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X-Ray Mag

GLOBAL EDITION
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San Diego
Wreck Alley & Islas Coronados

WWI Wreck
Rossarol

Red Sea
Dugongs

Ecology
Octopus

Sharks
Sand Tigers

Tech
Christine Slate Mine

GRAVEYARD OF THE ATLANTIC
North Carolina

COVER PHOTO BY OLGA TORREY

DIRECTORY

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COVER PHOTO: *Diver on wreck of Aeolus, North Carolina, USA*
Photo by Olga Torrey (**Fitimage.nyc**)

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Playful California seals, Coronado Islands, Baja California, Mexico. Photo by Olga Torrey

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21st Century Indulgences

Not sure what to make of HiFly's Airbus 380 "Save the Coral Reefs" theme. Flying is not exactly good for reefs.

Paying the price for our sins

A marked wave of climate change mindfulness seems to have washed over us in 2018 along with a heightened awareness of the issues with plastic pollution in the oceans. Neither of these issues are exactly new, but these subject matters have filled much of the public discourse like never before.

Households are cutting back on meat consumption, doing more recycling, ditching single-use plastics, and embracing a more responsible lifestyle as if it were the hottest new fashion—so much so that Collins Dictionary selected "single-use" as its word of the year.

All good, but we still travel more than ever before. And, for some reasons that appear to have something to do with the psychology of buying behaviour and the emotions that the consumer goes through, we still just do not seem to be buying into any of those carbon off-setting schemes offered when booking a flight, despite the massive CO_2 footprint.

The EU has reached an agreement on a single-use plastic ban, and 127 of the UN's 192 members have implemented some type of policy to regulate plastic bags, which, in conjunction with the aforementioned changes in consumer behaviour, will hopefully result in less plastic ending up in nature.

But only select countries have adopted any taxes on aviation for environmental purposes, and international measures to effectively put a price on carbon for the emissions of all flights have faced a range of political, commercial and legal challenges. In 2016, the International Civil Aviation Organization (ICAO) adopted a program called the "Carbon Offsetting and Reduction Scheme for International Aviation," but the scheme is still under development and has been widely criticised for its lack of ambition in relation to the Paris Climate Agreement goals.

For the time being, it is thus left up to you and me to make a personal choice and also buy carbon offsets when we absolutely must fly. And fly we must if we are not going to restrict ourselves to just diving off the local beach or in a nearby quarry. Most of the awesome destinations and amazing encounters with wildlife that we feature in this magazine cannot be reached without going on a plane. As a dive magazine, we could choose to just focus on these locations and the enriching experiences they offer, turning a blind eye to carbon emissions resulting from our beloved pastime. But as environmentalists and concerned citizens, we cannot stick our heads in the sand.

I had been agonizing quite a bit over how to resolve this inherent conflict when I came across how one of the daily newspapers dealt with the issue in regards to their own travel section and destination reviews: It made it a policy to shift to other means of transportation whenever possible, and when left with air travel as the only practical option, carbon offsets had to be purchased too. This policy applied to both staff and freelance contributors.

Going forward, we will do the same. Please join us and make sure carbon offsets are either already included in your fare or are purchased on the side.

— Peter Symes
Publisher & Editor-in-Chief

ANA's Airbus 380 livery depicts green sea turtles.

News edited
by Peter Symes

from the deep

NEWS

Us and them

Dolphins comprehend sentences. Whales have dialects and communicate by complex songs. Fish can count, and their use of sound plays a significant role in feeding and reproduction. When they hunt, nocturnal predatory fish use calls to stay together while those active during the day use calls to defend their territories.

Still more studies have shown that fish are capable of all the types of cognition found in primates—with the possibly sole exception of the ability to imitate. It has been demonstrated that fish feel pain and suffer. The evidence, as a whole, indicates that fish are sentient and possibly self-conscious. In other words, they are aware of the external environment and of their own internal emotional states.

Crustaceans too feel and remember pain and will learn from experience. Research into the behaviour of shrimps exposed to the antidepressant fluoxetine, showed that their behaviour is dramatically affected. Even nudibranchs have sleep cycles. And the list goes on.

There is no telling how far down the list of life forms we have to go before we find creatures which are "not thinking" or "not feeling." In fact, plants that do not even have nervous systems also respond to stress with a decline of one or several physiological functions, and as a consequence, their vitality declines.

The old dangerous idea that lifeforms we may encounter in nature, in particular lower ones, cannot suffer in various ways, and therefore we can treat them as we see fit or for entertainment must therefore be buried very deep underground. Fear and anxiety are indispensable defense reactions for the survival of animals, and have been relatively well investigated among various emotions.

Often, we stress or hurt animals just out of ignorance, and despite the best of our intentions, when we approach them too closely or even handle or disturb them during sensitive times, we are spooking them during resting, breeding or rearing. Cameras are poked in the faces of seal pups and turtles trying to nest; selfies are taken and flippers yanked.

PETER SYMES

Interaction with wild animals can be an exhilarating experience but let it happen on the animals' own terms.

Ignorance is most certainly not bliss. It puts wildlife, and in some cases ourselves, in harm's way because we are too ignorant to read the body language of an animal that feels threatened. Or we just profoundly affect their wellbeing and chances of survival.

Instead of rambling about like the proverbial bull in a china shop, we should rather pursue a wider understanding of other species. A door will then open not just to a deeper appreciation of the wonders of wild nature but also to our own roles in life. ■

The water anole, a small Central American lizard, may use a "scuba tank" bubble of air to respire when underwater.

(This screenshot image from Youtube is clickable and linked to a video on YouTube.)

Lizard goes diving with an air "tank"

The water anole (*Anolis aquaticus*) seems to be able to breathe underwater by using a bubble of air trapped on its nose.

Bubble on the nose

This extraordinary behaviour has been observed and filmed for the first time by ecologist Lindsey Swierk of Binghamton University, New York. "They are probably extracting lower concentrations of oxygen every time they're respiring the air bubble, but it might just be enough to keep them underwater for long enough that they can escape a threat," she said. Even though the bubble is relatively large, it remains attached to the lizard's head rather than floating off to the surface.

The bubble only remains in place for a second before the bulge completely disappears. This process repeats every few seconds as inhalation and exhalation of the air bubble allows for some exchange of fresh air among these air pockets.

Several aquatic insects and spiders have special adaptations —some hairy protrusions or other texture, combined with a hydrophobic or waxy coating—that allow them to trap a layer of air, called a "plastron," to breathe underwater. In some cases, it has been shown that these bubbles actually function as gills—oxygen diffuses into the bubble from the surrounding water while carbon dioxide diffuses out. Whether this is also the case with the lizard, it being much larger, is another question.

Diffusion?

In moving water, such as the stream in which this lizard lives, there may be some re-oxygenation of the bubble air by diffusion from the water. In the absence of significant gas exchange between the water and the air bubble in between breaths, the bubble trick could also be a way of suppressing a breathing reflex in the lizards.

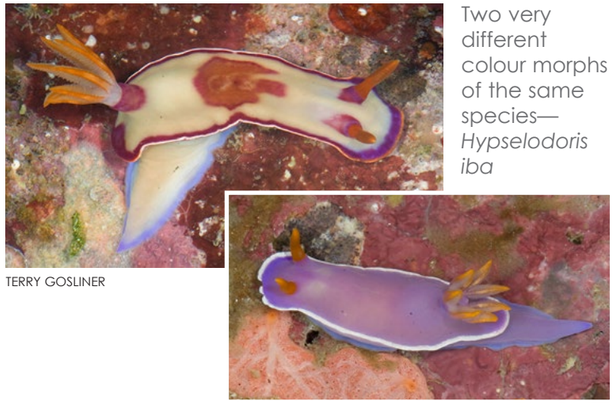
There may be alternative explanations, and a diving duration of 16 minutes does not seem too long, taking into account a dive response, the lower temperature and lower metabolic rates of reptiles and a high anaerobic capacity indicated by lactate accumulation. ■ SOURCES: ANOLE ANNALS, NEW SCIENTIST

Lots of new species of nudibranchs discovered

Researchers from the California Academy of Sciences have described 17 new-to-science sea slugs and also identified a number of distant relatives that have independently evolved the same color pattern—a first-ever genetic confirmation that color mimicry is widespread in the sea slug world.

When we find an anomaly in color pattern, we know there's a reason for it," says Hannah Epstein, researcher at James Cook University in Australia. "It reveals a point in evolution where a selective pressure—like predation—favored a pattern for camouflage or mimicking another species that may be poisonous to would-be predators."

One such color anomaly was revealed in *Hypselodoris iba*, a species that crawls across Indonesian reefs in two strikingly different color patterns: one lavender with a white stripe, and one cream with a lavender stripe and orange spots. The two were thought to be different species until a diver took a photograph of them mating. The lavender version of *Hypselodoris iba* looked strikingly similar to another purple species common to the region, *Hypselodoris bullocki*. Genetic data later proved that the different-colored individuals represented the same species.



Two very different colour morphs of the same species—*Hypselodoris iba*

When two different species like *H. iba* and *H. bullocki* present in the same color, the simplest explanation is that they share a common ancestor. These two species, however, are pretty far apart on the family tree; the more likely explanation for their similar appearance is that they reside in the same geographic region where being purple is advantageous for avoiding predators, either as camouflage or a warning of distastefulness. ■ SOURCE: CALIFORNIA ACADEMY OF SCIENCES

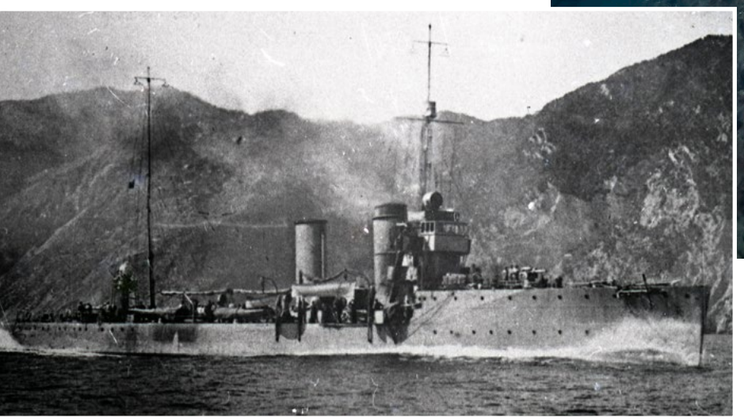
Diver on wreck of the WWI Italian scout cruiser *Cesare Rossarol,* which sank in 1918 at Lisignano in Croatia

Centenary of the Rossarol Wreck

1918 - 2018

Text by Cesare Balzi
Photos by Marcello di Francesco

The waters of Istria in the Adriatic Sea are littered with ships from the First World War and one of the best known is that of the *Rossarol*, sunk on 16 November 1918. Divers from many parts of Europe have developed a project to remember the tragic episode and safeguard the integrity of the wreck.



Historical photo of Italian scout cruiser *Cesare Rossarol*

History

The Italian scout cruiser *Cesare Rossarol* was a Poerio-class ship built at the Gio. Ansaldo & C. shipyard in Sestri Ponente. Entered into service on 1 August 1915, the *Rossarol* was actually a slender destroyer, 85m long and 8m wide. Her main armament comprised six cannons 102/45 and four torpedo launch tubes. With a displacement of 1,235 tons at full load, the *Rossarol* was able to reach a maximum speed of about 32 knots.

