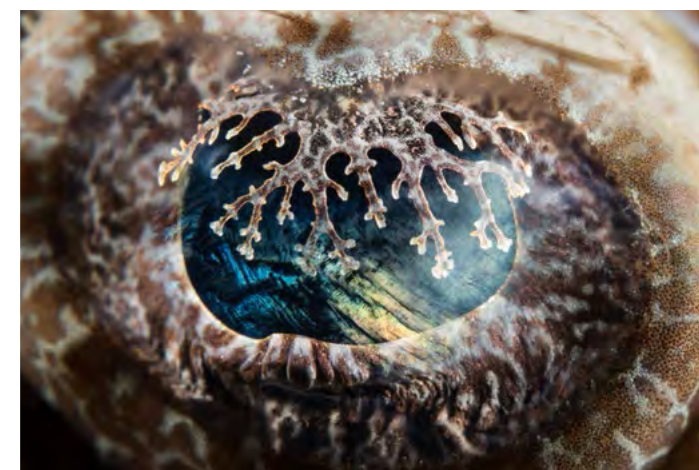
Underwater the scenery in the lagoon was every bit as impressive as the aquatic woodcarvings. I dived on multiple shallow coral gardens, each teaming with fish and several species of soft corals, many new to

me, tucked in amongst branching corals, sponges and algae. There were vast fields of staghorn and elkhorn corals and monstrous sea fans every bit as enormous as those found in the Russell Islands. I shot one of my favorite critters, the crocodile flathead fish, on three separate occasions, and once with the proper lens combination to capture simply its eye.

Cathedral. At a dive site named Cathedral, I swam through another vast cavern with amazing shafts of light, this one with multiple chambers and openings to the jungle above. I was also able to finally photograph the endemic white-bonnet anemonefish. Existing only in the Solomon Islands and Papua New Guinea, this cute little clownfish had eluded me for 12 years since I first discovered it in Papua New Guinea. I was shooting film at the time and had already exposed my 36 frames when I saw a white-bonnet under the boat during my safety stop. Surfacing to change tanks and reload my camera, I begged the captain to stay for one more dive, but the weather had turned and sadly he needed to get us off the reef; I never got another opportunity.

Florida Islands

From Marovo Lagoon, we circled back through the Russell Islands and then made our way northeast up to the Florida Islands, also known as the Nggela Islands. This island group lies directly north of Guadalcanal and consists of four



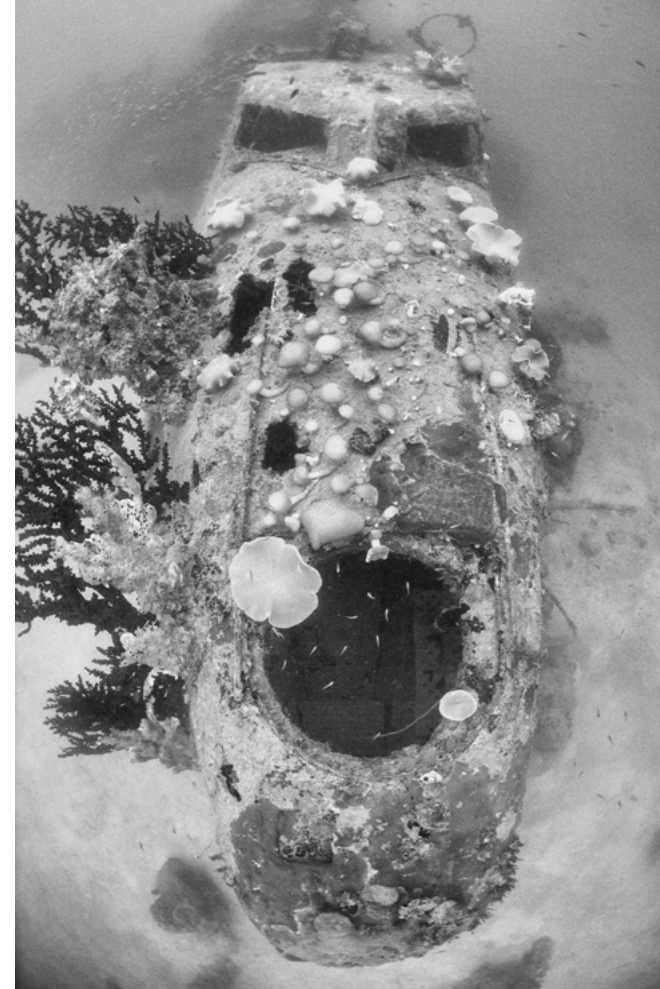
larger islands and roughly 50 smaller ones. The first day in the Florida Islands, we were diving reefs and several beautiful walls with large sea fans, black corals, barrel and elephant ear sponges and a huge field of staghorn corals. There was also a large dome of encrusting cor-

als, colonies of red whip corals and a mammoth aggregation of glassfish and golden sweepers.

Baby Cakes. At a pinnacle named Baby Cakes, we made a night dive and found several scorpionfish, two different species of lionfish, nudibranchs, hermit crabs and a colorful spider crab wandering across a sea fan.



Eye (inset) of crocodile flathead fish (above) on sandy bottom, and hard and soft corals (left) with Snell's window overhead, at Marovo Lagoon



Diver at fuselage and cockpit of a Japanese Mavis M5 airplane (far left) and cockpit of a Japanese Mavis M6 airplane (left), both sunk during WWII in 1942 at the Tulagi Seaplane Base, located in Gavutu Harbor

rate machine guns and a 20mm cannon in the tail turret.

M5 and M6 Mavis. Several of the seaplanes that were sunk on 7 August 1942, have been discovered in the past two decades. We were able to dive on the Mavis wrecks designated M5 and M6, both of which are sitting upright on a silt and sandy bottom in roughly 100ft (30m) of water.

The M5 is largely

intact except for a portion of the starboard wing, which is missing. The port side wing, with its engines still attached, remains connected to the fuselage and is supported by the float at its wingtip. The nose of the fuselage is bent upwards, likely from the initial impact with the seafloor, but the cockpit is surprisingly well preserved.

The M6 Mavis broke in half as she sunk with the tail section now nearly facing forward and both wings folded upside down, each on the opposite side to where they were originally attached. The destruction also opened up the rear of the cockpit allowing divers the opportunity to swim inside to

Tulagi Island

The small island of Tulagi is the current capital of the Central Province and was home to the British Administration of the Solomon Islands prior to WWII. Nearby to Tulagi, in a pre-dawn surprise attack on 7 August 1942, US Navy aircraft bombed the Japanese seaplane base at Gavutu Island. The assault resulted in the sinking of seven Japanese H6K Mavis flying boats, which were anchored to their mooring buoys in the harbor. Over the next 48 hours, US Marines landed on the island and took control of the base, capturing several wrecked seaplanes in the process and ultimately defeating the Japanese soldiers. I spent the last two days of my trip diving the numerous planes and ships that were sunk in the battles around Tulagi.

The Mavis seaplane was origi-



nally 84ft (26m) long and stood 20ft (6m) high with a wingspan of 131ft (40m). She was powered by four wing-mounted, 1000 HP, propeller driven engines that delivered a cruising speed of 138 mph

(216 km/h) for a range of 4,112 miles (6,580km) at a maximum altitude of 31,520ft (9,610m). A crew of nine managed her payload consisting of either torpedoes or bombs, as well as her four sepa-



The tail section of a Japanese Mavis M5 airplane, Gavutu Harbor (above); Hard and soft corals in Marovo Lagoon (left)



Diver at forward gun on HMNZS *Mōa* (above), a Bird class minesweeper of the Royal New Zealand Navy that served during WWII; A shallow coral reef encircles Tulagi Island, just offshore of the main island of Tulagi in the Florida Islands (top left); View of the left engine, wing and nose of a US PBV-5A Catalina seaplane, which was sunk during WWII just outside of Tulagi Harbor, Florida Islands (top right)



see what is left of the metal framework of the seats and the pilot's controls.

Visibility in the bay can deteriorate quickly, with runoff from recent rains, tidal flow and divers with poor buoyancy control. Our 30 to 40ft (9 to 12m) of visibility on the M5 dropped down to 5 to 10ft (2 to 3m) the next day on the M6, though we had a lot of particulate matter in the water both days.

US PBV-5A Catalina. In between the Mavis wrecks, I also dived on a US PBV-5A Catalina seaplane. Similar in function to the Japanese Mavis, the American-built Catalina was supported by a crew of 10 on a platform, which was slightly shorter in length and wingspan, had only two wing-mounted engines and a considerably reduced range and altitude capability.

The wreck sits upright, nearly fully intact in 110ft (34m) of water. Both engines have fallen from their mounts and are lying beside the fuselage with their propellers stuck in the sand. A large gaping hole behind the wing mount was potentially the cause of her sinking or was simply ripped open when the plane hit bottom. The machine gun once used by the waist gunner has tumbled to the seafloor though its ammunition is still waiting to be fired next to the gun mount. While you are exploring the wreck, be on the look out for an immense school of glassfish that now call the port side wing home and the assorted resident lionfish living in the cockpit.

HMNZS Mōa. The deepest shipwreck I explored was a Bird class minesweeper

of the Royal New Zealand Navy that was bombed by Japanese aircraft in Tulagi Harbor on 7 April 1943. The top deck of the HMNZS *Mōa* (T233) rests at 130ft (40m).

Very early one overcast morning, I was swimming across her bow towards the forward gun in negligible visibility. It was so dark and green down there that my camera had trouble finding focus and shooting at f/2.8 for 1/30 of a second, I still needed to raise my ISO to 3200 to get a decent exposure. After photographing the gun, my dive guide and I navigated from bow to stern to shoot the gigantic winch mounted to the back deck that was once used in minesweeping operations. With our bottom time expiring, we returned to the mooring line to begin our slow ascent back into the light.



Wreckage from a fighter plane that crashed onto Guadalcanal Island during WWII on display at the Vilu War Museum

Guadalcanal Island

After our final dive, which happened to be on the Mavis M6, we motored back to Guadalcanal and anchored in Honiara Harbor prior to disembarking the following morning.

Allied sailors named the body of water in between the Florida Islands and Guadalcanal Island the Iron Bottom Sound for the dozens of ships and planes, both allied and Japanese, which were sunk there during the Battle of Guadalcanal. Many of the battleships, cruisers, destroyers, submarines and transport ships rest at depths beyond what can be safely attained by recreational divers, but there are a number of wrecks that lay in shallow water and are accessible by shore or by boat from Guadalcanal. I did not get the opportunity to dive any of these wrecks during my stay on the liveboard; however, day trips are available from a few

local operators if you would like to extend your dive trip.

Topside excursions

Honiara. Traveling to the Solomon Islands from the United States, I stopped in Fiji for a few hours before catching a Solomon Airlines flight to Honiara. On the way home, I took the same path in reverse. Since the airline only flies to and from Fiji on Tuesdays and Saturdays, I still had roughly two days to explore Guadalcanal after getting off the boat before my flight home. During that time, I visited the Honiara Central Market, two WWII Museums and the US War Memorial.

The Central Market is located on the waters of Iron Bottom Sound in the heart of Honiara and offers fresh fish, flowers, fruits, vegetables and local crafts. The fish is carried directly from the fishing boats at the docks to the vendors in the market and is coveted

for its freshness. Local merchants come from neighboring islands to sell their produce and handiwork, and often stay for extended periods of time before returning home. A visit to the market is a spectacle for your senses and a wonderful opportunity to get a taste of the local culture and cuisine.

Vilu War Museum. To the west of Honiara, on a random dirt road approximately 45 minutes down the Tandai Highway, is the Vilu War Museum. There is a small insignia announcing your arrival at the main entrance but no road signs to actually get you there from the highway. Through the arched gateway is a jungle setting with large clearings that are filled with anti-aircraft guns, cannons, both a Japanese and American war memorial plaque and numerous WWII airplanes in various states of disrepair and re-assembly. All

Solomons

Large granite slabs memorialize the history, battles and fallen soldiers lost during the battle of Guadalcanal from 1942-1943. The Guadalcanal American Memorial was dedicated in 1992 on the 50th anniversary of the US invasion.



during the initial invasion of Guadalcanal. Seventy-five years of tropical weather and neglect have turned them into rusting shells of their former splendor. Many also now have full-grown banyon trees growing in, around and through them.

The museum also has a large collection of Coca-Cola bottles left behind after the war. The US military discovered that Japanese submarines were using the trail of floating empty Coke bottles, thrown overboard by US sailors, to sink ships during the war. Their

of the artifacts on display were recovered from the jungles around Guadalcanal and saved from the scrap metal dealers that laid claim to most of the wreckage left behind after the war. If you go, bring your sense of wonder, an appreciation of history, sunscreen and definitely bug spray.

Tetere Beach WWII Museum.

A little more than an hour in the opposite direction from Honiara is the Tetere Beach WWII Museum. Here, you will find dozens of abandoned LVT AMTRAC amphibious landing craft vehicles that the US troops left behind after using them to get ashore



LVT AMTRAC amphibious landing craft vehicles abandoned after WWII now have trees and vegetation growing out of them, Tetere Beach World War II Museum.





Feather stars on large gorgonian sea fan growing on wall at Russell Islands

solution to the problem was to instruct Coke to make bottles with thicker glass on the bottom, so they would sink instead of float; both types of bottles are on display at the museum.

Guadalcanal American Memorial.

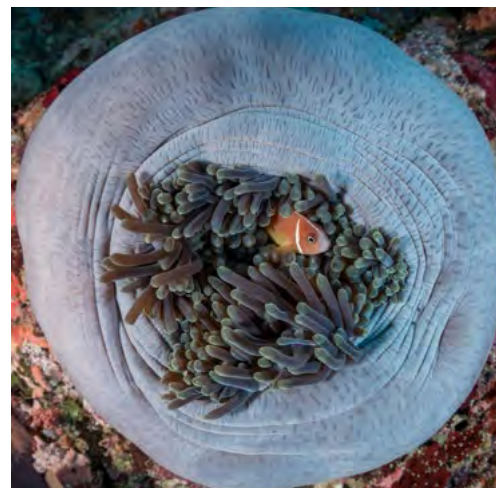
The Guadalcanal American Memorial overlooks Honiara Harbor and is perched on top of the first hill occupied by US forces. Dedicated in 1992 on the 50th anniversary of the Allied invasion, large granite slabs memorialize the history, battles and fallen American and allied soldiers lost during the Battle of Guadalcanal. A large star and plaque, at the center of the monument, honor an unknown soldier whose remains were discovered during the excavation of the site. The memorial is a humbling tribute to

all who fought and died to liberate the Solomon Islands.

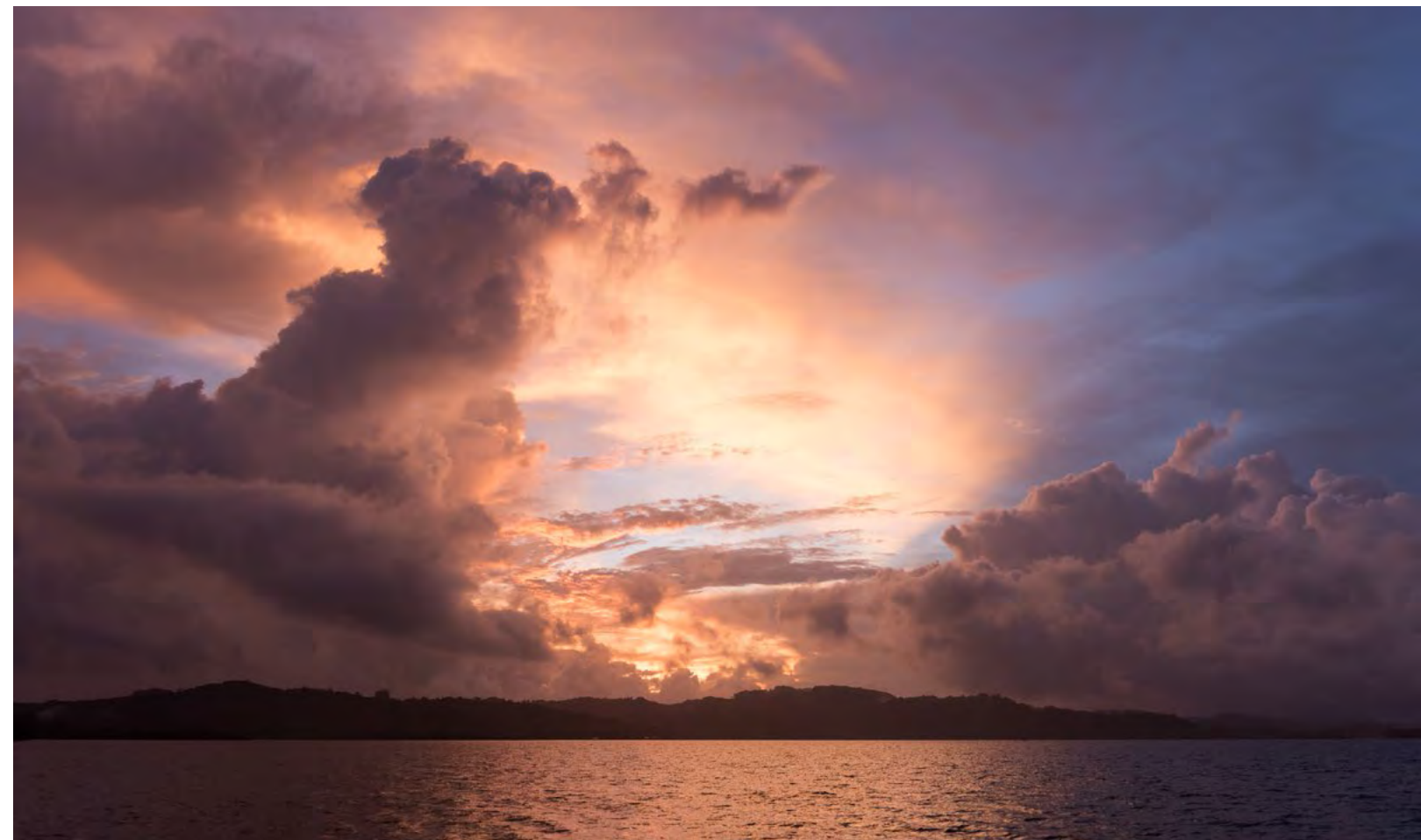
Afterthoughts

As a guest of the Solomon Islands Visitors Bureau, I had the pleasure of touring this beautiful country with one of their representatives. Ellison Kyere was wonderful company throughout my trip and incredibly valuable in coordinating local flights and excursions. The remote and rustic nature of the Solomon Islands is one of its biggest draws, especially for divers, but that factor can also make it a bit of a challenge to navigate. Having a local expert to pave the way was a tremendous help.

The Solomon Islands has to rank among my favorite dive destinations. The ability to experience even some of the WWII history that fascinated me in my youth



was absolutely magical. Add in the unspoiled and untouched reefs with their diverse coral formations, gigantic sea fans, colossal plate corals, the wide-ranging assortment of critters and fish life, and you have an exceptional and rare combination. I look forward to exploring more of this extraordinary country and hope you get the opportunity to travel here soon as well. Bring your sense of adventure and prepare to be amazed. ■



Pink anemonefish in a magnificent blue grey anemone (left) and a brilliant sunrise (above) at Florida Islands; Sun beams fall on an aggregation of chromis and damselfish over acropora branching hard corals at Russell Islands (top center)

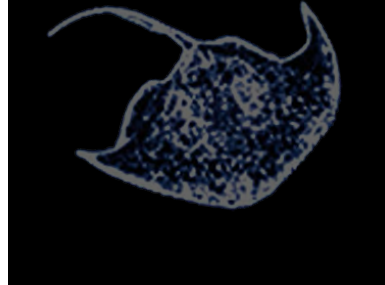
Solomons

Thanks go to the Solomon Islands Visitors Bureau (visitsolomons.com.sb), Dive Munda (mundadive.com), Solomon Islands Dive Expeditions (solomonsdiving.com), Agnes Gateway Hotel (agneshotelsolomon.com), Fiji Airways (fijiairways.com), Solomon Airlines (flysolomons.com), Solomon Kitano Mendana Hotel (kitanomendana.com), Heritage Park Hotel (heritageparkhotel.com.sb), Scubapro (scubapro.com) and Blue Abyss Photo (blueabyssphoto.com).

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



fact file



Solomon Islands



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

History The Solomon Islands were first visited by the Spanish in 1568 but have been inhabited for thousands of years. The country became a protectorate of Britain in 1893 and self-governing in 1976 but it took another two years to achieve their independence. Today the islands act as a constitutional monarchy to the Queen of England with a local prime minister overseeing the government. The Solomon Islands saw heavy fighting during WWII as allied forces sought to halt the Japanese Imperial forces from advancing to Australia and across the Pacific. On 7 August 1942 the United States and its allies began bombing the Japanese forces at Tulagi and Guadalcanal, and made amphibious landings of troops to begin a ground assault. The allies eventually captured the airfield on Guadalcanal and another up in Munda, in a bloody campaign that lasted for six months. The Japanese withdrew their remaining forces on 7 February 1943 in what would become a turning point in the war against Japan in the Pacific. Dozens of ships, hundreds of planes and thousands of soldiers were lost in the battles, and much of the wreckage can still be seen today, both on land and beneath the waves, with some yet to be discovered. Government:

Commonwealth realm with a parliamentary democracy under a constitutional monarchy. Capital: Honiara

Geography Consisting of over 900 islands, situated east of Papua New Guinea and north-west of Vanuatu, the Solomon Islands cover a land area of 28,400 sq km (11,000 sq mi). Guadalcanal Island is home to the nation's capital of Honiara and also Henderson Field, the only international airport. The distance from the eastern to westernmost islands is roughly 1,500km (930mi), and most of the islands are covered in tropical rainforests. Coastline: 5,313km. Terrain consists primarily of rugged mountains with some low coral atolls.

Climate The islands are humid and tropical with an average air temperature of 27°C (80°F). There are only very minor seasonal fluctuations in the weather; from June to August, it is cooler and less humid. Water temperatures range from 28° to 30°C (82° to 85°F) and a rash guard or 3mm wetsuit is sufficient for most divers. Visibility ranges from 25 to 40m (75 to 125ft) but can be less at some dive sites due to nutrient rich upwellings or recent rain run off. Tropical showers can occur daily and the lush vegetation is



Location of North Solomon Islands on global map (right); Map of Solomon Islands (below)



is broadly recognized as you travel throughout the country and there are also another 120 indigenous languages.

Phone/Internet

Country code: 677. Home phone service is negligible, but roughly 66% of the population has mobile phone service. Contact with the outside world is limited in remote areas, with very slow Internet connections.

Health & Security

There have been confirmed cases of dengue fever, as well as a risk of malaria and Zika virus. Avoid mosquito bites by using mosquito repellent and covering up. Most visits are reported trouble-free, but check your state department for current travel advisories on civil unrest, theft and violent crime, especially in the central market of Honiara. Please be aware that drug use is illegal in this country; swearing is a crime; and dress codes are modest. Refer to your state department or foreign service for more information on local laws and customs.

Decompression chamber

There is only one recompression chamber in the Solomon Islands and it is located in the capital city of Honiara. If that chamber is

nourished by 3,050mm (120in) of annual rainfall. Natural hazards include frequent earthquakes, tremors and volcanic activity; tsunamis; and tropical cyclones, but they are rarely destructive.

Environmental issues

Challenges include soil erosion, deforestation, and some dead or dying coral reefs.

Economy The majority of the population is sustained by agriculture, fishing and forestry, while the service industry accounts for roughly 20% of the workforce. Petroleum products and manufactured goods are largely imported and the primary exports include cocoa, coconuts, palm oil, rice, fruit, fish and timber.

Currency The Solomon Island Dollar (SBD) is the country's official currency and it was introduced in 1977. The dollar is subdivided into 100 cents and is available in both paper and coin denominations. Foreign currencies are not recog-

nized in remote areas, though the barter system and shell money may still be used. Shell money was the traditional currency of the Pacific Islands and may still be seen at museums, local shrines and the Honiara Central Market. Exchange rates: 1USD=7.81SBD; 1EUR=9.63SBD; 1GBP=11.11SBD; 1AUD=6.06SBD; 1SGD=5.95SBD

Population 647,581 (July 2017 est). Over 10% of those people live in the capital of Honiara and the remaining inhabit just 147 of the 992 islands. Ethnic groups: Melanesian 95.3%, Polynesian 3.1%, Micronesian 1.2% (2009 est.). Religions: Protestant 73.4%, Roman Catholic 19.6% (2009 est.). Internet users: 69,859, or 11% of population (July 2016 est.)

Language The official language of the Solomon Islands is English and though it is widely spoken at resorts and tourist destinations, only 1 to 2% of the population actually speaks English. Melanesian Pidgin English

unavailable, the next closest facility is 2,400 km (1,500 mi) away in Townsville, Australia.

Voltage 240V/60Hz, utilizing Australian style sockets. An International multi-prong adaptor is recommended.

Cuisine The local cuisine is influenced by both European and Asian cultures, with fish being the staple meat of the Solomon Islands. It can be baked, boiled or fried and is often served with sweet potatoes, rice, taro root, cassava and other vegetables. At tourist hotels and on liveaboard boats the food is often served buffet style with a variety of options to satisfy individual dietary restrictions.

Tipping Tipping is not expected but always appreciated. A 10% tip for the crew of a liveaboard or dive resort is appropriate for excellent service.

Transportation The only International airport is located in the capital city of Honiara on Guadalcanal Island. Solomon Airlines operates flights between Australia, Fiji, Vanuatu and Papua New Guinea as well as an extensive network of local flights between islands. Presently, there is not a departure tax to be paid when leaving the Solomon Islands.

Travel/Visa Passports must be valid for six months beyond expected stay, but not everyone needs a visa. Check with your country's state department for specific entry requirements. Most tourists are granted permit upon arrival. Carry a printed copy of your return or onward ticket.

Web sites Solomon Islands Tourism visitsolomons.com.sb

Reefs, Wrecks & Whale Sharks

St Helena

In the South Atlantic

Text and photos by Raf Jah



View of St Helena, a remote British Overseas Territory located in the South Atlantic Ocean. PREVIOUS PAGE: Whale shark seen at St Helena

The remote island of St Helena has been an enigma in the South Atlantic Ocean. Historically, the only way to visit the British territory was by Royal Mail ship or yacht. With limited yet lengthy sailings and even more limited and very expensive cabins, the island was effectively out of reach for most people. For over two decades, contributor Raf Jah had his eyes on St Helena, and he made a vow that when the day flights were announced, he would buy a ticket. He kept that promise and three months after the first Embraer E90 landed on St Helena's new air field, Raf and his wife Francisca stepped off the plane with a group of rather experienced divers. This is the story of their adventure.



Jamestown Airport at St Helena

Landing

Much has been made of the new airport on St Helena Island. And much has been made of the dramatic landings on St Helena.

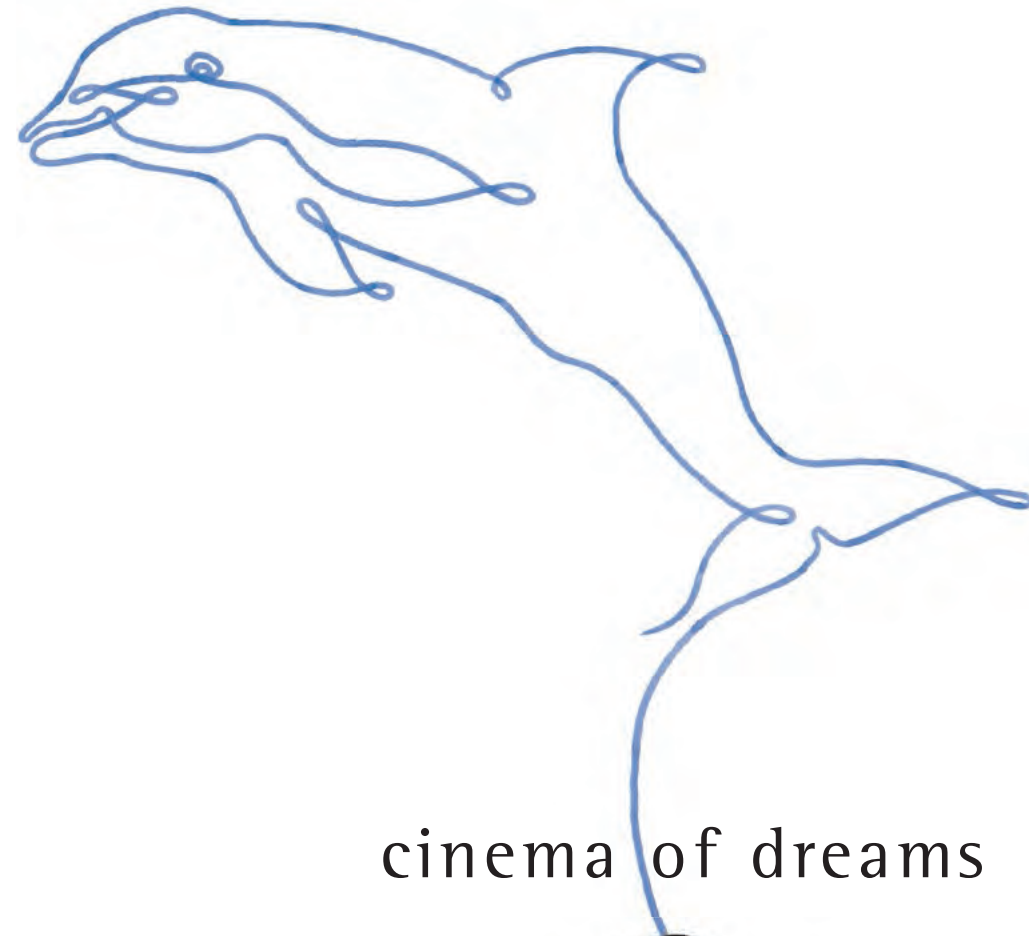
Our reality was simple: a 3-hour 15-minute flight from our last refuelling stop over the azure Atlantic Ocean. As we approached St Helena, I peered out of the window at the clouds and the shape that was the

Island. We made one pass by the island before beginning our approach. The plane curled past an impressive brown knob of rock and suddenly banked to the left and descended slightly. With a healthy

bounce, we made contact with the runway. The pilot steadied us, and then all three wheels were on the tarmac. With reverse thrust and a bit of breaking, the Embraer E90 rolled to a stop.

