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H-Ray Mag

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February 2021
Number 103



The Maldives
Deep South

Contributors' Picks
My Favorite Mammal Dive

Tech
Felicitas Mine

Wrecks
Scirè

Japan
Photo Contest Winners

B R A Z I L ' S

Fernando de Noronha

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COVER PHOTO: *Humpback whales in Tonga*
by Don Silcock (indopacificimages.com)

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Snorkeller seeking manatees in Three Sisters Springs, Florida, USA. Photo by Jennifer Idol



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DIVE
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Feeling Connected

The prolonged stillness that the pandemic has brought to affairs lately has also provided us with ample opportunity to pause and reflect—to ask and find out what matters to each one of us and what we really value in life.

I have been reflecting too and looking back on what diving has brought me over the many years I have practiced it.

The one aspect that sticks out in my mind the most is how my appreciation and sense of other species, in particular their sentience, has evolved or matured over the decades—in part as a result of close encounters with marine mammals, sharks, other fishes and cephalopods, and as a result of following ongoing scientific studies of what other species might be able to feel or think.

In this context, I cannot help feeling a tinge of irony when looking back on my days as a graduate biology student when the professors ingrained into us students that we should never fall for the temptation of *anthropomorphism*—the attribution of human traits, emotions or intentions onto animals—as it was not a scientific approach but rather an innate emotional response and an artefact of human psychology.

This indeed may be true, and as researchers, we should always

remain objective and draw our conclusions from facts. But in hindsight, I wish open-mindedness—another essential scientific virtue—had not been so readily brushed aside in this case. In fact, I now consider this instant dismissal of the notion that humans share a wide range of traits and responses with other animals, a grave error at the time.

Thankfully, more recent research has made significant strides in remedying these missteps—science does righten itself over time. Now we know, among other things, that fishes have complex cognitive skills, can do simple counting and are able to recognise faces; we know that they exhibit emotional responses, have personalities and that even sharks form some sort of social bonds. There can be no reasonable doubt left that fishes are also sentient beings. We already reckoned that marine mammals were sentient, but what about cephalopods?

The times I have had close encounters and interactions with marine life and had eye contact with, say, a dolphin, tiger shark or manta ray, I always got the feeling that there was “somebody home”—that I was

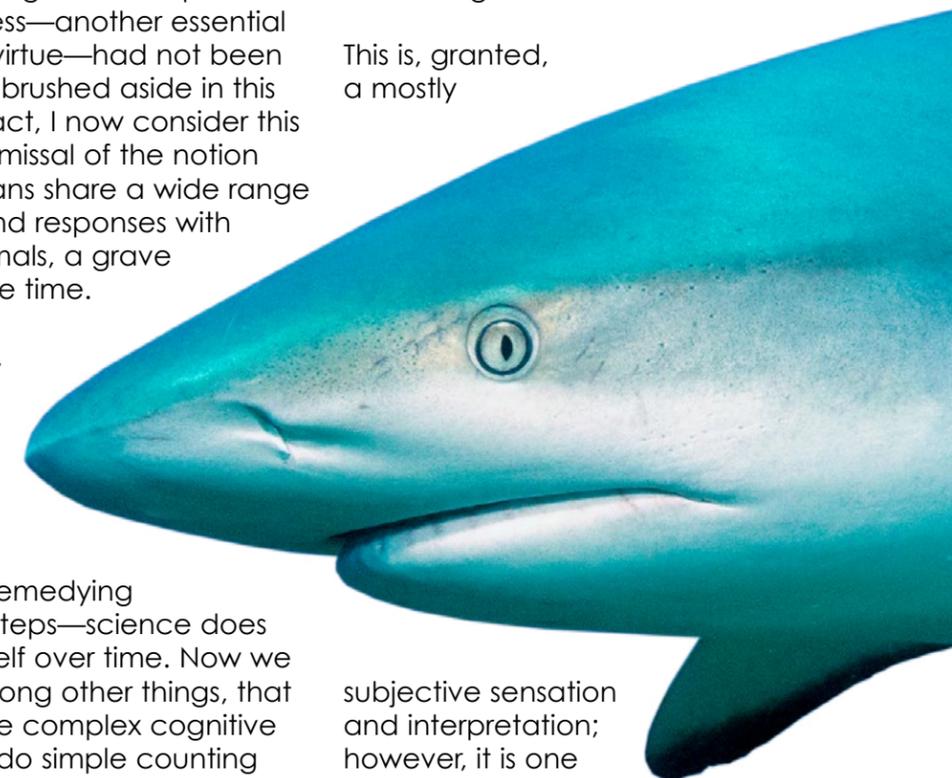
connecting, in some way, with another sentient creature, which also recognised me as such.

This is, granted, a mostly

subjective sensation and interpretation; however, it is one I firmly believe in nonetheless, and one which I am confident further research will substantiate.

In any case, these close encounters with marine life have both been the most enriching experiences underwater for me as well as the moments that really made me ponder and reflect upon what defines life and what indeed defines consciousness...

— Peter Symes
Publisher & Editor-in-Chief





Edited by
Peter Symes

from the deep
NEWS

Unravelling how some corals resist bleaching

Corals that are resistant to bleaching and those that are susceptible, host two different communities of symbiotic algae. The distinguishing feature between these algal populations was found in their cells, in compounds known as lipids.

Researchers at Michigan State University and the University of Hawaii at Manoa have been uncovering clues as to why some corals bleach while others are resistant, information that could help reefs better weather warming waters in the future.

The team analysed the biochemistry of corals using mass spectrometers to understand what set resistant corals apart from susceptible ones. The scientists found that two different communities of algae lived within the corals. Inside the algae cells were compounds known as lipids.

Lipids

Although the term "lipid" is sometimes used as a synonym for fats, fats are a subgroup of lipids. Lipids also include oils, waxes, certain vitamins (such as A, D, E and K), hormones and most of the cell membrane that is not made up of protein. Lipids are not soluble in water.

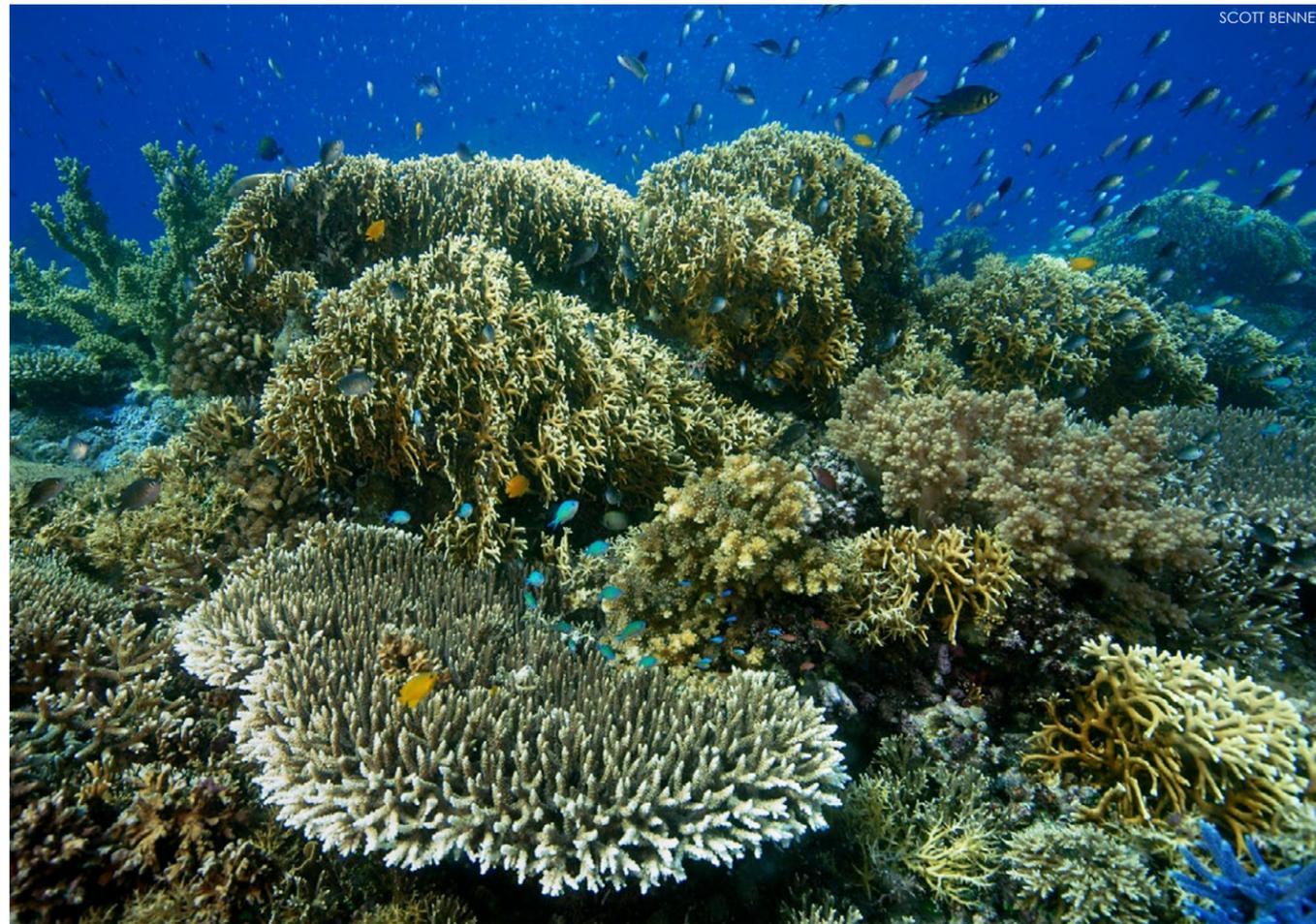
The researchers' analysis detected two different lipid formulations.

Bleaching-resistant corals featured algae that have what are known as saturated lipids. Susceptible corals had more unsaturated lipids.

"This is not unlike the difference between oil and margarine, the latter having more saturated fat, making it solid at room temperature," said MSU's Robert Quinn, an assistant professor in the Department of Biochemistry and Molecular Biology.

Biochemical insights

These findings indicate that natural bleaching susceptibility is manifested in the biochemistry of both the coral ani-



mal and its algal symbiont. This difference is stable through time and results in different physiological responses to temperature stress. Having these insights into the biochemical mecha-

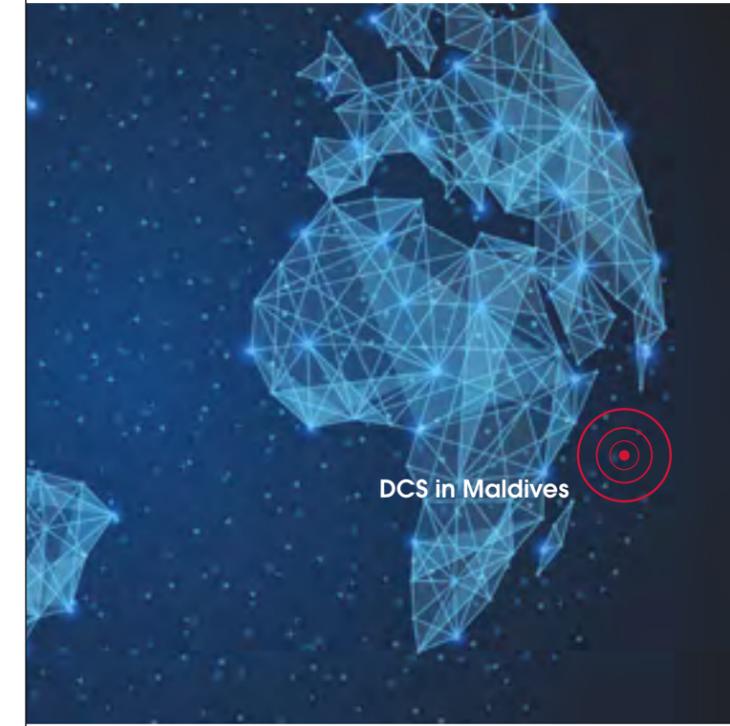
nisms of coral bleaching is promising for coral conservation and presents a valuable new tool for resilience-based reef restoration. ■ SOURCES: MICHIGAN STATE UNIVERSITY, NATURE



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

Ghost fishing—lost or abandoned net or other fishing equipment that is snagged on a reef or wreck—continues to trap marine wildlife.

Ghost Diving establishes a new chapter in the UK

The Ghost Diving Foundation has announced the establishment of a new country chapter. Divers in the United Kingdom are joining fellow team divers in New Zealand, Egypt and Korea in a shared goal of removing lost fishing gear.

The international volunteer diver organisation—formerly known as Ghost Fishing—was founded in 2012 to locate and remove lost, snagged and entangled fishing gear or “ghost fishing” equipment from our oceans and seas, across the globe. From day one this important role has always been conducted by groups of highly experienced, specially skilled, volunteer technical divers who are used to team diving on standard gases, using a set equipment configuration. The divers involved understand and appreciate the hazards of these dives.

In March 2020, this trend-setting foundation chose to rebrand and rename itself Ghost Diving, to highlight its primary mission. At the time, Pascal van Erp (founder of the not-for-profit Ghost Fishing organisation) told *X-Ray Mag*, “Now that the problem of ghost fishing has been identified and is better known, it’s time to focus on the solution. We have therefore decided to rebrand our organisation and put the technical divers on centre stage, because they are the ones who recover the lost fishing gear from the seas and oceans. They deserve recognition for their truly tremendous efforts.”

Establishing chapters

When Van Erp originally established the Ghost Fishing Foundation, he knew how important it was to preserve the marine environment. He recognised early on that it would be no small feat to clean up the oceans. He would need many willing and capable hands across the world that could do this in a safe manner. It is worth remembering that this was before *Blue Planet II* was aired, in which David Attenborough highlighted the issue of plastic oceans to the public.

Van Erp therefore worked to establish a global presence, and set up several international chapters around the world, with the same goals and vision as the original Netherlands chapter (now the headquarters). This included helping to launch Ghost Fishing UK (GF-UK). The British chapter was provided with a name, an identity, technical knowledge and procedures, guidelines and standards. GF-UK was also actively supported financially with a significant grant. The Healthy Seas Foundation awarded GF-UK a €15,000 grant in 2018-2019, to assist the UK chapter’s valuable work of recovering abandoned ghost fishing gear.

When the 2020 rebranding and renaming was announced, GF-UK was naturally invited to join the Ghost Diving Foundation because of the sterling work they had done in the United Kingdom. The UK Chapter decided to walk its own path, and the two organisations chose to part amicably. The split was partially understandable because the chapter had worked hard to be recognised as a British-registered ocean conservation

charity, and a name change would not be straight forward.

Today, GF-UK continues to remove lost, snagged and entangled fishing gear from wrecks around the UK coast. In the process they—as all Ghost Diving chapters do—rescue trapped animals. In addition, GF-UK focuses on writing and selling removal courses to non-technical divers. Recently, GF-UK has partnered with surface providers and a recreational diving organisation, so that this marine hazard can be highlighted in more communities.

UK chapter launched

Van Erp told *X-Ray Mag*, “Whilst both GF-UK and our chapters all work on the same cause, we have a different ethos and approach. For instance, one of our pillars from day one has been that every Ghost Diving chapter around the world trains their divers for free, so that they can safely survey and retrieve lost fishing gear using certain techniques and procedures.

“Following an initiative from local UK divers who like our safe standard of team diving, we have taken the decision to establish a new Ghost Diving chapter, ‘Ghost Diving (United Kingdom).’ Duncan Simpson and John Wheeler will respectively head up two teams, based in the



GHOST FISHING UK

north and south of the country. Each team will operate in their own area—Duncan out of Tynemouth and John is Cornwall based—whilst adhering to our organisation’s modus operandi. The pair met at a GUE Christmas Dinner, and got chatting about the projects they were working on, and what they wanted to achieve. As a result Ghost Diving (United Kingdom) was born.

“I am pleased that on a national level partnerships will be established with local diving and conservation groups, to form a strong front in the fight against marine pollution, especially those caused by lost fishing gear. To this end, Ghost Diving (United Kingdom) has already formed a partnership with Healthy Seas.”

Healthy Seas grant

One of the fundamental cornerstones of each Ghost Diving chapter is the efficient and proper recycling of the recovered

ghost gear. You cannot just remove it from the sea, and then do nothing with it. The “grave to cradle loop” must ALWAYS be closed! Ghost Diving (United Kingdom) will therefore be working closely with Healthy Seas to ensure that this always happens. This non-profit environmental organisation takes the nets and makes sure they become a valuable new resource, hence “from waste to wear”.

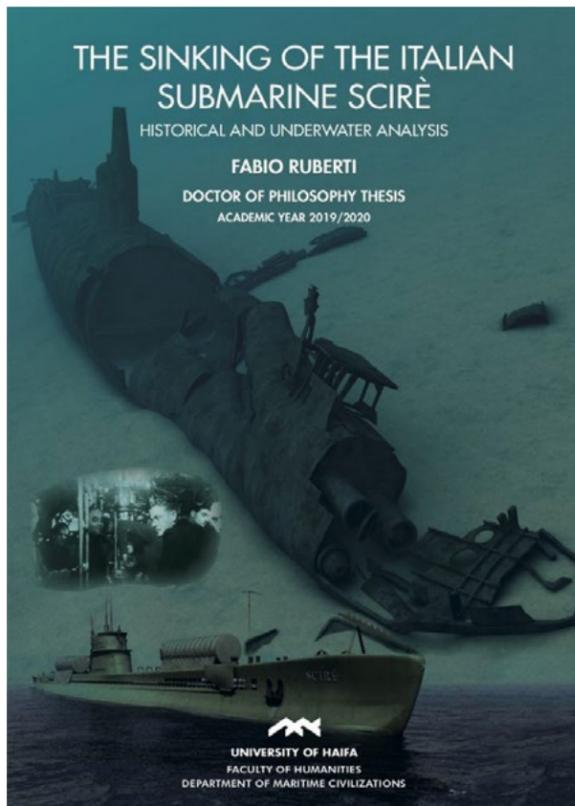
Van Erp confirmed that Healthy Seas has issued an important grant to the Ghost Diving (United Kingdom) Chapter, which will help fund their diving. In return, the abandoned or lost nets and ghost fishing gear that the divers recover will be sent for appropriate upcycling with Bracenet and recycling via Healthy Seas and its partners. “I am proud that Ghost Diving has such a strong alliance—we the divers work very well with the fishermen and the environmental partners, to clean up our oceans and seas,” said Van Erp. ■



IANTD Expeditions diver on the Scirè submarine wreck

Text by Cesare Balzi
Photos by Alberto Dabalà, IANTD S.r.l.

Today, the wreck of the Italian Regia Marina submarine *Scirè* lies at a depth of 33m in Haifa Bay and four IANTD expeditions were necessary to survey the wreck, collect measurements for a 3D reconstruction and accomplish historical, cultural and scientific research.



Cover of *The Sinking of the Italian Submarine Scirè*, written by Dr Fabio Ruberti



Scirè Wreck

— IANTD Expeditions to the WWII Italian Submarine

A. DABALÀ / IANTD S.R.L.

The sinking of the Italian submarine *Scirè*: Historical and underwater analysis is the title of the doctoral thesis by Dr Fabio Ruberti, president of IANTD Srl, which was published by the Faculty of Humanities in the Department of Maritime Civilizations

of the University of Haifa in Israel. Twelve years of research and seven years of study resulted in this 355-page thesis divided into five parts, of which four are related to the historical analysis and one to the archaeological and underwater

analysis of the wreck.

The historical part, in addition to a precise contextualization of the events, unveils unknown aspects, or little-known ones; while the underwater and archaeological part frames the needs and the

protocol to be used in the study of contemporary iron wrecks of great historical value—in this case, of a famous submarine as well as the urgency of its institutional protection. A multidisciplinary method has provided an outstanding opportunity



Starboard view of the 3D reconstruction of the *Scirè* wreck, in color (right); Four historical photos of *Scirè* and her crew members (lower right)



F. RUBERTI / C. CESTRA / © IANTD S.R.L.

to verify the existing data, add more details and enlighten on this important historical event.

Historical background

The *Scirè*, built in Cantieri Odero Terni Orlando Muggiano La Spezia shipyard, was named *Scirè* after a location in Ethiopia, marking an Italian victory in 1936 during the Abyssinian War. It belonged to the "Series 600 Class Adua" standard 680/698 tons and was launched on 6 January 1938, entering the service of the elite X Flottiglia MAS. The *Scirè* belonged to the Italian Navy Special Forces unit called X MAS (Decima MAS). This unit was the fiercest enemy of the Royal Navy in the Mediterranean, and the *Scirè* was its spearhead. Using innovative underwater warfare in covert operations, the actions of the X MAS, particularly those of the *Scirè* in Gibraltar and Alexandria, made British harbors unsafe, at least until mid-1943.

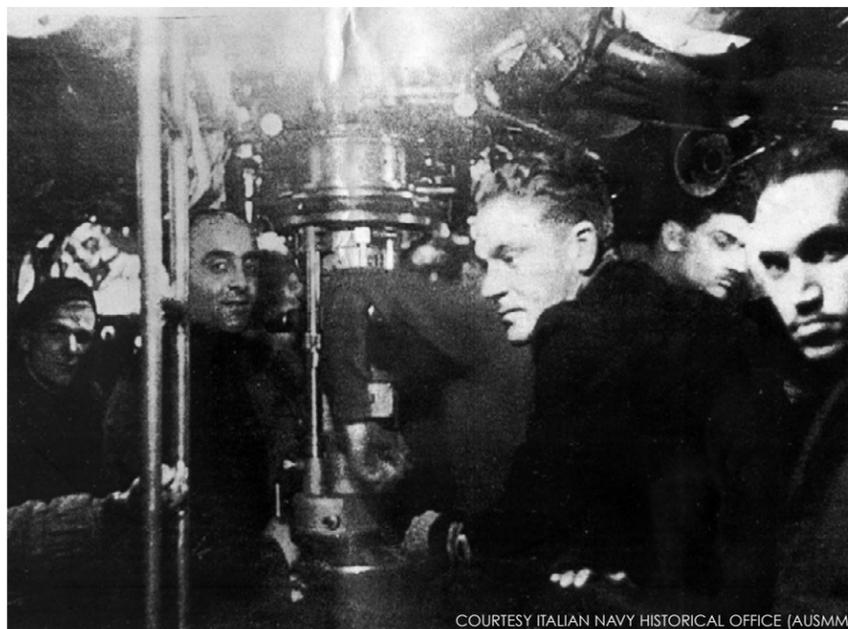
After three unsuccessful attacks, operation BG 4 took place in Gibraltar on 20 September 1941, when *Scirè* divers successfully attacked the tanker *Fiona Shell* (2,444 tons), the armed cargo ship *Durham* (10,893 tons) and the military



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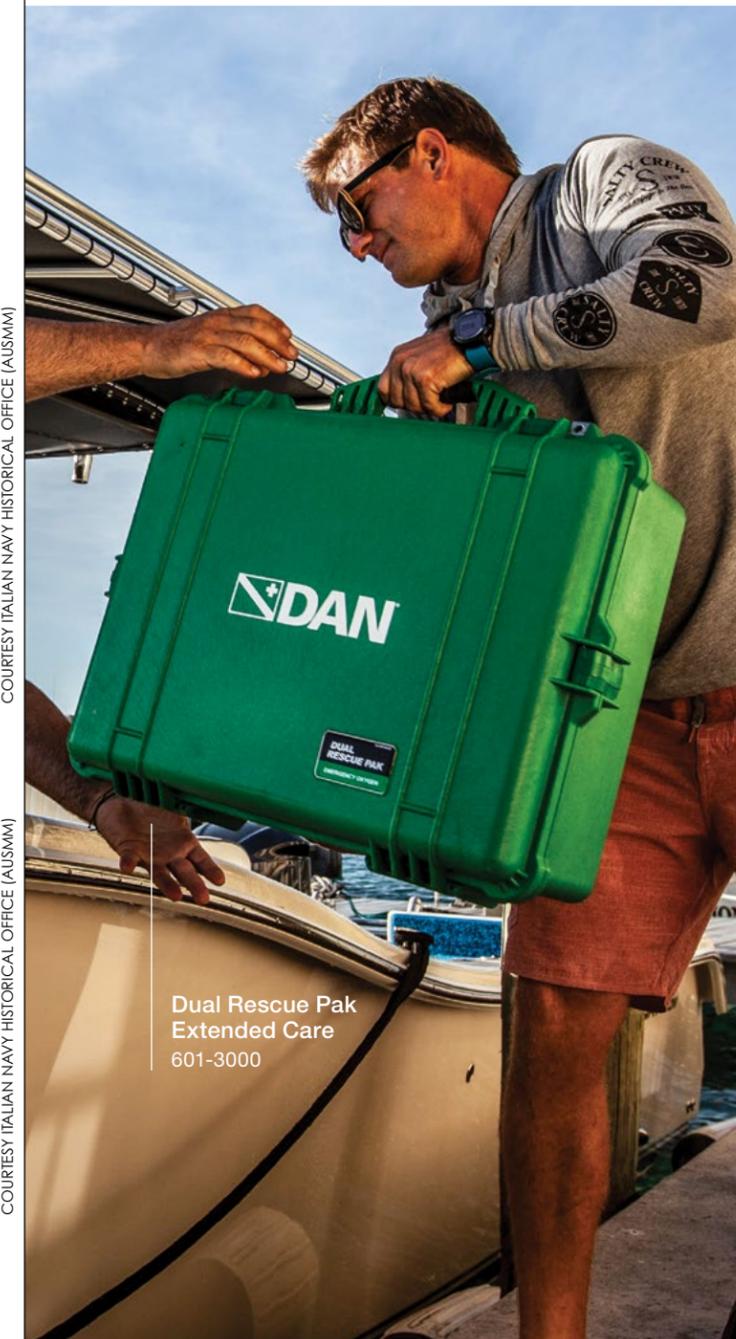
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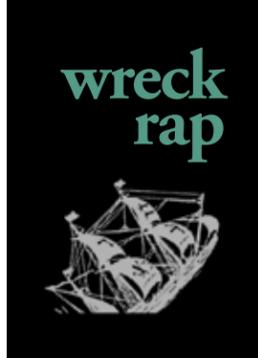
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Dr Fabio Ruberti talks to the Ehud Galili about the Scirè 3D reconstruction plans (right); IANTD Expeditions members Edoardo Pavia and Cesare Balzi viewing Haifa Bay (far right); Launch of the Scirè on 6 January 1938 (below)



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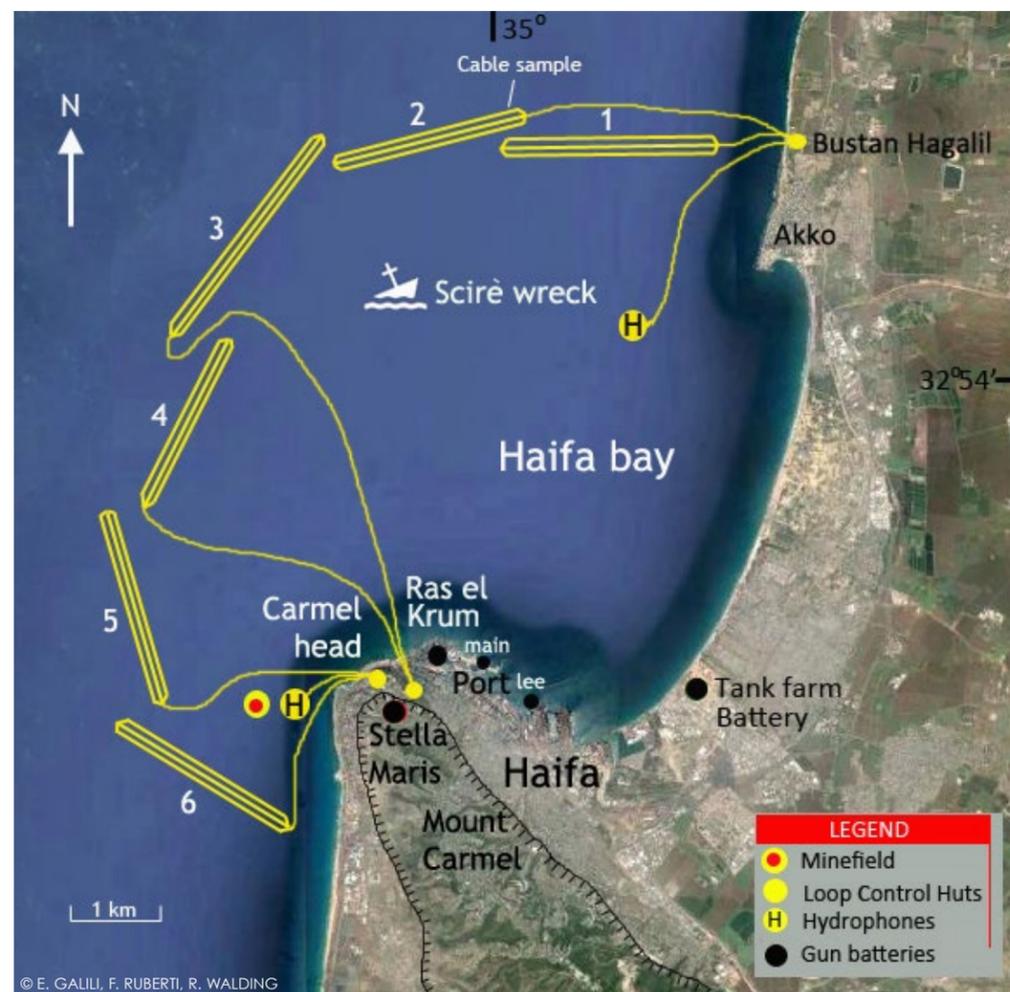
PHOTO COURTESY OF FINCANTIERI CANTIERI NAVALI ITALIANI S.P.A.



Diagram of the defences of the Haifa port in 1942, with the locations of the indicator loops (right)



A. DABALÀ / IANTD S.R.L.



detectors, indicator loops, mines, traps and gun batteries.

It was British superiority in intelligence warfare, however, that was the winning weapon. In fact, Ultra Secret was able to intercept and decrypt Italian and German coded messages

decided to begin researching the wreck in 2008 to prepare for the first expedition to the wreck site. He planned to research historical archives first and then continue in the field through underwater surveys and study of the wreck.

He started in Rome at the Historical Archive of the Italian Navy, searching for all documents involving the facts that led to the sinking of the Scirè. But all the documents he found did not reveal anything new or clarify the reasons for the submarine's demise, containing only facts that were already well known. Ruberti then decided to research the British archives, because he supposed that since British superiority in intelligence warfare was the winning weapon against the Scirè, the relevant documents could only be found there.

Since the British Ultra Secret machine was able to intercept and decrypt Italian and German coded messages, Ruberti decided to begin the research at Bletchley Park, the former code-breaking base of the British Secret Service

that allowed the British to locate and sink the Scirè. The submarine was lost on 10 August 1942 off Haifa.

Much about the fate of the Scirè remained unknown. Witnesses who participated in the event told different and contradictory stories. Italian publications in the years immediately after WWII left doubts concerning the fate of the Scirè. It was rumored that the Royal Navy had previous knowledge of the attack.

The archive research

Due to these reasons, Ruberti

tanker Denbydale (8,145 tons). On 14 December 1941, the greatest success of the Scirè was the sinking of two main British battleships in Alexandria's harbor: HMS Queen Elizabeth and HMS Valiant.

In the Mediterranean naval struggle, Haifa was an important strategic target because of its oil terminal and refineries, and much care was taken to protect these facilities. In this war scenario, Britain redoubled its efforts to combat the actions of the X MAS by improving its harbor defenses using ASDIC

during WWII. It was the right choice because almost immediately he discovered the true reasons for Scirè's demise.

While examining G.C. & C.S. Naval History, Vol. XX, "The

Mediterranean 1940-1943," Ruberti read a footnote on page 216: "On 10 August, the parent submarine Scirè was sunk off Haifa with her human torpedoes aboard. Her intention and her approach had

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Divers taking measurements for the 3D reconstruction of the *Scirè* wreck.

been elaborately followed by Special Intelligence, and she was destroyed according to plan," followed by a series of alphanumeric identifications of decrypted Italian and German messages. This declaration revealed the true reason for *Scirè*'s demise, generally unknown until now.

Ruberti's research continued at the National Archives in Kew, London, where he searched for the related documents mentioned with alphanumeric identifications in the G.C. & C.S. *Naval History* footnote. The task was not an easy one, but at the end of two years of research, 48 documents were found, revealing all the details of the interception and decrypting of Italian and German messages related to Mission SL1 against Haifa's harbor and a

report of the last moments of the *Scirè* submarine.

The end of *Scirè*

The British intercepted almost all the Italian messages between the Italian Navy high command ("Supermarina") in Rome and the Eastern Mediterranean Admiralty in Rhodes, and the messages of the German X. Fliegerkorps, whose task was the aerial reconnaissance over Haifa. They intercepted the submarine twice during her course to Haifa: first, southeast of Cyprus, then off the border between Lebanon and British Palestine.

The submarine was then caught by an innovative antisubmarine system of the Haifa defenses called Indicator Loops. She was chased by the armed trawler HMS *Islay* and depth-charged. She was hit

and surfaced for surrender, but the coastal gun batteries over Mount Carmel bombarded her to death.

This information is what came out of the recovered documents. Ruberti then published these findings in Italian magazines and scientific journals.

The British had located the wreck site immediately after the sinking of the submarine. They sent hard-hat divers down to inspect her with the intention of recovering an SLC (slow-running human torpedo) but were unsuccessful because the mission used only attack divers with limpet mines. When the British left Palestine in 1948, the location of the wreck site was lost. It was found again in 1952 by Israeli Navy officer Yohai Ben Nun, located in the shipping lane accessing the port of Haifa.



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Edoardo Pavia doing a pre-dive CCR check (above); IANTD Expeditions dive team (top); Diver at a prow structure of Scirè, with four torpedo tubes in the background (left)

Since our first expedition in 2008, we have been fortunate to have the assistance and support of the Israeli underwater archaeologist Ehud Galili and the help of some local divers to facilitate our underwater tasks.

The IANTD expeditions

The first expedition took place in 2008. The initial task was to survey the wreck and take measurements, identify the signs and type of damage the vessel suffered when it sank, and assess the condition of the wreck. We accomplished all of our goals in that first expedition.

Afterwards, Ruberti evaluated the high importance of the wreck in Italian history. The *Scirè* had been honored with a Gold Medal for Military Valor for bravery during war missions. So, he decided to use archaeological methods to further study the sub's wreck site with the goal of generating a detailed 3D reconstruction.

The 2011 expedition's aim was to take

more detailed measurements in a survey, but during the making of the 3D model, we realized that some measurements were missing, and others were not precise enough. As a result, another expedition would be necessary in order to generate a correct 3D reconstruction of the wreck site.

In the expedition of 2015, our team was sponsored by the Italian Foreign Ministry, the Association of Italian Navy Special Forces and the Institute of Rescue Medicine. A few days before departure, the Explorer Flag n°211 arrived, and we had the honor of carrying the flag with us on the expedition.

The most difficult part of the wreck to measure and reproduce was the starboard bow, because this is where the depth charges and the gun shell hit the vessel. To accomplish the task, a detailed plan of measurements, pictures and video shooting was implemented. A set of detailed underwater slates with the spe-

cific part to be measured were appositely prepared. Israeli underwater archaeologist Galili assisted us in our work.

On the first day of the expedition, we visited the remains of WWII British defenses in Haifa. In the following days, we accomplished all of our planned dives and goals. During the last dive, two Israeli underwater photographers, Dan Ashkenazi and Shlomi Palnitsky, joined us.

The data collected is now being used to study damages from the sinking and in finally producing the 3D reconstruction, which is in process. Presentations and articles are planned in order to spread the knowledge we have acquired with our exploration and study of the wreck of the *Scirè*.

After the success of the previous expeditions in 2008, 2011 and 2015, IANTD conducted its fourth expedition to the wreck of the glorious submarine *Scirè* in 2017, in collaboration with the Leon Recanati Institute for Maritime Studies at

the University of Haifa. This expedition's goal was to carry out scientific surveys and analysis, and to train PhD students of underwater archeology at the University in mapping and survey techniques of important historical wrecks.

Diving the wreck

Accompanied by my dive buddy Alessandro, I began the descent into the blue, with excellent visibility and a pleasant current, which helped keep the water clear of a thin veil of plankton. In fact, as the silhouette of the *Scirè* appeared, I felt deep emotion, the moment I laid my eyes on the submarine tower.

After this poignant moment, Alessandro and I began to carry out the tasks assigned to us in the bow area, moving with the utmost attention and the usual caution because, as our surface's assistant had reported to us earlier, we soon found ourselves face-to-face with the heads of two torpedoes, which jutted out

SCIRÈ FACTS

- TYPE: Small cruising submarine
- CLASS: 600 – Adua series
- OWNERSHIP: Regia Marina
- SHIPYARD: OTO Muggiano (La Spezia)
- SETTING: 30 January 1937
- LAUNCH: 6 January 1938
- ENTRY INTO SERVICE: 25 April 1938
- DISPLACEMENT: 697,254 tons at the surface; 856,397 tons underwater
- LENGTH: 60.18m overall
- WIDTH: 6.45m
- DRAFT: 4.66m
- OPERATING DEPTH: 80m
- PROPULSION: two 1,400 hp Fiat diesel engines and two 800 hp Magneti Marelli electric motors

SPEED: 14 knots at the surface; 7.5 knots underwater

RANGE: emerging 2,200 nautical miles at 14 knots or 3,180 nautical miles at 10 knots; 7.5 nautical miles underwater at a speed of 7.5 knots or 74 nautical miles at 4 knots

CREW: 44 including six officers (table)

ARMAMENT: four 533mm torpedo tubes in the bow, two 533mm torpedo tubes in the stern, a 100/47 model 1935 cannon (152 rounds), two single 13.2mm Breda model 31 machine guns (3,000 rounds) and six torpedoes

from their respective launch tubes. From this point forward, the superstructure of the boat was no longer recognizable, but gave way to a mass of twisted metal sheets submerged in the sand, as well as a tangle of cables and metal scattered





A. DABALÀ / IANTD S.R.L.



A. DABALÀ / IANTD S.R.L.



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Diver inspecting an inert MK VI Israeli depth charge on the port side of the bow of the *Scirè* (top left); Divers on the bow of the wreck (top right); Author Cesare Balzi kitted up for a dive on the wreck of the *Scirè* (left)

all around. Thanks to the good visibility, I recognized the prow wheel—that is, the forward end of the keel of the *Scirè*.