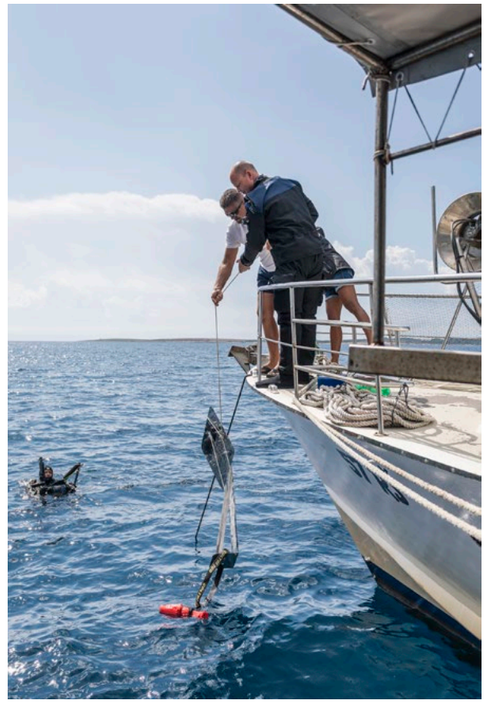
During the First World War, the *Rossarol* successfully carried out several missions in the Upper and Lower Adriatic, taking part in various combat actions, laying down mines and escorting armored units. Her tragic

wreck rap

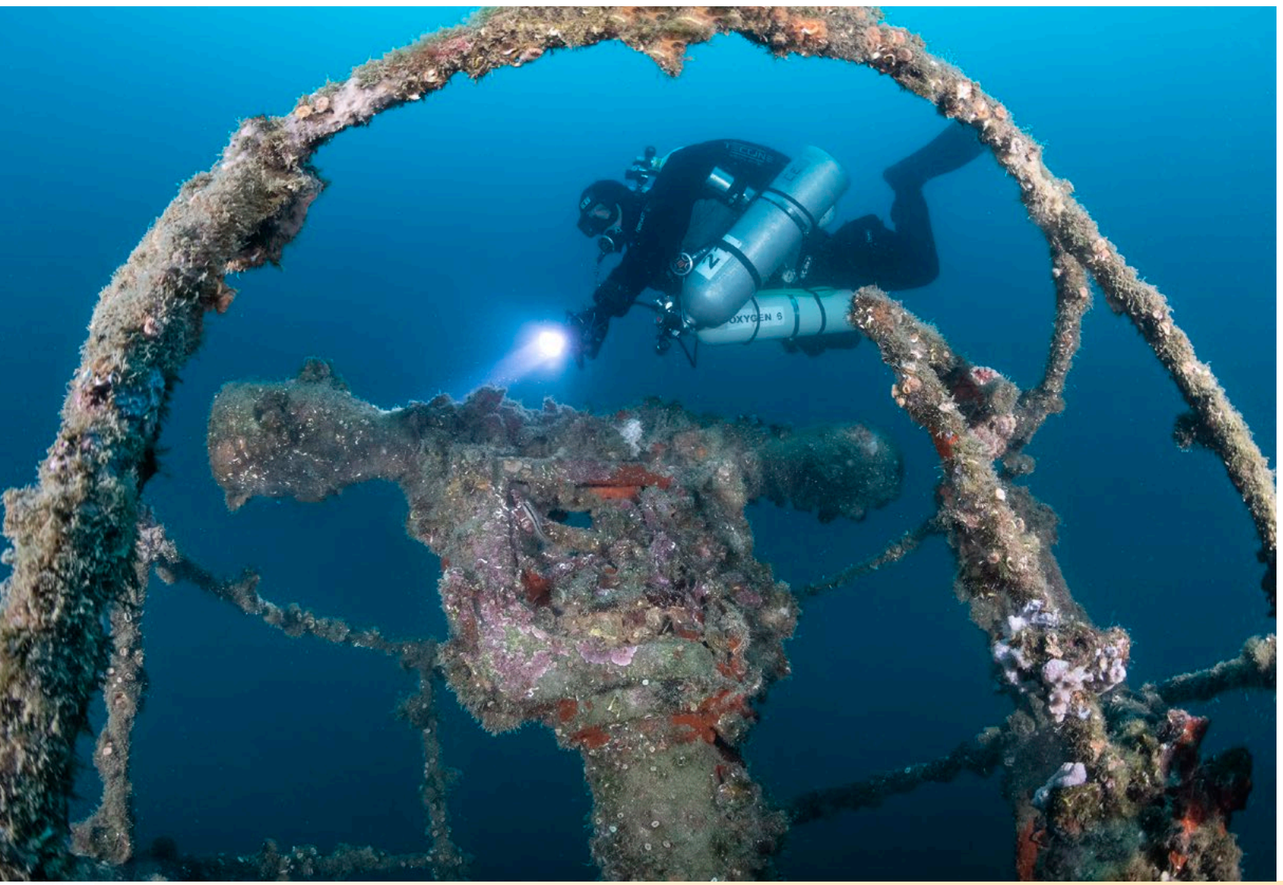
loss came when the Great War was already over.

At 11:40 a.m. on 16 November 1918, a few days after the signing of the Armistice that sanctioned the end of the war, the *Rossarol* dropped her moorings at the port of Pula in Croatia in order to transport a Serbian officer to Rijeka who was supposed to convince the Serbian-Croatian irregular forces not to oppose the Italian occupation of the city.

Part of the commemorative events that took place on the centenary of the sinking of *Rossarol* was the placing of a memorial plaque on the wreck site, seen here being lowered to the dive team (right); Gun on the deck of *Rossarol* (far right); GUE divers prepare for dive on *Rossarol* (lower right); Diver on wreck of *Rossarol* (below)



After about an hour of navigating the sea, the ship hit a mine less than a mile from the coast, at the mouth of the harbor to the town of Lisignano, and the violent explosion broke the hull into two. According to witnesses at the time, the *Rossarol* sank quickly. The stern reared upright in the water before sinking, while the prow continued to drift until it finally disappeared, swiftly swallowed by the waves.



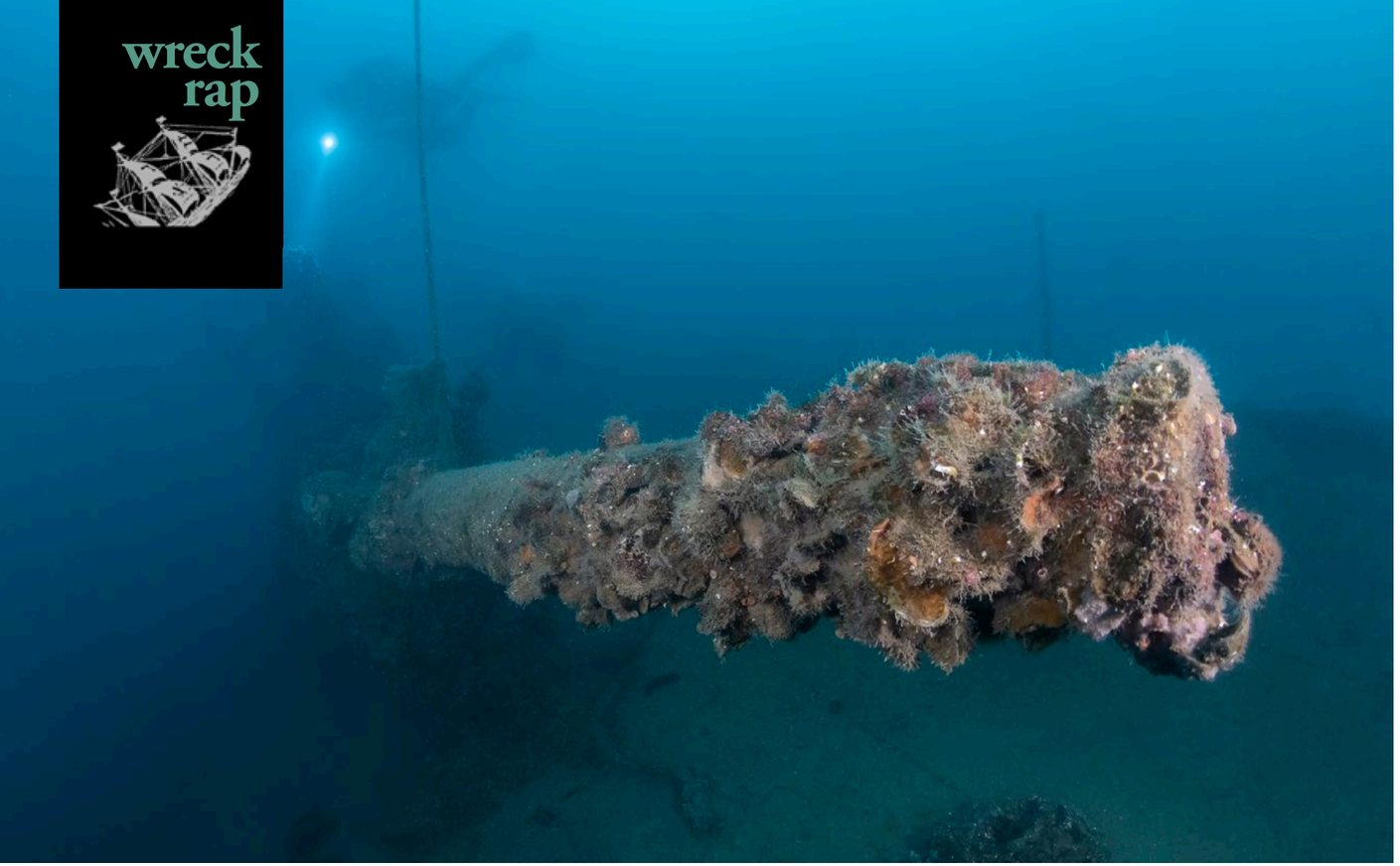
In the sinking, 100 men perished, including seven officers, as well as 93 non-commissioned officers and sailors, including the captain and commander of the vessel, Ludovico De Filippi, who was born in 1872 in Turin and decorated with the Silver Medal for Military Valor (Medaglia d'Argento al Valor Militare). Only 34 men managed to survive the sinking, rescued by other naval units.

Today, the wreck of the *Rossarol* rests on the sea floor at a depth of 49m. The stern, about 50m long, is tilted to one side, while the forward section is 336m away in an inverted position.

The project

Since 2014, divers of Global Underwater Explorers (GUE), in collaboration with Maurizio Grbac of Krnica Dive Center, have been carrying out a historical, cultural and scientific project on this wreck. The project—which is supported by Santi Diving Equipment, Tecline Diving and K01—has several objectives, including bringing the historical event to light, studying the location of the wreck, and safeguarding its state of conservation.

The results of the project were presented on 4 September 2018, as part of a press event in Krnica that hosted representatives from Austria, Finland, Germany, Italy, Norway and Sweden. The event was organized by the Tourism Agency of Istria and the Altum Mare association of dive centers, in collaboration with the Croatian National Tourist Board, the Lisignano Tourist Office, the Diving Network Ltd and the Krnica Dive Center. Unveiled at the event was a new website dedicated to the shipwreck(*Rossarol*.krnica.com). Here, one can find historical information, underwater images and annual reports about the wreck



and the project, as well as 3D reconstruction models of the two parts of the wreck.

Commemoration

Since the beginning of 2018, Istrian institutions have been keen to raise public awareness of the *Rossarol* affair, organizing a series of events marking the centenary of the shipwreck. In addition, there was no lack of commemorative dives to the wreck, one of which saw several GUE divers from the Netherlands, Germany, Italy and the Czech Republic placing a plaque near the wreck.

The day of the dive to place the plaque began with a briefing held by project leader, Jeroen Veltrop, who illustrated the procedures for connecting the stainless-steel plate to a concrete base, which had been placed on the sea bottom at the wreck site the day before. At the end of the Veltrop's briefing, the team—which included Peter Zaal, Berry van Leeuwen, Mathijs Geenen, Barend de Lange, Nicole Heuer, Joseph Chroust, Giovanni Grieco and Luca Palezza—performed the dive, with underwater photographic documentation of the event captured by Alex Dawson and Marcello Di Francesco.

