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X-Ray Mag

GLOBAL EDITION
April 2016
Number 72

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Canary Islands
El Hierro

Mexico
La Paz

Tech
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COVER PHOTO BY RICHARD BARNDEN

DIRECTORY

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COVER PHOTO: Squid, Black Water Diving, Palau
Photo by Richard Barnden

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Sea lion at La Paz, Baha, Mexico. Photo by Olga Torrey

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Image © Jonathan Lin

On animals with cute eyes...

A few months back, Sea Shepherd and Greenpeace got into another of their occasional bar brawls, this time over Greenpeace's acceptance of seal hunting and fur trading. As nearly entertaining all their lambasting and rebuking back and forth was to watch for a brief while, it also laid bare a deeper philosophical conundrum we, as divers and environmentalists (at least many of us, at any rate), need to get a grip on: When, if ever, is it okay to hunt marine mammals?

On a regular basis, we receive indignant letters and requests to disseminate calls to action for various environmental causes, a large chunk of which concerns marine mammals. Peak season coincides with the Faroese annual pilot whale hunt, which tends to see the inbox swell with various protests to sign or endorse or messages with gory pictures to disseminate. As we happen to reside in Denmark, we are also on the receiving end of demands that we lay pressure on Danish lawmakers to outlaw this business—never mind that the Faroe Islands is a different nation all together.

When matters get all emotional, reason and perspective have a tendency to go down the drain. So these occurrences tend to make me wonder what it's really all about: protection of a species or revulsion that the slaughtering of these animals is a bloody affair?

Well, slaughter usually is. Only we, in modern societies, have now become removed from that reality. The grisly business that goes on behind closed doors in the meat factories, which provide our burgers, pizza toppings and buffalo wings, not to mention the leather in our shoes, bags and wallets, is conveniently hidden from view.

Let it be abundantly clear that we are opposed to both the hunting of marine mammals and the fishing of sharks, but for reasons we are clear about. We are opposed because most of these species are endangered and because our aquatic ecosystems would be impoverished without these animals who, in many cases, play an integral role in the upkeep of diverse and healthy ecosystems. These are our objective reasons.

Subjectively, we are also opposed because it is our belief and choice that marine mammals shouldn't be our food. Such intelligent creatures, which we can so easily relate to, should be left to live free in the ocean for us to enjoy and interact with in their natural habitats.

Lastly, it is plainly saddening to see other sentient creatures being meaninglessly slaughtered in often inhumane ways. Meaningless, it is when Japanese whalers—using "science" as fig leaf—kill hundreds of baleen whales, only to stockpile their meat and eventually sell it off as dog food. Meaningless, it is too, and cruel, when unscrupulous shark finners kill thousands of animals just because some folks in Asia won't give up shark fin soup. It is senseless, really.

But consider where would we stand if these animals became plentiful again and could be sustainably harvested. Would our viewpoints change?

We seem to have no qualms about taking lots of fish—which in all likelihood are sentient beings as well—out of the same ocean for consumption. We also raise livestock, such as cattle and pigs, on an industrial scale, so those of us who are not vegetarians can eat. Often these intelligent and social animals are raised under atrocious circumstances, badly treated and only a few get to lead natural lives before their throats are slit and they are on their way to the supermarket in styrofoam trays.

Some conscientious consumers may gladly pay more for "organic" or "free-roaming" animals out of a belief that they are healthier, or a moral standpoint that such animals have led better lives. But what does that really mean? Wouldn't it have been better if these animals had lived in the wild all along? If so, that means hunting or fishing comes into play, which brings us full circle and back to the initial question of whether we should hunt or not, provided it can be done in a sustainable manner.

Greenpeace ended up endorsing sustainable sealing.

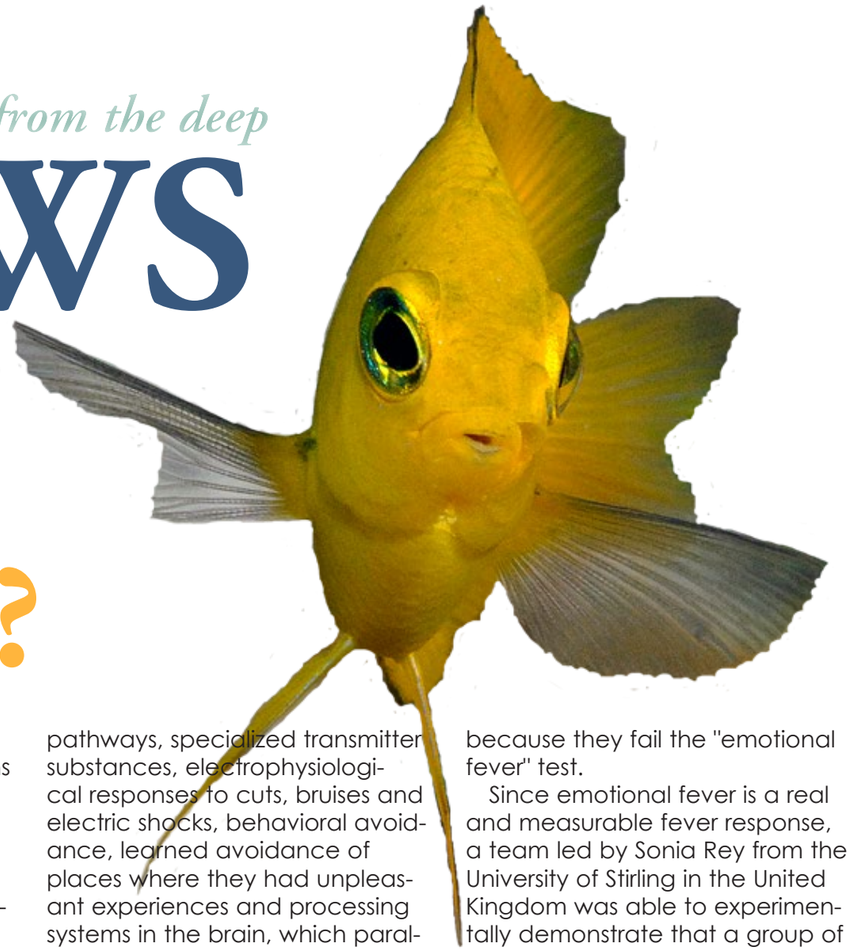
Food for thought…

— The X-RAY MAG Team

News edited
by Peter Symes

from the deep

NEWS



Do fish have personalities?

Fish perception and cognitive abilities often match or exceed other vertebrates, but to what extent—whether fishes are conscious, sentient beings or not—remains unresolved and controversial.

Although scientists cannot provide a definitive answer on the level of consciousness for any non-human vertebrate, there exist extensive evidence of fish behavioral and cognitive sophistication and pain perception. While the brains of fish differ from other vertebrates, fish have many comparable structures that perform similar functions. They have also been shown to have very good memories, live in complex social communities where they keep track of individuals and can learn from one another. According to Culum Brown a professor at Macquarie University in Sydney, Australia, fish are even able to develop cultural traditions and can even recognize themselves and others.

Sentience

A sentient animal has the capacity to suffer fear, pain or distress, as well as a sense of well-being. Some scientists disagree that fish can be sentient and argue that fish simply do not have the neurophysiological capacity to be aware of pain and that their reactions are measured according to human criteria—just because fish respond to a stimulus, they do not necessarily compute it as pain.

Professor Donald Broom of the University of Cambridge sums up the case for fish feeling pain:

"There are some differences in sensory functioning between fish and mammals because fish live in water, but the pain system of fish is very similar to that of birds and mammals. Fish have pain receptor cells, nociceptive neuronal pathways, specialized transmitter substances, electrophysiological responses to cuts, bruises and electric shocks, behavioral avoidance, learned avoidance of places where they had unpleasant experiences and processing systems in the brain, which parallel those in birds and mammals. Hence at least some aspects of pain as we know it must be felt by fish."

"Emotional fever"

Emotions are different from simple stimulus response reflexes by the fact that the behavior, or associated state variables, outlast the stimuli that elicit them. Capacity for "emotional fever" is a trait that has been identified as indicative of sentience and consciousness, Emotional fever is a transient rise in body temperature shown in response to a variety of stressors. Critics have contended that fish are not capable of the same type of conscious thought we are, because they fail the "emotional fever" test.

Since emotional fever is a real and measurable fever response, a team led by Sonia Rey from the University of Stirling in the United Kingdom was able to experimentally demonstrate that a group of zebra fish clearly have the capacity to show emotional fever. While the link between emotion and consciousness is still debated, this finding (published 25 November 2015 in *Proceedings of the Royal Society B*) removes a key argument for lack of consciousness in fishes.

Other recent literature provides numerous examples of the learning capacity of fishes and of complex things that fishes do. Some fishes are even able to make use of tools, which is taken as an indication of consciousness in other groups. ■

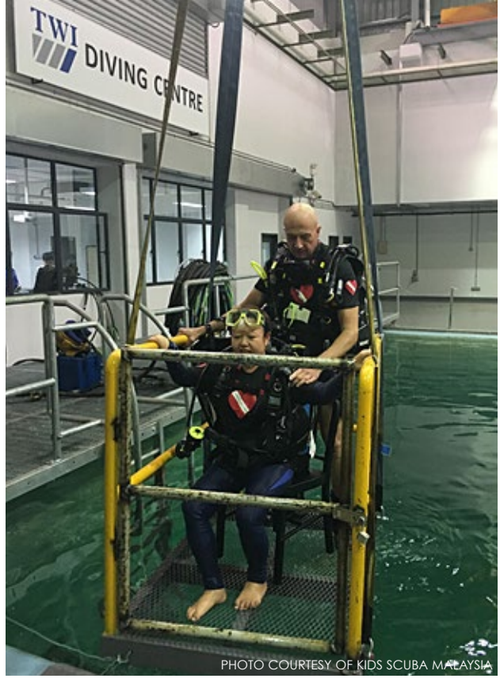


PHOTO COURTESY OF KIDS SCUBA MALAYSIA

Diveheart founder Jim Elliott assists one of the disabled dive team volunteers being lowered into the pool at the TWI facility in Kuala Lumpur, Malaysia, for an in-water scuba exercise

Kids Scuba Malaysia joins US Diveheart and People With Disabilities Malaysia

Kids Scuba Malaysia—the world's largest children's dive club—announced a new program that brought together the US disabled divers organization Diveheart and People With Disabilities (PWD) in Malaysia.

The non-profit organization, Diveheart, was founded in Illinois in 2001 by Jim Elliott. His vision was to build confidence, independence and self-esteem, through scuba diving, in children, adults and veterans with disabilities. This vision has been accomplished through many international exhibitions and demonstrations—one of the latest of which was held on 24 March 2016 at the TWI Technology facility in Kuala Lumpur, Malaysia, with Diveheart founder Jim Elliott and executive director Tinamarie Hernandez in attendance.

The seminar included in-water scuba diving exercises for each of the individuals with disabilities, accompanied by Elliott. The participants variously live with polio, blindness and neuro-muscular disorders. In addition, Blue Water Engineering provided a unique opportunity for the disabled diving team to experience commercial diving type equipment used in the offshore oil and gas industry, such as a Kirby Morgan 18 diving mask, which had communications with the diving supervisor on the surface.

Kids Scuba Director and PADI Instructor, Hj Syed Abdul Rahman, works extensively with children, teenagers, orphan youth and individuals with disabilities in Malaysia. He was instrumental in organizing the four disabled volunteers, scuba diving equipment and local media coverage. His Kids Scuba Dive Team of PADI-qualified diving assistants acted as in-water attendants.

Elliott expressed his heartfelt thanks to Kids Scuba diving team, TWI, Blue Water Engineering and the media for making it all possible. ■

PHOTO COURTESY OF KIDS SCUBA MALAYSIA

Participants of the event held at the TWI facility in Kuala Lumpur

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Want to enrich your diving experience? Looking for a competitive edge as a diving leader? Want to gain a better understanding of how to safely mix breathing mixtures? NAUI offers both an Enriched Air Nitrox (EAN) and a Mixed Gas Bender and Oxygen Service Course—each designed to provide you with the skills and knowledge needed to safely handle high pressure gases, prepare oxygen-enriched air and helium-based mixes, and prepare equipment for oxygen service.

Upon successful completion of this course, graduates are considered competent to prepare oxygen-enriched air and helium-based breathing gases without direct supervision for use by divers, provided that the equipment used is the same or approximates that used in training; and to prepare scuba equipment for oxygen service, provided that they have been authorized by the manufacturer for servicing the particular brand of equipment being placed into oxygen service.

The skills you will accomplish during this NAUI course include:

• Demonstrating proficiency of the breathing gas blending system used in training, i.e., each student will be able to complete a blending and cylinder filling operation without prompting by the instructor and without error.

• Analyzing the breathing gas mixtures resulting from your own breathing gas blending practice.

• Cleaning, verifying and documenting one cylinder, cylinder valve, and first stage of a regulator for oxygen service without prompting by the instructor and without error

• Filling a cylinder with a blend of EAN so that the final oxygen content is within ± 1% of the target amount.

• Filling a cylinder with a blend of Trimix so that the final oxygen content is within ± 1% of the target amount and the final helium content is within ± 3% of the target amount.

• Calibrating and using a helium analyzer to determine the helium content in helium-based gas mixtures.

Go beyond the basics. Choose to become more than just certified. Challenge yourself to become qualified as a NAUI Mixed Gas and Oxygen Service Technician! ■

If you do not find a NAUI Dive Center or professional in your area, please visit ***NAUI.org/locations*** *for a complete listing.*

wreck rap

Stuka Bomber Wreck

— Silent Witness of WWII

Text and photos by
Claudia Weber-Gebert

At the end of September 2014, the dive bomber Ju 87 R-2 was found by chance, during a harpoon competition near the Croatian island of Zirje. The significant discovery caused a stir at the time, since few of a total of 5,752 bombers produced in Germany were still in good condition.

The wreck is remarkably well preserved; it is even said to be the world's best preserved Stuka bomber. The engine was placed in a different bay, probably torn off by the impact at the sea surface or abducted by fishing nets. Otherwise, the plane is standing almost completely intact on its wheels on the seabed at a depth of about 28m, as if it had just made a soft landing.

The enthusiasm of divers who wanted to visit the wreck was great, but at first, the site was closed for divers and the wreck was put under monument protection. Experts from the Military Museum of the Croatian Ministry of Defence identified the aircraft very quickly as an Italian Sturzkampf-Bomber, or "Stuka" (for short), Junkers Ju 87 R-2.

Apart from this Stuka, only three more exist worldwide and are exhibited in the Museum of Science and Industry in Chicago, the Royal Air Force Museum Hendon in London and the Auto and Technik Museum Sinsheim in Germany. Two more specimens were recovered in Norway and Greece from the bottom of the sea. Both, however, are in much worse shape than the aircraft found in front of Zirje.

History

In the beginning of April 1941, Yugoslavia was invaded and occupied within a few days during the Balkan Campaign. In this Blitzkrieg, the German troops and armored units came to help the Italian allies under Mussolini. The ultimate goal of the Italians then was Greece—the path towards which

Clearly visible from the front are the inverted gull wings of the Stuka bomber which made the aircraft easily recognisable

Stuka

the typical MG15 machine gun from the rear cockpit and the control horn from the main cockpit. Plans to salvage the wreckage to preserve and exhibit have been abandoned. The Ju 87 R-2 was, however, declared cultural heritage and is a listed monument.

Since the end of April 2015, diving the bomber is permitted. To do so, dive centers can purchase a license and bring their divers to the wreck. However, at least one person from the dive center must be present during the dive to ensure that no one damages or removes parts of the wreck.

The depth is about 28m. The Stuka Bomber stands on the sandy bottom in poseidon grass. The engine has

The engine block, found in a different bay, is now placed near the wreck.

led over Yugoslavia.

According to the Croatian Ministry of Defense, information can be found in literature about the attack of three Italian Stuka bombers Ju 87 R (239th Squadriglia, 97 Gruppo Bombardamento a tuffo). On 12 April 1941, these bombers flew attacks on two Yugoslavian warships that took position in the bays of Jadrovac near Sibenik. Two of the Stukas were shot down, one of them was destroyed and the pilot was killed. The second Stuka bomber was damaged and forced to go down on the water. Since then, it has been sitting on the seabed.

No one knows exactly what happened to the pilots. The dome over the cockpit is missing and there were no human remains found. Presumably, the pilots were able to save themselves. (SOURCE: HTTP://VOJNAPOVIJEST.VECERNJI.HR; TRANSLATION RUDI HESS, BOUGAINVILLE DIVING, BIOGRAD)

Diving allowed

At first, the wreck was closed to the public. Experts have examined the aircraft and some parts, that are popular collectibles, have been removed and preserved for a museum, as for example

BUNDESARCHIV, BILD 183-J16050 / CC-BY-SA

Historical photo from 1943 of Junkers Ju 87Ds in flight

Hands off and fins off the wreck! Any damage will cause the risk of closure of this dive site (left); Rear cockpit with the circular window: the machine gun was removed. The rear gunner/radio operator operated one 7.92 mm (.312 in) MG 15 machine gun for defensive purposes. (lower right)

now been transported to the wreck and is placed just a few meters from it. While descending, the Ju 87 can clearly be seen from just about 10m under the surface.

The site is flagged on the sea surface with only plastic bottles on nylon cords, so that they cannot be found easily by unauthorized persons. Divers should strictly avoid contact with the wreck—so hands and flippers off! If the wreck is damaged by divers too badly, the Croatian authorities will take protective measures and close down the wreck again for all underwater activities. There are some more beautiful aircraft wrecks in the Adriatic, but these are at depths of 70m and more, and cannot easily be reached by amateur divers.

Thanks to the perfect organization of Rudi Hess of Bougainville Diving in Biograd—at the dive site and underwater—our dive team's photography trip to the past became possible.

About the Stuka

The Ju 87 R-2 dive bombers were produced in Germany by the manufacturer Junkers Aircraft Factory Ag from 1937 to 1944 in various types, with a total of 5,752 parts.

As single-engine low-wing aircraft with folding wings, rigid chassis and a two-man crew, the bombers were used by the German Luftwaffe as a precise weapon. In swooping maneuvers, bombs could be dropped with high precision and the intended targets were destroyed. Hence, the plane was given the name dive bomber or "Stuka" for short (Sturz-Kampf = dive fight). Although the Stuka bombers had serious shortcomings, they were the most successful air combat unit of WWII.

During a flight presentation in Neuhamm, Germany, on 15 August 1939, 13 Stukas crashed from a low altitude. However, since the "success rate" at the bombing was much larger and more accurate than that of other bombers, the Stukas were used during WWII by the German Luftwaffe and the allies again for airstrikes. The principle strategy of the Stukas (which flew slow, actually) was this: fly at high altitude to the destination, drop the bombs in a quick swooping maneuver

Front cockpit view: the control horn has been removed for the museum

above the target, and then leave the target as quickly as possible. The sniper in the rear cockpit had the task of clearing backwards approaching aggressors with a machine gun.

K. H. Eichhorn, born in 1943, was in the German Air Force from 1962 to 1976. He wrote in his online Airplane Archives the following concerning the special swooping technique of the Stukas:

"Importantly, there was an automatic dive control, in which the machine was transferred to horizontal flight in a preprogrammed distance from the ground. The pilot had to first adjust ten vital handles to program the dive. After that, he had to bring one of the red lines painted in various degrees in the cockpit dome in a line with the horizon, and then aim for his goal manually like a fighter plane, while only using the ailerons. The swooping angle very often amounted to exactly 90 degrees and started with a roll maneuver over one of the wings directly vertically above the intended target. Strangely, in the Junkers they had not, like many other bombers, the feeling of having already exceeded the normal 90 degrees. In general, the Ju 87 during the swoop, in which it was so marvelous, showed a much better performance than in the normal horizontal flight—particularly because of the glass cockpit dome. Once the signal lamp flashed in the altimeter, the pilot pressed a button on the steering column and initiated —usually at a height of 450m—the termination of the swoop. In the event of failure of this automatic feature, the pilot had

ALEKSEJ FON GROZNI / WIKIMEDIA COMMONS / PUBLIC DOMAIN

Diving procedure of the Ju 87

The glass canopy of the aircraft is missing. It is believed the pilots made it out of their aircraft in time.

Stuka

FACTS: Technical data for Ju 87 R-2

BUILDING MATERIAL: Duraluminium, all-metal construction method

COVERING: Smooth metal

CREW: 2

ENGINE: Jumo 211D, rated power of 950 hp at takeoff 1200 hp

WINGSPAN: 13.8m

WING AREA: 39.9m²

LENGTH: 11.1m

HEIGHT (on the ground): 4.01m

WEIGHT OF EMPTY AIRCRAFT: 1,185kg

MAXIMUM TAKE-OFF WEIGHT: 4,390kg

TOP SPEED (in horizontal flying position): 383km/h

DIVE SPEED: 650km/h

SERVICE CEILING: 8,100m

HIGHEST RANGE (no load): 1,252km

HARD POINTS LOAD: 500kg bomb or a bomb of 250kg plus two underwing tanks with 600 liters of fuel

SMALL ARMS: Two fixed machine guns MG17 7.9mm in the wings and one movable MG15 7.9mm machine gun in the rear cockpit ■

Clearly visible from above are the M17 wing guns. the inverted gull, or "cranked", shape of the wing improved the pilot's ground visibility and also allowed a shorter undercarriage height.

Stuka

to summon all his force to pull the machine into straight flight while carefully using the trim flaps to perform the maneuver." (SOURCE: www.kheich-horn.de)

The model Ju 87 was built in six different types. The suffix "R" from the Ju 87 R-2 model discovered in Croatia stands for “range”; additional fuel tanks for twice the range were installed under the wings. This was necessary for operations in the Mediterranean and across the Channel.

Most of the machines were equipped with an additional so-called "Jericho horn", which produced the typical siren sound of Stukas. It had a psychological effect aimed to instill fear and terror in the people in the target areas. These sirens were powered by small propellers on the landing gear in very rapid and steep nosedives. Incidentally, the Stukas' haunting howls are still often used in action movies when airplanes crash. ■

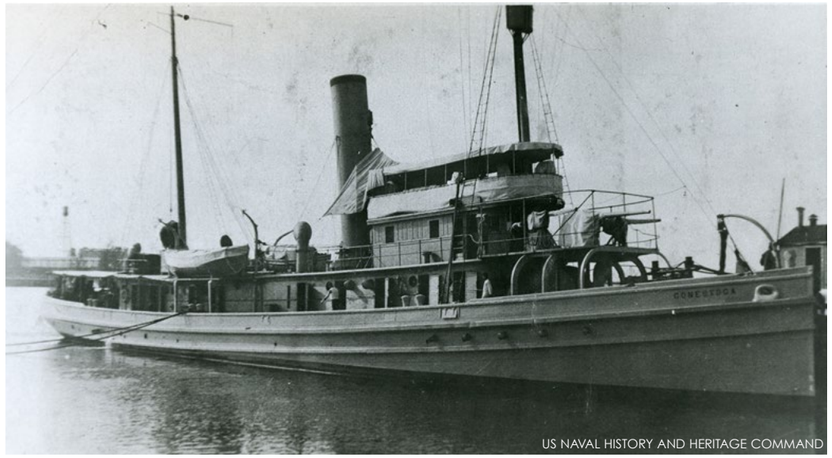
Claudia Weber-Gebert is an advanced diver, dive writer and underwater photographer based in Germany.

The wreck is resting on the seafloor as if it just made a soft landing, with the chassis of the wheels completely intact.

Even after more than 70 years in saltwater, the wings are not broken.

wreck rap

US Navy finds a tug that was lost for nearly a century



US NAVAL HISTORY AND HERITAGE COMMAND

The wreck of USS *Conestoga* has been discovered within the waters of Greater Farallones National Marine Sanctuary in California, 95 years after the Navy seagoing fleet tugboat disappeared with 56 officers and sailors aboard.

When it left San Francisco on 25 March 1921, *Conestoga* was en route to Tutuila, American Samoa, via Pearl Harbor, Hawaii. When *Conestoga* failed to reach Hawaii by its anticipated arrival date, the US Navy mounted a massive air and sea search around the Hawaiian Islands, the tug's destination. Unable to locate the ship or wreckage, the Navy declared *Conestoga* and its crew lost on 30 June 1921, the last US Navy ship to be lost in peacetime without a trace. Until now, what happened, and where the wreck and its crew lay, has been described as one of the top maritime mysteries in US Navy history.

In 2009, the NOAA Office of Coast Survey, as part of a hydrographic survey near the Farallon Islands off San Francisco, documented a probable, uncharted shipwreck at a depth of 56.5m (185ft). In October 2015, NOAA confirmed the identification and location of *Conestoga* during a mission that included an archaeologist from the Naval History and Heritage Command, as well as several senior Navy officers.

Battling a storm

Weather logs indicate that around the time of *Conestoga's* departure, the wind in the Golden Gate area increased from 23 miles per hour to 40 miles per hour, and the seas were rough with high waves. A garbled radio transmission from *Conestoga* relayed later by another ship stated the tug was "battling a storm and that the barge she was towing had been torn adrift by heavy seas".

Based on the location and orientation of the wreck in 189ft-deep water, three miles off Southeast Farallon Island, NOAA and its technical and subject matter experts believe *Conestoga* sank as officers and crew attempted to reach a protected cove at the island.

"This would have been a desperate act, as the approach is difficult and the area was the setting for five shipwrecks between 1858 and 1907," according to NOAA's report on the *Conestoga* discovery. "However, as *Conestoga* was in trouble and filling with water, it seemingly was the only choice to make." ■

ARTIST DANIJEL FRKA © RUSS MATTHEWS COL

Artist's impression of the shipwreck of the USS *Conestoga*

wreck rap

Vasco da Gama's shipwreck discovered off the coast of Oman

Vasco da Gama was the first European to reach India by sea, linking Europe and Asia for the first time by ocean route, as well as linking the Atlantic and the Indian Oceans entirely and definitively, and in this way, the West and the Orient. This was accomplished on his first voyage to India (1497–1499).

His ship, which sank in a storm in May 1503 off the coast of Al Hallaniyah Island in Oman's Dhofar region, is the earliest ship from Europe's Age of Discovery ever to be found and scientifically investigated by a team of archaeologists and other experts.

Commanded by Vicente Sodré, da Gama's maternal uncle, the Portuguese East Indiaman is believed to have been one of two ships left behind during da Gama's second voyage to India to disrupt trade between India and the Red Sea.

The wreck site was initially discovered by a team from Blue Water Recoveries Ltd (BWR), based in West Sussex, England in 1998 in an expedition to mark the 500th anniversary of da Gama's discovery of a direct sea route to India, but full-scale archaeological survey and excavation by Oman's Ministry of Heritage and Culture did not begin until 2013.

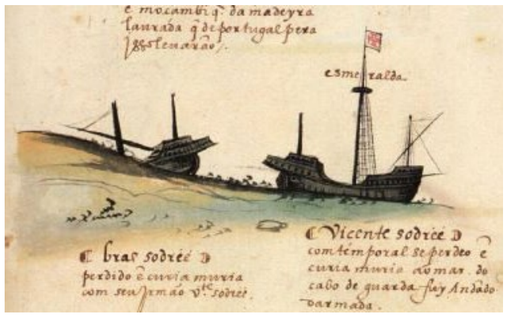
Gold cruzado coins minted in Lisbon between 1495 and 1501 were some of key individual artefacts that helped in identification of the wreck site as Vicente Sodré's *nau Esmeralda*.

DAVID L. MEARNS / BLUE WATER RECOVERIES LTD

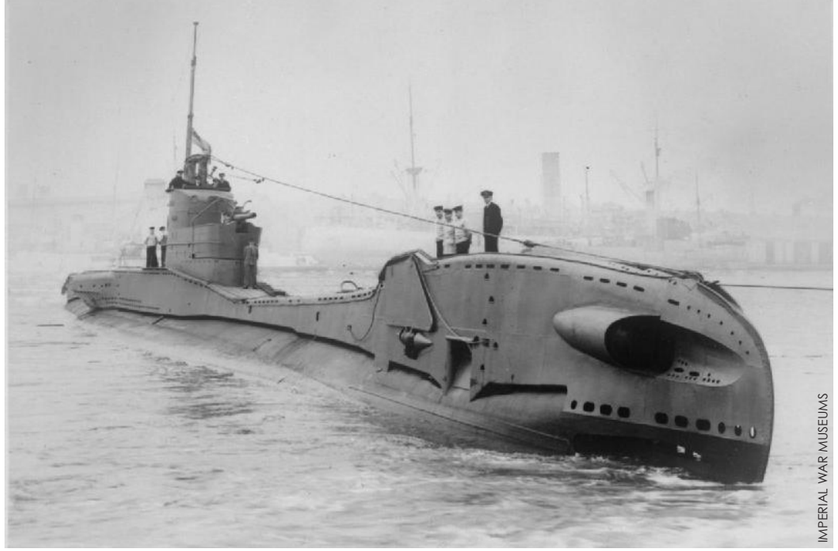
Portuguese ship wrecked on a remote island in the Sultanate of Oman in 1503 is the earliest ship of discovery to be found and scientifically investigated by archaeologists.

The ship predates the next oldest Iberian shipwreck by 30 to 50 years, so it is hoped it will provide new information about maritime trade and warfare during the turn of the 16th century.

"The armaments that the site has produced are already providing us with information about the martial nature of these voyages and the site has the potential to tell us much more about the men and ships that undertook these adventures and the peoples that they encountered," the project's archaeological director, Dave Parham, of Bournemouth University told the *Independent*. ■



Details of the wreck site reveal that the ship is believed to be the *nau Esmeralda* (shown right) commanded by Vicente Sodré, who was the maternal uncle of Vasco da Gama.



IMPERIAL WAR MUSEUMS

British T-class submarine, in this case, HMS *Thorn*—the sister ship to HMS *Tarpon*—underway on the River Mersey on completion

WWII British sub HMS *Tarpon* found off Jutland

The wreck was found and identified in the Danish part of the North Sea, near the fishing port of Thyborøn, by Danish commercial diver Gert Normann in March 2016.

HMS *Tarpon* left Portsmouth on 5 April 1940 and ordered to Norway. On the 10th, *Tarpon* was ordered to take up a new position but was never heard from again. Post-war German records showed that *Tarpon* had attacked the Q-ship Schiff 40/*Schürbek*, but her first torpedoes had missed. A sustained counterattack that went on most of the morning finally brought wreckage to the surface and it became clear the submarine had been sunk. All 59 crew members were probably killed by the blast wave when a depth charge hit right behind the conning tower.

Gert Normann, who accidentally found the wreck while undertaking another enterprise, calls the find unusual. "It is an unusual find and in particular so close to Jutland. It is a quite special sensation to see the wreck after its dramatic demise." Gert Normann told the Danish daily *Jyllands-Posten*.

Inaccurate positions

That 76 years should pass before the vessel was located is down to misleading information about the submarine's location, said Normann. "There are many listings of positions where submarines sank, but they are very inaccurate and many are completely misleading," he said, adding that he expected HMS *Tarpon* to be in the very deep waters of Skagerrak.

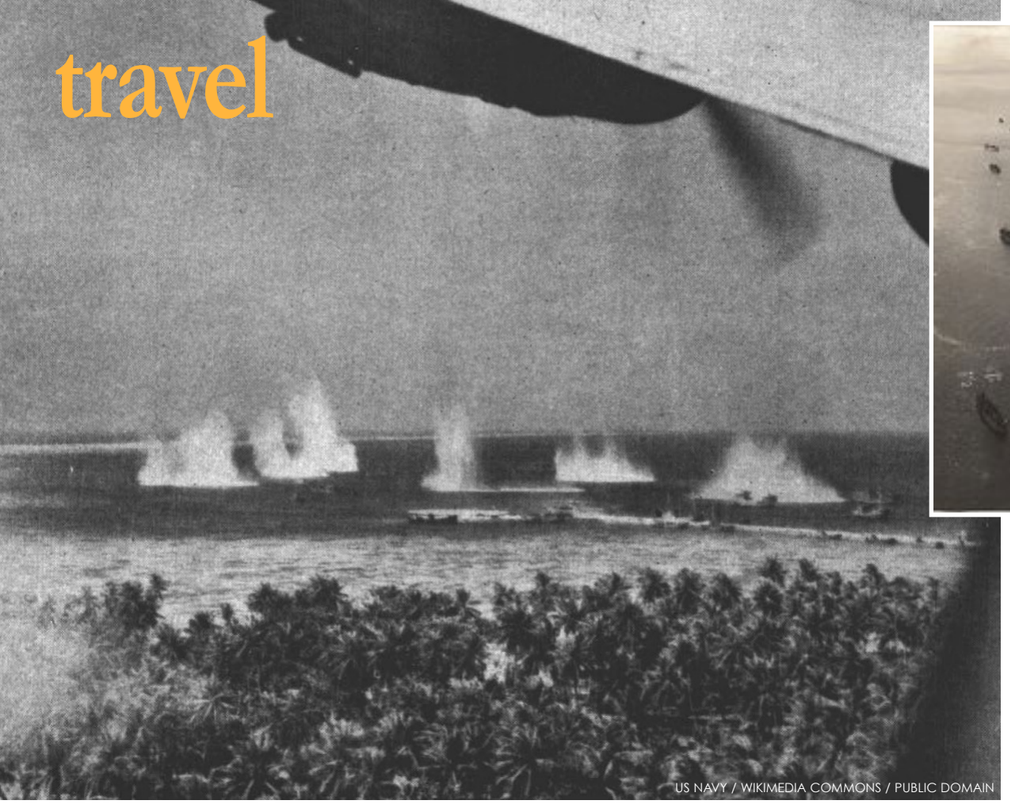
The submarine is considered a war grave, so divers are not allowed to penetrate the submarine. Instead, it is allowed to lie as an untouched tomb while the hull rusts away. ■

Japanese Wrecks of

Kwajalein

Text and photos by Brandi Mueller

Kwajalein



US NAVY / WIKIMEDIA COMMONS / PUBLIC DOMAIN

C THORPE / WIKIMEDIA COMMONS / PUBLIC DOMAIN

Japanese ships (left) under attack in Kwajalein lagoon as seen from a US Navy Consolidated PB4Y-1 Liberator, circa December 1943; A convoy (above) sails under the watchful eyes of three of VMB-613's crews. Patrols of the shipping lanes began on 3 April 1945 and continued through the end of WWII; The island of Ebeye (below) in Kwajalein Atoll being shelled by US Navy ships on 30 January 1944, among them was the battleship USS *Massachusetts* (BB-59)

US NAVY / WIKIMEDIA COMMONS / PUBLIC DOMAIN

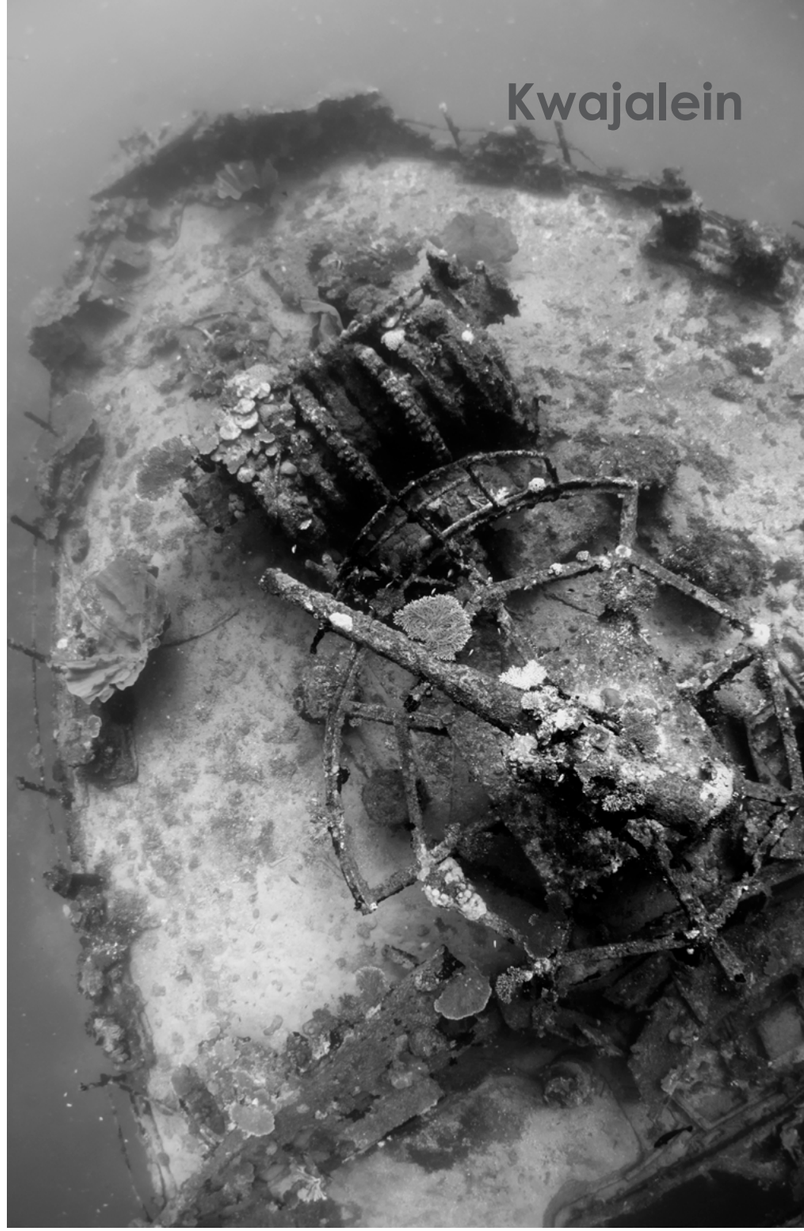
Look at a map of the Pacific Ocean and follow a line southwest of Hawaii. Right after crossing the International Date Line, but just before crossing the equator sits the Republic of the Marshall Islands. What could possibly be a map maker's accidental green spots in the vast pool of blue representing the Pacific Ocean, many have never heard of these tiny islands which are home to fantastic underwater treasures. The Marshall Islands, particularly Kwajalein Atoll, played a large role in the Pacific Theater of World War II and what was left behind in one of the Earth's largest atolls will keep any diver entertained for many dives.