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Winding road to Jamestown passes rugged landscapes

St Helena Air Terminal looked ultra-modern, with its shiny glass exterior and clean parking mat. State-of-the-art crash fire tenders, ambulances, re-fuelling trucks, various vehicles along with an out-of-place Dennis town fire engine were parked near it. In the afternoon sun, it all looked quite delightful and breezy, like a tiny regional British airport in glorious summer sun. For this was all undeniably British. Sadly, the vestiges of Britain were also in attendance, with needlessly officious immigration and quarantine officers. This was not the United Kingdom of 2018, but of my childhood in the 1970s. Rather than be bothered by

the foolishness of the situation, we made jokes about it until we finally exited the building.

The airport has been misnamed Jamestown Airport, but in fact, it should really be called "Spider Hill Aerodrome," for it sits next to the world-famous Spider Hill. Indeed, its runway sits in the direction it is, wind shear and all, to save the protected funnel

web spiders.

In the carpark, our friend and contact, Anthony Thomas of Sub-Tropic Adventures, met us and loaded our bags onto two vehicles. We set off along a winding road towards Half Tree Hollow and our accommodation. The jeep must have passed through four different ecosystems, barren desert to lush green forests and small patches of farmland.

After dumping our frogman kit, Anthony took us on a quick cook's tour. The island consisted of a large volcanic rock with lush green valleys, peaks and mountains starting at 2,000ft. With the cooling wind blowing at altitude, you could almost think you were in the valleys of wales.



Cannon at historic monument on St Helena overlooks a bay

St Helena





Jacobs Ladder, a series of 700 large steps, descends 700ft to the sheltered harbor of Jamestown on St Helena

Ladder Hill Fort

Then we descended to Ladder Hill Fort. Pronounced "ladi hiw for" by the Saints, this was an impressive fortification that overlooked Jamestown and its sheltered harbour. Once a simple East India Company fortification, Ladder Hill Fort had evolved over the centu-

ries with its last additions of naval guns being added in World War II. Now it was home to the "interim fire station," a tin roofed shed that housed a couple of British Dennis fire appliances and a Carmichael conversion- firefighting land rover. When I asked, I was told that the interim fire station was, in fact, the main fire station and had been "interim" for 20 years.

The fort was open to all, and afforded views of the yachts at anchor and the tenders and barges that service the Royal Mail Ship St Helena. The RMS, as she was known by the saints, was

due into harbour for its last sailing in a few days.

Jamestown

Below us was a series of 700 large steps that descended 700ft down into Jamestown. These steps were called Jacobs Ladder. Once a supply railway to the fort, it had now been transformed into a steep shortcut from town to Half Tree Hollow. We declined to descend the 700ft high steps and drove sedately down into St Helena's administrative capital, Jamestown.

It turned out to be a quaint English fishing village, with no recognisable shops. Jamestown had the same air as parts of Malta and Gibraltar, but with quintessentially British people. The saints spoke with a patois that sounds to have its roots somewhere between



Jamestown is a quaint English fishing village

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- Goran Ehlme Underwater photographer and head of Waterproof R&D

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THIS PAGE: Towering rock cliffs and rugged landscape of St Helena; Ladder Hill Road is a narrow winding path leading to the wharf (right)

Cornwall and Australia.

The only downside, was that the only restaurant that was open every night was that of the Mantis. Other restaurants or cafes would open for a few hours on certain evenings to cater for the saints and expats wishes. After a quick familiarisation with the sea, post office, tourist office and the rendezvous point for diving, we drove back up the hill and went to dinner.

To sea

Our diving started the next day. We had opted to stay in the Williams Estate, a series of well-appointed semi-detached bungalows on the side of a mountain. This meant driving down to the wharf every day. Ladder Hill Road was a narrow winding path, which had clearly been an old

wagon track. In most places, it was a single-track road, with a small stone wall between the driver and the drop. Descending against the flow of traffic required a keen eye and a swift foot for the accelerator and brake. We made it down with no issues and sought out the dive centre.

St Helena was not the most conventional of islands. Its towering rock cliffs had occasional fissures that dropped down to the sea in steep sided valleys. At the end of these valleys, there was sometimes access to the sea. This could be in the form of a rocky cluster or a stone beach. At the



mouth of every Jamestown was a case in point. The end of the valley was capped with a fortified wall, which sported a large gate. Beyond the wall was a now dry moat, the sea wall, and a shingle beach.

There was no jetty, as the island had no deep-water wharf. All ships had to anchor in the bay and have the containers and passengers offloaded by lighter or barge. Every single person going onto and off St Helena had to

arrive or leave from a set of steps, 20ft wide.

Anthony Thomas had just rented new premises for the Sub Tropic Adventures Scuba Diving Centre, but had not as yet, made the move with all his kit. As such,

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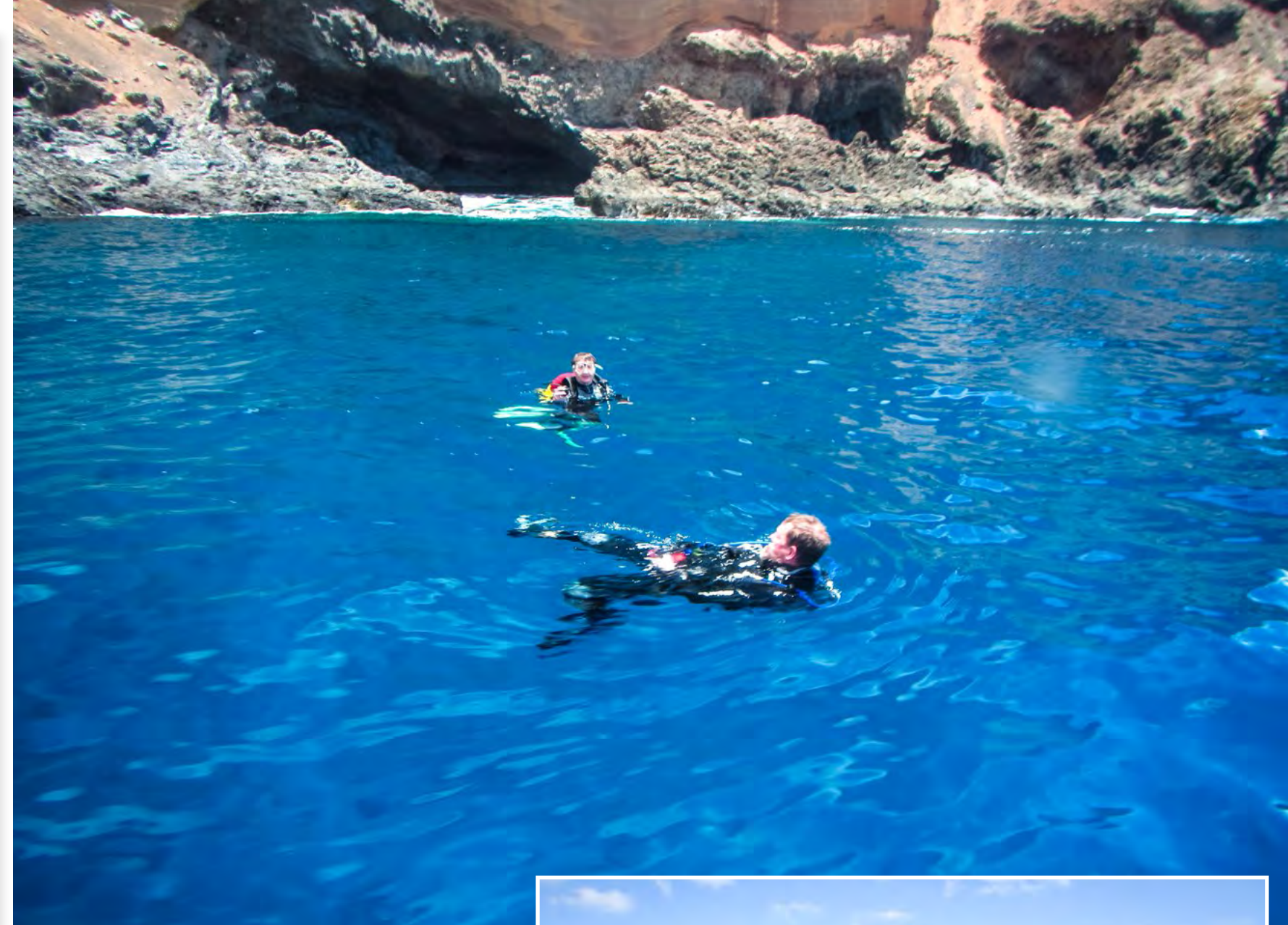
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we assembled by the famous steps and waited. A white Ford transit pick-up appeared, and Anthony and his no. 2, Paul Cherret, started to unload everything. We pitched in and helped while Anthony took a skiff out to collect his rib. Loading up took seconds, and we were on our way. Anthony was apologetic: "This is not normal. Soon, we'll have the dive centre down here and we'll pre-load the boat, and you will simply step aboard."

Anthony was definitely on the ball, but it made the expedition more real to unload our dive equipment, cylinders and weights, before assembling our scuba kit on the wharf. Just as we were ready, Anthony appeared with a solid south African manufactured RIB, equipped with radio, first aid kit, oxygen and twin 115 Suzuki four-stroke outboard engines.

Getting into any vessel from St Helena involves a step of the famous steps. Ropes hang down



Divers on a RIB (above) listen to a briefing before a dive, and test the waters of St Helena (top)



School of big eye squirrelfish (above); School of powder blue surgeonfish (right); Diver in Long Ledge cave (far right)



from a metal pole to allow people to pull themselves up at low tide. It seemed incongruous to depart for a dive trip in exactly the same way as governors, saints and traders had for over a century.

Anthony turned the RIB eastward, and we zoomed out on the flat calm water. It was a grey day for summer, and we looked back at the

island, which looked like a forbidding brown rock made up of towering cliffs and nothing else.

"When expats used to arrive

on the RMS, they would look at the rock and wonder where they had arrived. It was only when they went ashore and found

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the green valleys and views that they calmed down," chuckled Anthony mischievously.

Diving Long Ledge. Fifteen minutes later, we arrived at Long Ledge.

Paul threw the anchor in, and we checked our air and kit. After a safety check, we rolled backwards into the water and descended to 6m (18ft) and waited for Anthony.

At 22°C, the water was unsea-

sonably cold, and I regretted not bringing my hood. I squirmed and wriggled until all the water in my 5mm Mares suit was warm. I had chosen to buy a standard 5mm suit, rather than some fancy so-called semi-dry effort, and with



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Diver explores rocky underwater landscape of St Helena

careful use, the Mares was quite fine.

The others soon appeared, and Anthony led us into a series of swim-throughs or large caves. Each of these caves was brightly lit by shafts of light that pierced into the blue water. The water was extremely clear. The bottom seemed to be a mixture of sand and rock, and yet the rocks were colourful under a torch. Between each one, there was life of some sort. Nudibranches, flatworms and small fish were everywhere. Inside the caves,

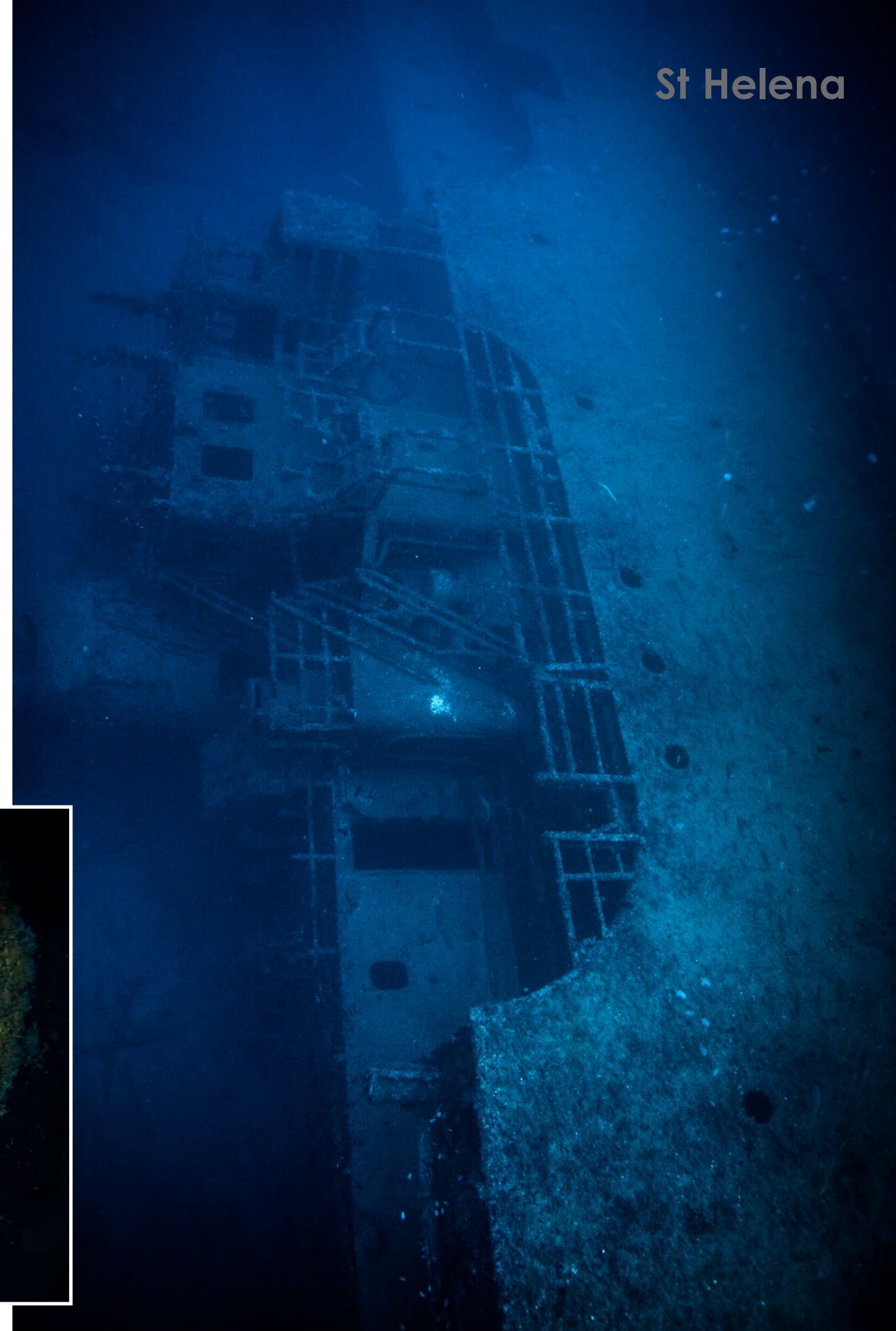
there were schools of sergeant majors and squirrelfish.

Anthony led us along a series of ledges until we ended up swimming along a finger that pointed out to sea. The bottom dropped away below us, and as we got to the end of the finger, the marine life started to build up.

The fish were clearly attracted to the point. This was a long ledge, and we were at the end of it. I popped down to 26m to have a look at the base of the ledge and found some moray eels and

Blue spotted puffer fish on reef at St Helena

School of butterflyfish (above) and fire worms (upper right) under ledges



pipefish wandering around. But by this time, I had been diving for 45 minutes and my air was getting low. I slowly made my way back up, and Cisca and I continued along the ledge at 10m, and then 6m, slowly off-gassing as we went.

Papanui. Our second dive was the *Papanui*, a broken-up steamer that sank in front of Jamestown in 12m of water. The rudder was full of life, but the broken plates and boilers made for a fascinating dive site.

We wandered off across the sand to find the second even more broken up wreck, and we were pleasantly

surprised to find it. We had quite a feeling of history, diving on these two ships, which were over a century old.

We ascended early, but soon the others popped up yelling and screaming about a devil ray playing with them for 30 minutes. I grabbed my camera and slipped back into the water to look for the ray. It appeared below me and started to do circles. I ducked down on a single breath hold and snapped three photos of the amazing creature below me. Having broken one of the cardinal rules of diving, I thought it best not to be too naughty and left my post-scuba dive, snorkelling activities at that.



THIS PAGE: Divers explore wreck of the steamer *Papanui*

TUBS/ WIKIMEDIA COMMONS / CC BY-SA 3.0



A British Overseas Territory, St Helena is a remote 16 by 8km (10 by 5mi) tropical island in the South Atlantic Ocean, located 4,000km (2,500mi) east of Rio de Janeiro in Brazil and 1,950km (1,210mi) west of Namibia and Angola in southwestern Africa. (WIKIMEDIA.COM)

Whale sharks

We spent five days diving in St Helena snorkelling with whale sharks and went for afternoon walks in the green valleys. It would be quite boring to list all of the dives, but if there was one dive that summed up the reason to jump on a plane to St Helena right now, it was Torm Ledge.

This dive site in St Helena is based upon a ledge that is about 45m deep and runs a mile out to sea. Only here does the drop off really begin and descend to 3,000m. Torm Ledge turned out to be an underwater pinnacle that rose up from the sea bed.

We dropped in at 9m and

were immediately surrounded by amber jacks, giant trevally and rainbow runners. As this was our last day underwater, I dropped down to 36m where the fish swirled lazily around my camera. They bumped into me, blew bubbles and hunted in front of me.

As I made my way back to 18m, a cloud of powder-blue surgeon fish covered the top of the pinnacle. When they lurched into the blue, they blotted out the sun. Cisca and I sat in the cloud, finning gently in the current watching the pelagics play and hunt.

Just when I thought it could not get any better, a dark shape loomed out of the blue and cruised slowly up to us. An enormous whale shark was right in front of us. It was so slow, I could even snap a photo of Cisca with

the shark in the background. The whale shark cruised away, around Torm Ledge, and came back, keeping us company until the end of the dive.

As we climbed back onto the rib, the whale shark, not satisfied with saying hello once, hung around us under the diver boat. We could literally see it from the pontoons. Someone slid into the water with a mask, and the whaleshark just sat there unperturbed.

After that, there was only the final

task of enjoying sundowners at Rosies Café, before descending Jacobs Ladder to the Mantis Hotel for an evening meal of plov, the St Helenan specialty. Central Asian pilav, or plov, arrived in St Helena through the East India Company. Now it is their national dish.

The next day, it was time for the trek past Napoleon's house to the aerodrome at Spider Hill. There was some sea mist, but the E90 landed as soon as it cleared. We walked across the tarmac and boarded the aircraft. It taxied to the end of the runway and roared down the concrete strip. Soon enough, we lifted off the British rock in the middle of the south Atlantic Ocean, turned south-east and made a course

for Africa. Four and a half hours later, we landed at Johannesburg Airport and the real world.

Getting there

Every week, an Embraer E90 arrives at Spider Hill Aerodrome. As such, the atmosphere of the island has not changed since the boat days. So, the time to visit is now, before the dynamic and spirit of the island is changed by multiple flights. We travelled with the African and Oriental Travel Company, which specializes in travel to St Helena and Africa. The company organises dive holidays in St Helena, starting at GB£800.00 per person. Flights are GB£780 from Johannesburg and GB£450 from Europe to Johannesburg. So, one week, ex-Europe, could cost a traveler around GB£2,030. For more information, visit: orientafricatravel.com.





Smaller is Better in
Anilao

— *Shooting Macro in the Philippines*

Text and photos by Kate Jonker



Huge yellow soft corals adorn the steep walls at Ligpo Island. PREVIOUS PAGE: A hairy squat lobster rests in the folds of a pink barrel sponge at Koala.



Pygmy seahorse, no more than 5mm long, at Sunview dive site

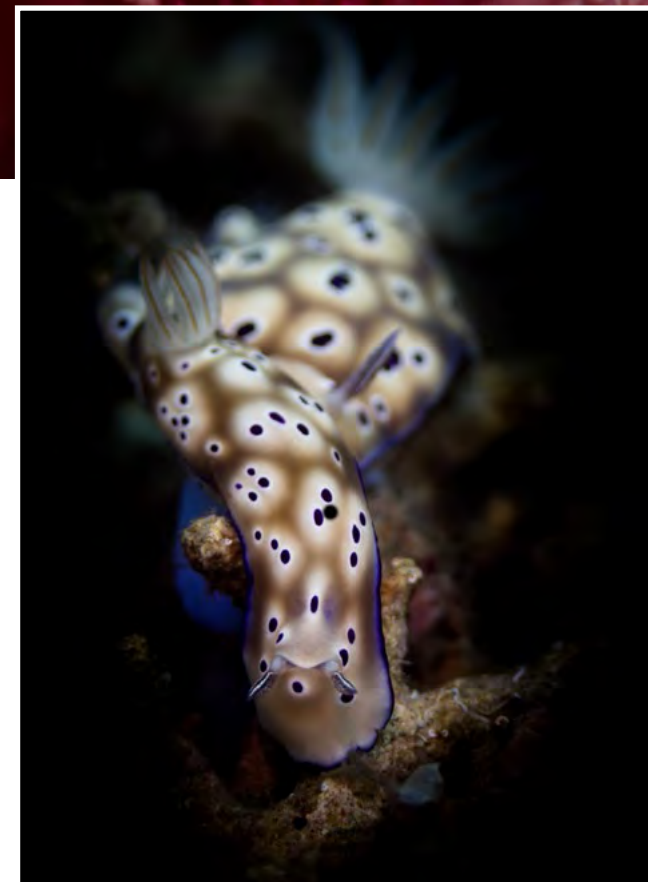
My dive guide finned quickly down the sandy slope and I kicked hard to keep up with him, my heavy camera and strobes creating quite a drag, slowing me down. By the time I reached the sea fan, in front of which he had stopped, I felt a thrill of excitement. I knew what he had found! Peering through my viewfinder and trying to stay calm, I followed his pointer downwards, and right there, at its tip, was my first ever pygmy seahorse. It was tiny—much smaller than I had expected—but this was Anilao, and I was starting to realise that “smaller is better” in this marine-diverse diving destination.

I had reached a stage in my underwater photography journey in which I wanted to do more than just take photos—I wanted to create works of art! I had chatted to friends who recommended a photo academy in Anilao in the Philippines that would revolutionise the way I thought about underwater

photography. I did my research and was hooked. Within a month, I was on my way, accompanied by my husband and two diving friends who were non-photographers.

Getting there

After a 23-hour flight from Cape Town,

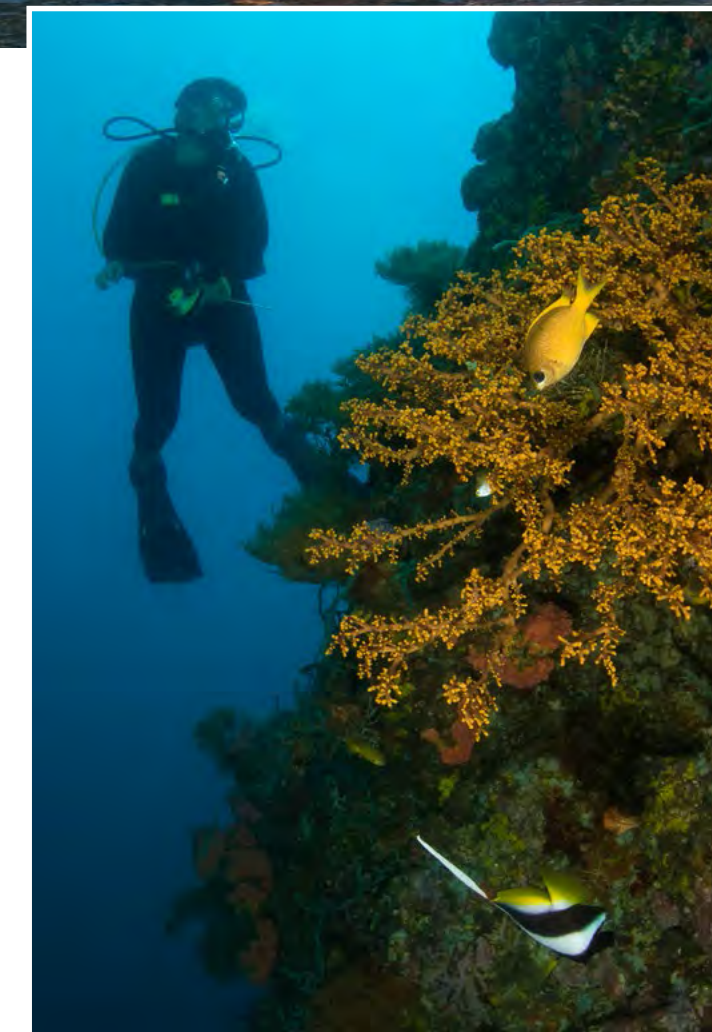


Tryon's hypselodoris nudibranchs, somewhat larger than many of the other nudibranchs I came across—these were 5cm in length.





Colourful local homes line the water's edge (above); The most common type of dive boat in Anilao is the bangka (above).



Colourful reef at Ligpo Island

we arrived in Manila—capital city of the Philippines—and were soon heading down the highway to Anilao. I was amazed at how busy and congested the roads were. Everyone seemed to be driving something, whether it be a car, a motor bike, a motorbike-come-taxi or a jeepney, which is the Philippines version of a bus that the Filipinos seem to love decorating—the more flamboyant, the better.

We eventually arrived at our destination. Anilao Photo Academy (or APA, as it is fondly known), is the brainchild of renowned underwater photographer Tim Ho. Run by a team of incredibly talented underwater photographers and dive guides, APA is widely recognised as the place to go to for underwater photography, and caters for photographers of all levels and camera types.

Once unpacked, we set up our cameras and watched as the sun set over the ocean, changing from

orange, to red to purple. We were in paradise!

Diving

Early the following morning, we excitedly boarded our boat for a day of diving. In the Philippines, diving is done from bangkas. These are long, narrow wooden vessels with two support floats made from thick bamboo poles on either side of the main hull. They are usually motored by reconditioned truck engines.

Our gear had already been put safely on board, along with enough cylinders for three dives and our food and drink for the day. To climb on board, you simply walked a few metres across the beach and up a gangplank. For those (like myself) with a poor sense of balance, there is always a helping hand to make sure you climb aboard safely.

Before the trip, I had been concerned about how I was going to protect my camera on the boat.

I need not have worried at all, as our cameras were treated like royal babies. They were carried carefully to the boat by the staff, who then put them on a special rubberised mat in the most stable and shaded part of the boat and then covered with towels for protection.

Once on board, we posed for the obligatory “selfies” before whisking across the mirror flat, indigo water to our first dive spot. We hugged the coastline, passing vibrantly-painted yellow, purple, red and green homes and large resorts, interspersed by steeply sloping, lush, tree-covered hills that reached right down to the waters' edge.

Koala. Our first dive was at Koala, named after an Australian who had had a house on the shoreline nearby. The bangka crew dropped anchor, and we kitted up and rolled backwards into the clear, warm blue ocean. The crew then gently



Coleman shrimps on fire urchin at Basura (top left); Red hairy shrimp, about 2mm in length, at Secret Bay (above)



Most dive sites in Anilao comprise shallow coral gardens with sandy slopes interspersed with coral outcrops, rubble-covered slopes, or gently sloping sandy bottoms. The bangkas anchor shallow and close to the shore and after entering the water, we would usually swim down to the deepest part of the dive site and then slowly make our way shallower.

I followed Ivan down the reef, and before long, he was beckoning me over

passed our cameras down to us. There were just the four of us on the bangka, accompanied by two dive guides: Ivan, who is an accomplished underwater photographer and amazing spotter (and soon became my buddy on the trip); and Doods, who was also an eagle-eyed spotter.

to a small green plant, where he pointed to something so tiny it was not visible to the naked eye. Peering through my camera's viewfinder, I saw a tiny creature that looked like a two-millimetre-long praying mantis and realised it was a skeleton shrimp!

Before long, I began to realise

how tiny the critters were. At home in Cape Town, our nudibranchs average 3cm to 5cm. Here, the dive guides were constantly searching for smaller and smaller critters for us to photograph. Most

were minuscule and I was very glad I had purchased a +12.5 magnifying dioptre for my camera before the trip, as this helped to photograph even the tiniest of creatures.



This tiny pink eyed goby was 5mm in length (above); Flabellina nudibranch at Sunview dive site (left)

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Red hairy shrimp, about 3mm in length at Gazer (left); Anemonefish at Twin Rocks (far left)

was doing this, saw that the nudibranch was lifting its mantle up and down. Every time it did this, Ivan would say "click" loudly and I would press the shutter. With much laughter, we soon got into the swing of things and I got one of my favourite photos ever. I call it the Marilyn Monroe nudibranch. After that, the critters just kept on coming. I was absolutely blown away—this was the famous muck diving I had heard so much about. I

in spicy sauce and more fruit. After eating heartily, chatting eagerly about our amazing muck dive and laughing some more about "Marilyn Monroe," we rested impatiently before our third and final dive of the day.