The staff of Krnica Dive Center prepared the gas mixtures—trimix 21/35, EAN50 and oxygen—which were ideal for this dive to the stern area of the wreck at a maximum depth of 49m. As a diver, I know this wreck very well and feel connected to it in large part because I have been using it as a training site for IANTD courses since 2008 and because I have documented the wreck site in the past. For more information (in Italian), see: https://www.scubaportal.it/il-relitto-del-rossarol-da-prora-a-poppa-con-dpv.html. ■

Rossarol monument at Liznjan in Croatia (above); Diver at canon on *Rossarol* wreck (top left)

The *Bonhomme Richard*, 1779. Copy of artwork by F. Muller, 1883

Wreckage of US Revolutionary warship Bonhomme Richard finally found —just off the beach in Yorkshire

Previously believed to be some six miles out to sea, explorers now say the site is walkable from the beach and visible from the cliffs above.

The Revolutionary War vessel *Bonhomme Richard* was one of the US Navy's first commissioned fighting ships. Captained by the legendary John Paul Jones, the 42-gun frigate was a gift from France originally named *Duc de Duras*. On 23 September 1779, *Bonhomme Richard* engaged in fierce combat with HMS *Seripis* during the Battle of Flamborough Head off the English coast. Although emerging victorious from the battle, *Bonhomme Richard* was irreparably damaged, and, despite all the efforts to save the ship, sank into the North Sea on 25 September 1779.

The clash is also immortalized in a famous quote from Jones. During the closing stages of the battle, *Bonhomme Richard's* mast was hit above the top-sail, sending a large section of the mast and the ship's Colors crashing to the deck near Jones's feet. "Serapis called out, 'Have you struck your Colors?' Resoundingly, John Paul Jones exclaimed, 'Struck Sir? I have not yet begun to fight!'," according to US Navy.

Years of search

Its location had been a mystery for decades and American explorers have over the years spent an estimated $200m on trying to find what is left of *Bonhomme Richard*. Since 2005, US Naval History and Heritage Command has collaborated on several surveys in search of the remains of the *Bonhomme Richard* in the North Sea, but none of them were successful. One season's attempts to locate and retrieve the ship, or some artifacts from her, using USNS *Grasp* were even filmed for the Discovery Channel's *Mighty Ships* series, which aired in 2011.

A walk from the shore

Then at long last, in the fall of 2018, the remains of the *Bonhomme Richard* were found off the coast of Filey, North Yorkshire, England, by the Land and Sea search team Merlin Burrows, a marine archeology firm based in Harrogate, which has now registered the site with the Government receiver. The revelation has set off a scramble to claim the land for tourism, with the lucrative US market in sight.

"It's one of the most significant elements that make up the founding history of the of the USA, and it's right on our doorstep," Bruce Blackburn, chief executive of Merlin Burrows, told the Yorkshire Post. "It's not where everyone thought it was going to be. We have made a brand spanking new determination of where the wreck is actually located.

"You can walk out on to the wreck from the shore. You can literally go to the beach and look in the water and see where it is. And you can go on the cliffs and look down on it and see the shadow's outline. The question for the community is, who owns the land and who will build a visitor centre on it." ■ SOURCES: THE YORKSHIRE POST, BBC, US NAVY

Link A short interview with Merlin Burrows CEO Bruce Blackburn by Radio Humberside on the discovery of the Bonhomme Richard.

Screenshot from video of the finds on the wreck. Click on image to visit video on Reuters.

400-year-old shipwreck found off Portugal

Archaeologists in Portugal have discovered off Lisbon a 400-year-old shipwreck they describe as the most important underwater find in the country for two decades.

The wreck of the still-unidentified vessel was found at the beginning of September by a team of experts surveying an area of sea around the mouth of the Tagus River, which runs through Lisbon and past the fishing port of Cascais, about 15 miles west of Lisbon. The Minister of Culture, Luis Mendes, said the area was considered a "hotspot" for wrecks. The wreck site, which sits about 12m below the surface. Historians explored the wreck, which about 100m long and 50m wide, and took notes of their findings.

Video footage shows the wreck found almost perfectly preserved 40ft below sea-level off the coast of Portugal. The clip shows spices, ceramics and cannons engraved with the country's coat of arms.

It is believed the ship was returning from India when it sank sometime between 1575 and 1625, which was the height of Portugal's rich spice trade with Asia. Aboard the ship divers found spices, including pepper; Chinese ceramics from the period; and cowries, a type of shell used as currency for the slave trade in some parts of Africa at the time.

The project's science director, Jorge Freire, called it the "discovery of the decade." The find comes as part of a 10-year archaeological project supported by the town of Cascais, the Portuguese government and navy, and Nova University in Lisbon. ■
SOURCES: REUTERS, BBC

The World War I US Navy cruiser *San Diego* was sunk as a result of enemy action off the coast of New York on 19 July 1918. The USS *San Diego* is still residing largely intact—rusting but well-preserved—in approximately 35m (115ft) of water, albeit upside down.

USS San Diego sunk by mine laid by German U-boat, US Navy study finds

In July 1918, the 15,000-ton armored cruiser *San Diego* sank off Long Island, New York, after being hit by an explosion. Until now, no one was actually sure what caused the explosion. German submarines had mined the coast, implicating a mine. But the ship's captain was perplexed that the explosion occurred aft of the ship's widest point, which gave rise to the notion that the explosion might have been caused by a torpedo even though no submarine or torpedo trail had been spotted. Other theories suggested a coal bunker explosion or sabotage.

"A dull heavy thud"

"The explosion felt like a dull heavy thud," Captain Harley Hannibal Christy, commander of the USS *San Diego*, wrote in a naval inquiry commissioned shortly after the warship sank. He had been standing on the bridge of the ship, on a clear day with light winds. After the blast, the commander directed the ship's gunners to "open fire on anything resembling a periscope." Between 30 and 40 rounds were fired, in case an enemy submarine was nearby. The captain was aware German U-boats may have operating in the area. As the ship began to sink, Christy ordered the crew to pile into life rafts and dinghies.

3D maps

To commemorate the 100th anniversary of the loss of *San Diego*, the only major US warship sunk in World War I, a two-year project by the US Naval History and Heritage Command was launched in 2017, with the aim of mapping the wreck, assessing the wreck's state of preservation, modeling its sinking and uncovering the cause that likely sank it.

The researchers used information from the underwater vessel to create high-resolution 3D maps of the wreck. They modeled impact and flooding scenarios to analyze how the ship might have been attacked.

It wasn't a torpedo

The flooding patterns were not consistent with an explosion set inside the vessel. The hole did not look like a torpedo strike. The underwater explosive hit an unguarded lower part of the ship, where the hull was only about a half inch thick, said Nahshon. Had it struck the warship's armored band, the 5-inch thick steel plating would have minimized the impact.

"Studying sunken military craft offers researchers a glimpse into the lives of the sailors who served in them, as well as the Navy and the nation they served," said NHHC's Underwater Archaeology Branch Head Robert Neyland, Ph.D. "We believe the modern remote sensing and interpretive tools at our disposal now will help our understanding of the site." ■

SOURCE: US NAVAL HISTORY AND HERITAGE COMMAND

The 19th-century steam yacht *Eira* was detected 18m under the Arctic Ocean using sonar. She was found near Cape Flora in Novaya Zemlya—also known as Nova Zembla, an archipelago in the Arctic Ocean in northern Russia.

Historic shipwreck found by divers near North Pole

A shipwreck found near the North Pole has been confirmed as the remains of the *Eira*, a British vessel belonging to Benjamin Leigh Smith that sank in 1881 after being crushed by ice floes.

The ship was only located in 2017 when video cameras spotted an object just about as large as the *Eira* on the seabed near Cape Flora, an island just 550 miles from the North Pole, which Smith named after his cousin. Divers trained for six months to reach the wreckage at a depth of 18 to 20m, with water temperatures ranging between zero and minus one degrees Celsius; and in September, scientists from the Russian Maritime Heritage Open Ocean 2017 expedition made the 2,000 mile journey back to investigate further. The crew made a miraculous escape to safety nearly 150 years ago.

After the *Eira* sank, the crew built a shelter from driftwood, rocks and ship masts and somehow survived six months of total darkness and intense cold in the Arctic winter. Fortunately, some of the men were experienced hunters from the Shetland Islands, and the group lived by hunting seals, walruses and polar bears. The 25 men had to wait 10 months for the ice sheets to clear before they could turn salvaged tablecloths into sails for a new boat. ■

OWEN BUGGY/ROB SORRENTI

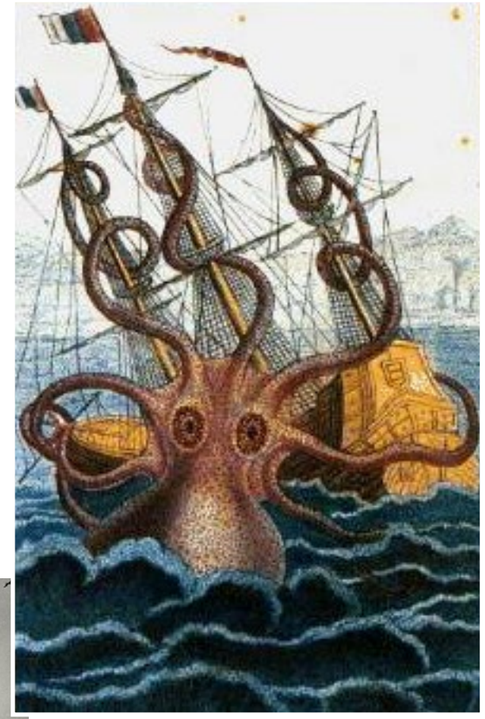
The *Kodiak Queen* on its way to its watery grave off Virgin Gorda, as if being dragged under by a mythical creature

The Kraken

Poem by Alfred Tennyson

Below the thunders of the upper deep,
Far, far beneath in the abysmal sea,
His ancient, dreamless, uninvaded sleep
The Kraken sleepeth: faintest sunlights flee
About his shadowy sides; above him swell
Huge sponges of millennial growth and height;
And far away into the sickly light,
From many a wondrous grot and secret cell
Unnumber'd and enormous polypi
Winnow with giant arms the slumbering green.
There hath he lain for ages, and will lie
Battening upon huge sea-worms in his sleep,
Until the latter fire shall heat the deep;
Then once by man and angels to be seen,
In roaring he shall rise and on the surface die.

In 1830, British poet Alfred Tennyson published the irregular sonnet *The Kraken*, which described a massive creature that dwelled at the bottom of the sea.



Painting by French naturalist Pierre Denys de Montfort, 1801, depicting the legendary Kraken as a cephalopod-like sea monster of giant size. Montfort proposed that ten British warships, which had mysteriously disappeared one night in 1782, must have been attacked and sunk by giant octopuses.

The *Kodiak Queen* started life as a military oil tanker named *YO44*. During the Pearl Harbor attack, it was filled with aviation fuel—a bomb waiting to go off. Somehow, she survived and was sent to work as a crabbing trawler in Alaska. It was here, working around Kodiak Island, that she got her name as the *Kodiak Queen*.

Kodiak Queen grabbed by the Kraken

In 2017, the *Kodiak Queen*—one of the few ships that survived the WWII attack on Pearl Harbor—was transformed into an underwater art installation and artificial reef off Virgin Gorda in the British Virgin Islands.

Movie buffs will know "The Kraken" from the *Pirates of the Caribbean* film series. It is a fictional, legendary, cephalopod-like sea monster depicted in various mediums like an octopus of gigantic proportions capable of drawing ships under. Authors over the years have postulated that the legend originated from sightings of giant squids, which may grow to 13 to 15m (40–50ft) in length. The giant squid (genus *Architeuthis*) is a deep, ocean-dwelling squid in the family *Architeuthidae*. It was proven to exist in 1857, but it was not until 2004, that Japanese researchers took the first images of a live giant squid in its natural habitat, and in July 2012, a live adult was first filmed off Chichijima.