From this point, we began taking measurements, writing with a pencil on forex tablets, the results that were obtained with the use of a measuring wheel. As I moved towards the center of the submarine, I noticed the major damage done to the hull—fatal blows inflicted mainly by depth bombs. Before reaching the tower, I saw on the right side, a section of the hull where metal sheets had been bent by shock waves and clear signs of compression of the resistant hull due to the explosion of one or more charges. Afterwards, we noticed a large gash, about seven meters long, in the vicinity of the officers' rooms, further devastated by cannon shots.

In the 1960s, workers of the Perrotta company, commissioned by the Ministry of

Defense, had removed part of the navigating hull, the external hull at this point, to recover parts, which are now preserved and exhibited in various Italian museums. The access hatches to the submarine, on the other hand, were sealed and welded in 1984 by divers of the Italian Navy, to prevent penetrations by adventurous divers.

The wreck today lies on the sea bottom, tilted to the left at about 25 to 30 degrees. This posture was also confirmed with the use of a plumb line, which was dropped to the sea floor from the top of the tower, positioned at the center of the wreck.

Before ending our preset bottom time, I had time to detect some more details to add to the digital reconstruction of the *Scirè*. These included the number of rings of chain that wrapped the sub's stern (left in 2002 by the American Sixth Fleet in an attempt to lift the submarine); the untouched resistant

hull at the stern where there were two torpedo launchers with their hold doors closed; a depth helm and the blades of the left propeller, which protruded from the sand. Finally, during reconnaissance in the surrounding area, I identified three unexploded depth charges in the immediate area of the submarine, on the left side of the wreck, which were probably some of the 16 charges launched by HMS *Islay*. ■

For more information, email: iantd@iantd.info or fabio.ruberti@fiscali.it. To view the table of contents of the work and the abstract, go to: academia.edu.

REFERENCE:
RUBERTI, F., (2020). THE SINKING OF THE ITALIAN SUBMARINE SCIRÈ, HISTORICAL AND UNDERWATER ANALYSIS, UNIVERSITY OF HAIFA, APRIL 2020.



A Fairey Barracuda Mk II carrying an 18-inch (46 cm) aerial torpedo

British WWII torpedo bomber found in Norwegian fjord

Norwegian divers have localised the wreck of a Fairey Barracuda—a British carrier-borne torpedo and dive bomber, which saw extensive service during WWII, most notably the large-scale attack upon the German battleship Tirpitz on 3 April 1944.

On 22 February 1945, nine Fairey Barracuda from 821 Naval Air Squadron are launched from the aircraft carrier HMS *Puncher* in the North Sea on a minelaying operation along the western coast of Norway, or more specifically Karmsundet, which is a narrow strait south of the coastal town of Haugesund. Due to navigational error, the planes made landfall farther south than planned, near the town of Stavanger, where they were met with heavy anti-aircraft artillery.

Two of the planes made their way north along Karmsundet, flying very low over the water. At Karmsundet, the narrow strait just south of

Haugesund, they took fire from all sides, and one of the planes was shot down some 500-600m south of Salhus narrows. According to eyewitnesses, one of the crew managed to free himself from the wreck and cried for help, but a nearby German vessel did not come to his rescue. The two other airmen perished with the plane, which sank to the bottom. The other Barracuda was also shot down and crashed into a barn nearby, killing all three airmen.

The wreck was located in the middle of Haugesund shipping channel by local divers Tore André Apeland, Roy Drange and Lene Herigstad, using an ROV, the Norwegian dive magazine *Dykking* reports. The search was initiated after Apeland caught an oil tank from the plane in one of his fish-ing pots in September.

Kystverket, the Norwegian coastal administration that is responsible for coastal navigation infrastructure, is said to consider moving shipping lanes such that diving on the only known accessible wreck of a Fairey Barracuda becomes a possibility. The wreck lies at a depth of 33m. ■ SOURCE: DYKKING



A three masted ship, similar to WA08, which sank in the Thames Estuary, Essex, in the mid-to-late 19th century, is docked at the busy Southampton Docks, with other sailing vessels visible in the background (image dated 1878).

Mystery shipwrecks protected

Two well-preserved but unidentified shipwrecks, known as “GAD23” off Goodwin Sands in Kent and “WA08” in the Thames Estuary in Essex, have been protected.

The two wooden cargo vessels, which were involved in day-to-day merchant trading in slate and coal by river and sea in England in the mid-to-late 19th century, have been protected by scheduling. This means that recreational divers can dive them, but their contents are protected by law and must remain in situ.

GAD23

The GAD23 is also known as the “Bowsprit” wreck because the long spar that runs out of the sailing ship’s bow is still visible. Ropes were once tied to it to support the ship’s foremast.

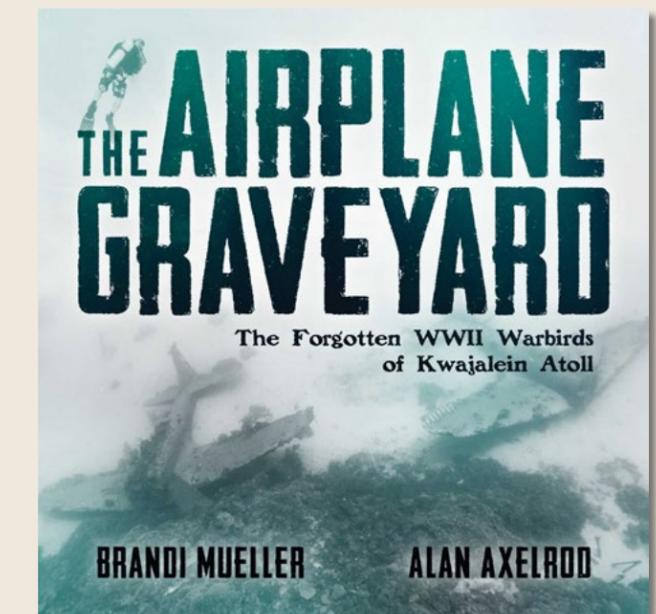
WA08

The mystery wreck WA08 discovered in the Thames Estuary in Essex is possibly the most intact post-1840 wooden cargo ship surviving in English waters. If the exact identity of the vessel could be established, it could shed more light on the Cornish slate trade post-1840.

Heritage Minister Nigel Huddleston said: “These shipwrecks serve to teach us about the legacy of Britain’s industrial past. I am pleased that these new protections will enable us to preserve them as we continue to learn more about the role they have played in our nation’s history.” ■ SOURCE: HISTORIC ENGLAND



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Edited by
Scott Bennett



Will vaccine passports enable the travel sector to reopen?

After almost a year of restrictions and lockdowns, stir-crazy holiday-makers are eager to get away. With vaccines now being administered and more on the way, travel is finally on the horizon. According to a recent report of the European Travel Commission (ETC), the number of European citizens planning to travel abroad during the spring of this year has marked a 20 percent increase compared to November 2020 figures.

In addition, an increasing number of countries have announced measures to drop quarantine restrictions for arriving visitors if they have received a Covid-19 vaccine. To confront verification issues, authorities in a number of countries plan to introduce “vaccine passports,” verifying that travellers have received the entire vaccine dosage and are safe to travel. However, vaccinations remain a tricky hurdle. Even in those countries that have commenced vaccinations, priority is given to high-risk groups along with health and essential workers.

However, the prospect of travel opens up many questions. With the situation fluid, it is hard to know whether planning a trip is even practical. While some countries are dropping quarantines, providing visitors can produce proof of vaccination, others are increasing restrictions or cancelling international flights altogether. Amid concerns about

new Covid variants, the UK government is now, under penalty of lengthy imprisonment, requiring arriving passengers from a number of countries to quarantine in selected hotels for up to ten days

Are tests trustworthy?

At the same time, some countries are giving assurances of Covid-free holidays to entice travellers. Yet, how can such assurances be guaranteed? Recently, Denmark imposed a ban on incoming flights from the United Arab Emirates due to suspicions that Covid-19 testing in Dubai may be unreliable. A statement from Danish transport minister Benny Engelbrecht said flights from the UAE would be suspended for five days “until it has been possible to investigate this issue to the bottom and ensure that the required negative tests are actual negative tests which have been taken properly.”

There are plenty of other potential consequences that many fail to consider. If their home coun-

tries have issued a stay-at-home order, travel or medical insurance would certainly be nullified. In the case of the Danish situation, many tourists were stranded in Dubai as a result, forcing them to seek another route home. A last-minute flight home would be costly, providing they could even get one at all, with many others in the same predicament.

Add additional nights at a hotel into the mix, and the expenses add up. While stay-at-home orders are not law, your home government is not in any way responsible to help, if you get stuck. Basically, you took the risk, you deal with the consequences.

Once the majority of the populace gets vaccinated and cases decrease, the situation will undoubtedly improve. Travel will finally resume, and normalcy will return. In the meantime, keeping abreast of the ever-changing circumstances can be a full-time job. ■

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Masks are now mandated on US vessels

Effective immediately, masks must be worn on all “public maritime vessels” in the United States. This mandate includes all commercial vessels used for dive charters or other dive-related activities.

Operators are required to use best efforts to make sure that any person on the vessel wears a mask when getting on, getting off and during travel. Best efforts include:

- “Boarding only those persons who wear masks.
- “Instructing persons that Federal law requires wearing a mask on the conveyance and failure to comply constitutes a violation of Federal law.
- “Monitoring persons on board the conveyance for anyone who is not wearing a mask and seeking compliance from such persons.
- “At the earliest opportunity, disembarking any person who refuses to comply. Providing persons with prominent and adequate notice to facilitate awareness and compliance of the requirement of this Order to wear a mask.
- “Best practices may include, if feasible, advanced notifications on digital platforms, such as on apps, websites, or email; posted signage in multiple languages with illustrations; printing the requirement on transit tickets; or other methods as appropriate.” ■ SOURCES: US CDC, US COAST GUARD

Gold Medal winner:
Survival, a photo capturing a butterflyfish feeding on spawning corals in Yakushima, Kagoshima

JNTO Underwater Photo Contest 2020 Winners

— Promoting Japan's Beauty & the Artistry of Diving in Japan

From October to November of 2020, the Japan National Tourism Organization (JNTO) held its second annual Japan Underwater Photo Contest, seeking photos taken by divers that showcase the undiscovered beauty and artistry of diving in Japan to the world.

From photos of species endemic to Japan to the unique views and one-of-a-kind colors found in Japanese waters, the photo contest received 765 submissions from 200 participants, ranging from hobbyists to professional photographers. Winners were carefully selected by judges Hideki Abe and Kazushige Horiguchi, both professional underwater photographers based in Japan, recognized worldwide for their incredible works.

The Gold Medal went to the photo entitled *Survival*, which captures a butterflyfish feeding on spawning corals, taken in Yakushima, Kagoshima Prefecture. The Silver Medal was given to *Floating*, a photograph capturing a majestic view of the moon jellyfish in Otomi, Fukui Prefecture. The Bronze Medal was awarded to *Daddy Giving Birth*, capturing the moment a seahorse gave birth to its young. (Please visit the JNTO photo contest website to see the photographers' names: www.japan.travel/diving/en/photo-contest2020/)



Silver Medal (right): *Floating*, a photograph capturing a majestic view of the moon jellyfish in Otomi, Fukui

Bronze Medal (below): *Daddy Giving Birth*, an image capturing the moment a seahorse gives birth to its young in Minamata



Winners

Macro Award (below): *Face to Face*, Minabe, Wakayama

Japan's sea life

Japan is home to many aquatic species, thanks to the range of water temperatures in its islands created by the combination of a cold subarctic ocean current and the warm current that flows from the south. The colliding currents and unique underwater terrain create an ideal environment for a wide array of marine life to thrive in its waters. The oceans of Japan are home to creatures that you cannot find in any other place in the world.

JNTO hopes that this showcase of the wonders of Japan's depths, viewable at www.japan.travel/diving/en/photo-contest2020/ will inspire viewers to someday come to see them up close and perhaps even to try their own hand at capturing them on camera. ■

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



feature



Jury Prize (above): Paradise and the City, Kinko Bay, Kagoshima



Jury Prize (right): Here I Go! Kushimoto, Wakayama



JAPAN DIVING

Dive into the Biodiversity Hot Spot

<https://www.japan.travel/diving/en/>

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feature



Wide Award
(above):
Yellow Dancer,
Hachijojima,
Tokyo

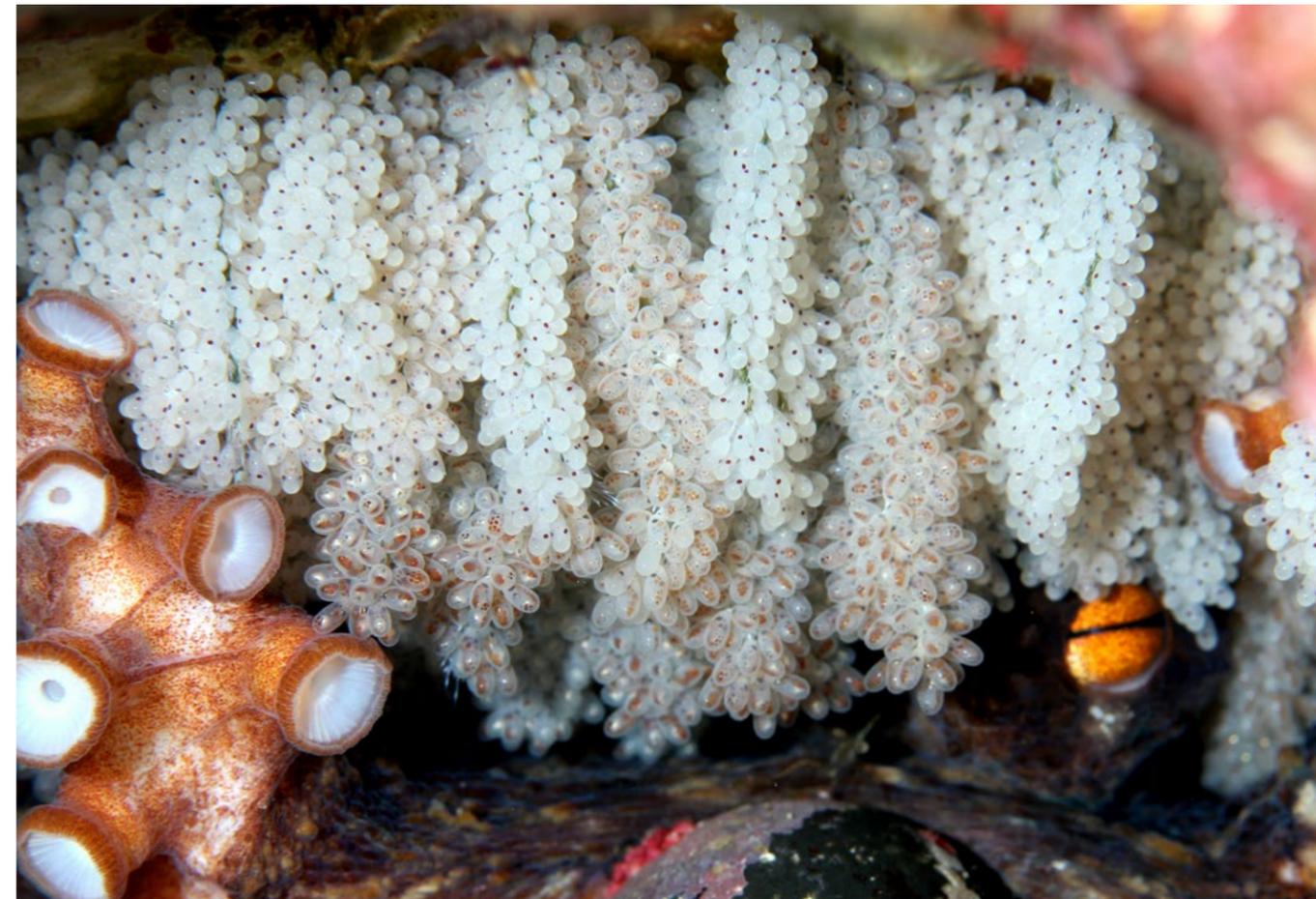


Winners

Japan Endemic
Award (left):
Girl Fight,
Omijima,
Yamaguchi

Nature Award
(below):
Mother's Eyes,
Omijima,
Yamaguchi

Japan Ocean
Award (right):
*The Kobudai's
Temple Visit*,
Tateyama,
Chiba





Honorable Mention
(left): *Dentist*,
Ishigakijima, Okinawa

Winners

Honorable Mention
(below): *Roar*,
Osezaki, Shizuoka



JNTO Award (above):
Curiosity, Mikurajima, Tokyo

Honorable Mention (left):
Lobster, Ogasawara, Tokyo

Honorable Mention (right):
Leaving the Nest,
Yakushima, Kagoshima



Honorable Mention (right):
Yellowstriped Butterfish in Ita,
Ita, Shizuoka

Honorable Mention (far right):
Only the Strong Survive,
Akajima, Okinawa



An aerial photograph of a tropical coastline. The water is a vibrant turquoise, transitioning to a deeper blue further out. Two large, dark volcanic rock formations stand prominently in the sea. In the foreground, a sandy beach is partially obscured by dark volcanic rocks. The sky is a clear, bright blue with a few wispy clouds.

Brazil's Fernando de Noronha

— *Hot Spot of the Atlantic*

Text and photos by
Pierre Constant



Bathers enjoy turquoise waters at Baía dos Porcos (above); Ghost crab at Praia do Boldró (right)

Five hundred and twenty-five kilometres from Recife on the northeastern coast of South America (or 350km from Natal as the crow flies), the minuscule specks of land of Fernando de Noronha are to Brazil what the Galapagos Islands are to Ecuador—but on the other side of the continent. In a way, the two archipelagoes are very similar, both of them are volcanic hot spots born out of fracture zones in the ocean, slightly south of the Equator and a prolific refuge for seabirds.

Laying 3°50'25" S and 32°24'38" W, the 21 islands that compose Fernando de Noronha's archipelago are much older though, with an estimated age of 30 million years. The hot spot is located on the South American Plate, which moves west-south-west at a rate of 45mm per year and in subduction under South America. Judging by the effect of the West Africa mantle plume, it is responsible for a series of volcanoes that extend west and away from Noronha, including the Rocas Atoll.

History

As the story goes, the archipelago was discovered in 1503 by the Portuguese expedition of Gonçalo Coelho, financed by Fernão de Noronha. It was credited to Amerigo Vespucci though,



an Italian member of the expedition, who made the first description of the islands. The French Capuchin monk Claude d'Abbeville visited in 1612 on his way to Brazil where a colony was to be founded. Abandoned, it was later occupied by the Dutch from 1629 to 1635, then fell under the French from

Pico do Meio beach (above); Red-footed booby (white variation) in flight over Baía dos Porcos (top center inset); Baía dos Porcos and Dois Irmãos islets (previous page)



Cactus in Noronha (above); Nossa Senhora dos Remédios Portuguese fort (left); Brown booby in flight (top left)

declared a Marine National Park. Tourism is nowadays the blood of the economy; Noronha has turned into a dream holiday island for wealthy Brazilians.

Fernando de Noronha became listed as a UNESCO World Heritage Site in 2001. It is now legally protected and managed by the Chico Mendes Institute for Biodiversity Conservation (ICMbio), an autonomous federal body attached to the Department of Environment. Also, part of the Master Plan, Atol das Rocas is administered separately as a biological reserve since 1979 and prohibited to visitors.

The management of Fernando de Noronha involves tourism, research, environmental education, protection and monitoring of biodiversity. A sustainable development plan was put in place for the Parque Nacional Marinho, with the help of the local population, in terms of ecotourism. Touristic infrastructure is strictly controlled, as well as tourism sites.

1705 to 1737.

It was finally taken over by the Portuguese in 1737. Consequently, several fortifications were built, including the fortress of Nossa Senhora dos Remédios. Fernando de Noronha would become a notorious prison for political prisoners.

Scientific expeditions such as Charles Darwin's on HMS *Beagle*, visited in 1832—before he landed in Galapagos three years later. The early 20th century saw Italian and

French settlements for commercial purposes and the laying of submarine cables.

Commercial flights of Aéropostale linked South America to Europe and Africa, with aviators Mermoz and St-Exupéry's historic runs. During WWII, Noronha became a US Air Force base and a strategic spot on the African war front. On continuation, the archipelago was administered by the Brazilian military from 1942 to 1988, when the islands were



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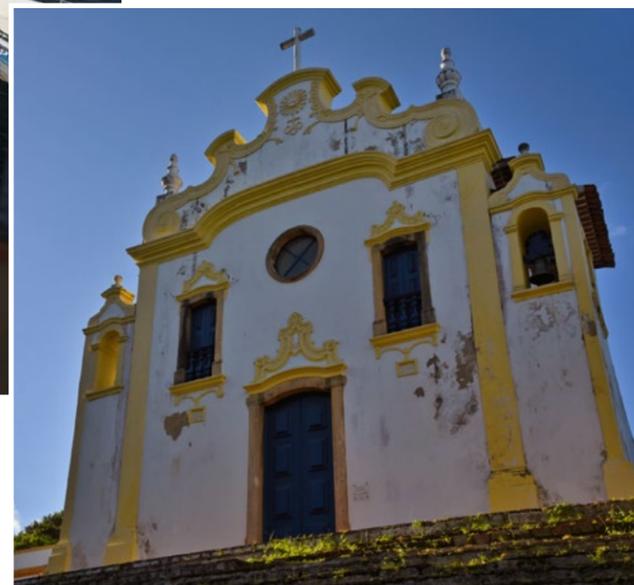


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The marina at Porto (above and left); Palacio São Miguel, Vila dos Remédios (top right); Church of Nossa Senhora dos Remédios (right); Noronha dove (far right)



Getting there

Operated by GOL, the flight from Recife takes only one hour, but there is a one-hour time difference

from the mainland. Upon arrival, one is expected to pay the TPA (Permanency Tax), which is R\$76 per night and increases the

longer you stay on the island. You are also asked for the Covid-19 negative PCR test, failing which you are subject to quarantine straightaway. It is also compulsory to approach the Fernando de Noronha Marine National Park office to pay for the entrance fee of R\$222 (foreigners), valid for ten days only, which you need to show when diving or visiting the national park sites.

Lodging and sites

Most of the lodging is done in pousadas, a version of a guesthouse with variable prices. Life and food are expensive on the island. Diving is obviously one of the most popular activities. There

are three dive centres operating out of Porto, on the northeastern coast, with dive shops located in Vila dos Remedios—the colonial Portuguese town, with historic buildings such as the Palácio de São Miguel and the church of Nossa Senhora dos Remedios. The imposing Fort of Nossa Senhora dos Remedios, on a bluff overlooking town, offer great views of Porto, Praia do Meio (Middle Beach) and the iconic thumb-shaped rock of Pico de Meio, a famous attraction at sunset.

Conditions

The islands are exposed to the South Equatorial Current flowing from east to west, as well as to

the southeastern trade winds. The “Inner Sea” on the northern coast has calm waters between April and November but experiences waves between December and March, when the northeastern trade winds become preponderant. Being exposed to the southeastern trade winds, the “Outer Sea” on the southern coast is usually rough but has clearer visibility.

Dive conditions are therefore influenced by the period of the year, and dive operations choose the sites accordingly. Water temperature is 28°C all year round, with a visibility ranging from 25m to 40m. With its 25 dive sites, Noronha is considered to have the best diving in Brazil.







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Yellowstripe or smallmouth grunts (top left); Marbled grouper (above); Black margate (left); Hawksbill sea turtle (far left); Coney grouper (below)

Underwater landscape

Being essentially volcanic basalts in black, the underwater landscape is rather dull, with boulders, ridges, and sometimes

canyons, swim-throughs and caves. In places of current, such as channels, sponges cover rocks, which turn very colourful in bright red tones. Otherwise, beds of

green algae and sea grapes are the norm.

Diving

Divers are picked up at their *pousada* by the dive truck, every morning at 7:15 a.m. Upon boarding the catamaran, face masks are compulsory. The dive briefing given by the guides covers facilities on board and the dive sites. Some of them do speak English or Spanish, although Brazilian is the norm. Dive sites are anything from 10 or 15 minutes to a maximum of 30 minutes away. During my stay in December, most

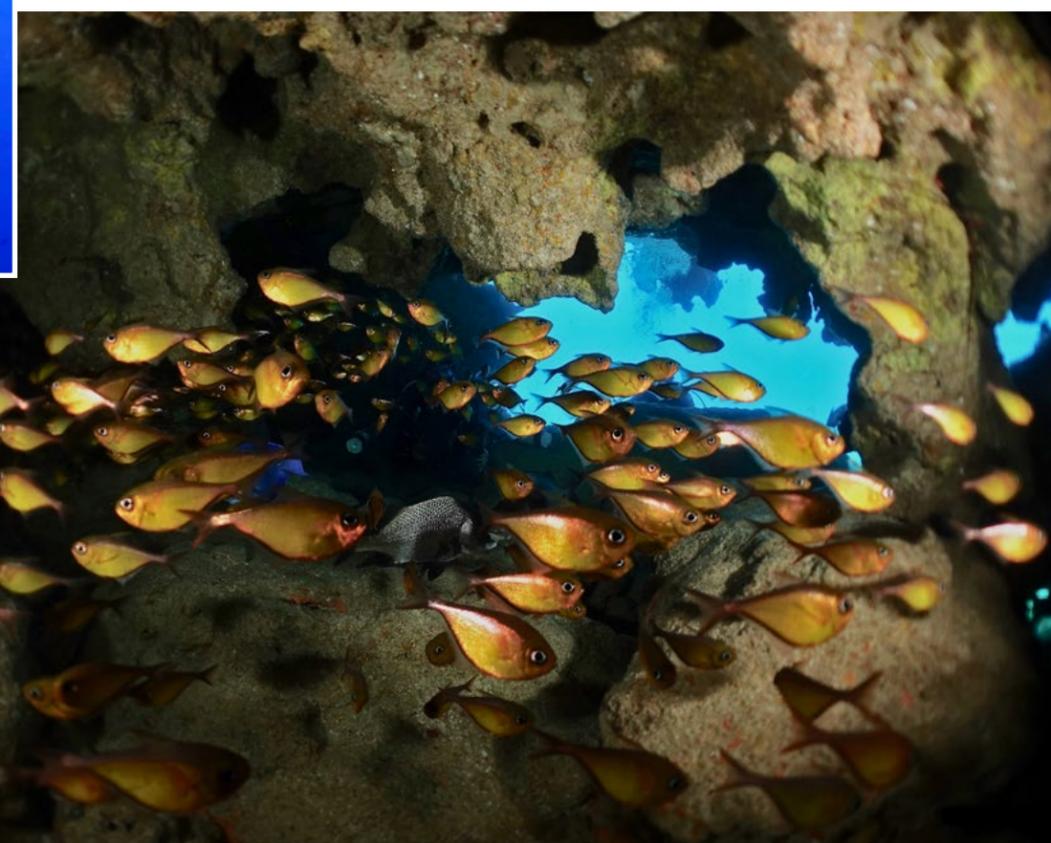
of the diving was done in the Inner Sea, i.e. on the northern coast between the eastern and western points of Noronha.

Cordilhieras. Cordilhieras, near the northeastern tip, is a submerged ridge with lots of algae. A common sight there is a small school of yellowstripe grunts (*Haemulon chrysargyreum*). Female Brazilian reef parrotfish (*Sparisoma amplum*) are green on the back and red on the belly, and adult males turn light blue

with a red crescent on the tail. Bermuda sea chubs (*Kyphosus sectatrix*), which are grey in colour, move in small schools, as do the black margate fish (*Anisotremus surinamensis*), which are large-bodied and silver, with a steeply angled head

and a black patch behind the gills. I came across a hawksbill sea turtle (*Eretmochelys imbricata*), which was absolutely tame and oblivious of us divers. The blue tang (*Acanthurus coeruleus*) is one of the rare species of surgeonfish around.





Ilha do Meio. Ilha do Meio (Middle Island) lies between Ilha Rata and Porto. The idea is to explore essentially caves and swim-throughs in shallow water, where you sneak in and out behind the dive guide, while the official underwater photographer of All Angle Images waits for you on the other side.



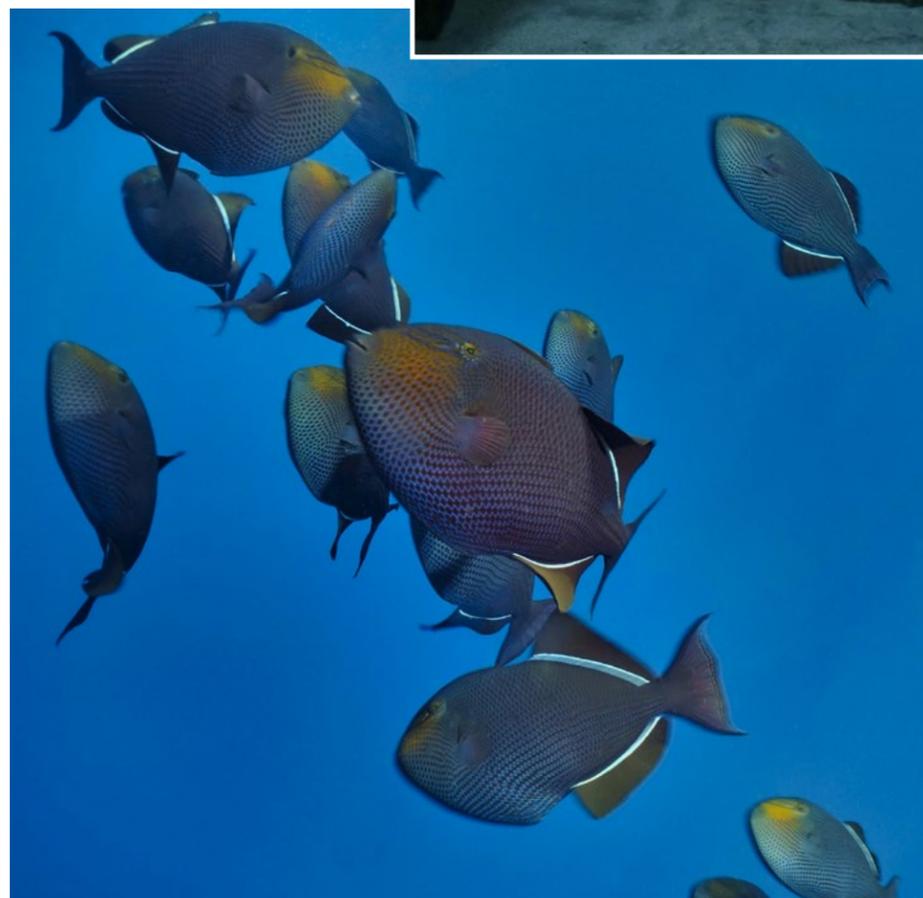
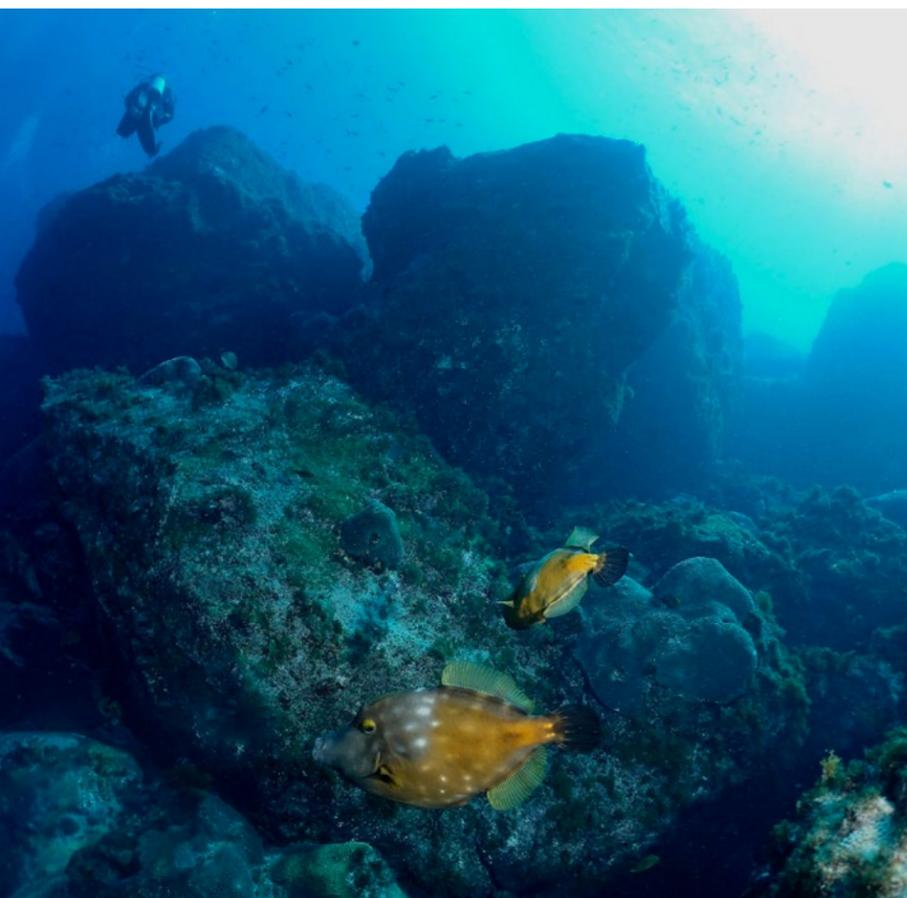
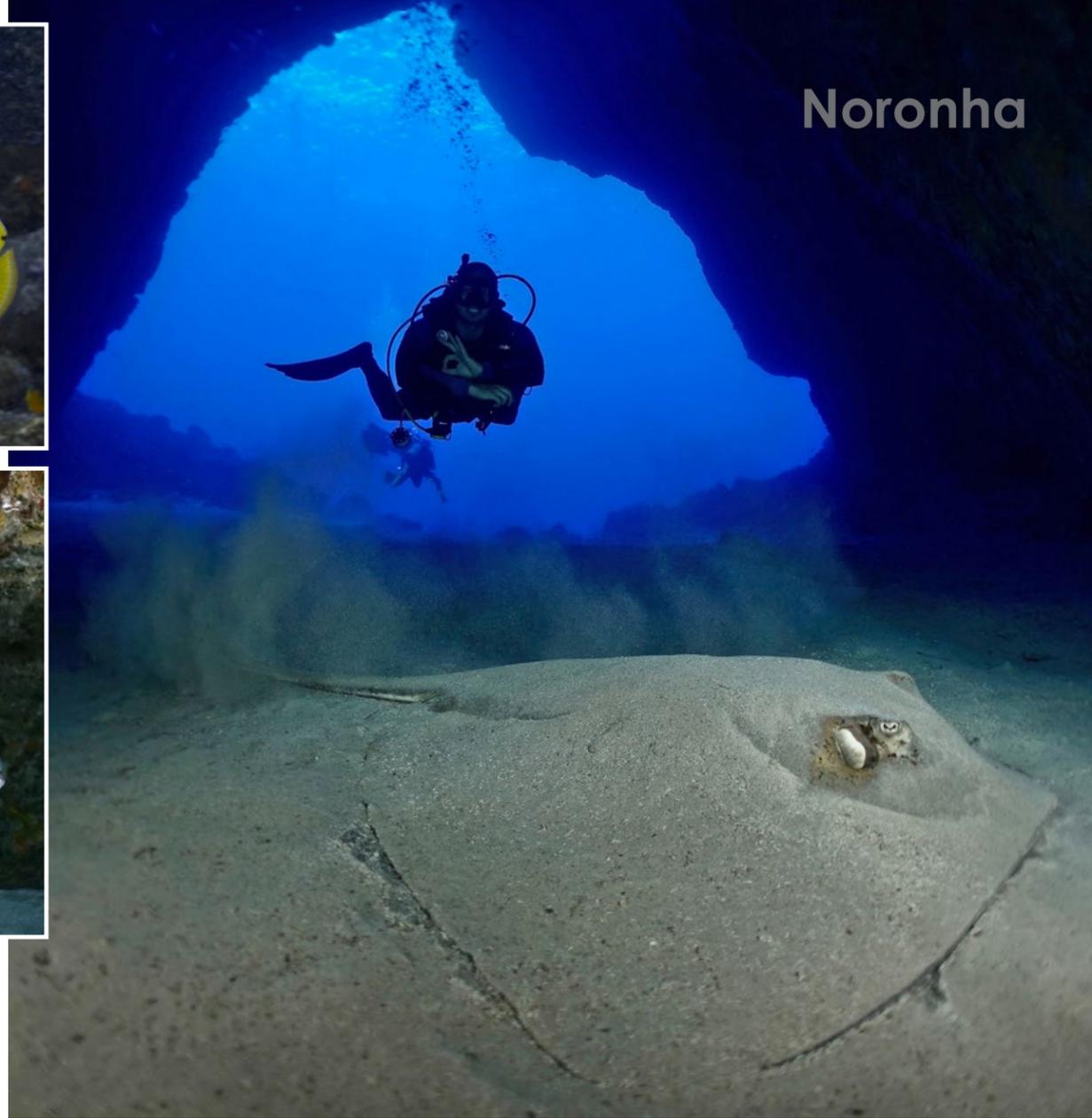
Brazilian divers are naturally delighted by such memories.

yellow bellies (*Cephalopholis fulva*), pairs of French angelfish (*Pomacanthus paru*) and blue tangs. As you emerge from the dive, you may find black noddies (*Anous minutus*) and tropicbirds (*Phaeton lepturus ascencionis*) happily flying about.