The Marshall Islands consist of 29 atolls with a total land mass around 180 square kilometers (70 sq. miles), (about the size of Seattle), but the atolls cover over 750,000 square miles of ocean (think the size of Mexico.) Anyone looking at this region of the Pacific would guess the diving would be pretty amazing and it doesn't disappoint. Healthy reefs, plenty of fish, and a lagoon filled with WWII shipwrecks, airplanes, discarded military supplies. There is even a ship that almost survived two nuclear bombs. Welcome to Kwajalein Atoll.

WWII—Operation Flintlock

Kwajalein Atoll was an important base for the Japanese Imperial Navy that had been awarded to them after Germany's defeat in WWI. During WWII, in retribution for Pearl Harbor, United States forces attacked in 1943 and 1944. Many divers know all about Operation Hailstone which took place in Truk Lagoon, because it gave us some of the best tropical wreck diving in the world. But less know about Operation Flintlock, a campaign in January and February of

Kwajalein Atoll from above. PREVIOUS PAGE: Green sea turtle on a kingpost of *Asakazi Maru*



Diver (left) photographs batfish on *Asakazi Maru*; Nurse shark (top center) and eagle ray (above) with diver over *Asakazi Maru*; Bow and bow gun of *Asakazi Maru* (right)

1944 prior to that in Truk. This battle was also devastating to the Japanese Imperial Navy, leaving more than 12 large wrecks sunk as well as several airplanes and much military surplus underwater.

Prior to Operation Flintlock, air raids had already sunk and damaged cargo ships, and light cruisers around both Roi-Namur and Kwajalein islands. Starting on 29 January 1945, islands to the northeast of the atoll were attacked, including Roi-Namur. Smaller islands were captured in the following days. Kwajalein was bombarded at the southern tip of the atoll. The attack came by air and sea, and media reported that more than 1,600 tons of ammunition was expended upon Kwajalein over 24 hours, which equates to at least three shells or bombs hitting the island every second. The islands of Kwajalein and Roi-Namur, as well as others, were leveled to the ground with hardly a tree left standing.

Many ships and planes were sent to the bottom of one of the world's largest lagoons. Almost 75 years later, those wrecks have been reborn underwater. Today, they are covered in colorful corals and sponges, the bow guns have tiny blue damselfishes living in them, and green sea turtles find refuge on the crossbeams of kingposts. Nutrient rich, warm tropical waters have led to marine life flourishing on these historical wrecks from the past.

Diving the wrecks—Kwajalein

The attacks on Kwajalein started in December 1943 with Operation Flintlock starting 29 January 1945. In December, several ships were sank, including the *Asakazi Maru, Choko Maru* and *Shoyei Maru*. The *Asakazi* and *Choko* were both attacked on December 4 and the *Shoyei Maru* on December 19.

Asakazi Maru. The *Asakazi Maru*, called K-5 Upright by local divers because it is sitting upright and because of its close proximity to a Coast Guard buoy labeled K-5, is a popular wreck with a resident green sea turtle usually seen sleeping in one of the kingposts. It is thought that three 1,000lb bombs hit the vessel and it was reported to have sunk in less than five hours. The damage from the bombs can be easily seen underwater as the entire superstructure lay in a heap. Recent storms have also caused more damage to the ship.

There is a 3-inch bow gun on a turret and a machine gun on the starboard

Diver (top left), longnose hawkfish (left), bow gun (above) and lionfish (lower left) on the wreck of *Choko Maru*

side of the wheelhouse. Popular artifacts to see in the holds include sake bottles and the outer section of a small car. The ship is 73m (424ft) and the top deck sits at about 30m (100ft). Nurse sharks are often seen resting on the top deck and eagle rays frequently swim past divers.

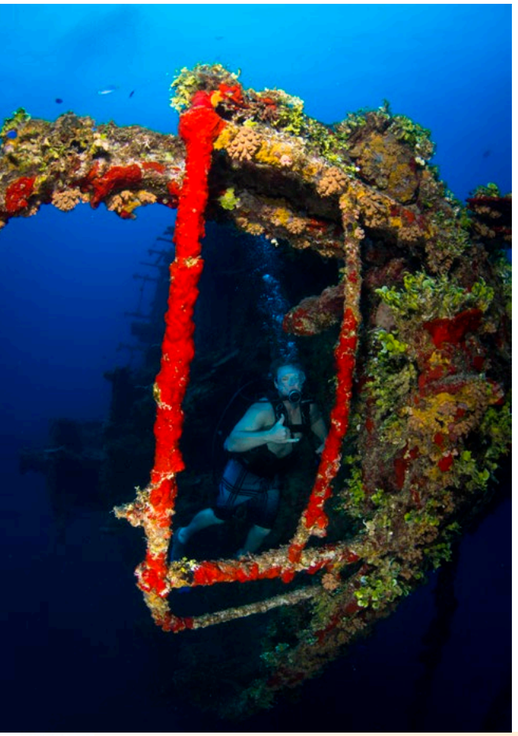
Choko Maru. Also sunk on December 4 was the *Choko Maru*, known as Barracuda Junction. Of course, once you name a wreck after an animal, you never see that animal there again. In lieu of barracuda, the wreck does have several lionfish that live in the cargo holds as well as black coral on one of the kingposts with resident longnose hawkfish. The 103m (340ft) ship is sitting on its port side in 44m (145ft) of water. A 3-inch deck gun on a platform at the bow points towards the surface at a very photogenic angle. Turtles and eagle rays are common visitors and the stern has bomb damage. Two kingposts rest in the sand and many pipes can be seen, having fallen out of the holds onto the seafloor.

Shoyei Maru. The *Shoyei Maru* (or possibly *Syoei Maru*) was sunk by a glide bombing attack on 19 December 1943. The ship lies upside down at 42m (140ft). Next to the ship is a F1M2 Pete, which may have been on the deck of the plane when it sank.

Akibasan Maru. The *Akibasan Maru*, known as P-buoy, is one of my favorite wrecks. Sitting upright in about 49m (160ft), this 115m (375ft) long ship is a fantastic dive. Having arrived just two days earlier from Truk Lagoon, the ship received three direct hits on 31 January 1944 from a single-engine plane and was reported to have sunk in less than five minutes. Today, the ship is home to a timid school of barracuda and some very friendly batfish that insist on following divers around throughout their dive.

The ship has two kingposts that are around 20m (60ft) and a large smoke stack with a pretty anemone most divers visit on each dive. The smoke stack also has the insignia markings of Mitsui Bussan Kaisha, the ship's merchant owner.

The holds of the *Akibasan Maru* are fantastic with many exciting artifacts. In hold #2, there are seaplane wings and pontoons with kanji characters, previously thought to be meant for Mavis seaplanes,

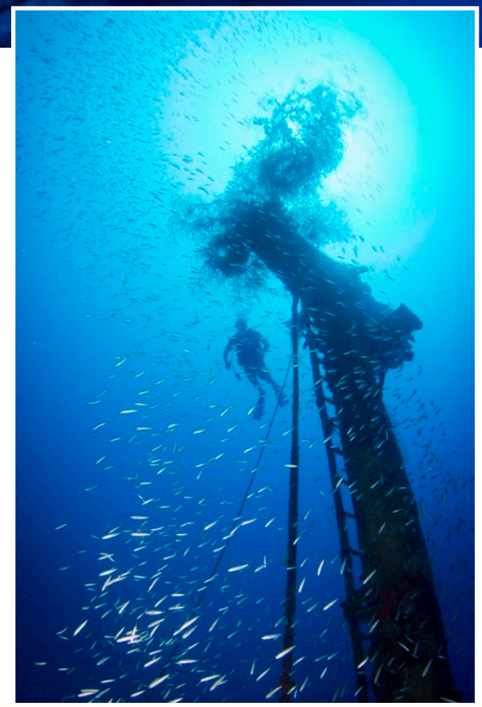


Diver on the *Tateyama Maru* (left); Batfish on the *Akibasan Maru* (above); The *Phantom Maru* (top right) was so named because divers kept finding it and losing it and then finding it again; Pretty pink anemone on the *Tateyama Maru* (right); Unexploded ordinance in a cargo hold of *Tateyama Maru* (far right)

although they were recently shown to actually be for E14Y1 Glen floatplanes. Other holds contain Japanese beer bottles, sake bottles and shoe soles.

Tateyama Maru. The *Tateyama Maru* (K5-side) is another favorite of the Kwaj diving community. This 103m (340ft) ship sits on its starboard side at about 42m (140ft) in the sand. A pretty pink anemone sits on the top rail with several anemonefish and cleaner shrimp. Schools of trevally are a common sight, as are friendly batfish. The sponge covering a lot of this ship is bright red when you put a light to it and the hull is covered in huge purple elephant ear sponges that are often shading sleeping green sea turtles. The ship was likely a converted water carrier bringing supplies to Kwajalein and was probably sunk by one or more 1,000lb bombs.

Phantom Maru. Heading north, away from the island of Kwajalein, several ships can be found closer to the island of Ebeye and even further towards Bigei. The *Phantom Maru*, so named because divers kept finding it and losing it and finding it again, is an unknown Japanese wreck only about 30m (100ft) long sitting upright at 45m (150ft). There is a machine gun at the bow and the superstructure is mostly disintegrated except for the metal posts left behind. Divers usually see a large school of jacks



Diver with the wheel (above) and the kingpost (right) of the *Palawan*

when they descend to the wreck.

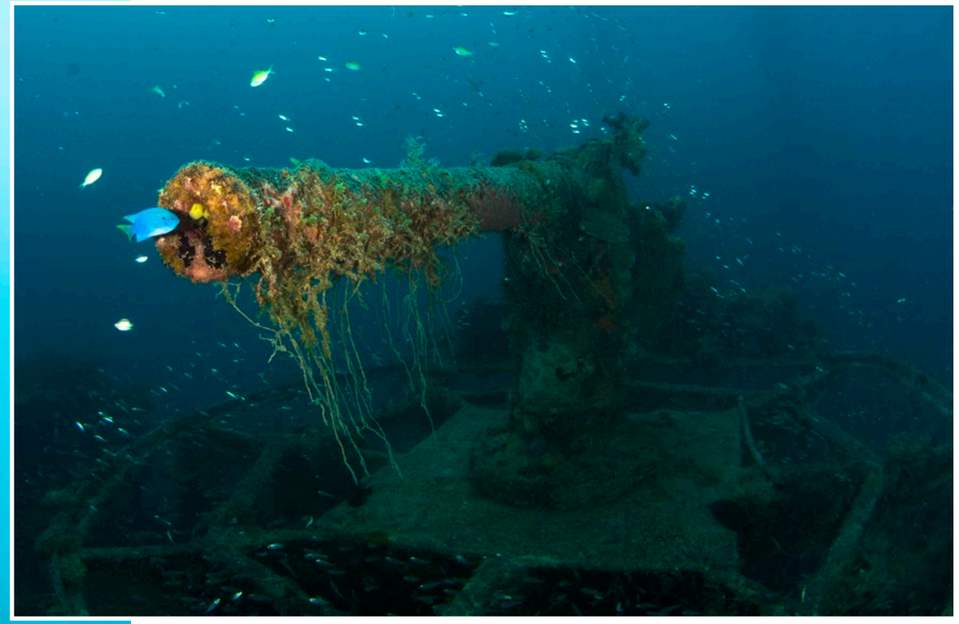
Palawan. The *Palawan* rests just north of the island of Bigei. The wreck was a Philippines engine freighter that was captured by the Japanese and then used by the Imperial Navy. What was most likely a wooden ship now only has the skeleton of the structure left, making the ship look very ghostly. Divers love this wreck because it has a large wheel that is great for photos. This ship has some of the best visibility of any of the wrecks because of a nearby pass that brings clean water from the oceanside into the lagoon. The ship sits upright in 45m (160ft) and is known for its huge black coral bushes that swarm with fish and are home to longnose hawkfish.

There are several other ship and plane wrecks that can be found in the lagoon of Kwajalein. Other vessels include submarine chasers, concrete barges, harbor craft and planes, most of which are marked and divers only occasionally visit. Japanese airplanes that can be found in the lagoon near Kwajalein include an E13A1 Jake and two Kawanishi H6K Mavis planes. American planes near Kwajalein include the remains of an F6F-3 Hellcat, several PBM-3R 'Mariner', and a PB2Y-3 Coronado.

Many of these wrecks were found in the 1960s and 70s by

Port holes (left), bathroom tiles (lower left) and bow gun with damselfish (below) on *Eiko Maru*; PBM-3R "Mariner" airplane (bottom right)

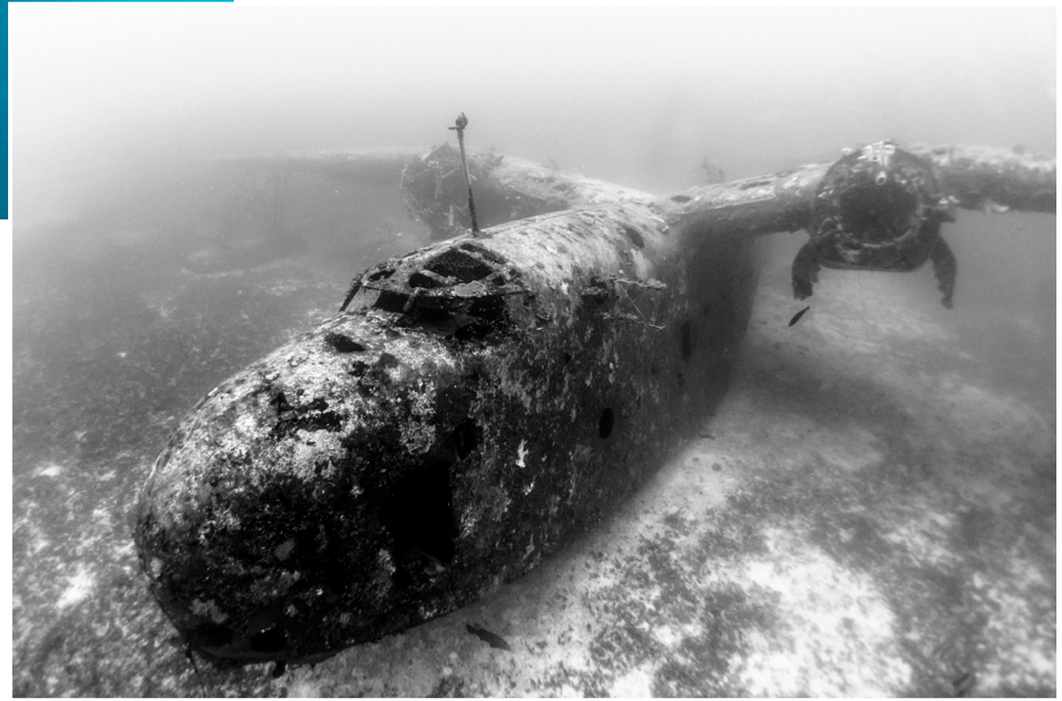
Kwajalein



divers working at the army base by dragging an anchor behind a boat until it snagged something. Luckily, these days, GPS coordinates make finding them a little easier. There is a good possibility there are other ships and airplanes that have not been marked yet.

Roi-Namur wrecks

About 65km (40 miles) to the north of Kwajalein Island, sitting at the top right corner of the atoll, is Roi-Namur. Also used by the Japanese, there are three large ships that can be found just offshore in the lagoon. Known to local divers as first, second and third ship; they are all very interesting dives with plenty of marine life.



Eiko Maru. The *Eiko Maru* (First ship) is thought to have been attacked but not sunk near Kwajalein Island and moved north where it later sank. The ship is not seen in images taken in December when the initial attacks on Roi occurred. This 104m (340ft) ship sits upright at 40m (130ft) in the sand with its two kingposts only being around 5m (15ft) deep. Schools of trevallies can be seen roaming all

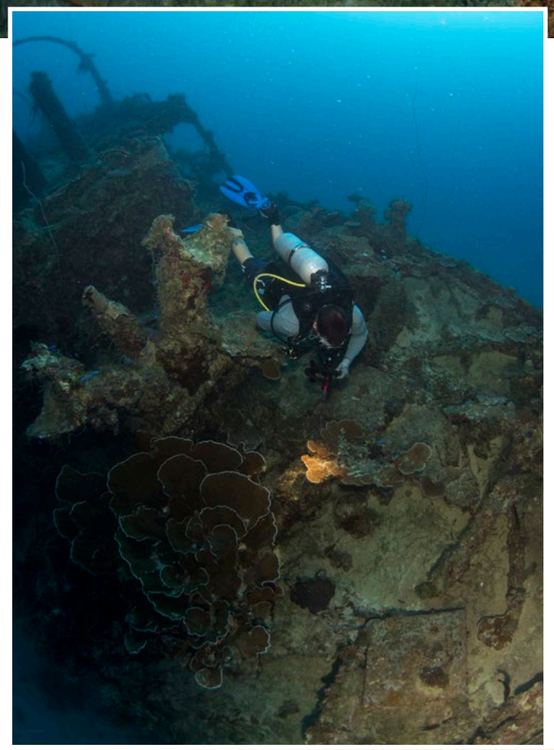
Fusiliers swim along the *Kembu Maru* (above); Damselfish peers into 5-inch bow gun on the *Kembu Maru* (left)

around the ship as well as zooming by the 3-inch bow gun that is usually also surrounded by tiny glass fish that make it look as if it is covered in glitter. Just off the bow is an American Landing Craft that can be seen from the ship on days with good visibility. Baby blacktip sharks are a common sight and they seem to come just close enough to check divers out and then disappear off into the distance.

Kembu Maru. Not far from the *Eiko Maru* is the *Kembu Maru* (Second ship). This ship has a fantastic intact 5-inch bow gun that is the largest in the lagoon. Also upright, the ship is covered with marine life, including a large school of bright blue and vibrant yellow fusiliers that will pour down almost like rain on divers, only to switch direction and move upward and vanish into thin air. Huge moorish idols guard the bow gun and peacock groupers perch themselves in the many nooks and crannies. The bottom of the ship is in about 45m (150ft) of water and there is one kingpost that reaches up to around 20m (60ft). The top deck is around 28m (90ft).

It is believed that the *Kembu Maru* was carrying aviation fuel; and after it was bombed, it was noted that there was a massive explosion and plenty of smoke. The results of this can be seen underwater as divers approach astern of midship. It looks as if the hull has been peeled back like an orange and the skin is flat on the ocean floor.

Sponges and corals have coated the *Kembu Maru* and marine life has made the wreck their home.



Diver at bow (left) and exploring the *Takunan Maru* (above).

Takunan Maru. Close to the others is the *Takunan Maru* (Third ship) which was a submarine chaser. Much smaller than the other two, it is only about 40m (130ft) long and sits on its side at about 40m (130ft). Most of the wooden hull and superstructure is gone. Nearby and also very close to shore is a mangled Japanese Zero aircraft.

Post-war—Airplane Graveyard

At the end of WWII, it was determined that excess war materials were no longer needed and that it would be more costly to transport supplies including aircraft, jeeps, and ammunitions back to the United States than to just dispose of it.

About three miles southwest of Roi-Namur, starting just off Mellu Island, an estimated 120 to 150 American WWII planes and plane parts were dumped in the lagoon. Local divers refer to this two-square mile area as the Airplane Graveyard and a dive in almost any part of this area will reveal several planes still in very good condition. The planes were stripped before being sunk and many have their propellors jammed into the cockpits.

The planes can be seen in as shallow as 30ft of water to as deep as 130ft; and most lie in the sand with only a little

US DOE / WIKIMEDIA COMMONS / PUBLIC DOMAIN

Operation Crossroads, BAKER Event (left): The BAKER Test was detonated on the Bikini Atoll on 24 July 1946; Half-buried Douglas Dauntless in the Airplane Graveyard (above); Propellers of the *Prinz Eugen* (right and lower right); Historical photo of USS *Prinz Eugen* at sea during Operation Crossroads (bottom right inset)

coral surrounding the area. A nearby entrance to the lagoon feeds clear water into the area, giving it fantastic visibility. (Sometimes you can see the planes from the surface, even though they are 100ft deep.) The planes include Douglass Dauntless SBDs, Avengers, Wildcats, a Corsair, a Helldiver, Mitchells, and a Curtiss C-46 Commando. Some rest in the sand nose down, some upside down, others on top of one another and some sitting perfectly on their wheels looking as if they could take off at any moment.

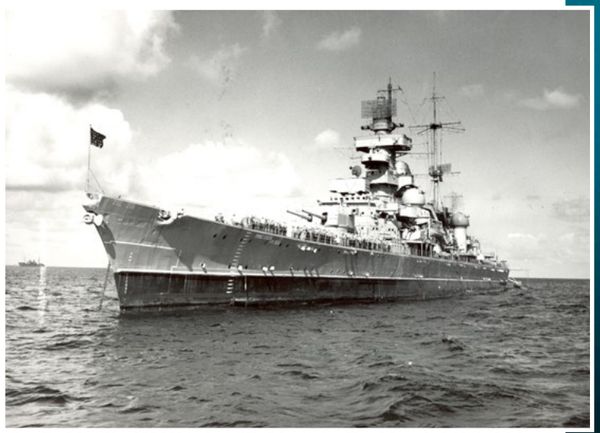
Prinz Eugen

The Marshall Islands are also known for the nuclear testing at Bikini Atoll, about 350km (220 miles) from Kwajalein Atoll. In 1946, Operation Crossroads involved deploying three nuclear test weapons to study the effects of nuclear weapons and radioactive contamination. Only two tests occurred and the third was cancelled. Ninety-five ships were lined up in Bikini Atoll's lagoon including the *Prinz Eugen*, a German ship that fought in European waters during WWII, and at the end of the war was transferred to the US Navy as a war prize.

After WWII, the ship then made its way across the Atlantic to the United States, through the Panama Canal into the Pacific Ocean and finally arrived halfway around the world at Bikini Atoll to be used in the nuclear testing. The ship was one of only nine that survived both the Able and the Baker bombs, both Fat Man plutonium implosion-type nuclear weapons (the same that was dropped at Nagasaki). Being highly contaminated, the *Prinz Eugen* was towed back to Kwajalein Atoll to be further studied.

Upon arriving in Kwajalein, a small leak in the hull was discovered, but the ship was too radioactive to allow anyone to go on board to repair it. It was in the process of being towed out of the lagoon to be sunk in the open ocean but it did not make it before sinking (still in the lagoon) next to the island of Enubuj (also known as Carlson Island).

Today, the ship is mostly upside down on its starboard side with two



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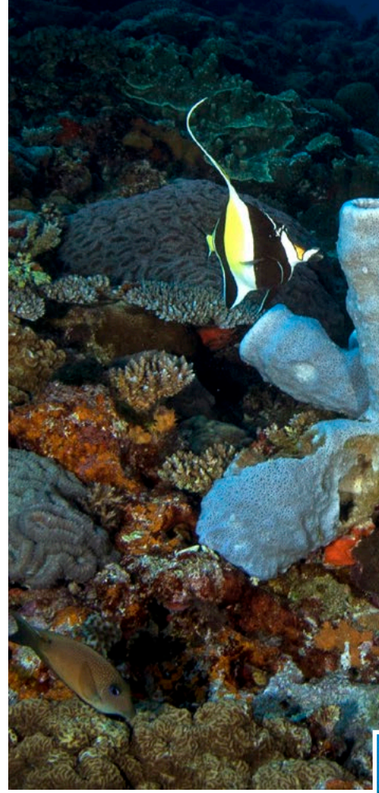


Kwajalein

Fuel leaks out of *Akakazi Maru* (left); Kwajalein from above (above) Moorish Idols on sponges (above); The reefs of Kwajalein Atoll are filled with life such as these raccoon butterflyfish (right inset)

propellers sitting out of the water. (The third propeller is in the German Naval Museum at Laboe.) The stern is shallow enough for snorkelers to swim along the huge propellers, both of which are partially exposed during low tide. The 207m (681ft) long ship rests on a sandy slope and the bow is in water about 36m (120ft) deep.

Dive boats usually anchor close to the ship's exposed propellers and start their dive swimming close to them and descending around the stern where several stingrays are known to reside. Looking underneath the ship, some of the crushed deck can be seen. Swimming along the starboard side and descending towards the bow, there are many windows and hatches to peek into, although everything inside has fallen from the floor to the ceiling, making it difficult to identify the interior. A popular place to view the ship is the torpedo room where there are at least six stacked torpedoes.

The bow rests with the deck down but it is possible to swim underneath a part of it to the other side where grey reef sharks are often seen. Swimming back along the hull, divers can see that much marine life is growing on the hull including large elephant ear sponge (*Ianthella basta*). Often, several octopi can be found hiding in the crevasses of the hull and huge schools of parrotfish and tangs can be seen feeding on the growth.

Today

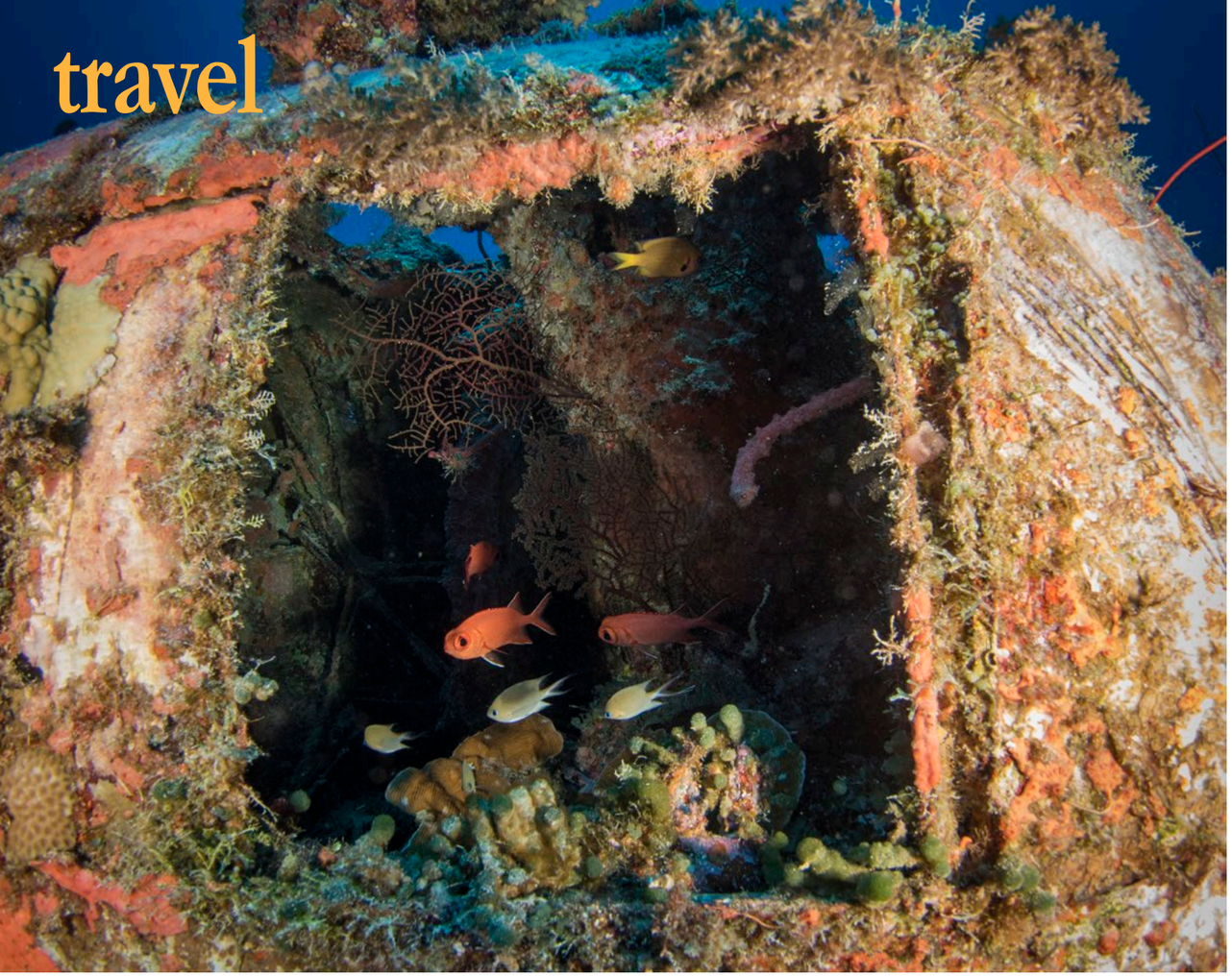
Several of Kwajalein Atoll's islands are currently leased by the United States, including the southernmost island, Kwajalein, and Roi-Namur to the northeast. Visiting these islands is not permitted without special permission. There are no commercial dive operations on the atoll other than the Kwajalein Scuba Club which caters to personnel of the US Army Garrison Kwajalein Atoll. Several infrequent liveaboards pick up passengers at Ebeye Island (Kwajalein Atoll) to start trips to dive Bikini Atoll and dive a few sites on Kwajalein Atoll before continuing their journey.

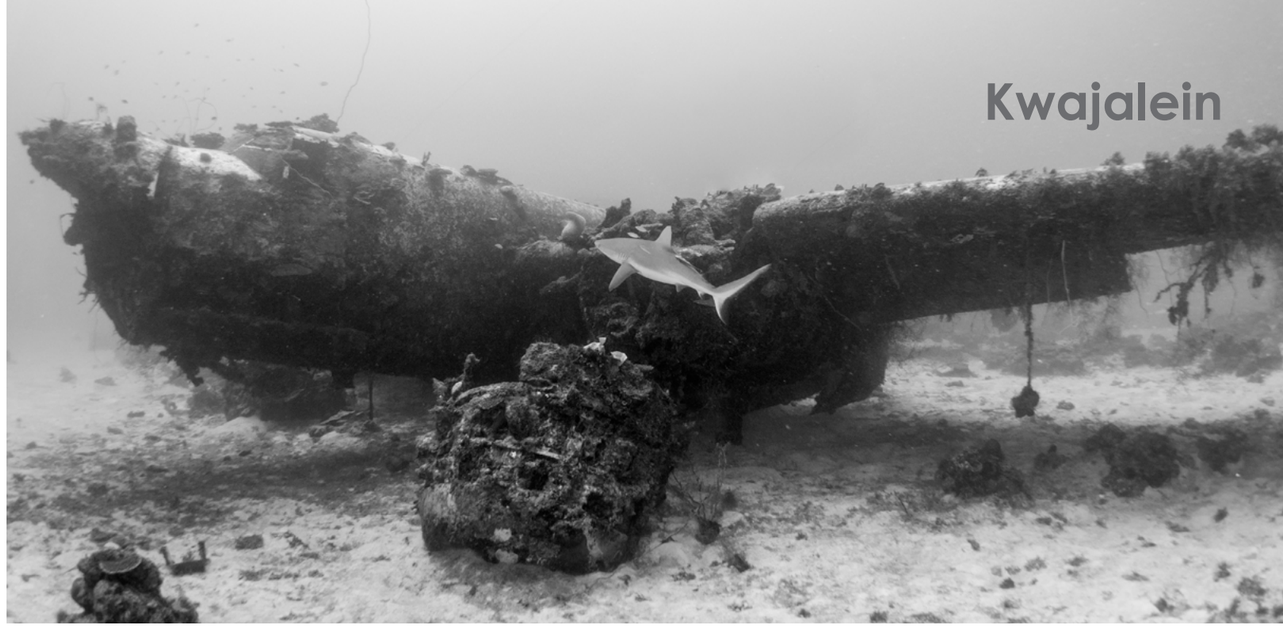
Threats

The Republic of the Marshall Islands is stated to be one of the first countries that will disappear if sea levels continue to rise. The highest points in the island are around 10 meters (30ft) above sea level, with much of the land very near sea level. Increases in the severity and frequency of large storms is currently causing extensive flooding which can be very damaging to housing, contaminate water supplies, and literally sweep people out to sea.

Another rarely discussed potential issue Kwajalein Atoll has (as well as Chuuk/Truk Lagoon) is the possibility of a large oil spill in their lagoons. When the ships sank, they had varying amounts of fuel within them. As time goes on and the ships disintegrate, at some point, the oil and fuel would no longer be contained within.

A particular problem is the *Prinz Eugen* which is known to have been almost fully fuelled when it sank. Divers see brown bubbles of oil coming from the wreck; and when there is little wind, an oil slick can often be seen coming from the ship. Each of these ships could possibly hold hundreds of thousands of gallons of fuel which would cause environmental havoc, especially for ships sunk in marine-rich areas such as Kwajalein Atoll.