Basura. Our third dive was at Basura, a sloping sandy site littered with coral bommies and rubble. We were getting into the swing of things now. Our dive guides would

After our first dive, we surfaced at the boat, handed cameras and fins up to the crew and climbed up a sturdy wooden ladder back on to the boat. Once on board, we were offered fruit and crackers, water, coffee, tea and ginger tea. We then relaxed in the sun and chatted excitedly about what we had seen.

Dakeda. After staring longingly into the clear blue water at the shallow reef below us, our surface interval was finally over and we moved on to Dakeda. Here, we were met with completely different underwater topography—a rubble slope. There were just dark brown boulders everywhere. No coral, no reef, no sand. No life! Had the recent earthquake covered everything up, I wondered to myself. Just then, Ivan called me over and scribbled some instructions on his underwater note pad, and I quickly reset my camera and turned off my strobes, wondering what was going to happen next.

He pulled out a narrow beamed torch and pointed it at one of the most beautiful nudibranchs I had ever seen, its yellows and purples in stark contrast to its dark brown rubble surroundings. I took a photo and as I



The "Marilyn Monroe" nudibranch, *Goniobranchus kunei*, at Dakeda



Blue and yellow adult male ribbon eel at Twin Rocks

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A porcelain anemone crab hides in a bubble anemone at Coconut (above); Thorny seahorse at Secret Bay (left)

to find. If we struggled to find the tiny critters with our dioptres, they would gently lift our ports until they were pointing directly at the subject. We were never rushed, but encouraged to take photos until we were happy with the results, and only then did they allow us to move on. By the end of the third dive, we were all in sensory

home base where we washed our gear and photographic equipment, showered and prepared our cameras for the following day. By the time our chores were completed, the sun was setting and we chatted about our day over ice cold local beers.

Dinner was a jovial affair, with divers from around the globe chatting about what they had seen and photographed, sharing photo ideas and discussing techniques. We then went through our photos from the day and tried to identify what we had seen in the huge library of identification books.

Daily routine

We soon fell into a routine: Wake early, drink coffee, have breakfast and board the boat at 8:00 a.m. for a day of diving. We would then return,

overload, having never before seen so many new and exciting critters in just one day. Even our two non-photography buddies were having a wonderful time.

Après dive

After our dive, we headed back to

find critters for us and call us over to photograph or look at them. As we approached, they would show us the direction we should come in at to be lined up to take the best shots. If the critters were really small, they would use a pointer to point down at the subject, making them easy



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This tiny soft coral cowrie at Manit Point is no more than 2mm in length (left); A reasonably large skeleton shrimp, about 3mm in length (above); A whip fan goby and shrimp share a branch at Sunview (right)



Playing with blue and snoot lighting whilst photographing a whipfan goby

rinse gear, prepare cameras for the next day, drink a couple of beers, have dinner, chat photography, try to identify all the amazing critters we had seen during the day and fall into bed.

Over our week-long stay in Anilao, we dived 20 different dive sites, some more than once. The macro life was incredible, and every day we discovered new fish, new shrimps, new nudibranchs and new photography techniques. We even "went wide-angle" one day, and explored Ligpo Island, with its huge pink barrel sponges, vibrant yellow soft coral trees and an area carpeted in anemones with their resident clown fish. Simply beautiful!

Helpful tips

I had travelled to Anilao to improve my photography and within the first couple of days, I had learned so much more than I had ever hoped to. Below, I share some tips from the trip.

Tiny critters. The photos you see in magazines, books and social media do not prepare you for the size of these critters. One expects them to be quite large, but in reality, most are really tiny! Take pink-eyed gobies, for example. I had thought they were about 5cm long. The ones I saw and landed up shooting were about 0.5cm long, and boy, did they move around a lot. It was challenging, it was fun and incredibly addictive.

You need to be patient and you need to take your guide's advice and follow his pointer.

Magnifying wet lenses. Do not even consider going to Anilao unless you have a strong magnifying wet lens (often called a dioptre) for your camera. Many of the critters are mere millimetres in length, especially the skeleton shrimp, pygmy sea-horses, hairy shrimp and many of the nudibranchs. I used my +12.5 dioptre wet lense most of the time, and the majority of other guests seemed to be using them too.

Flip dioptre holder. As some of the critters are too large for a dioptre, I would also advise getting a flip dioptre holder with a

67mm thread. One flap screws on to the front of your port and the other flap attaches to your wet dioptre. You are then able to flip it open when you do not need to use the dioptre, and close it again so that it is in front of your port when you do. This means you do not need to waste time screwing the dioptre on and off the port during a dive, thus reducing the chance of losing it, too.

Back button focus. This is a great feature of DSLR cameras, most mirror-less and some compact cameras. It is particularly useful when using magnifying wet lenses, which result in a very shallow focal plane. It works by removing the focus function from your shutter button and





Usagi nudibranchs are incredibly small. Also known as “Shaun the Sheep” nudibranchs, they can be found on the small green leaves growing in the sand at the dive sites close to Secret Bay.



allocating it to a button on the back of your camera. You then use the back button to lock focus on the critter and move the camera in and out millimetre by millimetre, pressing the shutter when you see your subject is in sharp focus. This makes it much easier on your shutter finger, as you will no longer need to hold your shutter half-pressed to keep focusing as you take your photos. When you move on to the next subject, you can use the rear focus button to lock focus on the new critter.

Magnifying viewfinder. I discovered that if one is taking photos of such tiny critters, a magnified viewfinder that can be attached to the back of your housing really gives you a better view of what you are

shooting. Both 180- and 45-degree viewfinders are available, and after the trip, I invested in a 45-degree viewfinder. Its magnified view now helps me determine whether my subject is in focus and aids in composition of shots. Looking slightly downwards and getting used to pointing the camera at a different angle did take a bit of getting used to, but in the end, it was great—and a lot easier on my neck, too.

Research beforehand. A piece of advice I would give anyone travelling to a new destination—especially to take photos—do your research, look at photos, watch videos. Know



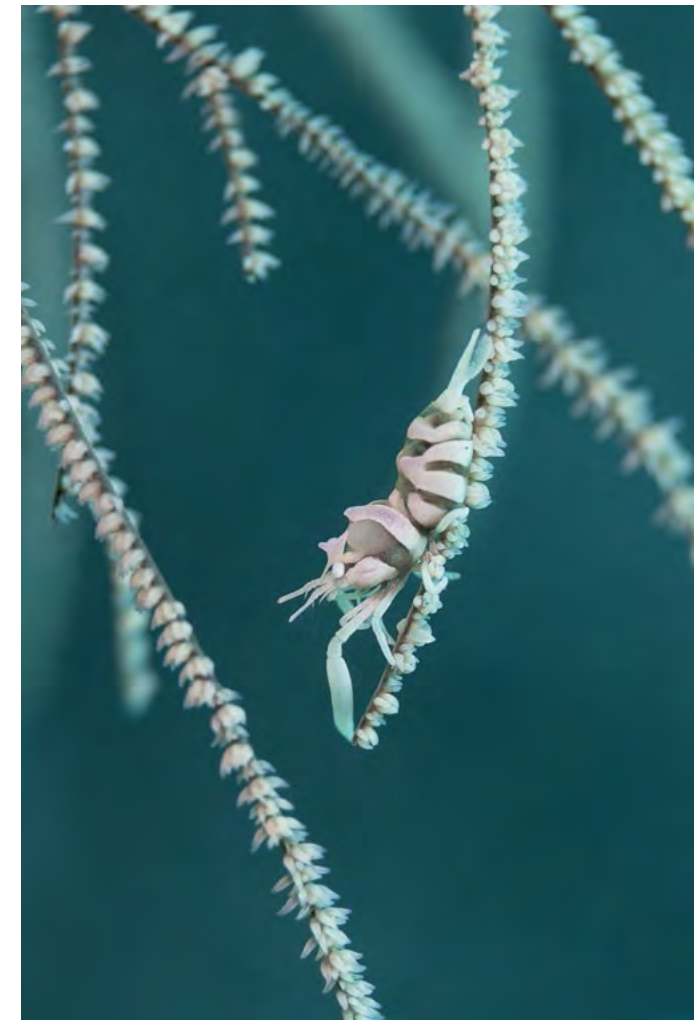
Tiny cuttlefish and juvenile filefish shelter together next to a small boulder at Saimsim (left); Snooted profile of a scorpionfish at Gazer (far left); Bornella nudibranch at Kirby's Rock (center)



what to expect. If you know what critters you will be seeing, find out what they look like, what their habits are, whether they carry eggs and where they can be found. Think of the best angles and lighting for that particular creature and how you could position your

strobes to bring out its textures or main features. A bit of background knowledge paired with the incredible expertise of the dive guides will help you get the most from your trip.

Spotting the critters. If you struggle to see the small stuff

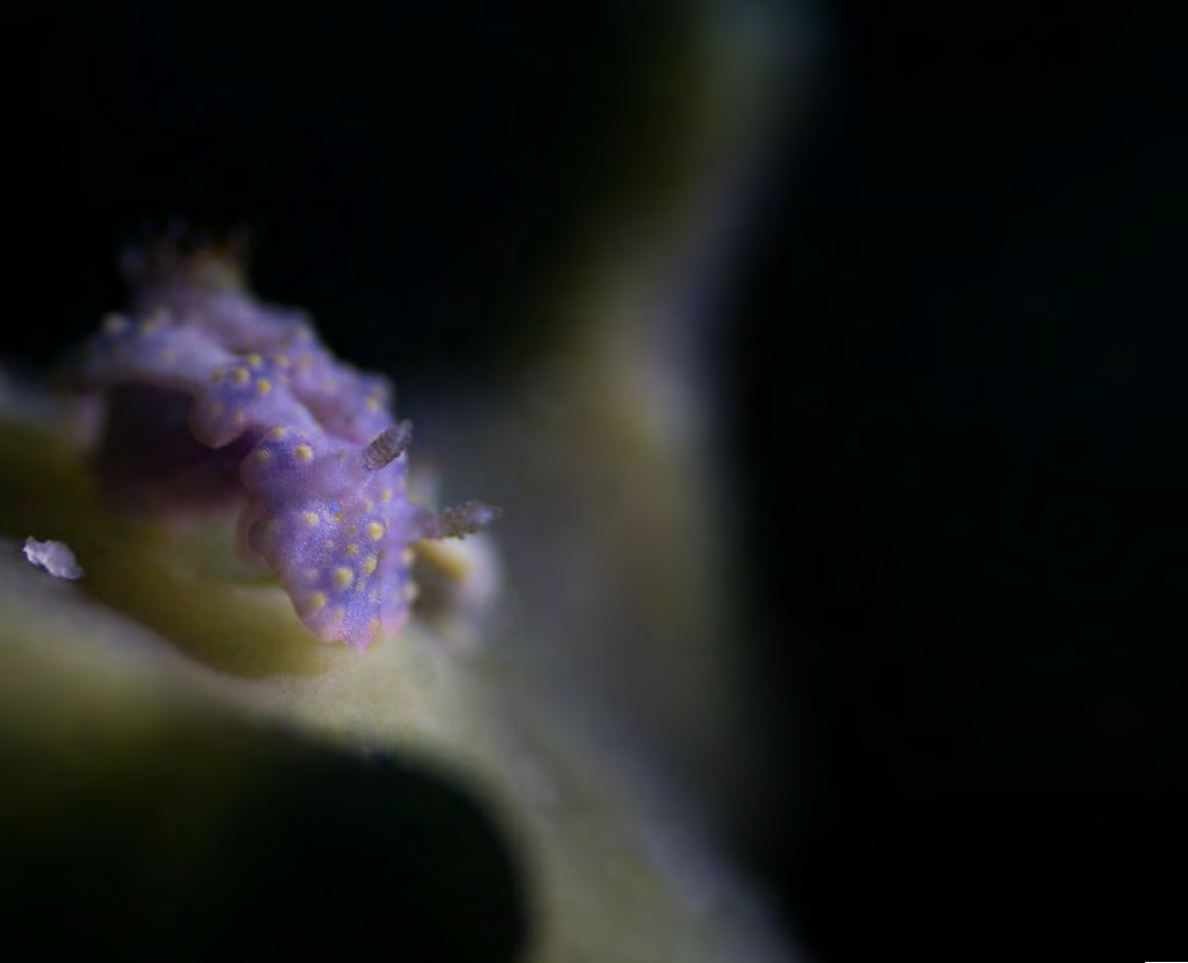


Zanzibar whip coral shrimp at Saimsim





Yamasui nudibranch at Saimsim



This nudibranch (above) is incredibly small. Just to put it into perspective, that is a grain of sand next to it! Two *Eurbranchus nudibranchs* at Balanoy (top right); Tiny psychedelic batwing slug (right), absolutely minute at about 2mm in size, at Dead Palm; Beautiful and tiny *Chromodoris reticulata* nudibranch at Bethlehem (far right)

and use reading glasses on land, invest in a mask that has special magnifying lenses that help you see tiny critters underwater. If you already wear contact lenses and need to wear reading glasses as well, investigate bifocal or concentric contact lenses that have both your near and far prescription worked into them. I have recently done this and can now spot the really tiny critters that live on the reef.

Hold steady. Buoyancy is incredibly important when taking macro photos. In Anilao, there was very little surge or current, making it relatively easy. You will either need to hover above your subject or prop yourself up by placing two fingers on your left hand on a bare piece of rock or sand. Whatever you do, it is vital that you first check that there is nothing close by or under the sand

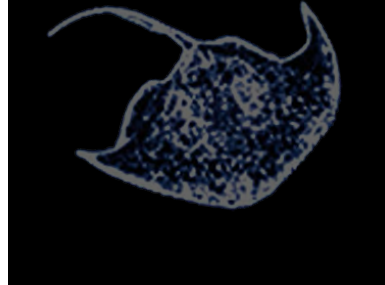
that you could damage, or that could injure you.

Pointers or muck sticks. Although I have a pointer, I have never used it. Many people use them to prop themselves up on the reef or on the sand whilst using their other hand to operate their camera. They are also used to point out critters to fellow divers or to bang on cylinders for attention. I thought that this trip would be the ideal place to test mine out, but I found that it just got in the way and never used it again after the first day. Many people use them with success.

Afterthoughts
After our trip, I returned home feeling inspired and rejuvenated, with so many new ideas to try out. The huge diversity of marine life in Anilao is incredible, the diving is easy and the people are welcoming and friendly, making this an equally enjoyable destination for photographers and non-photographers alike. ■

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

fact file



The Philippines



Text by Matthew Meier

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

History The Philippines have been inhabited for tens of thousands of years but it was not until 1543 that the country was named Las Islas Filipinas in honor of King Phillip II of Spain by the explorer Ruy Lopez de Villalobos. The islands were colonized and remained part of the Spanish empire for more than 300 years. Following the Spanish-American war in 1898, the Philippines were relinquished to the United States and in 1935 became a self-governing commonwealth. During World War II the islands fell under Japanese control but on 4 July 1946, after the United States helped the Filipino people reclaim control, the Republic of the Philippines was granted its independence. Numerous presidents and varying degrees of political and economic stability have followed, but the country remains independent to this day. The Philippines are a founding member of the United Nations and the World Trade Organization, and their current President Rodrigo Duterte was elected in May 2016. Government: presidential republic. Capital: Manila

Geography The Philippines are located east of Vietnam in Southeast Asia, between the Philippine Sea and the South

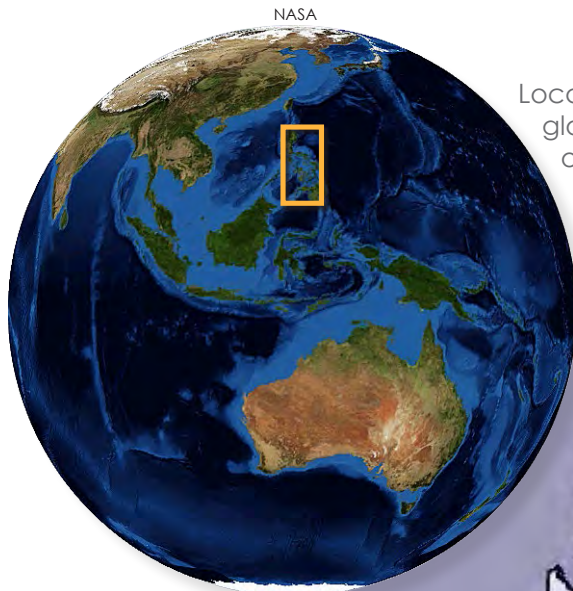
China Sea. The country consists of an archipelago of 7,107 islands, spread out over nearly 300,000 square kilometers. The terrain consists of volcanic mountains and coastal lowlands, ranging from sea level to the highest peak, Mount Apo, at 2,954m. The Philippines are situated at the northern tip of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

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

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

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

Currency Philippine Peso (PHP) Currency may be exchanged at the Manila airport, local banks and resorts. Credit cards are widely accepted at tourist destinations. Exchange rates: 1USD=51.98PHP; 1EUR=64.39PHP; 1GBP=73.88PHP; 1AUD=40.38PHP; 1SGD=39.73PHP



Location of the Philippines on global map (left), and location of Anilao on map of the Philippines (below); The dive boat used in Anilao is called a *bangka* (right).



KATE JONKER

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

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

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

Tipping Tipping is not part of the Filipino culture and is not required, though it is becoming more common among the local population. Tipping is, however, expected on liveaboard dive boats and at most tourist resorts. Each establishment will have their own guidelines and recommendations.

Transportation International flights from numerous countries and airlines connect through Manila and Cebu. Regional airlines connect from these hubs to a multitude of locations throughout the archipelago. There is also an extensive ferry system for traveling

between islands and an established network of roads once on land, although only about 26% of the country's roads are paved.

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

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

Travel/Visa A return ticket and a passport are required for entry into the Philippines and the passport must be valid for at least six months. Travelers from the United States and Europe typically receive a free 30-day tourist visa upon arrival. An international terminal fee of roughly 550 PHP is charged at the airport when you depart the Philippines.

Web sites Philippines Tourism experiencephilippines.org

Population The official population of the Philippines is 102,624,209 (July 2016 est.), with over 12 million living in the capital city of Manila. Ethnic groups: Tagalog 28.1%, Cebuano 13.1%, Ilocano 9%, Bisaya/Binisaya 7.6%, Hiligaynon Ilonggo 7.5%, Bikol 6%, Waray 3.4% (2000 census). Religions: Catholic 82.9%, Muslim 5%, Evangelical 2.8%, Iglesia ni Kristo 2.3%, other Christian 4.5% (2000 census). Internet users: 56,956,436, or 55.5% (July 2016 est.)

US CIA WORLD FACTBOOK



Edited by
Rosemary E. Lunn
and Peter Symes

**POINT & CLICK
ON BOLD LINKS**



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Equipment

O'Three rash guard

It is worth having a rash guard in your diving wardrobe. This handy garment has a multitude of uses. It makes it easier to don a wetsuit on and off, because it provides a slippery surface that makes slipping and sliding out of a suit a simpler process. In the event that you have bought a low-end bargain basement suit, which has particularly aggressive seams and/or an itchy lining, a rash guard helps protect your skin. In between dives, or in cases in which you need no thermal protection, a rash guard acts as a UV shield. The garment is chlorine and salt resistant, and machine washable at 30°C. **OThree.co.uk**



Mares torch

In setting out to design a new strobe, Mares defined light intensity, operating depth and duration as its main priorities. The EOS Strobe offers 450 lumen, 360-degree high visibility paired with an operating depth of 120m, making it incredibly safe and reliable. The rotating magnetic switch has two modes: a flashing mode, with up to 25 hours of burn time; and a steady light, which will last five hours. The body of this compact torch is made from durable anodized aluminum and comes in bright orange. The rechargeable lithium batteries are recharged via the supplied USB cable. **Mares.com**



Garmin Descent

From the maker of GPS navigation and wearable technology to the automotive, aviation, marine, outdoor and fitness markets, comes the first watch-sized dive computer to offer surface GPS navigation with full-color onscreen mapping and location reference. Built-in sensors include 3-axis compass, gyroscope and barometric altimeter as well as GPS and GLONASS capability that lets you mark your dive entry and exit points for surface navigation. The Descent supports single-gas, multi-gas, gauge and apnea diving, including nitrox and trimix, and its dive log lets you store and review data from up to 200 dives and share it online, via Garmin Connect and its included mobile app. Returning topside, Descent Mk1 also functions as a robust training companion, offering the best features of a multisport GPS. Special preloaded activity profiles are provided for swimming, running, biking, hiking, skiing, rowing, paddle boarding and more. Various timekeeping, lap counts and map-tracking functions are easily accessible. **Garmin.com**

Catchy title

WeeZle often receives bespoke orders for specific items of protective clothing. Their latest request? A Russian hat. This headgear is lined with TS1—a hydrophobic wicking fibre layer, which WeeZle uses in their Extreme Plus undersuit to provide warmth. The outer shell is shower-proof Paratex. The hat is machine washable with removable or replaceable leather chin ties, thanks to two strategically placed toggles. This hat comes in one size, six colors (black, blue, regular, drab olive, high-visibility yellow, and DPM) and weights just 112g (3.9oz). WeeZle states that its Russian hat is very warm—even if you fall overboard and it gets soaked.

WeeZle.co.uk



DiveRite Helmet

Divers have long used helmets as a place to mount spare lights, and for bump protection in tight places or while scootering. With the advent of the GoPro, they also became the perfect mounting platform for small action cameras. Finding the perfect helmet for diving has always been a challenge because divers do not want a helmet with added foam, which creates extra buoyancy and bulk. Dive Rite's helmet has a low profile design that is free of foam. An adjustable suspension system inside the helmet provides a comfortable fit. The quick adjust knob on the back of the helmet allows the diver to quickly adjust between hood thicknesses. An adjustable, quick-release chin strap keeps the helmet in place throughout the dive. Add a QRM receiver to either side of the helmet to easily mount spare or primary lights. **DiveRite.com**





opinion

Text by Simon Pridmore

This column is adapted from a chapter in my book, *Scuba Physiological – Think you know all about Scuba Medicine? Think Again!* The chapters in this book were originally written by scientists in the field of decompression research as part of a three-year project called PHYPODE (Physiology of Decompression). My (self-appointed) task was to rewrite their sometimes-complex research in a form accessible to all divers.

One interesting aspect they addressed was the concept of preconditioning as it may apply to scuba diving safety. In other sports, preconditioning strategies such as warming up, passive heat maintenance and prior exercise are used to ensure that athletes perform as well as possible on game day.

Tiny gas bubbles in the bloodstream are thought to be the main cause of decompression sickness (DCS), so the PHYPODE researchers looked at six preconditioning strategies that divers might be able to deploy before a dive to reduce the quantity of tiny bubbles produced during the dive, thus reducing both decompression stress and the risk of DCS.



Scuba Confidential: Preconditioning *for Safer Scuba Diving*

1. Pre-dive endurance exercise

An aerobically fit diver has a lower risk of developing DCS than an unfit diver and aerobically trained runners produce fewer bubbles on a dive than people who are mostly sedentary. Why this

should be the case is not yet clear. In the past, it was thought that a bout of aerobic activity immediately before diving had exactly the opposite effect. Pre-dive exercise was seen as a factor that increased the risk of DCS, because it was

thought that muscle contractions and tissue movement might produce gas nuclei leading to increased bubble formation. This theory has now been seriously challenged. In studies conducted in a hyperbaric chamber, divers produced fewer

bubbles when they had performed a bout of aerobic exercise 24 hours before a dive. Another study tested the effect of cycling for 45 minutes, two hours before a dive in the ocean. The results confirmed the data obtained in the chamber and

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opinion



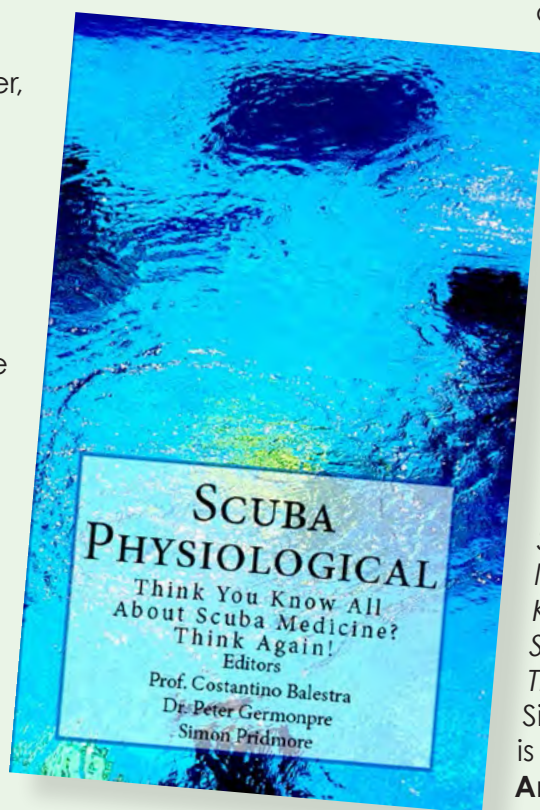
PIXABAY

A New Book for Scuba Divers!

If you are a diver, much of what you learnt about topics such as decompression sickness and narcosis in your scuba diving class is over-simplified and some of it is just plain wrong, as diver training agency texts have not kept pace with the science. Despite 170 years of research, the nature of decompression sickness and decompression stress remains unknown. Great

written by scientists in the field of decompression research as part of a three-year project called PHYPODE (Physiology of Decompression). Simon Pridmore is not an expert on diving medicine but, when he came across the material, he knew that many people in scuba diving beyond the scientific community would be interested in it. So, he contacted the original authors and proposed an

abridged, edited, simplified and re-formatted e-book, which would make the information more accessible to the general population of divers. They thought it was a great idea and *Scuba Physiological* is the result.



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

found that both moderate and strenuous exercise pre-dive reduced bubble production. A further study showed that running on a treadmill for 45 minutes, one hour before a dive, also significantly reduced the bubble count. Nobody knows yet what the optimal timescale is for doing pre-dive exercise, or even if there is one. Nor is it clear why pre-dive exercise should have this effect: but it seems clear that divers are best advised to keep aerobically fit.

2. Pre-dive hydration

Drinking water before a dive is an easy



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way to reduce the risk of DCS. When you are well hydrated during a dive, you minimise the negative effects associated with post-dive dehydration. The best way to stay well hydrated is to drink before you get thirsty, a little at a time, say a cup of water every 15-20 minutes. Drinking a large amount of water too fast will increase diuresis, the phenomenon that makes you want to pee, and will not hydrate your tissues.

A recent experiment involving military divers showed that drinking a saline-glucose beverage before diving significantly decreased the quantity of bubbles in a

diver's circulation after the dive.

A further study found that loss of body fluids during a dive correlated with bubble count, as measured approximately one hour after surfacing: the greater the fluid loss, the higher the bubble count. This suggests that it is also very important to rehydrate AFTER a dive, especially if you are doing more than one dive a day.

3. Pre-dive oxygen breathing

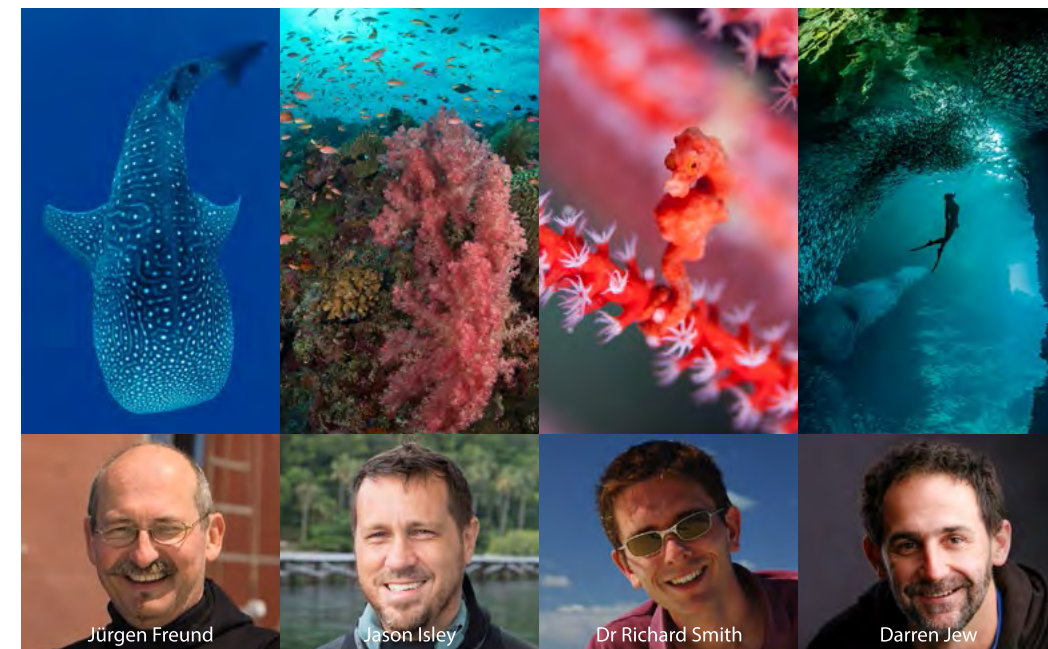
Oxygen breathing has been extensively investigated as a way of reducing DCS risk before altitude decompression and space walks. Oxygen breathing is also

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opinion



A study found that pre-dive heat exposure in a sauna significantly decreased circulating bubbles in the bloodstream after a dive.

first performed three control dives in a 34m (113ft) deep swimming pool with no preconditioning. Then, further dives were carried out with a preconditioning procedure that involved a 30-minute infrared sauna session two hours before the dive. The preconditioning led to a significant reduction in post-dive bubbles.