Art-ificial Reef

Richard Branson and the Maverick 1000—a global network of philanthropists and artists—brought the *Kodiak Queen* to her final resting place on the ocean floor, off Virgin Gorda in the British Virgin Islands, to become an underwater art installation and artificial reef. The project was designed to inspire a generation of ocean lovers, encourage tourism and help children across the BVI learn to swim.

Hurricane Irma

On 6 September 2017, Hurricane Irma released its ferocious power across the Caribbean and Florida Keys. Irma left behind a trail of unimaginable destruction, devastating the lives of thousands of people. The 80ft art sculpture of the kraken was badly damaged during the storm. The dive, however, is still a fascinating one for the ship lays intact, upright on the sea floor and has become home to hundreds of varying species of marine life. And her purpose lives on as a platform for climate change, reef protection and inspiring a local community to be the next generation of ocean conservationists.

Documentary

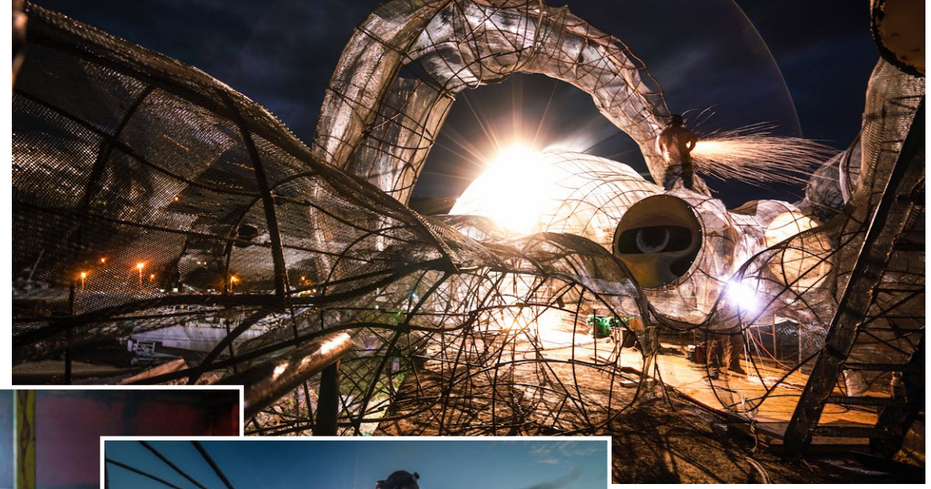
A documentary about the *Kodiak Queen,* voiced by Academy Award winner Kate Winslet, premiered at the Rhode Island International Film Festival in August 2018, where it won the Green Planet Award Grand Jury Prize. In this haunting and inspiring film, Winslet and filmmaker Rob Sorrenti take us on the incredible journey of the *Kodiak Queen*, and remind us of the momentous task ahead in restoring the British Virgin Islands. The documentary depicts nature's power, and its ability to both destroy and revive.

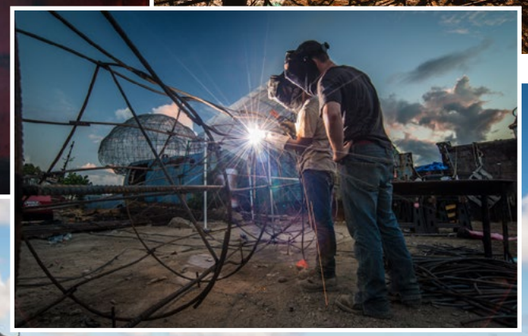
A hundred percent of donations will go towards protecting the beautiful BVI waters by supporting swim, snorkel and dive education programs for the local BVI communities.

Sir Richard Branson, Virgin Group Founder, said: "Rob has done a remarkable job with this documentary, capturing the spirit of this project brilliantly. The purpose of the *Kodiak Queen* was to give the BVI community a place to learn more about the ocean and also a protective habitat for precious sea life. We want this film to raise awareness of the challenges facing the BVI following Hurricane Irma and encourage more people to come and visit this magical part of the world." ■

wreck rap

All images this page by Owen Buggy





The *Kodiak Queen* was just another abandoned ship rusting away in a harbor in Tortola in the British Virgin Islands until it got turned into an underwater art installation, a recreational dive site and a marine life habitat.

Edited by
Scott Bennett

Inconsistencies of carry-on baggage allowances getting messier by the day

What to do with your camera gear? On the one hand, airlines instruct travelers to never check valuable items and put cameras, tablets, computers and the like in the carry-on. But then, at check-in, they make a right fuss about the weight of it. This mirrorless camera with a 24-70 zoom, which is a nice but not an overly massive lens, alone tips the scale at 1,325g or about 3 lbs.

Recent moves by Virgin Australia and Qantas to limit carry-on baggage to 7kg on domestic flights illustrates an on-going and concerning trend: the inconsistency of carry-on baggage allowances. Being a frequent traveller, this is a scenario I know all too well…

Airline check-in is easily the most stressful part of any trip. As a photographer with expensive photo gear, packing it in checked luggage is simply unacceptable. Arriving with damaged gear while on assignment (or worse, having your gear stolen) is simply not an option. All cameras and lenses must go as carry-ons, and do so in a regulation-sized bag which easily fits in the overhead compartment.

Yet, the rules seem to change like the wind direction, being not only at the whim of the airline but also the airline staff. As Forrest Gump famously said: "Life is like a box of chocolates; you never know what you're gonna get."

Qantas defended its recent move, claiming it will make the boarding process "fair" for all travelers, as many attempt to overload carry-on bags in order to avoid checking luggage. The airline claims injuries to cabin crews caused by closing overhead compartments crammed with heavy baggage.

Nothing but a cash grab

Many dismiss these arguments, claiming them to be nothing more than a cash grab. It is true that many do overstuff cabin baggage to avoid checked luggage fees. With additional fees mounting daily, one can hardly blame them. In my case, the bag weighs more than 7kg, but it does fit, and I do all the lifting.

However, it is the inconsistency of the rules that is the most frustrating aspect. Some airlines only weigh carry-on luggage if a passenger checks in at the airport rather than online, and each airline has wildly different allowance rules. According to British Airways' website, passengers are permitted one piece of hand luggage and one small item (handbag, laptop) on board. Hand luggage must not exceed 56cm x 45cm x 25cm, and the small item must be no bigger than 40cm x 30cm x 15cm. Both items can weigh up to 23kg each.

In contrast, Norwegian's recently enforced 10kg allowance carry-on encompasses a personal item as well as any tax-free purchases. This does not even consider the weight of the bag itself. Some roller bags can tip the scales at over 6kg before they are even packed. And then there is the issue of flying with multiple carriers on one trip, creating multiple hassles in the process.

Always check

The morale of the story? Always check and check EVERY time, as the same airline may have changed its policy since your last flight. This is but another example of airlines seemingly going out of their way to erode consumer confidence. In this day and age, one would think they would go out their way to entice rather than discourage. ■

San Diego

Gateway to Wreck Alley & Islas Coronados

Text and photos by Larry Cohen and Olga Torrey

LARRY COHEN

OLGA TORREY

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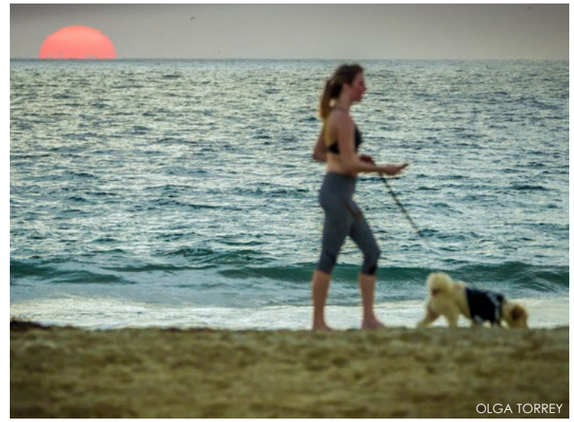
San Diego sunrise and sunset (right)



OLGA TORREY

Sailboats in San Diego (above). PREVIOUS PAGE: HMCS *Yukon* guns Great egret feeding (top center); Great blue heron (center)

San Diego, a major coastal city in Southern California, USA, has a thriving dive community. A number of well-known underwater image-makers and manufactures of dive gear are located in the San Diego area. Not only is there a wreck alley as well as shore and boat diving opportunities close to the city, Islas Coronados in Mexico is just 20 miles southwest of San Diego Bay.

Wreck Alley

The Yukon. San Diego's Wreck Alley is an area with intentionally sunken ships. One of the wrecks divers can find here is the HMCS *Yukon*, which was a Mackenzie-class destroyer that served in the Royal Canadian Navy (RCN) and later the Canadian Forces. She was named after the Yukon River that runs from British Columbia through the Yukon and into Alaska.

The ship entered service in 1963. The *Yukon* was mostly used as a training ship. Built on the west coast in North Vancouver, the *Yukon* was immediately transferred to the east coast. Based in Halifax, Nova Scotia, she remained on the east coast for a year, as part of the First Canadian Escort Squadron. The *Yukon* escorted Queen Elizabeth II aboard the HMY *Britannia* on visits to several Canadian port cities. She returned to the Pacific in 1965.

In 1970, *Yukon* sailed with sister ship, *Mackenzie,* and the auxiliary vessel, *Provider,* on a training mission throughout the Pacific. Working with several navies, the *Yukon* visited Japan.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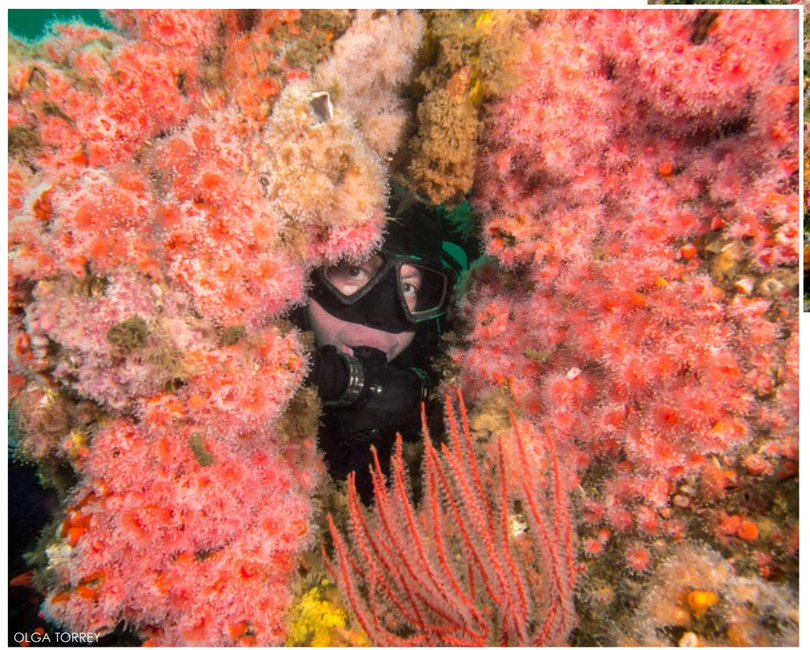
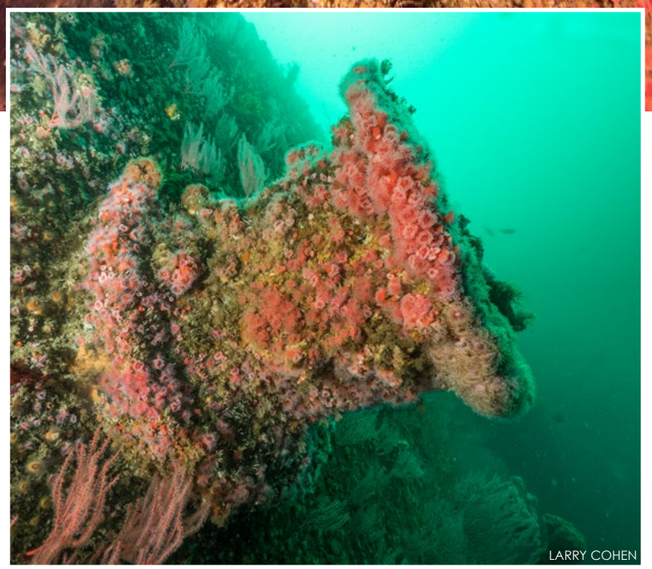