Looking into the cockpit of a sunken B-25 (top left) divers can see the plane now plays an entirely different role underwater than it did above; Shark (above) swims next to a sunken B-25 in the Airplane Graveyard; Japanese "Mavis" airplane (left); Japanese Zero Aircraft off Roi-Namur (far lower left)

Kwajalein MIA Project

An interesting group of scuba divers, WWII historians, archaeologists, and dabblers in all of the above (including your journalist) have recently formed a group called the Kwajalein MIA Project. What started about ten years ago with just a few WWII aircraft fanatics searching for a missing Kingfisher plane that went down during WWII has grown into a nonprofit now using historical information, side-scan sonar, and a whole lot of luck. In August 2015, they found the tail section of a Coranado plane known as *Gunga Din* and it is likely associated with an MIA possibly in the front section of the plane

that has yet to be found. This breakthrough find gave a lot of hope and expanded the search through historical documentation to find more on other planes with MIAs that went down in Kwajalein Atoll.

This volunteer team has no paid staff members and runs on some fundraised support and on volunteers' out-of-pocket donations. There are at least 10 known aircraft with 12 MIA service members within the Kwajalein Atoll lagoon and over 90 in the various atolls within the Marshall Islands unaccounted for; many have a probable chance of discovery using a side-scan sonar. The project is currently using a borrowed side-scan sonar which is only available a few weeks a year and they are currently fundraising to get their own which would allow for more time to search.

For a place that is often overlooked, the Marshall Islands and Kwajalein Atoll have a lot going for them. Great wreck and reef diving with historical ties to WWII, the Bikini testing, present-day US Army operations, climate change threats, the search for lost airplanes and more, there is no doubt you will be hearing more about these tiny islands in the middle of the Pacific in the future. ■

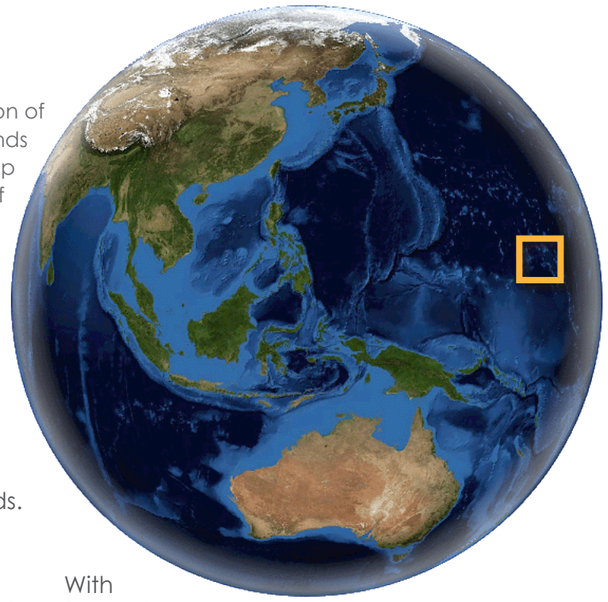
Brandi Mueller is a PADI IDC Staff Instructor and boat captain living in the Marshall Islands. When she's not teaching scuba or driving boats, she's most happy traveling and being underwater with a camera. For more information, visit: ***Brandiunderwater.com****.*

fact file

Marshall Islands

SOURCE: CIA.GOV WORLD FACTBOOK; XE.COM; HONDURAS.COM; WIKIPEDIA.COM; TURQUOISE-BAYRESORT.COM

RIGHT: Location of the Marshall Islands on global map
FAR RIGHT: Location of Kwajalein Atoll on map of Marshall Islands
LOWER LEFT: Moorish idols on wreck of *Tateyama Maru*
LOWER RIGHT: Diver with green sea turtle on wreck of *Asakazi Maru*



History As the easternmost part of the UN Trust Territory of the Pacific Islands, the Marshall Islands were under US administration for almost four decades. In 1986, the Marshall Islands attained independence under a Compact of Free Association. As a result of US nuclear testing on a few of the atolls from 1947 to 1962, inhabitants continue to pursue compensation claims. The Marshall Islands is host to the US Army Garrison Kwajalein Atoll Reagan Missile Test Site, which is a critical installation in the US missile defense network. Kwajalein is also host to one of four dedicated ground antennas that aid in the operation of the Global Positioning System (GPS) navigation system. Capital: Majuro.

Geography Located in Oceania, the Marshall Islands include two archipelagic island chains of 29 atolls, comprising several small islets, as well as five single islands in the North Pacific Ocean, approximately halfway between Australia and Hawaii. Coastline: 370.4km. Terrain: Low sand and coral limestone islands. Lowest point: Pacific Ocean 0m. Highest point: 10m, at an unnamed location on Likiep. Note: Bikini and Enewetak islands were once US nuclear test sites. Renowned as a World War II battleground, Kwajalein Atoll is the site of a US missile test range. The atoll encompasses the world's largest lagoon. The second largest settlement in the Marshall Islands is the island city of Ebeye, which is second only to the capital of Majuro. Ebeye is one of the most densely populated areas in the Pacific.

Economy The Marshall Islands relies upon US assistance and lease payments for the use of Kwajalein Atoll as a US miltary base. Small farms contrubute to agricultural production and subsistence, of which coconuts and breadfruit are the most important commercial crops. Handicrafts, tuna processing, and copra make up the limited industry of the islands, with some potential in tourism. With few natural resources on the islands, imports exceed exports, and aid from the United States of around $1 billion between 1986-2001 as part of the original Compact of Free Association (Compact) bolstered the island economy. The Compact's financial package was renegotiated in 2004 to extend over the next 20 years until 2024 and includes around $1.5 billion in direct US aid as well as a trust fund for the island's people for income provisions beyond 2024.

Climate The climate is tropical, hot and humid, with the wet season from May to November. The islands border a typhoon belt, hence experience occasional typhoons.

Environmental issues
Challenges include inadequate supplies of potable water and pollution of Majuro lagoon caused by discharges from fishing vessels and household waste.

Currency US Dollars

Population 63,174 (July 2008 est.) Ethnic groups: Marshallese 92.1%, mixed Marshallese 5.9%, other ethnic groups 2% (2006). Religions: Protestant 54.8%, Assembly of God 25.8%, Roman Catholic 8.4%, Bukot nan Jesus 2.8%, Mormon 2.1%, other Christian religions 3.6%, other religions 1% (1999 census).

Language Marshallese is the official language spoken by 98.2%, However, English is widely spoken as the second official language.

Links
Marshall Islands Visitors Authority
www.visitmarshallislands.com ■

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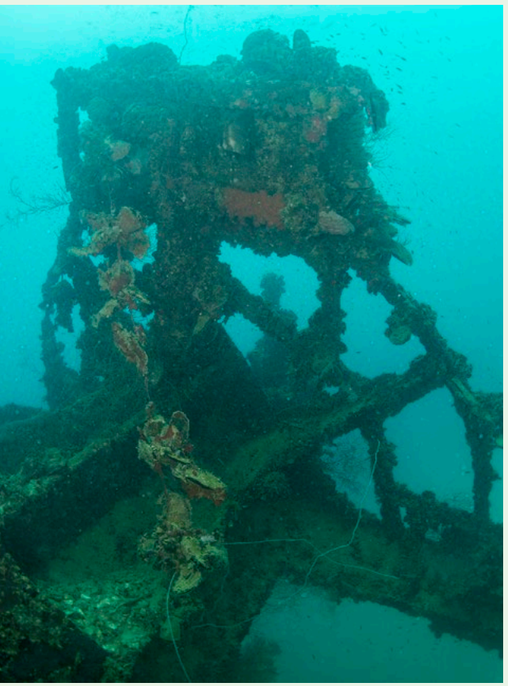
Wrecks of Palau

— Liveaboard Adventure in Micronesia

Text and photos by Richard Barnden

Palau Wrecks

WWII Corsair plane wreck at Palau (above); Moorish idols on *Ryuko Maru* (left). PREVIOUS PAGE: Foremast on *Iro* wreck



Gun turrit on *Bichu Maru* wreck

Palau is famous for its large pelagic life, manta rays, gray reef sharks and swimming with millions of stingless jellyfish. However, hidden beneath the waters of Palau's inner lagoon lies some of the planet's best wrecks. But how did some of Japan's Combined Fleet end up resting on the sandy bottom of this pristine island? And how are Palau's wrecks connected to the world-famous wrecks of Chuuk, also known as Truk Lagoon?

In September 1940, the United States placed an embargo on Japan by prohibiting exports of steel, scrap iron and aviation fuel due to Japan's recent takeover of Northern French Indochina. Eventually freezing all of Japan's assets and thus preventing Japan from buying oil, the move intended to politically cripple the country's army, navy and air force.

Pearl Harbor, Hawaii

On Sunday, 7 December 1941, the first wave of Japanese airplanes left six aircraft carriers on a mission to attack Pearl Harbor where the United States Fleet was anchored. Over 3,500 Americans were killed, 18 ships were sunk and over 350 aircraft were destroyed.

In one strike, the Japanese Navy scored a brilliant success and at the same time assured their ultimate defeat.

The Japanese attack brought the United States into the war, determined to fight to the finish and claim revenge for their public humiliation.

Admiral Isoroku Yamamoto

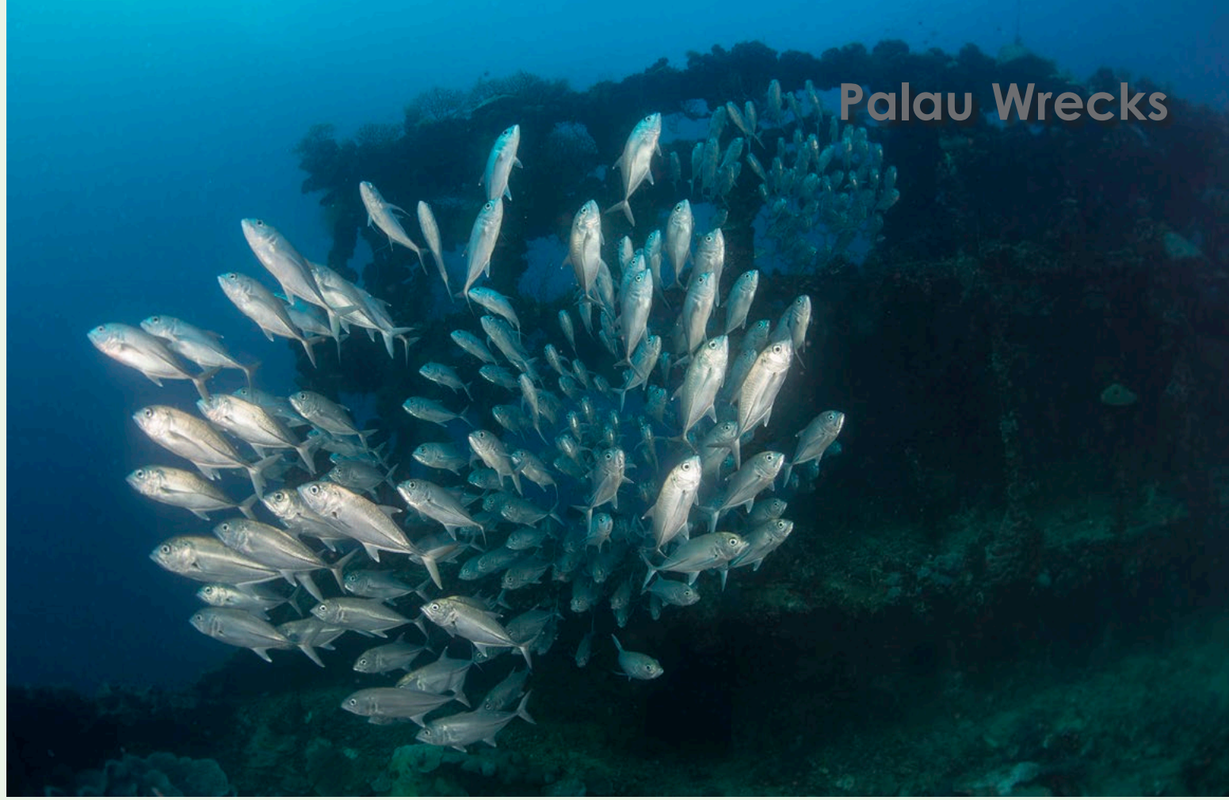
Yamamoto was credited as the mastermind behind the Japanese attack on Pearl Harbor. The Americans slowly sought revenge. Exactly one year after the Doolittle raid on the 18 April 1943, US secret intelligence had cracked the Japanese code giving away the admiral's exact position. While flying over the Solomon Islands, the Mitsubishi G4M "Betty Bomber" in which the admiral was flying came under attack by American P38 Lightening aircraft and he was killed.

The *Yamato*—the admiral's headquarters and the largest battleship ever constructed by any navy—remained anchored at Truk Lagoon and was soon to become one of America's next targets.

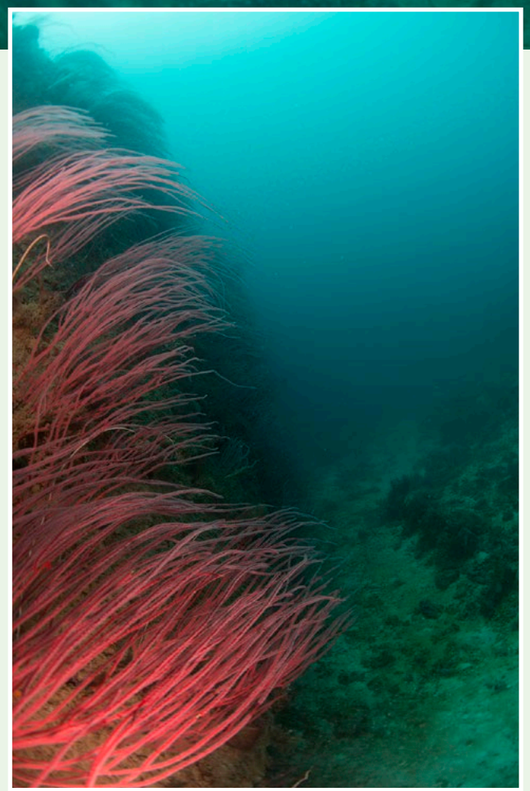
Operation Hailstone

Operation Hailstone, launched on 16-17 February 1944, was a massive naval air strike and surface attack on Truk Lagoon. Truk was a major Japanese logistical base as well as the operating base for the Imperial Japanese Navy's Combined

Sea fan corals on *Kibi Maru* wreck



Diver with gun on *Teshio Maru* (left); Jacks on *Iro* wreck (above); Corals on *Kibi Maru* wreck (lower left)



Fleet and Japanese air base. Some have described it as the Japanese equivalent of the US Navy's Pearl Harbor.

Prior to Operation Hailstone, a reconnaissance flight over Truk on February 4, 12 days before the attack was spotted by Japanese intelligence.

Fearing the base was too vulnerable and that attack was imminent, Japan relocated their aircraft carriers, battleships and heavy cruisers of the Combined Fleet to Palau a week prior to Operation Hailstone.

Operation Desecrate One

On 30-31March 1944, Operation Desecrate One was a United States Navy operation against the Japan's bases around Palau. It involved attacks by task force 58, once again with aircraft carriers USS *Enterprise*, USS *Bunker Hill*, USS *Hornet*, USS *Yorktown*, USS *Lexington*, USS *Monterey*, USS *Belleau Wood*, USS *Cowpens*, USS *Cabot*, USS *Princeton* and USS *Langley*—the same carriers that were involved in Truk Lagoon.

Just one month after Operation Hailstone in Truk, the Japanese were aware that the attack of Palau would be imminent. However, the speed at which the Americans organized such an attack and the amount of US Navy forces involved also led to another of Japan's defeats.

Thirty-six Japanese ships were sunk or damaged in the attacks. TBMs and TBF Avengers from those carriers bombed extensive minefields in and around the channels and approaches to Palau in the first tactical use of mines laid by carrier aircraft.

Salvage

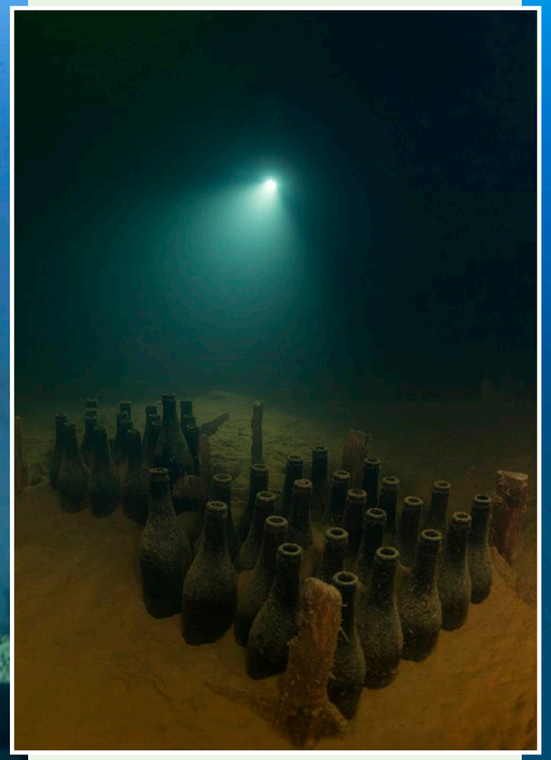
In the years following the war, the Japanese government was given permission to conduct salvage operations as a way to raise money to pay for war claims. Conducted by Fujita Salvage K.K. of Osaka, at least 15 wrecks or more were partially salvaged, some were even re-patched and floated. Scrap metal and artifacts were loaded onto some of the re-floated ships in order to tow them back to Japan to be sold. On the return voyage, the entire fleet was hit by a typhoon in the South China Sea and sank. Nothing ever returned back to Japan's shores.

Palau wrecks

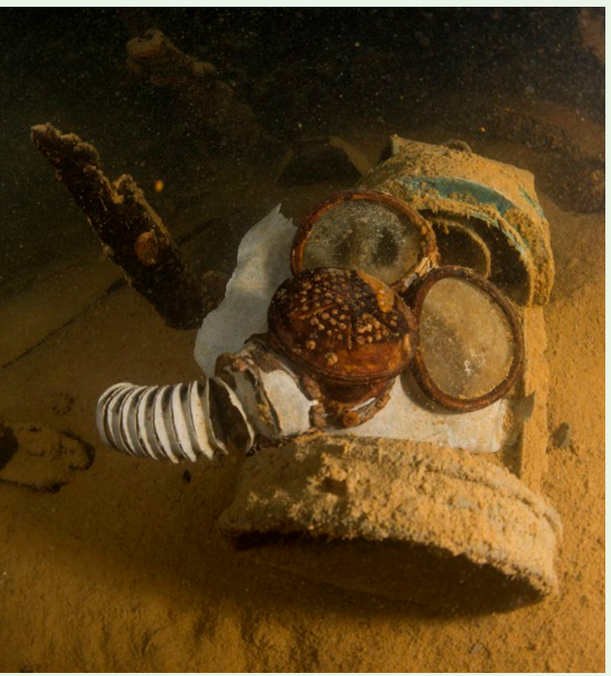
Although some wrecks have been salvaged and some artifacts removed compared with Truk, there are a handful of world-class wrecks that were either left untouched by the salvage company or simply not found until later.

Iro. *Iro* was launched on 5 September 1921 by Osaka Iron Work's Sakurajima factory. Unlike the *maru* style of boat

Engine room of *Bichu Maru* wreck



Bridge of *Iro* (left); Bottles of sake on wreck of *Iro* (above inset); Bow of *Iro* (right); Engine room spanners of *Chuyo Maru* wreck (lower right)



Lantern and gas mask on the wreck of *Iro*

converted from a civilian ship, this boat was designed for warfare and therefore does not have *maru* in its title. The *Iro* was a Japanese navy fleet oiler. It was 140m (462ft) long, with a 17.6m (58ft) beam and weighed 14,050 tons.

On 22 March 1944, while in a convoy to Palau, a Gato-class submarine, USS *Tunny*, struck the bow of *Iro*, foreword of the bulk head, before disappearing into the depths. The *Iro* survives but limps into Palau only to be attacked by Operation Desecrate One on 31 March 1944.

TF 58 planes found and attacked the *Iro*, anchored in a sheltered lagoon close to Koror. *Iro* sustained a direct bomb hit in the engine room and was set on fire. Of the 250 soldiers on board, 200 survived, but Captain Kitamura was killed in action. The *Iro* burned for days before finally sinking on 17 April 1944.

Sitting upright on the bottom at 40m (132ft), with the bow at 20m (66ft), *Iro* makes a great recreational dive.

Descending down the line you can start to see its coral-encrusted gun on a circular platform with a barrel diameter of 7 inches and a total length of 4.2m (14ft). Visibility can range from more than 30m (99ft) to around 10m (33ft) depending on the weather and wind direction. The port anchor is still in place. If you drop down on the starboard side and follow the starboard anchor chain to 30m (99ft), you can swim through the torpedo hole made by USS *Tunny*, which is now covered in black corals.

Sticking to the deck, behind the gun, is hold number one. Split into three levels, the first level holds a bathroom and toilet, with the bottom level containing wooden crates of sake bottles and gas masks peering out of the silt.

Continuing towards the stern, divers will pass the first kingpost with the bridge superstructure up ahead. Due to fire, the entire superstructure was burned out. However, some amazing hard table coral formations have now completely covered it.

On the starboard side, one can swim through the corridors leading to the crew quarters. After exiting, divers can continue towards the stern where a few holds further forward contain large oil drums used for storing oil. Up ahead is another super-

Diver inspects ammunition boxes (above); wheelbarrow and engine room wheel (center); and diver with engine room controls panel (top right) on wreck of *Chuyo Maru*

structure leading to another part of the crew quarters, with bedsprings and a bathroom on the starboard side.

The last exit on the right side leads to the engine room where the boiler is still in place. This is also penetrable from the deck. The catwalks have been blown into a tangled mess from bomb destruction and salvage efforts. However, some good penetration diving can still be made down here. The port side of the ship is difficult to penetrate due to fallen debris blocking some of the entrances.

Exiting the engine room, divers make their way to the stern where another large gun identical to the bow gun is sitting. However, less coral formations grow here due to the slightly deeper depth of 30m (132ft) and there is poorer visibility at times.

Entering the capillary steering gear section directly below the stern gun, one can penetrate into some other interesting compartments containing more gas masks, rope, lanterns, books and probably a lot more items hidden in the heavily silted parts.

As divers make their ascents, they can check out the anemone nests sitting near the top of the kingposts, as they make their way back to the mooring line.

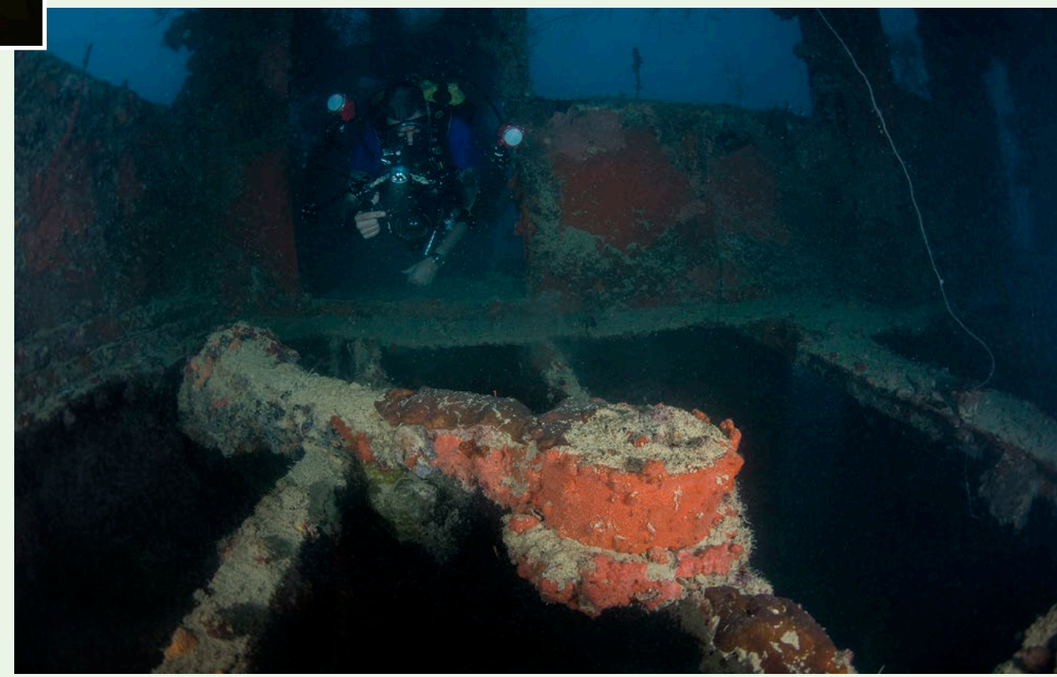
Chuyo Maru. Built in 1943 and owned by Toyo Kisen Kaisha in Tokyo, the *Chuyo Maru* was a medium-sized coastal freighter, at a length of 89m (285ft), beam of 12.4m (40ft) and 1,941 tons. Although not a huge ship, the vessel is full of interesting artifacts.

Although the location of this wreck was known by salvagers, it was not thought to be worth salvaging and was generally forgotten until it was rediscovered by Francis Turibiong and Klaus Lindemann in 1989.

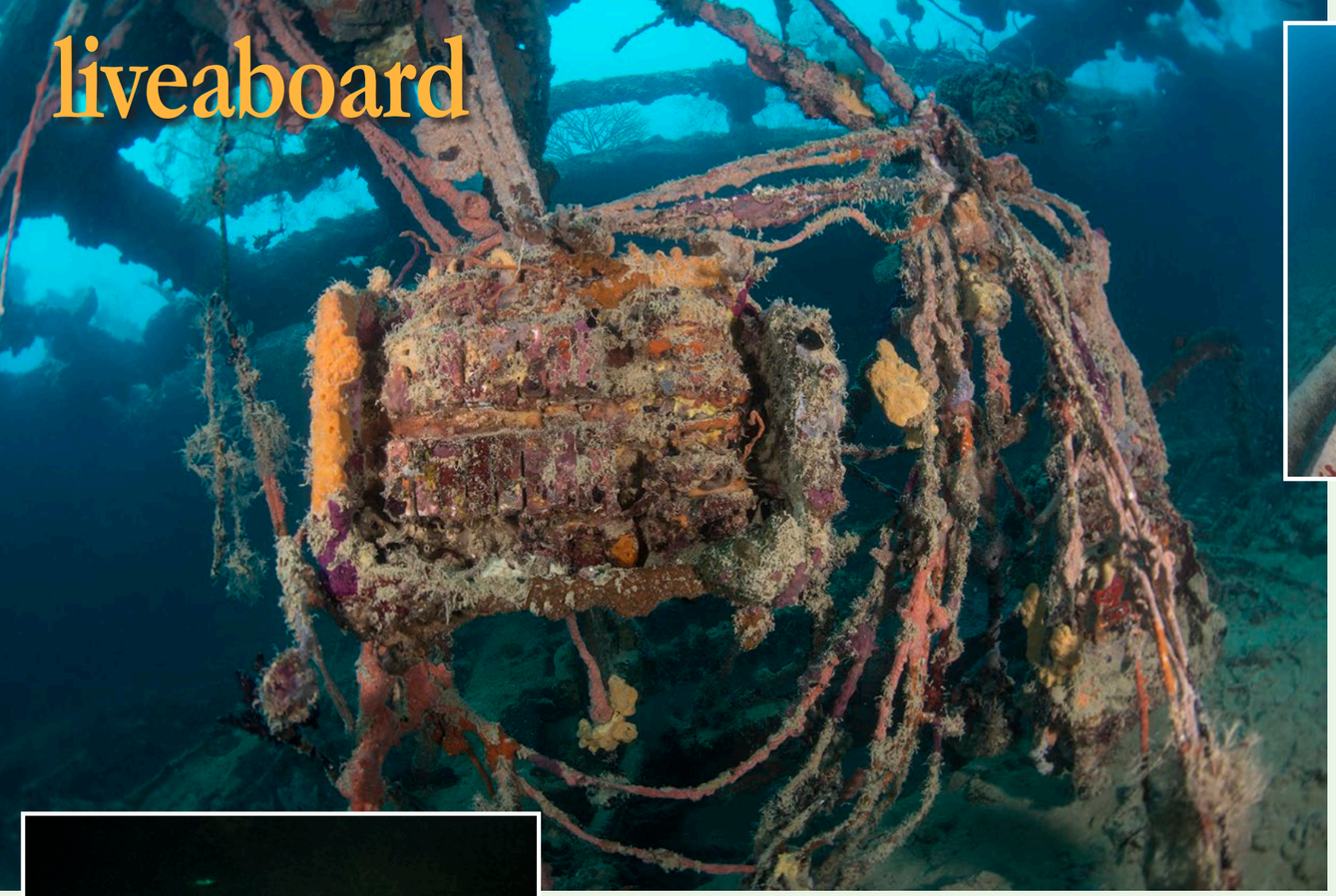
The bow is slightly raised above the main deck with a loading tower in the middle. On top of the forecastle is a double-headed anchor winch. On the port side of the deck are two anchors. It took our dive operation a while to find out how or why this was possible when we were informed that these were picked up and dropped by a passing superyacht by accident, while anchoring too close to the wreck.

The bridge superstructure was burned during the bombing. However, remains of the telegraph, which lies on its side, and brass compass, now completely encrusted by a red sponge but which is still standing, can be seen inside the bridge.

Continuing aft towards the stern, divers pass the main cargo holds, which are

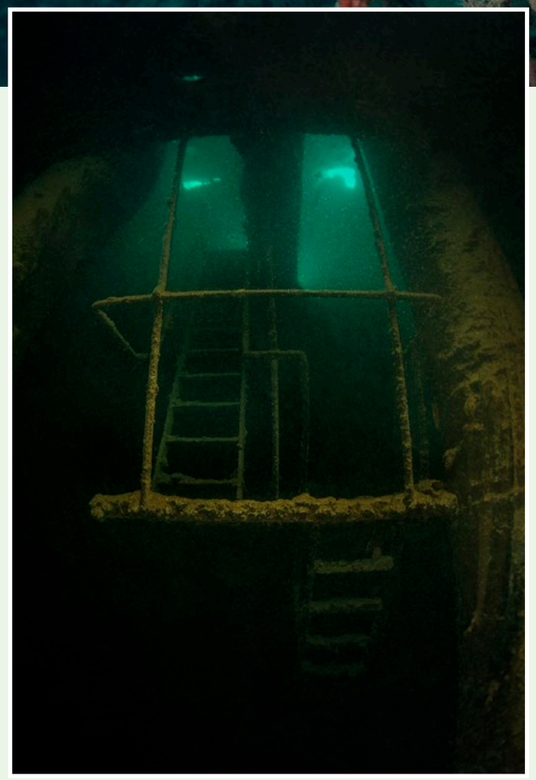


Diver at telegraph on wreck of *Chuyo Maru*



Pumps (left), communications center (far left), and safe (below) on wreck of *Amatsu Maru*

Palau Wrecks



Pump house of *Amatsu Maru*

empty. However, one can do some nice penetration through the ship, finding some wheelbarrows on the port side and ending up either swimming through a narrow skylight or through the crew's quarters into the boiler and engine rooms. Entering the crew's quarters directly to the right, one can see a small galley, with rice pots and cooking bowls still standing.

Continuing around a horseshoe-like room, there are remains of a bed, ashtray and even vinyl records protruding from the silt. A single door on the starboard side leads to a catwalk and stairs that connect the deck to the engine room entrance.

Inside the engine room, which is fairly large and still intact, a set of spanners are on the wall at the bottom level just above the silt. Pots and pans are scattered around and even some human remains can be found hidden in the silt (please be respectful of these and do not touch).

Further aft towards the stern, a 4.7-inch,1.82-ton short gun stands in all its glory with four ammunition boxes and two depth charges sitting in the launchers, port and starboard side. As this wreck was never salvaged, it has reminiscences of diving Truk lagoon, with its excellent, still-intact engine room and interesting artifacts scattered around the wreck, making it one of Palau's best wrecks.

Amatsu Maru. Built in 1943 by Mitsubishi, the *Amatsu Maru* was an auxiliary tanker and is the largest shipwreck in Micronesia, at 153m (502ft), 20m (65ft) beam and a little over 10,560 tons.

The *Amatsu Maru* was only partly salvaged after the war, as the salvage company originally decided to raise the ship. However, during an attempt to cut through its steel plates near the stern, the flame of the cutting torch hit trapped gases, setting off an explosion that killed two men. The Japanese then abandoned the salvage attempt, believing the accident to be a bad omen.

The bow is slightly raised above the main deck where there are ladders on both sides connecting it. From the bow, moving aft, toward the bridge, pipes, hoses and large valves used for loading and unloading the oil and fuel are visible. The bridge is constructed of three decks, the uppermost is the navigational deck, the second level is the communications center and the lower level shows fuel pipes leading through to the pump house. Some instruments can still be found on the second level. Here, communications control panels, still with rubber handles on them, can be seen as well as a safe with its door blown off, which now lies on the bottom level after some salvage. Urinals and toilets are also at the rear of the bridge area.

The bridge can be entered from above, between the support beams or through a small door on the starboard side deck. The main fuel storage area behind the bridge features a large piping system now covered with extensive marine growth.

A small square pump house, which must have been the con-

Communications center of *Amatsu Maru* wreck

trol center for pumping fuel, can be entered through a small door—not so much can be seen inside. However, it descends several levels down, and offers great photo opportunities. Both the center island and stern superstructures can be explored on at least three levels.

The *Amatsu Maru* was hit directly by several 1,000 lb bombs into the engine room. Diving through this section of the ship reveals huge piles of twisted metal, and one can only imagine the force of these bombs as one swims along into the now open area. Although this area is a complete mess, it is possible to find interesting still-intact parts and, again, great photo opportunities of light penetration can be achieved.

At the stern lies the twisted remains of a circular gun platform where the gun once stood. This has either been salvaged or completely blown off.

Following the stern down to the sandy bottom reveals a huge four-bladed propeller lying intact on the bottom. Due to its sheer size and deep dive profile, it is recommended that you dive this wreck twice to cover all of the highlights. ■

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TRIP TEASER
Come with X-RAY MAG to Wakatobi!

Join X-Ray Magazine in our

Wakatobi Getaway 2017

Text and photos by
Walt Stearns

Pristine coral reef around Wakatobi's jetty provides snorkelers with hours of entertainment.

In my long career as a writer/photographer, I have had the opportunity to visit a large number of destinations, which has translated into an even higher number of resort visits. Among the more widely regarded is Wakatobi Dive Resort in southeast Sulawesi, Indonesia.

Wakatobi is unique in that it could easily be classified as a destination, resort and an"experience" all at the same time. In my book, getting to see the really cool stuff in those far off corners of the world is what traveling is all about. When you consider Wakatobi, located below the southeastern corner of Sulawesi, Indonesia, in the Banda Sea—home to more than 450 coral species, some 3,000 varieties of fish, and an even greater number of invertebrate species—it is certainly not a reach (in terms of biodiversity) to say, "Wakatobi delivers."

The attraction to this pocket of the Indo-Pacific is further enhanced by the fact that its comprehensive reef system has remained surprisingly pristine, largely with the help of Wakatobi Dive Resort's Collaborative Reef Conservation program, which serves one of the world's largest privately funded and managed marine protected areas, the Wakatobi National Park. This protected area encompasses some 1,400,000 hectares of the Tukang Besi island group, which includes Wangi-Wangi, Kaledupa, Tomia and Binongko. If you haven't figured it out, the first two letters of each island spells Wakatobi.