So, it seems heat stress may give some degree of protection against bubble-induced injury from decompression.

5. Pre-dive vibration

In the old days, combat divers and commercial divers would drive their boat fast out to the dive site but return to shore

Preconditioning

slowly after the dive in the belief that this strategy would reduce the risk of DCS. The PHYPODE researchers decided to see if science could back up the theory and found that 30 minutes of whole-body vibration, (such as you would receive in a speedboat driven fast) before a dive could indeed reduce the quantity of bubbles produced after the dive.

6. Biochemical preconditioning (with dark chocolate)

The vascular endothelium is an organ you probably do not know you have. It is a single layer of cells that completely covers the inner surface of all

to one of four profiles: "air-air" (the control profile), "O₂-O₂", "O₂-air" and "air-O₂" where "O₂" was a dive with oxygen pre-breathing and "air" was a dive without oxygen pre-breathing.

The study found that oxygen pre-breathing resulted in a significant reduction in decompression-induced bubble formation, regardless of the profile. The beneficial effect of pre-dive oxygen was observed after the first dive and was maintained after the second dive even when oxygen pre-breathing did not precede the second dive. The "O₂-O₂" profile resulted in the greatest reduction in bubble scores measured after the second dive. The results also indicated that the beneficial effects were cumulative and long lasting.

This might be due to the physical effects of breathing gas without nitrogen (deni-

trogenation) although there are no data that suggest this. Instead, it might be because of the antioxidant and anti-inflammatory properties of hyperbaric oxygen itself. More research is needed.

4. Pre-dive heat exposure

Researchers also conducted studies to determine what effect pre-dive heat exposure in a sauna would have on bubble formation after a dive. Sixteen divers underwent a 30-minute infrared dry sauna session, followed one hour later by a dry chamber dive to 30m (100ft) for 25 minutes. Test results showed that the sauna exposure significantly decreased circulating bubbles after the dive.

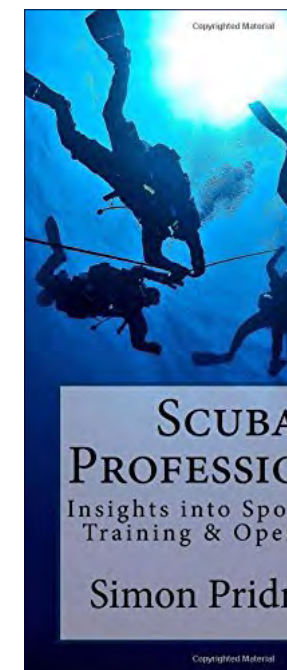
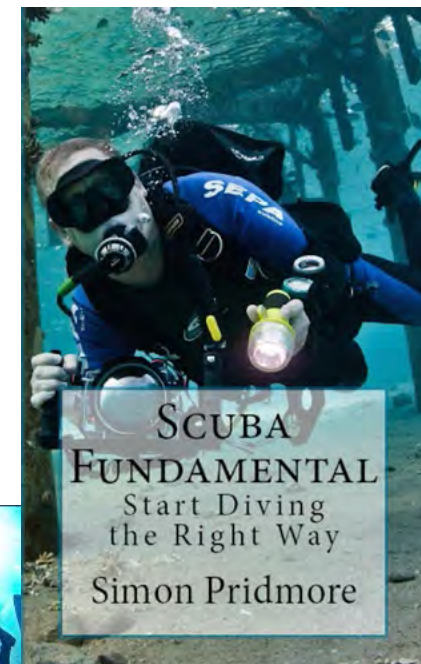
Another experiment was carried out, involving a group of divers who were known normally to produce particularly large numbers of bubbles after diving. In this study, the divers



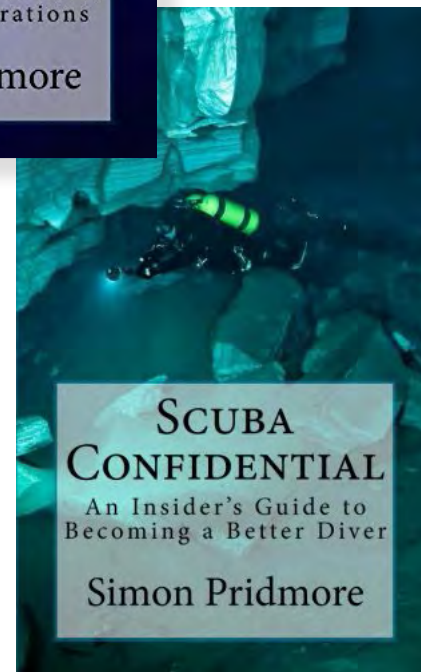
A study found that 30 minutes of whole-body vibration (like one gets riding in a speeding boat) before a dive could, in fact, reduce the amount of bubbles produced in the bloodstream after a dive.

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opinion

Studies have found that eating dark chocolate a couple of hours before a dive may reduce the adverse effects of bubbles in the bloodstream after a dive. Flavonoids in the dark chocolate generate nitric oxide secretion and decrease platelet adhesion, which makes it less easy for bubbles to form and maintain stability.

the blood vessels in your body.

Several studies on both animal and human subjects have shown that hyperbaric exposure results in dysfunction of the vascular endothelium. This may be the result of oxidative stress resulting from hyperoxia during diving and recent experiments have shown that taking antioxidants prior to diving can reduce the negative effects that diving has on endothelial function. Preconditioning by taking an antioxidant such as vitamin C might reduce endothe-

lial inflammation at depth and thus limit gas bubble formation.

Recently, some Belgian scientists studied the effects of dark chocolate on bubble production and endothelial impairment associated with diving and found that consumption of dark chocolate had a positive effect on the endothelium, although it had no significant effect on the quantity of bubbles developed during a dive.

Other recent studies discovered that eating 30 grams



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of dark chocolate two hours before a breath-hold free dive can prevent endothelial dysfunction, which is normally observed after free diving as

well as scuba diving. The flavonoids in dark chocolate seem to be the key ingredients. They generate nitric oxide secretion and decrease platelet

adhesion two hours after ingestion and this makes it less easy for bubbles to form and achieve stability.

The timing is critical. The decrease in platelet adhesion peaks two hours after chocolate consumption. Bubble production while scuba diving is not directly related to the preservation of endothelial function. Neither is it directly related to nitric oxide. However, preservation of good endothelial function after diving may reduce the adverse effects of the bubbles that have formed during the dive.

Conclusions

Further research is required into all of the

effects described here, but a few things are clear:

1. Divers should stay in good physical shape and maintain cardiovascular fitness.
2. Pre-dive procedures can help reduce decompression stress. Some help maintain endothelial function. Others are better at reducing bubble production.
3. Pre-dive oral hydration, exposure to heat, whole body vibration and oxygen breathing may represent relatively easy ways of reducing DCS risk. ■

For a more detailed summary of the PHYPODE findings on pre-conditioning, read Simon's book, *Scuba Physiological – Think you Know All About Scuba Medicine? Think Again!* available as an e-book via Amazon stores worldwide. For more information, go to: Simonpridmore.com.

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All divers who become unwell after diving should be discussed with a diving medicine physician as soon as possible.

Updated: Pre-hospital management of DCI guidelines and “mild” DCI

A paper was recently published in the March issue of *Diving and Hyperbaric Medicine*, which discusses the pre-hospital management of DCI. The lead author is Professor Simon Mitchell, Head of Anaesthesiology at the University of Auckland, New Zealand and a EUROTEK stalwart.



The guidelines for pre-hospital management of decompression illness (DCI) have not been formally revised since 2004 when a Divers Alert Network / Undersea and Hyperbaric Medical Society workshop was held and five consensus points were agreed upon.

Thirteen years have passed, and therefore aspects of the management of DCI in the field have been reviewed by a multinational committee.

The key issues addressed were:

- First aid strategies for DCI
- Remote triage of possible DCI victims by diving medicine experts
- Evacuation of DCI victims
- Effect of delay to recompression in DCI
- In-water recompression

These subjects were discussed at a dedicated workshop at the 2017 UHMS Annual Meeting

in Florida, and at subsequent meetings of the expert committee.

Defining ‘mild’

An emphasis was placed on resolving controversies around the definition of “mild DCI” arising over 12 years of practical application of the 2004 workshop’s findings, and on the controversial issue of in-water recompression.

The expert group conducted a thorough literature review and contributed a lot of objective evidence, all of which is cited.

Signs and symptoms

- “Mild” DCI signs and symptoms include:
- Fatigue
 - Musculoskeletal pain
 - Some skin sensory changes
 - Rash
 - Subcutaneous (under the skin) swelling



Some Key points

All divers who become unwell after diving should be discussed with a diving medicine physician as soon as possible.

A beneficial first aid strategy in suspected DCI is 100% oxygen, which should be administered as early as possible after symptoms arise.

Where possible, a horizontal position should be encouraged / maintained, including during evacuation, if practical. (If the patient is unconscious, the recovery position is recommended).

Provided the patient is fully conscious, hydration is recommended. Fluids should be non-carbonated, non-caffeinated, non-alcoholic and preferably isotonic. Drinking water is acceptable.

Keep the patient thermally

comfortable—warm, but not hyperthermic (too hot). Avoid exposure to the sun, unnecessary activity or excess clothing.

When to recompress

Recompression and hyperbaric oxygen therapy is the gold standard treatment for DCI. However, some divers with symptoms or signs meeting the definition of mild DCI may be managed without recompression therapy.

Determination that a case is “mild” and that the patient can be managed without recompression can only be made by a diving medicine physician on a case-by-case basis.

In DCI cases arising in locations without ready access to a suitable recompression chamber, in-water recom-

pression (IWR) using oxygen at a maximum depth of 9msw (30ft) can be considered provided:

- The team is trained, certified, practiced, and suitably equipped.
- The patient is not suffering from hearing loss, vertigo, vomiting, altered state of consciousness, shock, respiratory distress, or a degree of physical incapacitation that makes return underwater unsafe.

It should be noted that IWR may not result in a complete resolution of DCI, and all divers undergoing IWR should be discussed with a diving medicine physician as soon as practicable. ■

Text and photos by Brent Durand

Kayak Diving

— *Between the Boats & Beach*



Kayak diving provides a great opportunity to locate and photograph drifting marine life like this jellyfish.



The words “dive trip” are enough to make most divers start daydreaming of warm water, great visibility, thin wetsuits and talented guides who can find critter after critter. Change those words to “dive adventure” and you will find a small group of divers who immediately think of kayak diving.

Scuba diving from a kayak is the perfect way to access reefs that are not otherwise accessible from land. The sites may be situated under steep cliffs or too far offshore for a surface swim. These sites are only dived by infrequent kayak divers and the occasional private boat owner, so the reefs are healthy with little dive pressure (fishing is another story).

The best part of kayak diving is that you are on your own schedule, combining the peacefulness of gliding across the ocean surface with great exercise and the beauty of the underwater world. Dive times are not limited by an operator, there is never a crowd,

and the marine life can be more inquisitive, which is a great thing for photographers. There is also nothing quite like spending your surface interval being lulled to sleep on a gently rolling kayak.

Preparation

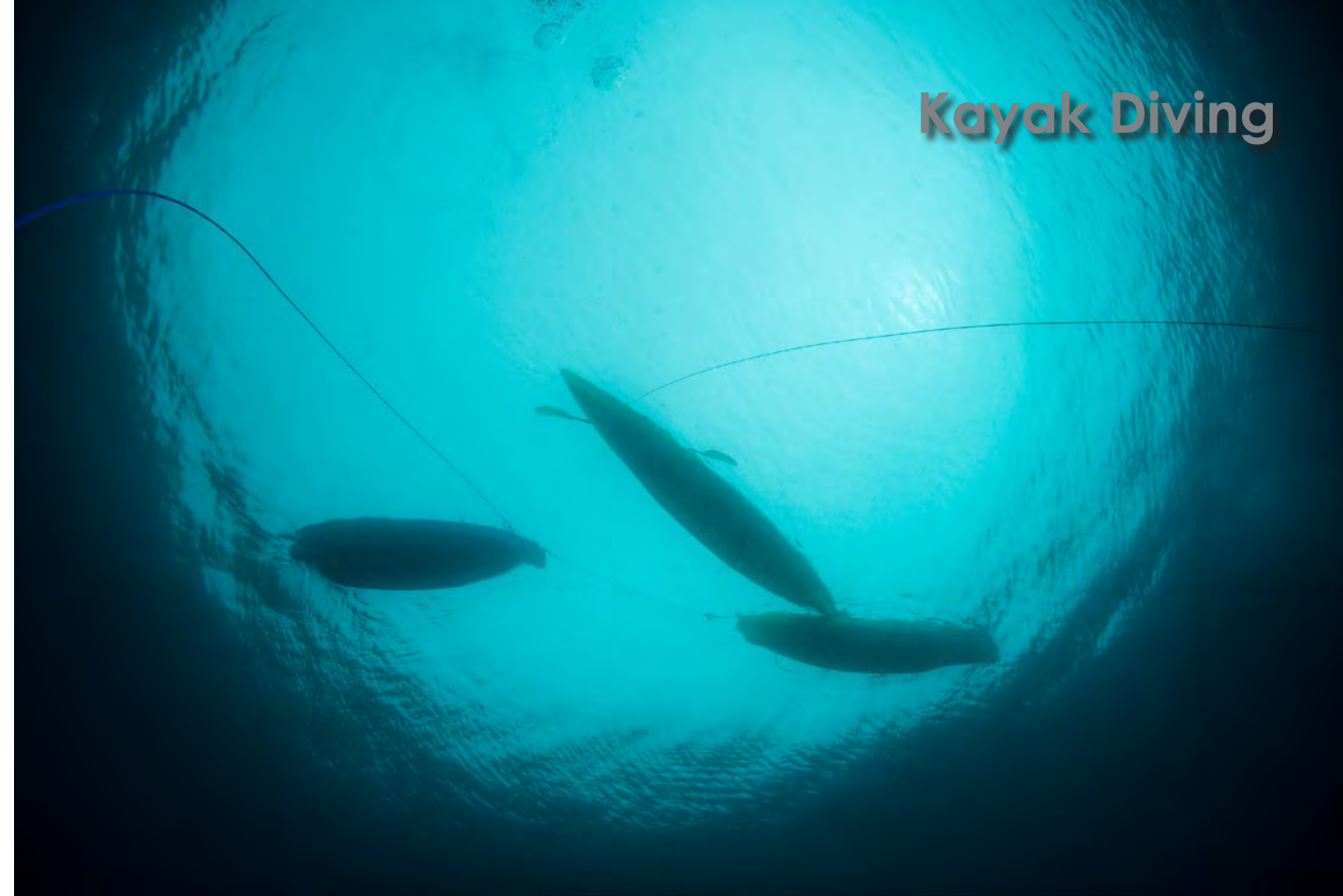
Preparing for a kayak dive is where the adventure begins. Divers need to pick a day with minimal swell, monitor wind forecasts, select a calm entry and exit

point, and create a detailed dive plan. Locating the dive site must also be considered, which could involve GPS, triangulation off coastal landmarks or simply paddling down the coastline looking

for good dive site indicators. If the site is deep, then nitrox may be desirable.

Below are some things to consider before embarking on your first kayak dive adventure.

1. Start out with experienced kayak divers. Seasoned kayak divers can show you all the tips and tricks, and maybe even share the location of a secret reef or two once you



Kayak Diving

Generally a boat dive site, the *Avalon* shipwreck in Los Angeles (left) is a great kayak dive; Kayakers as seen through Snell's Window (above)



A kelpfish poses for a portrait

get to know them. They will also have expensive group safety gear like radios and GPS.

2. Use a high-capacity tank. All the planning and paddling are much more worthwhile when you can spend more time underwater, so opt for a high-pressure 100 (12.9L) or ideally a 120 (15.3L) so that you can maximize bottom time.

My buddies and I generally try to do two dives to take further advantage of the efforts, switching to a second fresh tank during the surface interval.

3. Ensure all gear is secured firmly to the kayak. Kayakers are generally very stable,

but there is always the chance you could flip over while paddling through surf or even while sliding into the kayak. I use a ratchet strap for BCD and tank, and then lines with clips to loop through mask, fins and other accessories.

4. Don heavy gear in the water. Movement is limited on the kayak and moving around heavy gear makes the boat far less stable, so the best way to get your BCD and tank on is to inflate your BCD, clip it to the kayak, and roll it overboard. The gear is much easier to put on once you are in the water. When exiting, take off your BCD and clip it to the kayak, then

use your fins to kick and slide into the kayak. Once situated, you can pull the BCD/tank aboard and secure the gear.

5. Bring standard open water safety gear in case you do get separated from your kayak. This includes a large SMB and whistle. I also bring a reel to run from the kayak anchor to a recognizable portion of the reef or wreck.

Kayak diving is a great adventure and is sure to provide some great stories to share with your "dive trip" friends. ■

Brent Durand is a professional writer and photographer. Follow his adventures at: BrentDurand.com.

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opinion

Text by Mike Ange

In the first article in this series, we discussed the importance of building the diver's comfort zone and how the comfort level of the newly trained diver affects his or her long-term participation in the sport. This begs the questions: how much impact does drop-out actually have on the sport; and what can the instructor do to correct the problem?

The impact of diver drop-out is very difficult thing to assess due to a lack of data. The findings discussed in the first article in this series only tracked divers who completed an open water diver course.

Another organization in the United States, the National Sporting Goods Retailers Association, published a report during the period of the study that addressed all people who try the sport of diving. Although it is not defined, the results apparently (from context) include the "try a dive" courses offered by most training agencies. According to this data,

less than seven percent of the people who try diving will continue in the sport, and many of the dropouts cited the same reasons for dropout: comfort level.

What the statistics fail to address is how many of these potential divers would

have tried the sport in a longer and more comprehensive class but would have become active in the sport, as opposed to the norm of trying and moving on. If this applied to only 10 percent, what would the effect be on our sport and the indus-

try that supports it?

The more important question is: What can be done in the scope of the modern dive training to change outcomes and potentially increase the safety of the sport, even if the increase will be a small

increment in what is by all accounts a statistically safe sport? The most significant challenge faced by dive operators around the world is time. In an increasingly fast-paced world, potential divers have less available time for recreational



Retaining Divers by

Building a Comfort Zone

Analyzing the Obvious –Part II

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Confidence-building drill: Swimming 25m underwater on a single breath of air *horizontally* rather than *vertically* may be less daunting an idea to new students.

Comfort

gency ascent. From the educated diver's perspective, this is a simple skill; when in doubt, ascend to atmospheric air, and then solve the issue or terminate the dive.

For the new diver anticipating dives as deep as 20m (~60ft), this may not sound like a solution. For the new student who sees a free ascent from 2.5m as unachievable, a free ascent from 20m may sound like launching into space.

However, if we couple a very basic understanding of Boyle's law with the student divers' ability to swim horizontally 25m on a single breath of air, we have changed reality for that student. Some divers will "get it" without prompting, but for the rest, a simple statement will close the loop. "You have now made it 25m underwater on one breath of air, and this is 5m farther than the maximum depth you will be qualified to dive in this course,

and you did it without the benefit of the air in your lungs expanding." The underwater swim has now gone from a fitness test to a survival skill, and every survival technique mastered expands confidence.

Objections

So, what are the objections to this skill? Some in the training standards world think this skill is too difficult for divers to complete, and therefore it becomes a roadblock to producing new divers. In my experience, between 80 and 85 percent of divers pass this skill on the first or second attempt, and in 27 years of teaching, I saw less than a half-dozen fail to pass the skill (none of which were excluded from diving).

What about safety? The instructor should certainly be cognizant of shallow water blackout, and an instructional team—prepared to respond if an incident occurs—

pursuits every year.

Training agencies have responded by providing more efficient means of delivering purely academic material to student divers and by removing what are thought to be archaic skills. The response seems logical. After all, it makes sense, for example, to remove skills like buddy breathing, sharing gas by sharing a single second stage regulator. Nearly every training agency around the world, if not all of them, require the use of a safe second or octopus

regulator today, so what purpose can possibly be served by teaching a somewhat difficult and very time-consuming skill? It turns out the answers are surprising.

Problem solving

These skills, which have either been removed or made optional in most of the larger training agency programs, may not be that important for the obvious skills they teach, but they do significantly impact the diver's ability to problem solve. The ability to solve

known problems improves the confidence to solve unforeseen problems.

For the sport, the math is simple. Building confidence is the best way to deal with the fears caused when a diver is unable to anticipate what will occur. More confidence equals a larger comfort zone and a more comfortable diver, especially at the most basic levels, which equals more dedicated participants in our sport. Therefore, the problem for the instructor is to determine what

drills can safely be used to build confidence and the solution can be ridiculously simple.

Building confidence

Let's examine one previously required skill that is still used by many instructors in spite of the fact that it is no longer required by most agencies: swimming 25m (~75ft) underwater on a single breath of air.

One of the primary skills taught to basic divers in Open Water Classes is the controlled emer-



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opinion

Students must learn the difference between a breath hold and a swimming ascent after breathing scuba.

should monitor students. Never teach this skill in water more than 1m to 2.5m deep. Since the divers will never ascend to a significantly shallower depth and since the time of the free dive will generally be a bit less than 30 seconds, these concerns are well managed.

Instructors should not have students who do not pass the skill repeat it more than three or four times for three reasons: 1) CO₂ buildup makes the skill increas-

ingly harder to complete; 2) the risk of blackout incidents increases with each repetition; 3) the purpose of the skill is to build confidence, not create frustration, so let the divers attempt the skill during subsequent classes or perhaps at the end of the current water training session.

You will have to educate your students on the difference between a breath hold and a swimming ascent after breathing scuba, but this is already



required, and this exercise does not instill any "bad" knowledge that the dive student does not already have. Virtually anyone who has been swimming as a kid has learned to hold his or her breath and swim a few meters underwater.

Risk vs benefit

Risk versus benefit must also be included in every instructional plan. Some skills of the past are inherently dangerous and have been discontinued for good reason. For example, skills like breathing from a bare tank impose a level of risk that is unacceptable when compared to the benefits derived from that exercise. Skills that posed even a fairly minimal risk of embolism, drowning or underwater blackout cannot be justified in the training program.

However, this need not limit the instructor's ability to build confidence in divers. Simply examine the most common fears of your students and address them in a controlled manner. The two most dif-

ficult skills for divers to master also identify these fears: loss of vision and loss of breathing gas.

Ideas for confidence building

Have your divers complete a number of skills without a mask. Most training agencies require divers to swim some distance (8m, or 25ft, or more). Try alternate air source breathing or regulator recovery without the mask in 1m to 1.5m of water.

Buddy breathing (sharing one second stage) while swimming. This skill set has fallen out of favor as archaic because of the requirement for all dive gear to have an alternative second stage and to a lesser extent concerns about cross infection from shared mouthpieces.

Additionally, it can be difficult to master as compared to the other skills in an open water class and can be time inefficient. However, the benefits far outweigh these issues and that is why many instructors still teach this skill, and several agencies endorse it as an optional exercise.

Drills without a mask can build confidence

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opinion



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New divers have an almost pathological dependence on the regulator. This is evidenced by the number of mouthpieces that are bitten through in training rental regulators. The simple act of removing and replacing the regulator is a monumental step for some students. Even after repetitive regulator recovery exercises and alternate air breathing exercises, some students still retain a fear of losing the regulator.

Complicating those simpler skills by requiring control of the breathing pattern, coordinated swimming in tandem with your air-giving dive buddy, and navigating toward a

set point will take the diver's mind off the idea of immediately drowning. By the time the skill is mastered, confidence in your least confident students will have doubled.

Safety tips: Set the skill up with mostly horizontal swims and swim with your students so that you can monitor for breath holding. To reduce the risk of cross infection, you can also have the divers hold two regulators together and pass them back and forth but breath only on their own regulator.

Drills

A good instructional program will

provide drills that build the ability to solve problems. The more diverse those drills can be, the more confident the diver will be in addressing those problems he or she cannot anticipate.

Next to the actual ability to anticipate, which only comes with actual experience, the ability to intuitively solve those things the diver cannot anticipate is the second most vital skill for the new diver. The next article in this series will discuss the application of these same skills to more advanced forms of diving and the threat reliance on technology poses for the diver. ■

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Avoiding Bad Gas

Tips for Preventing Breathing-Gas Contamination

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Incidents involving bad breathing gas—air, nitrox, trimix or another mixture—are rare, yet they do occur. Health effects on divers vary depending on the contaminant breathed. Among the most severe symptoms of breathing contaminated gas are impaired judgment and loss of consciousness, both of which may be deadly underwater.



Sources of contamination include hydrocarbons from compressor lubricants, carbon monoxide (CO) from engine exhaust (or overheated compressor oil) and impurities from the surrounding environment such as methane and carbon dioxide (CO₂). Dust particles in breathing gas can also be hazardous, potentially impairing respiratory function or damaging diving equipment. Excessive moisture can cause corrosion in scuba cylinders and other dive gear and may cause regulators to

freeze due to adiabatic cooling (heat loss following increased gas volume).

Recommendations for divers

Ask questions and be observant. If you are unsure about the breathing-gas quality at a fill station, ask questions about compressor maintenance, procedures and testing. Ask if the compressor operator monitors for CO and how often they send samples to a lab for analysis. Look for posted breathing-gas-analysis reports, and note whether the fill room is clean, organized and well ventilated. Observe the proximity of the compressor intake to sources of exhaust, and look to see whether the compressor has an hour meter that can be monitored for regular maintenance.

Always conduct a pre-dive gas check. If your breathing gas has an unusual odor or taste, do not dive with it—this is a red flag for oil or combustion contamination. However, keep in mind that not all contaminants can be detected this way; CO, for example, is odorless and tasteless. Electronic CO detectors or products such as CO-PROTM can be used to detect the presence of CO in breathing gas. Divers should always use oxygen analyzers to determine the level of oxygen in a nitrox mixture to prevent oxygen toxicity.

Recommendations for compressor operators

Compressor operators can help prevent gas contamination and mitigate the risk of dive accidents in several ways:

Attentive compressor maintenance.

Proper compressor maintenance helps ensure breathing-gas quality as well as extends the life of the compressor. Breathing-gas contami-

nation is less likely in well-maintained and properly functioning compressors. If maintenance is neglected and the compressor overheats, the lubricating oil may break down and produce CO and other noxious byproducts.

Effective procedures. A fill checklist can help ensure safety procedures are remembered when cylinders are filled. Before starting to fill tanks, the operator should inspect the compressor's filters for damage and note the presence of contaminants such as cigarette smoke, paint fumes or engine exhaust near the intake. If the operator notes any chemical or oily odors after filling has started, he should shut down the compressor immediately. Other useful strategies for reducing the risk of gas contamination include keeping records of air fills and maintenance, ensuring operator qualifications are up to date, using proper oil and filters, and maintaining a clean and organized tank-filling room.

Air-quality testing. As a diver descends and ambient pressure increases, the amount of gaseous contaminants breathed also increases. This explains why a contaminated gas that is not toxic at



CONTAMINANT	SIGNS AND SYMPTOMS
Carbon monoxide (CO)	Headache, dizziness, weakness, nausea, vomiting, shortness of breath, impaired judgment, confusion, unconsciousness, potential death
Carbon dioxide (CO ₂)	Hyperventilation, dizziness, confusion, unconsciousness
Volatile hydrocarbons	Fatigue, headache, confusion, impaired judgment, numbness, cardiac arrhythmias, unconsciousness
Oil (condensed)	Headache, nausea, impaired respiratory function
Dust (particles)	Impaired respiratory function
Methane	Asphyxia due to dilution hypoxia

the surface may be at depth. Breathing gas must be tested for a variety of contaminants both regularly and continuously to ensure compliance with diving-adjusted contaminant levels.

Compliance with breathing-gas quality standards is not strictly enforced, and most of the responsibility for testing lies with the operator. Several methods of testing are available to compressor operators, and they vary in price and complexity. Continuous CO-monitoring devices include electrochemical sensors with color indicators. Devices that continuously monitor moisture level are also available. Operators can send a breathing-gas sample to an accredited laboratory for analysis of oxygen, CO, CO₂, moisture, oil/hydrocarbons and even particulate matter; this is recommended on a quarterly basis.

Confirming contamination

Identifying contamination incidents based on symptoms alone is difficult, as the associated symptoms are often similar to those of other diving-related (and non-diving) illnesses. If a diver suspects he was exposed to bad breathing gas, he should seek a medical evaluation and have the gas tested. Observing the health of other divers who had their tanks



Air Quality Specifications for Recreational Diving

CONTAMINANT	MAXIMUM LEVELS
Oxygen	20-22%
Carbon dioxide	1000 ppm _v
Carbon monoxide	10 ppm _v
Total hydrocarbons, including methane	25 ppm _v
Oil/particles	5mg/m ³
Water vapor	67 ppm _v
Objectionable odors	No odor

Source: Compressed Gas Association (CGA) Grade E, National Fire Protection Association (NFPA) 1500, American National Standards Institute (ANSI/CGA G-7.1'97)

filled at the same source may be helpful in determining whether a diver's symptoms are related to contamination.