OLGA TORREY


OLGA TORREY

Larry Cohen (far left and left) exploring the interior of the HMCS *Yukon's* supper structure, covered with strawberry anemones (top center); California sheephead fish on *Yukon* (top right); Olga Torrey on bridge of *Yukon* (right)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Capstan on the HMCS *Yukon*

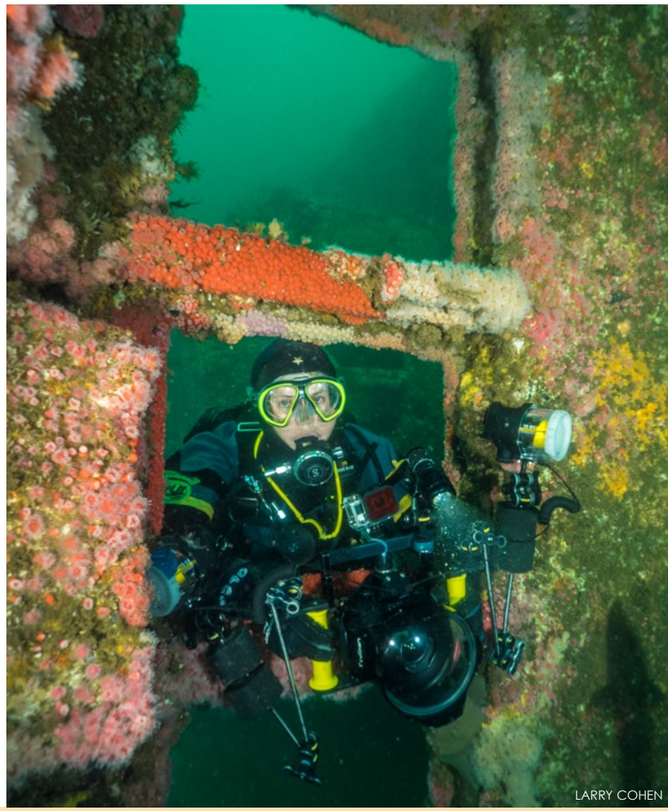
On 17 January 1983, the *Yukon* collided with the US aircraft carrier USS *Kitty Hawk*. She had slight damage and was repaired at the Burrard Yarrow shipyard at Esquimalt, British Columbia. In 1986, the *Yukon* was one of three Canadian vessels that took part in the Royal Australian Navy's 75th anniversary celebrations. On 3 December 1993, the ship was decommissioned.

Initially, the ship was supposed to be sunk by the Artificial Reef Society of British Columbia. She was anchored on the New Westminster docks for a year. She was then purchased by the San Diego Oceans Foundation and towed to San Diego in June 2000 to be sunk off Mission Beach. The night before she was supposed to be sunk, she surprisingly went down in rough seas.

The 111.55m (366ft) ship lies on its port side in 32m (105ft) of water. The deck is at 19.8-22.9m (65-75ft). The bridge, crow's nest, davits, twin 76mm (3in) gun turrets and smokestack are layered with colorful strawberry anemones, and clusters of majestic giant metridiums.

Visibility can vary. There are also large cut-outs so divers can penetrate safely. Sea life is abundant on this site. It is not unusual to see rockfish, perch, bass, lingcod, large sheep crabs, thorny sea cucumbers and California sheephead.

Ruby E. Another popular dive site is the *Ruby E*. This ship started life in the 1920s as the US Coast Guard cutter USCGC *Cyane*. She was a Thetis-class cutter that was 50.3m (165ft) long and had maximum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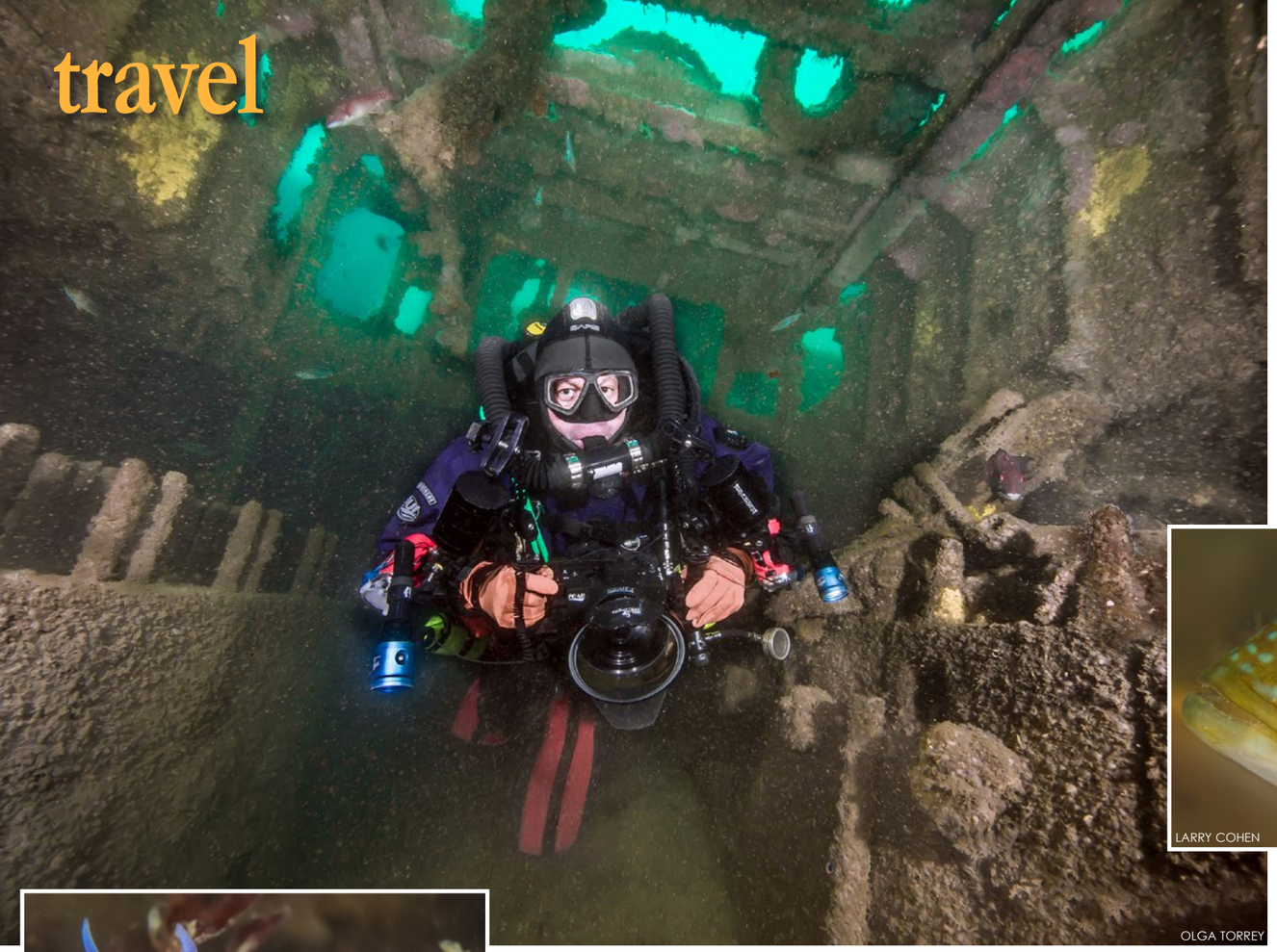
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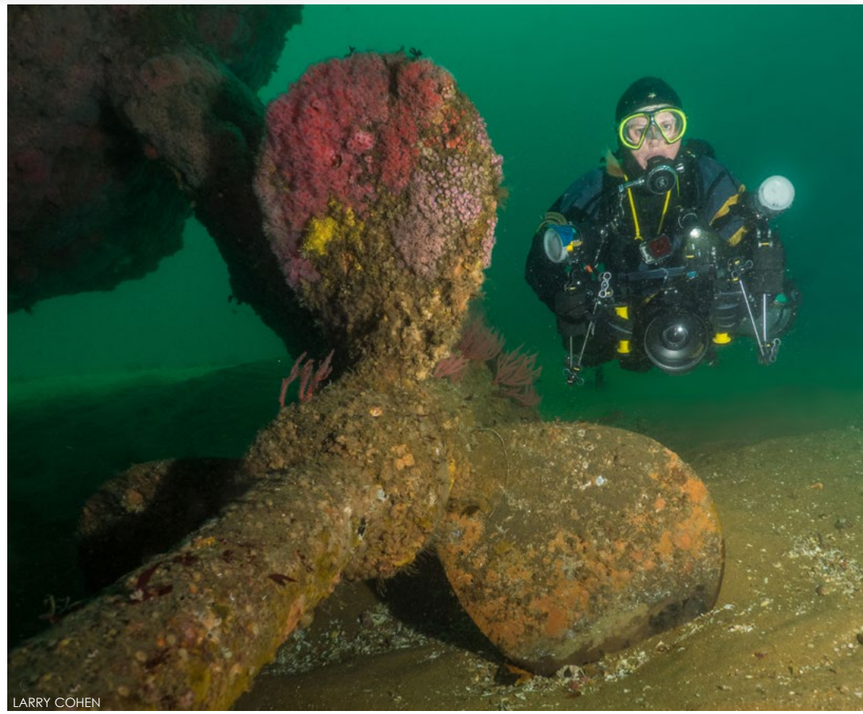
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THIS PAGE: On *Ruby E*, Cohen explores interior (left); kelp bass (above); Torrey at propeller (right); Spanish shawl nudibranch (lower left)


LARRY COHEN


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When visibility is low on Ruby E there are strawberry anemones to photograph

speed of 16 knots. She had a 4,828km (3,000mi) range and was designed to chase rumrunners during Prohibition. The ship was launched in 1934 after Prohibition was over and liquor in the United States became legal. Rumrunners still wanted to avoid paying import taxes and continued to smuggle liquor into the United States. Coast Guard cutters continued to pursue them and execute other missions.

The *Cyane* was based out of Ketchikan, Alaska, serving as a Bering Sea patrol boat during 1937 and 1938. In 1941, President Roosevelt transferred jurisdiction of the Coast Guard from the Treasury Department to the Navy. She was than converted to a subchaser. Armament was upgraded; this included sonar, depth charge tracks, anti-aircraft weaponry and a "Y" gun. The *Cyane* name was changed to the *WPC-105*. In 1942, the *WPC-105* helped remove the Japanese presence during World War II's Battle of the Aleutian Islands. In 1943, the crew published an anthology of prose, poetry, and songs called Cyanthology.

The ship was decommissioned in 1950. In 1954, the *WPC-105* was converted into a fish processing ship and renamed the *Can Am*. The *Can Am* was supposed to be fishing the waters of South and Central America. Instead she was used to smuggle drugs. She was caught and was impounded. This is an ironic twist of fate considering she was built to hunt rumrunners.

The *Can Am* was sold, renamed the Ruby E and was supposed to be used as a salvage ship. When the new owners defaulted on their loan, she was sold for scrap but was donated to become part of Wreck Alley.