Getting there

Getting there is not exactly a skip, jump and a hop—first you need to get to Bali. From there, Wakatobi Dive Resort has it

A brilliant crinoid "star" shines atop a barrel sponge at Treasure Chest. There is never a shortage of colorful nudibranchs (left) on the reefs at Wakatobi. They come in all colors and sorts, this pair of purple *Hypselodoris* nudibranchs appears to be getting very chummy. PREVIOUS PAGE: An "alien" cuttlefish sports its colors at the popular site, Starship, located on the western side of the Sawa reef system, just a 20-minute boat ride from the resort.

Wakatobi

The dive site Roma is a large, wide pinnacle that leads down to a wide coral ridge and is a favorite of Wakatobi's guests. Coming down its hard coral ridge, you will find large barrel sponges and sea fans sporting crinoids and prolific fish life.

covered with a private charter flight on board one of Garuda Indonesia's ATR 70 passenger propjets directly to the the resort's own airstrip. And to make matters even better, the only passengers you will see on your flight are guests staying at the resort or going aboard Wakatobi's liveaboard yacht, *Pelagian*. This ensures that everything you're bringing—dive gear, photo equipment, etc.—all of it is going with you on that flight, no worries there.

Accommodations

Accommodations include a collection of Indonesian-style bungalows and villas. Ocean bungalows offer a lovely beach and ocean view, while Palm bungalows are conveniently located among the beachfront's palm grove slightly further back. If you are seeking the ultimate accommodations, Wakatobi Villas will not disappoint. Villa numbers 1 and 2 have two full bedrooms with shower rooms, plus private plunge pools, and the package includes a private dive guide assigned to the villa guests for the duration of their trip.

Cuisine

While I am by no means a self-described foodie, Wakatobi's reputation for five-star dining services and premium meals is not an exaggeration. A seductive array of incredible cuisine, including traditional Indonesian dishes, American and international favorites, are all prepared fresh by a team of trained chefs. And they will cater to any dietary requests, needs or requirements. Believe me, you are going to be happy.

As gorgeous as that first breakfast or lunch might be, the view from your table is a mighty big distraction. The feature attraction that will always catch your attention, as it has mine, is the sharp boundary line between a broad expanse of shallows with a montage of sea grass beds and coral formations, and the deep blue where the edge of the reef drops off into the void. This is Wakatobi's House Reef, one of the best I have ever experienced.

Diving

The gateway to the House Reef is the resort's 80-meter (262-foot) long jetty where divers can enter the water by a ladder midway on the jetty, or take a step off the end where the reef's shelf makes a sharp turn downward, making it a near vertical plunge beyond 76 meters (250 feet). Of course, you can wade in from the beach in front of your bungalow or the dive center, and a few fin kicks across has you on the wall. In

Just a few fin kicks from the beach or off the jetty ladder is a snorkeler's heaven. Snorkelers enjoy a wealth of marine life and pristine coral reef. A diver (far left) gets friendly with clownfish at Treasure Chest. The site known as Zoo is one of the prime locations of Wakatobi's signature Fluo-Dives (top right) and the light show is nothing short of psychedelic. Divers, and especially photographers, love this experience as they can capture rare creatures in a whole new light.

Schools of black snapper are commonly seen roaming the upper portions of Wakatobi's reefs. Photographers (left) find endless opportunities to create stunning macro images. I have found seven species of clownfish on Wakatobi's House Reef alone.

addition to the "pool" always being open, dive center personnel monitor the House Reef between 6 a.m. and 10 p.m. every day. This team also provides taxi boat service on request.

The taxi boat—or shuttle, as I coin it—is quite an advantage. The dive team shuttle you via skiff to a portion of the reef of your choosing, dropping you at a spot based on the direction the current is flowing during the changing of the tides. For example, if currents are flowing north to south, the taxi boat can drop you off at Tanjung Patok, a lovely dive site that is part of the same reef as the House Reef. If it happens to be running south to north instead, the site known as Turkey Beach makes a clear choice.

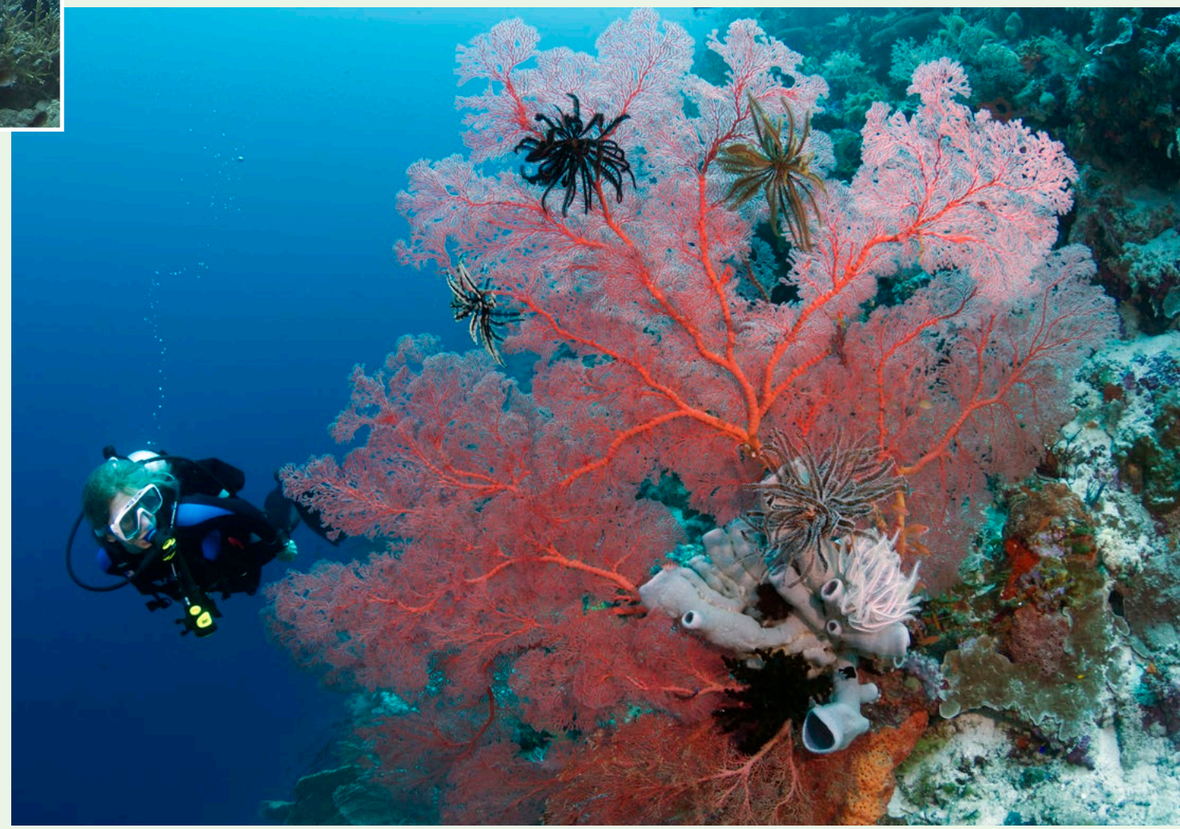
Dive center

A few steps from the water and jetty, the dive center provides a full range of support services, including full rental equipment, repair and instruction. The adjacent climate-controlled photo center offers ample workbench space for a multitude of camera systems with plenty of both 220 volt and 110 volt outlets for recharging batteries. Pretty much what would be expected at any well-run resort.

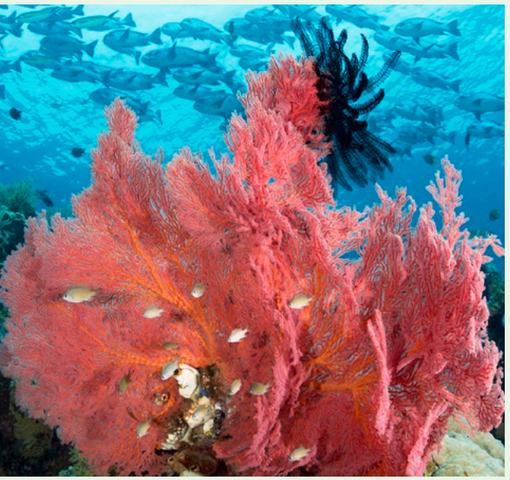
The dive center is first class, run by a very capable team. Dive guides are attentive and lead each underwater excursion, providing a personal experience for each diver/snorkeler. Another positive is that they also allow divers the freedom to explore each site at their own pace, as long as it is conducted within the safe range of their personal experience and training. Yes, so do a lot of other operations this side the world.

Fleet of dive boats

So, if you are wondering how Wakatobi differs from some of the others, let's start with the Wakatobi fleet of six dive boats. These locally-crafted vessels each measure 21 meters (69 feet) in length and provide an expansive amount of room with protected covering from the sun. Needless to say, surface intervals are relaxing. More amazing is that



If wall diving is something you enjoy doing, you do not need to go far at Wakatobi. Just a short swim from the beach or a step down from the jetty brings you to the outer edge of the House Reef. This adorable hairy squat lobster (top right) was spotted hiding in a sponge on Wakatobi's House Reef.



A diver peers through the brilliant keyhole of a giant overhang along one of Wakatobi's signature walls. At Treasure Chest (left), a scenic dive site just a 10-minute boat ride from the resort, brilliant sea fans and schooling black snapper are a common sight.

the typical maximum number of divers on board is 12, plus the crew (captain, two deck hands and two to three dive guides). Then again groups of 8 to 10 divers per boat is not uncommon. One of the best values offered by the dive center is a private dive boat. For a very reasonable price, you can take a dive boat for the day, which includes crew, full breakfast and/or lunch; dive where you want, when you want, and how long you want. Take a private dive guide along and you will find one problem: you are not going to want to go back—just send the meals over by taxi boat!

Service

Wakatobi is all about service, and I do not mean everyone knowing your name from day one (although that is true). From the moment you step ashore, you are made to feel like a king or queen. The staff really does not let you lift a finger. Throughout my travels around the globe, I have repeatedly heard remarks about Wakatobi's service ethos being an example for all resort operators. I have also heard many comments like: "The place is all about service and maximizing your diving—it doesn't get any better than this" or "All we can say is ask and you shall receive—it's an awesome place, and the service is far beyond anywhere else we have ever been." When you hear this over and over again from divers who have been to a destination, you simply have to see for yourself what it's all about. I can tell you, it is worth it.

Wakatobi offers a range of other activities and watersports from kayaking to even kitesurfing. The sheltered waters of Wakatobi's lagoon are ideal for first-time kite riders, so why not give it a try? There is an on-site spa, nature trails and village tours that showcase the island's flora and fauna, and provide a chance to experience the local culture. Add in the unrivaled diving and you have the makings of a one-of-a-kind dive vacation experience. Let's just say it's "an experience without equal." ■

Mexico's La Paz

— Sea Lions & Whale Sharks of Baja

Text and photos by Larry Cohen and Olga Torrey

OLGA TORREY


OLGA TORREY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Swimmers near Isla Espíritu Santo with sardines (above). TOP LEFT TO RIGHT: Cactus with Cacachilas mountain range in the background; Osprey catching lunch; Pelican catching fish. PREVIOUS PAGE: Sea lion dancing in the waters of Isla Espíritu Santo

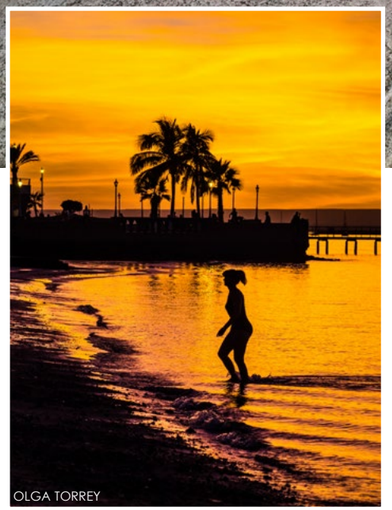

LARRY COHEN

Great egret; Red egret (center inset)

Baja California is a peninsula in the western section of Mexico. The peninsula has the Pacific Ocean to the west and is separated from the mainland by the Gulf of California (also known as the Sea of Cortez) to the east. These waters are home to 39 percent of the world's marine mammal species. Nine hundred species of fish and five of the world's seven endangered species of sea turtles live here.

In the north are the cities of Mexicali, Ensenada and Tijuana. California's San Diego is just across the border. Many liveaboard dive boats disembark from Ensenada. In the south is the city of Cabo San Lucas. Cabo is a party town that feels more like a city in the United States than in Mexico.


LARRY COHEN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Just a three-hour drive north of Cabo is the capital city of Baja California Sur, La Paz. This city has a small town feel and is on the Gulf of California coast. La Paz literally means "The Peace". There are still many tourists from around the world visiting La Paz, but most are interested in the natural world instead of the bar scene. La Paz does have the Malecon. This street runs in front of the coast and has its share of bars and restaurants.

This does not stop a variety of water birds from hunting in the bay just in front of the Malecon. Palm trees in between the bars are home to many birds, including woodpeckers and wild parakeets. The parakeets eat dates from the trees and also drop many of them on the ground. Hungry underwater photographers and divers pick up the dates as they are a great snack to go along with their beer! Along the Malecon are many sculptures with an environmental theme. Even the trashcans are in the shape of turtles and sea lions.

Whale sharks

The waters off La Paz are nutrient-rich with plankton, so visibility is low. Just 15 min-


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Wild parakeet enjoying a date


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Whale shark feeding in nutrient-rich waters. TOP LEFT TO RIGHT: Sunset in Malecon; Desert mountains near La Paz; Vulture and cactus in La Paz

OLGA TORREY

The whale sharks off La Paz are 7m (23ft) to 10m (33ft) in length

La Paz

utes off the shore are the breeding grounds for whale sharks. These whale sharks are the largest known species of fish, growing to 12.5m (41ft) and weighing as much as 35,833kg (79,000lbs). They are filter feeders, moving slowly through the water as they feed on tiny plankton.

Scuba diving with whale sharks is prohibited. The whale sharks off La Paz are 7m (23ft) to 10m (33ft) in length. The boat captain from The Cortez Club and other dive operations drop snorkelers in the water just in front of the whale sharks. The snorkelers then let the fish swim towards them. Swimming after the whale sharks is fruitless, as even baby whale sharks can easily swim faster than most snorkelers. After the whale sharks pass, the boat picks up the snorkelers to try another pass. This is tiring and frustrating, but being in the water with these extraordinary animals is a remarkable experience.

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Swimming after a whale shark is fruitless (above); Whale shark led by schooling fish (left)


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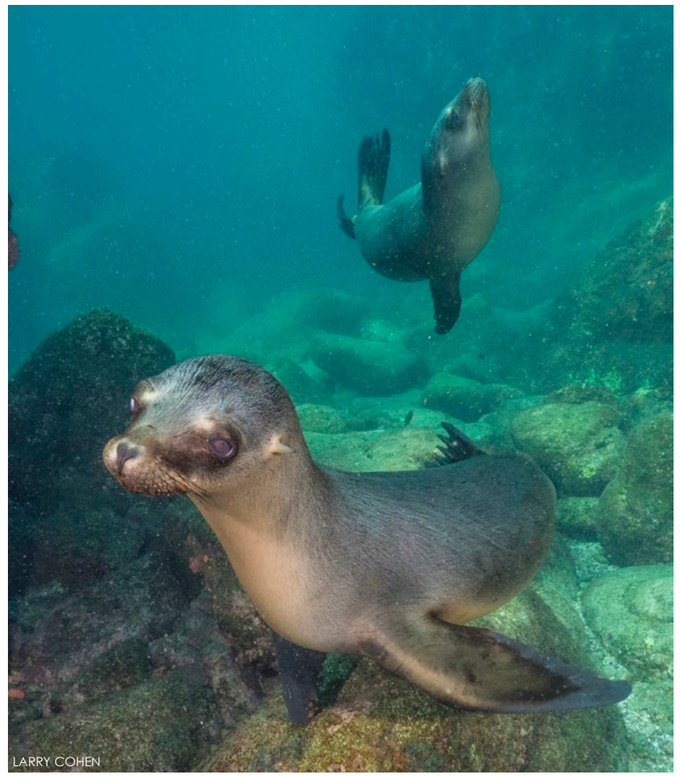
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OLGA TORREY

THIS PAGE: Sea lions frolicking; Mother and pup affectionately playing with each other (top center); Sea lion pup (above)

Sea lions

Isla Espíritu Santo is a two-hour boat ride from La Paz. This island is protected and part of the Biosphere Reserve by UNESCO. The Nature Conservancy continues to get other areas in Mexico protected. The highlight for divers and snorkelers is the large sea lion colony to the north of the island.

From just under the surface to about 60ft (18.29m) of water is a playground for sea lions. They are unafraid of people, so it is not unusual for them to come over and look the divers in the face. The pups would compete with each other for the attention of the photographers. It was heartwarming to see the way the pups and cows affectionately play with each other. The huge bulls would swim by, watching over this frantic scene.

Visibility is not very good due to the plankton-enriched water but because of this, the area is teeming with life. Many fish swim along with the sea lions. Large schools of sardines would come in waves creating even worse visibility. But seeing the large sea lions through

OLGA TORREY

OLGA TORREY

Moray eel and sergeant major fish; Sea star (right); Puffer fish (below)

the curtain of sardines was a miraculous, visual experience.

Other adventures

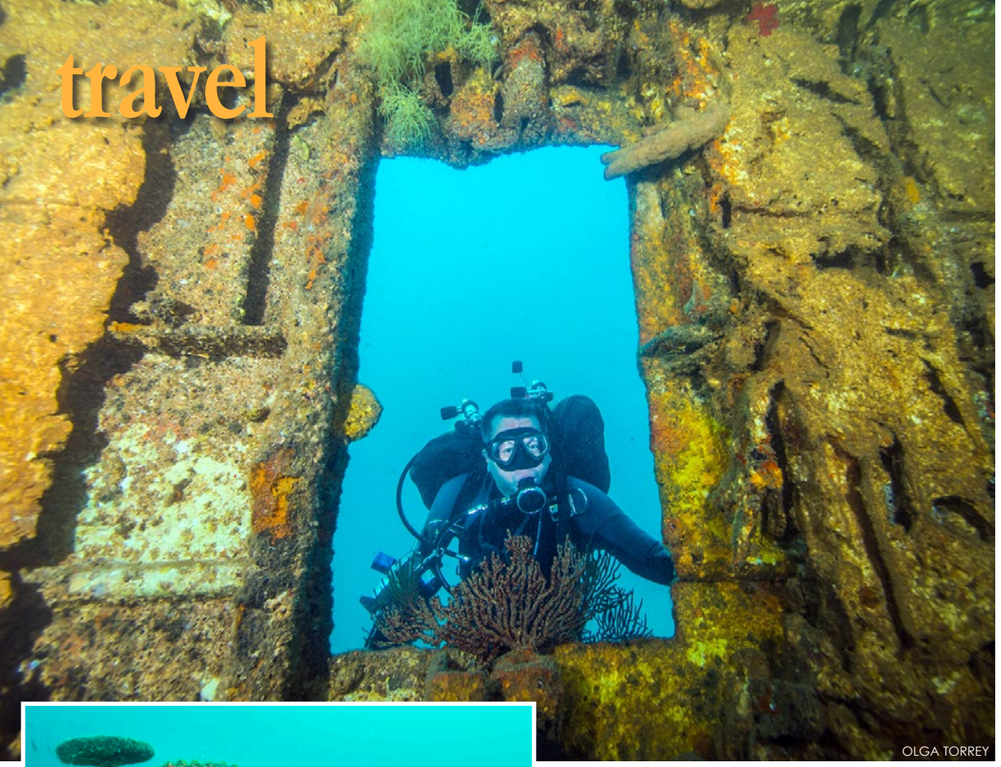
Baja Expeditions is one of the many operations that run trips to Isla Espíritu Santo. They have a campground set up on the island. Roomy tents with comfortable cots allow guests to do more exploring the next day. The food and drinks supplied by Baja is abundant and scrumptious.

LARRY COHEN

Baja Expeditions also works with Ecology Project International to bring groups of schoolchildren to the island. Besides hiking and learning firsthand about the environment, the children get to snorkel in these marine-rich waters. Some of them are from overseas, but 70 percent are local residents who come from all over Mexico for this incredible experience.

When camping on Isla Espíritu Santo, you could do a night dive on the rocks, just a short boat ride away. The rock wall has a variety of marine life including sea stars, moray eels, puffers, sergeant majors and hinds.

Between Isla Espíritu Santo and La Paz are a number of shipwrecks. The


OLGA TORREY


LARRY COHEN


LARRY COHEN

La Paz


LARRY COHEN

TOP LEFT TO RIGHT: Diver on *Fang Ming*; Port side of wreck; Angelfish inhabit *Fang Ming*. Winch on wreck of *Fang Ming* (left inset)

Fang Ming wreck sits intact and upright in 21m (70ft) of water. The Mexican government confiscated the ship for illegally transporting immigrants. On 18 November 1999, it was sunk as an artificial reef. The wreck attracts a profusion of marine life. There are many open cargo holds that are easy to penetrate with many fish inside. There are schools of sardines swarming around the exterior of the wreck. Machinery can be found on the deck with scorpion fish lying close by and circling Mexican hogfish.

Land adventures

Just outside La Paz, there are many land areas to explore. The town of Todos Santos is worth visiting. The town was founded in 1723 by Jesuit Missionaries (the name means "All Saints"). This small town has colonial architecture and cobblestone streets. In the center is the Hotel California, made famous by the rock band The Eagles in their 1976 hit song with the same title.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OLGA TORREY

Schools of sardines occupy *Fang Ming*; Machinery left inside wreck (left); Mexican hogfish (right)


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The mountains near La Paz are majestic; Tortugueros Las Playitas turtle egg incubation facility (left); Sea lions and snorkelers enjoying each other's company (right)

The hotel was opened in 1950 by a Chinese immigrant, Mr Wong. Wanting the locals to think he was Mexican, he changed his name to Don Antonio Tabasco. However, this did not work and the locals called him "El Chino," (meaning "The Chinese Man"). Todos Santos also has many natural areas to view birds and other wildlife. Horseback riding is a good way to see the countryside. The Tortugueros Las Playitas have a turtle egg incubation facility. On most nights between November and February, hatchlings are released on the beach.

Much of the landscape off the ocean is desert. The Cacachilas mountain range is located south of the city. These mountains are home to indigenous rock art. The sites are not officially open to the public since they are vulnerable to looting, vandalism and weathering. Anibal Lopez and his organization, Bajaocre.org, are working to protect and promote these cultural heritage sites. They give presentations in middle schools and universities. In this area, one can find many different kinds of cactus, plants and wild animals, including snakes. There are also many local farms.

Diving with sea lions is an encounter every diver needs to experience. It is as much fun as you can have underwater. Snorkeling with whale sharks makes you realize how large nature is and how humanity is just a small part. Between these underwater adventures and the majestic scenery above water, La Paz is a place everyone needs to visit. ■

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

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OLGA TORREY

Sea lions resting by the lighthouse between La Paz and Isla Espíritu Santo (above); Large male sea lion standing guard (left)

Canary Islands'

El Hierro

— At Old World's End

Text and photos
by Claudia Weber-Gebert

El Hierro is the westernmost island of the Canary Islands archipelago. PREVIOUS PAGE: Yellow cup coral

El Hierro

Have you ever experienced absolute silence? No hassle, no stress—people seeking mass tourism would certainly be out of place here. Just relaxation and downshifting—you can set your mind at rest here. This is what El Hierro is about.

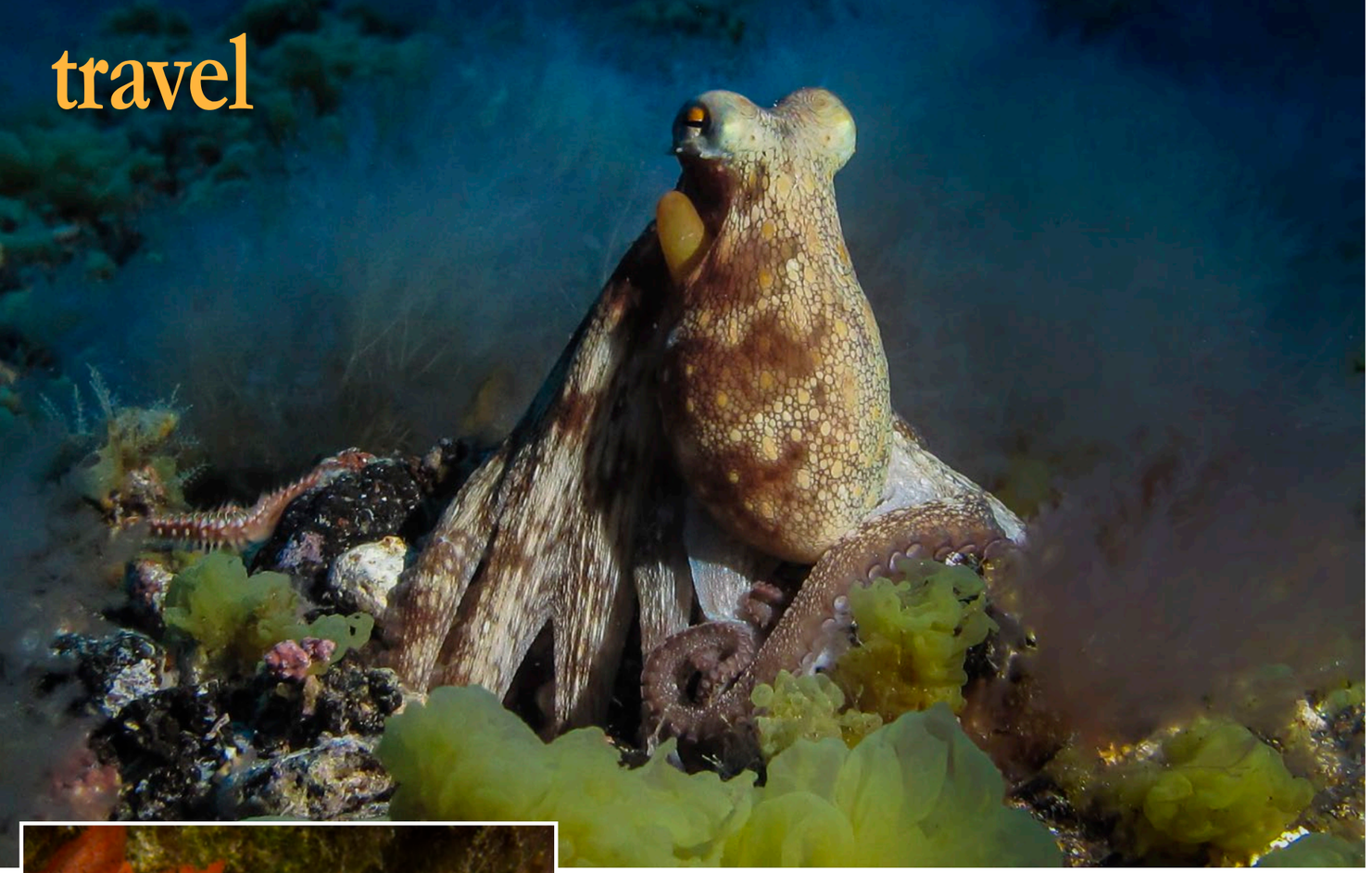
The smallest of the seven Canary Islands in the Atlantic Ocean is located on the western side of the volcanic archipelago. It is the end of the "Old World" where the zero meridian monument is found, in the vicinity of the Faro de Orchilla lighthouse. In ancient times in Europe (the Old World), it was thought that this was the westernmost point of the flat "disk" of the world upon which people lived—El Hierro was quite literally, the end of the world.

The island is of volcanic origin, evidence of which can be observed all over the place, both above and under water. It is the youngest Canary Island at 1.12 million years of age. One can find the so-called "ropy" lava in several places, which is otherwise found only at two other places on earth. There are black lava fields covered more or less with vegetation, coupled with conical hills, ash deserts, crater holes, the former crater region El Golfo with fertile orchards and a rugged coastline with bizarre rock formations. This is what you see today—an island which has uplifted itself from the sea bottom at a depth of nearly 5km as a result of volcanic eruptions.

With elevations from zero to more than 1,500m above sea level, the small island varies with diverse climates and vegetation zones and offers plenty of opportunities for outdoor activities such as hiking, mountain biking and, of course, water sports.

The town of La Restinga on the island of El Hierro in the Canary Islands

Mirador de la Peña, designer restaurant and viewpoint on El Hierro



Common octopus (above) and filefish (left) can be found on the reefs off El Hierro

In La Restinga, the most popular town for divers, it is sunny, and often in the neighboring El Pinar as well, which is located at about 800m above sea level—where fog and clouds dominate. Even the crater peak at 1,500m is overcast most of the time and there is limited visibility at the viewpoints.

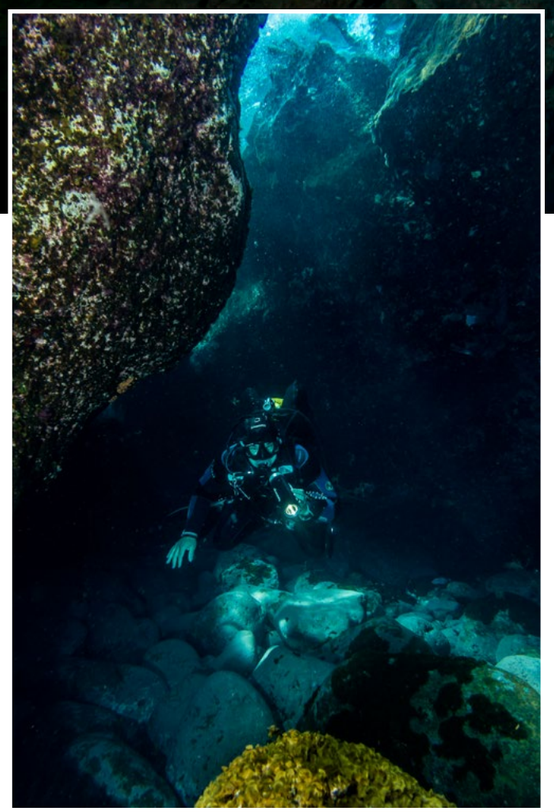
You can get to El Hierro from the bigger Canary Islands, like Tenerife or Gran Canaria, by ferry or twin-engine aircraft. There are also daily transfers to the larger neighboring islands, but the timetables of the ferry and airline companies are not always aligned. For a relaxed and quiet journey, usually a stopover in Tenerife or Gran Canaria is necessary in order to get to El Hierro. Direct flights to the island from the European mainland do not exist. The airport runway is not long enough for big airplanes and cannot be extended.

About 25km long and 27km wide, covering about 269 sq km, with 10,500 inhabitants and about 1,000 tourists—El Hierro is neat and comfortable. There are no hotels; holiday guests stay in apartments—mostly individual tourists who are looking for something special.

In the year 2000, El Hierro was declared a UNESCO Biosphere Reserve. Protection zones have been established to control fishing activities. In order to preserve this wonderful place, the government monitors and registers the number of divers going into the water, at which place and with which dive center, everyday. In 2014, the island was pronounced a Global Geopark by UNESCO.

The island's flora and fauna are very interesting, since, with its seclusion, endemic species have evolved over time both in the animal world as well as the plant world. Special programs are currently supported to raise and propagate the almost extinct El Hierro giant lizard (*Gallotia simonyi*), or in Spanish, *Lagarto gigante*, which can be about 70cm long.

Spotted moray eel searching for food in the sand and rocky crevasses



THIS PAGE: Cave entrances and rock formations at dive sites along La Restinga coastlne

Diving

Many of Spain's most popular dive sites are located in the south of the island, next to La Restinga. Although the town is very small, nine dive centers are located there. The staff of these centers will also help you with organizing the transfer from Tenerife or Gran Canaria and finding accommodations or a rental car.

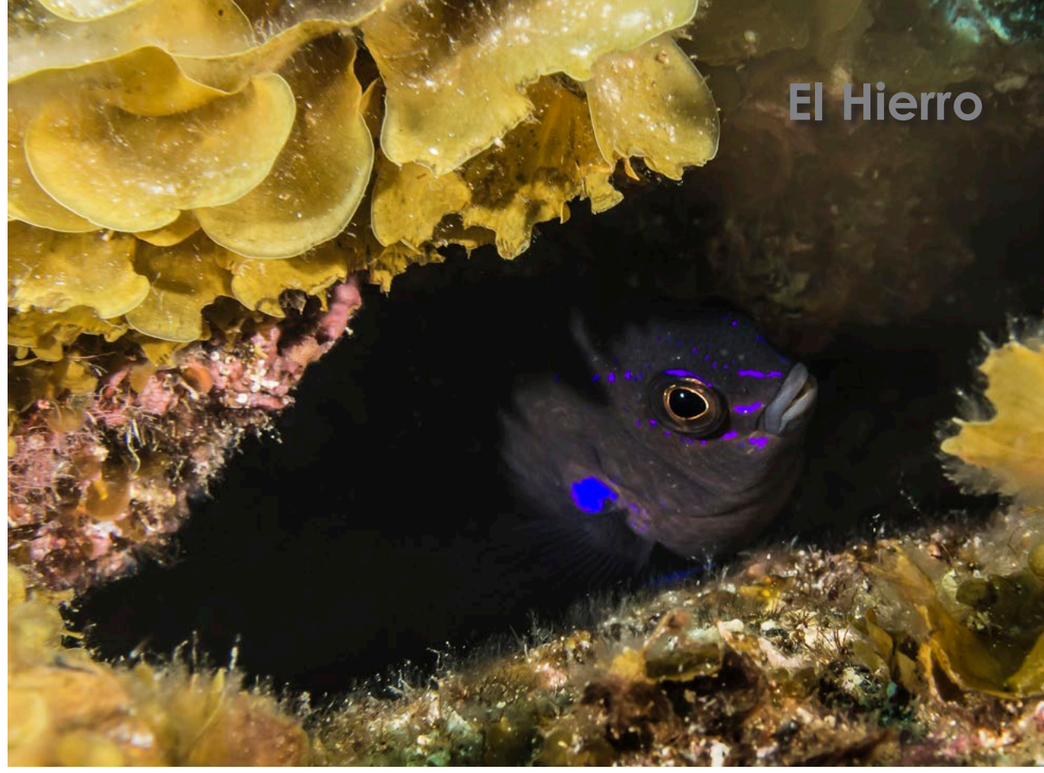
Three to four times every day, the numerous dive sites are visited by zodiac, starting from the harbor in La Restinga. Transit time to the dive sites is about five to 25 minutes. Here you can find dive sites for everyone—from sophisticated drift dives to the "leisurely walk" underwater, deep or shallow, drop-offs or sandy bottoms, depending on your preferences. However, the island is located in the Atlantic, which means the dive sites are not necessarily suitable for beginners. You should have at least one dive in open sea under your belt, elsewhere, before taking on the challenge of diving at El Hierro.

Wind and current should not be underestimated and which dive site is feasible on a given day is dependent on these conditions. Indeed, there are spots that you can only dive one or two days a year!

Depending on the diving center, the tours take groups of six to 12 divers. The equipment will be transported by car or trailer to the harbor, where it is loaded onto the boat. The distances are short.

The prices of different dive operators should be compared, but in addition to price, ask about the conditions! Often, the dives are limited to 45 minutes in cheap dive packages—no matter how much gas is left in the tank. Some centers make their dives "according to plan", regardless of strong currents or changes in weather conditions. In some cases, it would have been much better to choose a different site. An experienced and accountable guide is able to manage the situation and to prepare an enjoyable and unforgettable diving

TOP TO BOTTOM: Blacktail comber on reef; Lizardfish; Bearded fireworm; Atlantic blenny



Divers explore Baja Bocarones, a magma rock rising from the depths; Diver at El Bajon, where layers of lava, ash and sand are visible (top left); Canary damsel hides in rocky reef (top right)

experience for guests.