The caves are alive with copper-toned glassy sweepers (*Pempheris schomburgki*), small coney groupers with blue spots and

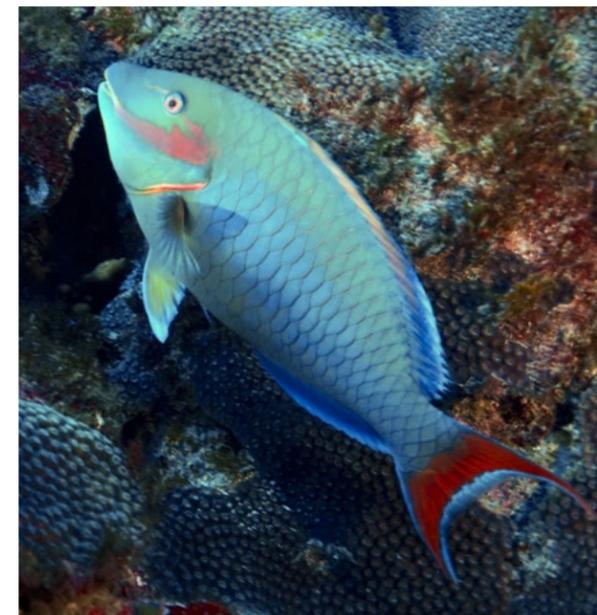
Photos of divers will be shown at the dive shop in the evening, and you can make your choice for R\$30 (5 Euros) a piece. Wannabe

THIS PAGE: Scenes from Ilha do Meio. Yellowstripe or smallmouth grunts in a cave (above and top right); Divers in a cave (top left); Honeycomb cowfish (top center); Scrawled filefish (center); Blue tang surgeonfish (bottom center); Glassy sweepers (far right)



Diver with southern stingray in Caverna da Sapata (above); Reef butterflyfish (top center)

Caverna da Sapata. At the western tip of the island, Ponta da Sapata is a nesting site for red-footed boobies (*Sula sula*). An underwater arch with a sandy bottom is a refuge for southern stingrays (*Dasyatis americana*), with pepper-coloured spikes on the back. Undisturbed by divers, they keep a Zen attitude. "Some turtles get lost in remote corners of the cave and end up as skeletons...", confirmed our divemaster Julio, who was happy to pose, all smiles, next to a skull. Good visibility favours great pictures. A miniwall on the outside of the arch revealed three scrawled filefish (*Aluterus scriptus*) and an orange-coloured whitespotted filefish (*Cantherhines macrocerus*).



Redtail parrotfish

Diver with whitespotted filefish (bottom left); School of black margates (top left); Black triggerfish (bottom center); French angelfish (center inset)





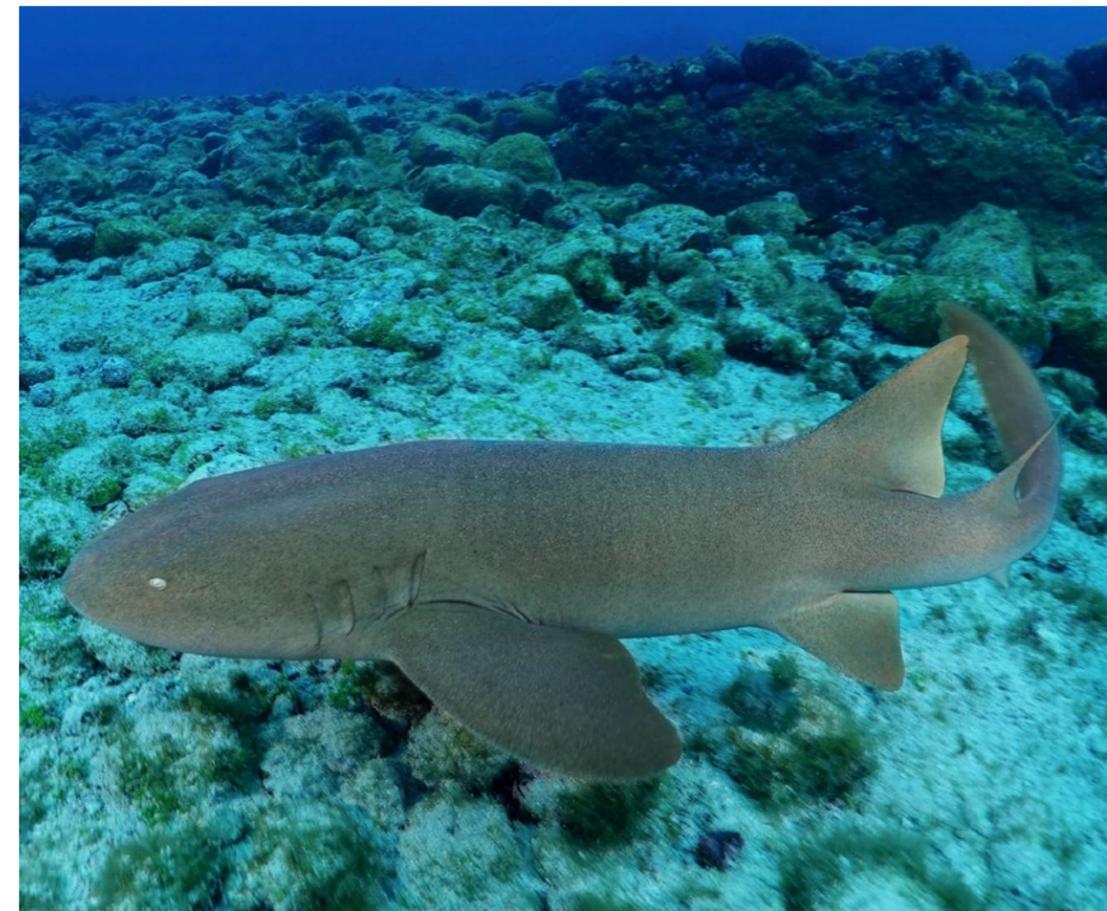
School of yellowstripe grunts (left) and Cape Verde spiny lobster (above) at Cagarras; Divers on rock formation (right) and black jack with school of grunts (below) at Cagarras; Diver with groovebelly or butter stingray in the channel at Buraco das Cabras (bottom left)



Cagarras. Cagarras, on the eastern side of Noronha, west of Rat Island, is a nesting site for masked boobies (*Sula dactylatra*). A deeper dive in the 32m zone, it is a spot for Cape Verde spiny lobsters (*Panulirus charlestoni*), black jacks (*Caranx lugubris*), French angelfish and the conspicuous Brazilian parrotfish.

Buraco das Cabras. Buraco das Cabras, at 20m in depth, is more productive, photographically speaking. A

wandering nurse shark (*Ginglymostoma cirratum*) created a stir, eventually approaching me without fear. Big stingrays covered in sand watched divers go by with a



Nurse shark at Buraco das Cabras (above); At Cagarras, a juvenile reef parrotfish, which is endemic to Brazil (left)



Divers on rocky pinnacle at Cabeço do Sapata (above); Hawksbill turtle grazing at Cabritos a Canal (top center); Bermuda sea chubs at Buraco das Cabras (center); Divers with old anchor encrusted with sponges at Buraco das Cabras (left); Divers with school of yellowstripe grunts at Cordilhiera a Pontal do Norte (far left)

serious look. Frantic displays by Brazilian “yuppie” divers made a show of exuberance with open arms, behind a turtle and in front of the official photographer.

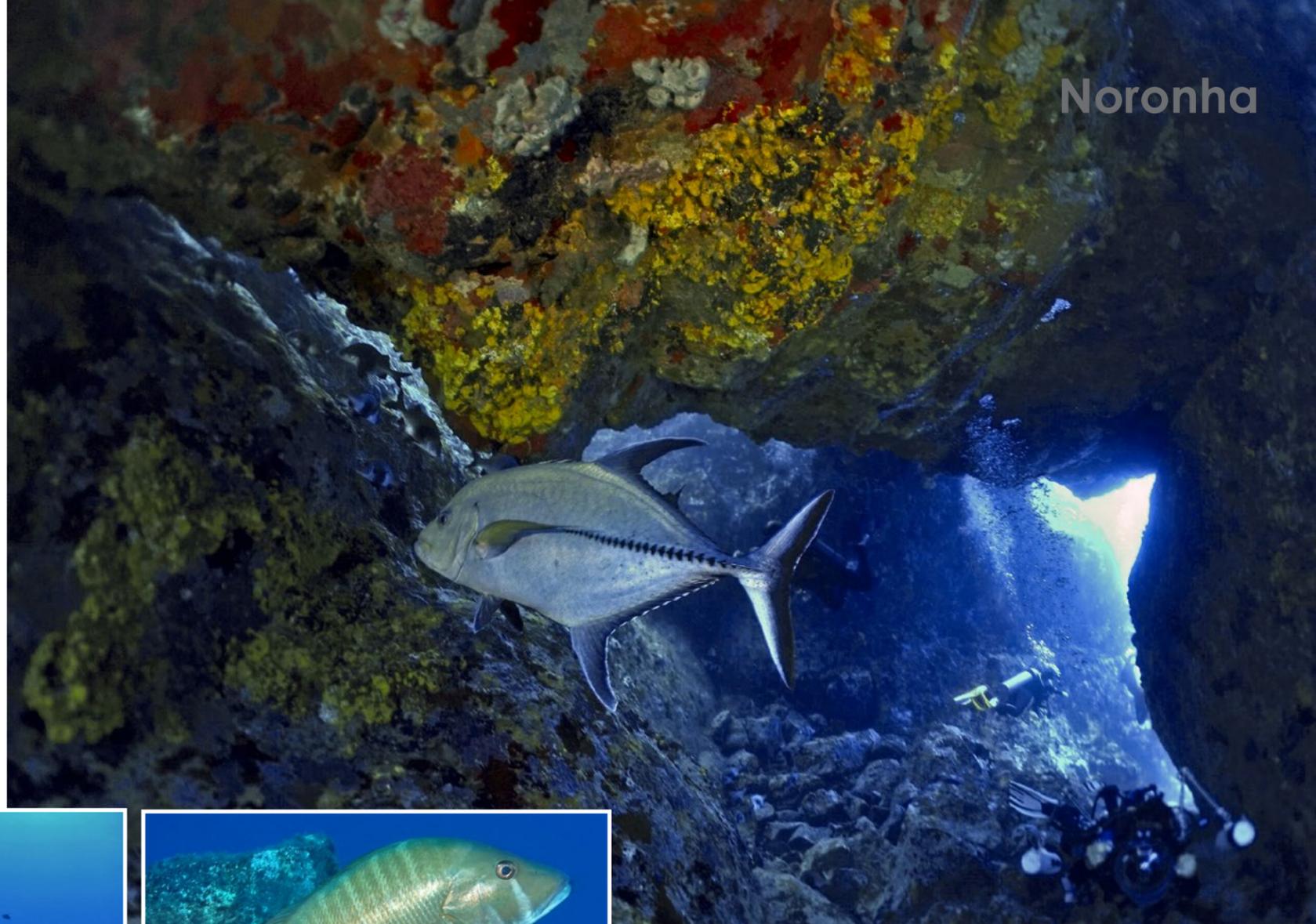
I had to wait patiently for my turn to approach the creature grazing between the rocks. An ocean triggerfish (*Canthidermis sufflamen*) sailed by, and

Bermuda sea chubs burst in small clouds. At the end of the dive inside the channel, between Ilha Rata and Ilha do Meio, a rather large, old Portuguese anchor, encrusted in red sponge,

caught our attention. Drifting with the current, I flew over a lovely peacock flounder (*Bothus lunatus*) carpeting a rounded rock.

Cabritos. Cabritos, on the northeastern tip, begins in Mar de Fora’s (Outer Sea) clear waters entering the channel. It is a colourful shallow site, with lots of mushroom-shaped rocks covered

with sponges. Black jacks and a school of doctorfish (*Acanthurus chirurgus*), horse-eye jacks (*Caranx latus*) with forked yellow tails and yellow goatfish (*Mulloidichthys martinicus*) complete the show. A



Brown or yellow-edge chromis (above) and sponges on reef (top left) at Cabeço da Sapata

second old anchor, even bigger than the first, left my mouth agape.

Cabeço da Sapata. My wish for the last day of diving was granted by dive guides Leo and Julio. On the western tip of the island, this offshore underwater pinnacle is usually subject to strong currents and water movements, but we experienced just a gentle swell. A large nurse shark passed by like a shadow over the white sandy bottom. A little school of horse-eye jacks swirled by.



Dog snappers (*Lutjanus jocu*), which were silver in colour with bars on the back, drifted like peaceful Zeppelins. Clouds of yellow-edge chromis (*Chromis multilineata*) swayed with the current over the pinnacle and schools of black triggerfish (*Melichthys niger*) hovered in the blue.



Dog snapper at Cabeço da Sapata (above); Rocky outcrop in a sea of sand at Trinta Reis (left)

Trinta Reis. Trinta Reis, in the Mar de Fora, is located in the middle of the southern coast, in-between emerging rock islets. The ocean was choppy as expected, but underwater it was all calm and serene.

The white sandy bottom is carved by ripple marks over a vast expanse, which provide the best photographic effect. We cruised into a swim-through, entering a canyon with southern stingrays and black jacks. Exiting out of it, I witnessed a Caribbean reef shark (*Carcharhinus perezii*)



Caribbean reef shark cruising over sandy bottom (above) and black jack in swim-through (top right) at Trinta Reis



Masked booby in Sueste Bay (above); Brown booby colony at Caieiras Beach (top right); The mocó, or rock cavy, of the Capivara family (right) and the teju, a rat-hunting lizard (far right), were both introduced to Noronha; Black noddi at Praia do Meio (left); Red-footed booby on a tree at Baía dos Porcos (far left)



wandering majestically over a vast expanse of white sand. It had an atmospheric environment, with a lot of light, which made one forget that once upon a time Fernando de Noronha was a place of extensive artisanal shark fishing, between 1992 and 1998. Species targeted included the dusky shark (*Carcharhinus obscurus*), Caribbean reef shark, silky shark

(*Carcharhinus falciformis*), lemon shark (*Negaprion brevirostris*), nurse shark, tiger shark and hammerhead shark—a sad history for these islands.

Wildlife

Wildlife on oceanic islands is extremely limited; mammals are virtually nonexistent in Noronha, with the exception of rats and the mocó. This chestnut-coloured

rodent, which resembles a small capivara, was introduced by the early settlers and meant for food. The black and white tegu, a lizard (*Tupinambis merianae*) found primarily in the forest, was introduced from Brazil's northeast in the 1950s to take care of rats. It is about 40cm long with a pink forked tongue, like a monitor lizard. Unfortunately, it also attacks local birds and has proven to be an unwanted predator on the island.

When Charles Darwin went ashore on 20 February 1832 (three years before he

visited Galapagos), he marvelled at the lush tropical forest with magnolias, laurel trees adorned with delicate flowers, and trees bearing fruits. Sadly, these original forests no longer exist, since Noronha became a penal colony. By the end of the 19th century, the island was almost completely deforested. The formal prison island lasted until 1957. A slow recovery began in 1988, when Fernando de Noronha became a Marine National Park.

Seabirds seem to be totally at home on the islands. Colonies of red-footed boobies, in both the coffee-coloured and the morpho-blanco varieties, are found nesting in trees on the extreme end points of Noronha. Brown boobies (*Sula leucogaster*) are seen fishing and diving along the beaches of the northern coast. Masked boobies (*Sula dactylatra*),



Sancho Beach (above); Red sea crab at Caieiras Beach on the eastern coast (left); Traditional "buggy" of Noronha (top center); Lunch at Mergulhão in Porto (right); Tropicbird (top right); Pair of white terns at Capom Açú trail (far right)



reserve of Atol das Rocas (137km west of Noronha), which was created in 1979 and is off limits to visitors, two main projects come into view. The Tamar Project for the conservation of marine turtles deals with five species known to visit the islands: the green (*Chelonia mydas*), hawksbill, loggerhead (*Caretta caretta*), olive ridley (*Lepidochelys olivacea*) and leatherback (*Dermochelys coriacea*) sea turtles. However, only the first two are commonly seen in the waters of Noronha.

The other project concerns the spinner dolphin (*Stenella longirostris*), which has a resident population in Baía dos Golfinhos, a secluded bay to the northwest of the island. A viewpoint is accessible to visitors who come early in the morning to watch the dolphins porpoising and playing in

the bay. Scheduled guided walks are offered by the park office.

Topside excursions

A number of *trilhas* (trails) are available for the independent visitor to the Marine National Park. Some of them cannot be undertaken freely and require advance booking, since they are led at specific times by a licenced guide of ICMBio. Most of these trails lead to beaches or viewpoints of interest and are anything from 15 minutes to up to three hours long.

A number of agencies also offer private tours with their own transportation, or even cruises for snorkelling or watching dolphins. Well-to-do Brazilians often choose to hire flashy colourful "buggies" for the day, sharing

them with friends, which gives them autonomy and a happy-go-lucky feeling, at a hefty cost though of R\$300 to 350 per day (50 to 60 Euros).

However, for the independent-minded traveller on a budget, it is possible to catch the free *Coletivo* (omnibus), which crosses the island from northeast (Porto) to southwest (Sueste) along BR-363. It runs back and forth all day long, providing access to the trail heads of all the trails and exotic beaches. Fernando de Noronha is truly a Brazilian experience, where the foreigner is most welcome, but certainly an oddity!

Towards the end of my stay, I passed by a house with a colourful signboard on the entrance gate. "Sorria, voce esta na Paraiso," it said, which means: "Smile, you are in paradise."

They call it paradise for sure, but paradise is indeed in the eye of the beholder. ■

With a background in biology and geology, French author, cave diver, naturalist guide and tour operator Pierre Constant is a widely published photojournalist and underwater photographer. For more information, please visit: calaolifestyle.com.

Conservation

Conservation projects are managed by the ICMBio. Besides the biological



Deep South Atolls

— *Beyond the Southern Hemisphere of the Maldives*

Text by Jordi Chias
Photos by Rafa Fernande





We were in Addu, the second largest “city” in the Maldives and capital of the southernmost atoll. Located 45 miles below the equator, and 540km south of Malé, this is the most remote of the 26 atolls that, scattered along almost 900km of the Indian Ocean, make up the archipelago of the Maldives. This piece of land, with a very unique history, was the starting point for our ship, the *Maldives Blue Force One*, on the route through the best Maldivian reefs in the Southern Hemisphere.

We started our trip by exploring the finest dive spots in this atoll. One of the most accessible was the wreck of the *British Loyalty*. This British navy ship was torpedoed in March 1944 by the German submarine U-183. The ship, dedicated to fuel transport, suffered extensive damage but did not sink. It was partially repaired and destined to function as a floating “warehouse.”

Finally, in 1946, it was sunk at its current location, just off Hithadhoo Island, and has become a very popular dive. The history of this shipwreck is not a coincidence since this atoll was a secret British air base in World War II, which is why it has some important infrastructure despite its remote location.

Diving the wreck was generally easy, as there was usually no current and its

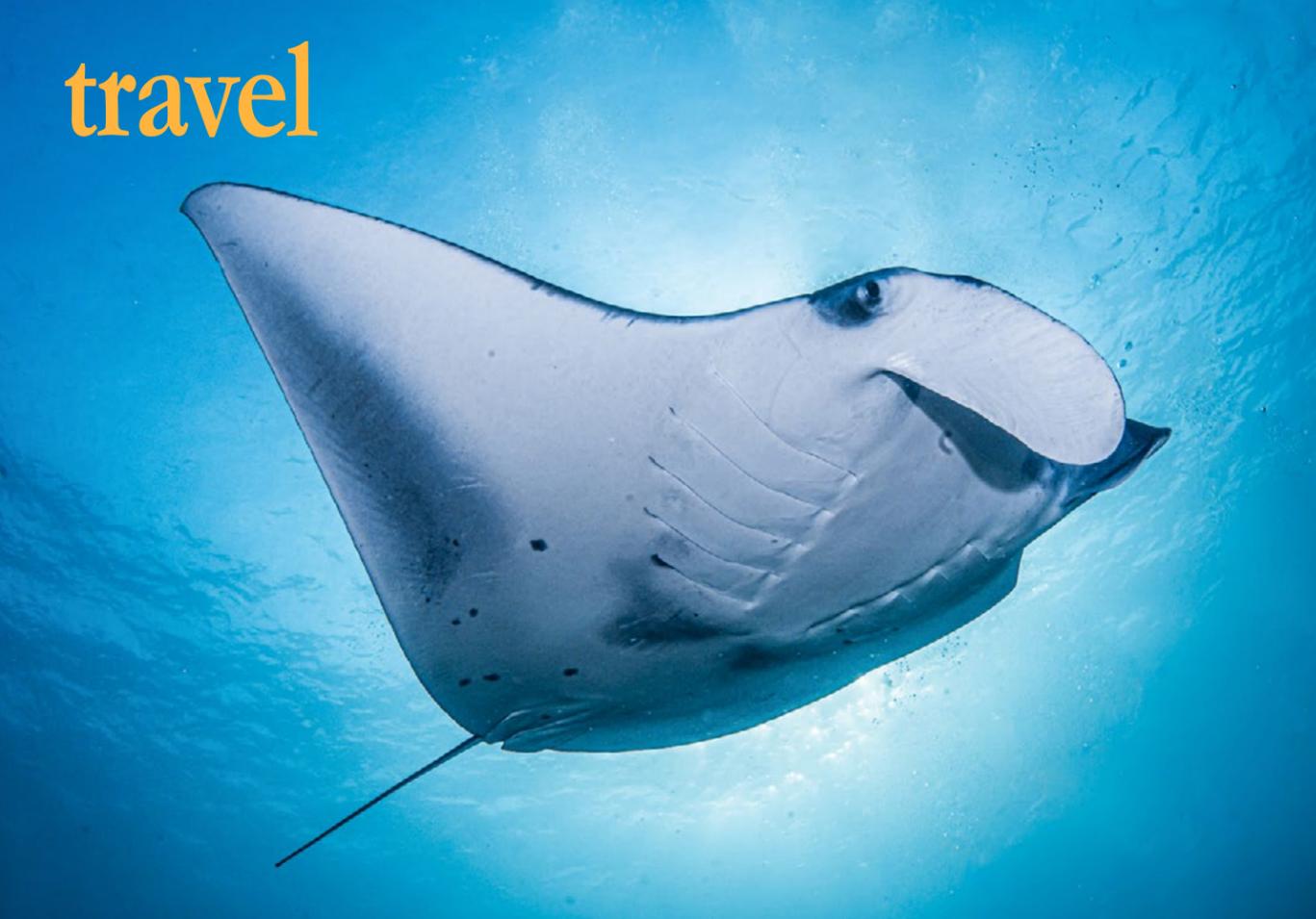
state of conservation was very good. The ship lay on the sandy bottom on its starboard side and was heavily colonized with hard corals. Large black coral trees could be found at the stern, below the propeller. It was also in this area where we found the highest concentration of fish. This wreck was an entertaining dive, an ideal way to start off our dive cruise.

Mudakan: A manta point

Another essential dive in Addu was Mudakan, one of the best-known manta cleaning stations in the area. We could sometimes encounter strong current here, so it was important to descend quickly to avoid passing over the coral head where the manta rays congregated.

Once we reached a depth of 15m, we let ourselves drift, always staying togeth-

Diver with whale shark in the Maldives (above); Pair of manta rays at Mudakan (top left); Snorkeler with whale shark covered in remora fish (previous page)



Maldives Blue Force One liveaboard, with dhoni attached, in the Maldives (above); Manta ray at Mudakan (top left)



Diver with huge school of jack fish at Vaadhoo (above)

er as a group, letting the current push us swiftly along the reef. Visibility was good, and after a brief drift, we spotted a group of eight to ten mantas on our horizon, swimming over a small coral bommie rising between the reef and the sand.

Following the instructions of the pre-dive briefing, we positioned ourselves around the cleaning station, using reef hooks to avoid damaging the coral and always staying a reasonable distance away so as not to interfere with the behavior of the mantas. One by one, everyone in our group found their place.

For the manta rays, this ritual was a daily task, but for us, it was an amazing spectacle. In a kind of perfectly orchestrated choreography, each manta ray passed through a specific point of the station, stopped, unfolded its head lobes and opened up its mouth completely. At that moment, dozens of tiny wrasses pounced on the manta in a stubborn cleaning

task. With their tiny mouths, they tore off dead tissue, cleaned wounds and plucked small parasites from the manta's skin. From time to time, one of them would overdo it and bite too much off. Then the manta, in a kind of "groan," would expel them abruptly, as if it had sneezed. Meanwhile, the rest of the mantas waited patiently for their turn, lining up and holding their positions against the current.

We were 22m deep, and after almost 30 minutes, the alarms of our computers began to warn us that it was time to ascend if we wanted to avoid exceeding our no-decompression limit. As we left the protection of the reef, the current expelled us from this privileged vantage point. The image of the mantas on the cleaning station faded in seconds.

After a brief safety stop, we returned to the surface. Gathered around the surface marker buoy (SMB) of our dive guide, our faces reflected the satisfaction of the expe-

rience we had just shared. In a few seconds, the dhoni came to pick us up and take us back to the ship where breakfast awaited—a great way to start the day. The dive in Mudakan was so good that no one minded repeating it before leaving Addu to head north.

The rules of the Great South

Addu Atoll is so far south that the effects of the monsoon are much less influential here than in the Northern Hemisphere atolls, where everything is ruled by the two main seasons. The presence of large pelagic species such as tuna, whale sharks and the emblematic mantas is closely linked to the winds and currents of the monsoon.

In the Southern Hemisphere atolls, this is slightly different. Recent studies reveal that at the few "manta points" that are known in the southern atolls, the mantas, although to a lesser extent, stay put—that is, they do



Divers with tiger shark at Fuvahmulah Island (above); Deep south atolls of the Maldives (top right)

not make large migrations like their relatives in the north, preferring to congregate in the eastern or western atolls “cleaning stations,” depending on the time of the monsoon.

In these southern atolls, any encounter is possible, and the dive sites are not crowded, but the best season does not usually last more than two months, from February to March. It is in these two months that the most favorable conditions occur; the predominant current is from the east, bringing clearer water to the channels.

Fuvahmulah: A different and unique island

North of Addu was the small town of Hulhumeedhoo, from where we set sail for Fuvahmulah. This island was perhaps the most unique of all in the Maldives. It was an island that did not

have the characteristic morphology of the atolls but looked like a rocky island. Instead of the typical lagoon, this island had two small freshwater lakes. In addition, some of the few remaining Buddhist vestiges of the entire archipelago were found here—remains that Islamization was responsible for reconverting.

To the south of the island, a coral platform stretched for several kilometers, making it one of the best places in the Great South to have exceptional encounters. There, one could see large groups of gray reef sharks, silvertip sharks, thresher sharks, schools of hammerhead sharks and occasionally some giant sunfish. In this area, the reef was just splendid, with some very exuberant acropores.

In the past few years, a dive center on the island has been organizing feeding dives and some tiger sharks

have appeared. In the pre-dive briefing, our dive guides explained that we would not take part in these feeding activities as it modified the behavior of the animals and could lead to safety concerns.

After a detailed explanation of the dive, we immersed ourselves in the vicinity of the tiger sharks, and we spotted two large specimens, which approached us calmly, without the lure of bait. Measuring more than three meters in length, they were spectacular sharks and very rare to see in other areas of the Maldives.

Walls of sharks and sleepless nights

With our minds loaded up with good memories, we continued our journey north. Halfway to the next atoll, we crossed the imaginary line of the equator. A few hours later, we arrived



Silvertip sharks patrol the reefs at Fuvahmulah Island. Other pelagic species that can be encountered here include gray reef sharks, thresher sharks, hammerhead sharks and sometimes even giant sunfish.



at Vaadhoo—a small island south of Huvadhu. Huvadhu is considered (with some controversy) to be the largest atoll in the Maldives, better known as Gaafu Alifu and Gaafu Huvadhu—the two districts into which it is divided.

We spent several days at Gaafu and had some of the best dives of the trip here. The dives were done on very steep drop-offs, very similar to one another, where the main attraction was the great schools of gray reef sharks. Often, if the current was strong, we found veritable walls of sharks, which remained immobile, a few meters from us, besting the current without apparent effort. In addition to the gray reef sharks, large schools of jack fish, small whitetip sharks and dog-tooth tuna completed the scene.

In this atoll, at night, we enjoyed one of the most incredible moments of the cruise. Dive boat crews have learned from local fishermen that placing large



Gray reef shark at Gaafu (above); A turquoise lagoon in one of the deep south atolls (top right); Wall of silvertip sharks at Gaafu (top left); Tiger shark at Fuvahmulah Island (left)



spotlights on the stern of their boats attracts large amounts of plankton, which in turn is a lure for large plankton feeders such as whale sharks, mantas and mobula rays.

As soon as it got dark, especially if there was no moon, one just had to wait a few minutes for large clouds of tiny crustaceans and fish larvae to accumulate under the powerful lights. Sometimes, the action would kick off well into the early hours of the morning, when several whale sharks would hang upright under the lights, with their massive jaws wide open, to gobble up as much food as possible.

This was the time to enter the water equipped with a mask, snorkel and fins to swim with the largest fish in the

ocean. It was truly a unique experience that was well worth losing a few hours of sleep.

For decades, the Maldivian atolls of the Southern Hemisphere have been largely ignored by tourism, and particularly by divers. Now, they are offered to us as an alternative full of surprises, with dive sites far away from the crowds of other places, dives that exude adventure and generate great emotions. Without a doubt, this is another way to experience the Maldives.

Travel info

Maldives Blue Force One was the ship on which we made the cruise. Measuring 42m in length, it has 11 spacious and luxurious cabins and suites, as

well as two outdoor jacuzzis. It has won awards in 2014 and 2018 for being the best-built boat in the entire archipelago. This liveaboard, in addition to its extraordinary team of guides, offers greater space, excellent comfort and great service for a price very similar to that of more basic boats.

Season

Maldives Blue Force One runs weekly routes all year round with guaranteed departures every Saturday. The Southern Hemisphere route lasts six weeks, from February to March, with an additional week at the beginning and another at the end to go down to the Southern Hemisphere or return to Malé. The one-week routes in the

THIS PAGE: At night at Gaafu, whale sharks fed on the fish larvae and tiny crustaceans that accumulated under the spotlights of the dive boat's stern.





Snorkelers can swim with whale sharks at Gaafu (above); Guests can enjoy a barbecue on a desert island (top right); Shark under the dhoni (right)

Southern Hemisphere depart from Addu Atoll and end at Gaafu Atoll. In the following week, the route is done in the opposite direction.

Documents

A valid passport with a minimum validity of six months is required. To ensure the safety of all, the Maldives Health Protection Agency (HPA) has made it a mandatory requirement for all tourists arriving in the Maldives to have a health

document in English, confirming that he or she has had a PCR test for Covid-19 with a negative result, which was carried out within a maximum of 96 hours prior to departure to the Maldives.

Currency

The official currency in the country is the Maldivian Rufiyaa, but payments on board are made with US Dollars and Euros. Payment by credit card is also possible.

How to get here

There are several companies that have flights to the Maldives: Qatar, Emirates, Etihad, Turkish, etc. At the same airport in Malé, one must take a domestic flight to Gan or Kooddoo, depending on where the cruise begins.

What to see and do

During the cruise, the liveaboard will visit a few islands so guests can learn about the local culture. There is also a barbe-

cue on a desert island towards the end of the cruise, featuring various dishes of the local cuisine. ■

For more information, please visit:

blueforcefleet.com or email: **info@blueforcefleet.com**. Find last minute offers at: **blueforcefleet.com/offers/last-minute-offers**. See the video: **[youtube.com/watch?v=MVzpTf7SsSE&t=38s](https://www.youtube.com/watch?v=MVzpTf7SsSE&t=38s)**



Adventure & Archaeology

A Modern Expedition

Underwater archaeologist working on a site of amphorae on the shipwreck of the *Mazotos*, in Cyprus

Text by Christopher Drew
Photos by Christopher Drew,
Maureen Langevin and
Raymond LeFrense

On opposite sides of the planet from each another, two historic shipwrecks sit in a constant state of change. Both bear historical witness to the story of their day, yet they are very different: One is a Mediterranean cargo vessel from over 2,300 years ago, the other a Norwegian tanker that sank off the coast of New Jersey in 1964. Although they differ in nearly every way, the one key thing they share today is how divers and researchers across the globe uncover and honor their stories: the intersection of mission, art, skills and technology in a modern expedition.

Well, what exactly is a modern expedition? What does it entail, what is it like, who are the researchers and how is it shared with the public as the results are interpreted and the conclusions promoted? And most importantly, *if one were interested*, what are the best immediate steps and training to take to join in on the fun?

CHRISTOPHER DREW



CHRISTOPHER DREW

A modern expedition, just like any before, starts with the mission. This mission is born from the intersection of a historical narrative or scientific demand, along with the modern contextual interpretation. In short—what story are we trying to tell, and how is it important? This story drives the mission objective and helps us

create the scientific questions to answer. This mission is delivered and narrated by art, the second part of a modern expedition. How do we tell the story? Is this story formalized History, or raw, unformalized personal history? When the gear is dry and the video uploading, what steps do we take to drive the narrative



CHRISTOPHER DREW

and engage our audience, and what is their reaction?

The third component of a modern expedition are the skills needed of the crew. This includes the obvious diving skills as well as the topside research phase, technical skills and skills when engaging with the public.

Last, but certainly not least, is technology. We use tech not for the sake of tech, but to drive the art, the mission, and in some cases, to help guard the safety of the dive team within their dive plan.

Mission, Art, Skills, Technology —MAST

When applied holistically, MAST, just like the mast of a ship, allows us to propel the mission, look far out to engage, deploy our skills and protect our teams. Let's look at a few case studies.

Amphorae: Art and technology

For our first example, lifted from the seabed is a single amphora. These vessels are typically used to carry bulk wine, olives, grain and other such goods. The word "amphora" essentially translates to "carry on both sides." Focusing solely on the combination of art and technol-

ogy first, we can examine amphorae to unlock some secrets.

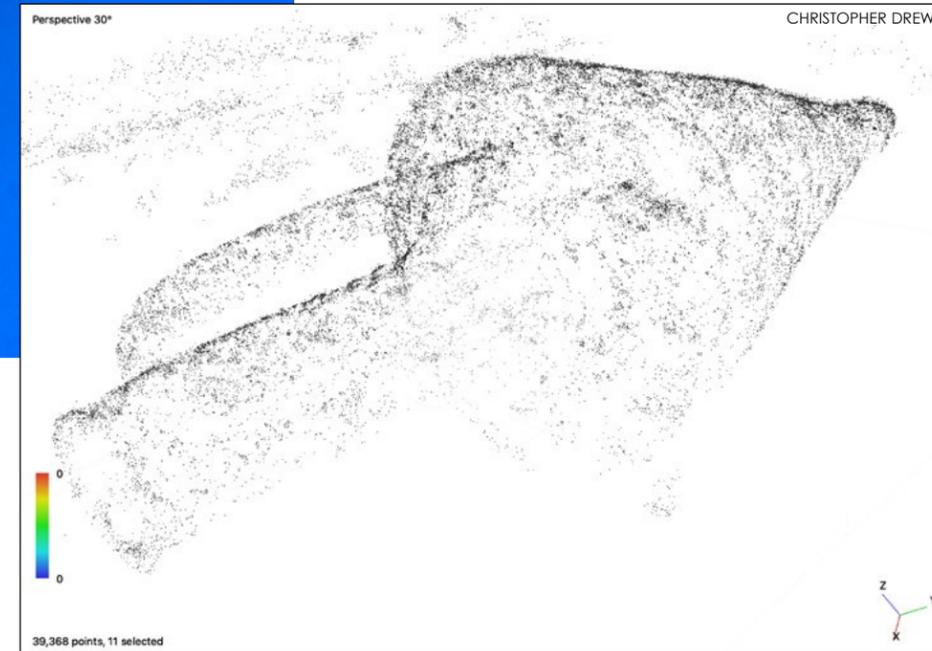
What if, instead of spending several hours sketching just one artifact and taking dimensions with calipers, we could instead spend five minutes taking pictures from different sides, storing those images on a site-server or even uploading them to a datashare, and then have a team of local and global experts model, archive and even publish each artifact? What if these dimensionally accurate scaled 3D models could be stored and shared indefinitely, allowing for effortless review years from now by the next generation of researchers?

Yup. I am talking about *photogrammetry*. This process allows us to use special software and a bit of math to create an accurate 3D model in just a couple of hours. For a single artifact, the researcher takes a series of photos from predetermined angles and coverage, often with a plain background.