LARRY COHEN


San Diego
OLGA TORREY

Torrey on *Ruby E* super-structure (left); Cohen at *Ruby E's* propeller (above)

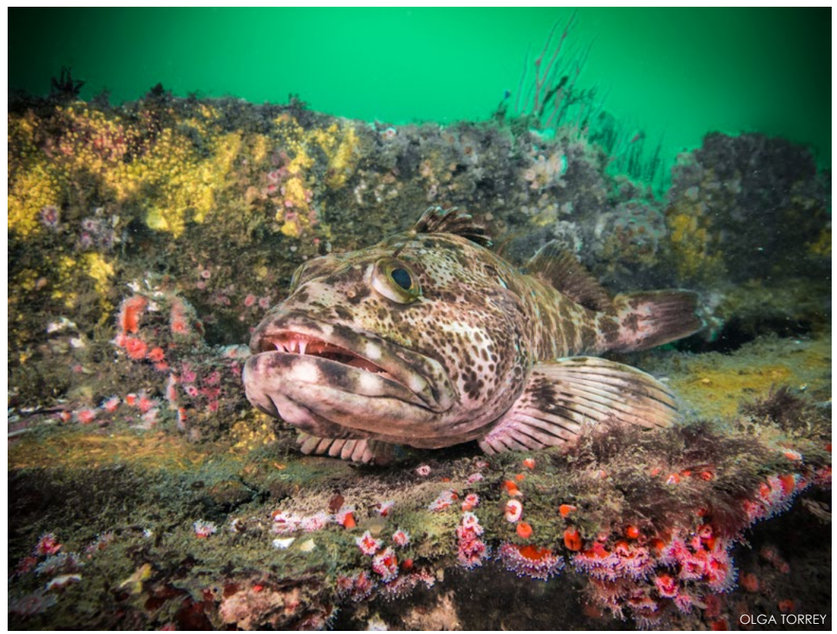
The fascinating story of this ship does not stop here. On 18 July 1989, the *Ruby E* became an artificial reef. She was towed off Mission Beach. The sea cocks were opened, and she was expected to sink. The ship stayed afloat with only a slight starboard list. As it turns out, there were two secret compartments fore and aft of the engine room. These sealed compartments were used to hide drugs during its smuggling days and now prevented the ship from sinking. Local lifeguards brought several large pumps onboard to speed up the flooding. Finally, the *Ruby E* slipped below the surface and landed upright in 25.9m (85ft) of water. The deck sits at 19.8m (65ft).

Visibility can be low, and it is not unusual for the current to be strong. Still the intact bow is a striking sight as it appears from the murky water. As you swim towards the stern, the deckhouse and pilothouse can be entered. In the stern, down by the sand, is the propeller and rudder. The wreck is completely covered with anemones and marine life. When the visibility is bad, there is still an abundance of tiny life to scrutinize. This includes a variety of nudibranchs.

El Rey. The *El Rey* is now an artificial reef of Wreck Alley. The ship traveled from Point Conception to Mexico, harvesting the kelp canopy within 0.91m (3ft) of the surface. Kelp is used commercially for toothpaste, shampoo, salad dressing, pharmaceuticals and other products.

The *El Rey's* bow is where the harvesting blades and kelp transport mechanism were mounted. The operator worked in a small booth on the bow. The superstructure that housed the crew was located on the stern along with the engine room and storage.

On the water for 35 years, the *El Rey* was also used to study marine life, assist other vessels in need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California Lingcod on the El Rey

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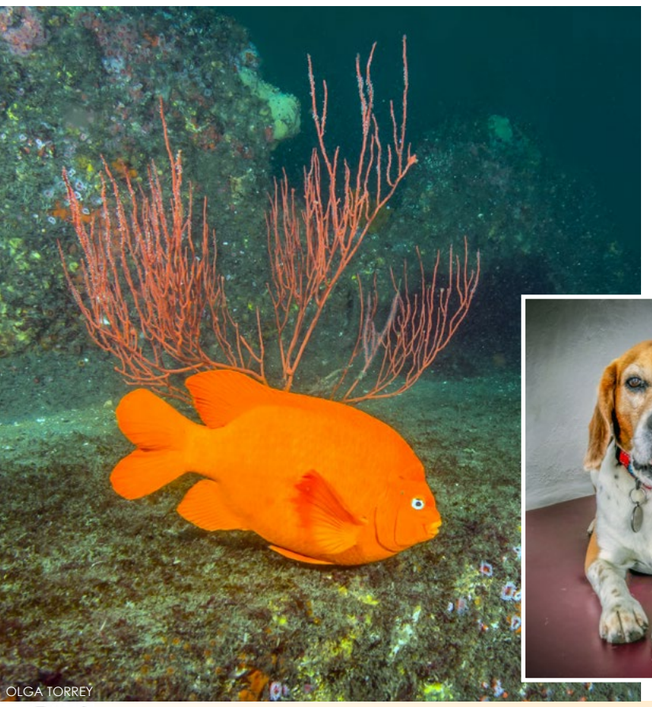
San Diego

THIS PAGE: On the Ingraham Street Bridge artificial reef, lush coral growth (far left), California sheephead fish (left), female California sheephead fish (below) and Garibaldi damselfish (lower far left); Captain, the beagle, on Marissa Dive Charters (lower left inset)



OLGA TORREY

OLGA TORREY

and occasionally recover bodies. The ship sailed 3,600 voyages and traveled more than 1,303,680m (810,000mi). In 1981, the ship was supposed to be scrapped. Instead, she was scuttled on 2 April 1987. The US Navy Demolition Team attached explosives to her hull, sending the ship to the bottom in 22.86m (75ft) of water.

The wreck is only 30.48m (100ft) long and much of the superstructure has collapsed. The wreckage is low-lying in the sand, but you can still see the distinctive kelp-cutting arm.

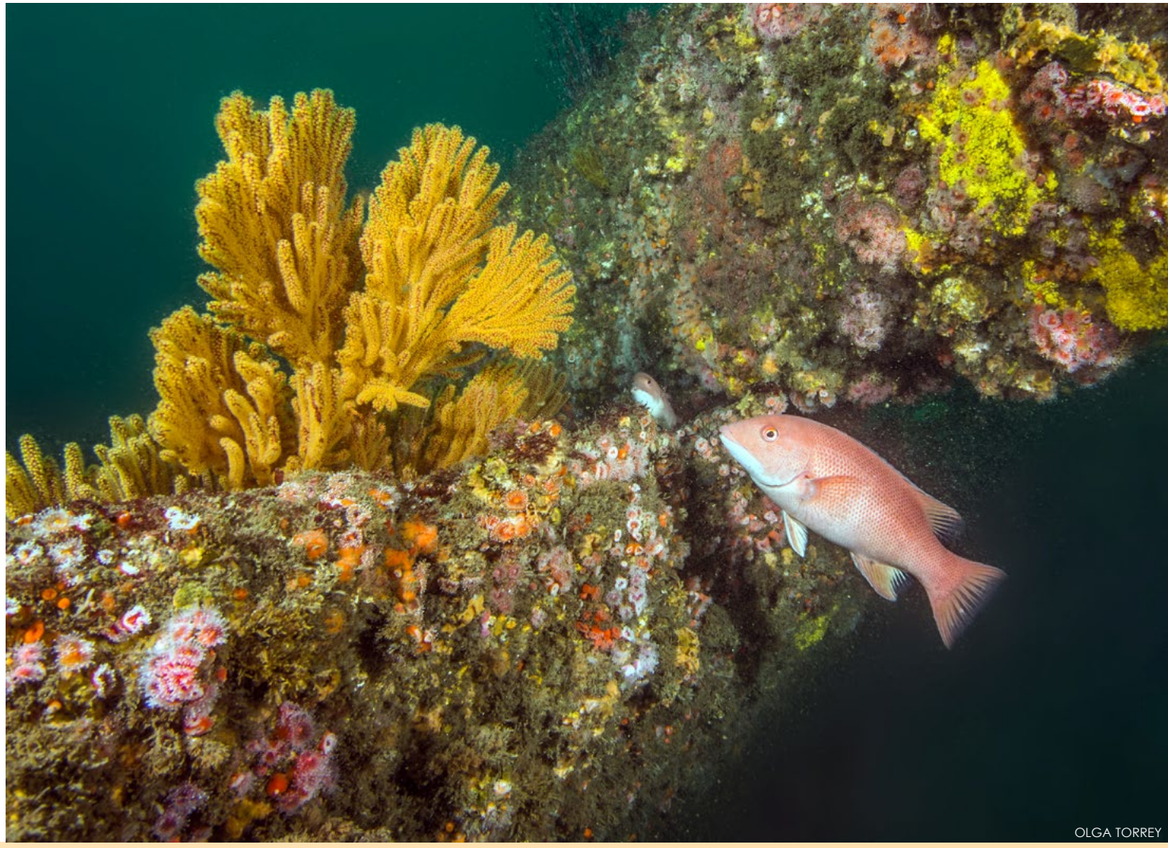
Ingraham Street Bridge. Not all the wreckage in Wreck Ally are ships. When Mission Bay was developed, and the old Ingraham Street Bridge was replaced, all rubble was taken out and scuttled in about 18.25m (60ft) of water. The structure is like a natural reef with kelp, fans and algae growing over which attracts a many fish.

Wreck dive operator

Wreck Alley is a short boat ride from the marinas in San Diego near Sea World. Marissa Dive Charters is one of the many boats that run to these dive sites. The 12.2m (40ft) Delta dive boat is rated for 24 passengers, but they take a maximum of 14. The experienced crew, including Captain Lora and divemaster Chris, run a safe and comfortable boat.

Breakfast and lunch are provided. There is a compressor on the boat; air, nitrox and other gas fills are available. Recreational and beginner divers will feel at ease on this dive boat, but the vessel also supports technical and re-breather divers.

Another crewmember who is always on the boat is the guest greeter: Captain, the beagle. Captain's job is to sit on divers' laps and look cute. He also alerts the crew and passengers



OLGA TORREY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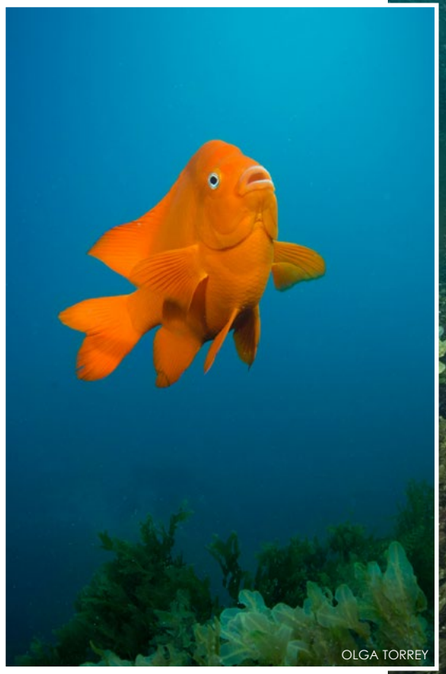
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San Diego

At Coronado Islands: brown rockweed seascape (left), Garibaldi damselfish at Lobster Shack (above), and Señorita wrasse (right)


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Spanish shawl nudi, Connor's Canyon Kelp Forest

by barking at sea lions, dolphins and other marine mammals.

Islas Coronados

Located southwest of San Diego Bay, the Coronados are a group of four islands off the northwest coast of the Mexican state of Baja California. These islands are barren and uninhabited except for a small military base and a few lighthouse keepers. The islands are only 12.9km (8mi) from the Mexican mainland.

The islands have an interesting history. Pirates used to visit the islands, including a pirate named Jose Arvaez. He used the bay as a base of operations. Later the bay was known as Pirates Cove and Smugglers Cove.

In the 1920s, Prohibition in the United States prevented people from drinking legally. US residents would venture across the border to Mexico's bars and casinos. Rumrunners smuggling liquor to US speakeasies would often use the Coronado Islands as a stop-off point.

In May 1943, L. Ron Hubbard commanded the U.S Navy's subchaser USS PC-815. He conducted unauthorized gunnery exercises and shelled the Coronado Islands. Hubbard claimed he thought the islands were uninhabited and belonged to the United States. The Mexican Coast Guard occupied the islands at the time. When the Mexican government complained, Hubbard was relieved of command. Later he became the founder of Scientology.


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Wildlife refuge

Today, the Coronado Islands are a Mexican wildlife refuge.