Our party of divers chose to dive with Jutta and Günter Baumgartel of Fan Diving. Their dive center strives to offer the most comfort; therefore, dive groups are limited to a maximum of six people. Personal service is really very important to the Baumgartels, as they take care of you, reading almost every wish from your eyes. In short: Jutta and Günter will always comfort their guests with advice and assistance, both above and under water! Defective equipment is repaired if possible and everything is straightforward—just as you would wish for a relaxing holiday.

Underwater photographers are especially in the right place with Günter Baumgartel. He knows every dive spot like the back of his hand. Accompanying you on every dive, he shows photographers the most beautiful places and hiding places of sea creatures, documenting with his camera the highlights of each dive for a brief photo presentation right after the dive. These photos are later a beautiful reminder of a successful diving holiday. The small dive groups are the reason that guest lists fill up very quickly—therefore you should register as early as possible.

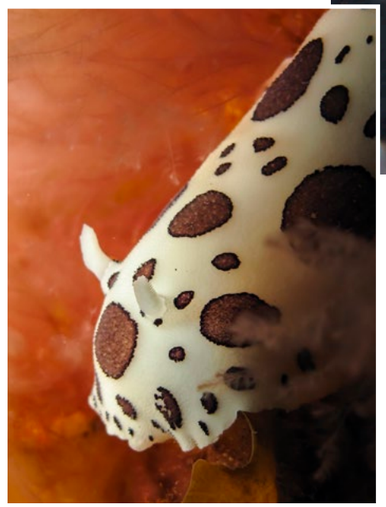
Volcanic features

On the boat trip along the coast to the dive sites, the geological history of the island is spectacularly evident: steep walls, various layers of lava, ash, sand, and remnants of pyroclastic explosions are visible. Also clearly identifiable are hard magma channels that penetrate the rock layers upwards, vertically.

El Bajon. El Bajon, an extinct volcano, is one of the most popular dive spots on the island—some say, the most beautiful spot in Spain. So this is where many Spanish divers want to go first. The rock declines steeply, down to a depth of 100m. In the various layers, which form terraces underwater, cavorts plenty of marine life. Usually, there is a mild to heavy current—so it is not an easy dive site. Due to these currents, you will often see big fish and schools of fish pass by, as well as mantas flying along.

Baja Bocarones. In addition to this awesome place, my personal favorite was Baja Bocarones—a magma rock with a 15m diameter, which rises like a needle from a depth of 42m on the sandy bottom up to 10m below the water's surface. While the rest of the volcanic cone has been eroded, the hard magma core still exists. Barracudas, mackerels and jack fish are always found here, and a "pet grouper" can be met nearly every time. At this place, you can sometimes even see manta rays, which circle

El Hierro



CLOCKWISE FROM LEFT: *Peltodoris atromaculata* nudibranch, or cow snail; Arrow crabs on rocky reef; Moray eel with cleaner shrimp; Large dusky grouper; Scorpionfish

around the rock from the bottom to the top.

Emmental. Even the dive spot Emmental, as its name implies, has many arches, bridges, canyons and swim-throughs. There are several places with wonderful underwater landscapes that make every diver's heart beat faster.

Equipment and conditions

Everyone who carries special diving equipment should be prepared for any necessary repairs. Standard O-rings are available in all dive centers, but everything different from the norm cannot be easily purchased in the shop around the corner. So please bring special parts from home.

With water temperatures of 18°C to 24°C and good visibility, at depths of some 40m or more, diving is possible all year.

Underwater world

Since no extensive professional fishing is allowed and the authorities support sustainable fisheries, fish populations are still large. By using traditional methods in the protection zones, overfishing is very unlikely. The Peto fishermen catch single fish with long pipe harpoons from a small boat. Parrotfish are caught with a special hook by the fishermen while snorkeling—so only small amounts are caught, sufficient for their own needs. Spearfishing is even banned in some zones. This is good for the underwater world—you almost feel like you are in a conservation area. Unlike the Mediterranean, there are still large schools of fish to find: shoals of sardines, mackerel, jack fish, peto (also known as wahoo or *Acanthocybium solandri*), tuna or barracuda .

Groupers have time to grow to an impressive size. They approach divers, are not shy at all, and even allow a certain proximity. Lobsters are very large and old and die of old age. With luck, you can also observe manta rays or see whale sharks, turtles and other large fish. Dolphins are also heard and seen on the surface—but the shy marine mammals do not go near divers. Whales migrate in autumn and pass

El Hierro

by a few kilometers from the coast, but rarely come close.

The overgrown caves and crevices provide shelter for eels, crabs, small animals or critters. You should always carry a lamp to light up the holes to find hiding animals—there is a lot to explore. On large sandy areas, sand eels can be found. The sand also offers good opportunities to find different kinds of rays, flatfish and a lot of octopuses.

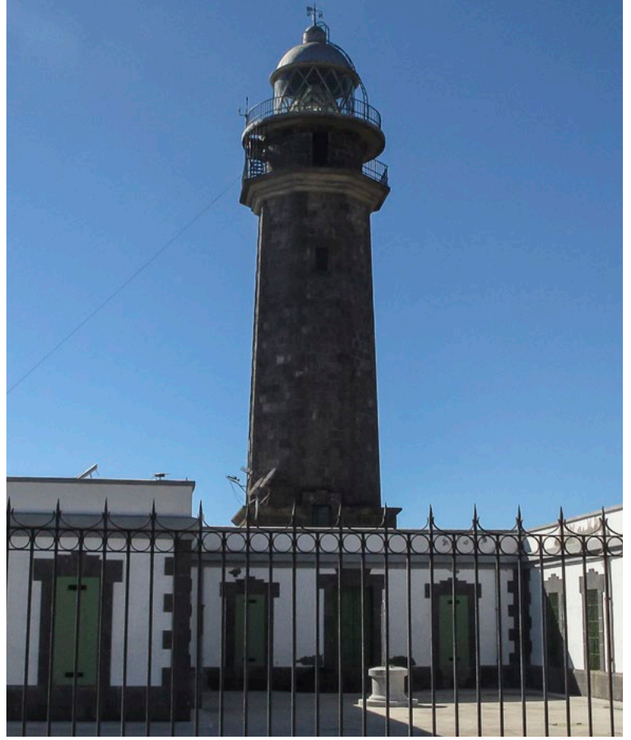
A true eye-catcher is the famous black corals on the steep rocky drop-offs. Unfortunately, these corals were the "losers" of the volcanic eruption back in 2011. Covered with mud, they had only low survival rates regionally. Only a slow regeneration is taking place here. However, the dead branches of the black corals turn into a starting point for other species, as yellow anemones partially colonize these branches.

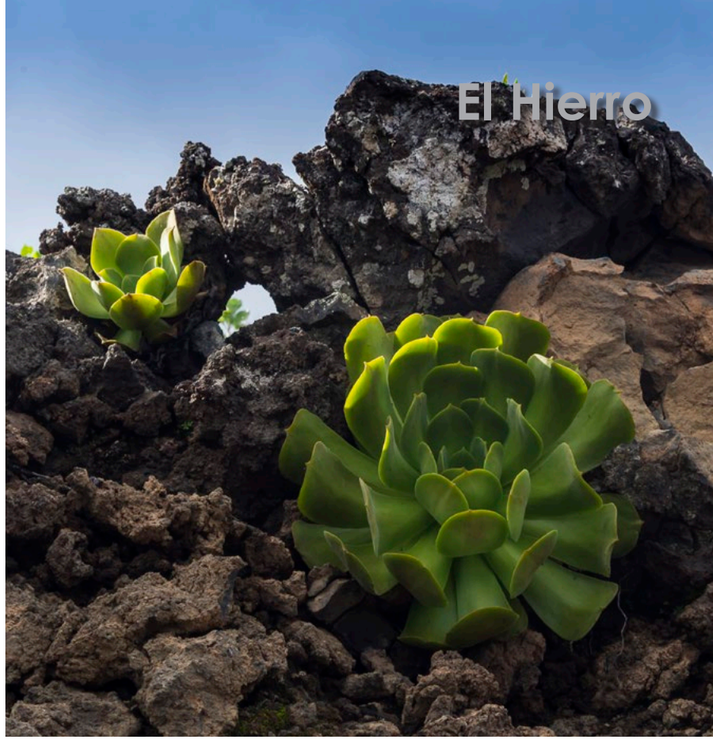
Underwater photography

An "El Dorado" for wide-angle underwater photographers, the rugged landscapes offer numerous and varied motifs: steep walls with black coral, dark sand surfaces with sand eels, caves, canyons and swim-throughs with wonderful perspectives and bizarre rock formations, various vegetation, shy marine life and large schools of fish. For macro-photographers, it is not so easy, but you can also find beautiful critters. Snails, shrimp, blennies and anemones always offer nice photo opportunities.

It is advantageous if you have a local guide with you, someone who knows the hiding places of the animals and the most beautiful caves and rock formations. In this respect, our choice of dive center, Fan Diving, was exactly the right thing. As a passionate underwater photographer, Günter Baumgartel led us to the hiding places of the underwater inhabitants and to the most beautiful areas. He is always ready with help and advice, even if things are not working or there are questions

COUNTER-CLOCKWISE FROM ABOVE: Common stingray; Colonies of black coral on reef; Garden eels on seafloor; Hermit crab; Cuttlefish





Sabina Herreña, 2,000-year-old confiers (above), and Faro de Orchilla lighthouse (top center)

about photographic technique.

Every year in autumn, an important photo event takes place in La Restinga: the international photo competition Open Fotosub in which well-known Spanish and international photographers compete. And it is no wonder, with all those stunning underwater scenes to shoot. This year, the competition requirements changed, allowing only apnea divers (freedivers) to participate.

Volcanic eruption of 2011

In October 2011, about 1.8km off La Restinga, a volcano erupted underwater and life in the fishing village turned completely upside down. The town had to be evacuated because of the risk of life-threatening fumes.

With ascending gases, a fish die-off took place and a layer of mud covered the ocean floor later on. An unexpected situation for fishermen, dive operators and local residents, all of them were put to a severe test. It was uncertain when everyday life would return to its usual routine again. No one could estimate the duration of the evacuation. However, since the beginning of March 2012, all dive sites have been re-opened; there is no more danger and there are no restrictions for diving.

One can see how quickly nature regenerates itself. What at first seemed destructive, for nature, was an advantage and a chance for renewal. The nutrient-rich mud from the eruption created a good foundation for flora and fauna underwater—hardly anything is visible of the disaster today .

Country and its people

You should definitely take at least one or two days to explore the island on your own. This is very easy with a rental car. Also public buses make the trip around the island possible.

Worth seeing are the Sabina Herreña—old conifers some 2,000 years old or more, which are considered landmarks of the island—or the holy garoe tree of the indigenous inhabitants. Other landmarks that can be considered for exploration include the Faro de Orchilla—the lighthouse with the monument of the former zero meridian; the laurel forests in the fog and cloud

Nature renews itself on ropy lava despite devastation of volcanic eruptions; Stone rose succulents on rocky terrain of El Hierro (top right)

View over coast at Las Playas; El Golfo (top right); Roque de la Bonanza (right); World's smallest hotel at Punta Grande (left)

region; the cliffs in the north; the "world's smallest hotel" at Punta Grande in the ancient loading port; or the plantations of the El Golfo region. Viewpoints and attractions are well sign-posted.

Everywhere on the island, the Tourism Authority has set up visitor centers with the latest technology, providing information about the history, geology and nature of a location. These centers are well worth a visit. I also recommend taking along a bathing suit and snorkeling equipment with you for an island excursion to visit one of the many natural pools or to snorkel near the Roque de Bonanza—a free-standing rock on the eastern side.

Only a few relics remain of the original inhabitants of the island—the Bimbaches—who came from the African mainland to populate the island. In the 14th century, the Portuguese and Spanish conquistadors took everything and enslaved the native population. Like Christopher Columbus, many sailors started their journey to the New World from the coast of the Canary Islands. They took advantage of the trade winds to sail their ships. Later the islands were a trading center for African slaves. The island's archives in the capital city of Valverde were destroyed in 1899 by a fire and many documents dating back as early as the 16th century, were unfortunately lost.

The Herreños, the present inhabitants of the island, are friendly and helpful people, as our party found out when our rental car broke down. Immediately, several local motorists stopped and offered us "tourists" help, acquiring auto assistance for us via mobile phone. In the town of La Restinga, you will inevitably discover pleasant village life—young and old come together in the evenings on the harbor promenade. Gossip of the day is exchanged until the late evening hours in this idyllic village with a feel-good character.

As for the food, prices are extremely low. For 10 Euros (about 11US$) you can enjoy a nice meal, including wine and coffee, in small restaurants. It is worthwhile to try the local dishes. Fruits and vegetables from local plantations are inexpensive. There are many different cheeses made from cow or goat milk to try, as well as many pastries typical of the island. Also try the small potatoes with a salty crust called Papas Arrugadas.

For those who spare no effort to get to El Hierro, the island is a secret treat, where one can leave behind mass tourism and stress. Payback is guaranteed. ■

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

Black Water

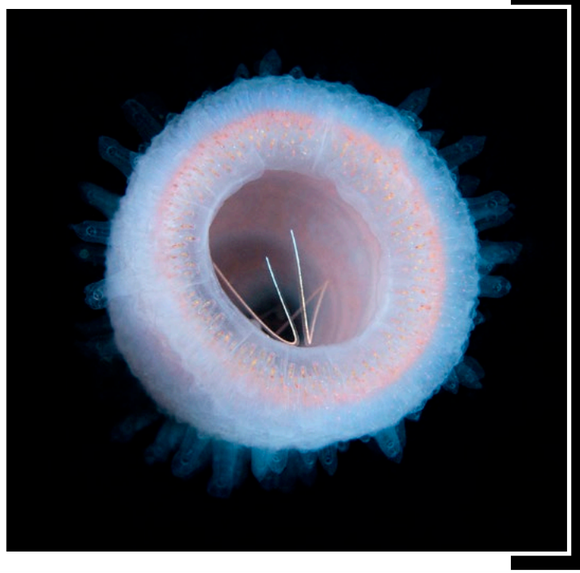
— Night Diving Adventure in Palau

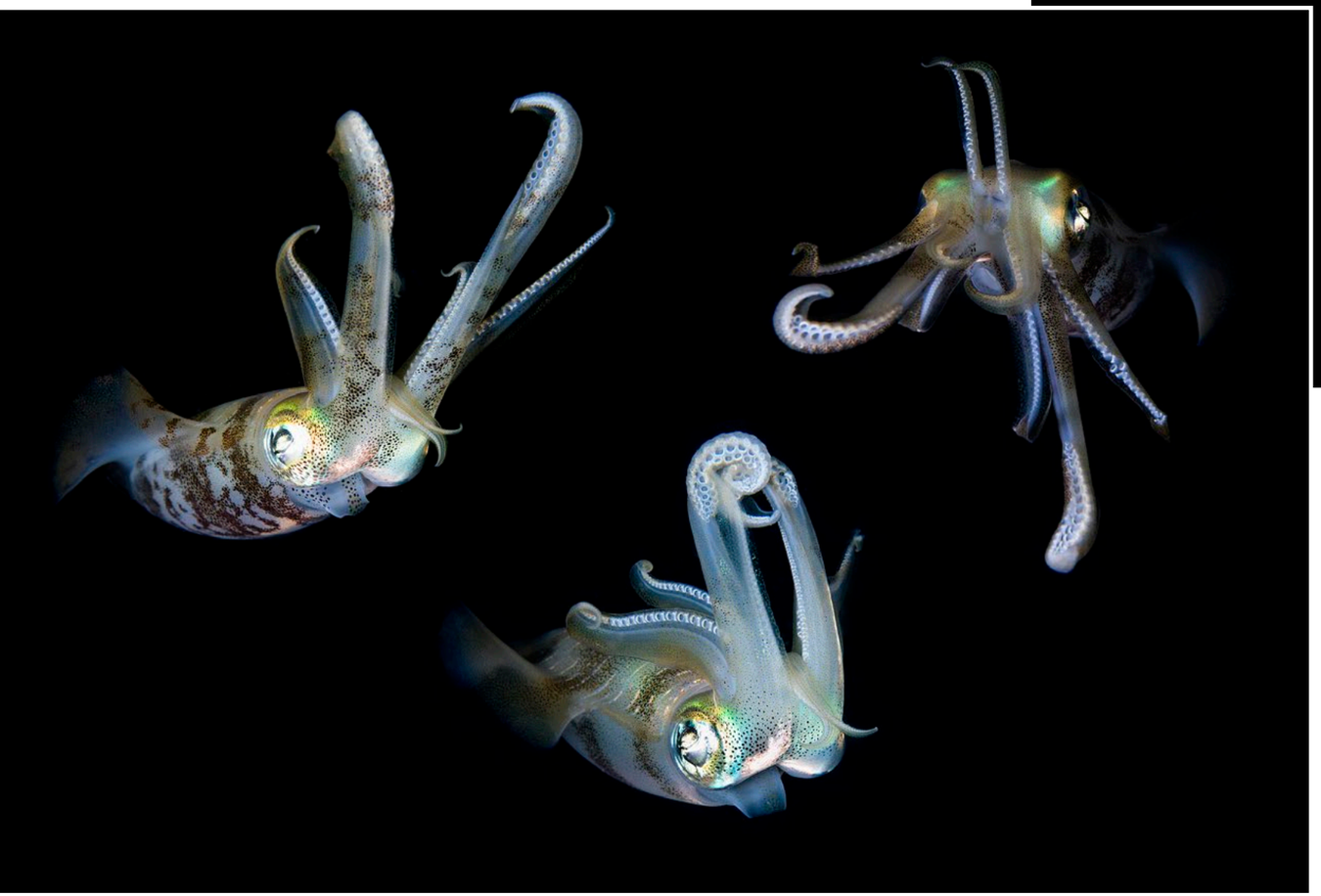
Text and photos by Richard Barnden

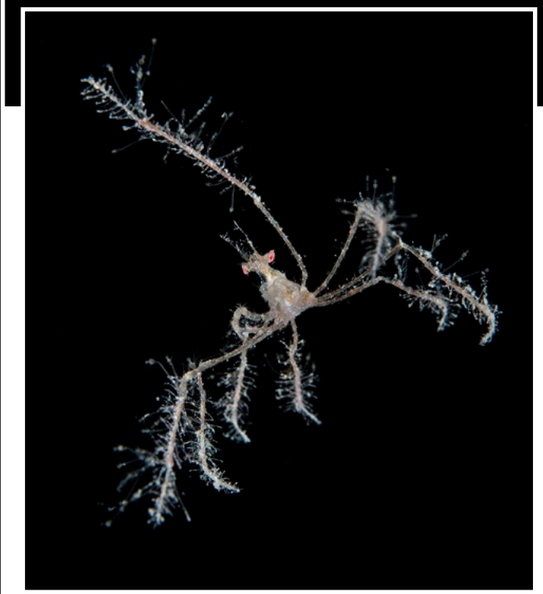
Black Water

Pyrosome (below), squid (bottom left) and unidentified cephalopod (right) found on black water night dive in Palau. PREVIOUS PAGE: Juvenile flying fish

The original concept of black water diving consists of going to an offshore location in the middle of the ocean at night and jumping into the abyss to watch the ocean's diurnal migration. By hanging lights at around 15m for a stable reference depth and drifting over a contour of a 1,000 meters, or as deep as you can, one can see microscopic zooplankton rising from the depths, bringing with them an array of magical creatures.





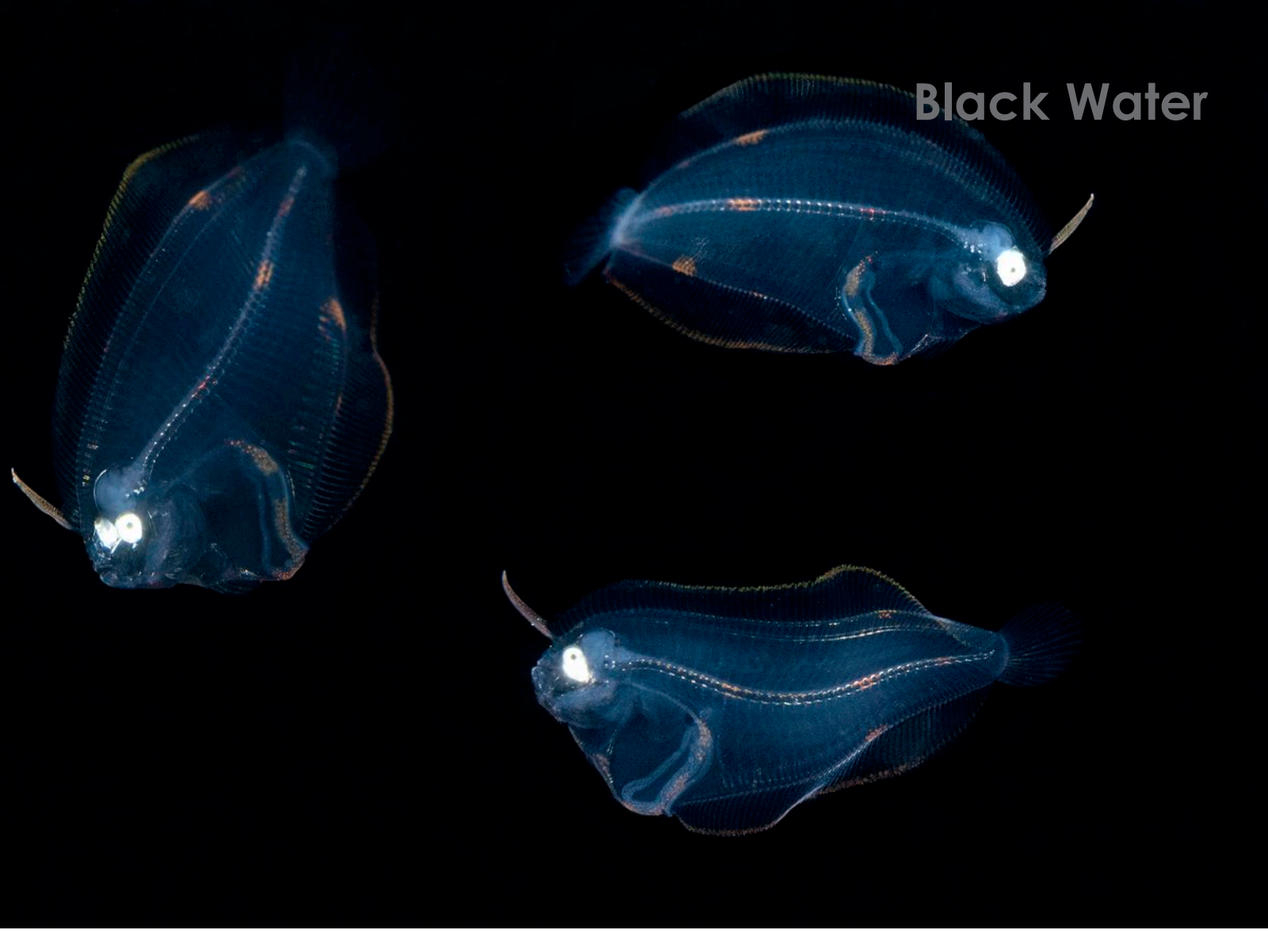


Decorator arrow crab hunting

Post-larval-stage fish, juvenile undeveloped species, gelatinous pelagic invertebrates, jellies, comb jellies, ctenophores, pelagic gastropods and pelagic cephalopods, to name but a few, are also migrating vertically. It is the biggest migration of animals on the planet and it happens every night.

Around one hundred million tonnes of bio mass rises from the mesopelagic layers (so deep that light cannot penetrate) to the epipelagic layers (close to the surface) to feed and respire on richer concentrations of oxygen, as well as look for a mate. As the sun begins to rise, these nighttime dwellers retreat back to the safety of the darkness, way down again in the mesopelagic layer to hide, returning once again the following evening.

There are many hypotheses as to why organisms would vertically migrate



at night. Light dependent predation by fish can be eliminated by hiding beyond their limits in the daytime. Also, by feeding in the warmer waters at night and residing in the cooler waters in the daytime, creatures can conserve energy. Or maybe creatures are simply hiding from the UV rays of the sun, which can damage delicate organisms if they are too close to the surface—both reasons might be valid at any given time.

The dive

After taking one last look with our dive lights for any breaking fins on the surface, our team of divers started descending down the line to the glowing ball of lights below. I instantly got that distinct feeling of floating in outer space—being suspended in that dark black abyss, with nothing at all around, is a sensation in itself. The first ten minutes were a little unnerving, as I wondered, are there sharks here, or not? And then, as things started drifting in from the darkness, I got my "macro radar" locked in, lost all my fears, and the excitement took over.

What can one see?

CLOCKWISE FROM TOP LEFT: Bobtail squid inside jellyfish; Juvenile flounder in the pelagic stage; Juvenile fish hiding in jellyfish; Cardinalfish catching lanternfish

Larval stage slipper lobster riding jellyfish (left); Shrimp riding salp (below)

of them, I had no idea what they were, with their transparent bodies and visible backbones.

As the dive unfolded, I began to notice the array of miniature jellies drifting all around me, in various shapes and sizes, with colors pulsating and flashing, as they looked for their prey of microscopic zooplankton, which were drawn to the lights like moths to a flame.

If one looked close enough, one could see even more creatures becoming visible. A whole new world seemed to just open up. Shrimps and crustaceans were using jellyfish as transporters, like hot air balloons or spaceships, as they drifted by in the open abyss next to me. They were hiding from predators, yet scouting for food at the same time.

One can see that juvenile fish, which were once pelagic fish

The first thing that caught my attention was a school of about 100 or more pelagic squid, which were darting in and out of the lights a few meters below. I saw these squid on nearly every black water dive. In the beginning, it was all new to me, so I did not pay so much attention to them; they were far too fast for me to be able to get a good shot. I did notice, however, that they were hunting—and not just the juvenile fish that were feeding on small crustaceans and copepods around the lights—they were also hunting each other.

Throughout the dive, there was action: juvenile creatures swam into the lights, stopped for a few seconds and darted off. Some were recognizable, but for most

Lens Beyond Ocean Photo Competition 2015
Memorable Picture Compact Camera – Lynn Wu

Paper nautilus on sea grass (above); Juvenile blenny hunting copepod (left); Unidentified squid displaying tentacles (far left)

larvae, are undergoing mutations and dramatic changes to their bodies, as they began to be drawn closer to the reef and their next stage of development. If you are extremely lucky, you get to witness a rare and never-before-seen oceanic critter—something that never returns to the reef and spends its whole life drifting in the abyss.

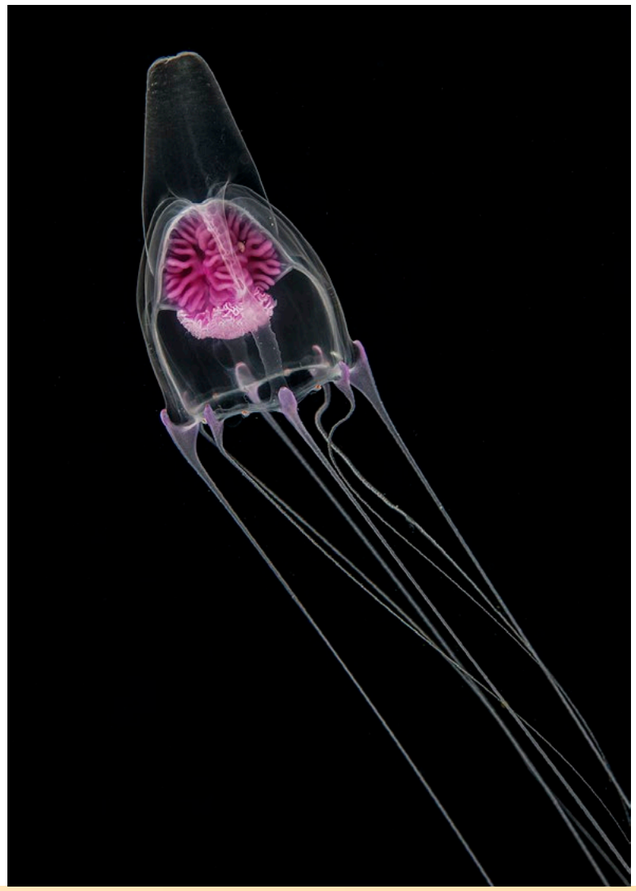
Equipment

Having good buoyancy is a key credential for doing this style of night diving, which involves being comfortable with one's setup. A full wetsuit and hood is advised; jellyfish are drifting with you and having that extra protection can always help with unwanted stings. You should always carry two lights. Your spotting light should be a narrow beam, if possible, which is much better at finding critters hiding a few meters away than a broad beam. Set your computer or depth gauge alarm to a maximum of 20m—it is very easy to be enticed into following something special into the depths below.

Photography

Taking pictures in black water is extremely difficult. I like to compare it to muck diving on steroids, or 3D macro. There is no time to frame your subject and change your settings while the creature stays in one place. One may see something cool and have just a few seconds before it swims off into the abyss.

Having a DSLR camera with a fast focusing lens will make your life a little easier. I have tried using a 105mm lens and found it very difficult. Finding the subject and getting it in focus is the art to taking good pictures here, and a 60mm lens gives one more speed and a little more room with which to play.



CLOCKWISE FROM TOP LEFT: Common squid; *Nausithoe punctata* jellyfish drifting; Brain of jellyfish can be seen; Stomatopod—larval mantis shrimp (mid-pelagic stage)

A big tip is to extend your arm and focus your camera on your fingers after every subject. This will allow you to find another subject quickly and start narrowing the distance and focusing at the same time, getting closer while taking shots.

Have your shutter speed adjusted to a nice, fast setting, with your aperture relatively closed, to try and get as much of your fast-moving subject frozen in the shot. The rest is down to good old-fashioned luck.

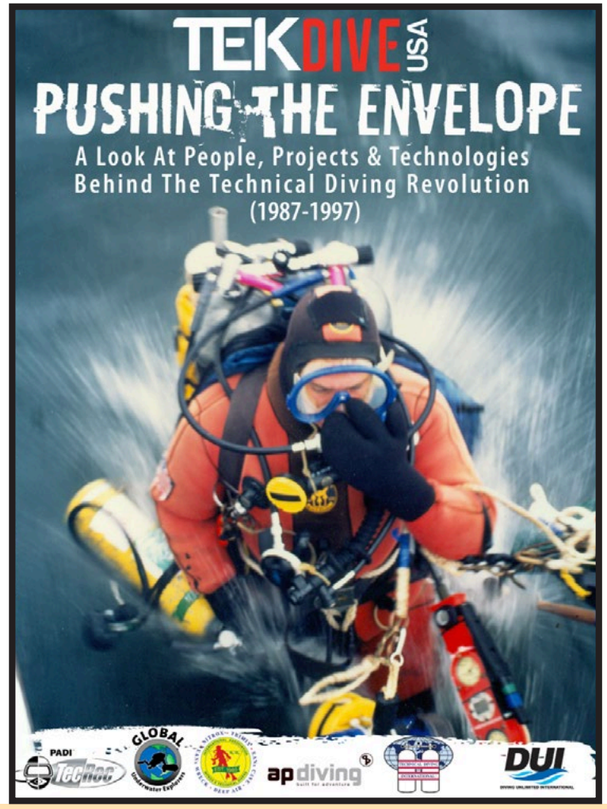
If you are shooting with a compact camera, or a camera with slower focusing capabilities, try using as much light as you can to light the subject, giving your camera as much help as possible. You will only be able to shoot in manual mode, or the camera's shutter speed will be way too slow and your pictures will come out blurry.

Topography

To do open ocean black water diving, weather conditions have to be near perfect. This includes not only the size of the waves, but more importantly, how fast the wind is blowing and causing the boat to drift. You don't want to spend all your time swimming after the boat or worrying about it drifting away—that's just not fun or safe.

Black water dive operation

Marine researcher Paul Collins and I run Unique Dive Expeditions in Pulau. A few years back, some good friends of ours, Scott Tuason and Tony Wu, came to Palau to do some spawning diving. On separate occasions, they both mentioned a "new style" of night diving in Hawaii called black water diving. Although this



CLOCKWISE FROM LEFT: Juvenile scorpionfish; Juvenile cowfish; Juvenile bobtail squid; Juvenile pufferfish expanded

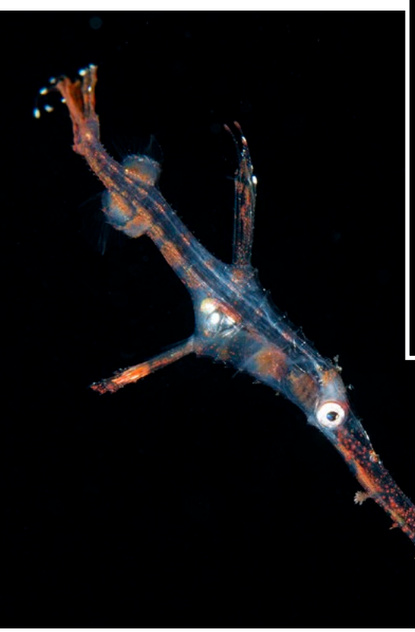
type of night diving had been offered on a commercial basis for over 10 years, Paul and I had no idea what it was all about. Our interests were piqued and we tried to incorporate black water diving into Unique Dive Expeditions.

After a run of bad luck with the weather, many of our black water dives had to be cancelled. Our operation needed to find an alternative, somewhere with constant shelter, if we were going to continue offering this type of diving regularly.

We thought we would experiment inside the reef at a site with a good drop off and some depth. We followed the same procedures, hung lights and waited 30 minutes. Even though the depth was considerably shallower, the results were outstanding. Nocturnal creatures that were usually extremely hard to find came out from their daytime hiding places, followed their own diurnal migration and hunted in the lights. Reef dwellers, sand dwellers, and all sorts of juveniles, which had recently made their way back to the reef and settled in their new habitat, drifted all around us.

The topography, it seems, makes a difference. Drifting in the middle of the ocean, at a location with a very deep contour, offers the best chance of seeing the deep pelagic organisms one will not see close to the reef. Sandy bottoms bring out bobtail squids and creatures hiding in the sand during the day, while deep drop-offs offer one the chance to see juveniles in all their glory, returning to the reef, just slightly resembling their parents and sporting similar coloration.

Cardinalfish with eggs



TOP LEFT TO RIGHT: Juvenile grouper; Juvenile surgeonfish; Larval crab, megalops stage; Krill with green eggs; Juvenile pipefish. CENTER LEFT TO RIGHT: Juvenile ghost pipefish; Two pygmy squid fighting over shrimp; Juvenile butterflyfish

Factors

There are many factors that can affect this vertical migration. Doing black water dives throughout the year, we were able to notice peaks and lulls in our dives around moon phases (light intensity) and seasons (temperature and stages of life).

Organisms want to find their optimum light intensity; whether this is no light or large amounts of light depends on how far up the organism will migrate. Studies have actually shown that on a full moon, organisms will not migrate up as far as when there is a new moon or no moon at all. This change may be due to the fact that it is easier for these organisms to be seen by predators when there is more light.