The next step is a computer analysis

Archaeology

A single amphora is lifted from the seabed (far left); A series of photos of the amphora is taken for photogrammetry of the artifact (left); A point cloud in 3D space is created through computer analysis of the photos (below)

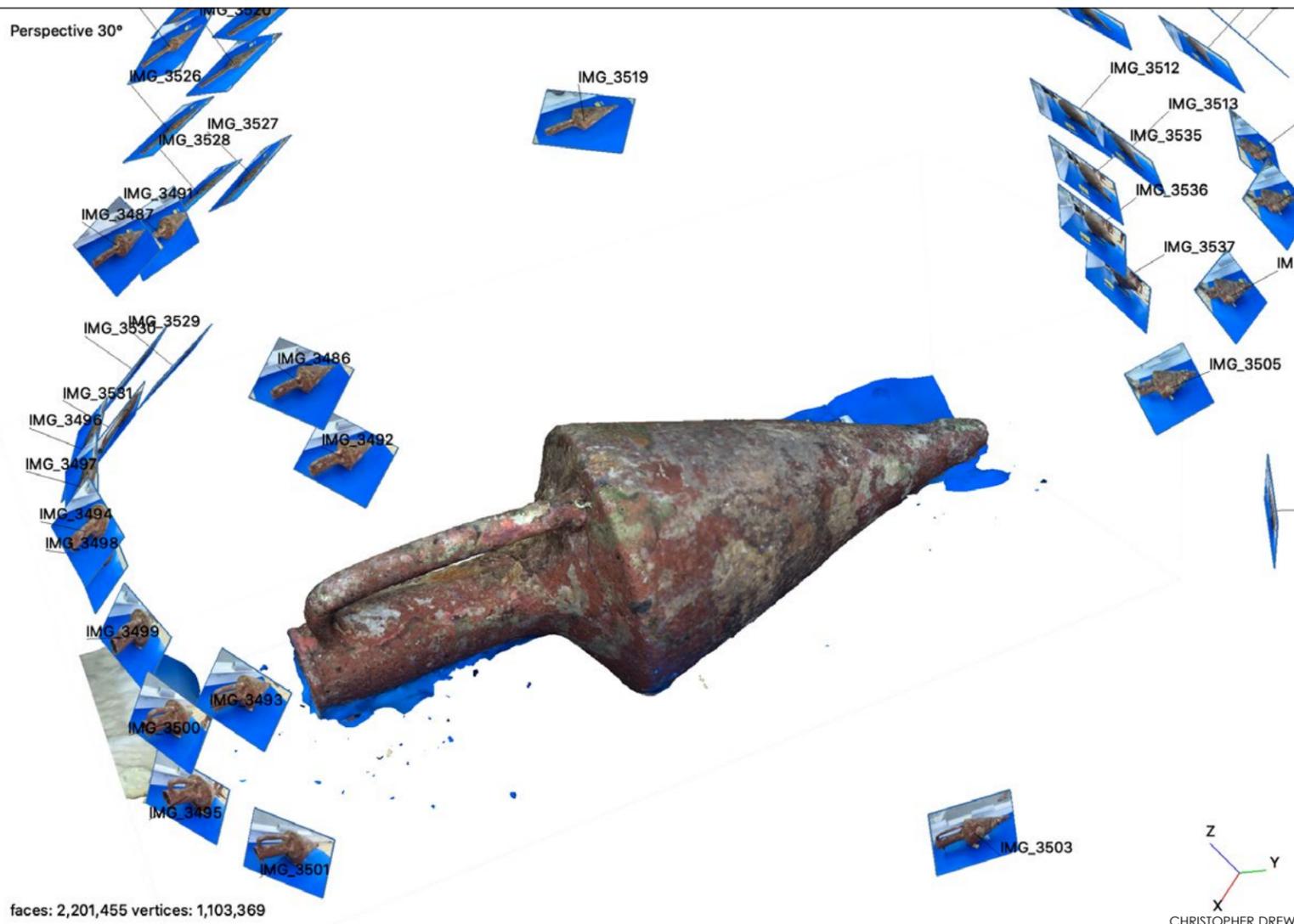


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of the photos, using calculated stereoscopic differences in contrast-edges from image displacement to generate a point cloud in 3D space. With accurately measured anchor points, the model will be scaled with accuracy possible in the sub-millimeter range.

The point cloud is then converted into a polygon mesh and processed for gap-filling and smoothing as needed. Finally, texture-mapping is applied to the artifact model, which is essentially a photorealistic wallpaper that is wrapped around it. For the readers out there with CGI/3D experience, the full-size models can grow to 1MM polygons, with textures of 70+ MP.

Let us merge art and tech again. We are going to take both the art and technical expertise and combine them for this exact amphora that we have recovered. Where do we stand? We have

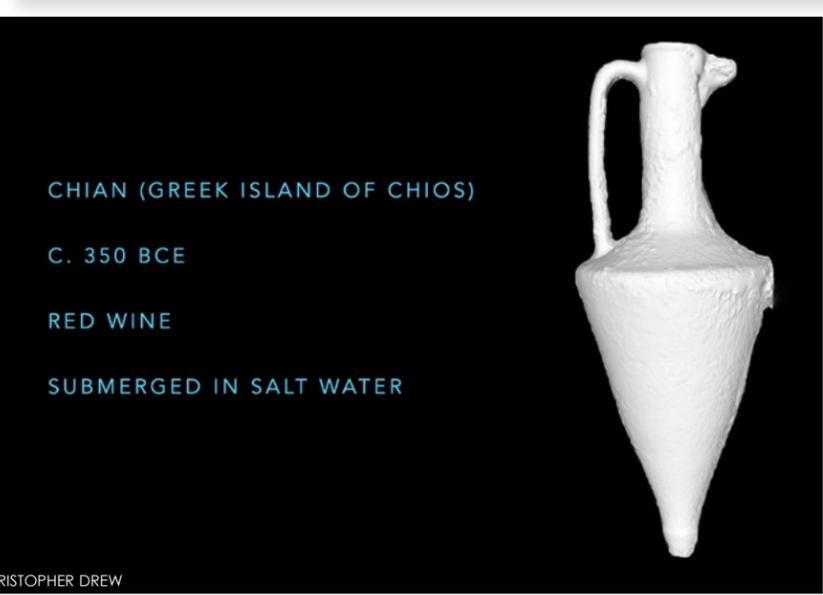
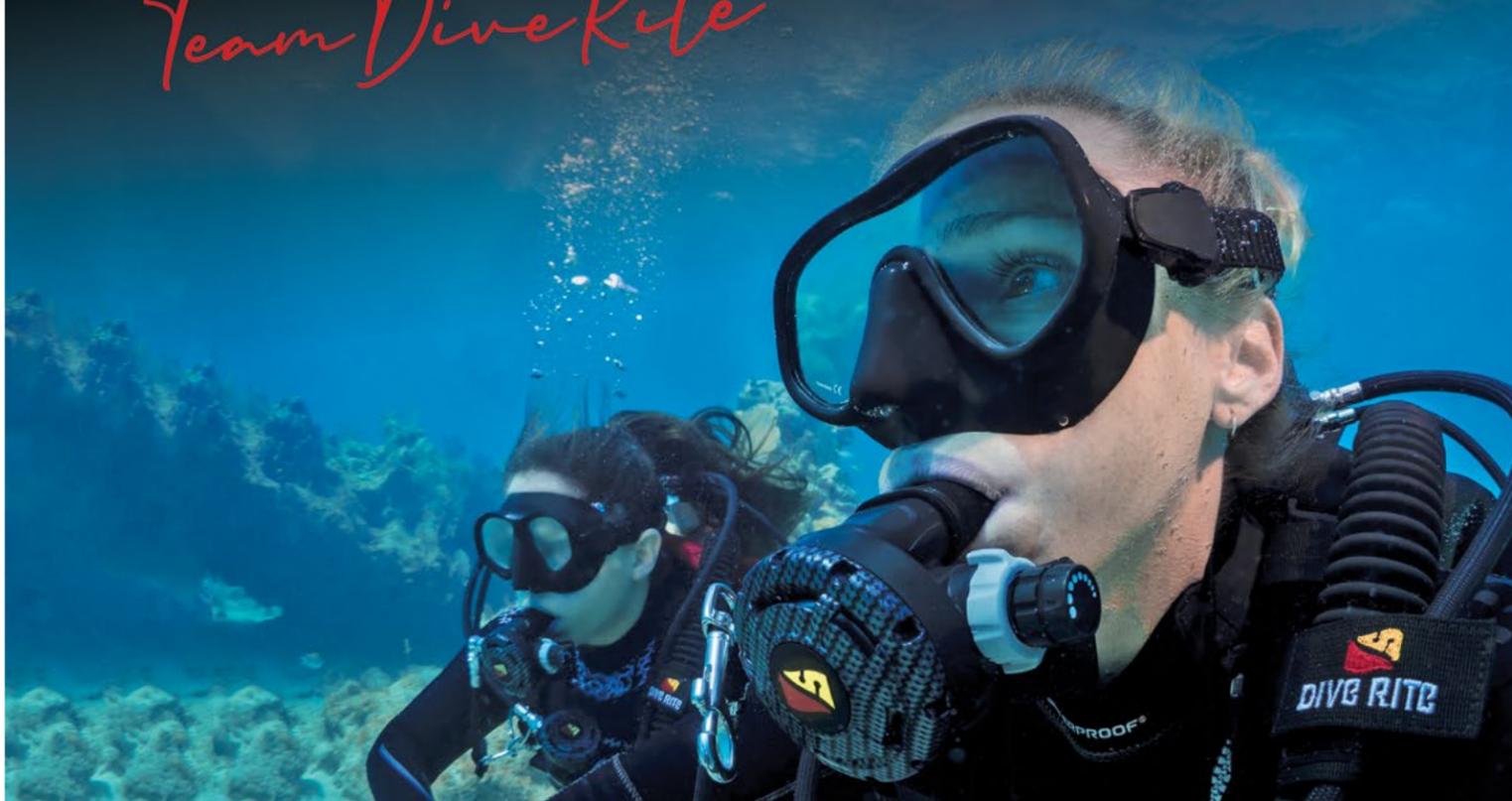


Local Dive Shops are the backbone of our sport. They are the gateway to training, the place where you meet dive buddies, get your tanks filled, book dive vacations, and of course purchase new dive gear. Being a small family run business ourselves, we understand that dive shops need your support now more than ever. We encourage you to support them any way you can to help keep our beloved sport growing.

SUPPORT YOUR LOCAL DIVE SHOPS



*Safe Diving,
Team Dive Rite*



CHIAN (GREEK ISLAND OF CHIOS)
C. 350 BCE
RED WINE
SUBMERGED IN SALT WATER

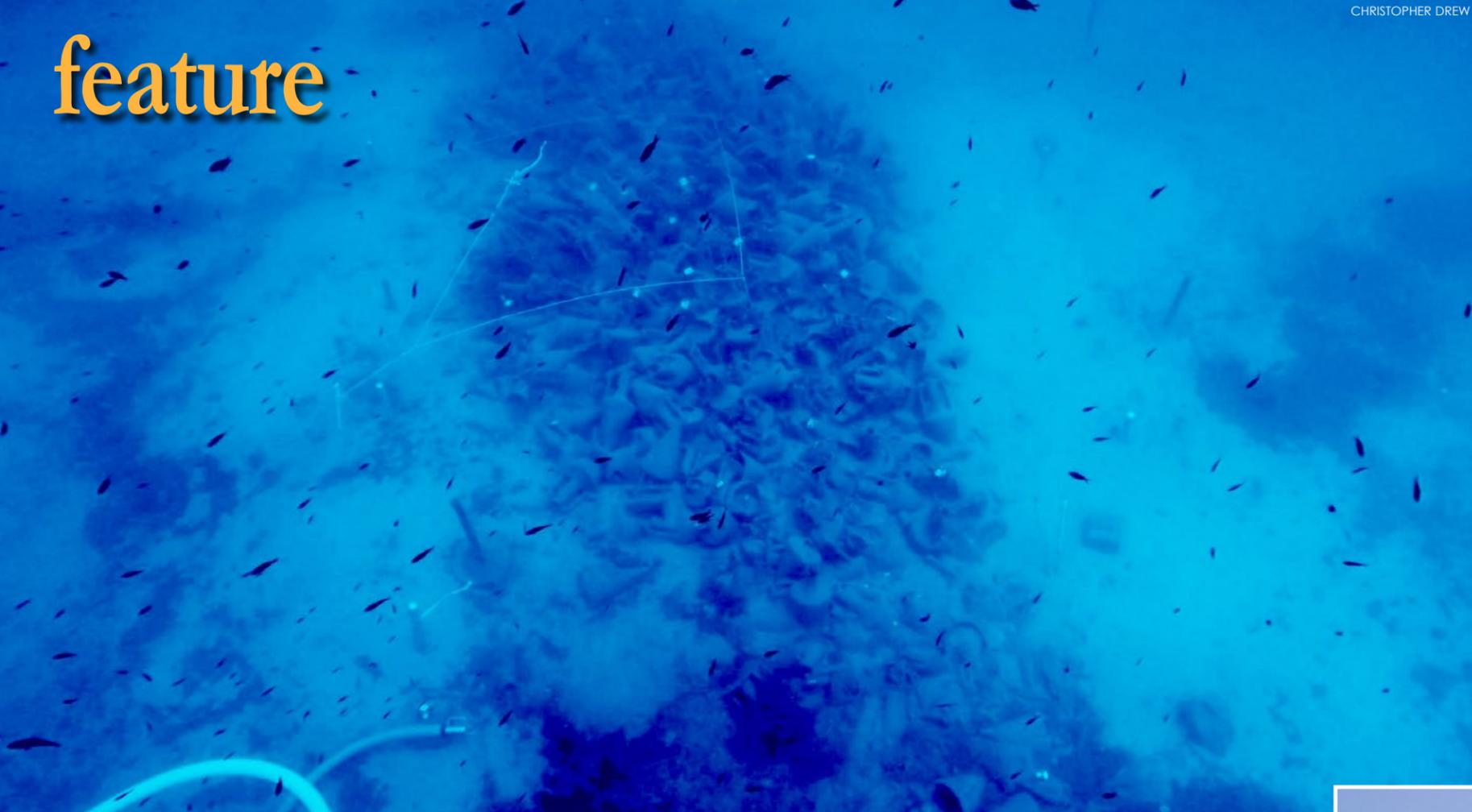
From the point cloud, a polygon mesh is developed so texture-mapping can be applied to the artifact model—essentially this is a photorealistic wallpaper that is wrapped around the model (above); Analysis of the clay and shape of the neck and handles leads to the identification of the artifact's origin and age (left).

et to be analyzed for mineral composition, radioactive dating, resins and several other factors. So, what does

of the handles and neck to find out where it is from and how old it is. We use the sorted contents and analysis of scrapings and resins from inside to determine the contents it held. We can also determine if it sat for hundreds or thousands of years in fresh water, saltwater, dry or humid air, or if it was buried underground and for how long. That is a lot right? What else can we tell? What mysteries can we solve with this artifact? Turns out, not much.

sketched, documented, measured, modeled and analyzed the artifact thoroughly. Samples of the ceramic have been taken and sent to labs all over the plan-

this tell us? What can a team find out about this exact artifact, and what stories can it tell? We use the materials analysis of the clay, and the shape



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We did not have the mission, and so we did not have the context. Context is what comes from this, and it is the MOST important thing, usually more so than the artifact itself! I am talking about the orientation of the artifact, the surroundings, its condition and location, and even the sediments and sea life on the object. These clues can help us tell the full story, to answer the scientific questions that drive the mission, and recent technological developments such as photogrammetry and remote collaboration allow us to expedite this.

Mazotos: Adding mission and skills

Returning to that single amphora, let us consider the mission. What is the context for this amphora? First, we need a site for these contextual surroundings to make the most sense. The wreck this amphora was recovered from is the shipwreck of the

Mazotos, in Cyprus. Cyprus is tucked away in the eastern Mediterranean, between Turkey and Cairo, just west of the Levant.

Our mission starts to take form: We need to study a mystery shipwreck 155ft down that was recently uncovered off the coastline, is in fantastic condition and looks to be over 2,300 years old. We need to find out where the ship was coming from, where it was going, the cargo and crew, why it sank and link this all to the ongoing narrative of the era—all the while protecting the context and recording the entire process in detail.

So, we have got an idea of the mission. How about skills? Let us look at a typical day on the *Mazotos* and see what is needed. First, divers enter the water daily to perform a series of photogrammetric surveys of not just the individual artifacts, but the entire wreck as a whole to capture the surrounding context.

Reaching our working depth for

this wreck, leveling off at 150ft just above the site, we slowly swim a zigzag-style pattern over the shipwreck, documenting every feature with our cameras and ensuring the scale-markers are accurately measured and captured. At this depth, the dive team only has 20 minutes of usable bottom-time. During these 20 minutes, in addition to recording photos, each team may also have to identify and tag amphorae, excavate artifacts with brushes or a dredge, and move artifacts to recovery.

While the team is completing their decompression on the surface-supplied trapeze stations, messages and artifacts are passed up to the safety divers for recovery. Tools and turnover are passed along by the safety diver to the next team as they enter the water. The next dive team then splashes in, passing the decompressing team on the way down, exchanging a brief salute



RAYMOND LEFRENSE



CHRISTOPHER DREW



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Dive team completes a decompression stop at a surface-supplied trapeze station, passing messages and recovered artifacts to safety divers (above); Drew uses a dredge to excavate artifacts (right).

and then seamlessly continuing the work.

After the dive is complete and debrief logged, each team transitions to topside work. Some members begin converting and tagging the images to usable photogrammetric data, while others assist the surface archaeology team as they sift through the dredge sediment and stabilize the artifacts for transportation to labs ashore. Other team members assist the Chief Diver with safety management, decompression timing, gas fills and pre-dive safety checks.

The photogrammetric process for a wreck site is much the same as an artifact like our amphora, if only on a much larger scale. The initial point cloud



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model is populated and scaled, the mesh cleaned and textured. Finally, the finished product is exported as a scaled orthophotomosaic overhead view.

Back to art—Is a freely navigable sitemap art?

What if we were to export this site and move it into a game like *World of Diving* or *Subnautica*? Is history accurately

integrated into what could be entertainment, now art? Was it already?

Let us bring the context back to art driving mission: This orthophotomosaic is then used by our team of artists, collaborating both locally and online, to generate line art through vector graphics programs like Inkscape and Illustrator. Overnight and into the morning, the sitemap line art is completed and laser-printed on waterproof paper to be affixed to our survey slates and used for dive planning, navigation, notes and artifact excavation. From this site plan, team archaeologists also work with the project director to determine the best strategy forward with the project. Only once all these steps are completed, and the context recorded with the artifact in-situ, is the artifact ready to be recovered and conserved. It takes an entire team of scientists, artists, archaeologists, and research divers to make

this happen seamlessly without losing any evidence.

On the Mazotos Expedition,¹ everyone on the crew worked together to blend all four elements. We combined mission with context, art with narrative, skills as they drive the team, and technology with photogrammetry and remote collaboration. Where do we stand now? What are the results of including the context as driven by the mission?

Just from looking at the overhead orthophotomosaic imagery, as well as the 3D models, archaeologists and researchers are able to determine:

- The anchor arrangement at the bow, allowing inferences to be made on the rigging method and even the proficiency and origins of the crew.
- The orientation of the ship when it sank

¹ UCY.AC.CY/MARELAB/EN/RESEARCH/MAZOTOS-SHIPWRECK

Using a trapeze station, divers Christos Iliadis and Kostas Kostantinou send recovered artifacts up to safety divers (right); Orthophotomosaic preview used for dive planning (far right); Historical photo of the *Stolt Dagali* (below)



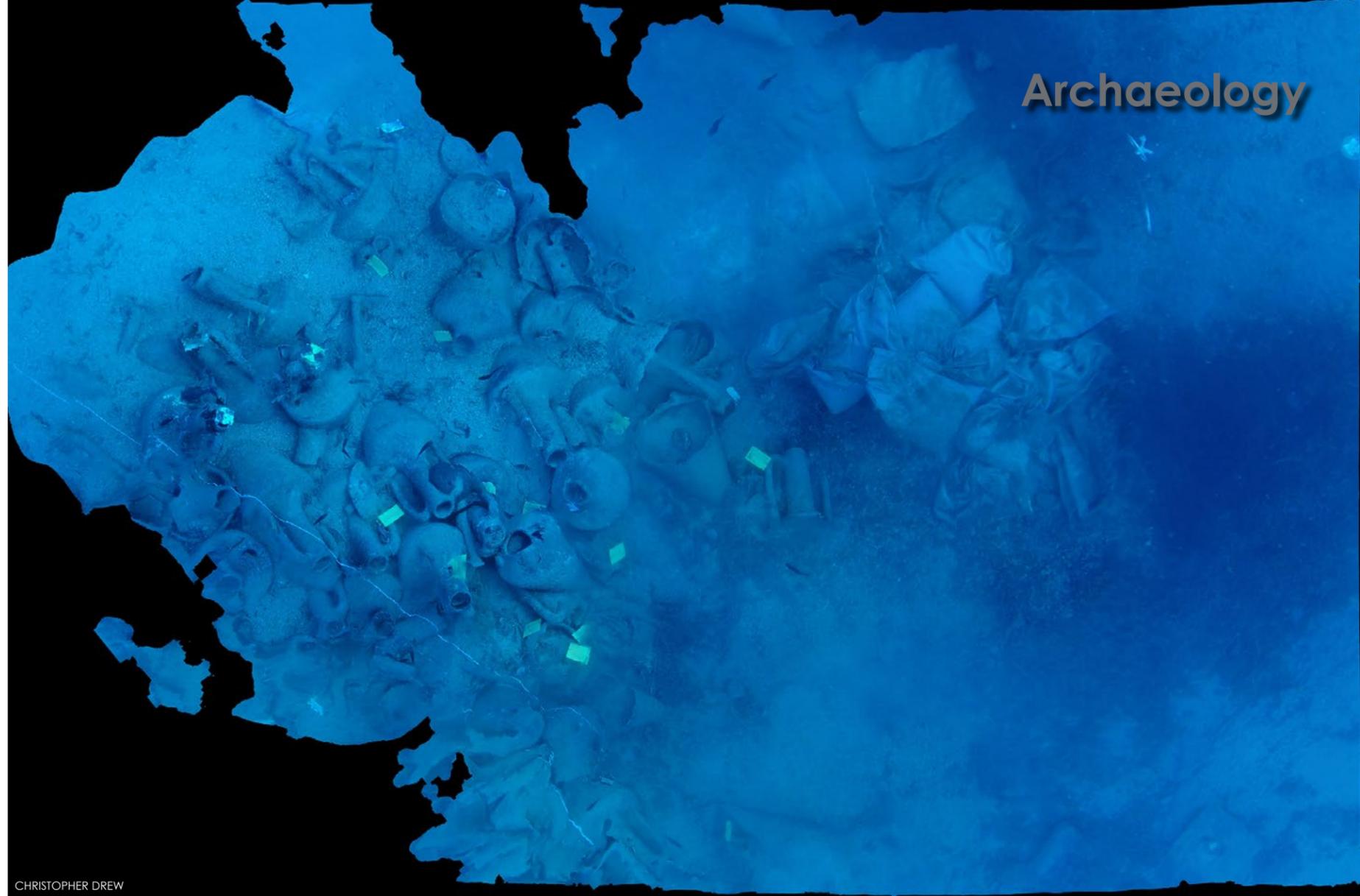
CHRISTOPHER DREW

and how the impact with the seabed occurred.

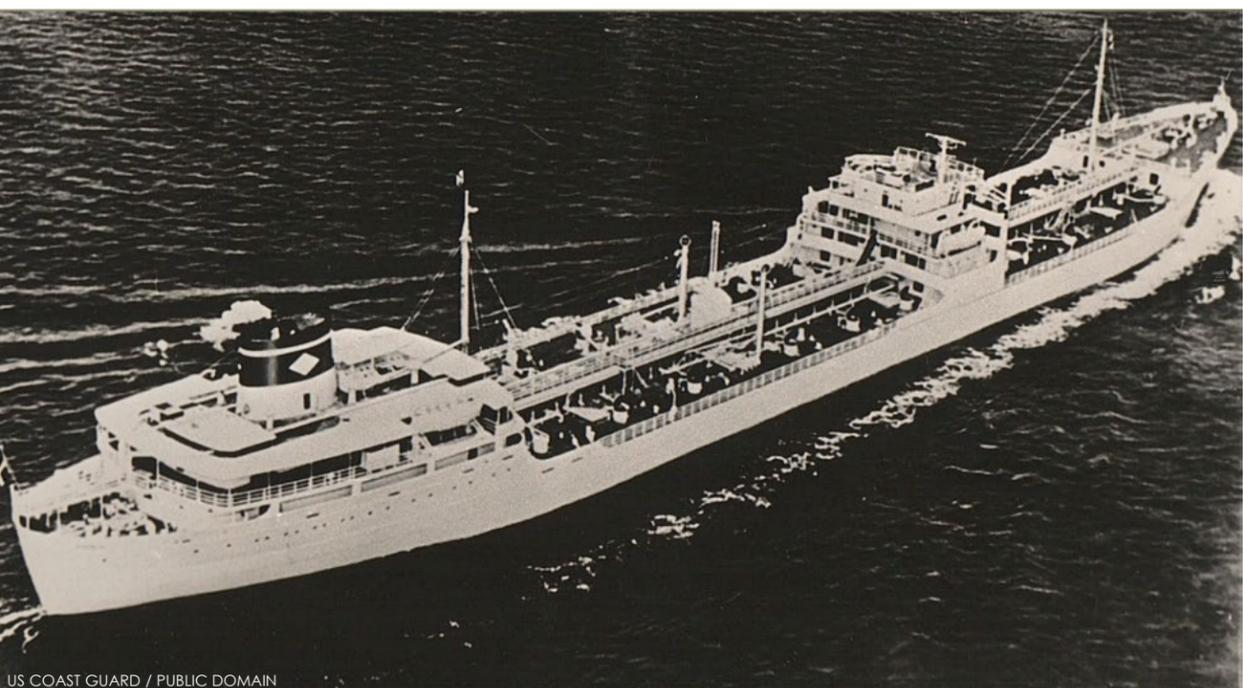
- Amphorae layering, contents and loading order, which gives insight into the economy, culture, origin and ports of call.
- The data from this single wreck site can be combined with other shipwrecks and land archaeology projects, as well as historical tax and trade records, to vastly affect the details of the time's narrative.

There is one other bonus, a moral one, of adding photogrammetric survey to an ongoing project: *the digital preservation of all site contextual detail for future researchers*. Once an area is excavated, that immediate opportunity is gone forever. Anything we overlook, any small clues hidden in the chaotic scatter and

layering and stratigraphy, it is all permanently altered the moment we begin a recovery... as well as by time itself, even when presumably undisturbed! We owe it to not just ourselves, but also future generations of researchers, and most importantly those who were lost at sea on these wrecks, to record and preserve the site as-found as well as every step along the way of recovery. On a site as rare as the *Mazotos*, it is a matter of ethics and truth. We must do it right, and modern technology makes it easier than ever!



CHRISTOPHER DREW



US COAST GUARD / PUBLIC DOMAIN

Stolt Dagali: Adding (some) autonomy

Clear across the world from the *Mazotos*, the wreck of the *Stolt Dagali* lies off the New Jersey coast in 130 FSW, with relief to 60 FSW. She was sliced in two by a collision from the *Shalom* on 26 November 1964, and the stern sank rapidly with 19 casualties. This particular region, the New York-New Jersey Bight, is one of the densest shipping traffic and shipwreck regions on Earth, with an estimated 7,200+ shipwrecks on file with the New Jersey Maritime Museum.

With new coordinates for potential wreck sites being found every year, rapidly changing sea weather in the region, and occasionally challenging conditions underwater, expeditionary dive teams operating in the North Atlantic face a

particularly interesting set of needs for dive operations: rapidly evaluating mystery coordinates and sonar returns, checking on the status of the dive teams when contingent circumstances arise, communicating with and recalling dive teams, and evaluating site conditions before committing divers—especially students!

We can immediately add one other piece of technology and skill to help meet these needs: the remotely operated vehicle (ROV). This handy piece of technology allows the surface crew to quickly zoom down the anchor line and check on decompressing dive teams, artifact recovery, site conditions and even the health of the site rigging. Sometimes, all of the above can be accomplished in just a few minutes.

There are many ROV models on the

market, but the key features for expeditionary diving operations are portability and durability. The model I personally use and highly recommend is the Sofar Trident, formerly known as the OpenROV Trident. This model can dive to 100m (330ft), has a solid three-hour working battery life, open-source payload bay, and can cruise at three to four knots. Surface support and control is through a wireless Android tablet with joysticks and HDMI, and with some work, the ability also exists to livestream the dive to anywhere on the planet for remote collaboration. The tether itself is structural kevlar, allowing for easy deployment and retrieval from anywhere topside.

Now, to be clear—an ROV must never replace accurate runtimes, objectives and team training in a properly



MAUREEN LANGEVIN / DIVE VOYAGER EXPEDITIONS



DIVE VOYAGER EXPEDITIONS

Remotely operated vehicle (above) operated by Christopher Drew and Kevin Fontana allows the surface crew to quickly check on dive teams doing decompression stops, recovered artifacts, site conditions and site rigging. Topside remote control of ROV (left)

increase diver autonomy, and protect the safety of the team while they fulfill the important objectives.

executed dive plan. In fact, due to the removal of decision-inertia, it is quite the opposite. As an example, if there is a moment of uncertainty topside while a dive team below is executing a +5 RT *as-trained and briefed* because of extenuating circumstances, the surface crew can quickly deploy the ROV in under ten seconds, zoom down to check on the team, exchange okay signals, check gas status, and make a far faster and informed decision on deploying the safety dive team and any additional equipment as needed. Safety in such a situation would never be contingent on the ROV,

as any failure in the ROV system would result in the same immediate rehearsed response from the surface team as before.

The use of an ROV to augment (but never replace!) a dive team extends even further than immediate safety concerns: It can also help to drive the mission. An ROV can allow a project director to remotely check on artifact survey and recovery, a classroom to join in live, and the Chief Diver to observe site conditions before making the decision to deploy the next dive team on a relay. All of these factors combine to reduce crew hesitation and inertia,

Next steps and resources

As a diver, what can you do to get started in expeditionary and research diving, particularly when at home? Let us break down the options:

Mission

The first step for many is finding a sense of mission, either by joining an ongoing and established project, or inspiring new projects. The way to start is to get involved in your local dive clubs—Meetup.com and your local dive shops are good places to start if you are looking for one!

From there, search for your local

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maritime museums and stop by, not just to check out the exhibits and research anything that catches your eye, but also to attend the social events and presentations. This is where, for me at least, inspiration and conversation drive new ideas the most. Before you know it, you will be volunteering and leading presentations yourself.

In addition to establishing a local anchor, branch out regionally to organizations with an established ongoing mission and training. For the United States, check out organizations like the Battle of the Atlantic Research and Expedition Group (BAREG)² and Scripps Center for Marine Archaeology (SCMA)³ for ongoing expeditions and reports.

On an international scale, two fantastic organizations to follow

² BAREG.ORG
³ SCMA.UCSD.EDU/EXPEDITIONS.PHP

are the Nautical Archaeology Society (NAS)⁴ and the Explorers Club.⁵ More details on all of these organizations training opportunities are covered below in the "Training" section.

Art

Focus on collaboration and engagement to grow your project's audience by thousands and immediately become more agile: Become familiar with platforms such as Twitch,⁶ Discord⁷ and Mattermost⁸ for running live remote classes and remote collaboration.

For sharing your work with the outside world, learn to use Sketchfab for 3D model showcasing, embedding your work in websites, and sharing results and

⁴ NAUTICALARCHAEOLOGYSOCIETY.ORG
⁵ EXPLORERS.ORG
⁶ TWITCH.TV
⁷ DISCORD.COM/INSPIRATION
⁸ MATTERMOST.COM

surveys on social media. Probably the single best example of Sketchfab⁹ and photogrammetric implementation in social outreach is the Thistlegorm Project.¹⁰

Another great example of public and researcher engagement on a technical level is the iMARE Culture¹¹ project. It is completely free and you can find examples of underwater augmented reality, navigation algorithms, 3D ship and artifact models, and even several games and exhibits.

Skills

What about Skills? For research on sites like the *Mazotos* and *Stolt Dagali*, one should curate diving skills in-water, and practice research/technical skills while topside.

⁹ SKETCHFAB.COM/3D-MODELS
¹⁰ THETHISTLEGORMPROJECT.COM
¹¹ IMARECULTURE.EU

The Capra Planner software is a free dive-planning and gas-planning utility developed by Anson of St. Andrews.

Core Diving Experience. Gained through the certification chain with substantial practice and application:

- Advanced nitrox
- Stage decompression
- Wreck diving and navigation
- Object and artifact recovery
- Rescue diver and emergency first response
- Drysuit and scooter (optional)

Research and technical experience. Many of these skills can be learned and practiced through apprenticeships, online classes and field school:

- Survey
- Site sketching
 - Artifact and pottery sketching
 - Baseline-offset survey
 - Trilateration survey
 - Reference marker tagging

Photography

- Photogrammetric capture patterns

- Photo logging and tagging
- Datastore management

Conservation

- Manual excavation
- Dredging and sifting
- Artifact stabilization and transport

When in doubt, the experts at the Nautical Archaeology Society¹² maintain the most up-to-date courses and syllabi for many types of study and can answer specific questions about enrolling in a field school. The NAS also offers a fantastic and thorough eLearning¹³ online program for maritime, underwater, intertidal and terrestrial archaeology.

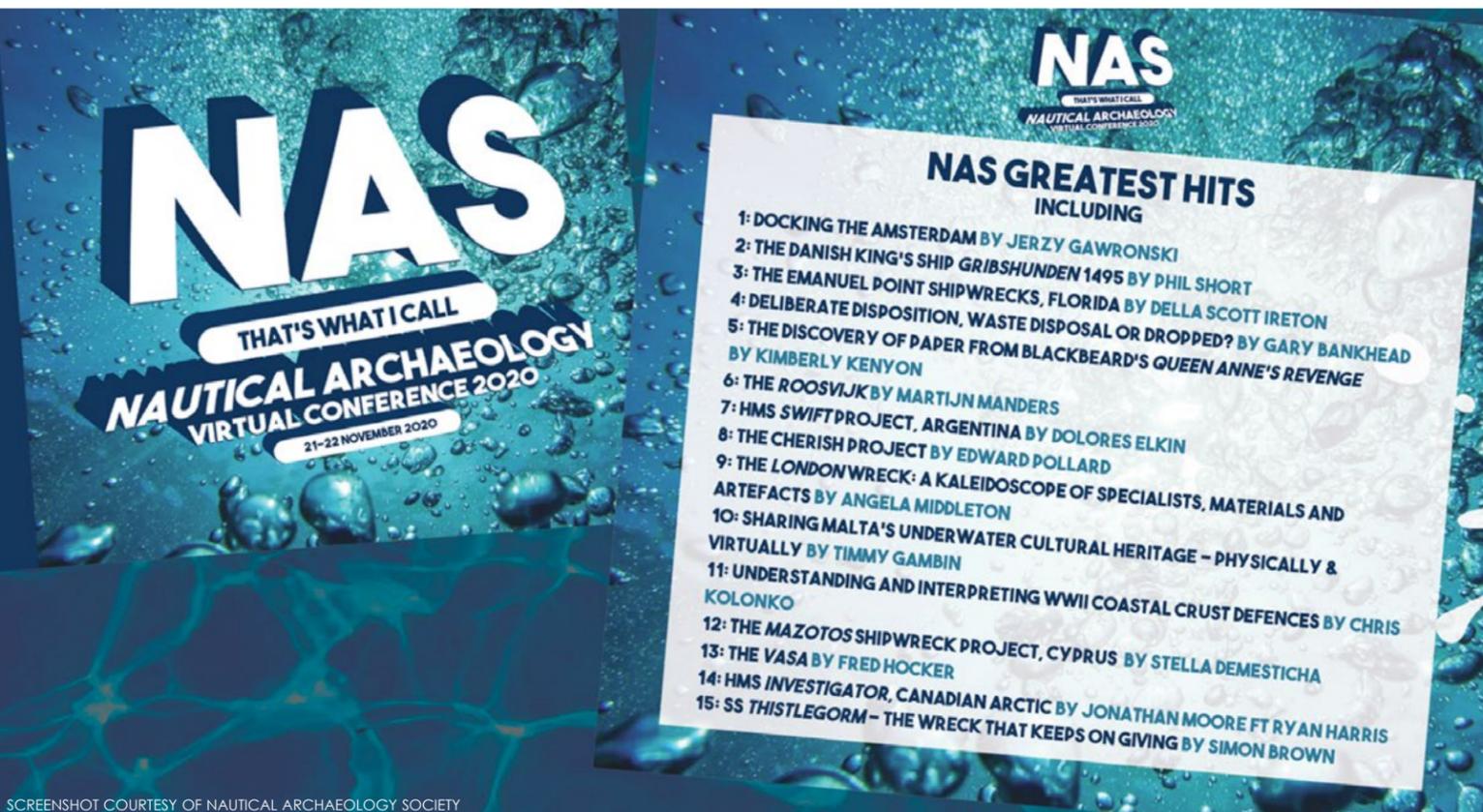
On the subject of the NAS, they have moved their conference online¹⁴ this year! This will allow anyone to attend, find inspiration, and meet col-

¹² NAUTICALARCHAEOLOGYSOCIETY.ORG
¹³ NAUTICALARCHAEOLOGYSOCIETY.ORG/ELEARNING
¹⁴ NAUTICALARCHAEOLOGYSOCIETY.ORG/ANNUAL-CONFERENCE

leagues—not to mention learn a thing or two about the latest projects in shipwreck and cultural heritage studies. More information on the NAS conference, as well as other current events, can be found in the "Field Training" section at Scuba.Tech.¹⁵

For those who are certified AAUS Science Divers,¹⁶ the University of California, San Diego, Scripps Center for Marine Archaeology (UCSD-SCMA)¹⁷ is running a field school with the University of Haifa in Israel, starting in 2021. Their other major work outside of Israel takes place in Greece and Puerto Rico, with project updates posted on Facebook.¹⁸ If you are interested and qualified, use the contact form at Scuba.Tech¹⁹ to write me a quick note and I will personally put you in touch with the project lead.

¹⁵ SCUBA.TECH/FIELD-TRAINING
¹⁶ AAUS.ORG/FAQS
¹⁷ SCMA.UCSD.EDU/FIELD-SCHOOL.PHP
¹⁸ FACEBOOK.COM/SCMAKORETPROJECT
¹⁹ SCUBA.TECH/CONTACT



SCREENSHOT COURTESY OF NAUTICAL ARCHAEOLOGY SOCIETY

The Nautical Archaeology Society's virtual conference was held in November 2020.

Dive team member enters the water at the *Mazotos* wreck site in Cyprus.