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Garibaldi damselfish (above) at Coronado Islands in Mexico; Sea cucumber and red urchins at Connor's Canyon Kelp Forest in San Diego (left)


OLGA TORREY


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THIS PAGE: California sea lions frolic underwater at Coronado Islands, just 20mi southwest of San Diego.


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The islands have colonies of gulls, pelicans, petrels and sea ducks. The largest known colony of the Xantus's murrelet is on the island. There are two elephant seal rookeries and harbor seals can also be found here.

For divers, the sea lion rookeries on the northernmost island is the place to be. In less than 12m (40ft) of water, hundreds of friendly sea lions will approach very closely and stare you in the eye. The hectic scene is fun and humorous but is also a little disconcerting. Underwater photographers have to work hard to get close to marine life. At times the sea lions of the Coronado Islands come too close to get a good photograph.

Dive charter boats require special licenses and Mexican immigration regulations require everyone to carry passports and a visitor permit that cost US$21. Private boats can get all the paperwork done online the night before.

The trip from San Diego to the Coronado Islands can be bumpy. Battered by wind and waves, sometimes the boat has to stay off the island and you have to swim in close to interact with the sea lions. It is best to swim on the surface and watch where the sea lions are sunbathing. As you get close to the island, descend and the sea lions will follow underwater and want to play.

Visibility can be 80ft (24.38m), and the water is slightly warmer than in San Diego. Still, the dive will be more comfortable if you wear a drysuit. Garibaldi and other fish can be seen among the kelp.

Topside attractions

Besides diving, San Diego has many attractions. The San Diego Zoo is considered one of the best in the world. The zoo, along with the San Diego Zoo Global Wildlife Conservancy, has been working to connect people and animals for over 100 years.


OLGA TORREY


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Ricardo Breceda serpent sculpture (above) in Anza-Borrego Desert State Park; Giraffe at San Diego Zoo (top left); Marbled godwit shore bird feeding (left)

The area around the marinas has many popular beaches. There are also wetlands and parks in this area with many bird species to observe.


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Anza-Borrego Desert State Park is about a two-hour road trip from San Diego. This is the largest state park in California. The park has 805km (500mi) of dirt roads, 12 wilderness areas and many miles of hiking trails. The park is named after Spanish explorer Juan Bautista de Anza and the Spanish word *borrego* (bighorn sheep). In the park, there are sweeping vistas with wildflowers, palm groves and cacti. It is possible to catch a glimpse of roadrunners, golden eagles, kit foxes, mule deer and bighorn sheep. Iguanas, chuckwallas and the red diamond rattlesnake are also common.

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Location of San Diego, California, on map of United States

The town of Borrego Springs is the only California town that is completely surrounded by a state park. Besides being an official International Dark Sky Community, dedicated to protecting the night sky from light pollution, it is home to around 130 rust-red, scrap-metal sculptures by artist Ricardo Breceda.

Ricardo Breceda was born in Durango, Mexico, but moved to Borrego Springs, California. He made a metal sculpture of a tyranosaurus rex for his daughter. She asked for a dinosaur after seeing the movie Jurassic Park III. He continued working on sculptures, and was eventually discovered by philanthropist Dennis Avery. Avery paid Breceda to construct sculptures in the Anza Borrego Desert. Driving through the barren monotone landscape it is extraordinary to spot sculptures of dinosaurs, elephants, scorpions, grasshoppers, a large serpent and other animals and mystical creatures.

Afterthoughts

Whether you want to dive wrecks, photograph wildlife or swim with curious seals, San Diego is a great place to experience all of these adventures. You will gain insight into local history and culture while enjoying the cuisine along the US-Mexican border. With quality dive and tour operations serving the various attractions to be found in the San Diego area, there is something for everyone above and below the waves. ■


OLGA TORREY

Ricardo Breceda horse sculptures (above) and elephant sculptures (top right) in Anza-Borrego Desert State Park

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, please visit: ***Liquidimagesuw.com*** *and* ***Fitimage.nyc****.*

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North Carolina

Wrecks & Sharks

Text and photos by
Larry Cohen & Olga Torrey

OLGA TORREY

North Carolina


LARRY COHEN


OLGA TORREY

The waters off the coast of the US state of North Carolina are treacherous. Bad weather, rough seas, heavy current and inlets that are difficult to navigate are common. So why do underwater explorers consider this area to be a world-class dive destination? Because when you do get offshore, it is extraordinary.

Visibility varies but can be more than 30m (100ft). The best diving conditions are between June and October, with late June to early August being the best.

Because of the sea conditions and the German "artificial reef program" of World War I and II, this area is nicked-named the "Graveyard of the Atlantic." More than 1,000 vessels have been confirmed in the shipwreck inventory conducted at the Outer Banks History Center on Roanoke Island. There are many more wrecks that have not been discovered or identified yet. Many of these wrecks are in diveable waters.

History

Since early colonial times, the North Carolina coast has been a shipping lane


LARRY COHEN

Diver on wreck of *W.E. Hutton*, formerly known as *Papoose* (above); View of the sea from Fort Macon State Park on Bogue Banks, North Carolina (top left); Great white egret in the Theodore Roosevelt State Natural Area (left). PREVIOUS PAGE: Sand tiger shark on wreck of the *Atlas*


OLGA TORREY

Manta ray makes a rare appearance on the wreck of *Caribsea*.

between northern US ports and the southern United States. Ships traveling to and from the United States to Europe, South America and Central America pass through these waters. Before better weather forecasting, radar, sonar, LORAN, GPS and other technical breakthroughs, ships sinking due to collisions and environmental conditions was common.

War caused many ships to vanish. More than 60 vessels were lost during the Civil War. At least 15 disappeared under the waves in World War I, and approximately 90 more were lost in less than a three-year period during World War II.


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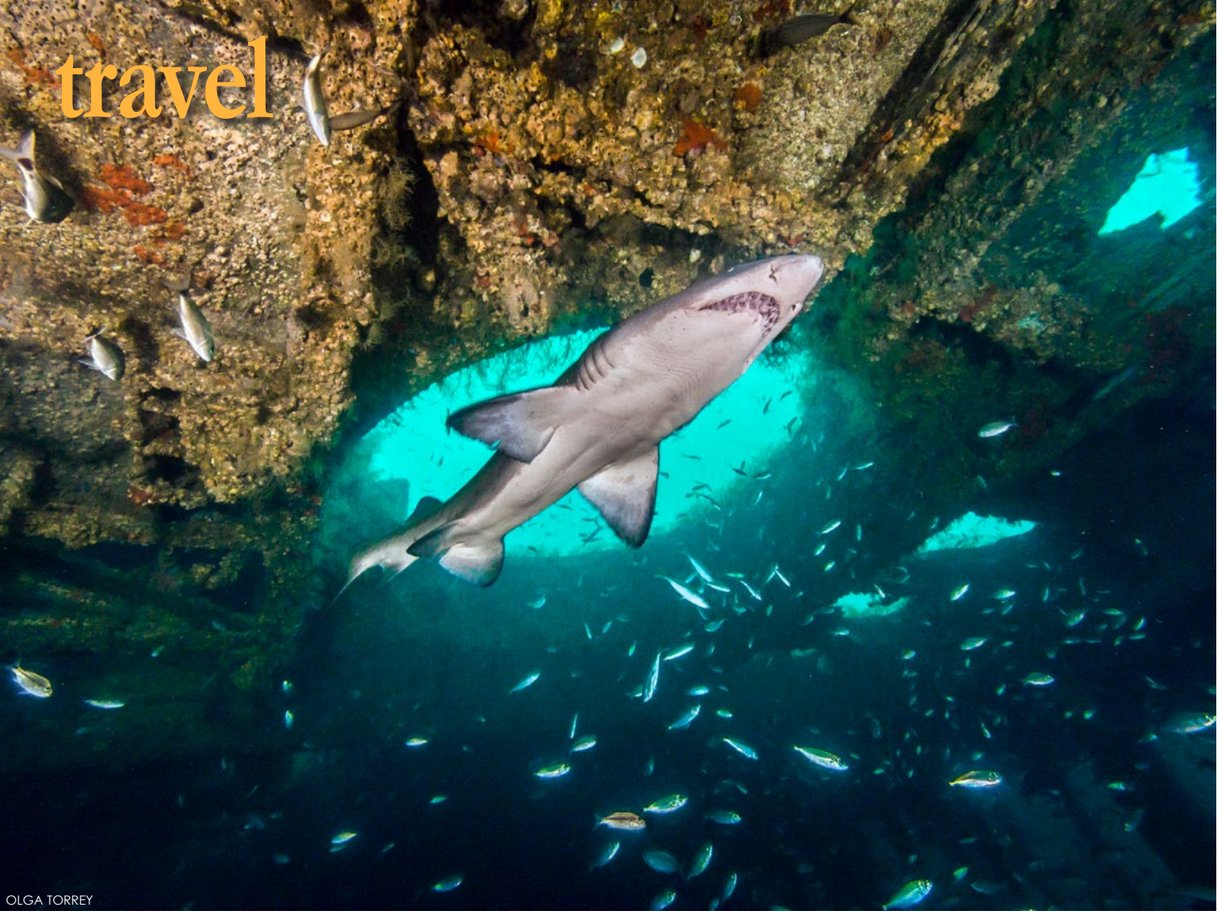
Sand tiger shark on *Caribsea* wreck

All of these wrecks are now time capsules. Time stopped when they slipped below the waves. Now divers can explore these sunken museums. Besides the historic ships, the North Carolina Division of Marine Fisheries scuttled 42 ocean artificial reefs. The ships were sunk on purpose to attract marine life, and some of them have an interesting history.

Marine life

All of these structures are home to some astonishing marine life. Cold water, which flows down the coast from the north, collides with the warm Gulf Stream current, coursing up from the Caribbean. Both currents bring in their share of inhabitants. The longer the boat ride, the closer the diving will be in the Gulf Stream.

Marine life normally found up north, including blackfish, American goosefish and bergall, can be found on North Carolina shipwrecks. Tropical fish, including a variety of angelfish, southern stingrays, Atlantic spadefish, greater amberjacks, hogfish and barracuda, are very common—so are gigantic spiny lobsters and other



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North Carolina

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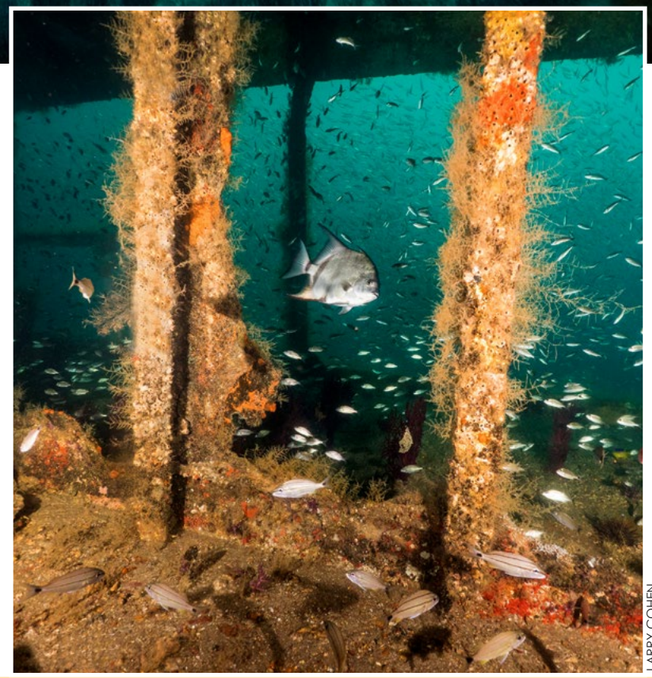

LARRY COHEN

THIS PAGE: Scenes from the *Aeolus* wreck; Sand tiger sharks on *Aeolus* wreck (top left and right); Grouper on *Caribsea* wreck (right)

crustaceans. Even the occasional giant manta ray has been spotted soaring over a North Carolina wreck.