Nearly every fish has its own pelagic life cycle and undergoes different developmental stages throughout this cycle. Some post-larval juveniles stay in the open ocean for much longer periods than others, and at different depths during their lives. These are called ontogenetic organisms. Whether they will come close enough to the surface to be seen depends on what stage of their lives they are in.

Having a place which has enough current to drift new subjects into the area but which is also sheltered enough for one to take photos is sometimes hard to find. Having current during open ocean black water diving does not matter so much as one is already drifting with the boat. Ideally, though, you do not want strong currents or strong wind, as it can be hazardous.

Doing open ocean black water night diving can sound quite frightening to some people, at first. Experimenting inside Palau's sheltered reef helped us realize that we do not necessarily have to travel miles and miles offshore to experience something similar to open ocean black water diving. Every place you try—whether it is a wreck, reef, drop-off, wall or sandy bottom—might just have something unique and special, hiding in the daytime, which might be willing to come out at night to see what's around to eat.

Next time you do a night dive, try shining your torch into the blackness, give your eyes a few minutes to adjust and see what is drifting by. You might be very surprised to find some magical creatures that are out there in the darkness that have never before been seen or photographed. ■

Richard Barnden is a British diver and underwater photographer who, with marine researcher Paul Collins, runs Unique Dive Expeditions in Palau. For more information, visit: ***www.samstours.com/palau-diving/unique-dive-expeditions.***

Juvenile moorish idol fish

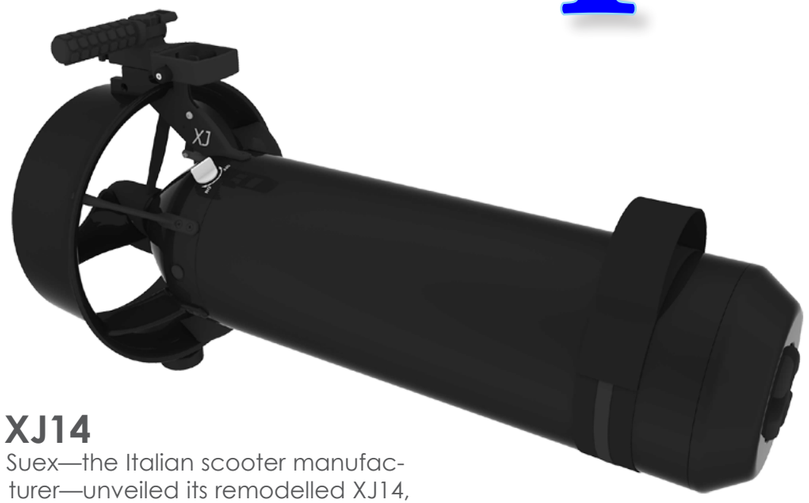
Edited by
Rosemary 'Roz' E. Lunn

POINT & CLICK ON BOLD LINKS

Equipment

Air Crystal

Cressi builds beautiful masks, so I expect great things from their latest offering—the Air Crystal. The parent of this top-of-the-range mask is the highly popular Nano-mask. You can see it when you look at the tapered structure of the Air Crystal. Small tweaks make a big difference—the skirt sides have added ridges to help increase the structure of the mask while enhancing how the mask seals on the face. According to Cressi, this dual-lens framed mask has a hydrodynamic shape, therefore the diver benefits from a wide and lateral field of vision. Available in seven color combinations. **Cressi.com**



XJ14

Suex—the Italian scooter manufacturer—unveiled its remodelled XJ14, XJ37 and the XK1 at the EDUI Show. Thanks to a redesigned body and propeller, these DPVs are now 20 to 30 percent more efficient and hydrodynamic. Several features have been upgraded. The handle has been completely redesigned so that it can be (a) stowed during towing, and (b), used by either hand. The trigger mechanism has also been enclosed to stop it from getting damaged. The most exciting feature though is Suex's "DRIVe" system, aka "Diver Remote Information View". During the dive, you are able to monitor your battery status and the burn time based on your current speed and drag. Once topside and dry, you can then place your Android or smartphone on the scooter battery to download additional data, i.e. your battery log. **Suex.it**

Seac Sub Smart

The Smart BCD weights in at 3.3kg and is fitted with Seac Sub's new safety release weight pocket system. The two pockets can accommodate up to 4kg of lead (8kg in total). Each pocket has an internal divider to stop one's lead from sliding about. Divers have a choice when it comes to securing hoses. Either clip it off in the traditional manner to a 25mm D-ring (this BCD has six in total). Or one can thread one's gauge inside the BCD—behind the zipped pocket and integrated weight system, sliding the end out of a slot above the pocket. What is the role of this BCD? We think it would make for a good travel BCD, or a practical "my first BCD". **Seacsub.com**

Suunto Zoop

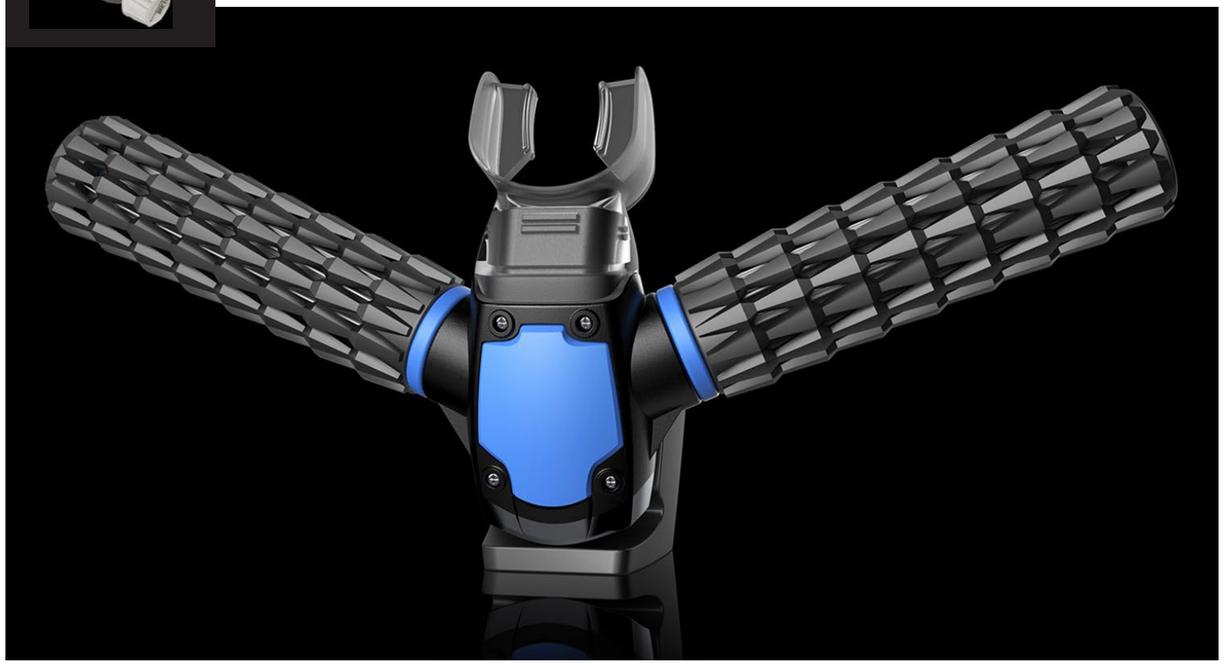
Woop, woop! The Suunto Zoop has had a makeover. The latest iteration is the Zoop Nova. Like its predecessor, this promises to be a great "my first dive computer" for recreational divers. The wrist- or console-mounted unit has enough features to support divers as their experience develops and become more adventurous, i.e. full decompression capabilities. The Zoop Nova is an air/nitrox/gauge/freediving computer that can be dived to 80m. It supports a single (non-switchable) nitrox blend - 21 to 50 percent EANx—and users are able to adjust their ppO_2 from 1.2 to 1.6 bar. The display has been augmented in this model —the digits are bigger and there is a backlight. **Suunto.com**

Atlas

Body Glove's latest creations—the Atlas 5mm and 7mm suits—have discretely hidden diagonal front zippers. These suits are a departure from Body Glove's usual suit design, and I cannot help but feel they have sought inspiration from the Swedish suit designer, Waterproof. The Atlas is manufactured from several anatomical panels cut from low compression Evoflex neoprene. You do get a better-fitting suit, which allows for a greater range of mobility if it has several panels, i.e. the leg benefits from articulated leg panelling. Body Glove has liquid-welded the microbead seams together (to help stop water ingress) with a black finish on the outside and a gold finish on the inside. There is a second "Waterproof-like" feature: Attached to the right hand hip is a large exterior pocket. This has two storage compartments, a large zipped cargo pocket and flapped pocket complete with daisy chain webbing. **shop.bodyglove.com**

"In concept, it sounds very good and it's very exciting, but I would not encourage anyone pulling out a wallet."

— Dr Neal Pollock



"If it sounds too good to be true…"

The creators of the Triton—a diving mask marketed as a "state-of-the-art oxygen respirator" and claiming to be able to deliver oxygen underwater via some "artificial gill" technology—have managed to raise over US$830,000 on crowdfunding platform IndieGoGo in just a few weeks, despite being dismissed by scientists and dive professionals alike as being completely implausible.

Text by Peter Symes. Illustrations courtesy of Triton's crowdfunding campaign on indiegogo.com

According to its creators, the Triton mask uses two specialized filters made from micro-porous hollow fiber to extract oxygen from water enabling underwater breathing by just sucking water through this porous membrane to extract oxygen molecules, which are then compressed by a "very powerful modified micro-compressor", which is in turn powered by "a powerful modified lithium-ion battery".

What is going on?

Though the project has not yet been proven to be a scam, no proof has been offered that any of its technologies actually work. But all of our red flags are certainly going up. Just think about it. How plausible is it that three unknown chaps have been able to solve a range of fundamental problems, which much bigger companies and surely the military have been working on for decades, and then come up with ground-breaking technologies beyond those of which multinational corporations are capable? That may happen in science fiction but not in real life.

Defying physics

For starters, consider from what volume you are supposed to inhale? There is no counter-lung or gas reservoir, just a tiny tank—which I will get back to in a minute. Let's crunch a few numbers first: As we know from our training, a typical diver breathes about 20 liters of air per minute. As this is not a rebreather, all of these 20 liters must be provided as oxygen extracted from seawater.

How much oxygen is there in seawater? The typical concentration is around 7mg/l or about 5ml/l (a liter of oxygen weighs 1.4285 grams). So, to get 20 liters of oxygen, the apparatus would be required to filter 4,000 liters of seawater (that is four tons!)

From where would all the energy come to push such a torrent of water past these gills? According to the inventors, it just comes from the motion of the diver swimming through the water. Surely that isn't happening.

And how about surface area? Fish gills, which have been fine-tuned over hundreds of millions of years of evolution, are proportionally much bigger. In addition, fish do not have the same metabolic requirements that mammals do. There is a reason marine mammals breathe air.

Improbable mechanics

Oxygen is not coming out of water dissolution just by itself either. Some gradient must be created to make it pass across this membrane or filter. Skipping past the interesting question as to how oxygen is actually converted into a gaseous and breathable state, how it is then captured and stored in a tank?

Let's say the tank can hold the equivalent amount of gas to that of a *small* rebreather counter-lung of 2 liters. From the illustration below, I would estimate that the tank cannot possibly be any bigger than 4 cubic cms.

According to Boyle's law, in order to squeeze 2 liters of free gas into 4 cm^3, a pressure of 500 bars would be required. Not even closet-size compressors can deliver that—not to mention that it has to be replenished for each breath. And this performance is supposed to be delivered by a micro-compressor of some hitherto unknown construction and driven by a lithium battery smaller than that of a cell phone?

There are plenty more issues to go on about, but let's leave it that. As a futuristic concept study, or elaborate April's fool joke, it was cool. Taking not so tech-savvy people's money is less so. ■

The contruction and components of the Triton artificial gill

Managing Stress in Diving

OLGA TORREY

Text by Matt Jevon
Underwater photo by Olga Torrey

Two hours into a cave dive and just about to turn based on the dive plan, I have at least a two-hour swim back out, stages to find and pick up, and a number of jumps and T's to navigate to safely exit the cave. I am mentally and physically stressed, and just short of halfway through the dive. I am, however, in fact loving being in the cave, loving what I am seeing, and loving the stress—it's keeping me sharp, focussed, team-, self- and situationally-aware.

We have become "conditioned" to stress being a negative issue, and of course "distress" is extremely negative and often debilitating. But positive stress, or *eustress*, is, in fact, a key motivator, focuser and driver for the best performances in sport, in life, and most importantly, in diving. Let's examine what stress is in more detail.

Being stressed is our response to a stressor—that is, a challenge and/or situation we face. Stress is the degree (intensity of reaction) and direction (positive eustress or negative distress) to the stimulus of the stressor. How we will respond or react will depend on how we read and process the demands we perceive the stressor is going to place on us.

This depends on many inter-related factors. One factor is the nature of the stressor. If it is physical, we will probably react physically; if it is emotional, we will make emotionally driven judgements; and if it is mental, we will try and "work out" our response. In addition, we each have a predilection for a particular type of reaction. Some people are naturally "thinkers", others are driven by feelings, and others prefer to act. Different environments may also drive us to a particular type of response. Of course, many stressors are multifaceted, so it is not possible or appropriate to state that there is a "one-size-fits-all" way in which we handle stress.

So how does this work in real life? When presented with a stressor, we will make (often subconsciously) two key decisions. Firstly, we decide if it is relevant to us (e.g. There's a great white shark. Is it interested in me?) We then instantly compare it to previous experiences, beliefs and knowledge (e.g. Yep, the great white is potentially a threat, or stressor,

Positive stress, or eustress, is, in fact, a key motivator, focuser and driver for the best performances in sport, in life, and most importantly, in diving.

PHOTO COURTESY OF ROSEMARY E LUNN

that is relevant to me, as we are sharing the same patch of ocean).

The second decision we have to make is whether or not we believe we can cope (believing is more important than the reality of whether we can actually cope or not). This decision can be made instantly, if emotionally driven; very quickly, if it is a conditioned behaviour; or more slowly, if we stop, think and solve the problem.

Whether we become positively or negatively stressed depends on whether we believe we have enough resources (e.g. previous experience, equipment, training, skills, recent practice, help from team mates, etc.) to cope. This perceived coping potential is huge: If we believe we can cope, this is when we can "survive the unsurvivable", but if we perceive we cannot cope, we may end up as casualties.

Stressors

Stressors perceived as relevant and positive, even at a high intensity, should result in increased focus and concentration, faster choice and execution of skills, greater self-, team- and situational-awareness, and a feeling of anticipation and excitement, while completely controlled, physically.

Stressors perceived as relevant and negative will result in indecision, negative emotions, confusion leading to panic, poor choices, attentional narrowing and self-isolation.

Stress management then is about handling the stress reaction appropriately by addressing the controllable factors that exacerbate the response, and by increasing our perceived coping potential. This means increasing our actual coping potential as well. In this way, we can still be positively stressed, leading to all the virtuous benefits I was enjoying on my cave dive, for instance, and avoid the pitfalls and disasters of negative stress.

It is also risky to assume that for a given stressor, we will have a consistent reaction. On a good day, it could be a positive reaction. If some or all of the following factors are not optimal, they will influence our stress response and direction. These factors include:

Fatigue – As we tire, we default towards an emotional response. Emotion places high demands on the resources we need to think and act our way through the situation.

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Dehydration – Proven to decrease our ability to think, which worsens with fatigue

Emotional state – Even a bit of bad news before the dive, an argument with the spouse, or an incident of road rage increases emotional activation, increasing the likelihood that one's response will be emotional in nature.

Poor nutrition – Low blood sugar levels can decrease our ability to cope with the natural hormonal response to stress, as well as contribute to fatigue.

Whether we become positively or negatively stressed depends on whether we believe we have enough resources (e.g. previous experience, equipment, training, skills, recent practice, help from team mates, etc) to cope.

No recent experience – Our trained and experienced reactions to situations fade quickly out of memory and physical ability. The longer we have not been exposed to the situation, the greater the delay in recalling past skills, training and experiences, and selecting an appropriate response. Sports skills (including diving) degrade by a third after only two weeks without practice.

Consequence – A stressor in a cave, or at 100m, is going to have far greater consequences than one on a 10m scenic dive. The greater the perceived consequence—and the key word here is "perceived"—the more severe the stress reaction will be.

Preparation is key

Our best strategy to manage stress is to prepare for the things that predispose us to distress or make it seem worse when it occurs, e.g. fatigue, nutrition and hydration levels. Be fit to dive, get a good night's sleep, eat well, stay off the booze, and drink plenty of water, checking morning first urine colour for hydration. (Bear in mind, hydration must be consistent over several weeks. Upping the fluid the day or two before a dive is literally pissing in the wind.) Recognise the good stressors and welcome them and your responses,


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knowing they will enhance your dive performance.

Distress

Let's focus on the distress part, as stress management in diving is pretty interesting. Most of us, at one point or another on a dive, have been a little distressed (e.g. swimming in a current, experiencing a gear failure, or put under multiple pressures by an instructor during a drill, etc). I am guessing that if you are reading this article, you survived the distress and hopefully learned from it. Maybe you added extra coping skills (more training or back-up gear), or you increased your perception of your ability to cope, having executed a great choice well to manage the stressor. You should have accrued experience, which you can refer to when making your two key appraisal decisions on relevance and coping ability.

We have all heard, though, about the distress situations (e.g. the sudden panic rush for the surface, missed decompression stops, ripping out a teammate's regulator). Steps can and should be taken to minimise the chances of the response resulting in these destructive behaviours.

Stress management then is about handling the stress reaction appropriately by addressing the controllable factors that exacerbate the response, and by increasing our perceived coping potential.

This means increasing our actual coping potential as well.

Training the dive mind

Pre-dive emotional status, if less than ideal, can really increase the risk of a disproportionate emotional reaction to any incidents. We want to go in the water with a calm mind, solution-focussed reactions preferred.

So, you got up and left, to the spouse saying: "Oh, diving again, is it? When will you be back? You won't be drinking with your buddies again, will you? How much was that new dive thingy you just bought?" Then, you got stuck in traffic, which made you late for the boat. Some inconsiderate person pinched the last parking space, so you had to haul your gear for miles to get to the boat, and the skipper is treating you like a recalcitrant toddler. Add in a bad trip out and 20 minutes waiting for the shot to hit metal, and I am guessing that your emotional status is not evenly balanced. How can we regain the equilibrium? It is going to take a few new skills. The best way to apply these skills is to put them into an emotional control routine. This can then be transferred to any situation, in or out of diving, and may save you some bruising to the knuckles.

Step 1. Find a place where you can be undisturbed for a couple of minutes. Sticking on some headphones works for some people, even if the music is not on. If you do have music, listen to a tune you find calming, but not so relaxing you go to sleep. We want to be calm, clear-headed and focussed, not so chilled, we are snoring.

Our best strategy to manage stress is to prepare for the things that predispose us to distress or make it seem worse when it occurs.

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Step 2. Engage in some deep tidal breathing, not to relax, but just to gain a sense of physical control over the body. Deep breathing is naturally associated with a sense of control over the mind. Some muscle contraction and relaxation exercises can help.

Step 3. Park all the crap that is currently bothering you, or has the potential to bother you. But, you can't just forget about it. Try it. Forget about a white elephant. No, seriously. Do not think about it. Stop thinking about the big-eared white thing! You can't, can you?

Okay, now imagine you have walked the elephant into an enclosure and you have closed the gates. Now, you can see the gates, but not the elephant. It is the same with stuff that bothers you. You have to convince your subconscious mind, which is rather like a hyperactive child, that you are not trying to forget its concerns, but you are putting them away and will deal with them later.

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I just imagine myself writing my troubles down and putting them in a box I can open up later. I then imagine putting this box with all the issues away in a safe place. I use a pocket of my dive bag. I do not want to bring this stuff on the dive, so a drysuit pocket will not do.

The key to stop these issues coming back is to plan and stick to the plan of coming back to the issues and dealing with them at the right time, i.e. when you are not diving. If this does not work for you, there are other techniques.

Step 4. Choose the right mood in which to be. Personally—and I encourage this mood in my teammates and students too—I like to be a little bit "up". I think a small degree of "being up for it" gets me over the danger of complacency that comes from doing this or similar dives hundreds of times before. I do not like the concept of relaxing before the dive. I think it is all right once you are in the dive, to relax into it after all the pre-dive and start-of-dive planning, what-if and safety drills have been done. It is choosing the optimum level: too excited, or worse, nervous, and you will miss stuff.

To get into the optimal mood, I use cues that key into it—e.g. music, a few key words, set physical routines such as gear preparation or putting on a drysuit—and some imagery that recreates the perfect mood for the dive.

A solid consistent pre-dive routine is pure gold in psychological terms.

Step 5. Rehearse the dive plan (using imagery–all senses, not just visualisation–only seeing it) and if the mood does not change, then a bit more positive excitement is all right. All, then, is good. Rehearse using imagery with the team.

By this point, the chances of any stressors having a disproportionate affect is greatly reduced. At this stage, put the consequence into context of your planning and preparation. Okay, it is a 100m dive, but you have built up to it with a good few 60m, 70m, 80m and 90m dives. Gear and gases have been thoroughly tested and checked. You have a great team, plus safety divers. There is ample backup. Conditions—including the environment, the team and vitally, your attitude and approach—are optimal.

If the rehearsal, either your own imagery or with the team, is not smooth and clear, then you are not ready to go and should not dive until you have a great mental and actual run-through of the plan. Treat it like there has been an equipment failure. There has—your head!

Rehearse the dive plan

Start to engage in the normal pre-dive routines: flow checks, safety and buddy checks, final plan reviews, safety drills, descent and bubble checks, etc. What can reinforce the value of these measures is to create an association between the physical routine and consistency in your thoughts at each stage of the routine. It is not just something you do, but it has meaning for you.

Think about why we do each check.

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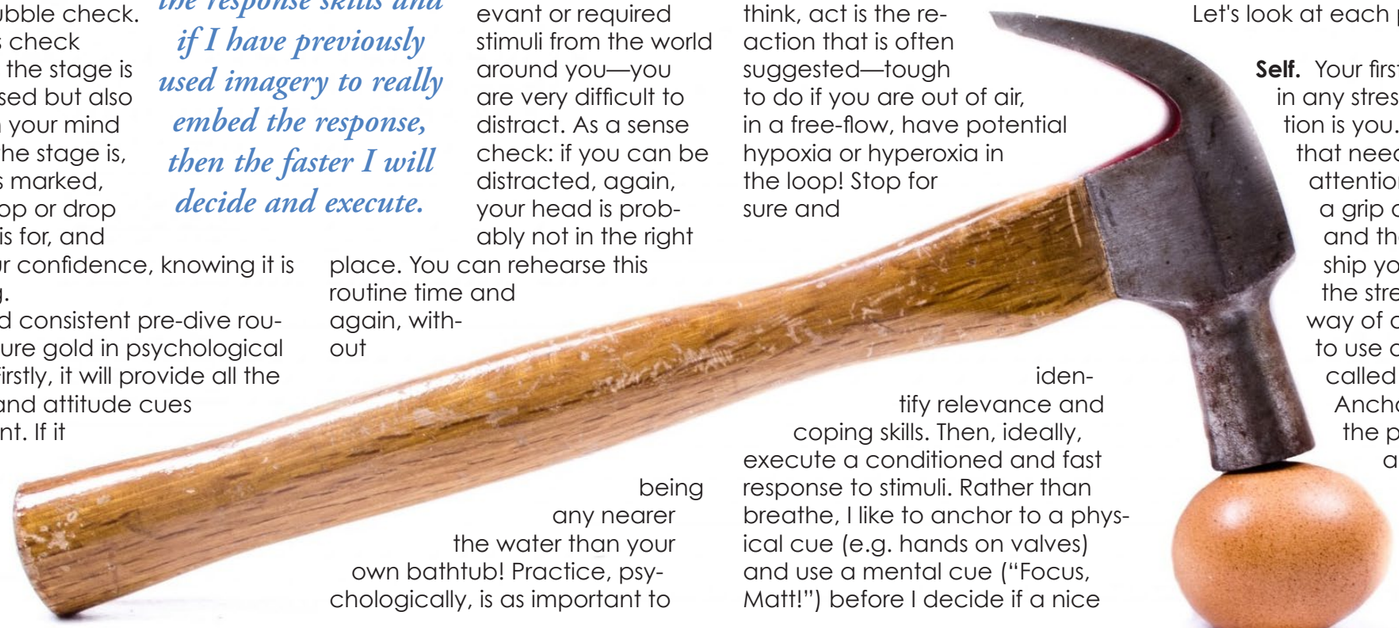
Not only does this ensure you are ready, but it also reinforces the why (e.g. Check your long hose is clear. Yes, it is safely clear, which reinforces that this gear is our response to an out-of-air diver). Turn your stage on for a bubble check. Yes. This check ensures the stage is pressurised but also "fixes" in your mind where the stage is, how it is marked, what stop or drop point it is for, and ups your confidence, knowing it is working.

A solid consistent pre-dive routine is pure gold in psychological terms. Firstly, it will provide all the mood and attitude cues you want. If it does not, you need to refine the routine. Secondly, it will have checklists, even if they are not written or ticked off (though that is a great practice, especially until your routine is rock solid). Thirdly, you will find that you shut out all but the most relevant or required stimuli from the world around you—you are very difficult to distract. As a sense check: if you can be distracted, again, your head is probably not in the right place. You can rehearse this routine time and again, without being any nearer the water than your own bathtub! Practice, psychologically, is as important to do as physical skills practice, and usually takes more time.

The better trained I am, the more I have physically practiced the response skills and if I have previously used imagery to really embed the response, then the faster I will decide and execute.



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In water, there are a great number of stimuli and occurrences that can cause us to have a stress reaction. Some of these are obvious and immediate, e.g. a free-flowing regulator, a burst hose, a silt-out. Others are more insidious, e.g. an onset of thermal stress, dehydration and often narcosis. Developing appropriate and timely reaction to these stressors is vital.

START

Stop, breathe, think, act is the reaction that is often suggested—tough to do if you are out of air, in a free-flow, have potential hypoxia or hyperoxia in the loop! Stop for sure and deep breath is a safe course of action.

What I prefer is to use the acronym START, to ensure that I have prepared responses for all foreseeable issues that can occur on a dive. Where possible, the responses should be similar and well-practiced under simulated stress. Stop, anchor thoughts, focus mind, judge relevance and coping, execute or decide then execute. The response should fit into this acronym:

S elf
T eam
A ction
R eview
T hink

Let's look at each part.

Self. Your first recourse in any stressful situation is you. It is you that needs the first attention, to get a grip on yourself and the relationship you have to the stress. The best way of doing this is to use a technique called anchoring. Anchoring brings the psychological and physical attention back onto you in a controlled way. A deep breath is often a good anchoring technique. But for reasons previously discussed, I am not a fan of this technique for diving.

Then, accurately and quickly identify the stress source. For example, on a closed-circuit rebreather (CCR) or on your dive computer, an alarm is a stressor, but it is not specific. It could be an ascent rate warning, a cell warning, a low PO2. Other than drawing your attention to the source issue, the alarm is actually no use to you and is a source of increased stress (I often want to take a large rock to people's constantly beeping computers!). We need to condition ourselves, through training, to respond to alarms with a calm, "Right, what's that!?" as opposed to a fluster of agghh's and oh sh*ts. Accurate identification of the issue and a good assessment of our ability to cope is of more value. Not once in my training, by the way, did I ever have an alarm beep or buzz simulated. I had the issues simulated on a card, which read "High PO2", for example. We identify relevance and coping skills. Then, ideally, execute a conditioned and fast response to stimuli. Rather than breathe, I like to anchor to a physical cue (e.g. hands on valves) and use a mental cue ("Focus, Matt!") before I decide if a nice

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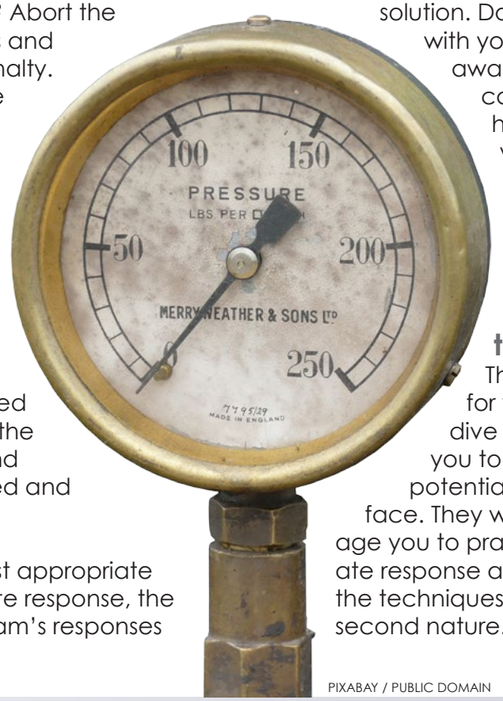
need to add simulated auditory alarms into training—physical and mental—especially for CCR.

So my reaction to an issue is, ideally: to centre myself (e.g. hands on valves), do self-referenced talk (e.g. "Focus, Matt"), then identify the issue. This takes about half a second to two seconds maximum, depending on the issue complexity. If the issue is critical, I am also perfectly placed to respond, as that probably involves gas loss or O2 shutdown! I decide if action is needed, based on well-practiced responses trained in simulated stressful situations, then implement the response. The better trained I am, the more I have physically practiced the response skills. And if I have previously used imagery to really embed the response, then the faster I will decide and execute.

Team. I need to check how my team responded. A great team will be right by me by now, especially if my chosen solution has, as it should, included a clear signal to them. At this point, they are checking my issue diagnosis, checking the response I have made or am making for correctness, helping out if that is the way we practice as a team, and most importantly, checking that my head or emotional state is okay.

Action. What next? Abort the dive, check my gas and decompression penalty. The team should be involved, either to implement a pre-planned action (e.g. light failure in a cave: Exit) or to check recalculated turn pressures or decompression requirements. The key is that this is a team decision, based on having averted the immediate crisis, and is done at a reduced and shared stress level.



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Review. At the most appropriate point, the immediate response, the solution and the team's responses and action should be reviewed. This should be as soon as possible—maybe once back at the shot line or maybe on the longer 9m or 6m decompression stops. If the soonest most appropriate time is back on the boat or at the dive centre, then that is when it is done. Hopefully, what you are then doing is affirming that all the right steps were taken. If not, then there is a training issue.

Think. Did the incident occur due to lack of training or practice? Was it an equipment or skills failure or a clarity of thought and action failure? How did you feel as the situation evolved? If my reaction was intense or involved uncertainty or early signs of stress or panic—regardless of having solved the issue—I would set up and practice scenarios on a controlled training dive until I was very confident in my solution. Do not just be pleased with yourself that you "got away with it". Be self critical. If you do not know how you got away with it, seek advice from an instructor who "gets" this stuff (not the Internet forum or your mates).

Response training

There are issues here for your training. Good dive instructors will expose you to 95 percent of the potential stressors you will face. They will train and encourage you to practice the appropriate response and repeat them until the techniques become skilful and second nature. In dive planning, your instructor should ask you to do a "what-if" plan (plus 3m plus 3 minutes), plus "what if x or y happens?" The further into technical or cave diving you go, the more skills and responses you learn.

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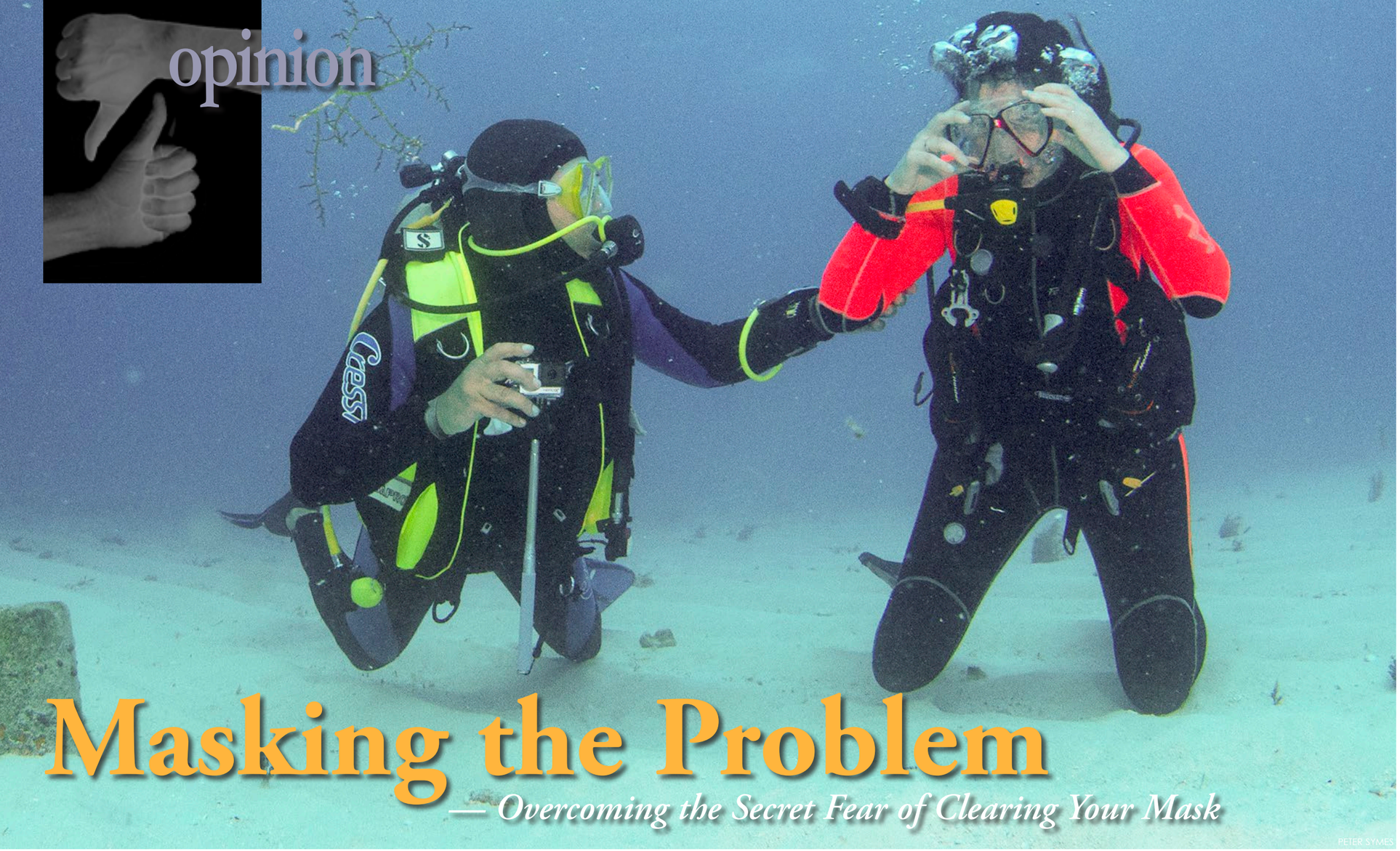
Try this, though: Write down 10 problems that can occur on a dive, not too common. Now write down your response. Was there enough detail in the response to meet the START criteria above? Is there something in there that focuses you and de-powers any emotional reaction? Can you close your eyes, and using your imagination, see, feel and hear clearly (using imagery) the issue and response? If not, then a solution re-plan and purposeful practice is required.