CHRISTOPHER DREW

Technology

The tech side is where the path widens the most, as there is nearly infinite room for technologists to grow in expeditionary diving:

Software development. The Capra Planner²⁰ project is an excellent free dive-planning and gas-planning utility developed by Anson of St. Andrews. For those interested in contributing, the project is now open to testers and developers for open-circuit dive planning, and runs on Windows and Linux. Code contributions for mobile app development are also under potential consideration.

For logging your dives, Subsurface²¹ is a free open-source dive logging application created by Linus Torvalds, and also syncs with iOS²² and Android.²³ It is under active development and supports most dive computers.

Photogrammetry. If 3D modeling and survey strikes your fancy, the single best two tools to learn are AliceVision Meshroom²⁴ and Agisoft Metashape.²⁵

²⁰ GITHUB.COM/THE-EMERALD/CAPRA-PLANNER

²¹ SUBSURFACE-DIVELOG.ORG

²² APPS.APPLE.COM/US/APP/SUBSURFACE-MOBILE/ID1093217161

²³ PLAY.GOOGLE.COM/STORE/APPS

²⁴ ALICEVISION.ORG/#MESHROOM

²⁵ AGISOFT.COM

An introductory course recap, training resources, syllabus review and practice photosets can all be found at Scuba.Tech.²⁶ From the homepage, just navigate to the "Photogrammetry" section and enjoy.

To share your 3D models and sitemaps with the rest of the world, make an account on Sketchfab²⁷ and start uploading!

Remotely operated vehicles. The Sofar Trident²⁸ is currently the best choice for an ultraportable, durable, scout class ROV. Be sure to start your learning in a pool, before progressing to dive team operations practice and eventually open-water environments! Operating checklists and training resources can be found at Scuba.Tech,²⁹ under the "ROV Operations" section.

Video production. Video production has experienced a recent surge of free and high-performance editing software. The single best free platform to learn today is DaVinci Resolve,³⁰ with links to free lessons

²⁶ SCUBA.TECH/PHOTOGRAMMETRY

²⁷ SKETCHFAB.COM

²⁸ SOFAROCEAN.COM/PRODUCTS/TRIDENT

²⁹ SCUBA.TECH/ROV

³⁰ BLACKMAGICDESIGN.COM/PRODUCTS/DAVINCIRESOLVE

found at Scuba.Tech³¹ under the "Video" section.

For broadcast and live-streaming, the Open Broadcaster Software (OBS)³² project is your best option to learn a free suite of tools to share your work (and yes, ROV footage!) with the rest of the world.

Conclusion

Whether on shipwrecks or ecological surveys, applying the MAST principles of mission, art, skills and technology will greatly increase the outreach of your projects while positively impacting future generations. Come join us in the next generation of research and media! ■

Christopher Drew is a research diver and videographer with Dive Voyager Expeditions,³³ owner of ScubaTech Productions, broadcast media production engineer and recent Stevens Institute of Technology graduate. He loves instructing, surveying and filming everything from local shipwrecks to expeditions worldwide, and knows that every dive will uncover both history and adventure! For more information, please visit: Scuba.Tech.

³¹ SCUBA.TECH/VIDEO

³² OBSPROJECT.COM

³³ DIVEVOYAGEREXPEDITIONS.COM

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My Favorite Marine
Mammal Dive
Contributors' Picks from Around the World

Text and photos by Larry Cohen, Amanda Cotton, Brent Durand, Lureen Ferretti, Frankie Grant, Kate Holt, Jennifer Idol, Kate Jonker, Kelly LaClaire, Matthew Meier, Brandi Mueller, Don Silcock, Olga Torrey and Beth Watson

We asked our contributors what their favorite marine mammal dive was and they sent us tales and images of magnificent whales, playful seals, endearing sea cows and curious dolphins. *X-Ray Mag* contributors reveal the intriguing behaviors of marine mammals underwater—from Crystal River in Florida to the tropical waters of Tonga, Dominica, the Bahamas, the Dominican Republic and the Red Sea, to the subtropical waters off Florida, Southern California and Baha in Mexico—where they captured their favorite images.

Heat run (left). Exposure: ISO 500, f/9, 1/250s; Mother and calf (previous page). Exposure: ISO 1400, f/9, 1/200s. Camera gear for all images: Nikon D800 camera, 16-55mm lens, Nauticam housing, no strobes

feeding grounds around the Arctic Circle, the southern humpbacks are in their winter breeding grounds (like Tonga). So, the two subspecies never actually meet!

Tonga is one of the few countries that allow, under quite strict guidelines, people in the water with the whales—an experience that can (and in my case, did) change one's life! Big animal encounters, such as those with the Tongan humpbacks, are amazing experiences. What

makes Tonga so special though is the “gentle giant” personas of the humpbacks, combined with their intelligence. Because they are mammals and very social creatures, an eyeball-to-eyeball encounter is something that will stay with you for a very long time!

You can read more about the “Tongan Tribe” and the incredible in-water encounters possible with them on my website in the **Complete Guide to the Humpback Whales of Tonga**.



Humpback whale escort. Exposure: ISO 1100, f/9, 1/200s

Humpback whales, Tonga

Text and photos by Don Silcock

The South Pacific archipelago that forms the Kingdom of Tonga is one of the best places in the world for in-water encounters with the southern humpback whale (*Megaptera novaeangliae*). The “Tongan Tribe” is one of the six main humpback populations in the South Pacific. Significantly, it was one of the last groups to be subjected to the horrors of

commercial whaling and has also been the slowest of those groups to recover.

The humpbacks start to arrive in Tonga from around the middle of July and call the 169 islands of the archipelago home until mid-October. They come to Tonga for two very basic reasons: to breed and to give birth, having spent the Southern Hemisphere's summer in the rich waters of the Antarctic, gorging and bulking up on the huge swarms of krill that abound there.

Their annual migration involves a journey of over 6,000km, which takes the whales up the eastern coast of New Zealand into the waters of the South Pacific and is one of the longest known animal migrations in the world!

The islands of the Tongan archipelago offer the warm waters and shelter that the pregnant females need when they give birth. Plus, the deep lagoons are often where the incredible “heat runs” take place as the females select their male suitors.

Apart from the distinctive white coloration on the undersides of the Southern Hemisphere humpback whales, there are no real differences between them and the Northern Hemisphere humpbacks. Technically, though, they are considered a separate subspecies because of their isolation from each other. That is because when it is winter in the Northern Hemisphere, it is summer in the Southern Hemisphere, which means when the northern humpbacks are in their summer



Bottlenose dolphin, Grassy Key, Florida, USA

Text and photos by Larry Cohen

In 2008, I got the opportunity to get in the water with the bottlenose dolphins at the Dolphin Research Center in Grassy Key, Florida. My friend Bette Zirkelbach was a staff member, and she arranged for me to photograph the dolphins. This was my first time in the water with any marine mammal. I found it an exceptional experience.

Dolphin Research Center has a fascinating history. Commercial fisherman Milton Santini collected dolphins for marine mammal parks and aquariums. He created a deep lagoon by his home and started Santini's Porpoise Training School. A few of the animals starred in the movie *Flipper* in 1963. In 1972, after Milton's favorite dolphin passed away, he sold the grounds, and it became the Flipper's Sea School. In 1984, Jayne

Shannon-Rodriguez and Armando "Mandy" Rodriguez acquired the facility. They formed the nonprofit corporation Dolphin Research Center.

The center is now a world leader in marine mammal care, research and education. The Dolphin Research Center used to be the southernmost member of the Marine Mammal Stranding Network. They no longer rescue cetaceans because of the risk of carrying disease back to the resident dolphins. However, they are the licensed manatee rescue team for the Florida Keys.

Their marine mammal population allows for research and data collection. The research focus is on how marine mammals think, their behavior, and husbandry. Many dolphins have been born at the facility. The Dolphin Research Center activities always stay true to the



original mission statement: "To promote peaceful coexistence,

The health and well-being of Dolphin Research Center's dolphins holds abso-

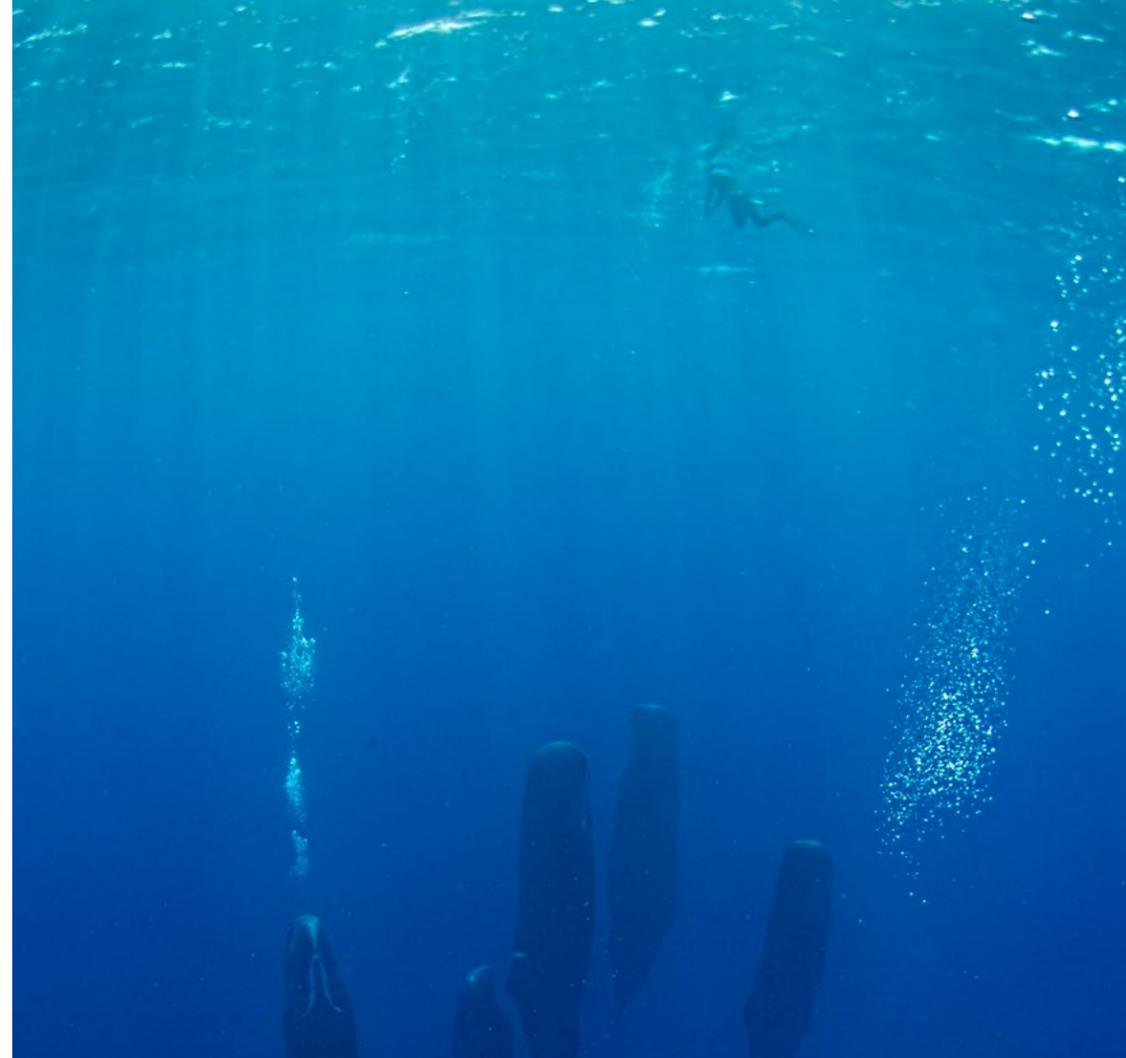
The bottlenose dolphins were playful and curious (above); Being in the water with a marine mammal was a fantastic experience (top left); Even with bad visibility, I was able to get an over/under photograph (left).

cooperation, and communication between marine mammals, humans, and the environment we share through research and education.

lute precedence over all other interests. DRC will undertake no program or activity that compromises this basic commitment." (dolphins.org)

Even with bad visibility, it was a pleasure being in the water with the dolphins. They were as curious about my camera gear and me as I was about them. I captured the photos with an Olympus DSLR with the Olympus 7-14mm lens and Sea&Sea strobes. Please visit: liquidimagesuw.com

THIS PAGE: Sperm whales in Dominica. All images were taken under government permit. Camera gear used: Nikon D850 camera, Nikkor 1.4 24mm lens, Isotta Housing, no strobes. Exposure: ISO 400, f/11, 1/250s



Sperm whales, Dominica

Text and photos by Amanda Cotton

It is truly a remarkable experience to swim alongside the world's largest, toothed predator—the sperm whale (*Physeter macrocephalus*). Having spent almost a decade visiting these majestic whales off the coast of Dominica, I eagerly await my time in the water with them year after year. Their intelligence and curiosity cannot be overemphasized as they are truly in a class by themselves. It is a pure delight when these whales seek out interactions with us divers. Special attention must be given to the boundaries set by, not only the government regulations put in place to protect these whales, but more importantly, the reaction and action of the whales themselves. It is extremely important we respect the rights of these marine mammals during our time on the water as we seek out interactions with them. Marine mammal encounters thrill and excite no matter the species, and oftentimes feels like a gift from the sea. A swim alongside a sperm whale feels like the biggest gift of them all. Visit: acottonphoto.com



THIS PAGE: Atlantic spotted dolphins in Bimini. All images were taken with a Canon 5D Mk IV camera, with a Tokina 10-17mm fisheye lens. Exposures: ISO 640, f/9, 1/250s (left); ISO 320, f/8, 1/500s (below); ISO 800, f/9, 1/200s (center); ISO 320, f/9, 1/250s (bottom right)



Atlantic spotted dolphin, Bimini, Bahamas

Text and photos by Brent Durand

Marine mammal dives are some of my favorites. These encounters have the ability to stir our emotions—to evaporate the fog of day-to-day complacency as we develop a sharp connection with the animal.

This is why swimming with Atlantic spotted dolphins (*Stenella frontalis*) in Bimini, Bahamas is my favorite mammal dive. I have been fortunate to twice visit this little island, spending a total of several hours swimming with these joyous cetaceans.

The dolphin dives are snorkel-only since entering the water is a quick endeavor. Spot the dolphins, motor into position, and slip quietly into the water. It is easy to get excited, splashing and swimming in an effort to see the dolphins, but the best encounters come from finding a place of calm, confidence and good water technique.

When these elements come together, the dolphins will engage on their own terms, swimming and playing with their new friend—you. One may find that the dolphins mimic your own

twists and turns as you engage with them. The experience is truly beyond words. Visit: tutorials.brentdurand.com





Humpback whale, French Polynesia

Text and photos by Lureen Ferretti

My favorite marine mammal is the one I have the good fortune of getting close enough to photograph. In 2020, my awe-inspiring and undeniably most incredible experience was with humpback whales (*Megaptera novaeangliae*) in French Polynesia. Three operators—one in South Tahiti and two in Moorea—used different techniques, but all shared love, passion and respect for the whales.

Most whale watching took place at the surface, waiting for them to come up to breathe or occasionally propel their 39 to 52 feet and 36 to 40 tons of body mass (for an

adult) out of the water, resulting in a huge splash. Once the whales got our attention, the operator determined if they were on the move or coming up for air and returning to sleep. If it appeared that they were going to sleep, we would swiftly and quietly enter the water and move in the direction they were observed. Finding them seemed easy, considering their size, but because they were perfectly designed to blend into their surroundings—with black on top, so when looking down, they look like the dark water and ocean floor below, and when looking up at them from below, their white belly resembled the bright sky above—it was not always an easy task. Once spotted, we waited for them to surface again. What an adrenaline rush, being so close to such a massive yet gentle majestic creature! Our

group was fortunate; we were able to capture photos and video to relive the experience and share it with friends.

Historically, scientists began tracking humpback whales to gain a better understanding of their migration patterns. They determined that there were 11 different populations of these whales, five from the seas around Antarctica. All humpback whales travel thousands of miles from their Antarctic or Arctic feeding grounds to tropical or sub-tropical areas to mate and calf. The humpback whales found in French Polynesia and Tonga come up from Antarctica, as opposed to those found in Cay Sal Bank, Hawaii, Central America, Mexico and Asia, which travel down from the Arctic. SOURCES: BRITANICA, NOAA, ROVE.ME

Visit: DeepWaterPics.com



THIS PAGE: Humpback whales in French Polynesia. Exposures: ISO 160, f/8, 1/100s (above) and ISO 400, f/8, 1/80s (top)





Harbor seal, La Jolla Cove, California, USA

Text and photos by Frankie Grant

La Jolla Cove is well-known as one of the best shore dives in Southern California. Here at “The Cove,” divers can explore meandering kelp forests, sea caverns, surf grass beds and deep underwater canyons, depending on which path you would like to take! It is also notably known for its pinniped interactions, including California sea lions as well as today’s guest, the harbor seal. Normally, these creatures are quite shy and often avoid encounters with divers, leading to only fleeting, over-the-shoulder glances from these beautiful creatures. On this particular day, upon completion of a 90-minute shore dive through the kelp forest, I returned, feeling rather unenthusiastic about the images I had captured—that is, until I found this curious female harbor seal in the shallows, waiting for me near the beach. I remained motionless as she came in for several minutes and examined both me and her reflection in the dome port. After four to five minutes, she turned and left, then came back for one last pass before heading back out into deeper water. Visit: frankiegrant.com

THIS PAGE: Harbor seal, *Phoca vitulina*, La Jolla Cove, within the La Jolla Marine Reserve, San Diego, California. Gear used for all images: Canon 7D Mark II camera, Tokina 10-17mm fisheye lens, Sea&Sea housing, ambient light. Exposures: ISO 160, 17mm, f/4.5, 1/250s (top left); ISO 160, 17mm, f/4.5, 1/250s (above); ISO 400, 17mm, f/5.6, 1/250s (left)



THIS PAGE: Manatees in Florida. Camera equipment used for all images: Nikon D610 camera, Nikkor 14-24mm lens, Nauticam housing. Manatees congregate in the springs in groups (above). Exposure: ISO 500, 14mm, f/8, 1/200s; Manatees will approach, but interactions with manatees must never begin with a human approach (left inset). Exposure: ISO 500, 14mm, f/8, 1/200s; Newly arriving manatees may be covered in barnacles from their time in the ocean (top left). Exposure: ISO 1250, 14mm, f/8, 1/200s; A curious manatee approaches in Crystal River (bottom left). Exposure. ISO 500, 19mm, f/8, 1/200s

Manatees, Florida, USA

Text and photos by Jennifer Idol

American manatees are as synonymous to Florida as orange juice and palm trees. They migrate from surrounding oceanic waters to warmer springs in winter to raise their young. They can be found in springs such as Homosassa Springs and around Crystal River in Three Sisters Springs on the western side of the state. On the eastern coast, they

are found in areas like Blue Heron Bridge and Blue Spring in the St. Johns River.

I grew up in Texas and Florida, so these beautiful sea cows have been a part of my memories since childhood. Clear springs enable viewing manatees from above water too, though snorkeling encounters are the best way to see them.

They were reclassified from an endangered species to a threatened species in 2017 and are also protected under the Marine Mammal Protection Act. To control interactions, paid permits are

required of professional photographers and filmmakers to photograph manatees in Crystal River National Wildlife Refuge. Strobes are not permitted.

Also known as the West Indian manatee, these mammals are gentle, slow-moving vegetarians that are decreasing in number due to boating injuries and loss of habitat. All species of manatees, including dugongs, are listed as vulnerable. Please visit: uwDesigner.com





THIS PAGE: Dugong in the Egyptian Red Sea. Camera gear used for all images: Canon EOS 7D Mark II camera, Sigma 17-70mm lens behind a compact dome port, Sea&Sea MDX housing, two Sea&Sea YS-D1 strobes. Perfect dining partners—dugong and golden kingfish share a meal (above). The dugong grazes on the sea grass and the golden kingfish feeds on the critters dislodged from the sea floor. Exposure: ISO 160, f/11, 1/160s; The dugong continues to graze, completely at ease with us divers (top right). Exposure: ISO 320, f/11, 1/200s

Dugong, Marsa Alam, Egypt

Text and photos by Kate Jonker

Twenty years ago, whilst on my Open Water Diver course, I came across an article on manatees and how they would hug you and never let you go. Although intrigued, I was a little scared at the possibility of “drowning by manatee” but knew I simply had to see one.

Living in South Africa, it was unlikely I would ever get to see a manatee, but the chance

of seeing its “cousin,” the dugong, was far greater—especially in the Red Sea. After unsuccessfully searching the Red Sea for 15 years, I heard about a resident dugong in Marsa Alam—and I packed my bags!

Within 90 minutes of arriving in Marsa Alam, I was climbing onto a small zodiac to search for the dugong when the skipper shouted, “It’s here!” He had seen the tell-tale sign of snorkelers frantically swimming on the surface in pursuit of a dugong. I could not contain my excitement and hoped they would not chase it away.

Just as we reached the group of snorkelers, a huge white shape emerged to greet us—a dugong! We waited for it to start grazing on the sea grass below and slowly descended to meet it. The docile giant ignored us as it hoovered up the sea grass, occasionally ascending for air and returning to join us again. I was amazed at how much it ate and how at ease it was with us. I was also relieved not to have been hugged to death so that I could live to tell the tale of finally meeting this elusive creature! Visit: katejonker.com

Dugong grazing on sea grass in Marsa Alam, Egypt. Exposure: ISO 320, f/10, 1/160s





THIS PAGE: Sea lions at Land's End, Cabo San Lucas, Baja California Sur, Mexico. Camera gear used for both images: Canon EOS 7D camera, Sigma 10mm fisheye lens, Aquatica housing, ambient light. Exposures: ISO 400, f/5.6, 1/120s (left); ISO 400, f/7.1, 1/200s (below)

Mammal Dives

twice. I had never seen pufferfish even approaching that size. I began to wonder what they had been feeding on when a flash of brown shifted my gaze. The sea lions had followed us.

Two of them had caught up to a smaller third and momentarily pinned him down on the sand a few meters away. Twisting and

snapping, the little one coiled his body in a tight circle and squirmed free before shooting past us—the chase was back on.

Again, I was struck by their resemblance to canines. It was like watching a pack of friendly, underwater dogs that all got the zoomies at the exact same time. It was sheer underwater pandemonium. I could dive this spot every day and I doubt it would ever get old.

A few watchful cows cruised by, keeping an eye on the pups and occasionally joining the game

when the mood took them—or when one of the pups cajoled them into it.

As usual, my air got low before anyone else's and my dive had to end far earlier than I would have liked. I signaled my buddies, who were always understanding, and we drifted up slowly, watching the chase continue below us.

We reached the surface, and my dive buddies were all smiles. "That was the best, EVER!" said one. "Hell yeah," replied the other. "Let's do it again!"



Sea Lions, Land's End, Cabo San Lucas, Baja California Sur, Mexico

Text by Kelly LaClaire
Photos by Kate Holt

My two dive companions and I back-rolled into the shallow water near the rocks at Land's End, Cabo San Lucas, and sank towards the soft, sandy bottom at four meters. Before we could even get oriented, we were swarmed by a group of adolescent sea lions chasing each other through our bubbles. They were lithe, energetic creatures and their game of cat-and-mouse did not stop because we had intruded. A few paused to take a curious glance at us, but just as quickly, they continued twisting in

sinuous figure eights before darting off again, mouths open in pursuit of their playmates.

"My goodness," I thought to myself. "They're like puppies." I glanced at my dive buddies. They were both smiling, and I smiled back. It was impossible not to; these animals were delightful. And watching them—being near them as they play—was absolutely mesmerizing. I wanted to stay right there for the rest of the dive.

One of the bigger bulls of the colony had other ideas, however. He got a little grumpy that we were so close to his rock and rushed

me, veering off at the last second. He was telling me I was in his territory and I took the hint. We moved off reluctantly, following the sand to deeper waters, flashing the Hawaiian shaka sign, i.e. "Right on, that was awesome!"

A few minutes later we were at 20m when a small, sunken fishing boat appeared. It was covered in small corals and teeming with life. Three giant porcupinefish caught my eye. They were nearly a meter long and I blinked



Mammal Dives

Common dolphin (right). Gear: Nikon D2x, Nikon 70-200mm lens. Exposure: ISO 200, f/4, 1/250s; Humpback whale peduncle throw (bottom right). Gear: Nikon D2x, Nikon 70-200mm lens, Nikon 2x Teleconverter. Exposure: ISO 200, f/5.6, 1/800s



California sea lion pups at play in the Coronado Islands, Mexico (above, top right and left). Camera gear used: Nikon D3 camera, Nikon 24mm lens, Subal housing, Sea&Sea YS-250 strobes. Exposures: ISO 400, f/5.6, 1/80s (above); ISO 200, f/5.6, 1/80s (top right); and ISO 400, f/5.6, 1/80s (left), using a Nikon 24-85mm lens

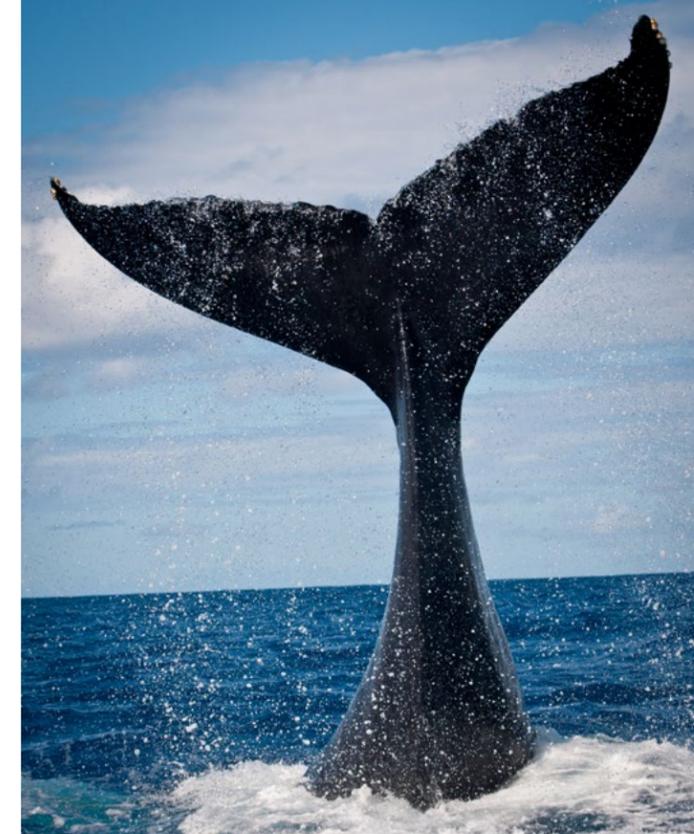
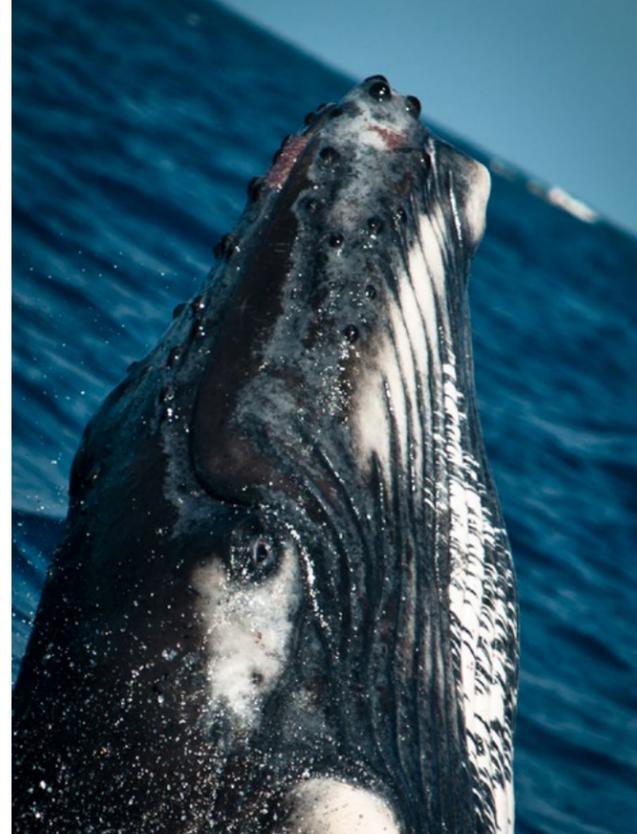
California sea lions, Coronado Islands, Mexico

Text and photos by Matthew Meier

The Coronado Islands are located eight miles west of Baja California, Mexico, just 15 miles south of San Diego, California, in the Eastern Pacific Ocean. One of my favorite places to dive with California sea lions is off of North Island, at a dive site called Lobster Shack. These curious and playful creatures are especially active in the fall when the adolescent pups have grown strong enough to venture away from their parents. I tend to stay in the shallow waters, close to the rocky shoreline, to take advantage of the daylight overhead and the numerous sea lion teenagers plunging off the rocks to

investigate the divers below. It is often possible to have 15 to 20 sea lions playing in front of you, blowing bubbles, gazing at their reflections in a mask or dome port and occasionally nibbling at your fins. In lesser numbers, you can also encounter harbor seals and the random elephant seal at the islands. When a big male or bull sea lion swims past, he is marking the boundary of the rookery, or breeding colony, and if he starts barking at you underwater, it is advisable to back up. Additional marine mammals such as Pacific bottlenose and common dolphins, as well as gray, humpback, fin and blue whales, can be seen during the transit to and from San Diego. Visit: MatthewMeierPhoto.com





A baby humpback takes a good look at snorkelers, while taking a breath at the surface, before returning to mum (above). Exposure: ISO 250, f/7.1, 1/100s; A baby practices breaching (top center). Exposure: ISO 320, f/5.6, 1/1600s; Humpback tail slap (top right). Exposure: ISO 320, f/78, 1/1600s. Camera gear used for all images: Nikon D90 camera, Ikelite housing (no strobes)

Humpback whales, Dominican Republic

Text and photos by Brandi Mueller

Between the months of January and March, the North Atlantic humpback whale population migrates to warmer waters and many of them spend the winter at the Silver Bank, a shallow area about 90 miles off the Dominican Republic. Each year, pregnant females give birth here and mating occurs. The shallow waters protect the babies from predators like sharks, and the mothers nurse their young and get them ready to migrate to the northern waters to feed in the summer months. A few permits are given for snorkelers to visit the area to have passive interactions with the whales. It is hard to explain how incredible it is to be in the water with such massive and beautiful creatures (they can be as large as 40 to 50ft), particularly when they make eye contact, and you are reminded that they are mammals just like we are.

The mothers and babies were particularly amazing to see. Mothers only breathe about once every 20 minutes, but the babies have to come to the surface to breathe more often. They often look like they are snuggling under mom's chin until it is time to go to the surface and they take a breath and return back to mom. It was also incredible to see the mothers teaching behaviors like breaching where the mother would jump out of the water and then, a few seconds later, the baby would do the same.

There are 14 known humpback populations, and the whales almost never cross into populations in other parts of the world. The Northern populations tend to have fewer white patches than the Southern populations, like those often seen by snorkelers in Tonga. Each population will have a seasonal song that changes slightly over time, but it is sung by the entire group. Different populations will have different songs. Each humpback can be identified individually by its unique tail pattern. Visit: brandiunderwater.com



A baby looks out from under mom's protection. Exposure: ISO 320, f/9, 1/100s



California sea lions, La Paz, Mexico

Text and photos by Olga Torrey

Isla Espíritu Santo is a two-hour boat ride from La Paz. This island is protected and part of the Biosphere Reserve by UNESCO. A colony of California sea lions inhabits the northern end of the island. When I was there, I saw a group of 15 individuals. Among them was a large male with females and a few pups. Females choose their mates while moving through different territories.¹

The females avoided males that were too aggressive or energetic. This behavior explained why the large males spent their days lazily floating on their backs, sunning their bellies under the bright sun and not worrying about the pups. Unlike the females and puppies, the bulls did not come very close to the divers and snorkelers.

The females chased their pups, trying to prevent them from being too playful. Gulf of California

sea lions stay in the Gulf year-round. They do not migrate.¹ The plankton-enriched waters teemed with life. Large schools of sardines were so dense that as they passed, it felt like a vast cloud had come over my head, blocking out the sun.

It was my first time diving face-to-face with the California sea lions. Pups chased the schools of sardines and then turned their attention to my camera strobes and fins, playfully biting them, to my delight. I gave my blue rubber shoe to one pup to play with, and the sea lion was so happy with its new toy!

It was so fun that I wished I could have another day to dive with the sea lions. La Paz is at the top of my list of favorite dive sites because of the rich marine life, fine weather, good food and friendly people there. I will gladly make my way back to visit Mexico the next time the opportunity presents itself.

All images were captured with an Olympus

OM-D E-M5 camera in a Nauticam housing. I used the Panasonic Lumix G Vario 7-14mm f/4 ASPH lens. For lighting, I used dual Sea&Sea strobes.

¹ SOURCE: WIKIPEDIA.ORG. Visit: fitimage.nyc

Female sea lion prevents her pup from getting too close to divers (above); Sea lion family bathing under the sun (top left); Sea lions are curious about divers (top right); Sea lions are synchronized swimmers (bottom right)





Camera gear used for all images: Canon EOS 5D Mark IV camera, Canon EF16-35mm f/4L lens, Nauticam housing. Two sea lions circle, hunting a bait ball (above). Exposure: ISO 640, f/11, 1/100s; A playful sea lion blows bubbles (left). Exposure: ISO 640, f/9, 1/100s

Sea lions, Magdalena Bay, Mexico

Text and photos by Beth Watson

My favorite mammal encounter is with sea lions during the migration of bait fish in Magdalena Bay, Mexico. This wildlife hot spot is located along the Pacific coast of the Baja California Peninsula. It is an extraordinary habitat made up of mangroves, barrier beaches and sand dunes, which help support the rich marine ecosystem. Bait fish migrate through the area, congregating in massive numbers, generating lots of oceanic activity. The fish attract an abundance of predators, including sea lions, whales, dolphins, mobula rays, sharks, birds and other mammal and marine species. A typical day is spent on the open ocean searching for frigates and other bird species. Birds diving into the ocean are an indication that a bait ball may be near the surface. Once a bait ball is found, it is time for the snorkeler to calmly and quietly slip into the water. It is exciting—you never know what will show up! It is an unforgettable experience to be in the water while this predation is taking place. Visit: bethwatsonimages.com

A sea lion glides effortlessly through a bait ball (above). Exposure: ISO 640, f/11, 1/100s; Snorkeler watches as two sea lions frolic at the surface (top right). Exposure: ISO 640, f/ 11, 1/100s





The Javanese moray eel, also known as the giant moray (*Gymnothorax javanicus*)

Text by Ila France Porcher

Often on dives in the tropics, the divemaster will caress one of the big Javanese moray eels (*Gymnothorax javanicus*) looking out from the coral surroundings, until the animal undulates from his hole and wriggles around him, apparently because it enjoys being stroked. This provides evidence that there is more going on in the minds of these mysterious animals than most sources let on.

Richard Johnson, a scientist who did much research on Polynesian sharks, described a meeting he had witnessed between a blackfin reef shark and one of these huge eels. The two animals

had apparently come into conflict over a fish, with the result being that the shark bit the eel. The eel wrapped itself around the shark's gills so that the hapless shark went careening around,

beating the eel against the coral structures until it let go.

This suggests that the eels are courageous and affirmative in their actions.

Javanese moray eels are

among the largest eels and attain a length of three metres and 30kg in weight. I was often warned by a variety of experts that they are dangerous—that they will bite and not let go—and are so strong

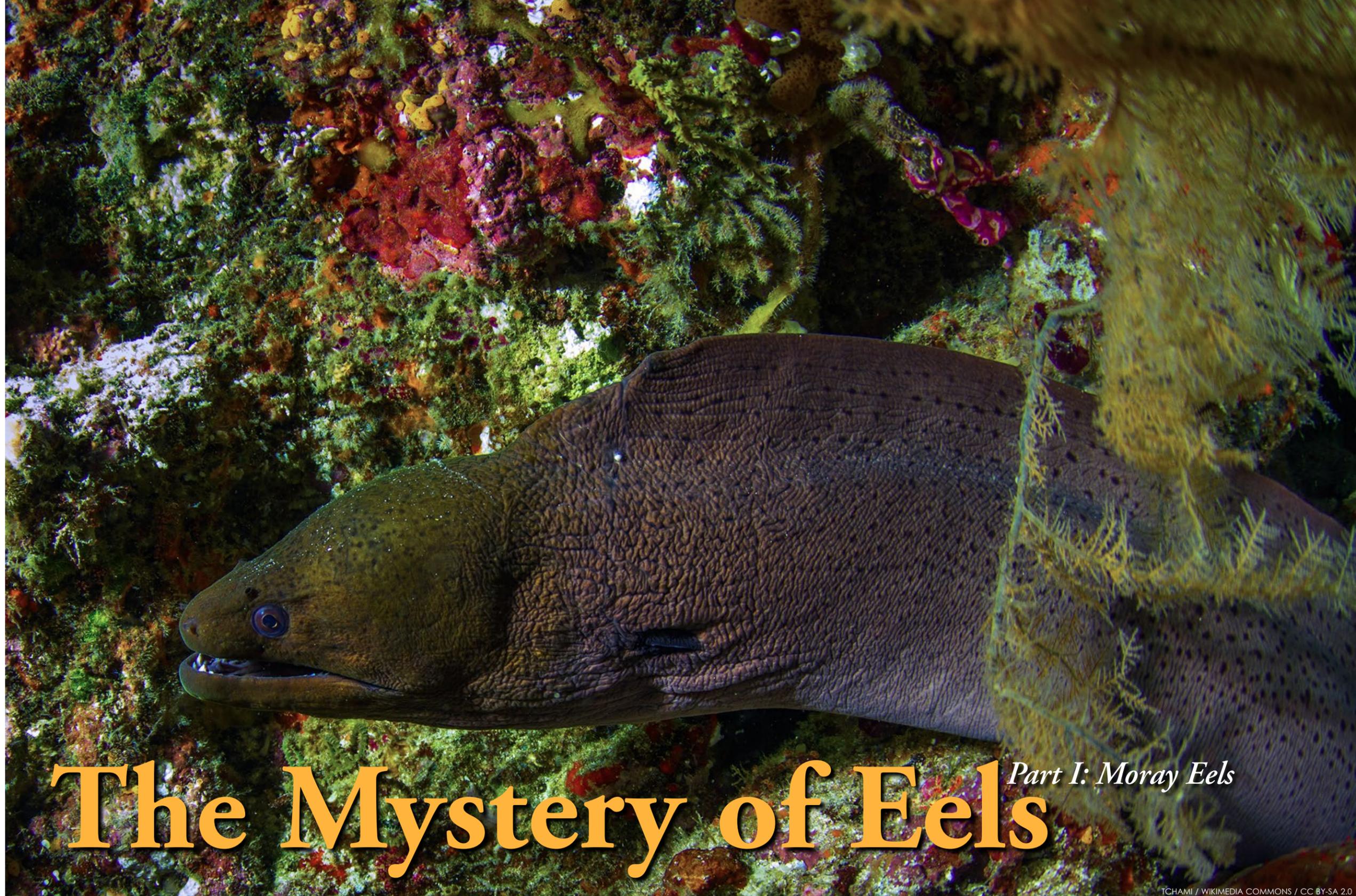
that they could drown you. During my studies of sharks, they would gather at the feeding sessions I held once a week in a study area far from shore.