DAN Research

DAN occasionally receives reports of problems from divers breathing contaminated gas, but we suspect this issue is underreported. To encourage divers to report compressed-gas contamination, DAN will assist with gas analysis. If you were involved in an incident possibly related to breathing contaminated gas and you have lawful control of the tank, please preserve the tank and contact DAN Research at +1 (919) 684-2948 or via DAN.org/DivingIncidents. ■

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Feather star
photographed with
black background,
Philippines

Text and photos
by Steve Rosenberg

Crinoids, or “feather stars” as they are commonly known to the scuba diving community, are echinoderms, members of the phylum Echinodermata, meaning “spiny skin,” which includes many well-known species like sea stars, sea urchins and brittle stars. Their highest concentrations are found around Indonesia, the Philippines, the Solomon Islands and Australia’s Great Barrier Reef. Most divers take a quick look at the shapes and varieties of feather stars, but usually pass on by, in search of other interesting subject matter. However, there is more to them than meets the eye!

Many divers who have traveled to the Indo-Pacific are familiar with feather stars and admire them for their bright colors and interesting shapes. Feather stars are also well

known to divers because of their propensity to attach to the wetsuits of careless divers. The arms of feather stars are very sticky and will cling to almost any surface

much like “living velcro.”

Unfortunately, when they extend their arms they will often stick to almost anything that passes by, including hands, wetsuits,

fins, buoyancy compensators and camera gear. It is very easy to damage a feather star when you just brush against them. Their arms are fragile and often tear off

when they stick, so divers need to be very careful when they swim close to the reef surface that are populated by these interesting creatures.

Fascinating Feather Stars

& The Creatures Within





Characteristics and behavior

Most species hide under rocks, in crevices or under coral ledges during the day, coming out usually at night and slowly make their way across hard surfaces to find good places to feed. Feather stars walk on short legs and are actually free swimmers. Swimming may be a slight exaggeration, in that they are able to propel themselves through the water by alternating sweeps of their arms.

Each feather star has up to 200 arms per animal. They feed by extending their arms up and out into the water column to catch bits of plankton passing by in the current. Tiny fingerlike tube feet that line their arms pass the bits of plankton into special food gutters that run along the center of each arm. Tiny microscopic cilia (hair-like projections) carry the food along the gutters that run the length of the arms down to the mouth of the feather star. Crinoids are

distinguished from other echinoderms by the fact that their mouth is pointed upward, unlike their starfish cousins. They are often found perched atop rocks and coral heads in areas prone to current, in order to capture bits of plankton carried along by the water movement.

Hosts to commensal critters

Few divers take the time to carefully look closely enough to see that crinoids are actually hosts to many tiny commensal animals. The underwater world can be a scary and dangerous environment for small and vulnerable critters; potential predators lurk around every corner. Many of these small marine animals have adapted to the constant threat from predators by finding ways to become less "desirable" or less accessible. For a number of these small animals, such as shrimp, clingfish and squat lobsters, crinoids provide the perfect

refuge.

Symbiosis is a relationship between two organisms that live together. Usually the larger partner, in this case the feather star, is referred to as the host. The smaller organism, in this case squat lobsters, shrimp or clingfish, is referred to as an associate. Within the marine biology community, this relationship is typically described as commensalism, which primarily ascribes a benefit to the associate, or mutualism where there is a benefit to the host and to the associate. The tiny residents of the feather stars receive two major benefits, protection from predators a ready source of food. The feather star itself receives a lesser benefit in that these tiny house guests serve as a cleaning crew, picking off scraps of plankton and detritus that get stuck in various parts of the host.

Many of these tiny animals have an incredible ability to disguise them-

Squat lobster inside host feather star, Philippines (above); A crinoid shrimp sits atop an arm of a feather star (top right); Feather stars extend their arms into the water column to gather plankton, Philippines (top left)



Feather Stars

A tiny shrimp hides within the folds of a feather star (above); Feather star perched on reef surface, Philippines (left)



Gold squat lobster blends in with a crinoid of the same color, Philippines

selves within the host by mimicking the colors, shapes and textures of the crinoid. Some underwater photographers simply look at the host feather stars as interesting and colorful animals and may take a couple of quick snapshots of the outside of the host with the water column in the background to create interesting images of the feather stars. However, most photographers rarely spend the time to focus on the tiny residents hiding within.

In some ways, this can be seen as more challenging because the tiny residents are pretty elusive and pose inherent difficulties because of their size and ability to hide in plain sight. They also have a frustrating ability to navigate easily within the sticky, retractable and writhing arms of the feather stars. We, as photographers, find it very rewarding when we are able to capture images of the interesting macro subjects we discover within the hosts. Again, though it should be

noted that much care needs to be taken not to injure the animals.

Squat lobster. One of the more spectacular companions or “associates” is the aptly named squat lobster, from the Allogalathea family, a small crab that lives among the arms of the crinoid. Working as a miniature house cleaner, these crustaceans quite often take on the colors of their host in order to camouflage themselves further from predators. During the day, they hide amongst the arms or feet of the crinoid, before boldly walking the surface of the arms at night, picking up tiny morsels of food that have become stuck to their host. A second species of crab, commonly known as “crinoid crabs,” are frequent inhabitants of crinoids but are less conspicuous than their larger relative, the squat lobster.

Shrimp. Not to be outdone by their crustacean cousins, various shrimp

have also created a commensal relationship with crinoids; several species can be found cohabiting within these spectacular echinoderms. Although different species seem to all be called “crinoid shrimp”, there are many differences in size and shape between the species of *Periclimenes*, *Laomenes*, *Brucecaris*, as well as several others that are associated with crinoids. Similar to the squat lobsters, these fragile shrimps live within the protective folds of the feather star as a form of shelter, while feeding on the microscopic food items that they can find within the arms of the host.

Fish. Crustaceans are not the only ones that have created a relationship with crinoids; several species of fish also use crinoids as protection. The beautiful ornate ghost pipefish is often found trying to blend itself among the arms of a crinoid, as a means of camouflage. There is even a small species

Dive and Travel Galapagos

The Complete Guide to Dive Sites, Land Tours, Wildlife & Travel Basics Throughout the Archipelago

By Steve Rosenberg and Greg Bassett

Dive and Travel Galapagos is the latest in a series of informative dive guides by Steve Rosenberg. The 2017 NATJA Gold Medal award-winning e-book provides detailed descriptions of 47 of the most popular dive sites and dozens of land tours throughout the archipelago. The guide also contains practical

information on travel basics and some of the fascinating wildlife that visitors will encounter. This electronic interactive guide has many useful features and can be used as a travel log, allowing you to add your own comments and notes. It contains hundreds of high resolution images and several videos of what you will experience on land and in the sea. Available on iTunes, Google Play and Amazon. Download it today!

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of cuttlefish, known simply as the “crinoid cuttlefish” that hides in crinoids and adapts its color to match!

The most unique fish to call the crinoid home is the tiny, yet spectacular, crinoid clingfish. This fish—which looks like a cartoon character, with bulbous eyes, tapered tail and sometimes garish coloration—lives nestled within the disc of crinoids and feeds upon bits of plankton and small crustaceans trapped within the crinoids’ appendages. Trying to photograph these small fish is a lesson in frustration. They are constantly darting and dipping around their host, hiding amongst the arms.

For the photos in this article, standard macro equipment was used, including a Nikon D7100 camera, 60mm macro lens, Subal housing, and Sea & Sea strobes; the images were captured using the fol-

lowing specs: ISO 200, F/29, 1/200th of a second.

Final thoughts

With so much traffic happening within a crinoid, it is always a great idea to stop and observe whenever you see one on a dive. For photographers, it is a definite must to peer inside these colorful and exotic-looking reef inhabitants, due to the multitude of potential macro photographic opportunities they can provide. ■

A professional underwater photographer and photojournalist since 1980, Steve Rosenberg has produced over 20 destination guide books in print for international publishers including Lonely Planet, Cruising Guides and Aqua Quest Publications; as well as hundreds of articles for US and international publications. With

thousands of his images appearing in books and magazines worldwide, Rosenberg has won 250 awards for his imagery in international competitions. He is an active member of the Society of American Travel Writers (SATW) and the North American Travel Journalists Association (NATJA). In 2013, Rosenberg assembled a new team of professionals for the purpose of producing interactive e-books to be used as scuba and travel guides, as well as powerful marketing tools for destinations, resorts and liveaboard operations. The most recent guide is the NATJA Gold Medal award-winning Dive and Travel Galapagos, which was released in August of 2017. See video here: <https://youtu.be/Ku-5VCCDo-CQ>. For more information, visit: Rosenbergebooks.com.

Crinoid clingfish in feather star (above); *Periclimenes* sp. crinoid shrimp camouflaged against the host feather star (top right); Harlequin ghost pipefish against feather star (top left)

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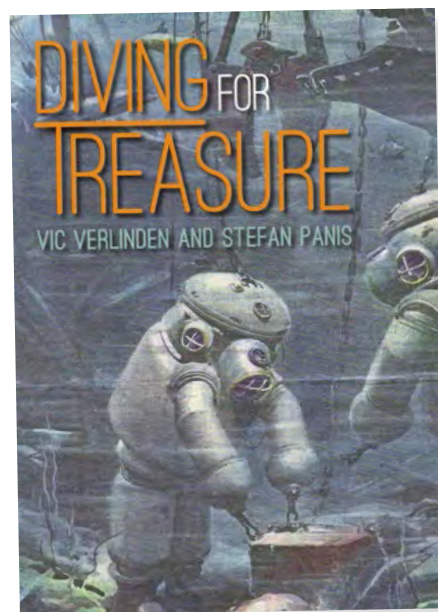
Indonesia

The 50 Best Dives in Indonesia: The Ultimate Guide to the Essential Sites, by Tim Rock and Simon Pridmore

Indonesia is undeniably one of the best places to be if you are a diver. But with so many fabulous dive spots here, how does one decide which one to head to? That's where this book comes in. Written by two seasoned dive professionals, it

shortlists 50 of the best dives in Indonesia—the best of the best. Expect locations like Bali, Komodo and Raja Ampat, as well as lesser known ones like Mapia, Maputi and Manuk. Attractions range from shipwrecks, deep walls, huge fish aggregations, weird creatures, wild rides, ancient reefs, kaleidoscopic seascapes and even an undersea volcano. Complemented by full-colour photographs and maps, this is an essential read for anyone keen on diving in Indonesia.

Series: The 50 Best Dives
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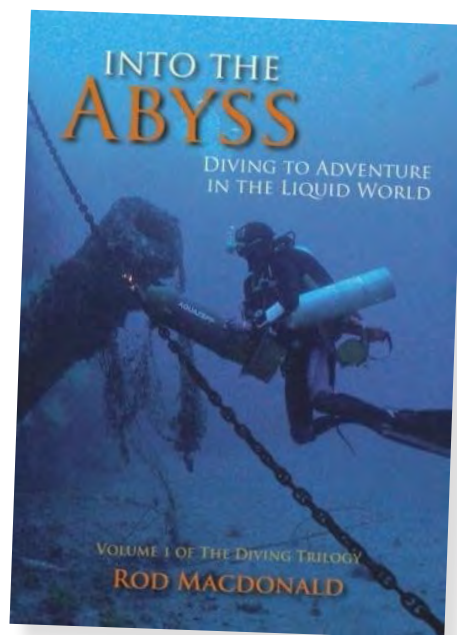


Treasure Hunting

Diving for Treasure, by Vic Verlinden and Stefan Panis

Over the past decades, we have sought to retrieve sunken treasure held within wrecks. Such expeditions, often prolonged and dangerous, require technical expertise (using rebreathers) and extensive dive experience. In this book—the result of several years of research and photography—the authors describe several deep wrecks and the treasures they hold, as well as the challenges involved when undertaking such dives, like adjusting the camera housing to accommodate the depth to having to dive at specific times of the year. Each entry contains the wreck's history as well as a modern diving account with photographs.

Paperback: 144 pages
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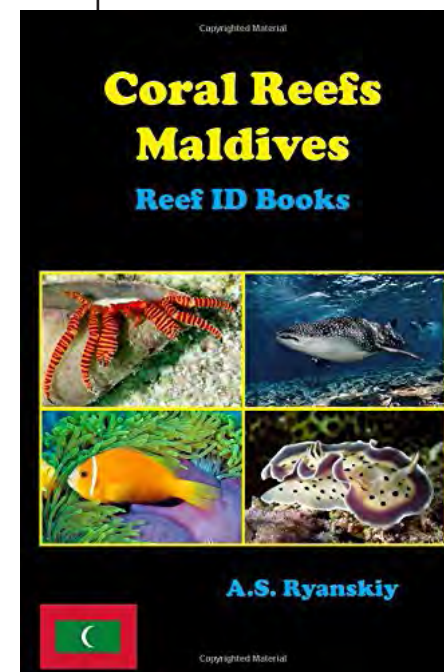


Dive Tales

Into the Abyss, by Rod Macdonald

Rod Macdonald is an accomplished diver known for his series of authoritative dive-related guide books. In this book—the first in *The Diving Trilogy*—he takes readers on a journey of his life's adventures from his time as a novice diver in the 1980s all the way to trimix diving in the 1990s. From diving famous shipwrecks to the world's third largest whirlpool, the author shares the excitement of his experiences (often filled with danger and drama) as if he were relating them to the reader in person.

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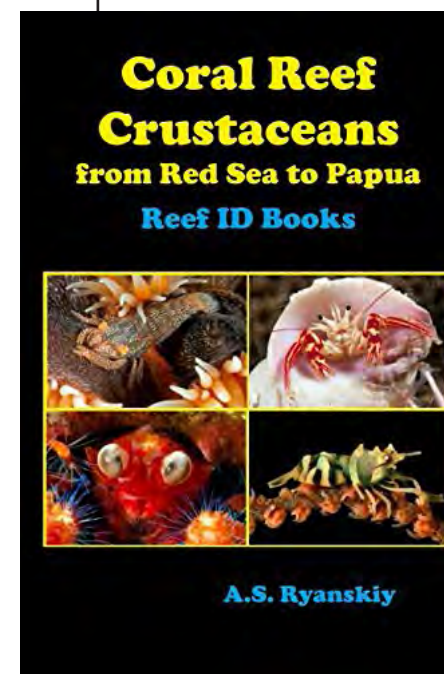
Text by Peter Symes

Yay! I just got a couple of new and comprehensive ID guides to help me identify fish and marine critters on the countless underwater images that pass this editor's desk on a daily basis. Good guides are hard to come by, because only very few are really comprehensive enough, or scientifically thorough. Even with marine ID guides filling four feet of book shelf space in the office, it has primarily been to Helmut Debelius' many classic fish guides and Andrea and Antonella Ferrari's guides that I have routinely referred, when in need of establishing identities of species.

The two guides by Andrey Ryanaskiy, I recently bought, have now become part of that quite select, little group of trusted resources—only these two new guides are also travel-friendly, being of a size and weight that is just small enough to

slip into a photo bag or carry-on. *Coral Reef Maldives*, for example, which I could not resist actually weighing on my kitchen scale, weighs just over 300g. Yet, it lists more than 1,200 species of fish and invertebrates, which is more than most. I cannot quite ascertain how many fish species in the Maldives archipelago are known to science. Numbers stated by various sources range between 1,500 and 2,000. But as many of these will surely be obscure, elusive and/or hiding, I would say the recreational diver and underwater photographer will be rather well covered with this guide. It is

a bare-bones, straight-to-the point ID guide, so there is no narrative to go with the various species. But that is the way a good guide should be. Once a species has been correctly identified, further information can easily be searched on the web. Are there bits and pieces I feel are missing? Yes, such as a bit more information about how to discern between two closely-resembling species—pointers on the often miniscule differences to look for. But then again, one cannot have it both ways, having a compact yet still quite comprehensive guide, that is also travel-friendly and lightweight. In the end, I prefer it this way, as in just two books there is nearly twice the amount of species than other titles hold, and the books still only weigh about half as much.



Coral Reef Crustaceans follows the exact same overall style, size and format but covers a wider geographical area—from the Red Sea to

Papua—nearly half the planet. It lists more than 900 species, and I suspect I will draw on it a lot since crustaceans rarely get quite the attention fishes do. Truth be told, I have often found myself a bit more challenged in this area. But this guide now makes me feel more hopeful that I will soon be able to identify a lot more shrimps, crabs and other critters. ■



Beaked Whales *of El Hierro*

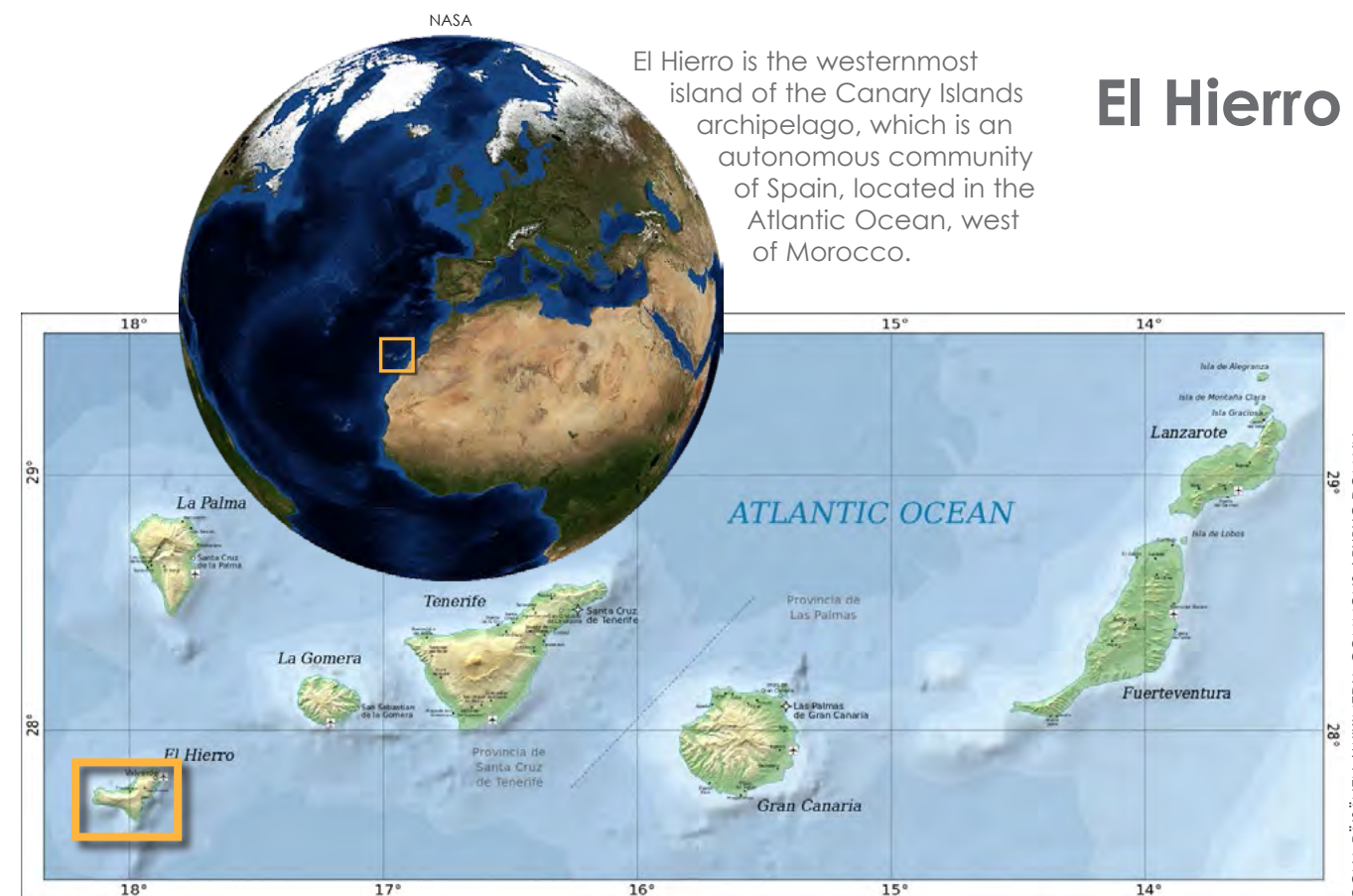
Text and photos by Claudia Weber-Gebert



THIS PAGE. View of beaked whales above and below the waves (previous page)

El Hierro

El Hierro is the westernmost island of the Canary Islands archipelago, which is an autonomous community of Spain, located in the Atlantic Ocean, west of Morocco.



Beaked whales are shy animals, which are only found far out to sea, but in El Hierro, where the landscape slopes steeply underwater, the whales can be seen closer to shore

Beaked whales—now honestly, who has ever heard of Cuvier beaked whales (*Ziphius cavirostris*) or Blainville beaked whales (*Mesoplodon densirostris*), or even knows what they look like? Anybody? No? It's no wonder—they are shy animals, they can be seen at the water surface only for a very short time, and they are usually not very noticeable. Unlike their relatives, the dolphins, beaked whales are found only far out to sea, far from the coast and therefore, they just simply are less well-known.

The whales also do not ride on the bow waves of boats, but rather avoid noise and are extremely quiet representatives of their kind—a species that lives quite

inconspicuously in our world's seas and hunts at great depths. As a result, little has been known about these whale species until 2004, when a large number of strandings, worldwide, were recorded, in the context of acoustic disturbances. Underwater photos of these marine mammals are rare because of their seclusion.

The research project

The marine biologists of the University of La Laguna in Tenerife (ULL) have been commissioned by the US Navy to investigate the beaked whales at the small Canary Island of El Hierro. Funding for the project has been secured to the end of 2018.

The background of this project involves the stranding of 60 animals in 2003 in the Canary Islands after the Navy carried out military sonar tests in the waters of the islands. The stranded beaked whales were covered with hematomas, air bubbles were found in their livers, their sensory organs for echo location were destroyed, and they experienced agonizing deaths. Not even the animals that

had not died yet could be helped.

The US Navy was accused of having caused the strandings and the cruel death of these whales. Of course, everything was denied, and to prove the contrary, the University of La Laguna received money for the research project from the US Navy.

The project, which is still on-going until the end of 2018, comprises the following. First, all military sonar tests have been suspended in the Canary Islands, so-to-speak, creating a protected zone. Then, two to three times per year, teams of marine biologists and ULL students come to El Hierro for at least three weeks to do intensive research work. During this time, focus is given to various aspects of the study, such as cataloging, sound recordings with the hydrophone, biopsies (collection of skin samples), behavioral research, photos and videos, etc. The results are subsequently evaluated, and the research results published. There is also a lively exchange with other researchers worldwide. So, the beaked whales are now quite well researched;



Views of the island of El Hierro in the Canary Islands (left and lower left)

research on the beaked whales is made possible. In addition, an agreement was signed between the University of La Laguna and the Woods Hole Oceanographic Institute, which allows joint projects to be presented and shared.

At the end of September 2016, I had the opportunity to spend some time together with the researchers at La Restinga on El Hierro, to observe the work and to take part in it, to take photos of surfacing beaked whales and to get information directly on the spot. It was a wonderful experience,

with a nice "Zifio" team and with wonderful and fascinating whale excursions. The permits for underwater photography were also available to me, but the research work always had absolute priority, and so, only a few underwater photographs with the GoPro were possible.

Why El Hierro?

The question is quite simple to answer: It is the geographical location of the small Canary Island. Cuvier and Blainville beaked whales hunt at a depth of about 800-1,600m. These depths are usually far off the coasts and make research work expensive, extravagant or nearly impossible. Not so on El Hierro.

Already at 100-200m from El Hierro's coastline, with its steeply sloping underwater landscape, the seabed reaches the appropriate depth. Both beaked whale species are found here all year

and the military. While the military only wants to assess possible collateral damage, the scientists naturally want to learn more about the size and the health status of the populations. The funds are therefore used very sensibly and

time together with the researchers at La Restinga on El Hierro, to observe the work and to take part in it, to take photos of surfacing beaked whales and to get information directly on the spot. It was a wonderful experience,



many details of their living habits are available on worldwide database networks.

Beaked whales belong to the order of the whales (Cetacea), subordinate tooth whales (Odontoceti), and the family of the beaked whales—Ziphiidae, which are called "Zifios" by the Spanish researchers.

The research in the Canary Islands is intended to determine

the size of the populations, the age of the animals and the rate of reproduction. For the US Navy as well as for the scientists, it is important to know if, for example, when 10 animals die in the case of strandings, it is 10 out of 100 or about 10 out of 1,000 animals. This is the determining factor in maintaining the population.

The importance of the results is, however, very different for science



Rugged coastline of El Hierro has a steep slope underwater, so beaked whales are often seen near shore



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Tabletale dorsal fin of a beaked whale (above) Researchers survey the water for beaked whales from a boat (right), while others search from land (top right)

round, because their prey in the open Atlantic is in the immediate vicinity of the island.

A small motorboat is all that is required to study the whales along this coastal strip. For the studies, seasons are chosen in which the sea is particularly calm and the shy beaked whales, which only appear briefly on the surface, are easier to spot. In case of high waves, sighting is almost impossible, since only the whale's short gray back with a small fin can be seen for a brief time at the surface. The beaked whale's blow is hardly more than half a meter high and cannot be seen at the distance. In the windy shadows of the island of El Hierro, on the Mar de las Calmas—"the calm sea"—the conditions are ideal, and the animals can be explored at close range.

A typical research day

The leaders of the research team are Crístel Reyes Suárez from the University of St. Andrews in Scotland and Agus Schiavi from

the Universidad de La Laguna in Tenerife. Both are responsible for the research and findings on El Hierro.

The research day begins at 7:30 a.m. There are two teams: a "terra" team and a boat team. Both teams alternate daily, so that it does not become too one-sided. The work on the boat is simply more interesting, but without the terra team, nearly impossible. The terra team drives by car to their post. The boat team goes by boat out into the bay. The "external work" ends around 4:00 or 5:00 p.m. After that, the data is saved, and the first analyses are made. Only after 8:00 p.m. in the evening is there time for lunch—a long and exhausting day.

The terra team is located on a hill above the bay, equipped with two to three binoculars with integrated compass and up to 50x magnification. They have the task of systematically screening the water's surface along the coast. If the animals show up, the species is determined and the number



of animals counted, if possible. Through the scale in the binoculars, the position of the animals can be defined quite precisely by means of a computer program. The position is then transmitted immediately by radio to the boat.

Observation & designation

Each group of animals that is spotted is given a letter, supplemented by a number, depending on how often the group shows up on the particular day: "A-1" at the first sighting; or "A-2" if the animals

surface again. The next group is named "B," the third is given the letter "C," and so on. This data is stored on a map in the computer so that a complete overview of the sightings is available at the end of a day, with notes on time





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Rugged coastline of El Hierro (above); Researchers survey the water for beaked whales from a boat (right), while others search from land (far right)

duration on how long the whales' dives were, or how long their surface pauses were. The students' positions on the binoculars and the computer alternate every 20 minutes, so that the eyes do not tire too much by observing the surface of the water.

On the boat, each of the four or five team members is given a direction for which the water surface is systematically to be scanned. On board, this is very tiring for the eyes. The glittering water surface becomes a major challenge, especially in the early afternoon hours. For both teams, the sun and the heat are a factor, which cannot be underestimated over the three weeks of daily surveying without interruption. Sun protection and head cover are absolutely necessary. In between



surveys, a jump into the water to cool off is necessary, especially in case there is no wind. Then the heat on the boat becomes intolerable.

If a group of beaked whales is sighted, the teams communicate by radio and the boat immediately heads towards the position. Depending on the distance, the boat is simply not fast enough.

But as the terra team has a better overview, the boat will be directed to where the contact with the zifios will be most successful. Usually, two to three whale groups are observed at different positions along the 1,000m course at the same time, and the probability of which direction is most appropriate for the boat is assessed.



Research activities

The tasks on board are clearly distributed: One team leader drives the boat, one or two students take photos of the animals, another person holds the GoPro on a pole into the water, and the second team leader gets the air gun ready for a possible biopsy. When the boat arrives near to the beaked whales, everything must

go very quickly, as the animals surface for an average of only three to five minutes before they descend again.

So, what must be done? Intensive observations of the animals, counting individual whales, determining how many are adults and how many are young animals, taking as many photos as possible with a telezoom lens on

the swaying boat, putting the GoPro on the correct side in the water against the water pressure from the moving boat, maneuvering the boat to the animals, sidestepping the person with the biopsy rifle, and then at the same time, still ensuring that not all team members are on the same side of the boat at the same time.

In other words: maximum con-



centration on the tasks at hand, for the short time the beaked whales are at the surface!

To do this, the entire team must be well-coordinated and understand each other without using too many words. All the activities must be done hand-in-hand. If biopsies are made, all the other team members have to go to the opposite side of the boat for safety reasons. The air pressure gun is extremely sensitive and can occa-

sionally free itself upon impact in high waves!