Psychological skills are harder in many ways to learn and master than physical skills. They need clarity—this is the skill part of it—they need consistency, and they need a lot of practice and repetition. Just like the physical skills, psychological skills need quality practice, with real intent and purpose. ■

A native of the Republic of Ireland, Matt Jevon, MSc., is an experienced and passionate open and closed circuit 100m trimix diver and full cave diver. Whether using backmount, sidemount or his favourite JJ-CCR rebreather, Jevon believes technical diving is all about being safe, having an awesome dive and enjoying experiences few people share. Jevon holds instructor qualifications from TDI, PADI TECREC and IANTD, and partly owns South West Tech—a TDI dive centre in Ireland. Jevon is also an approved JJ-CCR instructor and dealer. In addition, he is a sports psychologist, senior rugby coach and works in strategy and private equity. For more information, please visit: ***www.swt.ie*** *and* ***www.mattjevon.com****.*



Masking the Problem

— Overcoming the Secret Fear of Clearing Your Mask

There are many divers who harbour a dangerous secret. Hermione is one of them. On a recent dive, the latest of over 200 she has done over the past 12 years, the unthinkable happened. Despite having carefully followed her usual predive cleaning routine, her mask started fogging up halfway through the dive. Her guide was pointing out small creature after small creature, and eventually the fog became so thick she could not see what he was showing her.

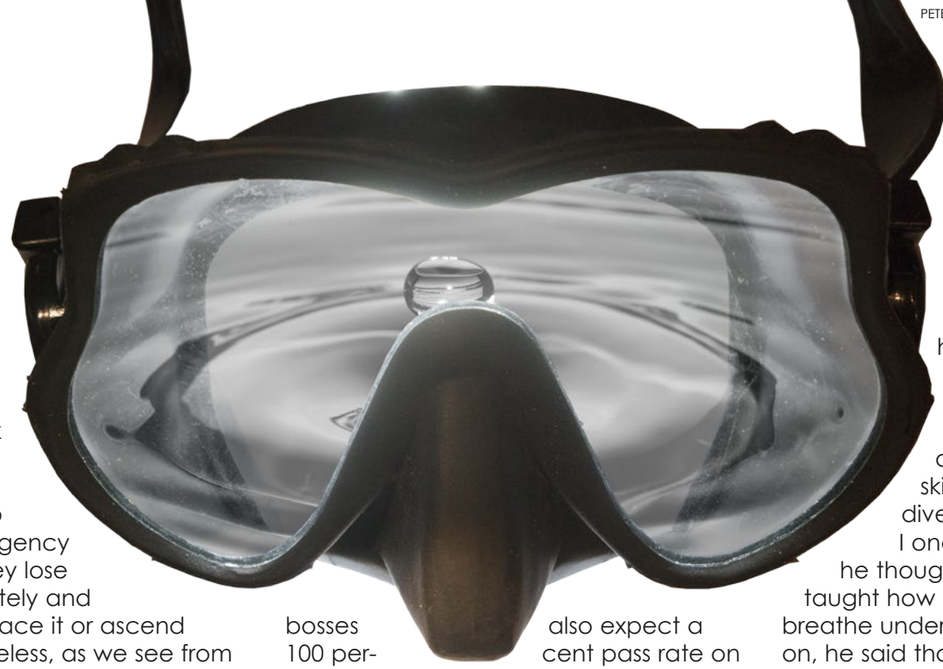
Text by Simon Pridmore

She screamed into her mouthpiece in frustration and the guide, looking at her, indicated that she should clear her mask. She dimly perceived his signals through the mist and squealed again, signalling with her thumb that she wanted to go up. They ascended and when they arrived at the surface, Hermione made herself positively buoyant, took off her mask, flushed it out, spat in it, wiped the spit around and flushed it out again. Then she replaced it carefully on her face and brushed a couple of rogue strands of hair out from beneath the rim.

The divemaster waited patiently and, when she had finished, he asked why they had had to ascend and why she had not just cleared her mask underwater. "Because I CAN'T!" she screeched, still stressed. "I never could."

Hermione's secret

Hermione's secret, one shared by more divers than you would imagine, is that she goes on every dive terrified of getting water into her mask and onto her face. So she is certainly not going to voluntarily allow water to enter her mask so she can defog it. She knows that if she does this or if her mask ever fails in any way, there is a good chance that she will panic and bolt to the surface. She therefore spends every dive



PETER SYMES

subconsciously aware that she is potentially only seconds away from disaster.

Yet she is so keen on the sport that she continues to dive, hoping that it will never happen. Over time, this hope turns into a misplaced conviction. The false logic she applies is that if she has done x hundred dives and has never had a mask leak, been caught by a flying fin or had a mask strap break, then none of these things will happen on her next x hundred dives. And, if her mask fogs up, she can always ascend and sort it out at the surface, even though this may spoil the dive.

Teaching troubles

It does not feel natural for anyone to have water covering their nostrils while they are breathing through their mouth. A lot of people understandably become anxious in such circumstances, worrying that they may inadvertently inhale water and choke. However, it is a common experience for divers. This is why they are taught in their beginners' course how to deal with water in their mask and manage any anxiety. They are also taught how to deal with an emergency situation where they lose their mask completely and have to either replace it or ascend without it. Nevertheless, as we see from Hermione's example, evidently there are people who manage to become certified divers without actually learning to master these skills or manage their anxiety.

How does this happen? The fact is that some people need more time to learn things than others, especially when they have to overcome deep-seated fears. Today, with large classes and tight schedules, there is often little time for extra lessons or additional one-on-one sessions. Both students and dive centre bosses also expect a 100 per-cent pass rate on courses. So, instructors are under pressure and this allows the Hermiones of this world to beat the system.

Here is one case in point. A friend of mine had a new girlfriend. The girlfriend was a diver and wanted my friend to learn to dive so they could go on dive trips together. But although he could swim, my friend had a fear of the water. So I was surprised to find out that he had completed a diving course and that he and his girlfriend were planning a dive trip. I congratulated him on overcoming his fear of water. "Well," he said, "there were a couple of things I couldn't do." He went on to explain that, in the pool sessions, he had been unable to fill his mask and clear it without panicking and popping to the surface.

I asked him how he had managed to pass the course and he told me that, after a few failures in the pool, his instructor had told him that he should not worry about filling his mask and clearing it, let alone removing and replacing it. All he would ever need to do as a diver was to be able to exhale through the nose to expel any dribbles of water that got into the mask, and if he could do that, then he would be fine.

My friend of course was delighted to hear this and was certainly not going to question what the instructor had told him. He now had his card and carefully avoided diving with operations that require divers to perform mask skills during checkout dives.

I once asked him why he thought new divers were taught how to clear a filled mask or breathe underwater without a mask on, he said that he guessed it was just a challenge thrown in to see how tough they were. "What if your mask strap snaps during a dive or someone bashes you with a fin and your mask goes flying?" I said. He looked at me in shock, having never contemplated either possibility. The following week, he signed up for a couple of private pool sessions with a local instructor.

A clinical solution

The solution to this problem is similar to the one my friend came up with: mask clinics. Dive clubs and dive centres often run pool sessions during the off season to keep divers involved and give them opportunities to practise their skills. Some of these sessions should be designated exclusively as mask clinics.

They would be open to all divers at all experience levels so that attendance would carry no stigma. Nobody would risk any embarrassment by attending. Technical divers could practise stress tests; advanced divers could work on achieving higher levels of no-mask confidence and newer divers could practise mask clearing, replacing a mask or just surface swimming with no mask at all. Perhaps instructors and divemasters could also develop games and competitions to help build diver confidence and make the sessions more fun.

Eventually, Hermione and others like her would then be able to conquer their fears and finally enjoy diving without the constant fear of impending doom looming at the edge of their consciousness. ■

Simon Pridmore has been part of the scuba diving scene in Asia, Europe and the United States (well, Guam) for the past 20 years or so. He is the bestselling author of Scuba Confidential: An Insider's Guide to Becoming a Better Diver *and has just published a new book entitled* Scuba Professional: Insights into Scuba Diver Training & Operations. *Both are available from Amazon in a variety of formats.*

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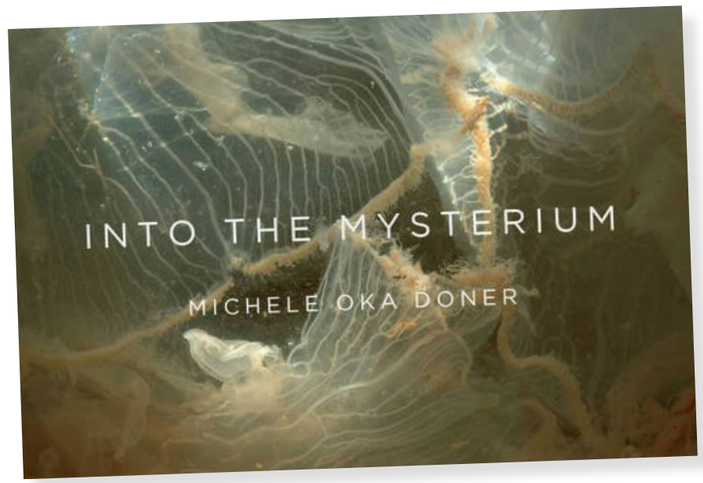
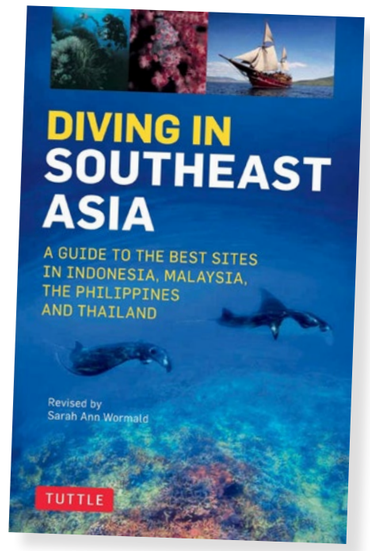


Jellyfish

Into the Mysterium, by Michele Oka Doner.

Although we now have the ability to dive somewhat freely in the oceans (with the proper gear and training), the oceans remain a highly mysterious realm. This book brings to light nearly 100 photographs of the most mystifying and entrancing marine invertebrates from the Gulf of Panama, the Caribbean, the Florida Keys and the eastern Pacific, taken over the last 50 years, from rare seahorses to now-extinct corals.

Paperback: 80 pages
Publisher: Regan Arts - Books
Date: 7 April 2016
ISBN-10: 1942872992
ISBN-13: 978-1942872993

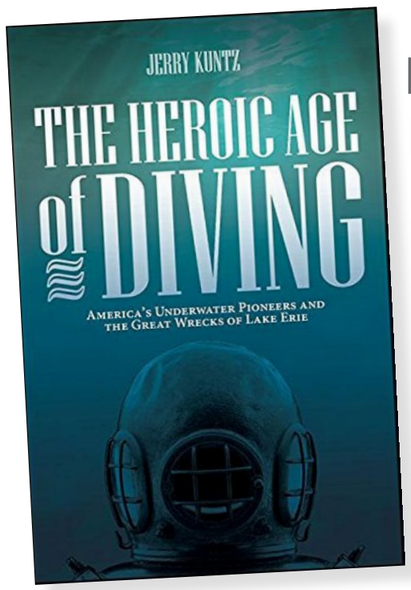


Southeast Asia

Diving in Southeast Asia: A Guide to the Best Sites in Indonesia, Malaysia, the Philippines and Thailand, by Sarah Ann Wormald and David Espinosa.

The dive sites in the western Pacific are of many different types: from small isolated atolls and bommie-filled reefs to wrecks draped in beautiful soft corals—all populated by a vast variety of marine life. This book is a comprehensive guide to the dive sites in Indonesia, Malaysia, the Philippines and Thailand, backed by the authors' extensive dive experience. It also contains useful dive information and travel practicalities, with maps and more than 100 photographs.

Paperback: 288 pages
Publisher: Periplus Editions
Date: 10 May 2016
ISBN-10: 0804845948
ISBN-13: 978-0804845946

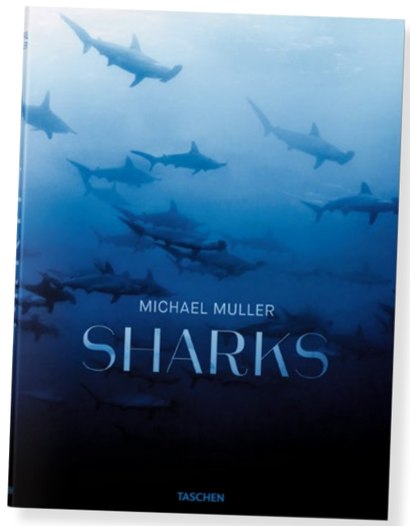


Dive Pioneers

The Heroic Age of Diving: America's Underwater Pioneers and the Great Wrecks of Lake Erie, by Jerry Kuntz.

This book takes us back to the 1800s, when America's engineers started focusing on undersea technology. Think diving bells and hard-helmet diving suits, in a world populated by visionary inventors, daring divers, treasure hunters and entrepreneurs. This inspiring book tells how these pioneers use the emerging scuba technologies of their times and how three infamous shipwrecks in Lake Erie were salvaged during those times.

Paperback: 224 pages
Publisher: Excelsior Editions
Date: 1 April 2016
ISBN-10: 1438459629
ISBN-13: 978-1438459622



Sharks

Michael Muller: Sharks, Face-To-Face with the Ocean's Endangered Predator, by Philippe Cousteau, Dr Alison Kock and Arty Nelson, with photography by Michael Muller.

After paying his dues taking photos of the world's actors, musicians and sports personalities, photographer Michael Muller goes up against the ocean's top predator in this book, armed with just a patented seven-bulb, 1200-watt plexi-encased strobe lighting rig. No cage necessary. Complementing his spectacular photos of sharks are essays discussing exploration and conservation of the oceans, as well as a section explaining the technical aspects of the photos in the book.

Hardcover: 300 pages
Publisher: Taschen GmbH
Date: 15 March 2016
ISBN-10: 3836553597
ISBN-13: 978-3836553599

Indonesia

Diving in Indonesia: The Ultimate Guide to the World's Best Dive Spots: Bali, Komato, Sulawesi, Papua, and More, by Sarah Ann Wormald.

This book zooms in on diving in Indonesia, covering five area—Bali; North Sulawesi; Central, South and Southeast Sulawesi; Raja Ampat and West Papua; and Maluku. For each area, useful information about difficulty levels, logistics, marine life and conservation features are covered, alongside highlights at specific dive sites. To top it off, there is also useful information on travel practicalities, emergency services and even a basic Indonesian dictionary that includes words related to diving.

Paperback: 320 pages
Publisher: Tuttle Publishing
Date: 15 April 2016
ISBN-10: 0804844747
ISBN-13: 978-0804844741

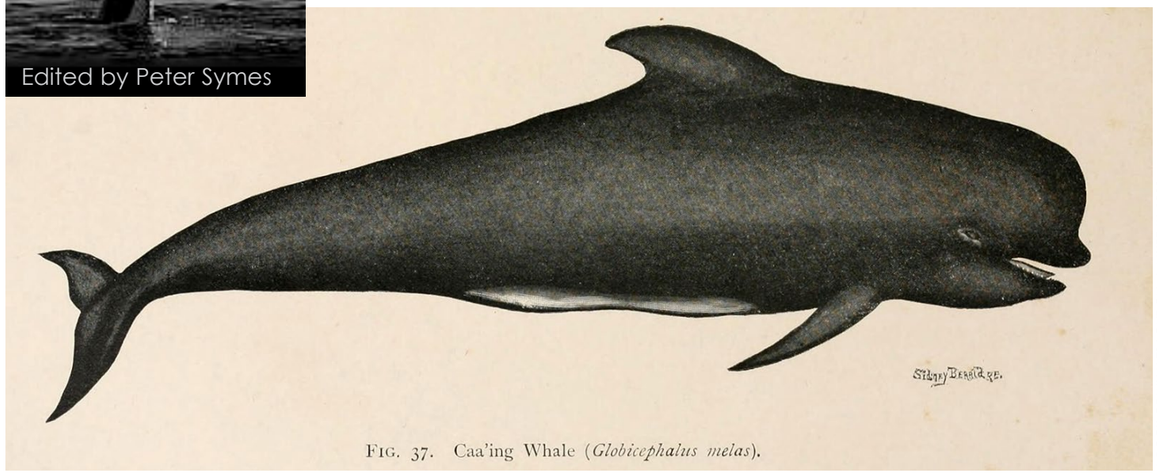


FIG. 37. Caa'ing Whale (*Globicephalus melas*).

A BOOK OF WHALES LONDON, J. MURRAY, 1900

Long-finned pilot whales make many different kinds of sounds. In addition to squeaks, whistles, buzzes and other calls likely used for communicative functions, they also produce rapid clicks that function as a type of bio-sonar known as echolocation.

Computer analysis could unlock secrets of whales' many dialects

Scientists have recorded and analyzed the calls of pilot whales and found that an automated program can identify different social groups by their dialects.

Whales make a wide range of sounds, from whistles and calls to clicks and buzzes. Previous studies have classified whale vocalizations mainly based on how humans perceive sounds or which aspects of a sound spectrum they find important. Searching only for noises that seem meaningful to the human ear may lead to overlooking audio features that only whales are attuned to.

Taking a different approach, a team of researchers from Norway and Germany looked to use a computer to analyze whale communications to overcome such a bias. The team came up with a computer algorithm that analyzes sound recordings that quantify how various noises change over time, allowing for studying the sounds whales make in a new way.

In the waters off the coast of Norway, the team followed six separate groups of long-finned pilot whales, recording several hundred calls from each group. The program analyzed recordings of groups of animals, examining all the frequencies present in the signal.

Rather than classify individual calls one by one, it calculated a coefficient to represent all the features of interest. The scientists were thus able to show that each family had its own distinct dialect. The team thinks their software could help analyze the vocalizations of other species, too, and plan to try the algorithm on orca recordings. ■

NOAA

(File photo) Blue whale surfacing in the Pacific

Blue whales around Antarctica are split into three populations

DNA analysis shows Antarctica's blue whales are made up of three populations, which are genetically distinct. While the three groups share the same feeding grounds in the Antarctic, they likely occupy separate breeding grounds.

The majestic blue whale is the heaviest ever known. It can weigh more than 160 tons and reach more than 30m in length. The largest of several subspecies is the Antarctic blue whale. They typically feed at higher latitudes during summer and migrate to breed at lower latitudes during winter.

The population structure possibilities span from each population having a separate non-breeding ground(s) to sharing of a non-breeding(s) between different populations. Knowledge of population structure—such as the number of populations, their distribution and their degree of interbreeding—is needed to define population-based units for management and conservation purposes. Understanding their population structure is complicated because whales are one of the most logistically difficult and expensive animals to study because of their mobility, pelagic lifestyle and often remote habitat.

With access to a collection of biopsy samples stretching back to 1990 and totalling 142 whales, it became possible to create the largest and therefore most powerful genetic data set so far created for Antarctic blue whales. By comparing similarities and differences in the DNA of individuals, it is possible to tell which individuals are part of the same population and estimate the number of populations.

The analysis indicated that individuals from the three populations occur together throughout the Antarctic, although possibly in different proportions in different areas. The three populations go their separate ways when they head north to breed—presumably heading into the three major Southern Hemisphere ocean basins: the South Pacific, South Atlantic and Indian Oceans. ■

The Lemon shark's yellow colouring serves as a perfect camouflage when swimming over the sandy seafloor in its coastal habitat.

Sharks don't bite like we do

Text by Ila France Porcher
Photos by Peter Symes

Though sharks have gained a mythical reputation for being biters, their behavior in nature is the opposite of what we would expect from the vicious animals depicted in the media. I had many opportunities to observe sharks under circumstances in which I expected them to bite, as a dog, cat, horse or bird would tend to do. Yet they did not.

All other species, wild and tame, with which I had the intimacy I shared with sharks, had bitten me sooner or later, either by accident or in a fit of pique; even my pet dog sometimes grabs my hand in her teeth along with the offered cookie.

Further, while the blacktip reef sharks I knew enjoyed roaming with favorite companions, I never saw them fighting with each other. They had friends but no enemies!

For years people had told me—and I half believed myself—that one evening, I would be bitten and would bleed to death, or faint and drown. Since I was alone far from shore as night was falling, I could expect no one to save me, and these circumstances enhanced a tendency to react with darkening consciousness and soaring terror at times.

The graceful creatures were the color of the twilight waters, and as night fell, they became just motions in the shadows. As if they knew they had an advantage, it was then that they became emboldened, and would suddenly shoot forward faster than my eyes could follow them—the speed at which a shark can suddenly move, is one of the startling things about them.

So I had long acquaintance with the phenomenon of fear. Often it took all my psychological force to compose my mind in order to overcome it.

Occasionally, things went wrong—the boat overturned in high winds, or my camera fell overboard, for example—and I would find myself in tossing waters opaque with blood and excited sharks, in a situation for which I was unprepared. Yet, no matter what happened, no shark bit me, time after time.

Why?

Why had none of those hundreds of sharks of four different species, some many times my size, ever bitten me? I

shark tales

THIS PAGE: Lemon sharks feed selectively on species that are slower and more easily captured by using a stalking technique.

would watch my favorite, Martha, coil through the sea in front of my face, snapping up the treats I was freeing for her while ignoring my hands and the little plastic bag I had brought them in, and be convinced that it could not be a random coincidence.

There had to be a reason.

Mammals vs sharks

One night I accidentally kicked a shark with all my force, not realizing that the six foot animal was between my legs as I finned upward to reach into my kayak. Expecting her to turn and slash, I peered underwater to scrutinize the situation, but neither her speed nor her trajectory changed as she curvetted on to circle me.

It was then I realized that I was expecting a reaction from a shark that was based on my knowledge of mammals. Like the other species we know well, we readily bite in fear. Anyone who has been seriously assaulted knows that the instinct to bite in self defense is very thinly veiled beneath our civilized daily lives. Birds too, readily bite in aggression and fear. It is a reaction that we take for granted--it is an important part of our personal defense system, which is instinctive at its root, and reinforced by countless learning incidents, beginning in infancy, and continuing throughout our lives.

But that night, I realized that these requiem sharks must not share this strong tendency to bite, either from fear or aggression. Separated from us evolutionarily by a gulf of time spanning half a billion years, and having evolved in an oceanic environment, sharks are not territorial, and do not seem to have developed the same tendency that mammals have, to bite in fear or aggression.

It seemed possible that our fear of sharks is based on the intrinsic knowledge that we, and animals like us, readily bite, and we assume that sharks do too. With their big mouths and shocking sets of teeth, our imaginations are undone as we consider them opening to bite us.

But they don't.

They even seem to have an inhibition against biting companion animals. They don't regard us as prey, and apparently view us as other creatures who share their ecological community. This is apparent, for example, during shark dives.

Rare aggression

Dr Samuel "Doc" Gruber of the Bimini Sharklab in the Bahamas wrote back with these comments when I asked him about this subject :

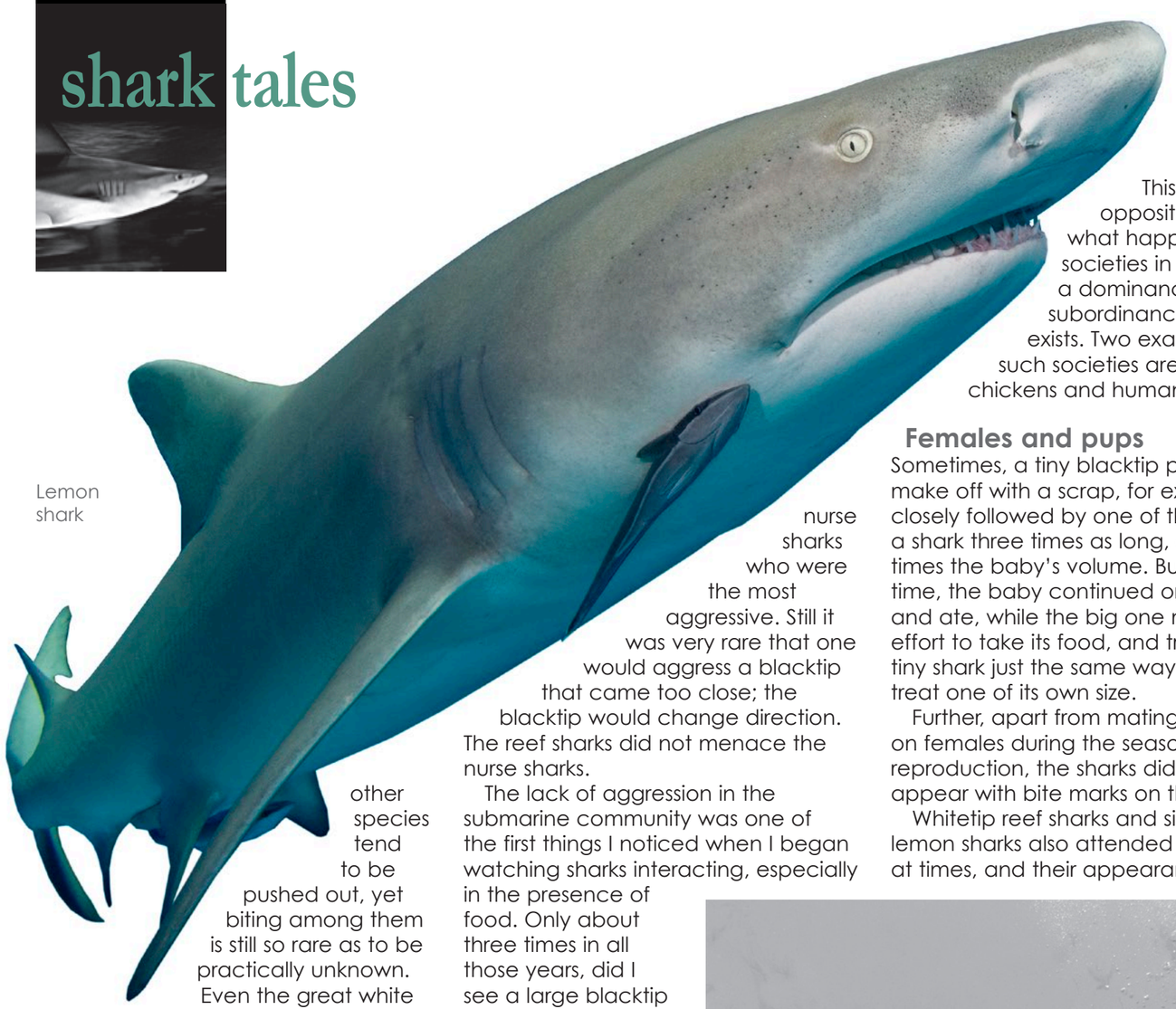
"After years and years of observing sharks in competitive feeding situations, I have become impressed by how little aggression is shown by these animals. I often read in books when I was young that sharks can go into a frenzy and will attack and kill one another. I find this to be exactly opposite of what occurs. What I see is that sharks, when competitively feeding, are almost gentle and balletic. For example, if two sharks rush at a piece of bait and one clamps onto the other's head they will carefully unclamp, back up, and move off. They do not bite or hurt one another.

"Aggression between sharks of the same species seems to me to be very low; they are very tolerant of each other. White sharks might be the exception, but at a big whale carcass, they do not seem aggressive.

"When being handled, some species will definitely bite and others won't bite no matter how much you try. The lemon shark and blacktip shark are two examples of sharks that will definitely bite if you manhandle them. Bull sharks and hammerheads will not bite no matter what, and the same goes for tiger sharks. With tiger sharks, young ones will try to bite, older ones will not."

Feeding sharks

Dive club owners, who work with sharks daily, year after year, report the same phenomenon of non-aggression among feeding sharks. A possible exception has been noted at certain multi-species commercial shark feedings, where over long periods of time, and intensive daily provisioning, certain species of sharks—those that are larger and more pushy—become more numerous, while



Lemon shark

Shark bites

nurse sharks who were the most aggressive. Still it was very rare that one would aggress a blacktip that came too close; the blacktip would change direction. The reef sharks did not menace the nurse sharks.

The lack of aggression in the submarine community was one of the first things I noticed when I began watching sharks interacting, especially in the presence of food. Only about three times in all those years, did I see a large blacktip appear to make a snapping motion toward a smaller one. But in each case, I was able to see that the small one did not suffer a bite as a result. At each session, the sharks swooped around together, often touching, with never a sign that the smaller ones were afraid of the bigger ones or avoided them.

other species tend to be pushed out, yet biting among them is still so rare as to be practically unknown. Even the great white shark has been shown by Dr Peter Klimley to ritualize conflict when ownership of a seal prey comes into question. Through a remarkable series of videos taken of feeding great white sharks, he documented how the shark who splashes water farthest, with a slash of its tail, wins the seal. Thus, a physical battle for the seal is avoided. Given their dentition, a battle between great whites would gravely harm both sharks. (See Klimley's wonderful book, The Secret Life of Sharks.)

Differences among species

Within the community of sharks I studied in a lagoon in Tahiti, it was the opposite of what happens in societies in which a dominance-subordinance hierarchy exists. Two examples of such societies are those of chickens and humans.

Females and pups

Sometimes, a tiny blacktip pup would make off with a scrap, for example, closely followed by one of the biggest, a shark three times as long, and many times the baby's volume. But, each time, the baby continued on its way and ate, while the big one made no effort to take its food, and treated the tiny shark just the same way it would treat one of its own size.

Further, apart from mating wounds on females during the season of reproduction, the sharks did not appear with bite marks on them.

Whitetip reef sharks and sicklefin lemon sharks also attended my sessions at times, and their appearance had no effect on the harmony in the site. Once I watched a lemon shark the size of a horse slowly come up behind a nurse shark pup who was lying on the sand munching on a little scrap. The pup was the size and color of a human baby with long fins, and the lemon shark could just about have inhaled it whole—yet, it passed on. The huge animal did not even take the baby's scrap!

Nurse sharks

My sessions ended as darkness enveloped the scene, and only the nurse sharks remained, languidly writhing around the site amid the flitting fish, until it was carpeted in nurse sharks. They would scrape and suck out the contents of the fish heads, wriggling about in clouds of sand, wrasses and yellow perch.

When it was almost too dark to see them, a massive, pale form would appear off in the coral, weaving in and out of view as she floated cloud-like through the shadows, waving an unbelievable tail. In slow motion, she

Reef shark

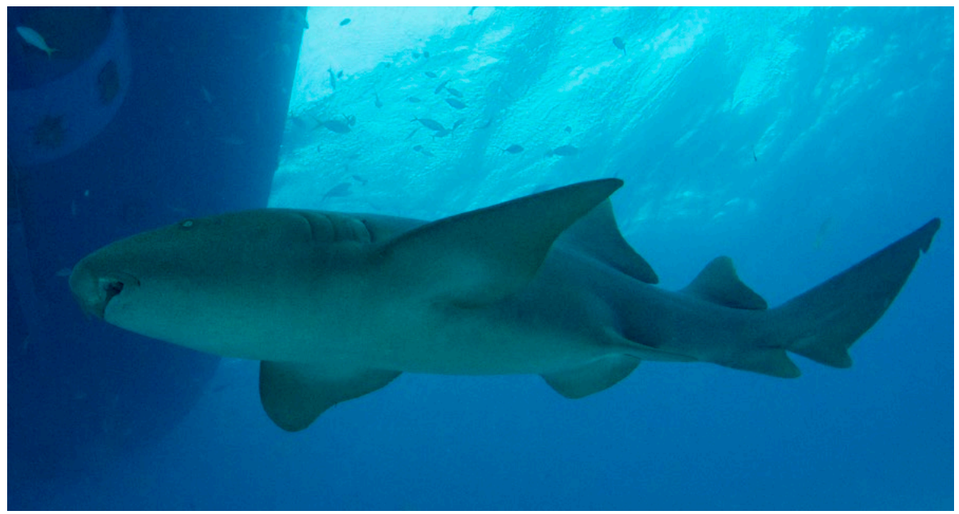
shark tales

would waltz through the site, her fins spread wide, as she pressed the water left, then right, as if to an unheard rhapsody. She was the biggest nurse shark—with a body as massive as a draft horse—a magnificent creature that would undulate with her beautiful, lazy ballet through the twilight surroundings until I left.

One night, a two-meter nurse shark was lying nearby under a coral formation, close beside a Javanese moray eel of about the same length. 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 counter-intuitive, enhancing the feeling of being in a community in which a certain camaraderie existed, one whose true qualities no human mind could conceive.

The unusual behavior of the sharks points to the way their societies are dramatically different from those of the animals that we know best, a subject I will be writing more about, in time. ■

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



THIS PAGE: Nurse sharks

Do sharks form social bonds?

PETER SYMES

Many species of sharks, including the lemon shark, are known to actively prefer to be social and live in groups or loose aggregations. Social interaction is thought to be important for the survival and success of juvenile lemon sharks.

Although scientists have long considered sharks to be loners, new research shows that sand tiger sharks exhibit behaviors typically seen in mammals and only rarely observed in fish.

Sand tiger sharks, top predators that live in coastal waters off the Eastern United States, have experienced drastic population declines over the past several decades. Understanding how these sharks move and interact could help biologists better conserve this species and determine how vulnerable they are to human activities. During summer, the sharks congregate in the shallow waters of the Delaware Bay but are highly migratory, traveling as far south as the Carolinas and Florida during the winter and early spring.

Finding out

Using acoustic tracking devices to trace the movements of over 200 individual animals in the open ocean for over a year, researchers found that sand tiger sharks form complex social networks. Initial data from two individual sharks showed they encountered nearly 200 other sand tigers throughout the year, as well as several individuals from other shark species.

Best friends

The researchers even identified a number of "best friends". This status was afforded to those sharks that met the animals in question more than 20 times over a 12-month period. While this finding is quite surprising in itself, the researchers were even more intrigued by the seasonal variation of the sharks' social behavior, which seemed to peak in the summer before dropping off in late winter and early spring.

These sharks exhibit what is known as *fission-fusion social behavior,* meaning that the number of sharks in a group and the individuals that are part of the group change by location and time of year. Groups would stay together for certain times of the year and fall apart during other times.

The researchers also found that sand tiger sharks re-encounter the same sharks throughout the year. Another surprise was a sudden lack of encounters with other sand tiger sharks in the late winter and early spring. ■

Be quiet near breeding bull sharks

ANDY MURCH | ELASMODIVER.COM

Bull shark diving is becoming a popular tourist activity in the waters around Cancun, Playa del Carmen and Cozumel. Although bull sharks have been implicated in many attacks on bathers, divers are normally not harassed unless they are spearfishing.

Divers and tourists are being asked to refrain from using noise-generating instruments underwater as female bull sharks are returning to breed in the warm, shallow waters of the Riviera Maya on the Caribbean Sea.

Luis Lombardo Cifuentes, director of Saving Our Sharks, told *Riviera Maya News* that they have noticed the sharks displaying a fearful behavior this year and are asking divers to use extreme caution when approaching them by being very quiet and not making noise in the water.

Bull sharks have been known to be aggressive towards humans. They have a very sensitive ears and find noise annoying, which may cause unwanted aggressive behavior. The sharks are very territorial and will attack anything that gets into their environment and is perceived as a risk. Bull sharks are listed as the third largest risk to humans when it comes to sharks, only behind the great white shark and the tiger shark.

Also lives in fresh water

The bull shark is found in tropical and subtropical coastal waters worldwide as well as in many river systems and some freshwater lakes. It commonly enters estuaries, bays, harbors, lagoons and river mouths. It is the only known shark species that is found in fresh water, and can spend long periods of time in such environments. It is not likely that the bull shark's entire life cycle is within a freshwater system, however. ■

Edited by
Michael Menduno

Belgian Mines of Mons

Text and photos by Vic Verlinden

Mining was an important pillar of the Belgian economy in the 19th and 20th centuries. Tens of thousands of laborers found employment in this now-defunct industry. Our team's underwater exploration of this forgotten industrial archaeological site was like a trip back in time.