They were wary of the sharks

and avoided being caught out in the open.

An eel reacts

Early in my study, a Javanese eel appeared just after dawn as the



The Mystery of Eels

Part I: Moray Eels

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sharks were picking through their scraps. He took one of the pieces of food and put it in a grotto in the coral. Then he glided in his serpentine fashion back out into the open to take one of the biggest and best pieces of meat. These I had been lucky to get. Shark food was hard to find, but on this rare occasion, the fish shop owner had given me a few chunks of bonito meat that had become too old to sell.

I wondered if the sharks would do anything to protect their food. One of the juvenile males zoomed up to the eel

Giant moray eel (right and bottom left); A shark and a moray eel meet face-to-face on the reef (below); Giant moray eel swimming over the reef (lower right)



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Eels

THOMAS HUBAUER / FLICKR / CC BY-SA 2.0



KRIS-MIKAEL KRISTER / FLICKR / CC BY-SA 2.0



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in an intimidating gesture, but the other sharks ignored him. He was bigger than most of them. He retreated with his prize under the coral formation next to mine.

When the sharks circled away,

the eel slid again from his hole, and targeted another choice morsel. So, outraged by his wanton thievery of the food I had gone to such trouble to procure, I swam over and waved my

camera at him, indicating that he was to back off.

The eel undulated forward, gazing up at me gesticulating at him on the surface, and lifted his front half towards me. He opened his mouth with a venomous look one normally sees only in nightmares, and thrust his gaping jaws repeatedly in my direction, while waving slowly back and forth in the turquoise waters. I glared at him and he at me as sharks shot around us. When I returned to my perch, the huge eel glided into my coral formation and repeatedly thrust his head out at me. I had to retreat to another dead coral structure.

I continued to take notes and draw, but the lighting was not right for photographs from the only other formation available to hold





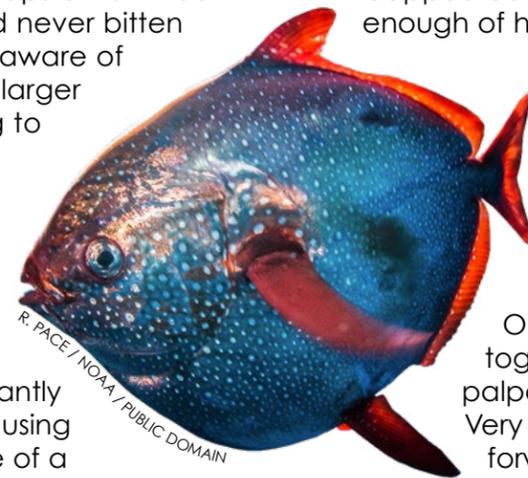
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My, what big teeth you have! Giant moray eel reveals its chompers as it gapes (left); Opah or saumon des dieux (below); Agile giant moray eels make their dens in reef crevasses (bottom right)

moments. Once I found him curved up under the overhang, his menacing smile opening and closing centimetres from my elbow, yet out of my view unless I leant over and looked there.

He was clearly aware of eyegaze. I had been putting my hand there repeatedly to drift scraps of fish meat to the fish, yet he had never bitten me. When I became aware of him, I began floating larger pieces to him, hoping to convince him of my benevolence. But I avoided letting my hand get near him again.

One night, as it grew dark, he began looking at me expectantly from the grotto. I was using the rectangular frame of a saumon des dieux or opah (*Lampris guttatus*) to feed the fish, and its flesh was tough, and difficult to scrape off for distribution to the hundreds of characters impatiently waiting. Slowly I worked, scattering the handfuls, and wafting pieces to the moray eel. From



R. PACE / NOAA / PUBLIC DOMAIN

time to time, I was interrupted by the sharks and then resumed feeding the fish. Once in a while, the eel retreated, and the space filled with groupers and squirrelfish, all waiting for crumbs to come their way.

It was nearly dark when the eel reappeared and extended enough of his length from the grotto so that our eyes were on the same level. From there, he looked at me alertly and I looked back, wondering what was in his mind.

Our faces were close together and there was palpable eye contact. Very slowly, he moved forward, his eyes fixed mine, and gently took on his side of the frame of the opah I was still holding. He began to pull it, with the slightest pressure, without breaking eye contact. It was as if he was asking if he could have it—the whole thing—and waiting to see my

on to. So, when a female shark who rarely visited approached, I returned to my original one, and waited, camera poised, for her to come close. But I had underestimated the emotional state of the eel, who now appeared under my nose, energetically trying to push himself through a hole just a bit too small to permit him to reach my face. I had to change locations again.

For the rest of the session, whenever I looked at the eel, he menacingly thrust his head towards me. It was daunting to see his emotional reaction and for how long he held his grudge! There was no doubt that he had understood my gesture when I had advanced and waved my camera at him. Though I had not actually attacked or chased him, he had fully understood anyway!

A cooperative eel

At the evening feeding sessions, the big eels were common visitors. Their heads waded from their retreats around the clearing in the coral, and they flowed like anti-gravity snakes from one formation to another as they manoeuvred to get a scrap. As the session passed, they accumulated around me and slowly moved closer. During the height of the warm season, there would be four or five spaced around me, equidistant from one another.

One began to linger in the labyrinths of the formation I habitually used as a perch and he would reach up from a deep grotto on my left as I fed the fish. Sessions passed, and he persistently lurked there, surprising me at unwelcome



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Cooperative hunting occurs when coral groupers solicit moray eels to hunt in the reef so the groupers can feast on any escaping fish.

Cooperative hunting

Redouan Bshary's review of fish cognition (2002) describes how these huge eels engage in cooperative hunting, which involves cognition and was considered unique to humans before it was seen in chimpanzees and dolphins.

At Ras Mohammed National Park in Egypt, Javanese moray eels were solicited by Red Sea coral groupers

roamed through the tunnels in the coral formations, the grouper would wait for the escaping fish.

A tiny eel

Sometimes, a tiny eel would appear nearby during the fish feedings. One began looking out of a hole in the coral near my right hand, at times, and became increasingly confident there. I handed him bits of food in turn, while scattering crumbs for the fish. When they became excited, he would slip a long length of his body out and oscillate wildly back and forth like an insane snake, trying to bite them.

He was present at my right hand no matter which dead coral structure I was using, so he was there intentionally. Then, when I began feeding the fish, he would emerge from his tiny hole, grab some meat in the fish head I held, and yank with all his might. I would waft a piece his way, which he would snatch, then he would search around my hands for more. Occasionally, he would get himself entwined in my fingers. Nothing I had ever felt could compare with his softness. After a while, he began touching my fingers while I watched the sharks, but never when I was looking at him.

He too was aware of eye gaze.

The mysterious community

As night fell, the blackfin sharks



response. The heavy piece was about 35cm square. I let go, and he carried it gracefully into the grotto.

His behaviour was very different from that described by the experts. He seemed to understand my actions of providing a snack for those gathered, and his behaviour in the situation was reasonable and intelligent.

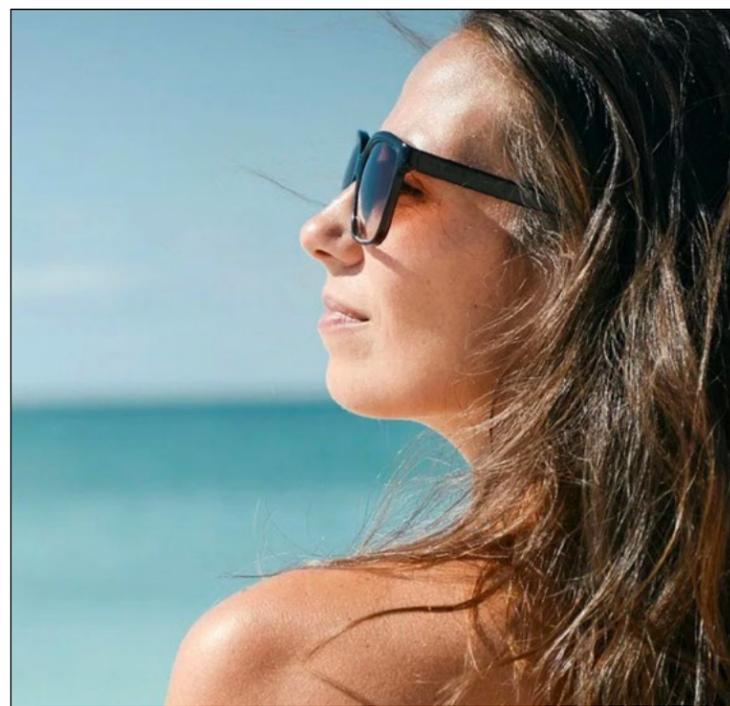
(*Plectropomus pessuliferus marisrubri*), and lunartail groupers (*Variola louti*). These large fish would come up to within a metre of where the eel was resting in its grotto and shake their bodies in an exaggerated gesture. Often, the eel would emerge and swim next to the fish, sometimes so close that they touched. Then, while the eel

Lunartail groupers, or *Variola louti* (above), and Red Sea coral groupers, or *Plectropomus pessuliferus marisrubri* (right), will cooperate and hunt with moray eels to get a meal.




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With no sign of aggression or fighting among large species, there was a sense of community on the reef, and interactions between moray eels (above and right), blacktip sharks (left) and sicklefin lemon sharks (right) seemed to be, for the most part, reasonable and peaceful.

of the fish, eels and sharks present shot directly away from him, so that his entry was highlighted by thousands of shining streaks radiating away from the place he had entered. (This flight of fish away from the centre, when startled by a predator, is called a flash expansion.) However, the lemon shark would just take a fish head and depart, whereon the peaceful gathering immediately reformed.

Though both sharks and eels have shown that they will respond with their version of anger to aggressive affronts, they also showed continuously, week after week, year after year, that they were reasonable and essentially peaceful.

Indeed, no human mind can conceive their true qualities. They are clearly more complex and noble than we have assumed

and show every sign of being sentient. ■

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



ANDY MURCH / BIGFISHEXPEDITIONS.COM

Special thanks to Rico Besserlich (maviphoto.com) and Andy Murch (bigfishexpeditions.com).

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would disperse into the coral surroundings until only the nurse sharks remained, languidly writhing around the open region in the coral amid the flitting fish. There were enough of them to carpet the site—two of over three metres in length, and about five that were not much smaller than that, plus a few juveniles. They would scrape and suck out the contents of the fish heads, wriggling all over as they did so, in clouds of sand, wrasses and yellow perch.

One night, one of them was lying under a coral formation, close beside an enormous Javanese moray eel. The two of them were touching all along their sides, the

nurse shark eating, the eel looking calmly out at me. For two species renowned for their aggression and even for being dangerous, the sight was unexpected. It enhanced the feeling of being in a community in which a certain camaraderie existed, which was far from the blood-and-teeth, dog-eat-dog way that nature is usually presented.

All of those animals gathered in peace for each session, and there never was any aggression or fighting.

Occasionally, a much larger Pacific lemon shark swept in. Startled by the arrival of such a huge and unexpected guest, all



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Edited by
Rosemary E. Lunn
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Equipment

Hoodoo

Canadian brand Bendetti Optics Hoodoo style combines the sleek modern lines



of the classic wayfarer with the curved functionality of a wrap to form the perfect pair of lightweight, go anywhere sunglasses. Built for medium to larger faces, these sunnies will be your new favourites and the ones you go back to again and again. The flexible frames are made from super-soft polycarbonate frames. Double-thick triacetate polarized lenses offer 100% UVA/B protection.

BendettiOptics.com



Hydroflex

Aqualung's HydroFlex wetsuits are designed for warm water and come in 1mm and 3mm thicknesses—the 3mm variant is also available as a shorty. They are made from a four-way, super-stretch neoprene, which Aqualung states can stretch up to 250% more than standard neoprene. Seams are rubber-sealed for warmth and durability and printed designs and panels resist abrasion. Aqualung.com



Xenos

Fourth Element states the design criteria behind its Xenos line was to make the suits as easy as possible to get on and off. This is achieved by cutaway ankles and smooth linings in the arms and legs. The 7mm neoprene with Thermoflex linings on the torso and the Glideskin wrist seals ensure that this suit can take you into a cooler comfort zone. For water temperatures from 12–22°C, the suit can be combined with a hood or hooded vest, which will protect the body core. Other features include snag-free, hook-and-loop neck closures, with improved sealing surfaces to further reduce water ingress. Hardwearing Supratex-lined knee panels provide tough, yet comfortable knee protection. Fourthelement.com

O'Three Beanie

One way to help protect your body temperature when you are at the surface is to wear a hat. The latest one to hit our shelves is from O'Three. The UK-based



drysuit manufacturer has launched a smart heavyweight beanie made from 100% soft-spun acrylic. This luxury hat comes in two striking colours: Oxford Navy and Mustard.

One of the things I hate about wearing a hat is that it can be a tad itchy. Not so, this O'Three garment. I have been wearing it on cold days (and nights) and found it to be very cosy and comfortable. The secret is that this "one-size-fits-all" beanie has a fleecy Shearling thermal band, which provides extra warmth around your ears. The result is a super snug experience. This high quality hat is "cable" knitted using a multi-yarn, and subtly finished with a custom etched faux leather O'Three tag—just perfect for winter walks and spells on the surface. OThree.co.uk

Carbon

Scubapro's new regulator combo with the gnarly designation, MK19 EVO BT/G260



Carbon BT, is an upgrade to the popular G260 technical diving system that is both lighter and more corrosion-resistant since it is made from carbon fibre. Scubapro states it is designed to be its premium regulator system for cold water, silty diving conditions and technical diving. It is rated to 40% nitrox out of the box, but currently, O₂ kits are not available for this regulator. It has a diver-adjustable inhalation effort knob and a dive/pre-dive switch to prevent free-flows in cold water or when used as an octopus. Scubapro.com

Oceaner Splash Bag

Dry bags. We all need and use these invaluable bags to keep our personal possessions dry during a dive, or to stash wet kit post-dive. The vast majority of dry bags are made from a lightweight flexible material such as nylon. This tends to be quite rugged, and it is very effective at keeping gear dry. However it does not provide any cushioning protection. The Canadian-made tubular "Splash Bag" by Oceaner looks as though it might offer a better solution—a dry bag that has light impact resistance because it is manufactured from durable Nylon II neoprene. (This does not mean that the bag will provide waterproof protection to its contents if you take it diving). The Oceaner Splash Bag is fastened in the traditional manner, i.e. the roll-top opening is secured with a durable plastic buckle, and all the seams are glued and blind-stitched. Available in four colours: Black, Silver, Burgandy and Green Camo. Oceaner.com





Text by Simon Pridmore
Photos by Andrey Bizyukin

Today, technical diving is well into its fourth decade. We now have better tools, technology and systems than we did in the past and we know far more about which methods, decompression strategies and gear configurations work well and which do not.

There are more people doing technical dives than ever before and there are more professional dive operations catering to technical divers. Far from being an outlier, as it was in the early days, technical diving is now just another branch of the mainstream scuba diving world.

However, despite these developments, divers are still coming to harm on technical dives in the same way they did a generation ago.

As in so many other fields of human experience, familiarity breeds complacency and this leads to overconfidence, negligence and carelessness.



Ten Commandments

for Technical Diving Ops – Part I

Operational thinking

An excellent strategy to guard against complacency and protect you and your dive team from becoming too casual about your diving is to establish set operational procedures for all your technical dives. View these procedures as unbreakable rules—commandments

written in stone.

Think of every technical dive as an operation—whether it is a training dive, an afternoon fun dive with friends, a dive into a cave you have already visited 50 times or the exploration of a deep shipwreck that nobody has ever seen before. If it is a technical dive, it is a technical

diving operation, and the commandments apply.

You and your dive team should set your own commandments, according to your collective backgrounds, aims and circumstances, but here are a few ideas that the teams I have dived with over the years have come up with.

First commandment: Prepare paperwork

In the United Kingdom, every scuba diving instructor is required to prepare and complete a number of forms before every teaching dive they do. The two primary documents are a project plan and a daily dive log. These cover details of





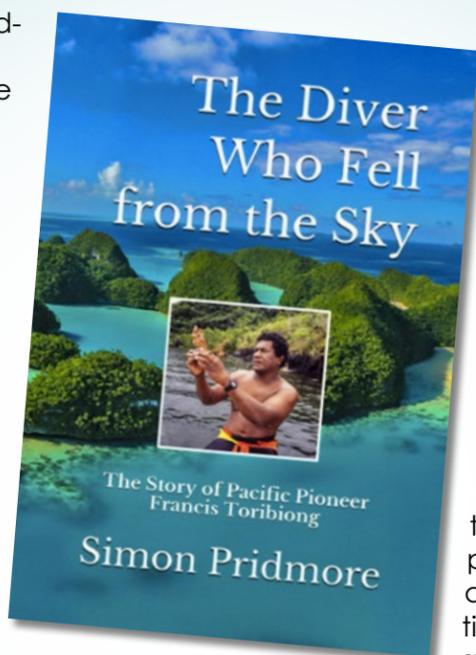
the personnel, plans, places and emergency procedures. The first is general and involves issues relating to standard operating practice. The second is specific and covers the people involved that day, the sites they are diving and the

prevailing weather conditions.

Samples of these can be easily found online via the Health and Safety Executive (HSE) and British Sub-Aqua Club (BSAC) websites.

A New Book from Simon Pridmore

When his country needed him most, Palauan Francis Toribiong came along and helped the Pacific island nation find its place in the world and become an independent, forward-looking 20th century state. And he achieved this, improbably, via the sport of scuba diving. This is the inspiring tale of an absolutely unique life, written by Simon Pridmore and illustrated with images of the beautiful islands of Palau, above and below the water.



him this title, people were speaking both literally and figuratively.

Toribiong was so completely different from all of his contemporaries in terms of his demeanor, his ambitions and his vision, that it was as if he had come from outer space. Palau had never seen anybody quite like him and there was no historical precedent for what he did. He had no operations manual to consult and no examples to follow. He wrote his own life.

Toribiong was born poor, had no academic leanings and no talent for diplomacy. Yet he was driven to succeed by a combination of duty, faith, a deep-seated determination to do the right thing and an absolute refusal ever to compromise his values. And, as well as all that, he was Palau's first ever parachutist—known by islanders as “the Palauan who fell from the sky.” In giving

Toribiong was the first Palauan ever to seek and seize the international narrative. No Palauan, in any context or field, had previously thought to go out into the world and say: “This is Palau—what we have is wonderful. Come and see!” This is his astonishing story.

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Why are documents like these useful for technical diving operations?

- They make sure that you have remembered all the essential things.
- They help you assess risk.
- You have procedures immediately on hand if you need to deal with an emergency, so you do not have to make up plans off the top of your head during the chaos and confusion that always accompanies an accident.
- They give you a full record of every dive you do.
- They mean that you have most of the dive plan and emergency plan already written for the next time you go to the site, so you do not have to rely on memory or keep “reinventing the wheel.”
- Finally, as all the divers sign off on the paperwork in advance, the team

can be confident that every member knows and accepts his or her role.

Second commandment: Nominate a supervisor

Shortly after I started technical diving, I made a pilgrimage to Florida, as everyone did in those days, and I dived with a guy named Jim Mims, who ran trips out of Pompano Beach to a number of deep gulfstream wrecks. Jim was a vastly experienced diver but, when we met, he told me he did not do much diving himself anymore. Over time, I found out why. He did not dive because he was too busy running the dives.

He set the shot lines onto the wrecks, supervised the gases, gave the briefings, helped the divers gear up and get in, watched for divers coming up early or missing the decompression station, supervised his safety divers, sorted out prob-

lems, debriefed the dives and collected the shot lines. If he had been on the dive himself, he could not have done any of these things and each of them was crucial for the safe completion of the dive.

Later in my career, I noticed how major technical diving expeditions adopted a similar strategy, appointing a highly qualified diver to run the dives. This, of course, is a procedure borrowed from the world of commercial diving, where the surface supervisors—the people in direct control of dive operations—are all veteran divers.

Obviously, if you have a dive team, it does not make sense to have the same person always in the role of dive supervisor, as that individual will never get to dive. The solution is to rotate the job among all members of the team so the team as a whole becomes more experienced and therefore stronger. Also, everyone gets to dive.





opinion



Third commandment: Deploy safety divers

As well as a supervisor, every technical dive operation needs to have at least one safety diver working in the decompression zone. Without in-water safety divers, there will be some gaping holes in your emergency response plan.

The most important part of any technical dive is the decompression phase and, however good a diver you are, there are situations that may arise during this phase that you and your fellow deep divers cannot resolve because you are trapped by your own decompression burden. You cannot descend without increasing your ascent time and reducing your gas supply, and you cannot ascend beyond your decompression ceiling without increasing your risk of DCS. Your movements and your options are strictly curtailed. The dive supervisor is unlikely to be able to help because normally they will be up on the boat.

This is where in-water safety divers come in very handy.

The safety divers need to be experi-

enced technical divers who are going to take the job seriously, not just fun divers recruited to make up the numbers with the promise of a free dive. The safety divers are in charge of setting up the decompression station and back-up decompression gas on the planned ascent route before the deep dive team arrives. They also have to watch and be ready to react in case the deep divers have been unable to ascend along the planned route and are coming up elsewhere.

Most importantly, the safety divers need to be in place and alert at the point where the divers plan to switch to their first decompression gas, a moment in the dive where mistakes are often made, and an extra pair of eyes is extremely valuable.

Divers often get task-loaded and make mistakes at this time. They need simultaneously to switch to the right gas, make sure they are neutrally buoyant and neither ascend beyond their stop depth nor drift down below their safe oxygen depth. Then, they have to record the gas switch on their dive

computers to keep their decompression schedule on track.

Throughout the decompression phase of the dive, the safety divers continue to watch over the divers and remain on the lookout for any problems. While the majority of the safety divers' attention will be focused on the deep dive team, they must also have the discipline to remain aware of

their own status and not go into decompression. This is because they have to be able at any time to surface, if necessary, to do things like communicate with

the boat or get more gas.

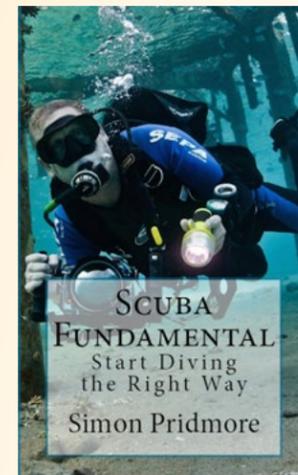
In the next part in this series, I will suggest a few more commandments for tech diving ops. ■

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



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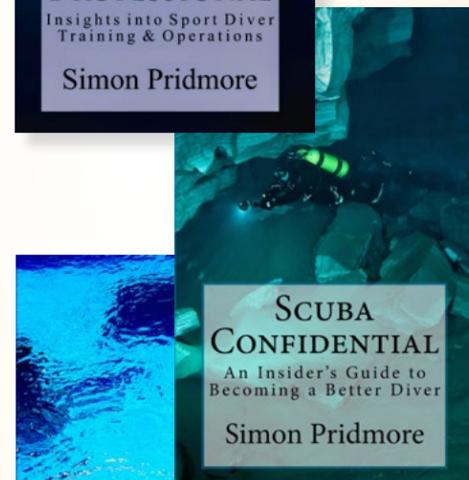


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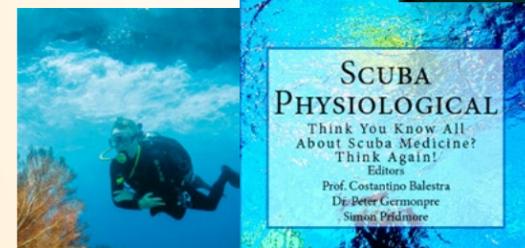


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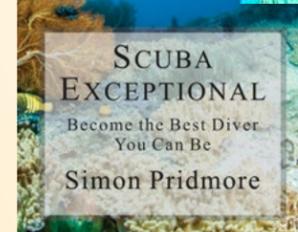
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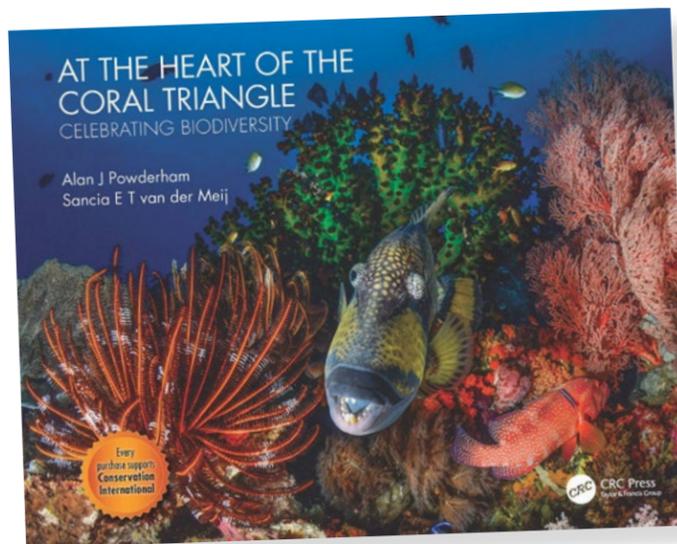
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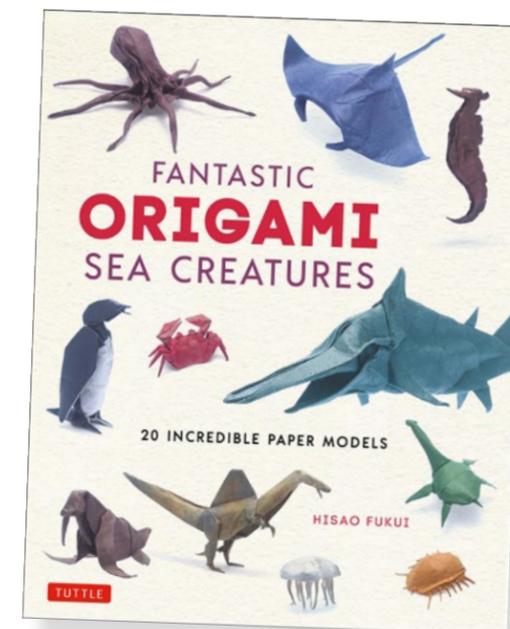


Coral Triangle

At the Heart of the Coral Triangle: Celebrating Biodiversity, by Alan J Powderham and Sancia van der Meij

This book celebrates the biodiversity within the Coral Triangle. Being home to 75 percent of the world's coral species and around 2,500 species of fish, the biological and environmental biodiversity here is boosted by the active and complex geology of the Ring of Fire and vast calderas. Using stunning photography and an engaging and accessible text, the book highlights and celebrates this exciting richness alongside the message that it needs our care and protection.

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ISBN-13: 978-0367428167

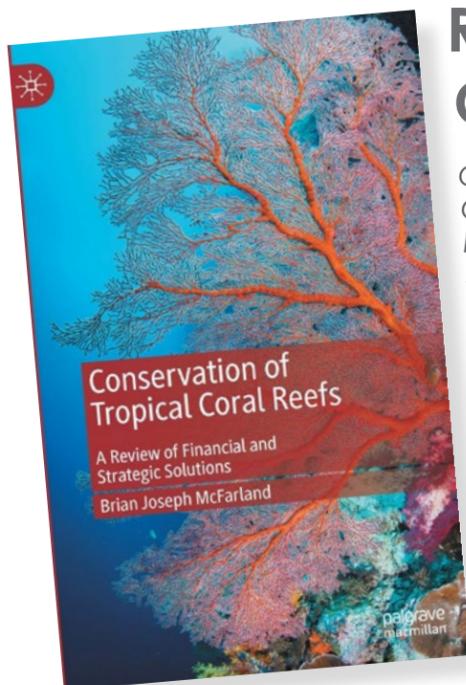


Sea Creatures

Fantastic Origami Sea Creatures: 20 Incredible Paper Models, by Hisao Fukui

In this book, Japanese origami expert Hisao Fukui provides step-by-step illustrations on how to fold paper into 20 complex and intricate sea creatures, from prehistoric creatures like an elasmobranch, spinosaurus and ichthyosaurus to present-day animals like a crocodile, blue whale, manta ray and goldfish. Even marine animals with multiple limbs or tentacles, like the crab, squid, octopus, jellyfish and marine isopod, are also featured.

Publisher: Tuttle Publishing
Date: 22 December 2020
Hardcover: 112 pages
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ISBN-13: 978-4805315781



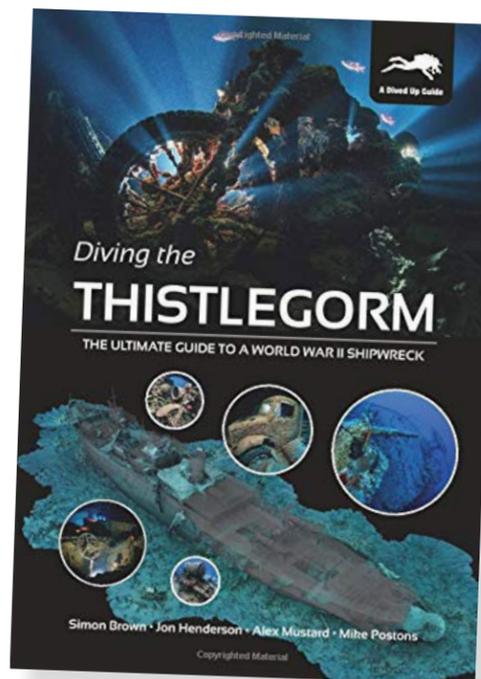
Reef Conservation

Conservation of Tropical Coral Reefs: A Review of Financial and Strategic Solutions, by Brian Joseph McFarland

This book focuses on how the conservation of tropical coral reefs is financed. Beginning with tropical coral reef degradation and loss, alongside an overview of tropical ecology, global environmental policy and finance, it reviews several conservation financing

instruments like ecotourism, debt-for-nature swaps, impact investments and government domestic budgetary expenditures. There are 30 case studies (spanning 23 countries and six continents) which tell the history of international conservation finance and provides options for individuals, businesses and governments to support conservation financing projects.

Publisher: Palgrave Macmillan
Date: 17 December 2020
Hardcover: 783 pages
ISBN-10: 3030570118
ISBN-13: 978-3030570118



Thistlegorm Wreck

Diving the Thistlegorm: The Ultimate Guide to a World War II Shipwreck, by Simon Brown, Jon Henderson, Alex Mustard and Mike Postons

This book is the culmination of decades of experience, archaeological and photographic expertise, many hours underwater, months of computer processing time, and days spent researching and verifying the ship's history and cargo. This visual guide uses reconstructions and explanations to take the reader through the *Thistlegorm* wreck in extensive detail, identifying individual items and illustrating where they can be found. Readers will come away with an understanding of what has been learnt and what mysteries are yet to be solved.

Publisher: Dived Up Publications
Date: 2 December 2020
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Edited by Catherine GS Lim & Peter Symes



Rice's whales are already considered endangered by the United States, with a population estimated at fewer than 100.

Rice's whale confirmed as a new species

It was historically identified as a subspecies of the Bryde's whale, but new genetic and anatomical evidence confirms it is a new species, which is most closely related to the Eden's whale.

Rice's whale (*Balaenoptera ricei*), previously believed to be a population of Bryde's whales, is an intermediate-sized species of baleen whale. Prior to its formal description as a distinct species, the Rice's whale was separately assessed by the IUCN red list as "Gulf of

Mexico whale", and is listed as critically endangered.

It is difficult even for experts to tell large baleen whales apart in the field but researchers have known for a long while that a group of Bryde's-like whales in

the Gulf of Mexico were different. They have a feeding strategy that takes them deep underwater to feed near the sea-floor, whereas Bryde's whales tend to forage near the surface. They have also only been consistently sighted within a small stretch in the northeastern corner of the Gulf of Mexico where they remain year-round, and they do not appear to be mingling with Bryde's whales, which are found in the Indian, Atlantic and Pacific Oceans.

To definitively tell similar-looking species apart, scientists need genetic evidence. So, researchers began collecting tissue samples from Rice's whales. Lynsey Wilcox, a geneticist with the US National Oceanic and Atmospheric Administration, who helped uncover the new species, and colleagues first began collecting tissue samples from Rice's whales in 2000, eventually collecting samples from 36 different individuals. In 2014, a genetic study found Rice's whale to likely represent a distinct species or subspecies of whale.

To compare their morphologies, the scientists first inspected skeletons held in museums, but in early 2018, a beached individual was found in Everglades National Park in Florida, and transported to the Smithsonian for a morphological examination, which revealed a number of differences. Together, the genetic and skeletal differences were enough to warrant a new species designation. ■

SOURCES: MARINE MAMMALS SCIENCE, ENDANGERED SPECIES RESEARCH

I was surprised that there could be an unrecognized species of whale out there, especially in our backyard.

—Lynsey Wilcox, geneticist with the US National Oceanic and Atmospheric Administration



Catalogue #3720 and calf were sighted 10 miles east of Wassaw Island, GA, on 19 January 2021.

Good news for north Atlantic right whales in southeastern United States

As at the end of January 2021, 68 north Atlantic right whales have been spotted in the waters off the coast of southeastern United States, a number that wildlife officials in Florida describe as "encouraging."

According to the Florida Fish and Wildlife Conservation Commission, the whales spotted this winter were aged from one to more than 47.

Three of these are young calves that have been spotted for the first time. The mothers of these calves are a 12-year-old whale named Champagne, a 19-year-old named Infinity and a 14-year-old with no recorded name (but is known simply as Catalogue #3720).

The advocacy group Defenders of Wildlife describes it as the most encouraging calving season in years. The *Guardian* reported that the group's senior attorney Jane Davenport said the right whales had been experiencing an

"unusual mortality event" since 2017, in the form of 32 confirmed deaths in US and Canadian waters and 14 serious or non-survivable injuries.

"While these births are an encouraging sign, the continued threats underscore that we still have to redouble our efforts to protect these vulnerable babies and their mothers," she said.

Pointing out the threats they face, like entanglement in fishing nets and speeding vessels, she added, "We're killing right whales far faster than they can reproduce. Unless we move quickly to abate these threats, we're running out of time to save the species from extinction."

According to Defenders of Wildlife, scientists estimated that there were about 356 right whales alive at the end of 2019; of these, fewer than 70 were adult females. ■ SOURCE: FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION

Edited by Catherine GS Lim

ROBERT BALDWIN / ENVIRONMENT SOCIETY OF OMAN



A blue whale diving off the Arabian Sea coast of Oman

Whale songs reveal existence of new blue whale population

A new population has been identified based on its unique whale song, recorded in three locations: the Arabian Sea coast of Oman, the Chagos Archipelago in the central Indian Ocean, and Madagascar in the southwest Indian Ocean.

It has long been recognised that a unique blue whale population resides in the Northern Indian Ocean, but it was assumed that whales in the Arabian Sea belonged to the same population that has been studied off Sri Lanka and ranges into the southcentral Indian Ocean. However, the songs tell a different story.

The first recording was obtained in 2017 by Dr Salvatore Cerchio,

Director of the African Aquatic Conservation Fund's Cetacean Program and a Visiting Scientist at the New England Aquarium. He had recorded it while conducting research on Omura's whales in the Mozambique Channel off Madagascar.

It turned out that the Oman recordings contained the same whale song, and they were even more prevalent off Oman than at Madagascar. It was then that the researchers realised that they had most likely found a population of blue whales in the western Indian Ocean that was not yet recognised.

"It was quite remarkable to find a whale song in your data that was

completely unique, never before reported, and recognise it as a blue whale."

"Before our recording effort off Oman, there were no acoustic data from the Arabian Sea, and so the identity of that population of blue whales was initially just a guess," said Andrew Willson from Five Oceans Environmental Services LLC, who was responsible for the deployment of the recording units.