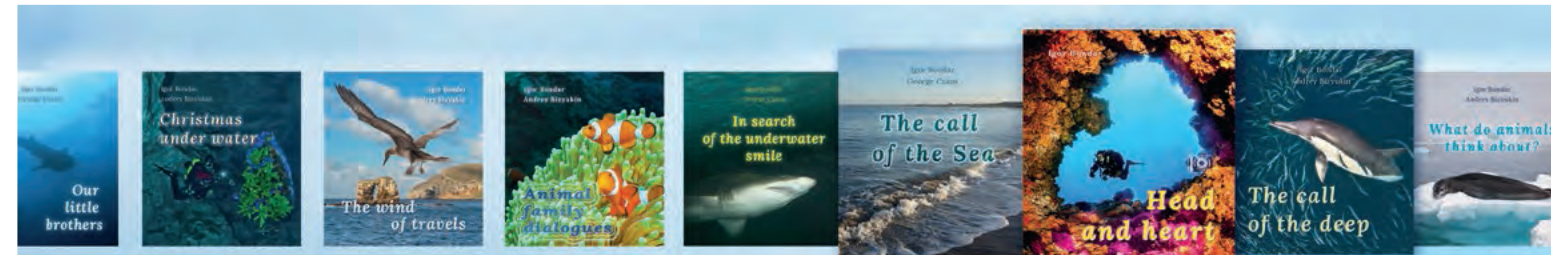
Diving behavior

The zifios, which are usually in groups of three to five animals, hunt at a maximum depth of 800m. After three to four short dives with an average duration of 20 minutes each and approximate depths of 800 to 1,000m, a deep dive with an average duration of one hour is often made, down to

Cuvier beaked whales will sometimes split off from groups to join others; Before a deep dive, beaked whales will do a little jump at the surface (left)

a depth of 1,600m or even more. Maximum dive times of over two hours were recorded. Then a few deep breaths followed at the water's surface and the whales disappeared again. The deep dive could be identified very well, since the whales first made a small "jump" and inhaled particularly intensively.

For the researchers on the boat, this meant waiting one hour or more for the animals to show up again. Usually, they surfaced again along the same course and from the same depth to which they previously descended. In the meantime, researchers looked for other groups of whales, collected plastic waste from the sea, or looked at photos and communicated with the terra team, saving data of what had been observed onto the computer. During this time, individual animals were cata-



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Mother beaked whale with newborn calf (above)

logged, groups could be identified, and animals were found to be changing groups, or dividing and recombining groups.

High points

And waiting was always worthwhile. What was routine for the research teams was exciting and absolutely thrilling for me as an observer. Somehow, I was lucky enough to find ideal conditions on the days I could be on board the boat. The sea was as calm as ever, and there were more animals at the surface than at any time during the researchers' three-week-study on El Hierro.

There were also previously unprecedented observations: A member of a group of four adult Cuvier beaked whales, which had been observed unusually close to the coast the day before, had given birth to offspring. Between the four adult animals, a small gray head was looking out of the water—a sighting that made

every researcher's heart beat faster. Mother and newborn calf could be observed in the shallow waters when the remaining three adult animals had gone to hunt prey. We noticed that the mother had not eaten food lately; her ribs were clearly visible on her back.

For me, it was a special moment when the whales performed their so-called "breaching" behavior, when they would spring out of the water. Three of the four animals in a group of Blainvilles amazed us for four minutes, jumping out of the water within the immediate vicinity of our boat. This behavior is not common. It was an absolutely rare moment of happiness I was allowed to experience!

Findings of the study

Talking to Dr Natacha Aguilar de Soto, head of the University of

La Laguna, it turns out that the military sonar tests had clearly been the cause for the strandings in 2002 in the Canary Islands of these extremely sensitive beaked whales.

"In the search for deep sea food, whales often hunt in family associations," said Aguilar de Soto. "After the feeding phases in the depths, they surface for air and to digest. Afterwards, they dive again to hunt for more food. It is important that both the descent and the ascent phase

are slow. Thus, the entire body can adapt to the changing water pressure. If, however, whales are hit by the extremely loud sonar of military ships, their sensitive organs are destroyed. The animals have a lot of pain and panic. Full of agony, they swim as fast as possible to the water surface. This rapid pressure change

is the reason for blistering in the blood and organs. Air foams properly in their body. It doesn't only interfere in the oxygen supply of the cells, but the fat particles entering the blood from the surrounding cells block the veins and lead to a pulmonary embolism. It is therefore not surprising that in the study of dead animals, a liver full of air bubbles can be found."

Read about this finding on the Internet at the Portal de Canarias. Researchers say the effect is known as diver disease.



Beaked whales were observed jumping out of the water, also known as "breaching" (above and top center); Before a deep dive, beaked whales do a little jump, which can be seen at the surface (center inset)



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Oasis Explorers is a newly launched technical training facility located at Bunaken Oasis Dive Resort and Spa in North Sulawesi, Indonesia. The facility is the first in Bunaken Marine Park to offer multi-agency technical training, trimix and CCR compatibility, and a vastness of unexplored deep dive sites, all in the setting of an award-winning luxury dive resort. Expect a state-of-the-art filling station, specialised equipment, experienced surface support and expert advisors.

Oasis Explorers will also be working on opportunities in North Sulawesi for more detailed scientific surveys, environmental awareness for deep-water marine species and the first comprehensive mapping project beyond recreational depths.

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Set in the world-famous Bunaken National Marine Park, Bunaken Oasis offers a truly luxurious diving experience.

Exceptional air-conditioned cottages with sea-view balconies. Chill-out bar, and gourmet panoramic restaurant. Custom-built spa with qualified therapists.

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5* PADI affiliated Oasis dive centre designed for photographers and dive boats that are second to none, with fresh water deck showers, toilets and, above all, space.



Acoustic disturbances

Acoustic disturbances not only influence the beaked whales but all whales that hunt with echo location. Loud noises overshoot the echo signal, so the whales can no longer locate their prey. This is why in the Canary Islands, areas with noise from ferries is carefully surveyed.

Fortunately, the following has been noted: Since the sonar tests were banned in the Canary Islands, the population of beaked whales is healthy and there have been no more strandings!

There are only five sites worldwide where stationary beaked whale populations can be observed and studied right off the coast. This includes El Hierro, just like Hawaii, Italy (Liguria), Greece

and a different population in Nova Scotia in Canada.

Critically, in Greece, military sonar tests are being conducted by the US Navy. A memorandum is in the process of being drafted so that no further military tests can be carried out in Greece.

The results of the study include the cataloging of the whales' dorsal fins and scars on their backs by means of photography, communications between whales, and behavioral patterns—all of which can be exchanged with other research stations to facilitate studies worldwide. By tagging whales, the scientists can get diving profiles, which document the whales' hunting behavior underwater; sound files; speed and depth of dives; and much

The dorsal fin of the beaked whale (left) can be seen when the whale does a little jump before a deep dive;

It is a challenge to see the whale's blow (center), which does not reach very high above the water's surface.

more. Here is a link where you can listen to "whale communication": <http://soundtags.st-andrews.ac.uk/projects-and-species/tags-on-species/>

Micro-plastics ingested

One finding of the biopsies was frightening. Besides "normal" examinations, skin samples were also examined for micro-plastic. Since beaked whales eat only at a depth of around 1,000m, the findings proved that the water column is loaded with micro-plastic up to that depth! It is one more reason to



finally do something about the pollution of the sea and all our plastic waste.

El Hierro will soon be declared

a national marine park, due in part to the findings of the studies by the marine biologists of ULL Tenerife. Negotiations are already underway; it will not take very long. What a success! ■

Claudia Weber-Gebert is an advanced diver, underwater photographer and dive writer based in Germany.

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View of the seas around El Hierro in the Canary Islands of Spain



Text by Matt Jevon

I was recently given this picture, signed by David Prowse—the original actor who played Darth Vader—by one of my students. It's awesome. Why? Well I am a bit of a Star Wars fan and a lot of a geek anyway, but also, there is a little sub-culture in technical diving, especially cave and rebreather diving, in which divers like to refer to themselves as members of the dark side! It's kind of cool... For us anyway and we like the T-shirts. There are several other sub-cultures in technical diving. For example, I was told once that I was an **ideal candidate for technical diving since I rode a motorcycle, had tattoos and listened to heavy metal music. Guilty as charged.**

But let's look at this seriously for a minute. Why do these things appeal to us? Why do we like to be recognised and to have a group identity? Well, we could fall back on the "that-is-human-nature" argument, and certainly, there are

cogent points to be made for this idea. We could argue that it is down to our socialization; it is considered the norm to be part of a social group with the same values and aspirations. Of course, there are some outliers who will proudly say

they would not want to be part of any group that would have them (thanks Mr Marx). In effect, though, most of these people are not true loners; otherwise, we would never know about them. In reality, proudly not being in a sub-culture is, in

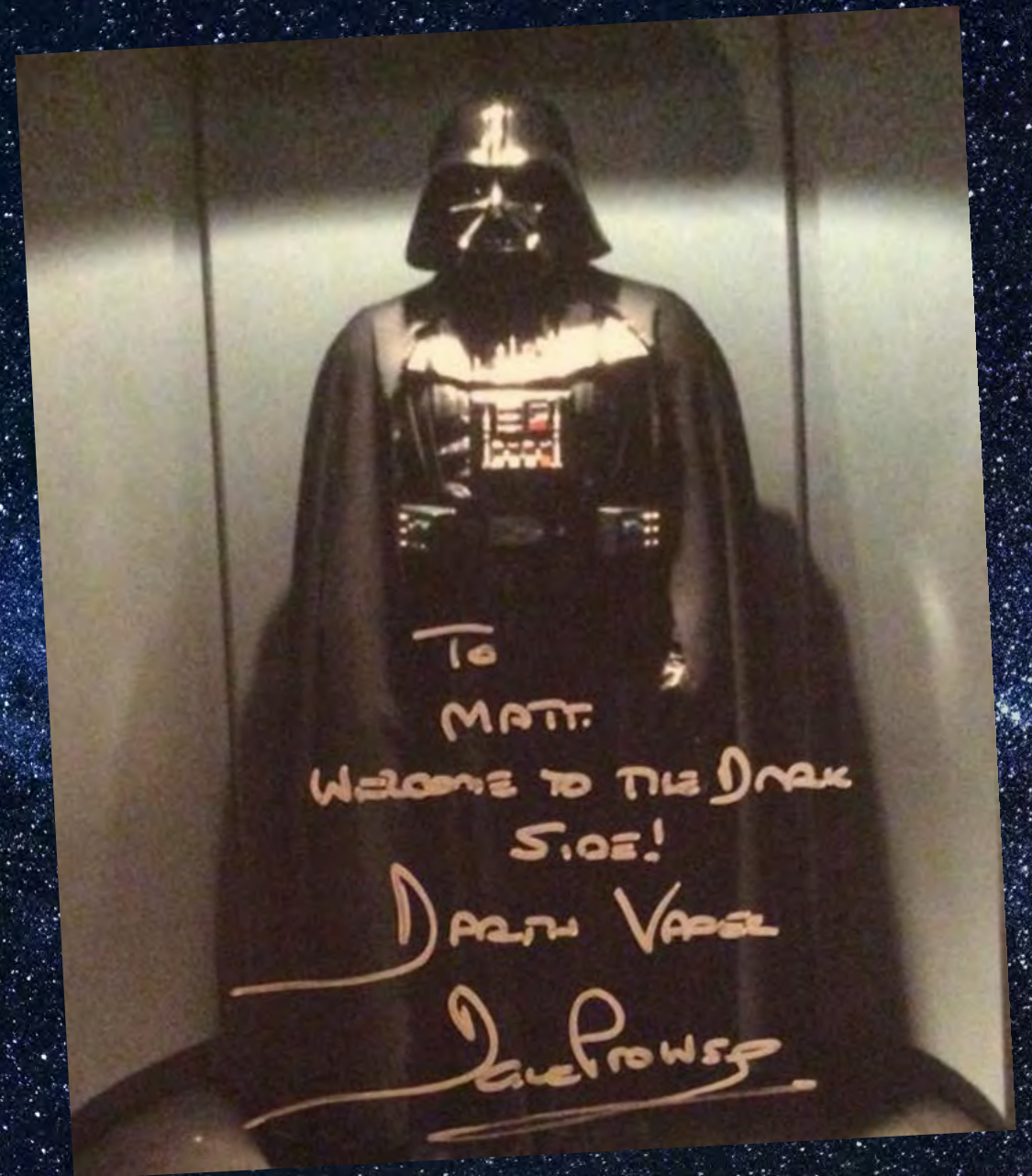
fact, just another sub-culture.

Group identity

Having both our individual and group identity and culture helps normalise our behaviours; it provides expectations of

Peer Pressure

In the Dark Side



BACKGROUND IMAGE: PIXABAY





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Other	9%
Marine Envenomation	9%
2% Motion Sickness	2%
2% Non-Fatal Drowning	2%
2% Pulmonary Edema - IPE	2%
2% Fatality	2%
2% Arterial Gas Embolism (AGE)	2%

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age bad decisions, driven by a desire to present themselves as acceptable potential group members.

I saw this recently by a diver on a Facebook group. In an attempt to promote this person's own standing, a litany of behaviours were self-reported, which were deviant from good technical diving practices, deviant from standards set by respected agencies in the field, and exceeding limits of training and experience. When challenged, the response was defensive

how we will behave in a group and is very, very powerful. This is where the danger lies. Sometimes the group can carry people with it beyond the point of acceptable behaviour, beyond the boundary of calculated risk, and far more dangerously, can, in the visibility of their achievements to aspirant members of that group, encour-

and demeaning of the commentators. When offered help, it was used as a stick with which to beat the challengers, but, ultimately not taken up.

Strive for understanding

Rather than dismiss criticism out of hand, let's strive for understanding. We witnessed these behav-

iours because the diver wanted to be accepted into a technical diving community, but the diver's values were at odds with the possible communities that diver could join. Perhaps the diver felt he or she needed to boost his or her image and made claims about dives done, which backfired. Instead of gaining respect, the diver gained criticism, and was then caught in a corner with no escape. Perhaps the challenges put to the diver, mine included, put up perceived barriers the diver could not see a way past. Or, perhaps the diver had, indeed, a poor attitude.

For whichever of these reasons, the diver became motivated to prove him or herself to the group by making big claims and assertions. In other more dangerous circumstances—that is, in the water rather than online—that same response could have resulted in injury or death.

Instructors always train divers not to succumb to peer pressure. Any

diver can abort the dive at any time without question or reproach. Do not underestimate the power of the group to demand compliant behaviour, though, as well as the strength of the desire people have to be seen to be a part of that group, if not a leader. Particularly do not underestimate the ability of the group to make a bad decision, which then leads an individual beyond the person's physical, technical and mental abilities.

Dive safe. Oh, and may the Force be with you! ■

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



Looking for a Competitive Edge as a Diving Leader?

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Text by NAUI Worldwide Training Department. Photos courtesy of NAUI Worldwide.

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NAUI Worldwide invites dive leaders from across the industry to participate in its

Leadership Rescue Workshop series taking place internationally beginning in 2018. The Leadership Rescue Workshops are open to any certified dive leader, including divemasters, assistant instructors and instructors from all training agencies.

This workshop challenges participants with dynamic, live-action scenarios developed from real-world incidents and accidents. Dive leaders learn valuable procedures to manage operations for a host of scenarios—from an out-of-air diver bolting to the surface to major watercraft collision incidents with serious in-water trauma.

“Whether we’re commercial divers, scuba divers or freedivers, on most days we feel like we’re one with the water. We forget how unforgiving this environment can be. The water’s a tough place in which to operate, and people forget this.”

Upon successful completion of these three-day training courses, graduates will have the knowledge and skills necessary to become competent rescue leaders and will receive a certificate of completion and certification card. Most importantly, divers will discover what commonly taught rescue procedures work better in books than in the real world, and what really works and why.

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- Safely extricate unconscious or injured divers onto boats.
- Perform a realistic in-water ventilation with drowning mannequins.
- Stop bleeding trauma.



- Perform a surface tank power swim.
- Learn a professional field neurological exam for gas bubble injuries.
- Perform basic life support on moving boats in rough seas.
- Learn how to set-up gear for accident prevention and management, and much more.

See what the workshop is all about. Go to: <https://youtu.be/eBVx-KdF-28>.

Go beyond the basics. Take your rescue skills to the leadership level. Challenge yourself to become qualified as a leader in rescue techniques.

Stay tuned to the NAUI events page for updates on upcoming workshops. Inquiries about the new Leadership Rescue Workshop can be directed to the Training Department at training@nau.org or call: +1 (813) 628-6284. Take a moment to watch NAUI's video explaining more about the workshop: <https://www.youtube.com/watch?v=eBVx-KdF-28>

The next Leadership Rescue Workshop will

be held in Cebu, Philippines 31 August – 2 September 2018. For full details and registration information, visit: <https://www.nau.org/events/leadership-rescue-workshop-philippines/>

Listen to great interviews with Butch Hendrick and Andy Olday in which they discuss their participation in the NAUI Leadership Rescue Workshops on Scuba Radio.

Hendrick: <http://scubaradio.com/2018/02/scubaradio-2-24-18-hour1/>

Olday: <http://scubaradio.com/2018/02/scubaradio-2-3-18-hour1/>





Edited by Peter Symes



Dolphins use names among themselves

Bottlenose dolphins can use copying of signature whistles as a way of addressing or labeling animals on an individual basis. In other words, they appear to be calling each other by name.

In animal communication research, vocal labeling refers to incidents in which an animal consistently uses a specific acoustic signal when presented with a specific object or class of objects. Labeling or naming is one of the describing features of human language. Although the widespread use of alarm and food signals in animals gives the impression of labeling, the structure of these signals is usually predetermined from birth. A cognitively more complex use is when labels are acquired through learning.

Unique identity signals

Bottlenose dolphins develop their own unique identity signal, the signature whistle. A signature whistle is a learned, individually distinctive whistle type in a dolphin's repertoire that broadcasts the identity of the whistle owner. This whistle encodes individual identity independently of voice features. The copying of signature whistles may therefore allow animals to label or address one another. Bottlenose dolphins therefore appear to be unique as nonhuman mammals to use learned signals as individually specific labels for different social companions in their own natural communication system.

Dolphins can use learned vocal labels to address each other; signature whistles are used like names.

Similar to human names

As infants, bottlenose dolphins develop their own signature whistles to use throughout their lifetimes. Group members repeat these whistles back during vocal interactions, forming a system similar to that of human names, marine biologists at the University of St Andrews found already in 2006.

Further research by this and other teams went on to show signature whistles form an important and stable component of an individual's vocal repertoire, but dolphins are capable of vocal learning throughout their lives and individuals can copy the signature whistles of others. This development is influenced by vocal learning, with animals often using calls heard in the environment and modifying them to create a novel and unique pattern.

In isolated dolphins, the signature whistle accounts for close to 100 percent of all whistles produced. In wild groups, however, only around half of whistles are signature whistles; the rest are other shared whistle types. Animals that meet at sea tend to exchange signature whistles before they join each other. ■

SOURCE: NATIONAL ACADEMY OF SCIENCES

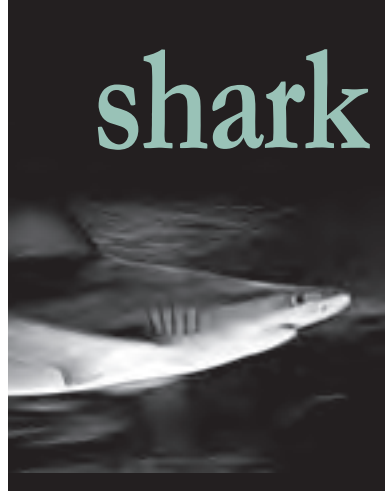
A signature whistle is a learned unique identity signal.

First sighting of bottlenose dolphins off Canada's Pacific Coast

A group of approximately 200 common bottlenose dolphins and roughly 70 false killer whales (*Pseudorca crassidens*) has been sighted off the west coast of northern Vancouver Island, British Columbia, Canada, and may be the northern-most recording for this species in the eastern North Pacific. This sighting, which took place on 29 July 2017, represents the only occurrence of common bottlenose dolphins recorded in Canadian Pacific waters.

Both species typically live in warm temperate waters further south in the eastern North Pacific, but this sighting suggests that they will naturally range into British Columbia, Canada, when conditions are suitable. There has been a warming trend in eastern North Pacific waters from 2013 to 2016, and researchers from Halpin Wildlife Research hypothesize that the trend may be the reason behind this unusual sighting. ■

PETER SYMES



Occasionally a nurse shark would menace a blackfin, though the blackfins would not threaten them. One would suddenly turn sharply towards the offending blackfin as it passed and then circle, watching it. The blackfin would turn away and depart. It was surprising that the nurse sharks were more aggressive than the large-eyed, swift-swimming requiem sharks.

Discriminating tastes

They were also more adept at finding the choice morsels of food among the scraps I brought. These, they targeted and engulfed one after the other. They seemed to have no limit to the volume they could suck in.

When I threw a treat to a blackfin, often he or she did not notice, and it was pounced upon by one of the sluggish-looking nurse sharks the moment it hit the sand. Not only were they able to locate the food better, but they were paying attention and did it faster, too—their appearance of slothful indolence and stupidity was all show!

Klinotaxis vs tropotaxis

Nurse sharks are said to use *klinotaxis*, a method of following a scent which

The Underrated Nurse Shark

Text by Ila France Porcher

Plentiful nurse sharks attended the sessions I held during my shark study in Tahiti. They are heavily-built animals with large, graceful fins, a long, pennant tail, and small eyes. They forage on the sea floor for a variety of foods at night and sleep in grottos in the coral during the days. Though these unusual sharks typically lie around on the sea floor, they are also capable of clamoring. They use their pectoral fins like paws to prop themselves up, while searching out food higher in the coral labyrinths.

As darkness fell, a small nurse shark would appear, attach itself to a scrap, and rest there, its wide fins stirring, as it adjusted its position to feed. Soon, more would materialize from the dim surroundings and drift

in uneven circles. Plunking themselves on top of the shark food, they slowly munched and sometimes gyrated, while the blackfin sharks circled over them. It was common for there to be three sharks of more than three meters in length, five over two meters, and several between one and two meters long, each scraping and sucking out the contents of a fish head, wriggling and undulating about in clouds of sand and lagoon fish, spoiling the visibility.

The really large nurse sharks were as massive as draft horses, and they came later, as night fell. A pale, blimp-like form would appear off in the dimness, weaving in and out of view in slow motion as it floated through the coral, waving its improbable tail. It would waltz into the site, fins spread wide, pressing the water left, then right, as if to an unheard rhapsody, and, in a swirl of sand, it would settle upon the scraps.

Behaviors

Those sharks produced startling sounds of underwater thunder as they munched—daunting proof of the power of their

bites. Often, as one tried to extract some nourishment, he pushed the fish head forward until he got his head inside. Then he reared upwards until he stood on his tail. When several of them did so, with the fins of the fish heads curving outward above their pale bodies as they swayed slowly back and forth, the scene took on the appearance of a macabre dance.

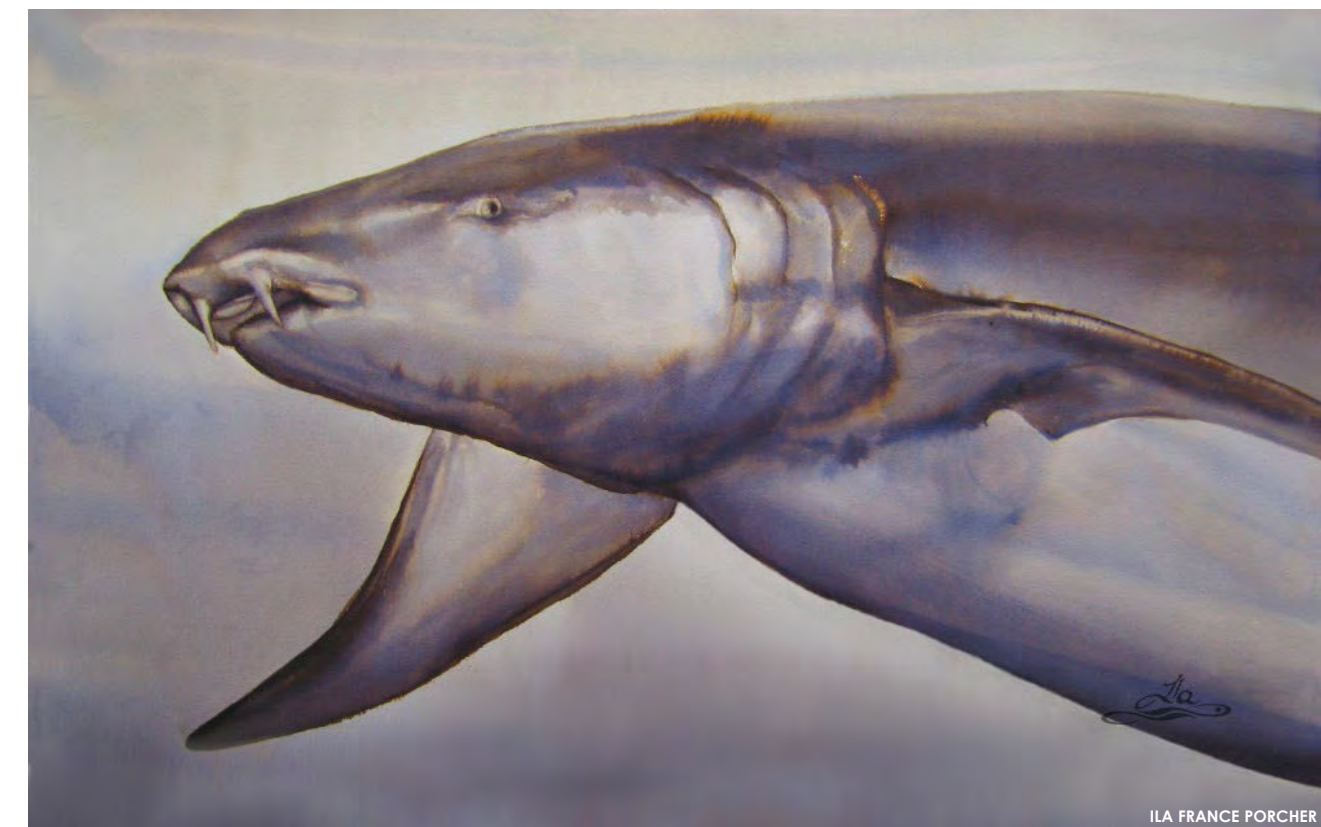
Nurse sharks trying to scrape food from the fish heads would rise vertically.

But usually there were not enough fish heads for each of them to have one, and several would go for the same one. As they undulated and pushed forward, their pale forms rose until their tails waved at the surface, forming a flower of nurse sharks, each one flailing its fins and flinging its enormous tail around for balance, while somehow their noses were all in the same fish head! The lack of aggression among them was striking.

Excitement but no aggression

Sometimes the blackfins became excited as the nurse sharks tore the fish heads apart, and circled them at about three meters distant, intermittently charging

in to try to get one. At times, a veritable tornado of blackfins circled the nurse sharks, moving fast and seeming highly excited, yet never was there any conflict among them.



ILA FRANCE PORCHER

shark tales



Peek-a-boo. A curious nurse shark appears to investigate what a biped is doing out of his natural element. As inoffensive as nurse sharks may appear, they are ranked fourth in documented shark bites on humans, likely due to incautious behavior by divers on account of the nurse shark's slow, sedentary nature.

involves comparing odor concentrations to the right and left with each undulation, and turning towards the side on which the concentration of scent is strongest. This brings them directly and rapidly onto the source.

Blackfins, on the other hand, likely use *tropotaxis*, moving upstream towards a scent until it is no longer perceptible, then moving left and right until the stimulus is again perceived. The shark repeats the pattern until it finds the source of the odor.

This difference might partly explain why the nurse sharks were so much more apt

than the blackfins at finding the fish scraps I provided. Such food was not the blackfins' usual fare, and resembled more closely the sort of nourishment that nurse sharks might locate. Yet, the nurse sharks were also more alert in noticing that there was something to find!

When I brought a second person with me, no nurse sharks appeared, even during the periods in which they were so numerous at the sessions that they carpeted the site. Could it have been because they knew me and not the other person?

That two people were too many, but one was all right? It was another unsolved mystery that these languid sharks were so fussy about the presence of a second person that they would forgo the prospect of an easy meal and remain invisible unless I was alone.

Following behavior

One of the largest was an unusual individual. He appeared in a barren region where I began to hold the occasional feeding session while the blackfins were being fished. Sharks who ranged on both sides of the area visited, so there I could keep track of more of them in the effort to learn which ones were still alive, and if any more had appeared with injuries or hooks.

The unusual nurse shark began following me one eve-

ning while I roamed from one blackfin to another, checking for hooks and injuries. Every time I turned around, he would be coming along about two meters behind. For 15 or 20 minutes he followed, and when I left, he came with me to the surface. As I held the kayak prior to getting in, he drifted by in slow-motion, with just a few centimeters between us.

The biggest nurse sharks had always been the most cautious and shy. They arrived as darkness was falling and withdrew if I moved around, to float gracefully back later. Never had a nurse shark, or any shark, followed me persistently in this way over a long period of time. Many sharks expressed curiosity, but this relent-

less, slow and peaceful following behavior was new.

At the next session he came again as night fell. I was diving repeatedly to see the extent of damage to the jaw of a young blackfin who had been fished and escaped near death. So I became aware of his following me slowly, as if he was avoiding being seen. Two other big nurse sharks who were present avoided me as I swam around, and when I moved very much, they vanished and returned later, which was their normal behavior.

This time the unusual shark was following about a meter behind, and when his face approached my right arm, I tried an evasive movement and doubled back

past him. He flexibly turned with me at the same snail's pace to resume his position in my wake.