For more than 70 years, phosphate mines were exploited close to the Wallonian city of Mons, in Brussels, Belgium. The phosphate was used, among others, in the sugar industry and to create fertilizer. To the local population, the mines were of great importance as they provided jobs and income to many thousands of local inhabitants who worked year after year underground to delve the phosphate. They worked 13-hour days in harsh conditions and were always in danger of their lives. In that day and age, child labor was normal and the youngest were barely 12 years old. During World War II, the mines were also used by the Resistance to hide refugees and weapons.

Phosphate was first discovered in 1875 and the mining of it continued till the 1950s. During this period, hundreds of thousands of tons of this precious product was brought to the surface. When phosphate mining was stopped and the mines closed, they found a later purpose as a mushroom farm. Meanwhile, a large part of the mines had been flooded by the rising groundwater. This water was so pure that a local brewery used it to produce beer which was then sold locally. The flooded part is now the largest reservoir of spare drinking water of the whole area. The total length of the tunnels is more than 260 kilometers! From 1995 onwards, guided tours were organized in the dry portion of the mine so people could learn how our ancestors lived in the past. During this period, the tunnels and caves were also examined by paleontologists, who then discovered remnants of prehistoric animals in the mines.

Diver entering the wet zone off the mine; Diver preparing at start of dive (below)

The first exploration dive

The mines of Mons are perfectly hidden in the landscape and, as such, it was no easy feat finding someone to guide me during the exploration. The flooded tunnels are many kilometers long and one should be well prepared before starting a dive like this.

Kevin Haeke, an experienced cave diver, was prepared to guide me during a dive. First of all, it was quite a job getting all the material needed and the rebreathers to the spot where we would enter the water. When all the equipment was there, we took our time to prepare and test our rebreathers.

I would make the first dive without a camera so I could concentrate on reconnoitring the area for when I would return with a camera for the photo dive. After a final check, we started the dive and I followed my guide into what was for me unfamiliar terrain. At the beginning, the visibility was bad but the further away we swam from the point of entry, the clearer it became, eventually turning into crystal clear water.

Exploration in one of the big galleries of the mine (left); Tools left behind by miners (above); Video team at work (below)

The first part of the tunnel we swam through was fairly narrow, but after the first corner to the right, the space became much larger. During the first hundred meters of our exploration, we encountered many objects used in the past during the excavation process.

Right from the start, where we entered the mine, one of our team members played out a guideline. This would enable us to always find our way back to the entrance. One of the advantages of phosphate over slate rock would be the walls having a much lighter color (yellow and orange). This light coloring gave us the impression that the visibility was also much better.

After swimming for a while, we noticed several side tunnels on the left and right, which each had side tunnels going in different directions. It quickly became apparent one had to be very careful with the guideline so as not to get lost. The total size of the labyrinth is about three kilometers long by 450 meters wide.

After almost 40 minutes of swimming, we reached an area where we could poke our heads above the surface, revealing another exit. After a short break, I was guided safely back to the entry point by my two guides.

The dive left a deep impression on me and I planned to return as soon as possible with my camera.

Underwater photographer's paradise

It was not long before I found some good diving friends willing to join me on a dive to take pictures in the phosphate mines of Mons. Stefan Panis and Karl Van Der Auwera are regular dive buddies, and the third diver I found (Michael van Dijck) had lots of experience in cave diving. Before my second dive, I wanted to prepare myself properly and spent half a day preparing my camera and the flash units.

Our intention was to light up as much of the long tunnels

Diver explores one of the smaller spaces

as possible using remotely operated flashlights. Stefan and I would be diving with Buddy Inspiration rebreathers and the other two divers would be using open circuit. To take the pictures, we would swim towards the clearest part of the mine and take some shots there.

Michael's assignment was to guide us safely back to the entry and not lose sight of the guideline. On this dive, I was solely focused on the photography and choosing the right angles so I would not be paying attention to the guideline; hence, Michael was my safety diver.

Several minutes after our departure, we reached the clear waters and I started to take my shots. We had agreed not to swim too close to the bottom so as not to disturb the sediment and reduce our visibility.

On this dive, I noticed the height of the main tunnels was at least six meters, and they were four meters wide. At some points, the strut bars to prevent the tunnels from collapsing were still visible.

At several spots, the iron tracks of the mining carts and locomotives were still recognizable. Again, during this dive, it became clear to me how large and extended this system was and how easy one could get lost in it. Therefore, we paid attention to where we placed our markers so as to be able to find our way back.

After a swim of about 500 meters, we decided to return and reconnoitre some of the side tunnels on the way back. These were much lower than the main tunnels and gave me the impression that some of them were dug above each other. At this spot, I took some last shots before we made our final return to the starting point.

Along the way back, we tried to get a mental image of the numerous tunnels of this underwater city. When we surfaced at the exit after more than 80 minutes, the whole team was euphoric about this beautiful dive spot. It would take many more diving hours to map this beautiful and enigmatic hidden place. ■

Having dived over 400 wrecks, Vic Verlinden is an avid, pioneering wreck diver, award-winning underwater photographer and dive guide from Belgium. His work has been published in dive magazines and technical diving publications in the United States, Russia, France, Germany, Belgium, United Kingdom and the Netherlands. He is the organizer of tekDive-Europe technical dive show. See: ***tekdive-europe.com****.*

photo & video

Edited by
Don Silcock

Text and photos by Rico Besserdich

The path to a better image is always a path that comes with a deeper understanding about which elements of an image are in charge of awakening the attention of the viewer. The goal is to create images that please you and your audience alike. This does not always require the creation of a masterpiece of art, as the interpretation of "what is art" is quite a controversial topic anyway.

Contrast, Line, Haptics

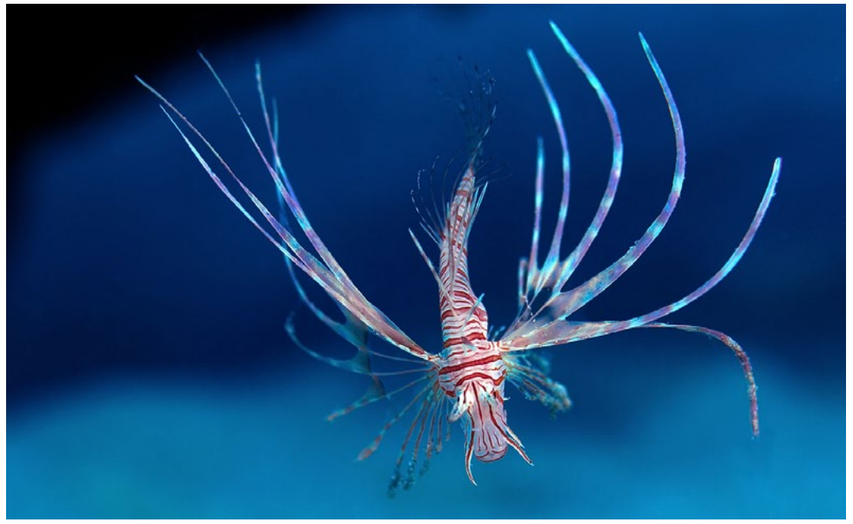
— As elements of image composition

LEFT: A colorful subject in front of a dark background is an all-time winner, based on a very simple (yet effective) concept of working with contrasts.
ABOVE: Lines guide the viewer's eye, sometimes toward a subject, sometimes away.

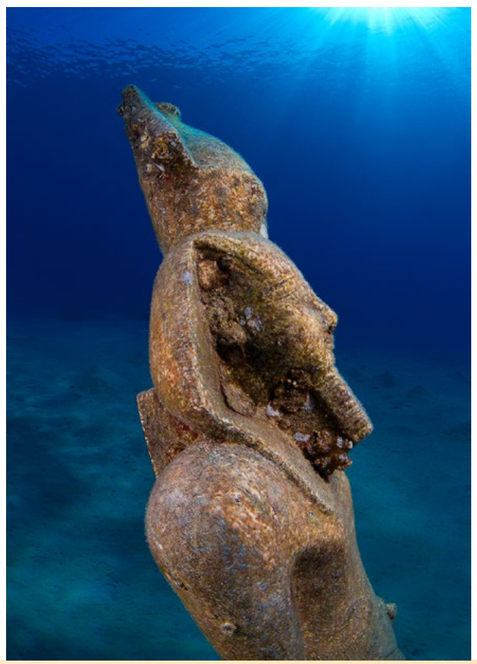
Art aside, the creation of interesting and attractive underwater images is not that difficult once the basic principles of photography, in the classical sense, are understood. Regardless of which subject is photographed, a strong key to effective imagery lays in the composition of an image. Image composition is not done by just knowing the Rule of Thirds (though knowing it certainly helps). There are several more factors and elements of composition that are critical, and I would like to introduce a few of those now.

The objective is to come to a clear

The most extreme contrast is the one between brightest white and darkest black.



Red tones and blue tones combined (above) always produce an eye-catching color contrast; Orange fish and blue water background—it is simple and it always works (right)



Blue and orange/yellow color tones—a classic when working with color contrast in image composition

intention, as every good image begins with the photographer's intention.

Contrast

An intention of working with contrast is an important element of image composition in underwater images. Contrast creates depth (or not!), guides the viewer's eyes to the main subjects of an image (or not!) and is almost always the key feature of an image that attracts the viewer's attention (or not!). Because, in general, contrast is defined as: a strong "eye-catching" difference.

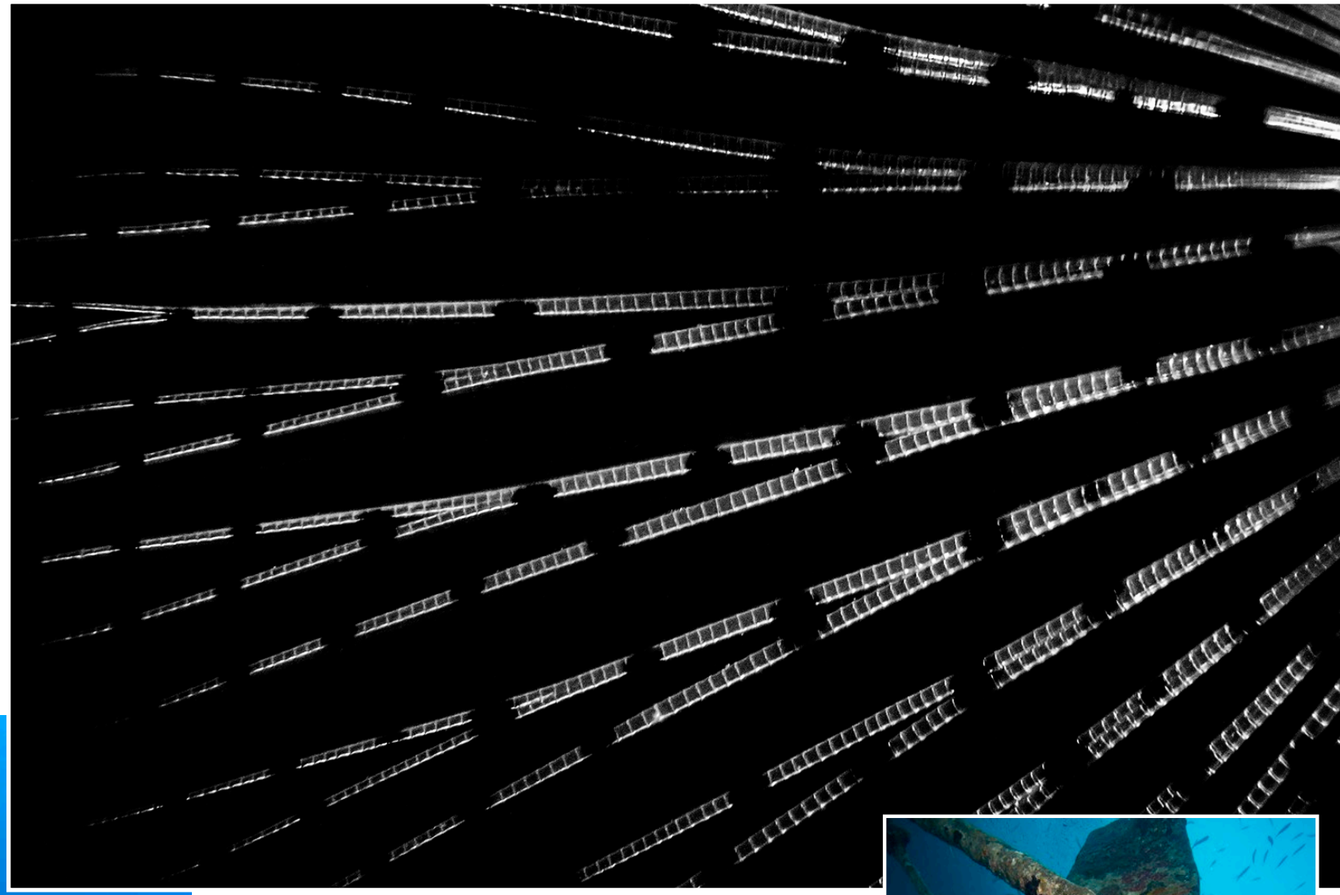
In photography, contrast is the difference between bright and dark areas of an image. The stronger the difference, the stronger the contrast. The human eye is able to perceive around 100 different levels of brightness. The strongest possible contrast is the difference between high noon sun and darkest night—mainly the difference between black and white.

Images with low contrast are mostly perceived as "flat". Images with high (or even very high) contrast display bright areas brighter and dark areas darker—in some cases, by paying the price with a loss of image quality. Super-contrast images do attract the eye upon first viewing. A second viewing then would reveal that actually lots of image details in bright and dark areas are lost. That's not always a bad thing. There are many excellent underwater images that work with extreme contrasts. Everything simply depends on the photographer's intention, assuming an intention exists.

In underwater photography, contrast is often altered to boost the overall expression of the image. But contrast is a bit more than the difference between black and white. An image with a yellow or orange fish and blue water in the background is always an eye-catcher. This then refers to color contrast, especially the contrast between "cold" (blue) and "warm" (orange,

Composition

Lines and color contrast (left)—In some images we will find several composition principles combined. Lines do not always need to guide the eye to a subject of interest (below). Sometimes, they work well just being lines.



yellow). An image of a glowing squid in front of a black background refers to a "dark/light" contrast, and such images (with a black background) have remained popular over the years.

Strong contrasts always attract the viewer's eyes, but one thing should be kept in mind: Do not overuse it. Especially extreme contrast-boosted color images are perceived as "uncomfortable". The image flickers, the viewer turns away.

But contrast in an image does not always refer to contrast in technical terms, as there are also "psychological contrasts". Dead sharks with their fins cut off, animals stuck and dying in fishing nets, or waste and garbage in the water are examples of such "psychological contrast". It has a strong effect on the viewer.

Whatever kind of contrast is used, if done with intention, will result in a stronger image.

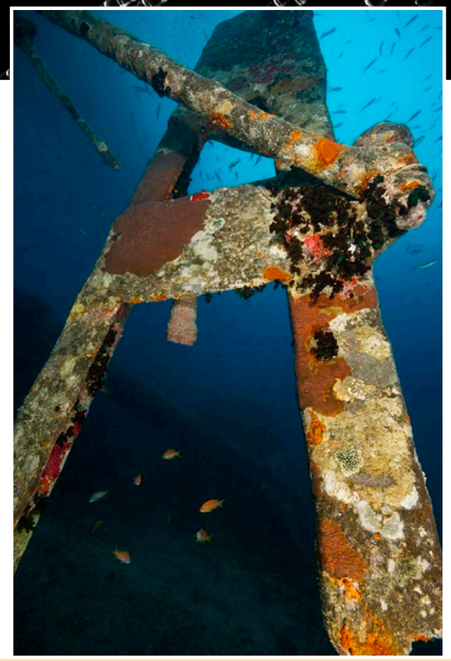
A different kind of contrast is a contrast based on psychological effect. Here: anger about all that crap that lies on the sea floor

Lines

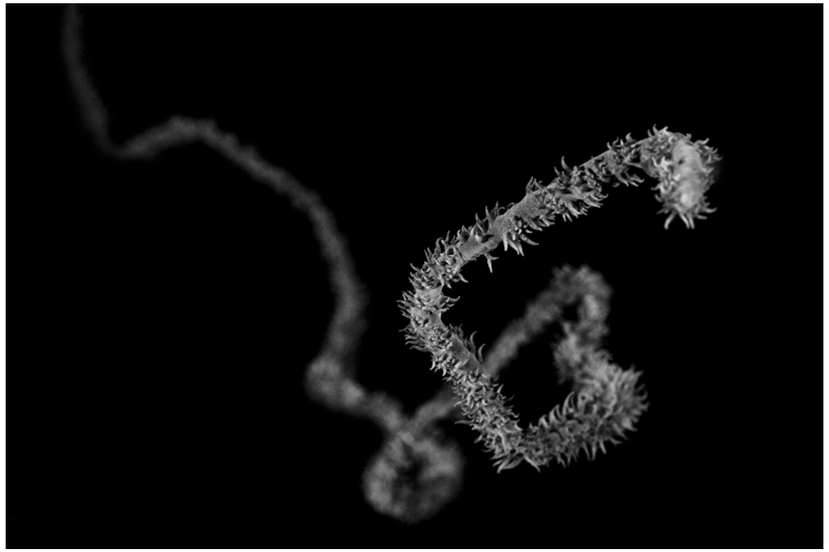
If they do not occur as a separate element, lines form at the edges of objects through color contrast or are notionally derived by connecting image elements. Most of the time, we distinguish between actual lines and imaginary lines.

Lines guide the eye of the viewer and can contribute a lot to the clarity and harmony of an image. People are used to recognizing a "system", or a clear structure, when viewing images; this is true in underwater images as well.

By using lines as an element of composition, we, as photographers, can take viewers by the hand, so-to-speak, guide their eyes and show them where



Once the eye spots a line, it will follow it automatically to find out where it leads (above); Lines and contrast—in this example of extreme contrast, the beam of light works as guiding line to the main subject (below); Lines do not always have to be straight—curves work well too (lower right)

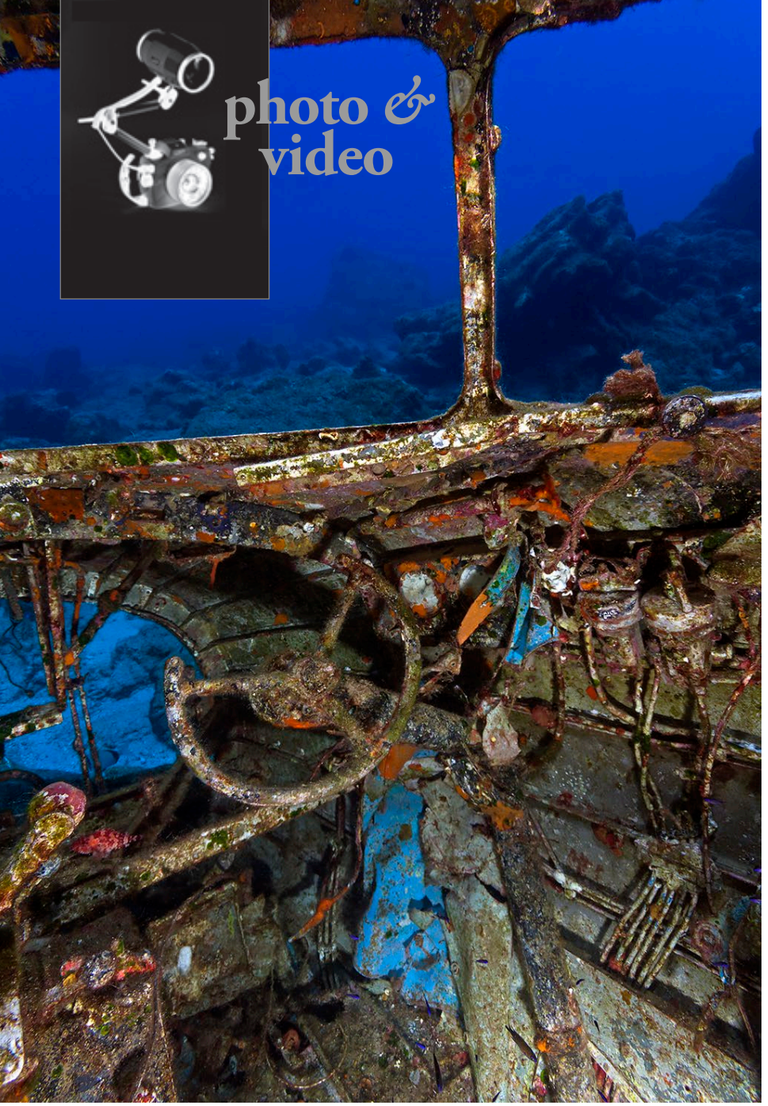


to “walk the line”. While actual lines convey clarity, imaginary lines stimulate the eye and create a feeling of harmony.

For example, in an underwater photograph of:

- A diver at a safety rope—the rope creates an actual line. The rope guides the eye and gives an impression of “depth”.
- The back of a whale (or dolphin) evokes an imaginary line.
- The water border in split shots (over/unders) creates an actual line.
- Sun rays create actual lines.
- A swimmer swimming in an Olympic pool creates a combination of actual and imaginary lines.

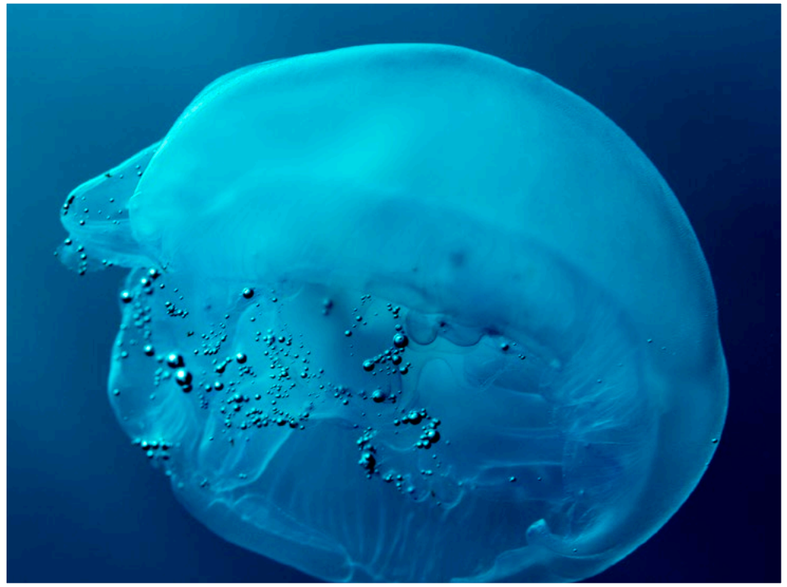
Of course, lines of any kind do not always have to be straight. They can be rounded or even interrupted. Just think of underwater images of whip corals (they have a rounded line) or sunlight patterns on a sandy seafloor (they have interrupted lines). Once the eye spots a line, it always wants to follow it and see where it goes. Knowing this provides the intention-driven photographer a strong tool in creating “eye-catching” images.



What might it feel like to touch this subject (below)? Some subjects awaken a sort of "haptic curiosity"; It (right) looks so soft and fluffy! May I touch it? No, you may not; You obviously don't want to touch this (bottom left). However, some images can evoke a haptic feeling—it is all about imagination; It's tricky to resist playing with this plane wreck's steering wheel, isn't it? (left)

sion on a human being: people understand a thing by touching it:

> *Haptic perception (Greek: hapt□s "palpable", haptik□s "suitable for touch") literally denominates "to grasp something". Perception, in this case, is achieved through active exploration of surfaces and objects by a moving subject as opposed to passive contact of a static subject during tactile perception. Haptic perception relies on the forces experienced during touch.* (WIKIPEDIA)



But there is also a "virtual haptic perception", and such virtual input can be triggered by looking at a photograph. Still, we want to touch it, yet we can't (or are not allowed to). But our brains suggest a virtual haptic perception of an object or thing, and we start to imagine "how it would feel like" to actually touch it.

In some cases, an underwater image can work with haptics as well. Just think of soft sand on the sea floor, or why the jellyfish is named jellyfish, or smooth and rough metal structures (such as wrecks), or just algae, which can not only look beautiful (but don't have to!), they can inspire one to wonder what it feels like to touch it. ■

Haptics

We know not to touch anything underwater, right? But if we could, what would it feel like? Soft? Slimy? Rough? Is it pleasing and nice, or stinging and hurtful? Most of us will never know, but we try to imagine it anyway. This refers to a kind of psychological effect, going back to very early childhood when we discovered, as babies, the world around us, simply by touching everything we could (or at least everything our parents allowed us to). Physical contact with a thing creates a strong impression on a human being: people understand a thing by touching it:

Rico Besserdich is a widely published German photographer, journalist and artist based in Turkey. See: ***www.maviphoto.com****.*

Is it still movable? A small "haptical provocation"—despite the image itself is not super-fancy or interesting, the viewer can't help but think about that small wheel. May I touch it? No!

Corinne Chaix

PORTFOLIO

PREVIOUS PAGE: *The Puppeteer*, by Corinne Chaix. Acrylic and pastels on canvas, 6 x 7 feet

Text edited by Gunild Symes
All artwork and photos
by Corinne Chaix

Corinne Chaix is a French artist based in Venice, California. She creates surreal paintings, often placing human beings and marine life together in strange and mysterious scenes, playing with themes of confinement, illusion, parody and fantasy. *X-RAY MAG* interviewed the artist to find out more about her work and her perspectives on art and the underwater world.

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

CC: I grew up in Paris, France. My mom was an art student and my dad an architect, he was bringing home piles of oversized discarded blueprints from the office, for us to use as drawing paper. The back of these blueprints were my magic worlds where anything could happen if I had a marker. I would tape them on my bedroom walls and on the floor, to draw the "real size" backgrounds of my fantasies. I would also create the paper costumes to go with it.

I always knew I wanted to be a painter, so I took Fine Arts in college, in Paris, but I also took computer science courses to make sure I could support myself financially, and in a way I would enjoy.

Afterwards, I worked for 12 years for a company developing a very sophisticated 3D software (Maya). These tools, which originally replicated real physical phenomena, can be tweaked to distort them. However, I never use computers as my "art" medium. To make art, I need to get my fingers dirty with pastels or paint, but working with the software gave me fantastic information regarding lighting effects and perception.

Looking Out (left), by Corinne Chaix. Acrylic and pastels on canvas, 6 x 4 feet; *The Specialists* (right), by Corinne Chaix. Acrylic and pastels on canvas, 6 x 4 feet

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

CC: My family's origins are in the south of France, where we were spending all of our vacations. My most cherished childhood memory took place in the island of Porquerolles (off the coast of Provence). I remember being on a wooden deck in the small harbor, squatting on my haunches, my head on my knees with a homemade fishing rod. I didn't care much about fishing, I was just staring at the flapping transparent water and the undulating fish. It was just completely beautiful, and I became hooked on the underwater world.

My other favorite places were the old small museums where prehistorical animal reconstructions were displayed next to human skeletons and shelves of anatomical anomalies floating in amber-colored formaldehyde tanks.

My favorite books were myths, legends, adventure and science fiction novels, especially those of Jules Verne. His stories fascinated me as well as the original book illustrations. I loved *20,000 Leagues Under the Sea* so much that my dad made me, as a present, a few years ago, a fabulous Nautilus model, which is floating from the ceiling of the living room in our house in the south of France.

In my home in Venice, California, I painted in my home studio and I

She Prefers the Company of Fishes, by Corinne Chaix. Acrylic, pencil, ink on paper, 30 x 22.44 inches

was also raising four children. I couldn't afford to use oil paint which requires a long drying time and has a very strong smell. Over the years, I developed my own technique which is a mix of different mediums: I use pastels to sketch, acrylic mix with pastels to paint and sometimes ink. I didn't mean to fake an oil painting effect but, once (the painting is) fixed, people usually think it is oil.

X-RAY MAG: Your images have a surreal aspect to them, with meanings behind each that are intriguing and mysterious. Please describe the concept or thought behind paintings such as the Underwater Society series and the Walking on Water series.

CC: I live in Venice, California. The sunny beach and the surfers are my daily surroundings, but there is a subcutaneous, constant menace of a big earthquake paired with a tsunami, which would sink my house, and this probably has a big impact on my subject matter.

About the *Underwater Society* series: Each painting is like a still of an ongoing silent movie, describing the life of the "Underwater Society". It is still developing.

The subjects come up to me, they can be just absurd scenes like "cadavre-exquis" (exquisite cadaver) collages, which don't necessarily make sense at first, or their meaning can switch, and become more complex as I work.

I love to draw architecture, and some scenes are loosely "staged" after historical places (like the Doges Palace in Venice, Italy, for *The Puppeteer*) and interiors in decay with details like over-

Chaix

Shark, by Corinne Chaix. Acrylic and pastels on canvas, 20 x 24 inches

sized velvet drapes, reminiscence of their past grandeur.

Although I am not trying to parody a real world, with time, the rules and roles of the Underwater Society started to emerge.

There is a hierarchy among the characters: guards and workers are standing, always seriously absorbed in their "questionable" tasks, supervisors are sitting and often nostalgic and sick. All are dressed with formal costumes, often

Shark, by Corinne Chaix. Acrylic and pastels on canvas, 20 x 24 inches

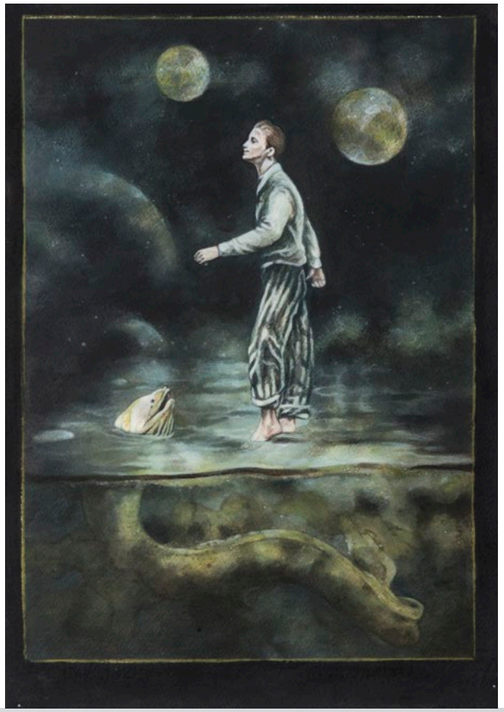
She, by Corinne Chaix. Acrylic, pastels, ink on paper, 30 x 22.44 inches

Underwater Society 2,
by Corinne Chaix.
Acrylic, pencil, ink on
paper, 8.3 x 10.2 inches

too large for them, and are wearing diving helmets. The diving helmets are not connected to anything, they protect them, but they are heavy and prevent them from having a larger field of view, and they also isolate them.

The animals have also attributes: Sharks are moody but wise; murenas (moray eels) became the dangerous pets, which make men sick but to which they are addicted; and octopus are fun and underestimated.

I love Renaissance paintings; I use classical composition and realism to convince the viewer to suspend his disbelief and pass over the line between the real and the dream. But my scenes are just a starting point for the viewers to continue with their own interpretations.



Walking on Water 3,
by Corinne Chaix. Acrylic,
pastels, ink on paper

About the *Walking on Water* series: Some of my characters have been out of the water, taking off their helmets and uniforms, and a few have been walking on the water, usually with their murenas staring at them.

I painted the *Walking on Water* series when my dad became very sick. I don't really know what I believe in, but this was for me a soothing dreamy image of the passage between life and death, an evocation of the possible existence of something miraculous.

X-RAY MAG: What is your artistic method or creative process? Briefly, please describe in step-by-step terms, how you create your artworks?

CC: I precisely sketch my ideas before starting on a larger scale. I use photographs as loose references, for architecture, animals, and one of my sons has often modeled for me. I stage the scene just as a director would do. The first phase is drawing the scene with pastels, the second, to apply all shadows with diluted black ink or acrylic, the third phase is to apply the color.

Then begins the long process of elimination and the multiple transparent layers of pastels and acrylic to create the water effect. I treat each inch of the surface like an abstract painting.

X-RAY MAG: What is your relationship to the underwater world and marine life? Are you a scuba diver or snorkeler and how has this influenced your art?

Underwater Society 1, by Corinne Chaix. Acrylic, pencil, ink on paper, 8.3 x 10.2 inches

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

CC: I tried scuba diving and I experienced the magic "Alleluia" moment when flying back up through the rays of light. To this day, I cannot think about a more beautiful experience than snorkeling in shallow transparent waters surrounded by fish.

I have snorkeled in the Mediterranean Sea, in the Atlantic, in the Caribbean, in Indonesia, Thailand, Vietnam, Africa, France—spending most of my time in less than two meters of water. I had a lot of "moments" and communication with fish: One was in Vietnam where we were on an island, in a resort shamelessly built next to a coral reef. I stayed for a week, and the same fish was waiting for me, at the same place, every day.

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

CC: The ocean covers more than 70 percent of the planet, and the level of the water is going up quickly. It is time to include it as a major element in our lives and our near future. As a mother, I really don't understand how parents can so coldly ignore their children's future by trashing the planet and oceans to a point of no-return, how hotels can be built near coral reefs, how corrupted officials can let boats use destructive fishing methods like bottom trawling and explosives.

In my opinion, the media should report more often about the state of the ocean. I wish we had more inspiring TV shows like "Surface" from NBC.

I hope my underwater images can inspire the viewers as well.

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

CC: I am just providing clues, and it's important for me that viewers have their own projections, which they often do. Nothing makes me happier than when someone tells me "I know what's going on" and narrates his version of the scene.

My paintings also depict a dreamlike, but dark, sunken world and the absurd relationships men have with their environment and companions; in "The Puppeteer" painting, one of the character is trying to control an octopus like a puppet, although the octopus is larger than him and so much more in his element.

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

CC: I am showing my work but I am not part of any group or

Underwater Society 5, by Corinne Chaix. Acrylic, ink on paper, 8 x 10 inches

The Genie of the River, by Corinne Chaix. Acrylic and pastels on canvas, 72 x 58 inches

Shark, by Corinne Chaix. Acrylic and pastels on canvas, 20 x 24 inches

movement. I feel lucky the world "narrative" is not an insult anymore and figuration can co-exist with abstraction.

When I was an art student, I could be respected for my ability to draw, but it was difficult to show in a gallery when abstraction was reigning. The collectors who buy my artwork are doing it because they feel compelled by my images, not just to decorate their living room.

X-RAY MAG: How do people respond to your works? What feedback or insights have you gained from the process of showing your work to various audiences?

CC: I had a lot of unexpected interpretations of my work, often very epic; this makes me think I might be able to help some people to find their own portal for their dreams.

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

CC: I am working on a "Boxed" series. These are portraits of people I know, boxed with some of their traits. The box is not very different from a diving helmet; it is still a protective and isolated environment.

In May, my studio in Venice, California, will be on the tour of Venice Art Walk. This is one of my favorite events. All kinds of visitors pass by, and, unlike in a gallery, they are not shy about talking to you. ■

For more information and to see more artwork by Corinne Chaix, visit the artist's website at: ***www.corinnechaix.com***.

Shark, by Corinne Chaix. Acrylic and pastels on canvas, 20 x 24 inches