"Our work shows that there is a lot more to learn about these animals, and this is an urgent requirement in light of the wide range of threats to large whales related to expanding maritime industries in the region." ■ SOURCE: ENDANGERED SPECIES RESEARCH

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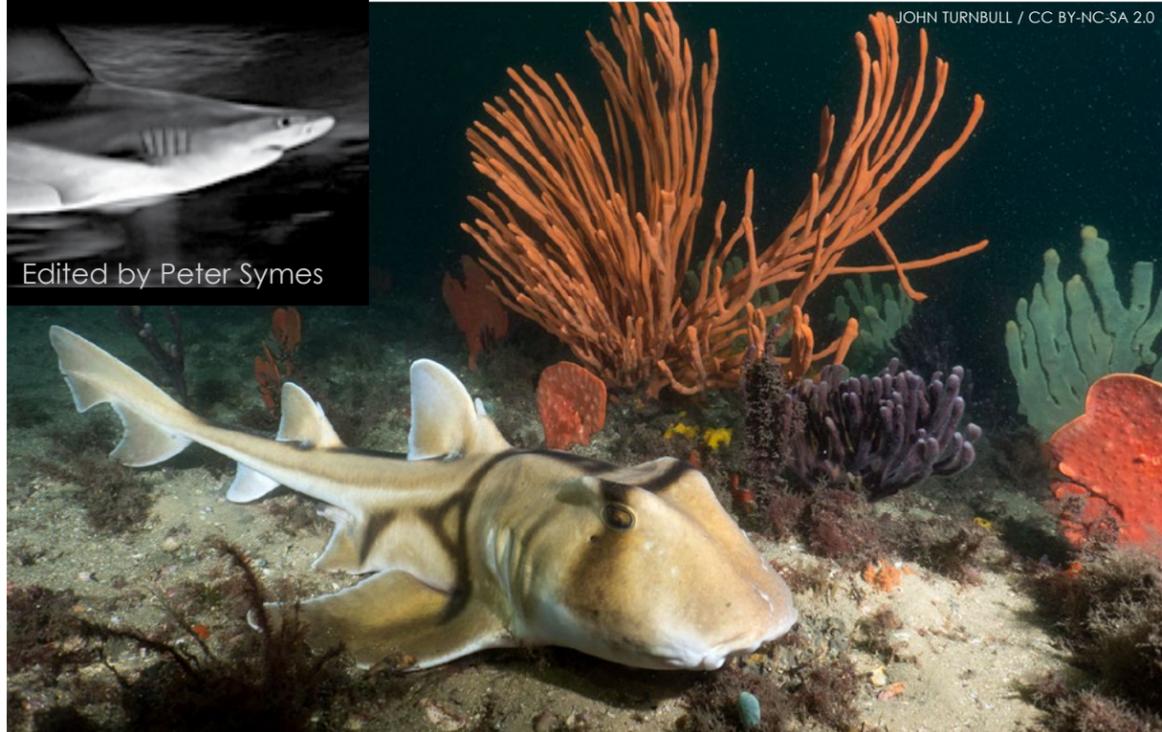
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Edited by Peter Symes

The Port Jackson shark (*Heterodontus portusjacksoni*) is a benthic, buccal pumping species, which remain motionless for extended periods of time.

Do sharks sleep?

Whether periods of prolonged inactivity, such as when sharks are resting on the seabed, represent sleep or quiet wakefulness has long been unknown. New findings indicate sharks do indeed sleep.

Sleep is ubiquitous across the animal kingdom, but despite anecdotal reports of sleep-like behaviour in nurse sharks and other seafloor-dwelling species, the question of whether sharks actually sleep has been intensely debated but remains unknown. A key criterion for separating sleep from other quiescent states is an increased arousal threshold. True sleep is characterised by a lack of movement that can be rapidly reversed, and a decreased awareness of surroundings. These behaviours are regulated by an animal's light-dark circadian rhythm and its homeostatic need to balance time asleep with time awake.

In an aquarium, researchers tested captive Port Jackson and draughtsboard

sharks—species that have previously been shown to exhibit reversible periods of stillness and circadian activity patterns—by applying a series of mild electrical pulses to the sharks' tanks to see how they responded. In both species, they had to apply a stronger electrical pulse to get a response from an inactive shark than from one that was swimming.

Sharks deprived of rest, however, show no significant compensatory increase in restfulness during their normal active period following enforced swimming. Nonetheless, increased arousal thresholds in inactive animals suggest that these two species of shark sleep. ■

SOURCE: JOURNAL OF SLEEP RESEARCH



Climate change shifts the range of white sharks

Unprecedented sightings of juvenile white sharks at the northern end of Monterey Bay signal a significant shift in the young white sharks' range.

Researcher have concluded that the northward range shift demonstrates water temperatures within their preferred temperature range of juvenile white sharks are becoming harder to find.

The animals have historically remained in warmer waters in the southern California Current. Between 1982 and 2013, the northernmost edge of the juveniles' range was located near Santa Barbara (34° N).

But after the dramatic North Pacific marine heat wave that hit the California coast between 2014 and 2016, their range shifted dramatically north to Bodega Bay (38.5° N). Ever since, the young sharks' range limit has hovered near Monterey (36° N).

This spatial shift is significant as it creates potential conflicts with commercial fisheries, protected species conservation and public safety concerns.

Scientists from Monterey Bay Aquarium and their research partners analysed data from tags deployed on juvenile white sharks since 2002 to see where the animals were spending most of their time. The team analysed 22 million electronic data records from 14 sharks and then compared these data to 38 years of ocean temperatures to map the cold edge of the animals' thermal preferences. The resulting chart showed a significant northward shift in the young white sharks' range. ■ SOURCE: SCIENTIFIC REPORTS

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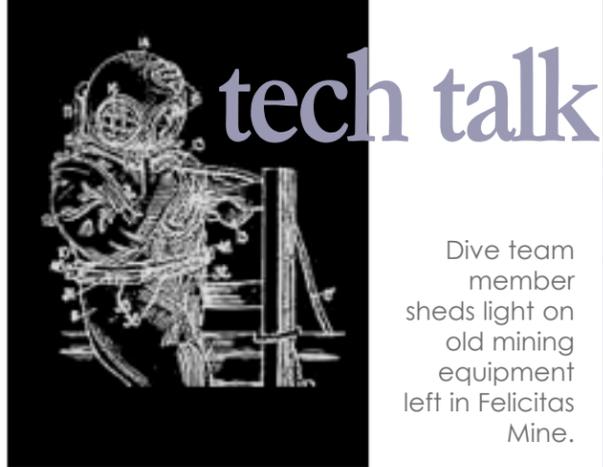
PHOTO COURTESY OF LUREN FERRETTI

The South Florida Underwater Photography Society (SFUPS) is a non-profit social organization dedicated to the promotion of excellence in underwater photography through its membership.

BENDING
ATMOSPHERES

A Journey from Inner to Outer Space

By **Glenn J. Butler**
with **W.B. King**



Dive team member sheds light on old mining equipment left in Felicitas Mine.

Text and photos by Andrea "Murdock" Alpini. Archive photo courtesy of Wolfgang Röhr

The more time passes, the less the distance is that separates one from the object of one's desire—in this case, it was a place. With time spent seeking, observing, studying, writing and pinning drafts of questions, all waiting for an answer, I decided to follow a line of inquiry into diving an old German slate mine in Schmallenberg (east of Düsseldorf) to understand its feasibility, aesthetic beauty and historical meaning.

Only a few hours separated me from the place where German miners had worked for centuries. My team and I were going to dive this mine, called Felicitas, where hundreds of workers had lived and dreamed for decades, covered by a soft, sooty layer of slate, advancing through tunnels and caressing the black dreams of ancient slate rocks, which coexisted with the personal loneliness of cold water, rocks, forgotten stories and spent breath. We would be descending below the edge of the earth, to move closer to the surface of life. Our story would become just another layer upon those left by the miners of Felicitas Mine



Felicitas Mine

— *Diving a German Black Slate Mine*

ANDREA "MURDOCK" ALPINI

in the past: "The anonymous history is stratified."

Day One

In the morning, we moved out from our

base camp in Hütten. In the last few days, we had measured more than a thousand meters of cave line. We clarified our main targets and the areas of the mine I wished to film. We fixed our checkpoints where

we would drop off cylinders and spots where we would place our directional markers. My caving van was filled with 19 deco cylinders and twinsets, ready to be used in the Felicitas Mine.

Fifty kilometers separated us from our arrival at the mine. As we neared the site, I noticed that the façades of houses were black, as were the roofs. The houses were built in a purely German style



Team member brings dive equipment into Felicitus Mine for the dive expedition.

Felicitas Mine

called “Fachwerkhäuser.” Looking out the car window, it seemed like we were on top of Golgotha Mountain during an Easter of biblical proportions; the sky was obscured by deep black clouds, in the same color as our surroundings. This black was more than a shadow, it was authoritarian, fascinating, and it absorbed all the rays of opalescent light.

Day Two

Approaching the mine was exciting. As we neared the site, we saw the old road sign that read “Abela Heilstollen” the name later used for the Felicitas Mine. I wished to be there, inside the mine, at the water’s edge. As soon as we arrived at the site, I started walking around the ancient barracks. We were surrounded by cornfields.

Far away in the distance, at the end of the field on the left, I saw a cement turret rising over the corn plants. It marked the end of the left branch of the mine—one of our main targets. Looking at it and estimating the distance that we would have to cover later, while swimming on open circuit, was impressive. The right branch, also known as “The Old Mine,” was closer; that is, it was 530m from the starting point of the dive. Today, we wanted to reach the end of it.

When we got inside the dry part of the mine, everything was the same as it had been left a few decades ago when the mine ceased operations and was sold to a new owner for another business. Slate machinery had been abandoned inside the chamber.



ANDREA “MURDOCK” ALPINI

Our team started to unload the heavy diving equipment from the van. We split the equipment into three groups: my own, my colleague Gianni Cecchi’s, and finally, my other colleague Flavio Cavalli’s. Flavio was our surface assistant and gas-mixing supervisor (checking regulators, tanks MOD), and last but not least, our interpreter for Wolfgang Röhr, owner of the mine and archival photos.

Our daily plan consisted of three different dives, each one with a different final goal. The very first dive would focus only on setting down our sturdy main line, a 120m length of solid 8mm rope. During the second dive, we would carry six cylinders of safety gas (in the end) and EAN 50 plus oxygen, at 21m and 6m depths, to complete our decompression procedures. At the end of the main line, we came to a T. Turning left brought one directly into the new part of the mine. On the opposite side was the old part of Felicitas Mine.

During our second dive, we explored 270m of old tunnels, leaving directional markers with distances, and clipping safety gas cylinders along the way. We also visited the Santa Barbara—a real bunker where explosives had been stored. A layer of concrete had separated the TNT from the slate tunnel. Inside, the room looked like a bank vault. What I saw in front of my eyes was not so different from the Kaaba in Mecca.

We had placed the stages and markers for our third dive of the day. Now, it was time to come back and start decompression.

At 7:10 p.m., we put our heads underwater again. We left at Flavio’s “OK” signal and swam the first 120 meters of the mine; we had to be quick about it to save time for the next part of the dive. We wanted to reach the end of the Old Mine’s tunnel.

When we arrived at a fork, we entered an old brick tunnel—a stunning sight. Below us, the ancient rail track slid away. We were now 350m away from the entrance, more or less, and 170m separated us from our “touchdown” goal. Along the way, we observed that many parts had collapsed; sometimes, it was the walls and other times, it was debris that had fallen from the ceiling.

Large ruins marked the area at around 430m. We had to swim another 100m before we reached the farthest end of the old branch of the mine. The ambience of the space was sometimes scary and gloomy. This part of the mine was very tricky and precarious to navigate.

Visiting the right branch of the mine was a great adventure—definitely a “must-see” place in Felicitas. We then returned back to the main T where the path split.



Historical archive photo of the Felicitas miners class of 1958



tech talk

Stage cylinders were clipped onto the main line in Felicitas Mine by a team member.

Here, I found myself in front of a sacred shrine made of iron. It was a holy place where miners used to pray every day before starting their jobs but also before leaving the mine. On my left, I could see our floating deco cylinders, clipped onto the line. I seemed to struggle between a "holy and profane love."

Day Three

Fifteen minutes to 6:00 p.m. The third dive of the day awaited us in Felicitas. Earlier, in the morning, we had placed the emergency line along the left branch. Large, empty spaces and huge machinery left inside the modern part of the mine characterized this area, which comprised a

main tunnel with additional side chambers. It was in 1997 when Felicitas Mine finally closed down its extractive operations.

My mind drifted back to our earlier dive... We had dived around noon. Our planned bottom time was 50 minutes, just enough time to drop our cylinders for further progression.

Today, we would not explore the mine to the end, so we decided to simulate different diving scenarios instead. We wanted to be ready for the main dive tomorrow.

We spent a lot of time below the Steel Barrel Tunnel, which climbed upwards;



Felicitas Mine

ANDREA "MURDOCK" ALPINI



ANDREA "MURDOCK" ALPINI

The dive team with all the dive equipment needed to dive the Felicitas Mine

the steel here seemed to be very fragile. On top of the barrel, some massive, huge stones covered its roof.

Exiting the Steel Barrel Tunnel and moving to the right, about ten meters ahead, more or less, we found the first of the large-scale empty chambers where slate was mined. To the left of the main path, there was a small storage area; we used its rooftop as cylinder pick-up/drop-off stations. All around us, it was muddy and sometimes silty. Most likely, the silt had been stirred up by unstable rocks that had fallen down.

We continued ahead and later, we went back, passing the same spots again and again, which helped me memorize this place, which was wrapped in darkness. At the end of the day, we calculated that our full length of penetration (and return) was 1,500m, with each of us carrying four to six cylinders at all times, using only our fins to move forward, without the

aid of a diver propulsion vehicle (DPV). The afternoon ran late and the last dive of the day was calling to us, the most demanding one. We needed to drop off the heavy 20-liter tank filled with Helitrox 30/10 at the farthest checkpoint on the map. This was our "home plate."

For the first time, we passed over the final fork. Here, the tunnel was narrow, and we plodded ahead, like a horse in training. Slow thoughts passed through my mind and brought me back to the main T. Another tough scuba diving day in the mine was over.

Day Four

The Big Wednesday had come. We were submerged up to our hips. I switched on my powerful video lights.

No video shooting had taken place on our way in. We had spread our stage tanks with extra gases on the main line during the last two dives, so now it was

time to swim quickly. Today, we wanted to reach the final target: the end of the left branch. Felicitas Mine was awaiting. We had to go west!

Thirty-five minutes had passed when we reached the planned checkpoint: the "anvil" 20l tank of trimix. Now that we had reached it, I thought to myself, we are not too far from "The End." Staying focused on breathing, being calm and relaxed... this was what we had to do. It was a blind tunnel, with no way out and no chance to find a different way back. We had to pay careful attention while we swam and moved forward, as with one wrong frog kick, visibility would quickly drop to zero.

Here, at the end of all the black shadows we had left behind, the slate was simply amazing. A stunning scene and atmosphere surrounded Gianni and me. I filmed the moment, as I knew I would want to relive it again and again later.



ANDREA "MURDOCK" ALPINI

The rocks of Felicitas felt crisp and sharp to us, and we were enthralled by their colors, which ranged from black to yellow, gray to fire-red, and finally to bright light blue. Awesome!

I was breathless, without words.

In front of me there appeared to be two stairways to heaven. The first one was a wooden ladder, and the second one was made of steel now corroded. Climbing these ladders was the only quick exit this mine had. The entrance was 650m away, reaching it during an emergency was impossible on foot, let alone by swimming. Now, it was time to go back.

Day Five: The End

The beginning of the mine corresponded with its end. Miners or divers must walk the same steps before reaching the surface again. When one changed direc-

tion and left the black shadows behind, the darkness swallowed everything on the path.

Only human memory can preserve the spirit of life that had lived here. The mine does not care how powerful the lights that you bring inside its rocky belly are; it will always give you darkness and obscurity in return.

In July 1969, Man left a footprint on the moon. One of the most beautiful memories I collected from Felicitas Mine was the sight of the workers' footprints on the ancient ground. Along the tunnels of the mine, tracks and traces of anonymous miners, pickers and serial drinkers will remain forever, frozen in time.

To return to Felicitas to learn more about its stories and secrets, discover more forks and find more beautiful places to film...

these were my thoughts when I left Germany in the summer of 2020. Diving inside the German slate mine was a human journey through historical, economic and anthropological times.

Goodbye, foreign land. ■

The dive team included Andrea "Murdock" Alpini, Gianni Cecchi and Flavio Cavalli. The team's sponsors included PHY Diving Equipment, Scubatec, Tecnodive, Big Blue Lights and TEMC gas analyzers.

Based in Italy, author Andrea "Murdock" Alpini is a technical diving instructor for TDI, CMAS, and ADIP. Diving since 1997, he is a professional diver focused on advanced trimix deep diving, log dives with open circuit, decompression studies, and research on wrecks, mines and caves. Diving uncommon spots and arranging

ANDREA "MURDOCK" ALPINI



Felicitas Mine

Behind the wooden and corroded steel ladders was raw slate in various colors (above). A shrine of iron (left) was the place in Felicitas where miners used to pray every day before starting their jobs and also when leaving the mine.

*diving expeditions, he shoots footage of wrecks and writes presentations for conferences and articles for dive publications and websites such as ScubaPortal, Relitti in Liguria, Nautica Report, SUB Underwater Magazine, Scuba Zone, Ocean4Future and InDepth. He is also member of the Historical Diving Society Italy (HDSI), and holds a master's degree in Architecture and an MBA in Economics of Arts. He is the founder of **Phy Diving Equipment (phidiving.com)**, which specializes in undergarments for diving, as well as drysuits, hoods and tools for cave and wreck diving. Among other wrecks, he has dived the Scapa Flow wrecks heritage, Malin Head's wrecks and the HMHS Britannic (-118m), FW58C (-110m), SS Nina (-115m), Motonave Viminale (-108m), SS Marsala (-105m), UJ2208 (-107m) and the submarine U-455 (-119m)—always on an open cir-*

cuit system. His first book, Deep Blue, about scuba diving exploration (in Italian) was released in January 2020 (see [amazon.it](https://www.amazon.it)).

For more information on courses, expeditions and dived wrecks, please visit: wreckdiving.it.

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photo &
video

Lionfish,
the image
to be used
for this
tutorial

Text and photos by Rico Besserdich

In this series of articles on postproduction of underwater images, we have worked a lot on white balance settings, basic and advanced exposure corrections, contrast and curves, advanced techniques of removing colour casts, basic and advanced retouching, final colour boost, cropping and sharpening. Finally, our image is ready! And now, we arrive at the question: What do I do with it? How do I save it for further editing, or how do I create final files for Facebook, websites and printing?

The good news is that if you did your entire image processing in a RAW converter, such as Adobe Camera Raw or Adobe Lightroom, you have



Proper Export

of Underwater Images in Postproduction

nothing to worry about, with regard to keeping your work files. Editing RAW files is non-destructive, and your original photograph is never altered. You can

always go back to "zero," improve your postproduction, try something new or start from scratch (without loss of quality).

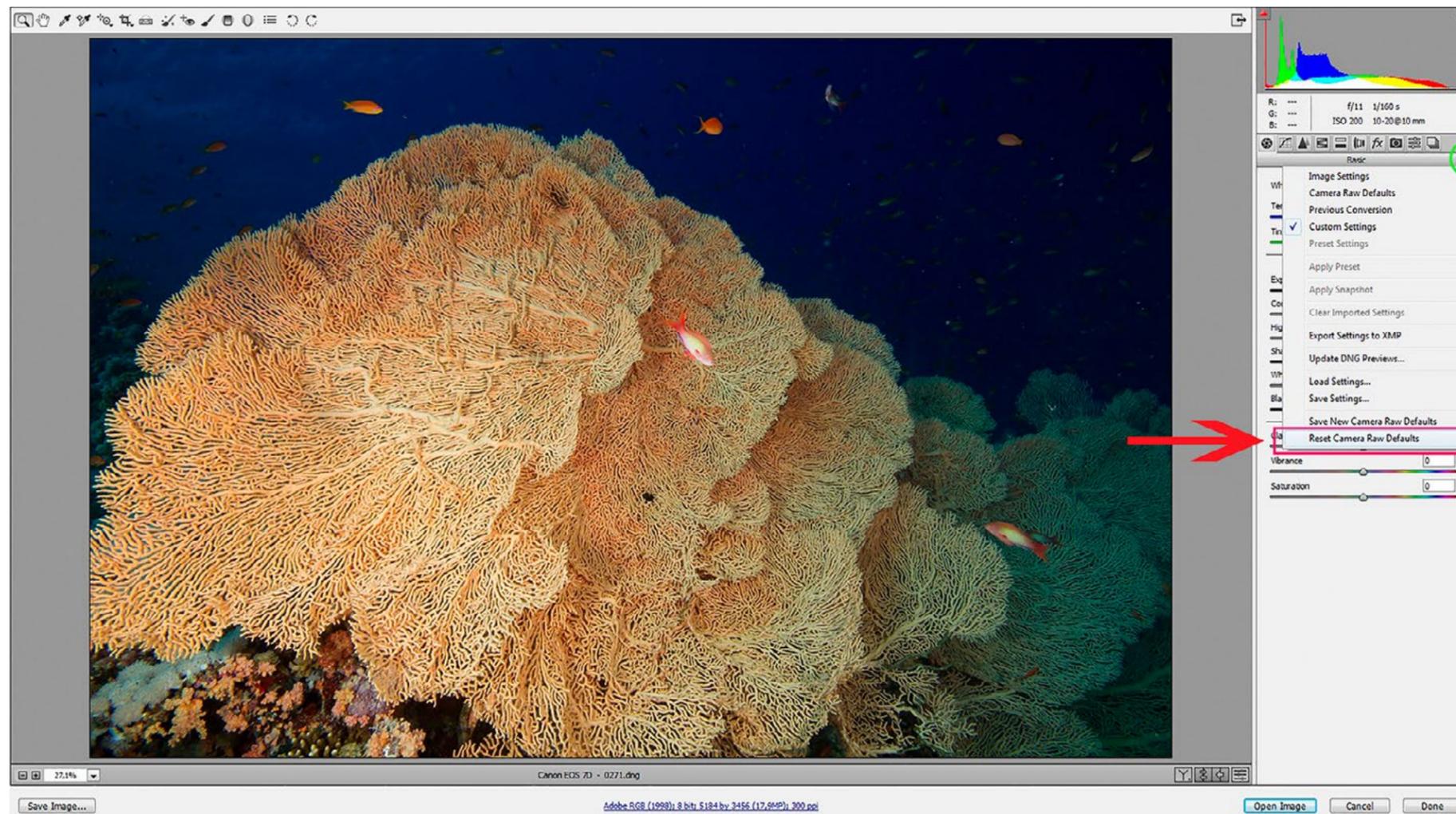
In Adobe Camera Raw, just open the Options menu at the top right of the "Basics" module (green circle) and select "Reset Camera Raw Defaults."

Your edited RAW file will then reset to its original state. Alternatively, you can manually set altered values of exposure, contrast, etc., back to "0," just in





Screenshot 1. In Adobe Camera Raw, to reset an edited image to its original unedited state, open the options menu at the top right corner of the "Basics" module (green circle) and select "Reset Camera Raw Defaults" (red arrow). Or, in case you do not want to revert completely back to the starting point, you can manually set altered values of exposure, contrast, etc., back to "0."



Screenshot 2. In Adobe Lightroom (below), to reset an edited image to its original unedited state, just right-mouse-click in the image itself (in Lightroom's Development module) to access the submenu. Then, select the "Reset" options in the "Settings" submenu and your RAW image will get set back to "0."

case you do not want to completely revert back to the starting point (See Screenshot 1).

In Adobe Lightroom, you can access a submenu when doing a right-mouse click in the image itself (in Lightroom's development module). Select the "Reset" option in the "Settings" submenu and your RAW image will get set back to "0." (See Screenshot 2)

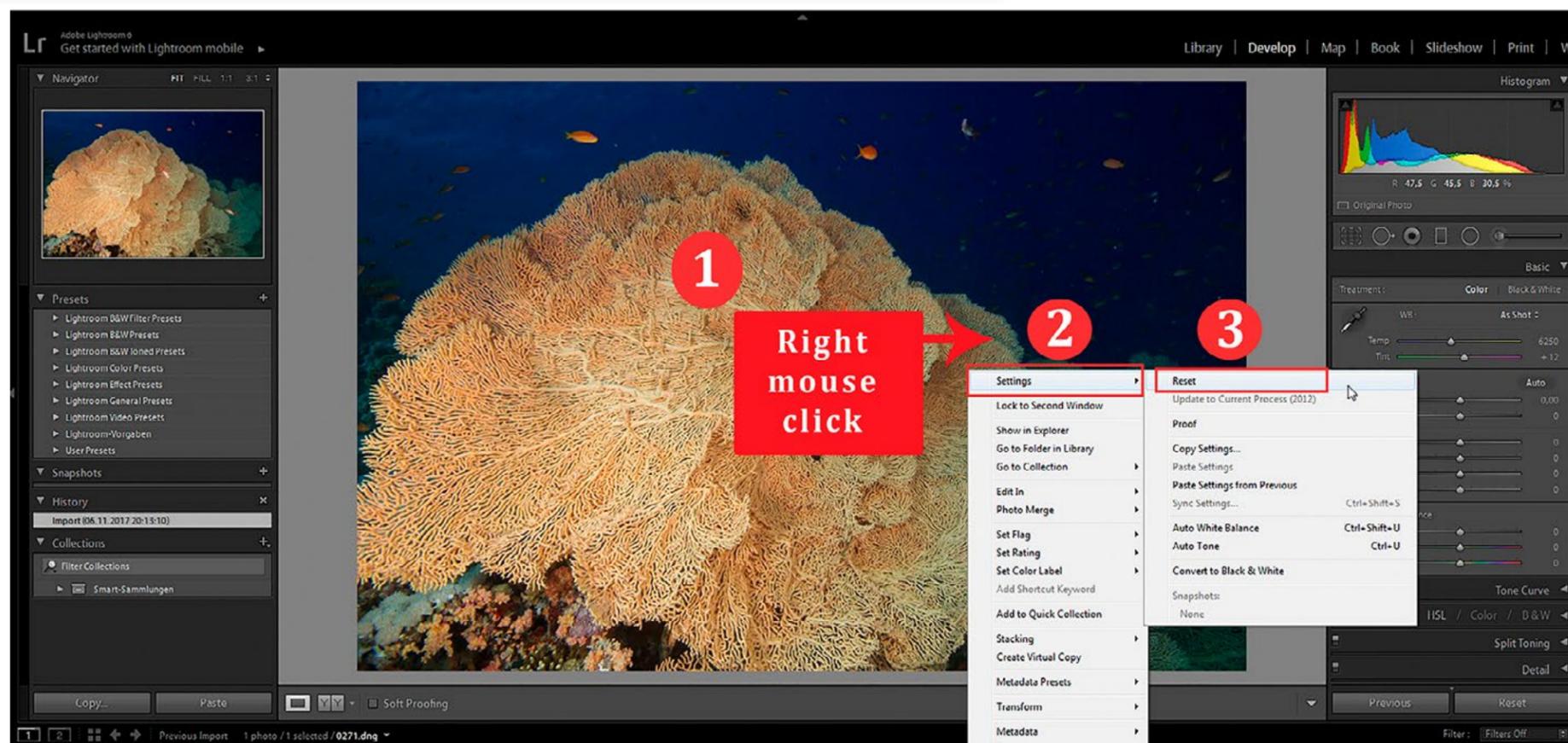
In case you have done more editing in Photoshop and maybe want to return to that work file later, it would be wise to save that file and all layers as Photoshop PSD files. Only this file format provides the opportunity to modify, change or alter your former steps of postproduction in Photoshop.

How to export any ready, edited image pretty much depends on the planned usage.

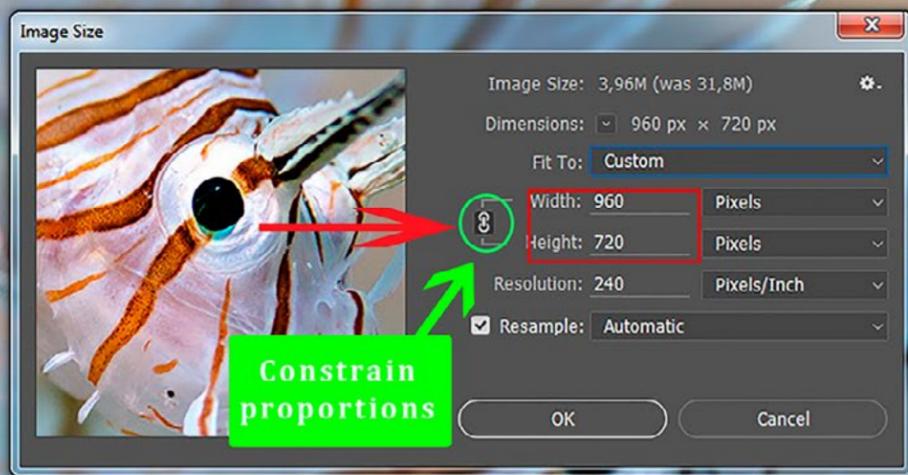
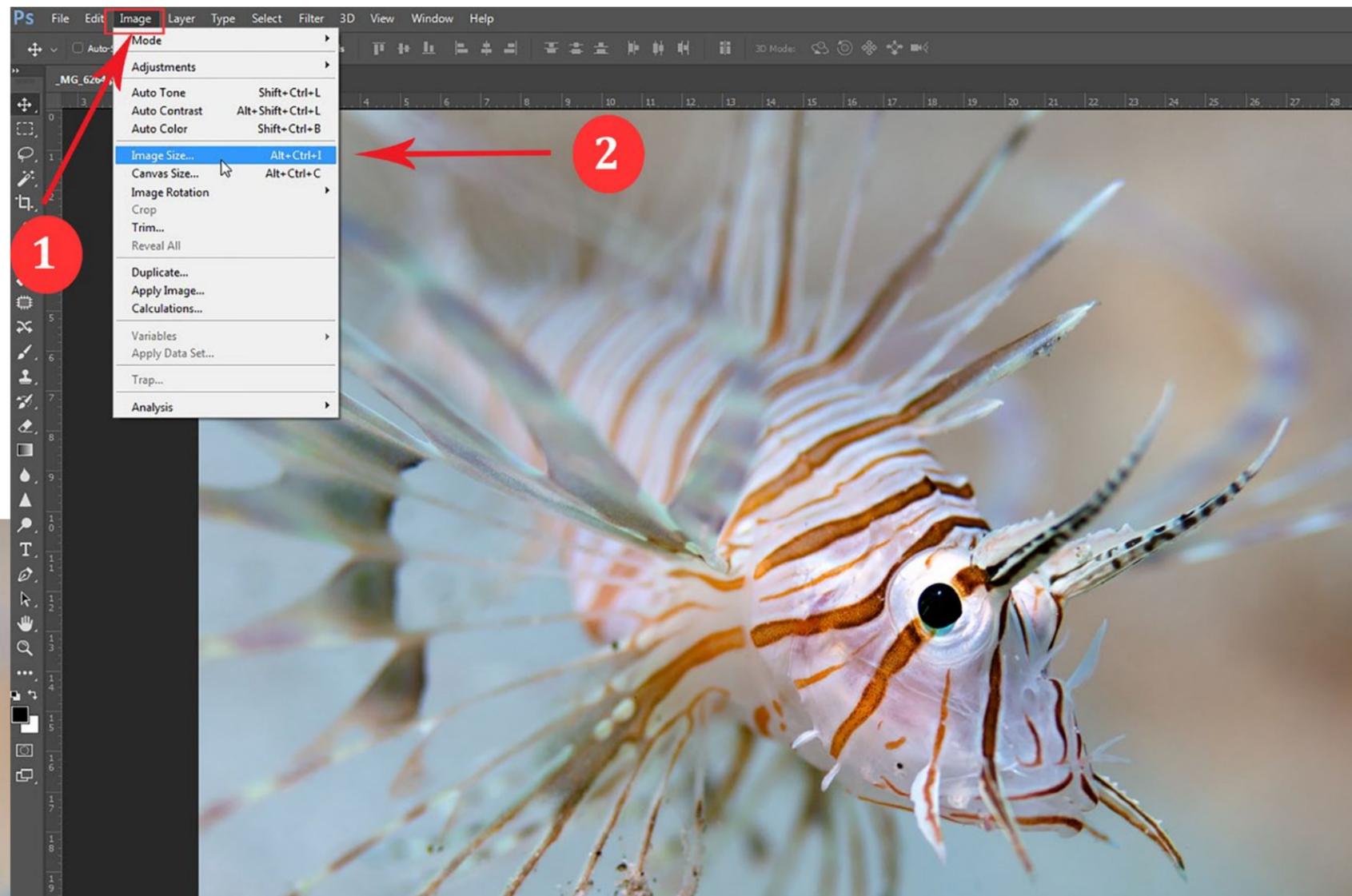
Exporting images for Facebook and webpages

Our original images are way too large for internet usage, and their RGB colour space is not ideal for the majority of internet browsers. For example, only Apple's Safari browser is capable of rendering images in RGB colour space; all other browsers (such as Google Chrome, Microsoft Internet Explorer, Mozilla Firefox and so on) can only display/render images in the sRGB colour space. If such a browser detects an RGB image, it will convert it to sRGB by itself. This then often results in loss of contrast and colours, thus making the images look a bit "flat." They might look perfect on a Mac, but they will not look very good on a PC.

Not every potential client or fan uses Apple products to view your images in the World Wide Web. So, we will need to downsize and optimise images for



Screenshot 3. To downsize and optimise images for web presentation, and make sure they look the same (good) on all devices, go to: "Image" in the top navigation bar and select "Image Size" in the dropdown menu.



web presentation, making sure they look the same (good) on all devices. That's easy to do!

1. Go to "Image" and select "Image Size." (See screenshot 3)
2. Let us consider that we want to export this image for sharing on Facebook. In the upper field, called "Pixel Dimensions" (red area), I have changed the width of the image to 960px. As long as "Constrain Proportions" is checked (it should be), Photoshop alters the length accordingly. I leave all the rest as it is. (See Screenshot 4)

Please bear in mind that it is pointless to upload a full-resolution image (i.e. 6000 x 4000 pix = 24 megapixels) in 300 dpi and RGB to Facebook (or any other social media platform) as these web applications are not designed to display such

large images. The better method is to prepare your images for web use before you upload them. As for Facebook, 960px (on the longest side) usually does a fine job. Bigger is not better, and unnecessary.

There are easier ways to do this, but I am using this one for a special reason: Resizing images always comes with a slight loss of sharpness. But we want our images to look as good as possible, and no minute is ever wasted if you are striving for the best.