As I saw the absolute dedication with which he was following my every motion, I became alarmed. I was quite far from my kayak, and, without changing my swimming movements, drifted towards it then flew into it like a dolphin. The huge shark moved on, just under the boat, his wings undulating around him. To follow me steadily for so long during each of the two sessions seemed extraordinary for such a large individual of a species with a preference for lying languorously munching on the lagoon's floor. Further, he had not appeared at



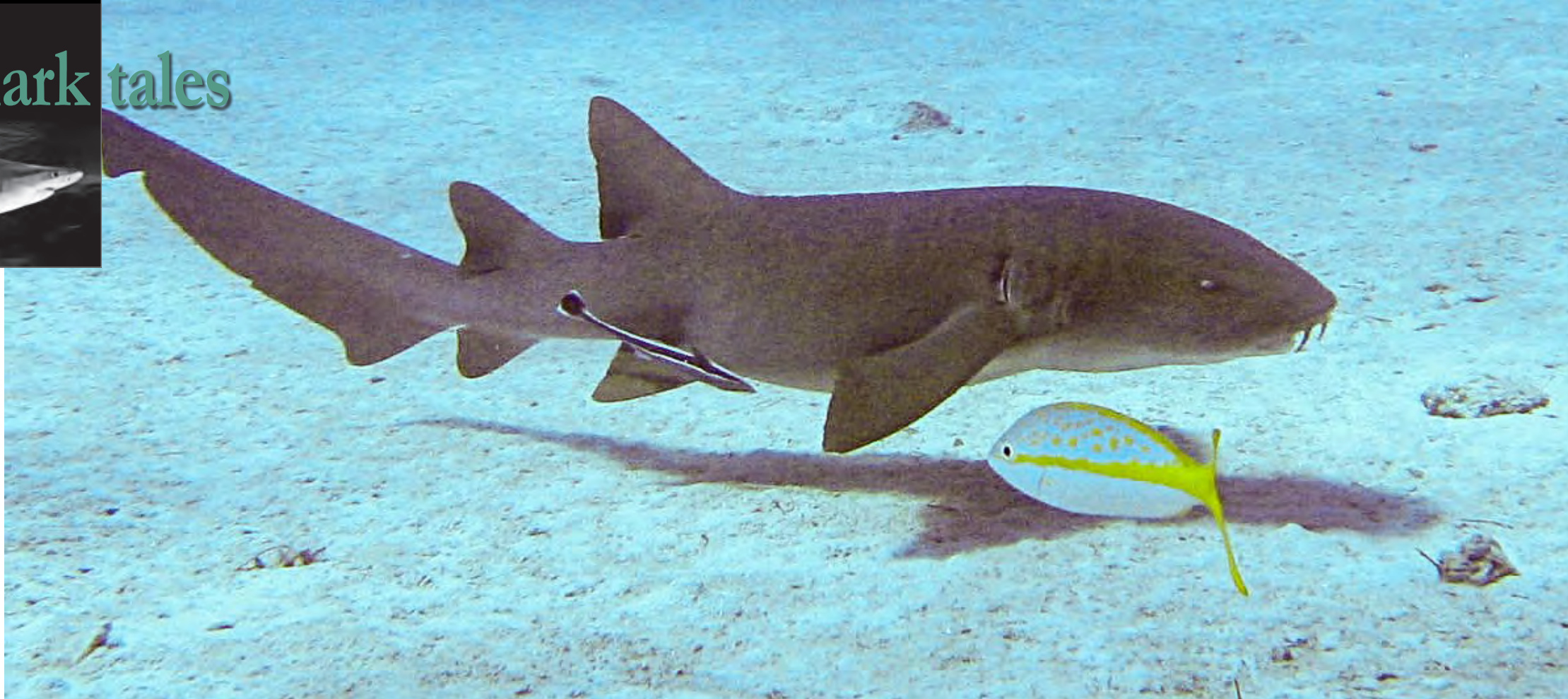
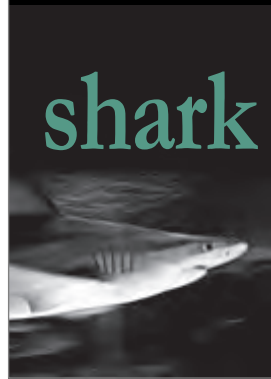
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Love the Water

an intervening session when a colleague had been with me.

Poor sight or interesting scent?

Arthur Myrberg, a shark ethologist with whom I discussed the situation, noted that the shark was keeping his distance from me for some reason—he could easily have come right up to me, yet he had not. He speculated that there could be something wrong with him, and suggested that if he could not see well, he would be unable to count on his vision to maintain a safe distance from objects. After sunset, vision by diurnal animals—those who are adapted to the dim light of dawn and dusk—becomes poorer.

However, Myrberg said that he had never encountered such behavior and felt that the situation was dangerous since, he told me, large nurse sharks will bite and not let go. The shark's attention to me, he pointed out, suggested that I was trailing a scent.

Yet, by then I had been observing sharks for many years and none of my scents, including blood, had ever interested any shark of any species. That no

other had behaved this way, suggested that the motive concerned this individual and no others.

When I returned to examine the situation more closely, I washed myself and all of my gear with unscented soap to take care of the "interesting scent" theory. But the unusual nurse shark did not appear again for several weeks, while passing storms brought poor conditions.

An unusual individual

Then, one evening I was returning to the feeding site after accompanying one of the blackfins, when a familiar shape swept into position behind me. The huge nurse shark followed within a meter, and when I held onto my kayak and remained there unmoving, he circled away, then accelerated to charge one of the other big nurse sharks who was lying by the food, munching. He chased him out!

I had never seen a nurse shark chase another, and his behavior did not fit in with the theory of his being blind. Here was an unusual case of aggression between two sharks of the same species!

As I watched from the kayak, from time to time, he glided away from the scraps and drifted slowly around me, but he was less interested in me when I remained still. Apparently, it was when I was moving around that he was stirred to follow.

He seemed more active than the other nurse sharks. He was constantly moving and changing position, and trailed another of the large nurse sharks nose to tail for awhile. He did not look handicapped—he seemed to be in excellent shape to be so active.

I concluded that he was simply an unusual individual.

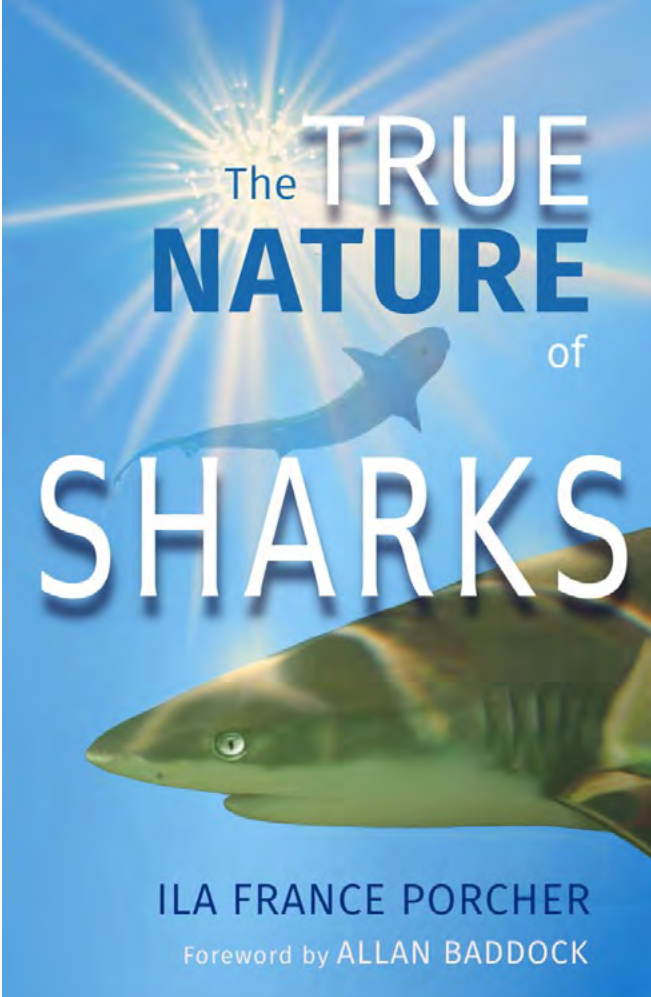
Territorial behavior

Another of the very large nurse sharks took to monopolizing the fish scraps one wet season when few were available. Usually there were some fish heads and spines lying on the sand for the nurse sharks, and when there were not, they undulated around looking for them and could be unexpectedly energetic. During a series of such sessions, this enormous shark would systematically try to pick

up every scrap, and put it in the place where he was lying. If I handed the blackfins a last spine, they would carry it around the area, taking bites and passing it from one to the other, but as soon as they dropped it, as they inevitably did, this nurse shark would land on it.

This possessive behavior was reminiscent of territoriality, but the way only one individual displayed it suggested that the shark's actions were the result of intelligent competition for food in an unusual situation, and not an example of territorial behavior. Though some sharks are known to have home ranges, these are not defended as territories are, and territoriality among them is unknown. ■

Ila France Porcher, author of The Shark Sessions and The True Nature of Sharks, is an ethologist who focused on the study of reef sharks after she moved to Tahiti in 1995. Her observations, which are the first of their kind, have yielded valuable details about their lives, including their reproductive cycle, social biology, population structure, daily behavior patterns, roaming tendencies and cognitive abilities.



The TRUE NATURE of SHARKS

ILA FRANCE PORCHER
Foreword by ALLAN BADDOCK



Caribbean reef sharks can tell if a human is facing towards them.

When sharks get *sneaky*

You never see the shark that bites you, the saying goes. Sharks comprehend body orientation and therefore know whether humans are facing them or not, when they select an approach pattern when interacting with humans.

Though different species vary—and it varies a lot from individual to individual, as sharks do not have stereotyped behaviour—sharks that are openly curious tend to approach from the front, usually passing just within visual range initially. Those

that chose to attack their prey prefer to do so from prey's blind side.

Out of sight

In their two papers "Are Caribbean reef sharks, *Carcharhinus perezii*, able to perceive human body orientation?" (2013) and "A study of shark stealth behavior in the proximity of divers" (2015), Erich Ritter of the Shark Research Institute and Raid Amin of the University of West Florida investigated how sharks would approach typical prey, as well as humans, and found that these predatory fish prefer to avoid the field of vision. In other words, a shark would tend to approach a person from behind.

A test was designed to evaluate if sharks—in this case study, Caribbean reef shark (*Carcharhinus perezii*), which are normally shy or indifferent to the presence of divers—exhibited any measurable preference based on body orientation when approaching a person, and if they choose a certain swim pattern when close to a human being. The researchers found that when approaching a single test subject, significantly more sharks preferred to swim outside the person's field of vision.

"Our discovery that a shark can differentiate between the field of vision and

non-field of vision of a human being, or comprehend human body orientation, raises intriguing questions not only about shark behavior, but also about the mental capacity of sharks," said Ritter.

Keeping their distance

In addition to determining the general direction of its approach, a shark also chooses a minimal approach distance, at which it turns away from the diver. This minimal approach distance likely indicates some kind of a personal sphere.

This space has previously been described as the shark's *idiosphere*, or inner circle, and ranges between one and two body lengths. About half the sharks swam farther than one mile off the sea floor when approaching the test subjects. However, larger sharks preferred to remain closer to the bottom than smaller sharks, regardless of whether they moved in from the front or the back of a test subject. ■
SOURCES: ANIMAL COGNITION (2013), OPEN JOURNAL OF ANIMAL SCIENCES (2015)

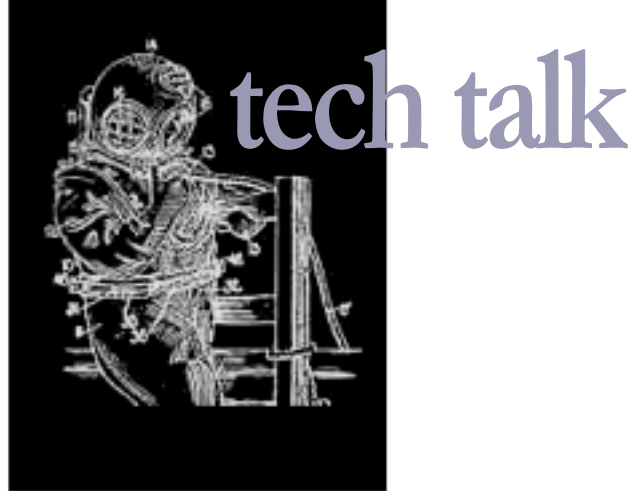
"Look at that weird creature!" A pair of sharks—in this case, a lemon shark (*Negaprion brevirostris*) on the left and a Caribbean reef shark (*Carcharhinus perezii*) on the right—appear to be watching and trailing an unsuspecting diver, together.



PETER SYMES



PETER SYMES



Text by Larry Cohen, Steve Jones and Peter Symes. Photos by Larry Cohen, Olga Torrey and Peter Symes

There are many advantages to diving closed circuit for the underwater image creator such as better interaction with wildlife or longer dives. However, there are also a number of disadvantages to consider such as added complexity and task loading.

Why use rebreathers?

In underwater imaging, one of the most important rules is to get close to the subject. The challenge therein is marine life does not always cooperate. A large noisy animal blowing bubbles tends to intimidate most marine life. A diver using a closed-circuit rebreather may still look strange, but as the device eliminates the noise and bubbles, creatures that are otherwise difficult to get close to often hardly notice the presence of the diver, or at least they react differently. Animals that may not be outright scared by a scuba diver in the first place also tend to have more natural behaviour, or will at least keep less of a distance, allowing the photographer to get much closer.



Why, When & How to Use

Rebreathers for Photography

OLGA TORREY

Another primary use of a rebreather is to extend the duration of dives, say, on wrecks. Many of Steve Jones' photographic assignments are on wrecks that lie relatively deep, and he needs time to

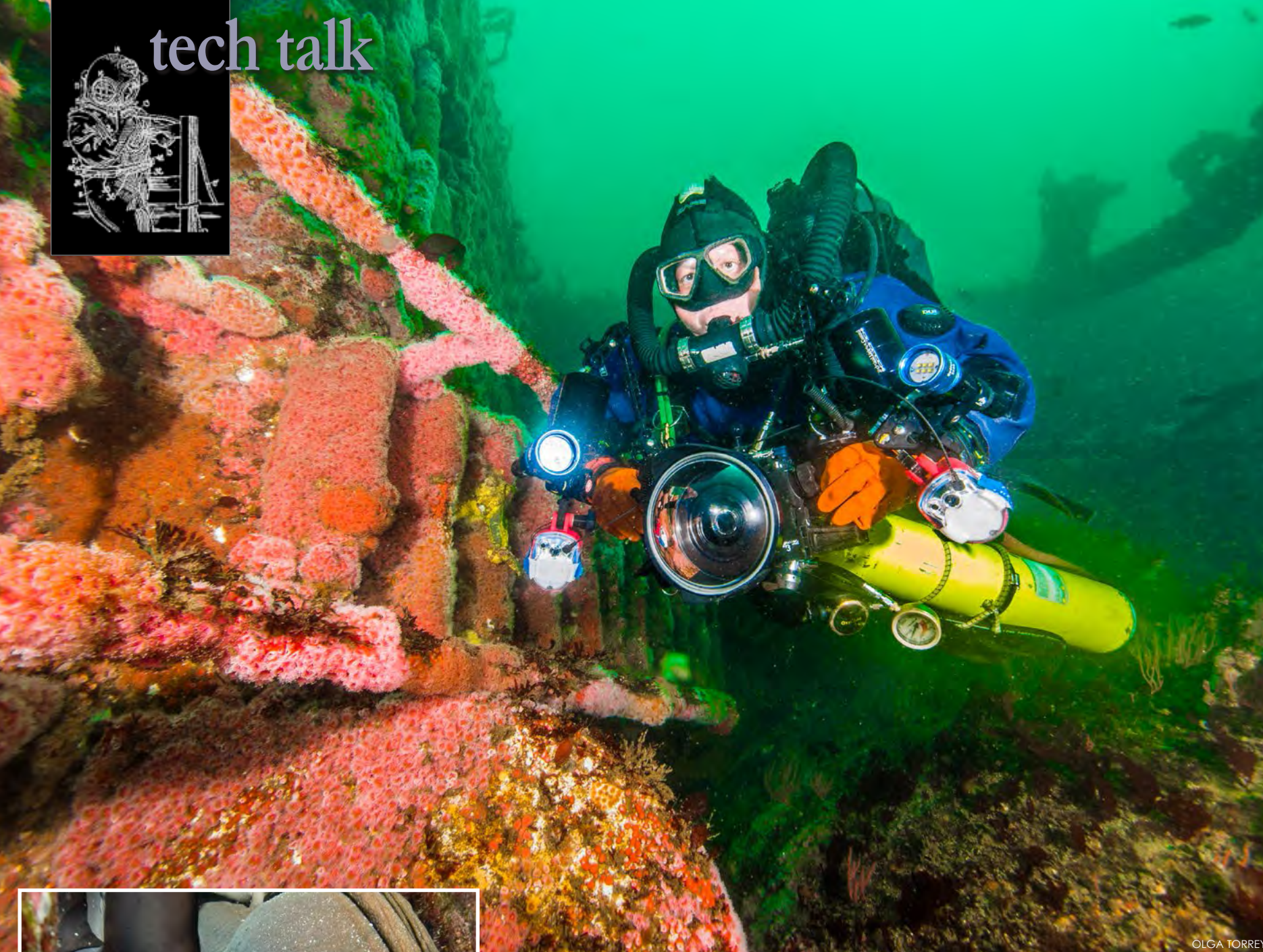
work at depth in order to set-up off-camera lighting and get the key shots. Sometimes he will only have one chance at a subject due to tides or the trip schedule, so the rebreather allows him to make the

most out of each opportunity.

Having a practically unlimited gas supply is a real advantage. Decompression times are shorter with a rebreather than on open circuit for most dive profiles.

More bottom time and less decompression time means more shooting time. The time in the water is more comfortable when diving closed circuit. The breathing gas is moist and warm, so the diver will be





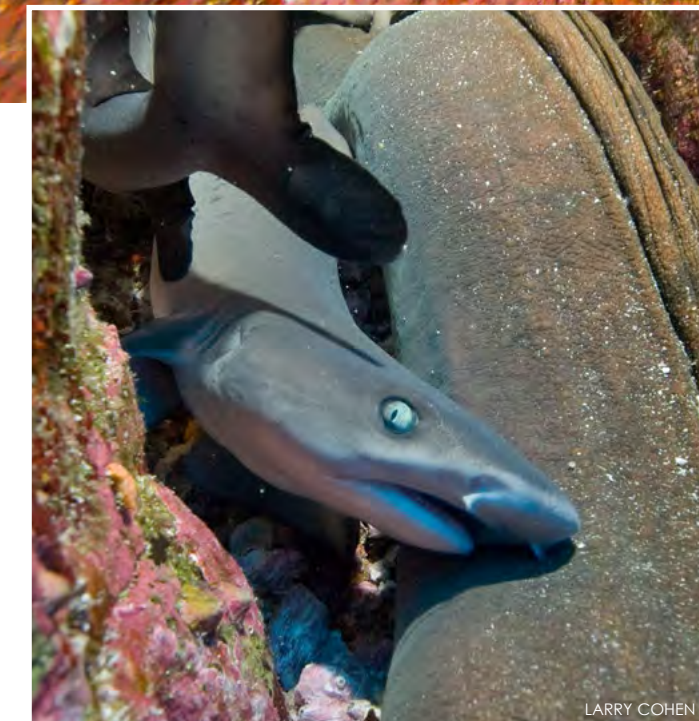
OLGA TORREY

Rebreathers limit the amount of silt generated on wrecks due to the lack of bubbles. Notice in this photo how diluent and stage bottles have to be tucked in a manner so the diver and the equipment are more streamlined.

tool and there are multiple occasions when open circuit is a better choice—particularly if diving in strong currents, or hard swims are involved to get in position. Darwin and Wolf Islands in Galapagos are prime examples where a rebreather would be more of a hindrance than a benefit as these are high-energy dives. There are also cases where the lack of bubbles can actual be a disadvantage in the encounter with wildlife. For example, the Revillagigedo Islands on the west coast of Mexico are known for diver-friendly giant manta rays. Not only do these gentle giants allow open circuit divers to get close, they appear to



START HERE



LARRY COHEN

warmer in cold water. This allows the underwater image producer to experiment more and concentrate on the image with less time restrictions.

Gas is easier to manage

Gas logistics for deeper dives on wrecks are much more manageable on a rebreather; another benefit is being able to switch to the optimum gas for each dive in a cost-effective manner. Given the task loading of operating a camera and rebreather, Steve uses a trimix diluent when deeper than 35m. Swapping a 3-litre diluent tank from air to trimix is straightforward,

whereas getting a twinset filled with trimix may not be, when in more remote locations (and it's never cheap). Of course, all that has to be weighed against the large costs associated with the rebreather—gas cost savings alone will never justify the investment of buying a unit, as the overall cost of ownership is much more expensive than open circuit for most divers.

Pros and cons

Diving on a rebreather can simply be enjoyable, changes the way you dive, and the benefits are simply huge. But as with all things, the rebreather is a



LARRY COHEN

With rebreathers, photographers can get closer to shy animals and capture behavior (above and lower left)

A lot of preparation

A disadvantage is the extra set-up time—one can never “just jump in.” The preparation time in regards to the rebreather is on top of camera set-up, so a great portion of assignments is spent getting gear ready. Of course, keeping the loop clean and hygienic also adds further tasks, but this is particularly important in the tropics where germs fester quickly. Nobody likes a smelly breathing loop!

actually enjoy the bubbles. It is not unusual for mantas to swim over and stay above divers, allowing the bubbles to massage their undersides.

Lots of schlepping involved

Another issue is the huge amounts of baggage one has to carry. This limits the airlines that can be used for long haul flights, as



PETER SYMES

Image makers using rebreathers find themselves having not one but two sets of complex equipment to mind and set up correctly so a great portion of assignments is often spent getting gear ready.

the load of camera equipment, plus a rebreather, will take a minimum of two pieces of 32kg hold bags, plus hand luggage—all of which sums up to weights that some airlines will not allow you to carry. Last but not least, not all dive operators support rebreathers, so there are many occasions when we would love to use the rebreather but have to dive open circuit.

Safety matters

Safety issues have to be considered. When diving closed circuit, we do not have to worry as much about the quantity of gas, but about the composition of the gas we breathe. Rebreathers are gas-mixing machines. Typically, they use two tanks. One tank will have oxygen and one will have a diluent gas, which could be air or

a helium-mix depending on how deep one is planning to explore. Oxygen sensors show divers what their partial pressure of oxygen (ppO₂) is.

Constant attention

When diving on a rebreather, frequent monitoring of ppO₂ is of utmost importance, and this adds to task loading, constituting an ongoing distraction for the image maker who has to juggle paying attention to their life support gear (rebreather with all its attached paraphernalia) while being creative and working with a camera set-up, which comes with its own complexities.

Heads-up display

Using a heads-up display or a

heads-up computer such as the Sheartwater Nerd is a good idea. This way, the diver can monitor essential dive information more easily while creating images.

Many divers consider rebreathers to have more risk when diving shallow, but are the safer option when diving deep. Also there are enormous savings to be made on helium, as much less is needed as diluent than is required for open circuit. For these reasons, rebreathers are great tools for deep scientific diving and photo documentation of those studies.

Less disturbance

When diving inside overhead environments, it is common for bubbles to produce silt from hitting the ceiling of a cave or wreck.

Contrary to most animals, giant manta rays seem to enjoy the bubbly massage they get from open-circuit scuba



LARRY COHEN



LARRY COHEN

This could be dangerous, or at the very least, ruin conditions for creating images. Using a rebreather, on the other hand, does prevent silt caused by bubbles, but buoyancy control is critical.

Unlike on open circuit, a rebreather diver cannot control

or adjust buoyancy by inhaling or exhaling. On a rebreather,

the exhaled gas from the lungs goes into the rebreather's counterlungs, so the total volume of gas is always constant, and so is the buoyancy unless gas is added or vented. It is thus important to get rebreather training for the overhead environment you will

be working in. You need to have experience diving that particular environment with a rebreather before carrying in a camera.

Training and experience

Using a rebreather is more complex than diving open circuit and requires more preparation, discipline and diligence. Consequently, training and experience is needed before one also brings along camera gear on dives.



OLGA TORREY

Using rebreather avoids bad viz caused by bubbles knocking particles loose, but buoyancy control is critical.

ing, as divers need to make sure that both their camera gear and their rebreathers are ready to hit the water. Gas needs to be analyzed, scrubber must be packed correctly, and o-rings on both the camera and the rebreather have to be checked and cleaned. Pressure checks need to be performed on both imaging and life support systems.

Take the time needed

A mistake prepping camera gear could be expensive, while a mistake preparing the rebreather could also be deadly. Hence, it is critical not to rush and to work in a structured, disciplined manner, which is why rebreathers come with checklists to follow prior to each dive.

Hours of tinkering

At a dive resort, open-circuit divers without camera gear will be enjoying the beach or an after-dive drink, while rebreather diving photographers continue to work



LARRY COHEN

While being busy nailing the shot, the diver must never forget to keep an eye on the partial pressure of oxygen (ppO₂)

hard to get their gear rinsed and put back together for the next day of diving. It is better to get it done in the evening when issues can be rectified in an orderly and

calm manner, rather than feeling rushed the next morning because the dive boat is about to depart.

Tether the camera

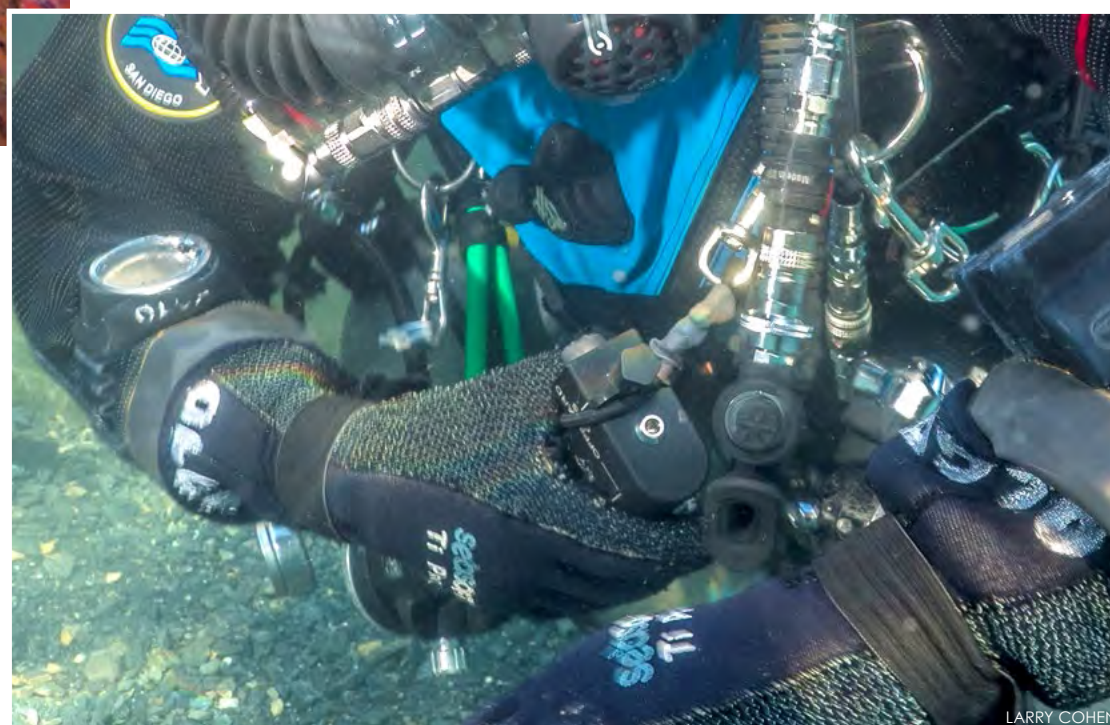
Camera gear should be tethered to divers. Using a coiled lanyard is a good idea. This way divers will always have imaging equipment connected to them in case they have to drop the camera to operate the rebreather. It is best to leave the port cover on the port until you start shooting. This

will prevent scratches caused by the port banging against bailout tanks and other gear.

Steve secures his camera to his harness with two double-end clips and pushes it off to his right when descending and ascending. "I always keep my hands free during these parts of the dive;

"I always keep my hands free during these parts of the dive; I don't want to worry about losing the camera. I keep the port cover on until I need the camera, to protect against scratches."

I don't want to worry about losing the camera. I keep the port cover on until I need the camera, to protect against scratches. Camera handling in the water is straightforward. I just unclip one of the two double-enders, still keeping the camera attached to my harness by a bungee leash, in case I need to drop it in a hurry. Fumbling with



LARRY COHEN

One-handed operation

Next, the rebreather needs to be set up to be camera-friendly, so the diver can operate it while one hand holds the camera. Manual addition of oxygen and diluent should be a one-handed operation. The dive surface valve (DSV) needs to be closed when removing the mouthpiece from your mouth to avoid getting water in the loop. This should also be a one-handed operation. Many people think it is safer to use a bailout valve (BOV). This is a DSV

with an open circuit regulator attached. Using one hand, typically by flipping a lever underneath the mouthpiece, the diver could go from closed circuit to open circuit in case of a failure on the rebreather. This is what is known as "bailing out."

Much more preparation

Getting ready for the dive is also more time consum-

Manual addition of oxygen and diluent should be a one-handed operation in order not to have to let go of the camera.





*A simple rule:
rebreather comes first,
camera comes second,
no exceptions.*

port cover removal/replacement is often the biggest frustration, especially if I'm wearing dry gloves!"