3. So, after downsizing the image, I add a little tiny bit of sharpness to it once again, just to equalise the sharpness loss due to resizing. In the "Unsharp Mask" panel, an "Amount" of 25 to 40 with a "Radius" of 0.5 to 0.7 and a "Threshold" of "0" usually does a good job here. (See Screenshot 5 on next page)

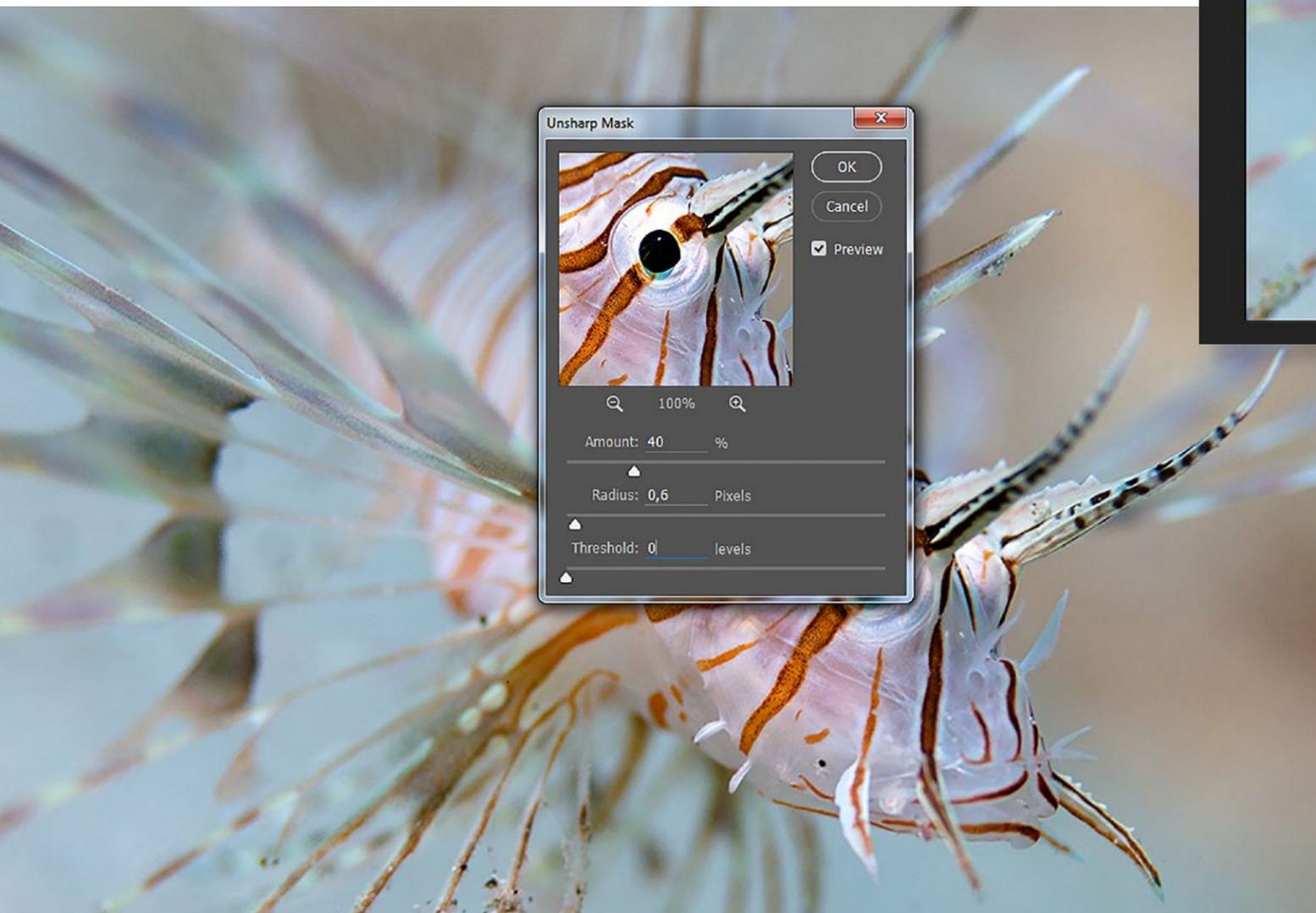
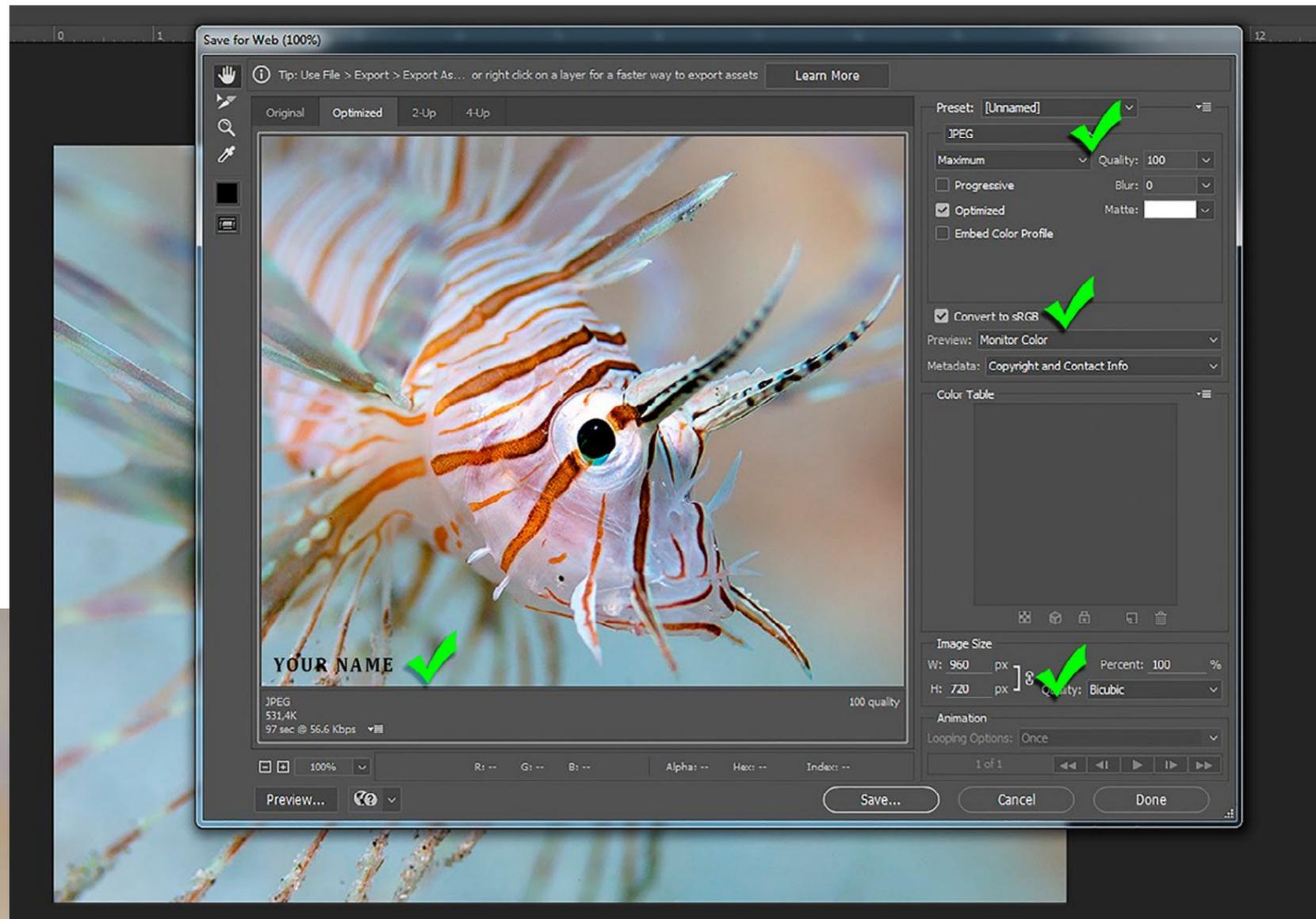
Screenshot 4. Use the "Image Size" panel to adjust pixel dimensions (red box) of image files for posting on social media like Facebook. Remember to check that the "Constrain Proportions" icon is selected (green circle).

Screenshot 6. Important: Use the text tool to add your copyright and name to the image. To save the resized image file, go to: File > Save for Web, and make sure the "Convert to sRGB" box is checked. Remember: When you finally close the PSD file, make sure you click "No" when asked if you want to save the changes, or else you will overwrite your full-size original Photoshop file with the downsized one.

- At this point, it might be a good idea to write your copyright/signature in the image by using Photoshop's text tool. Never forget this step when preparing images for web usage.
- The rest is easy. Just go to: File > Save for Web (or File >

- Export > Save for Web in earlier Photoshop versions, starting with CC 2015) and check that the checkbox "Convert to sRGB" is activated. (See Screenshot 6)
- Finally, close the PSD file, and then when Photoshop asks you, "Do you want to save

the changes?" you select, "NO"! Otherwise, you would overwrite your full-size original Photoshop file with a downsized one.



Screenshot 5. To equalize the sharpness loss due to re-sizing, use the Unsharp Mask panel to slightly adjust the sharpness of the image file. Set the "Amount" between 25 and 40, with a "Radius" of 0.5 to 0.7 and a "Threshold" of "0".

Exporting images for printing

Printing digital images is a bit of a science on its own... and I am not talking about our home printers. First of all, digital cameras produce images in the RGB colour space. Screens of all kinds (including TV screens and beamers) display images in RGB or sRGB, but printers print in the CMYK colour space. There are a few magazine editors out there who may cause a headache for you by requesting weird file formats in the CMYK colour space.

We, of course, could do it too, but we would never be able to fine-tune the colour

management of our image in accordance with the printing devices used by professional printing companies. This final fine-tuning of the image file (called a "proof") should be done by the staff of the printing company where the image will be printed. (Image export for professional prints will be the topic of the next tutorial in this series.)

While low-cost printing services are happy with a JPG with lowest compression (level 12) and in the RGB or sRGB colour space, professional prints require files that come with as much image information as possible. Saving your image as an uncompressed TIFF or uncompressed PDF ensures

that the very best possible file gets sent to the printing company or publisher.

To do so, you just need to go to: File > Save As, and then, in the "Format" section of the menu, select TIFF or Adobe PDF.

One last tip: When finalising images for prints, you always need to slightly oversharpen them, as a slight loss of sharpness is a side effect of the printing process. ■

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



Nauticam WWL-1B wet wide converter

The new WWL-1B wide-angle converter by Nauticam features the same optics as the WWL-1, but it now includes an integrated aluminium buoyancy collar to make it nearly neutral underwater. The wet-changeable underwater wide-angle conversion optics supports full-zoom range, allowing flexibility for various underwater shooting situations. It is compatible with various lenses from Sony, Sigma, Nikon, Olympus, Panasonic, Canon and Fujifilm. It is recommended for zoom lenses that start at 28mm focal range (for instance, the Sony 28-60mm). When using a 28mm lens, the maximum field of view is 130 degrees. The wide-angle converter has four optical elements with anti-reflective coating, is made of hard-anodized aluminium alloy, weighs 1.35kg (0.12kg underwater) and is depth-rated to 150m. nauticam.com



Inon SD mount bayonet with locking system for GoPro Hero

The mount bayonet allows the attachment of Inon's UFL-G140 SD underwater semi-fisheye conversion lens or the UCL-G165 SD underwater wide close-up lens to the standard GoPro Hero action camera underwater housings. The adaptor is made of reinforced plastic (FRP) and can be easily attached with a thumbscrew. Furthermore, it allows the attachment of additional accessories such as ball mounts, grips/trays or tripods. The adaptor weighs 40g, and the lenses can be attached or detached underwater. inon.jp



Inon LE600h-S and LE600h-W LED flashlights

Inon's new series of underwater torches for photography offer a higher CRI (CRI 90) to reproduce the natural colour of a subject when shooting still images with the LED flashlight as a primary lighting source. The LE600h series is designed to produce 6500K constant light, providing a beam angle of 30 degrees (for LE600h-S) or 75 degrees (for LE600h-W). inon.jp



Nauticam housing for Sony A7C camera

Nauticam has released a housing for Sony's latest mirrorless full-frame camera, the A7C. The housing comes with Nauticam's patented port locking system and rotary locking latch. A special feature is the HDMI 2.0 support, which allows the connection of external monitors such as the Atomos Ninja V. The NA-AC7

housing is compatible with Nauticam's premium optics such as the WWL-1/WWL-1b wide-angle converter, and the CMC-1/CMC-2 macro diopters. Both optics are known to perform well with the Sony FE 28-60mm f/4-5.6 lens. The housing's dimensions are 307mm x 172mm x 103mm. It weighs 1.78kg topside, and 0.19kg underwater (with camera). The housing is depth-rated to 100m and has a port opening for N100. nauticam.com



Seacam housing for Canon EOS R5

Seacam has announced the production of a new "silver-line" underwater housing for the new Canon EOS R5 full-frame mirrorless camera. According to the announcement, the housing will offer full access to all the camera's controls, including the rear multi-controller. It will accept both Canon R- and EF-mount lenses (by using Canon's adapters), and will include three ports for strobe triggering, vacuum or remote control. Furthermore, an HDMI 2.0 port will be included. Dates for the completion of development and availability are not yet confirmed but expected to be announced within the next two to three months. [facebook.com](https://www.facebook.com/seacam)



Comparison I. *Lea Lea's Lookout Swim-Through* (right) and *Last Colors on the Pond* (bottom left), by Sheryl Checkman. The underwater image was taken in the late morning around 11:00 a.m. at Lea Lea's Lookout dive site, Little Cayman, Cayman Islands, in September 2018. Exposure: ISO 400, f/8, 9mm, 1/200s. Gear: Olympus OMD-EM5 Mark II camera, Olympus M. Zuiko 9-18 mm F4.0-5.6 lens, Olympus PT-EP13 housing, two Sea&Sea YS-D1 strobes

X-Ray Mag Photo Challenge: Comparisons

Back in 2020, we challenged underwater photographers—many of whom found themselves stuck inside or unable to go diving during the pandemic—to search through their image archives and match a topside shot with one of their own underwater shots, in a side-by-side comparison. Featured here are the eye-catching and sublime image comparisons of three photographers, from the New York Underwater Photographic Society (NYUPS) at the NYC Sea Gypsies dive club, who rose to the challenge.



SHERYL CHECKMAN



SHERYL CHECKMAN

Edited by G. Symes
Photos by Sheryl Checkman,
Anita George-Ares, John Ares,

Sheryl Checkman

Sheryl Checkman is a graphic designer living in New York City. She got involved with NYUPS to meet and learn from other like-minded underwater photographers in the New York area.

"Always a lover of the ocean and swimming, I got my open water certification in 1988 after returning from a trip to Club Med, Turks & Caicos, where I took the week-long Club Med certification course," said Sheryl. "I started to take photos underwater in the

mid-2000s in order to combine my love of the underwater world with my artist's eye for beauty and pattern. I started out with point-and-shoot camera systems with no flash, and then later exchanged my equipment for my current micro-four-thirds system, housing and strobes.

Initially, Sheryl combined and manipulated her photos into what she called "dive art," creating her own underwater world-view from the initial low-resolution images. She said, "As I upgraded my equipment, I began taking some underwater photography workshops in order to learn to take photos underwater that did

not need manipulation to make them stand out. I have used this year out of the water to continue to improve my photographic skills on land so that when I can get back underwater, I can use what I have learned."

Regarding her Comparison I, Sheryl said, "In choosing this pair to compare, I found that the most compelling similarity for me is the perspective of view and the framing. In both of these images, light is the subject. In the underwater image, the light coming through the coral swim-through is framed by the cut-out in the reef structure. In the land photo, the light of the last colors

Last Colors on the Pond, by Sheryl Checkman, was taken just as the sun was going down around 8:00 p.m. at the pond near Central Park South, New York City, USA, in August 2020. Exposure: ISO 2000, f/8, 14mm, 1/30s. Gear: Olympus OMD-EM5 Mark III camera, Olympus M. Zuiko 14-150mm f/4.0-5.6ll lens, ambient light



photo & video



SHERYL CHECKMAN



SHERYL CHECKMAN

Comparisons

Comparison II. *Sea Turtle on Marilyn's Cut* (far left) and *Daylilies Reaching for the Sky* (left), by Sheryl Checkman.

The underwater photo was shot at 2:45 p.m. at Marilyn's Cut dive site, Little Cayman, Cayman Islands, in September 2018. Gear: Olympus OMD-EM5 Mark II camera, Olympus M. Zuiko 9-18 mm f/4.0-5.6 lens, Olympus PT-EP13 housing, two Sea&Sea YS-D1 strobes. Exposure: ISO 200, f/8, 10mm, 1/200s

The topside photo was shot at 5:57 p.m. at the Conservatory Gardens of Central Park in New York City, USA, in August 2020. Exposure: ISO 200, f/11, 8mm, 1/100s. Gear: Olympus OMD-EM5 Mark III camera, Olympus M. Zuiko 8mm f/1.8 fisheye lens

of the setting sun are framed by the dense tree foliage surrounding the sky and water."

About Comparison II, Sheryl said, "I chose this pair also for the perspective. In each, I am looking up—towards the surface in the underwater image—and towards the sky in the land image. The coral and the sea turtle are reaching for the light towards the surface above just as the dillies reach for the sky."

In her Comparison III, Sheryl said, "I chose this pair for their similar diagonal

composition and also both subjects' ability to camouflage themselves. When shooting the dragonfly, I had to look very hard to see him against the background of the garden foliage. I shot with a shallow depth of field in order to separate him from the background. The juvenile filefish is hiding among the stems of the crinoid, blending in at the same angle."

For Comparison IV, Sheryl said, "I selected this pair to compare more for their difference than similarity. The seahorse is camouflaged, almost colorless, blending

in with his surroundings, while the monarch butterfly is quite prominent, its bright yellow and black color silhouetted against the purposely blown-out sky. They both, however, give me a similar feeling of being at home in their surroundings. The seahorse is holding on to the coral foliage just as the butterfly stands on the flower."

View more of Sheryl's photos under the portfolio tab on her website at checkmandesign.com, or 500px.com/p/sherylcheckman?view=galleries&.



SHERYL CHECKMAN



SHERYL CHECKMAN

Comparison IV. (bottom row) *Monarch Butterfly* and *Seahorse*, by Sheryl Checkman. The butterfly was shot at 7:03 p.m. in August 2020 at the Butterfly Garden in Central Park, NYC, USA. Exposure: ISO 200, f/6.3, 150mm, 1/160s. Gear: Olympus OMD-EM5 Mark III camera, Olympus M. Zuiko 14-150mm f/4.0-5.6 II lens



SHERYL CHECKMAN



SHERYL CHECKMAN

Comparison III. (middle row) *Dragonfly* and *Hiding in Plain Sight*, by Sheryl Checkman. The dragonfly was photographed at 6:16 p.m. at the Butterfly Gardens in Central Park, New York City, USA, in August 2020. Exposure: ISO 200, f/5.6, 150mm, 1/50s. Gear: Olympus OMD-EM5 Mark III camera, Olympus M. Zuiko 14-150mm f/4.0-5.6 II lens

The filefish (above) was shot at 12:02 p.m. at Red Sand dive site in Alor, Indonesia, in October 2017. Exposure: ISO 200, f/5, 1/125s. Gear: Olympus OMD-EM5 Mark II camera, Olympus M. Zuiko 60 mm f/2.8 macro lens, Olympus PT-EP13 housing, one Sea&Sea YS-D1 Strobe

The seahorse (left), by Sheryl Checkman, was shot at 1:09 p.m. at Blue Heron Bridge in West Palm Beach, Florida, USA, in May 2018. Exposure: ISO 200, f/8.0, 42mm, 1/200s. Gear: Olympus OMD-EM5 Mark II camera, Olympus PT-EP13 housing, M. Zuiko 14-42mm f/3.5-5.6 IIR lens, one Sea&Sea YS-D1 strobe





photo & video

Comparison II. *Bubble* (right) and *White-spotted Jellyfish* (far right), by Anita George-Ares. Bubble was taken in Old Town, Prague, Czech Republic. Exposure: ISO 400, f 8, 1/640s. Gear: Canon EOS Digital Rebel XTi camera, Sigma 18-300mm f/3.5-6.3 lens



ANITA GEORGE-ARES



ANITA GEORGE-ARES

White-spotted jellyfish, by Anita George-Ares, was taken in Dumaguete, Philippines. Exposure: ISO 100, f 11, 1/160s. Gear: Canon EOS Rebel SL1 camera, Canon EF-S 60mm f/2.8 macro lens, Ikelite housing, two Ikelite DS161 strobes

Comparison I. *Human Shark* (below) and *Great White Shark* (lower right), by Anita George-Ares. Of the photo, *Human Shark*, Anita said, "I was walking in the Old Town of Prague, Czech Republic, when I came across a man in a shark suit who was trying to attract business for a local restaurant. I took the photo as the scene was both incongruous and humorous." Exposure: ISO 400, f /7, 1/250s. Gear: Canon EOS Digital Rebel XTi camera, Sigma 18-300mm f/3.5-6.3 lens



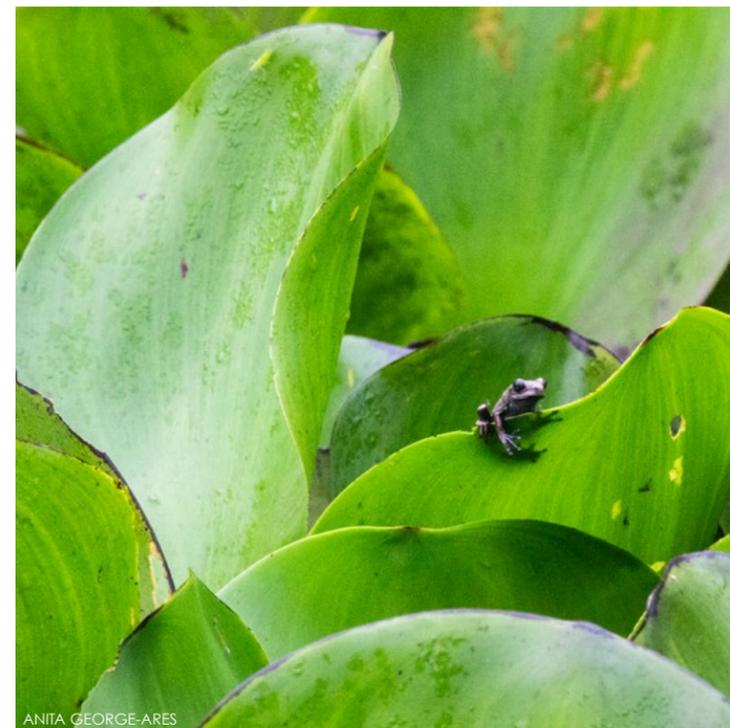
ANITA GEORGE-ARES



ANITA GEORGE-ARES

"I was 12m down in a four-person shark cage off Guadalupe Island, Mexico," said Anita. "I was looking out into the blue when a great white shark rose up and we were suddenly face-to-face. My first thought was, 'This looks like the cover of Peter Benchley's novel *Jaws*.' My second thought was, 'Take the photo!'" Exposure: ISO 400, f /7, 1/80s. Gear: Canon EOS Digital Rebel XTi camera, Canon EF-S 10-22mm f/3.5-4.5 lens, Ikelite housing, ambient light

Comparison III. *Frog* (below) and *Clark's Anemonefish* (bottom right), by Anita George-Ares. "I was in a boat with a guide and a small group of birders on the Cristalino River in Western Brazil," said Anita, "when I photographed this small frog perched on a water hyacinth leaf." Exposure: ISO 6400, f/16, 1/320s. Gear: Canon EOS Rebel SL1 camera, Sigma 18-300mm f/3.5-6.3 lens. The anemonefish photo was taken at a depth of 20m, within the Dauin Marine Sanctuary. Exposure: ISO 200, f/8, 1/160s. Gear: Canon EOS Rebel SL1 camera, Canon EF-S 60mm f/2.8 macro, Ikelite housing, two Ikelite DS161 strobes



ANITA GEORGE-ARES



ANITA GEORGE-ARES

Anita George-Ares

Anita's love of the ocean and diving came from her father who was a scuba instructor. She later became a marine biologist, scuba instructor, and inductee into the Women Divers Hall of Fame (wdhof.org). Initially, she used underwater

photography to document marine life and behavior during research expeditions. Currently, she lives on Staten Island, a New York City Borough. She and her husband are both members of the New York Sea Gypsies, which includes NYUPS. In Comparison I (above and left), the

main subjects in both images are sharks. Anita said, "There is a similar symmetry in the vertical position of the snout with the teeth and nostrils in view."

Of Comparison II (top row), she said, "The Prague bubble reminded me of a large comb jelly. Since I did not have an

image of a comb jelly, I substituted an image of a white-spotted jellyfish. The subjects of both images have a similar horizontal symmetry and transparency."

Of Comparison III (bottom row), Anita said, "The frog is perched on a green, translucent water hyacinth leaf. The

anemonefish is nestled among the tentacles of a green, translucent bubble-tip anemone." More of Anita's photographs can be seen on her **Facebook** page.



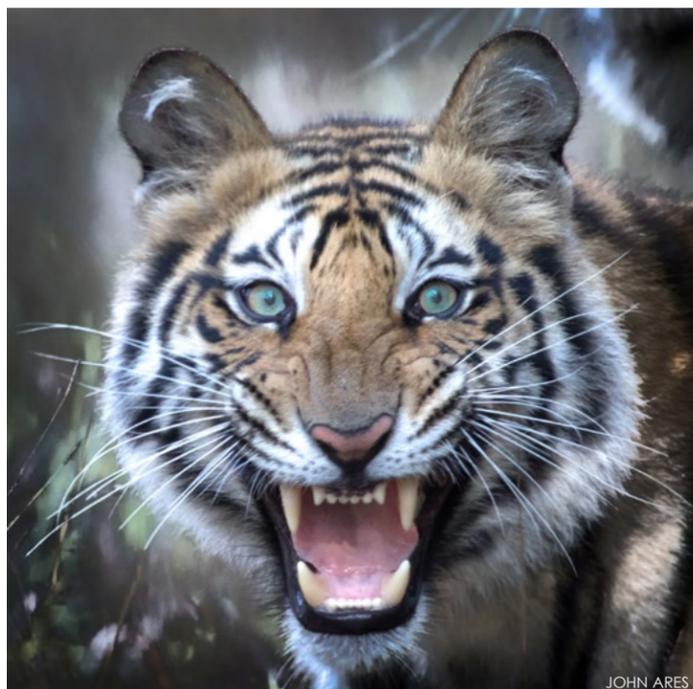


photo & video

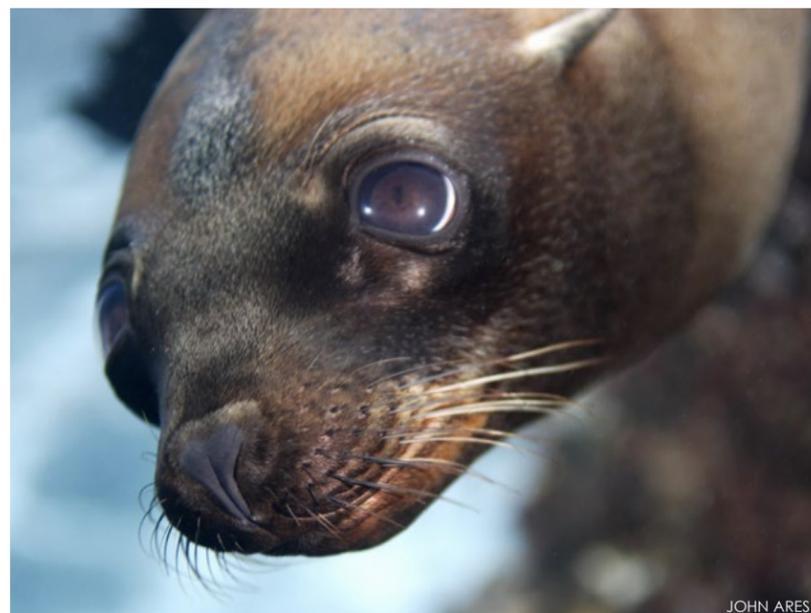
Comparison I. *Feathers* (right) and *Scales* (far right), by John Ares. *Feathers* was taken with a Canon 7D Mk II camera, with 200mm lens. Exposure: ISO 1600, f/3.5, 1/1000s; *Scales* was taken with a Canon 7D Mk II camera, 600mm lens, Ikelite housing, dual Ikelite DS161 strobes. Exposure: ISO 800, f/6.3, 1/1250s



Comparison II. *Tiger* (right) and *Sea Lion* (below), by John Ares. *Tiger* was taken with a Canon 7D Mk II camera, with 600mm lens. Exposure: ISO 800, f/6.3, 1/200s



Sea Lion was taken with a Canon 10D camera, 50mm macro lens, Ikelite housing, dual Ikelite DS161 strobes. Exposure: ISO 100, f/2.5, 1/200s

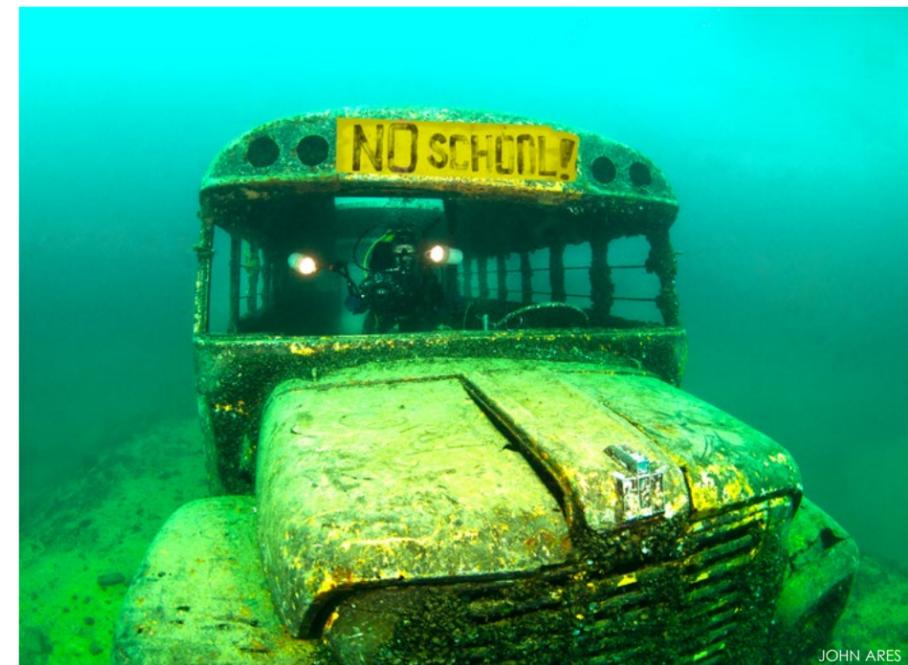


John Ares

John is an award-winning professional photographer and former PADI Course Director. He has been doing photography since age seven and diving since 1974. It was inevitable that he would bring a camera underwater. He has a master's degree in marine Sciences and has taught underwater photography, Lightroom and Photoshop. While he shoots nature, travel, fine art, portraits and food photography, his main passion is underwater photography. He has been a contributor to DivePhotoGuide.com, written scientific articles and his photographs have been published in Aqua, the International

Journal of Ichthyology among others. John has been a member of the NYC Sea Gypsies for many years, so it was natural for him to get involved with NYUPS.

In John's Comparison I, he said, "For the first pair, it seemed that feathers



Comparison III. *No School* (above left) and *Dutch Springs Bus* (above right), by John Ares. *No School* was taken with a Canon XTi camera with 200mm lens. Exposure: ISO 100, f/11, 1/400s; *Dutch Springs Bus* was taken with a Canon 10D camera, Canon 10-18mm lens, Ikelite housing, dual Ikelite DS161 strobes. Exposure: ISO 400, f/5.6, 1/160s.

and scales were naturally complements of each other. One exclusively for Birds and one for Fish and Reptiles. The Elliot's Pheasant feathers were at the Staten Island Zoo in New York City, and the sturgeon was actually washed up on the beach in Staten Island, NY."

Regarding his Comparison II, he said, "The second pair has whiskers in common, in addition to eye contact. The

tiger was photographed in the wild in Bandhavgarh National Park in India. The sea lion was photographed at Los Islotes, La Paz, Mexico."

On John's Comparison III, he said, "The third pair are both school buses surrounded by forms of water: the first one in snow in Vermont, USA, and the second one underwater in Dutch Springs Lake, Pennsylvania, USA, with a little "wink-

wink" nod to the Vermont bus."

John's work can be seen online in about 100 galleries, which can be found at: JohnAres.com. ■

Special thanks to Larry Cohen and Olga Torrey for their assistance with the X-Ray Mag Photo Challenge and this article.

Vanessa Barragão



P O R T F O L I O





Coral Garden, by Vanessa Barragão (this page and previous page). Created with 100% recycled wool, 300cm x 400cm x 500cm. Displayed at "Domotex" solo exhibition in Hanover, Germany, in January 2019, and "OneFifteen" solo exhibition in Taipei, Taiwan, in July 2019.

Portuguese textile artist Vanessa Barragão creates beautiful, exquisite artworks inspired by the textures, shapes and forms of corals and invertebrate life found on ocean reefs. Employing handmade ancestral crafts, she uses only sustainably sourced upcycled materials. X-Ray Mag interviewed the artist to learn more about her creative process and perspectives on sustainability in the textiles we use as well as eco-conscious consumption in our daily lives, as she aims to raise awareness of how these affect the planet's fragile ecosystems.

Text edited by G. Symes
All artwork by Vanessa Barragão
Photos by Studio Vanessa Barragão

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

VB: I had dreamed of being a fashion designer all my life until I actually started studying fashion design in university. There, I realized that it was not what

I wanted for myself at all and more importantly, I realized how wasteful and polluting the fashion industry really is. Afterwards, I felt I had to do something about it, however small of an impact I could make.

X-RAY MAG: Why coral reefs and underwater themes? How did you come to these themes and how did you develop your style of textile artworks?

VB: During my childhood, I used to travel with my parents and sister to the Caribbean. That was where I saw coral reefs for the first time and this image has stuck with me ever since. Their colors and textures, and all the life forms surrounding them, were fascinating to see up close.

Visiting year by year, their loss of colors and the environmental degradation surrounding the area were obvious. From then on, my art and my mission of raising

Close-up view of *Coral Garden*, by Vanessa Barragão. The piece aims to raise awareness about coral bleaching caused by pollution and global warming, which is affecting reefs around the world.





Vanessa Barragão



THIS PAGE: Work in progress and close-up detailed views of *Nostalgia* by Vanessa Barragão (right column)



awareness became connected. I have always loved to draw and create things manually, many times using artisanal techniques that have been passed on and taught to me by my grandparents.

X-RAY MAG: Who or what has inspired you or your artwork and why?

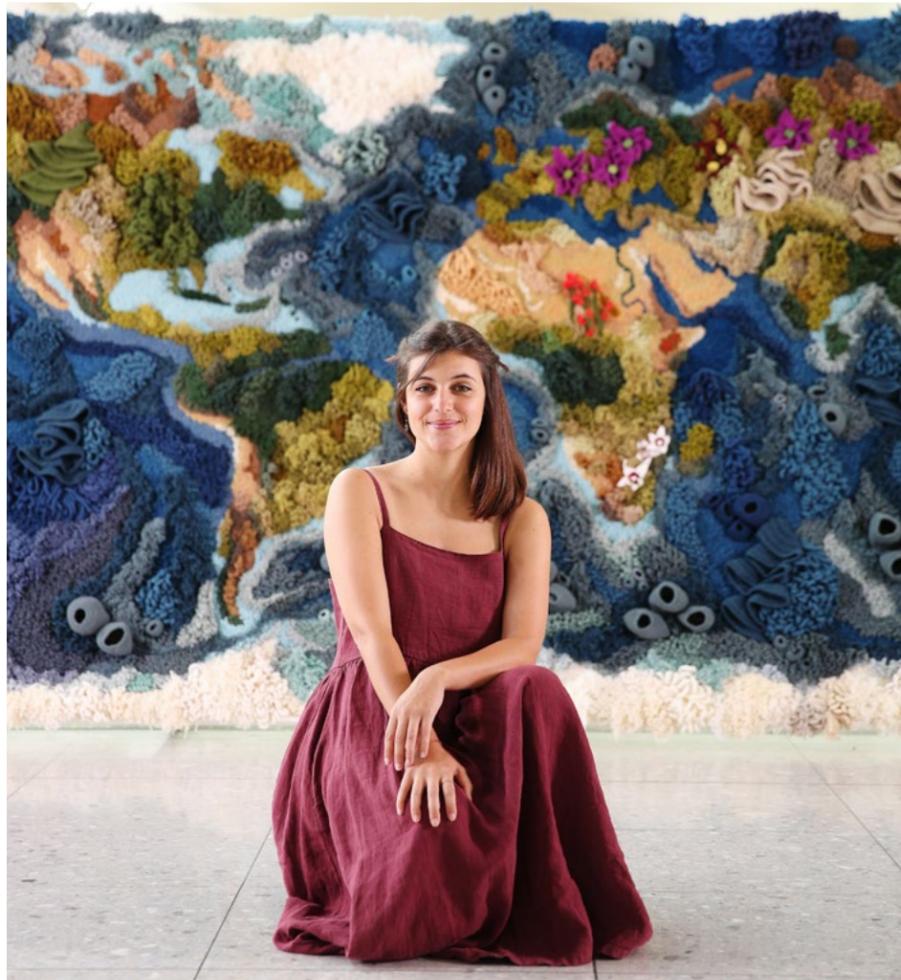
VB: My inspiration and interests were always very much based on nature. For example, that time I saw corals

as a child was a big turning point in my creations, even then.

My biggest mentors are, without a doubt, my grandparents. They taught me most of the techniques I apply to my work and they are, to

The artist at work on various pieces at her studio in Portugal

portfolio



The artist Vanessa Barragão (above) in front of her massive 20-foot wide tapestry artwork, *Botanical*, which emulates the map of the world, with the diverse ecosystems and topography of the planet represented by various colors of yarn: blues for oceans, greens for forests, warm tones for deserts, and white for polar regions. The artwork was commissioned by Kew Gardens and Heathrow Airport in London, United Kingdom, where it has been exhibited since July 2019.

Close-up detail views of *Botanical* by Vanessa Barragão (right and top right)



this day, a big part of the creative process behind my tapestries.

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

VB: First of all, the materials I use in my artworks are 100 percent recycled and sourced by myself from textile factories all over Portugal. All the waste I have collected over the years would go to the trash otherwise. All yarns collected go through a meticulous selection and cleaning pro-

cess to ensure that they can be used in my tapestries.

From that point on, the creative process is very spontaneous. Most times, I do not make any sketches, and the works grow very naturally and spontaneously, according to my mood, to the people around me, the weather, etc.

X-RAY MAG: What is your relationship to the underwater world and coral reefs? Are you a scuba diver or a snorkeler and how have your experiences underwater influ-

enced your art? In your relationship with reefs and the sea, where have you had your favorite experiences?

VB: Even though I spent my childhood vacationing by the Caribbean and having lived all my life by the sea until today, the sea still frightens me! I am not a scuba diver, but the experience that has impacted me the most underwater was snorkeling in Raja Ampat—the range of colors, variety of life forms, and the stunning scenery I saw there was just amazing.





Bleached Coral, by Vanessa Barragão. Created with 100% recycled wool, 125cm x 200cm. This piece aims to raise awareness and urge reflection upon how our actions contribute to global warming and pollution, negatively affecting our fragile coral reefs, even in remote areas of the world. The artwork was displayed at the "Change is a Team Sport" exhibit at the Adidas Studio/Superbowl in Miami, USA, in January 2020.



Detail of *Bleached Coral*, by Vanessa Barragão

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

VB: With my artworks, I intend to raise awareness of how important recycling, upcycling old items, and preserving artisanal methods of production really is and how our consumption habits need to

change—many things we buy are unnecessary and come from very wasteful industries. We need to buy consciously.

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

VB: In my opinion, it is important that every artist expresses a thought, a feeling or idea through his or her art. That is my main mission behind each piece I create.

The biggest challenge as an artist is that you always have to come up with new ideas, different from the rest, and sometimes this can be exhausting. I think one of the biggest benefits of

being an artist in today's world is the possibility of being able to share it with the whole world using social media platforms like Instagram, which can open many doors.

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

Gerl Coral (below) by Vanessa Barragão, and detailed close-up (right). Created with 100% recycled wool, 120 x 230cm



Melissa's Garden, by Vanessa Barragão, was inspired by the artist's experience snorkeling the colorful coral reefs of Raja Ampat, Indonesia. Created with 100% recycled wool, 120 x 145cm



VB: Just like with real corals, people are always very tempted to touch my artworks with their hands—and not just children, adults do it too! I find it very curious because this is not something people usually do with paintings, sculptures or even rugs. But I do understand that the variety of textures is very inviting to the touch, just like corals are! [ed. – But please don't touch corals—they are indeed fragile].

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

VB: I am currently working on a public art project in Taiwan, which I will unveil in a few months. I have also been creating pieces for private clients. I would love to

teach some online courses—a lot of people ask me about it, but so far, I have not had the time to do so. Hopefully, in the future, I will.

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

VB: I rarely get the chance to speak to an audience of sea divers and snorkelers, so I want to take this opportunity to challenge you to share your underwater photos with me! Inspiration is always welcome. ■

For more information, go to the artist's website at: vanessabarragao.com or Instagram [@vanessabarragao_work](https://www.instagram.com/vanessabarragao_work) or Facebook [@vanessabarragaoartist](https://www.facebook.com/vanessabarragaoartist).

Inside the artist's studio in Portugal (left)