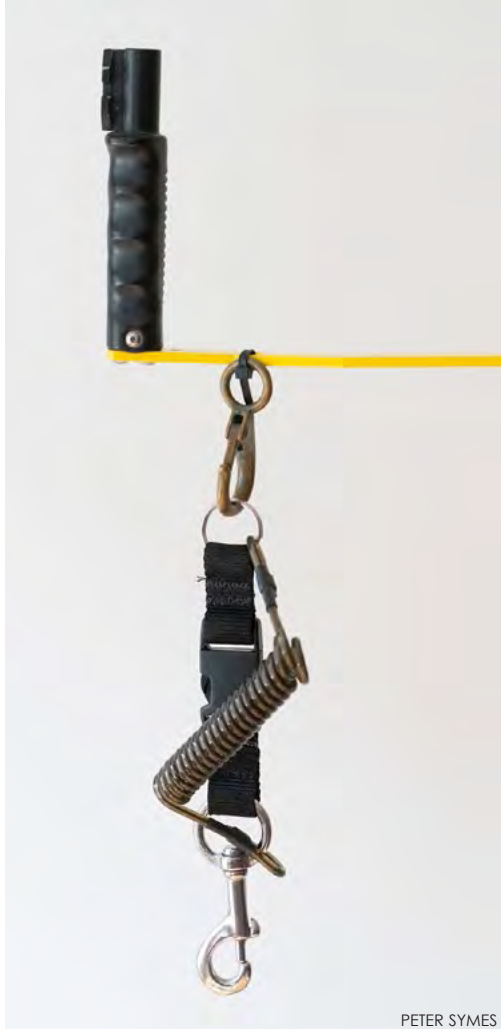
Streamline and tuck

The principles I follow are simply good tech diving practices. I streamline my kit as much as possible, ensuring all my clutter is stored in pockets. Getting my bailout tanks neatly stored is also paramount. I tend to dive with all my tanks on the left, and keep ancillary equipment such as camera, and a clipped-off scooter if carrying one, on the right; however, sidemount-style bailout configurations are also very neat and streamlined.

So, should an aspiring underwater photographer or videographer embrace closed-circuit technology or avoid it? This depends on many factors, and the decision

should not be taken lightly. Being able to multitask, monitor the rebreather and think about the image is important. Ultimately, there is no right or wrong answer—it is up to each underwater photographer or videographer to weigh the pros and cons, and then decide. ■

Larry Cohen and Olga Torrey are well-traveled and published underwater photographers based in New York City, USA. They offer underwater photography courses and presentations to dive shops, clubs and events. For more information, visit: Liquidimagesuw.com (Larry) and Fitimage.nyc (Olga). Steve Jones is an underwater photographer, technical diver, journalist and expedition leader based in the United Kingdom. For more information, visit: Millionfish.com.



PETER SYMES

A coiled lanyard clipped onto a camera housing's (not shown) handlebar. The carabiner can be clipped onto a D-ring on a BCD. Unclipping the black buckle allows the lanyard to stretch. These pieces of kit are also quite useful for open circuit divers but near indispensable when using rebreathers, which may occasionally require the use of both hands.



LARRY COHEN



LARRY COHEN

A bailout valve (BOV), which typically is operated by flipping a lever underneath the mouthpiece (the silvery peg in the middle on the left image above), allows the diver to switch from closed circuit to open circuit in case of a failure on the rebreather.



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A mindset is a habitual or characteristic mental attitude that determines how you will interpret and respond to situations.

Text and photos by Rico Besserdich

Is underwater photography difficult? Actually, no—at least, not to any significant degree when compared with any other discipline of photography. Each single stage of creating an underwater photograph, if seen in isolation from the rest, is not so tricky. It is the sum of all its parts, as well as mastering the whole, which can appear confusing at times. It is often believed that professional photographers have “special secrets,” which make their shots stand out from the rest, but mostly, it is rather a question of following a proper mindset.

In terms of underwater photography, we can say that the mindset is the systematic approach to staying organized and getting the best out of our photo dives. If you, for example, tend to run around your hotel room, searching for your hous-

ing's o-ring in the last stressful minutes before the departure of the dive boat, while at the same time, wonder about whether or not you have charged your strobe batteries (and where are those

batteries, by the way?), you could definitely use a change of mindset.

Before the dive

Say, you are planning to join a dive boat

trip for two to three photo dives the next day. Thinking ahead about things before they happen, and not when they happen, is an important first step.

Location. Before assembling all your photo gear, consider first where you are going to dive and what kind of conditions you will find there. Is it a dive spot for shooting macro or a wide-angle?



Developing the Mindset of a Successful Image Maker





photo & video



Is there anything particular you plan to take photos of, such as special critters or a wreck? Is it deep or shallow? What are the general light conditions, such as the position of the sun?

You can obtain this information from the dive center, dive guide, other photographers with knowledge of the dive site and if all else fails, do a little research on the Internet. With this information in hand, you can choose the appropriate equipment configuration for the task at hand, such as which lens to use as well as strobes, strobe arms, etc. Ideally, you have dived the spot before and have prior knowledge of what is down there—maybe even taken some test shots to develop an idea—and now, you are going back to take the shot you want. For underwater photography, it can be highly advantageous to dive the same place multiple times.

- Camera body
- Camera battery
- Lens
- Memory card
- Housing
- O-ring(s)
- Strobe(s)
- Strobe battery
- Strobe cable
- Strobe arm(s), strobe clamps and other related accessories

And...

- Spare batteries for both camera and strobe(s).
- Spare memory card
- Spare o-rings
- Silicone lubricant
- A bag or box to transport/store your gear
- A small towel



Equipment. Having decided on what equipment and camera rig configuration is needed for the task ahead, the next step is to collect all the required parts and place them on a clean, dry and dust-free surface. This could be a table or even the bed in your hotel room.

You will probably be looking at the following:

Take your time when assembling your photography gear. Do this methodically and calmly, and without being distracted. Ensure that all batteries are fully charged (also the spare ones), the memory card is empty (or still has lots of free space), and all o-rings are smooth (lubricated) and clean.

Once this is all done—a quick job for compact cameras, but sometimes a bit more comprehensive for a dSLR or mirrorless systems—do a few test shots to make sure that your camera and strobes are working correctly. If something is not functioning properly (e.g. the strobe is not firing) you now have the opportunity to locate and correct the fault. Often, it is a matter of a



Collect all the required camera gear and parts on a clean, dry, dust-free surface

Assemble and check your camera rig and gear the day *before* you go on a dive (left and below); Scout out the dive site *prior* to your photo dive (far left) to note light and sea conditions as well as critters to shoot.

cable connection not being fitted properly or the camera or strobe settings are not set correctly.

Rather than being in a rush, heading out to a dive in a few minutes, you are going to do this equipment check the day before the dive. Then, you can perform these procedures in a relaxed manner, with plenty of time to get your gear sorted out in an orderly fashion. Store your prepared gear in a bag or box and charge your spare batteries overnight. Once set, go and enjoy a nice evening or just rest and dream of diving and photography. Come the next morning, you will only need a few minutes to make a final check before you go diving. It should not really be necessary, but it does not hurt—better to be safe than sorry.

Checklist:

1. **Camera:** Is the memory card inserted? Is the battery fully charged and inserted?
2. **Lens:** Is the lens appropriate for the task ahead? Is the lens cap off? Is the lens clean? Is the lens switched correctly to either auto-focus or manual focus?
3. **Strobes:** Are the batteries inserted and fully charged? Are the o-rings okay? Is the cable connected? Is the strobe firing?
4. **Housing:** Are the o-rings okay? Is the housing properly closed?

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Don't miss any action; Be prepared to shoot the second you hit the water by preparing the proper settings before rolling in

strobe, I set it to around 40 percent power (in manual mode).

I do this for a good reason. It frequently happens to photographers, even once in a while for seasoned ones, that they hop into the water, descend to just a couple of meters, only to suddenly and somewhat unexpectedly find themselves surrounded by awesome photogenic objects. Sharks, turtles and huge shoals of fish—you name it. Rest assured that photos of National Geographic caliber were not created by unprepared photographers who were fumbling about with their camera settings, fighting to get them set. Those who do tend to see their awesome models swim away and disperse before they

are done messing about with their equipment.

For this simple reason, it is better to be prepared and have your camera ready to shoot from the very moment you get your head under water. You never know what may suddenly pass in front of your lens while you are descending (or ascending), so you might as well be ready with proper settings just in case something exciting happens out of the blue. Having these standard settings dialed in beforehand works well in many settings.

The mindset of a successful photographer stems from posing the fundamental question: What do I want?

There are underwater shoot-

Mindset

ers who are perfectly happy with following a guide and being in a group, content with taking some quick snapshots in different directions, and just want to see as many different things as possible during their dive. Then there are others who prefer spending their entire dives just photographing on their own, often entirely focused on only one particular subject. Such photographers tend to have an outright dislike for following groups or guides, and they are just happy hanging around in shallow waters under the boat, spending all their air, concentration and energy on the "shots of the shots." If the latter rings familiar, keep on reading.

Quickly check that your spare parts (batteries, silicone lubricant, o-rings, etc.) are in the box (or bag) and fully functional—and don't forget a towel!

Remember to turn your camera and strobes back off after the final check in order to conserve battery charge. You will turn them on again right before entering the water.

Getting wet at last

Our mindset is what forms the blueprint for a general plan and how we define checklists for how we want to go about accomplishing things—the foundation for accomplishment is preparation. Although there are some basic traits that we often see reflected in the habits of advanced photographers, each individual photographer will have to form in time his or her own individual mindset.

Right. We are now ready to



dive, are all kitted up and our photo gear is all set. Finally, we can go and take some photographs. But hold on... Did you switch on your camera and strobes? Surely you did. But have

you made any exposure settings yet? If not, let me share with you my personal choice of settings, which I use at the beginning and end of every dive: f/8, 1/125 s, ISO 200. And if I am diving with a



Some photographers prefer to be alone, away from groups, to focus on life in one spot under the dive boat or a pier





photo & video



Mindset

Rather than zipping in all directions, just stay put and look around; You will notice stuff you would normally miss by being in a hurry

- **Equipment paranoia** – My camera or strobes are flooding! Relax, because you took your time and prepared your gear properly.
- **Stress with buoyancy** – Acquiring good buoyancy skills should come before taking a camera underwater.
- **Fogging or flooding dive mask** – Only use dive masks that work well for you. Test (and maybe replace) them until you are perfectly happy with one before you have to embark on a serious photo dive!
- **Group or peer pressure** – Dive with a buddy who shares or understands your passion and avoid being

tucked into a dive group. Consider a private guide if no dive buddy is available.

strobe off and place them in a freshwater tank, preferably in one that is specifically designated for photo gear only, as opposed to the one where people rinse their regulators or other dive equipment.

If there is no such a tank, use the fresh water shower to rinse the salt water away. Saltwater itself does not damage your underwater housing and strobe, as long as it stays wet, but once it dries it is quite different matter. If there is no fresh water available, it is now time to bring out the towel. Remember the towel? That is the towel I told you to pack in your camera bag or box! Wet the towel and wrap it around your camera housing (leaving the camera still inside) and store the whole thing in a shaded and safe place. This will do for the time being, and as long as the towel is kept wet, prevent the salt from

the seawater on your rig from crystallizing. You can rinse your underwater photo gear later on, once you are back at home or in your hotel room.

Never open the camera housing before you have cleaned and dried it properly.

In between two dives (e.g. during your lunch break), the best place to store an underwater camera is always the freshwater rinse tank. Just leave it in there, if possible. Push each button of the housing a couple of times while the housing is in the tank.

Viewing your images

Keen photographers usually cannot wait to review their recent shots directly after the dive, often while still wearing their neoprene suit and half of their scuba gear. That is fine, but please bear in

Stop and look around. Instead of swimming aimlessly around and shooting anything that cannot swim away from you fast enough, I recommend just descending calmly a few meters while keeping your eyes open. If you have not started your dive with a plan of what to shoot, just stay put and have a good long look around you. More often than not, you will start noticing stuff you would not have noticed if you were in a hurry. A lot of interesting creatures are camouflaged and not easily spotted.

If macro photography is your passion, find yourself an interesting-looking part of the reef and watch out for small critters. If wide-angle photography is your chosen discipline for the day, watch out for the direction of the sun and for interesting structures and shapes.

Take your time to just hang around in the blue and get inspired.

Slow down. If you need to swim (say to reach the reef), swim about quite slowly. Incredible, interesting subjects might appear on your way, but if you swim too fast and do not look around, you will race right past them without even noticing.

Once you have found an interesting subject or reached your planned location, pause for a moment and consider:

- What is it?
- What camera and strobe settings might I need?
- How can I approach it?

Don't scare the subject. Keep your distance at first in order not to scare your subject away while

you dial in the settings needed, and only then approach it very cautiously.

Don't rush. Take as much time as you want to create your shot. It is not a matter of quantity but of quality. And quality can never be rushed.

Eliminate distractions. Another important step in developing your mindset is to make it a routine to always seek to eliminate possible distractions and disturbances as far as it is practically possible. Think about what may interfere with your ability to fully focus on the task at hand and consider beforehand what can be done to eliminate such factors.

Here are a few examples and their solutions:

tucked into a dive group. Consider a private guide if no dive buddy is available.

After the dive

What do we do after the dive? We stay true to the same philosophy by remaining organized, preventing stress and going over our routines in a methodical and structured fashion. Keen underwater shooters always think of their photo equipment first and of themselves second after re-entering the dive boat, coming ashore or wherever they planned to get dry again.

The first step is to take care of the camera in its housing. Larger dive boats and almost all shore-based dive centers will have special rinse tanks, filled with fresh water. Turn your camera and



Never open the camera housing before you have cleaned and dried it properly.





photo & video

Geometric or peppered moray eel (right) and tube worm (far right); Keep your distance at first, so as not to scare your subject while you dial in the appropriate settings; then approach very cautiously.



THIS PAGE: Don't judge your photos by your camera's LCD display, as it only displays a JPG preview in very low resolution—instead, review photos on a computer's larger screen and zoom in to 100% magnification to determine which images are good and which are not; Remember, the rear LCD screen draws a lot of battery energy, so if you would like to review your photos between dives, make sure that you carry spare batteries, especially when using compact or mirrorless cameras.



mind one thing: Don't judge the photos by your camera's LCD display.

No matter if you shoot RAW, JPG or DNG, the camera's LCD displays only a JPG preview in a very low resolution. Only by reviewing your photos on a computer's larger screen AND by zooming in to 100% magnification are you able to properly deem which images are any good and which are not.

Unless a photo is totally black or blurry, do not delete images directly from your camera while reviewing them on the camera's LCD screen. Sometimes, photos that may not look promising on the LCD may turn out to have that "little extra" something, and photos that seemed awesome on the first view on the LCD, often do not appear as nice when reviewed on a large screen.

Also keep in mind that the rear LCD screen draws a lot battery energy, so if you would like to review your photos between dives, make sure that you carry along spare batteries, especially when you are using compact or mirrorless cameras.

Daily transfer.

Once back home, you should transfer the images from the camera to a computer, regardless of whether the memory card still has space for more photos. Just stay organized and transfer your images after each day of diving. Empty the memory card to prepare it for the next day of diving. You may now charge the batteries (camera and strobes) as well.

Sorting images. Create folders sorted by date, location, or a specific photographic project you are working on, and store your images in there. Once again, stay organized.

Hint: Do not start transferring images from the camera to the computer if the camera battery is already low. Replace the battery before the transfer or use a card-reader.



Selection and processing. At this point, you may now grab a well-deserved drink and start reviewing your photos of the day on your computer. For the first round of selection, I recommend deleting only the really bad or unsuccessful images (totally out of focus, totally black, etc).

Stay calm if your RAW photos do not look like they did while reviewing them on your camera LCD. Remember that LCD cannot show you RAW images, it can show you only low-resolution JPGs, which are often somewhat altered by the camera's own image processor.

If you are out for a couple of

days for diving and photography, it would be a mistake spending endless hours on post-production during your trip. Such matters are much better processed at home.

However, during a dive trip you can review your photos for a primary selection, and for further development of your idea. Your photo review can show you what to improve upon or do differently during your next dive tomorrow. And don't forget your towel! ■

Rico Besserlich is a widely published German photographer, journalist and artist based in Turkey. For more information, visit: Mavipphoto.com.





PRODUCT PHOTOS COURTESY OF THE MANUFACTURERS



GoPro Hero

The latest entry-level GoPro is now available, featuring a 10MP still camera with a burst option of 10 frames per second, video stabilization, touch screen display, Wifi and Bluetooth, stereo audio and 1080p video at 60 frames per second. The camera is waterproof down to 33ft (10m) and can be controlled by voice command above the surface. Looking just like the higher-priced Hero 5 and Hero 6, this new Hero costs just US\$199.99. For more information, visit: Gopro.com.



Ikelite 200DL UW Housing

Introducing a full-featured waterproof housing for the Panasonic Lumix DC-G9 micro four-thirds camera. The housing features the Dry Lock port system that accommodates a large number of lenses with the appropriate extensions and zoom gears. TTL is possible with Ikelite DS-series strobes and the optional PT1K Panasonic kit attached to the camera's hotshoe. Additional straight magnified and 45-degree magnified viewfinder options are available, along with a vacuum system, each sold separately. Pre-order now for a late April shipment at an MSRP of US\$1,595. For more information visit: ikelite.com.

Gnarbox

The second generation Gnarbox rugged backup device is currently up on Kickstarter. For photographers and videographers who are traveling without a laptop, the Gnarbox acts as a single-step back-up system for content. Now available in 128GB, 256GB, 512GB and 1TB sizes, plus two pack bundle options, the Gnarbox allows creatives to download and edit their work directly on the device with various mobile apps. Extra batteries may also be purchased as part of the package. Gnarbox supports USB 3.0, microSD and SD cards and may be connected to external hard drives for additional storage space. For more information, visit: Gnarbox.com.



What to make of which batteries to use or not to use underwater

Panasonic warns photographers not to use the otherwise popular Eneloops brand of rechargeable batteries underwater, *Wetpixel* reports. Meanwhile photography bloggers speculate whether IKEA's far cheaper batteries could be identical to Eneloop's.

Petapixel recently ran an article titled, "Are \$5 IKEA LADDA Batteries Identical to \$20 Eneloop Pro Batteries?" Apparently, the batteries are made by the same factory in Japan, and seem to perform similar in tests.



Our good colleague at *Wetpixel*, Adam Hanlon recently reported that the extremely popular Eneloop rechargeable batteries are now not recommended for strobe use. Panasonic, which owns Eneloop, specifically states on its website, "Please do not use Eneloop Ni-MH batteries in underwater lights or other airtight appliances." Adam mentions it could be interesting if the strobe manufacturers had something to say. Otherwise, we'll all keep using Eneloops as usual, I'd say!

Eneloop vs. Ikea

In February, *DPR* published a test in which the recycle speeds of the inexpensive rechargeable IKEA LADDA batteries were compared against more expensive Panasonic Eneloop Pro batteries using Godox TT685 flashes. The results were surprising: The LADDA batteries actually demonstrated a noticeably faster recycle speed versus the Eneloop Pros.

Could they, in fact, be the same batteries?

These surprising findings led other bloggers to speculate what the difference between the two brands really was, if any. For example, *Petapixel* ran an article asking, "Are \$5 IKEA LADDA Batteries Identical to \$20 Eneloop Pro Batteries?" For starters, both brands of batteries are apparently made by the same factory in Japan. Next, Matthew Eargle of *AirborneSurfer*, who performed a test, found a difference of less than 0.05 percent between the two batteries which led him to conclude, they are extremely likely to be the same battery. ■

Daide Angheleddu



P O R T F O L I O

portfolio

Text by Gunild Symes

All artwork by and photos courtesy of Davide Anghelèddu

Italian artist, designer and architect, Davide Anghelèddu, creates bronze, aluminum and nylon sculptures inspired by the forms of zooplankton, marine microorganisms. *X-Ray Mag* interviewed the artist to find out more about his artwork, creative process and perspectives on art, technology and the underwater world.



Flyer, 2010, sculpture by Davide Anghelèddu (above and previous page). Nylon, 70 x 50 x 40cm

Anghelèddu



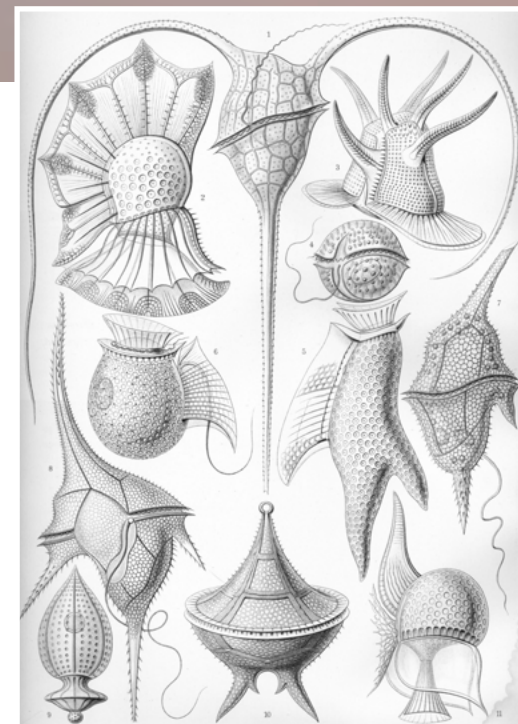
Atlas Remeshed, sculpture by Davide Anghelèddu. Aluminum, 35 x 30 x 20cm; Inspiration for the artist's sculptures came from *Kunstformen der Natur* (*Art Forms of Nature*), 1899-1904, which included lithographic and autotype prints of marine microorganisms (zooplankton) by the German biologist Ernst Haeckel (right).

After graduating with a degree in architecture from the Politecnico di Milano, Davide Anghelèddu specialized in interior design at an architecture studio, where he amassed a great deal of knowledge and experience in 3D digital modeling. He developed the concept of digital representation of not just the end product of a project, but each stage of refinement along the way in the process, starting with the initial idea, or "seed", from which the ideal shape would develop.

This concept formed the basis for his artistic work in sculpture as well. For Anghelèddu, the

idea that 3D modeling should be a creative tool for visualizing prototypes was important. In his work, he employed what he called a "3D software cocktail", which combined the geometric precision of 3D CAD tools with the more agile yet less precise 3D modeling tools used in animation films, in order to create complex shapes that closely resembled those found in nature.

Anghelèddu was particularly inspired by the illustrations of marine microorganisms by the 19th century German biologist and philosopher Ernst Haeckel, published in *Kunstformen*



Anghelèddu



Radiolario, 2009, sculpture by Davide Anghelèddu. Bronze, 21 x 19 x 19cm

der Natur (Art Forms of Nature) in 1899-1904. Haeckel named and described thousands of new species and was instrumental in promoting and popularizing the theory of evolution in his home country.¹

Anghelèddu was struck by the astonishing beauty of these images, especially those of the radiolarians siliceous skeletons, a component of marine plankton. The artist was intrigued by the wandering nature of plankton. Indeed, the term, "plankton," is derived from an Ancient Greek term for "wandering".² But while plankton can move itself vertically, its movements on the horizontal plane are

determined by the wave action of the seas. Anghelèddu said, "I found this image strongly evocative of man's life, who is partially the author of his own decisions and who is partially in the hands of uncontrollable and uninfluenceable forces."

Creative process

Anghelèddu's artistic method is closely linked with technology. According to the artist, new digital technologies have opened up new frontiers in the field of sculpture. "Nowadays, sculpture can be conceived in a totally virtual environment," he said, "built by machines using a layer-by-layer principle," which Anghelèddu uses in his artworks.

His bronze sculptures are created with two separate processes: laser sintering and lost-wax casting. First, a virtual model is cut into layers of .15mm and loaded into a laser sintering machine. With a high-powered laser, nylon powder is solidified layer by layer, creating a physical model of great precision and "potentially unlimited complexity". Then, lost-wax casting takes place, which is a method that has remained basically the same over the last 3,000 years. A mold is created in which bronze will be filled to create the final sculpture. This mold is created around the nylon model. The nylon is then heated and evaporated, serving as the "wax" in the lost-wax casting. Then the mold is filled



with bronze. Once the bronze has cooled, the sculpture is extracted from the mold.

The technology of 3D modeling is essential in the creation of Anghelèddu's sculptures. This technology includes 3D data acquisition, reality-based 3D modeling, 3D time-evolving reconstruction and 3D visualization, which is being used in the field of digital heritage (preserving cultural or natural heritage with digital media). While critical in rendering a project, the technologies often require a dedicated super-computer to construct and visualize models. To simplify this, Anghelèddu developed a way to optimize these technologies during his doctoral research, making 3D modeling more widely accessible by using low-cost computers, tablets and



Wings, 2010, sculpture by Davide Anghelèddu (above and top center). Bronze, 59 x 29 x 28cm

¹ WIKIPEDIA.ORG/WIKI/ERNST_HAECKEL
² WIKIPEDIA.ORG/WIKI/PLANKTON

portfolio

smartphones.

He turned to the techniques used in the gaming industry to integrate the tradition 3D modeling methods, representing three-dimensional geometries on two-dimensional maps, for example. Although this process was created for digital heritage projects, it was something that could also be applied to complex 3D models.

Anghelddu was aware that early on in his doctoral research, the developments in digital heritage would influence his artistic endeavors, as he experimented with new techniques for creating 3D models for sculptures. In creating his artworks, these techniques were reapplied to the raw data of photos. More specifically, he used a re-topology algorithm, used in the first phase of post-processing in large 3D models in digital heritage projects, which he then applied to the 3D points that represented

the shape of the acquired object. A smooth surface of the original geometry of the object could then be generated, which became the starting point for the evolution of his sculptures.

Sea forms

Anghelddu is an avid scuba diver and snorkeler. His parents are from Sardinia, so every summer he would go there for vacation. "When I was a child, I explored the sea near the reef, and I think that my perception of beauty was influenced by the shape of the underwater world," he said.

The artist became very interested in representing these organic shapes using computer graphics. "I love to take photos of interest-



ing shapes," he said. "Today, it is possible to obtain a 3D model from photos, thanks to automatic photogrammetric technology. I had great experiences capturing real organic shapes in the underwater world and trying to convert them into a virtual model. That model can then be the starting point for my next artwork."

Eco-conscious

Conservation is a theme evoked by the artist's sculptures inspired by marine microorganisms. "Since antiquity, water has been considered the source of life by

Greek philosophers," he said. "All living things are made up of a large percentage of water. Humankind is not separated from the living environment. We are not immersed in the environment, but we are part of it. Consequently, harming part of the environment is equivalent to damaging part of ourselves. Plastic poured into the sea inevitably ends up entering our food chain.

Anghelddu

This alters our biochemical balance with unknown consequences. My artwork about plankton also places the focus on the food chain and the problems it involves for mankind."

Radiolarians inspired Anghelddu's first artworks and

laid a foundation for following artistic projects. Starting with primary forms, he subjected them to external forces, which destroyed them on one hand, and on the other, gave them new shape and new life.

The surfaces of his sculptures



Framework, 2010, sculpture by Davide Anghelddu. Bronze, 67 x 35 x 32cm

Framework, 2010, sculpture by Davide Anghelddu (above and center). Nylon, 67 x 35 x 32cm



Screw, 2010, sculpture by Davide Angeleddu. Bronze, 39 x 53 x 47cm

discipline might be completely novel and inspirational to another.

Feedback

Indeed, Angeleddu's artworks have elicited insightful comments from viewers. "During my first exhibition at the Kinetica Art Fair in London, I spoke to an Arab journalist. I told him that my sculptures were 'strange' in the specific context of the exhibition because they didn't move and everything else was moving. He told me, 'Your artworks are perfect for a kinetic exhibition because they are apparently static, but they move people inside.'"



are corroded, displaying a worn, green patina. Their initial geometric forms are evident, he said, but then they are ravaged by time. A fragile object results, which the artist likens to human life, which is also continually evolving. Angeleddu said that the most important parts of the objects he makes are the missing ones. Their shapes resemble their skeletons, he said, and one may feel that maybe the true work was a previous form of itself, or a form that it will evolve into later. His artworks represent time passing, and "the continuous becoming of life", implying the preciousness of every form of life.

Challenges and benefits

Angeleddu said that "cooperation" is both

the challenge and the benefit of being an artist today. Working primarily on his own a century ago, Einstein was able to develop the theory of relativity and begin a scientific revolution. Today, the world has changed, and researchers need to work in groups to devise experiments and test their theories, said Angeleddu. He thinks that same trend is true for other fields, including art.

Interdisciplinary cooperation enriches the final artwork because various points of view can be raised by collaborators in a group. And the interaction of members from different disciplines helps a group find new solutions, because the positive integration of different areas of knowledge helps one see a bigger picture. What was obvious to one

Angeleddu recently exhibited his work, *Atlas Remeshed*, at the Science Museum in Seoul, Korea, last November. It is an artistic view of the so-called "ATLAS experiment" conducted at the Large Hadron Collider (LHC) accelerator at CERN in Geneva, Switzerland. The aims of the experiments are to find new sub-atomic particles to demonstrate new theories on the basic forces that have shaped the universe since the beginning of time and which will determine its fate, said Angeleddu. One such particle is the Higgs Boson, which is the focus of the artist's work. ■

For more information, visit the artist's website at: daveideangeleddu.weebly.com.



Shell, 2009, sculpture by Davide Angeleddu. Bronze, 45 x 15 x 14cm