Many different species of sharks, including lemon, bull, tiger, white dusky, sandbar, spinner and thresher sharks, can be found in North Carolina waters. The most common one, and the star of the show, is the sand tiger shark. Sand tigers can be found gathered on the shipwrecks. Scientists believe they are here during the summer months to mate. Sand tigers can grow as large as 3.65m (12ft). Their pointed snouts and jagged teeth, give them a terrifying look, but they are very gentle and swim slowly. Photographing these large, scary-looking sharks with a shipwreck in the background makes the prefect Kodak moment.

Aeolus

The artificial reef *Aeolus* has a history. She started life as an attack cargo ship and later became a cable repair ship. Now, she sits in 27.43 to 33.5m (90 to 110ft) of water. The ship was split into two during a powerful hur-

Diver (above), black sea bass (right) and ocean spade fish (below) on the wreck of the *Caribsea*

ricane, and the stern is sitting upright but is intact. The stern has a ceiling but no longer the sides; the decks are mostly open. There are usually four to a dozen sand tiger sharks in this area of the wreck. Many divers call this area "Club *Aeolus*," or the shark ballroom.

Caribsea

The *Caribsea* is a wreck with history that is also a great place to observe sand tiger sharks. The *Caribsea* was a cargo freighter. On 11 March 1942, the ship was on a voyage from Santiago, Cuba, to Norfolk, Virginia. It was carrying a cargo of manganese. At 2:00 a.m., two torpedoes struck her on the starboard side. The torpedoes were fired by the German submarine U-*158*. Only seven of the 28-crew members survived. They spent ten

OLGA TORREY

Diver and schools of fish on *W.E. Hutton (Papoose)* wreck

OLGA TORREY

hours in the water. The freighter SS *Norlindo* rescued the survivors. Now, the ship sits in 21.34 to 27.43m (70 to 90ft) of water. The boilers, engine and bow are the highest point of the wreck and divers will find those areas the most interesting. Visibility on this wreck could be low. Besides sand tiger sharks, it is not unusual to see Atlantic spadefish, flounder, grouper and greater amberjacks.

Papoose/W.E. Hutton

There are still new discoveries to be made on dive sites that have been visited for years. The wreck which was known to be the *Papoose* is now believed to be the *W.E. Hutton*. This wreck is 36 nautical miles from shore and sits right in the Gulf Stream; visibility of 30m (100ft) is not unheard of here. The wreck is upside down in 36.5m (120ft) of water. It is 132.5m (435ft) long. Between the structure, visibility and marine life, this is a spectacular dive, both inside and outside the wreck. The highest part of the wreck is at the stern. The rudder area rises

Sand tiger shark on the wreck of the *W.E. Hutton (Papoose)*

about 9.14m (30ft) from the bottom. In 2014, the rudder blade broke away from the stern and fell into the sand, but the rudder is still a remarkable subject for photos.

USS Schurz

The USS *Schurz* had a split personality. In 1894, the ship was constructed in Wilhelmshaven, Germany. She started life as the German gunship SMS *Geier*. At the outbreak of World War I in 1914, the *Geier* was docked in Honolulu, Hawaii, undergoing repairs. This was before the USA entered the war. She was held by the United States where she remained in dock for over two years. When the United States entered World War I in 1917, the US Navy took over the ship and renamed her the USS *Schurz*. Now the ship served as a United States gunboat fighting against the country where she was built. On the night of 18 June 1918,

Amberjack on the wreck of the *W.E. Hutton (Papoose)*


OLGA TORREY


LARRY COHEN


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THIS PAGE: Scenes from the wreck of the USS *Schurz;* Anchor of the *Schurz* (lower right)


OLGA TORREY

approximately 28 nautical miles from the North Carolina coast, the merchant ship SS *Florida* was running without lights to avoid being torpedoed by German U-boats when she plowed into the USS *Schurz*. The SS *Florida* was seriously damaged but did not sink. The *Schurz* sunk in 33.5m (110ft) of water, three hours after the accident. On the bridge, one sailor was killed and the commander was injured. Nearly 210 sailors survived.

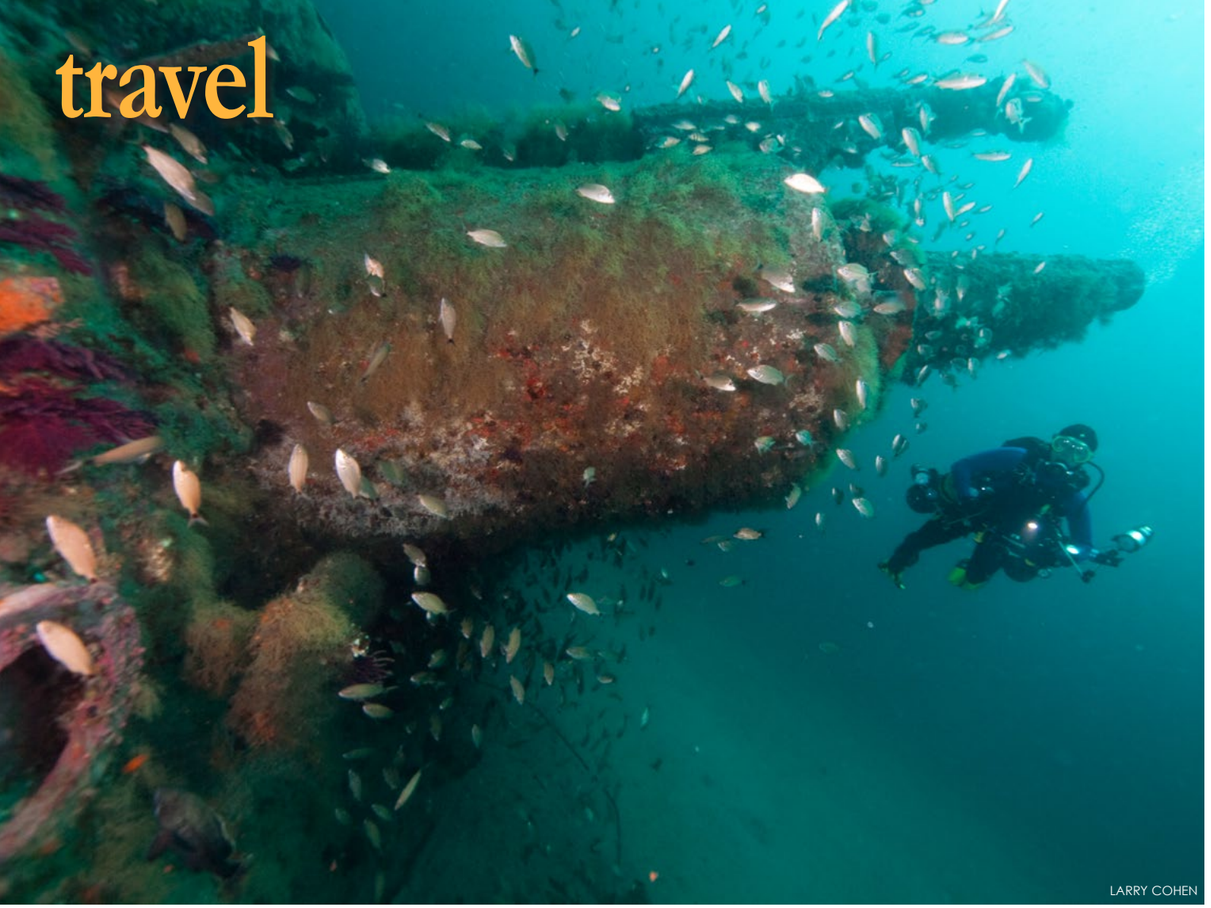
Nowadays, the upper sections of the hull have collapsed, spilling the innards of the ship out onto the sand on the port side. A large pile of heavy gauge chain in the middle of where the foredeck once stood marks the location of the anchor chain locker. Off to the port side, a pair of large 5-inch guns lie atop one another. The four boilers and engine are the highest parts of the wreck. Some days, the baitfish is so dense that you cannot see the wreck through the school of fish.

U-352

The story of the German U-boat, U-*352*, is legendary. German U-boats were sinking so many merchant ships off the US coast that the German navy called this "The happy Times." The U-*352* was not so lucky. She never made one kill. The U-*352* was a type VIIC U-boat that was built in Flensburg, Germany, in 1941. The U-*352* left for the United States at the beginning of April 1942. It cruised at a slow speed, and crewmen reported that they had been able to sunbathe on deck. Once, the sub was spotted and had two bombs dropped on her, but she escaped without damage.

The U-boat cruised the North Carolina coast looking for merchant ships to sink. Around 4:00 p.m. on 9 May 1942, the crew spotted what they thought was a merchant vessel. Commander Hellmut Rathke eagerly ordered a torpedo to be fired at the ship. Unfortunately, the torpedo missed. It turned out that this was not an unarmed merchant ship but the Coast Guard cutter *Icarus*. Realizing his mistake, Commander Rathke brought the U-*352* to the sea bottom at 29m (95ft). This was not deep enough to avoid the barrage of depth charges deployed by the *Icarus*.

Knowing that the damage was too extensive to escape, Rathke gave the order to abandon the sub. When it returned to the surface, the *Icarus* immediately opened fire with 50-caliber and 30-caliber machine guns. The Coast Guard ship then fired a 76mm (3-inch) gun on what was left of the conning tower. This forced men who were clinging to the conning tower to jump into the water. At around 5:14 p.m., the U-352 slipped under the sea in 33.5m (110ft) of water.



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THIS PAGE: Scenes from the wreck of the German U-boat, U-*352;* Diver at conning tower of U-*352* (above)

LARRY COHEN

The *Icarus* changed locations for approximately an hour while waiting for instructions on how to proceed. They then returned to the site and rescued 33 survivors, one of whom past away while on board. The survivors of U-352 were later questioned and were held in several prisoner-of-war camps until the end of the war. During questioning, the German sailors did not admit to seeing the US coast, but they were able to listen to American radio programs. Reportedly, they enjoyed listening to jazz.

Olympus Dive Center founder, George Purifoy, and several friends discovered the U-*352* in 1974. Diving the 66.5m (218ft)-long wreck feels like taking a time machine back in time. While diving the U-*352*, which sits upright with a 45-degree list to starboard, it is impossible not to think about the drama that took place that fateful day on 9 May 1942.

The outer hull has deteriorated, but the sub is otherwise intact. The top of the conning tower is the highest point and sits at 27.5m (90ft). During a dive, you can see the forward torpedo tubes where the bow has cracked, a gun mount and the conning tower. Even though the interior can be accessed through the galley hatch, the U-*352* is a war grave and penetration is illegal. The wreck attracts schools of baitfish sometimes so thick you cannot see the wreck. Amberjacks as well as a variety of smaller fish, sponges and some corals can be seen.

The story of the U-*352* does not stop with its sinking. In September 1985, Olympus Dive Center hosted a reunion of the survivors. During that reunion, the "Funkmeister" (radio operator) Kurt Kruger came to Purifoy with a request. Kruger described in great detail the location of his personal locker on board and told Purifoy that there was a coat, camera and pistol in his locker. He requested Purifoy to bring up the contents of his locker on a future dive. Purifoy agreed and brought up the contents of the locker.

Most clothing in the locker were destroyed by seawater, but the coat remained intact. Kruger identified it as his because of the radio operator patch sewn on the coat. Purifoy also salvaged the camera and pistol. It is likely those items also belonged to the radio operator but they could not be positively identified. Kruger asked Purifoy to keep on permanent display his personal


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North Carolina Aquarium at Pine Knoll Shores (far left); Havelock, home to the world's largest Marine Corps air station (above); Corn fields (right); Artifact from 1916 on display at Olympus Dive Center (right)

LARRY COHEN

items at the Olympus Dive Center. Now everyone visiting can admire these treasured artifacts.

These are just a few of the wrecks that can be explored when visiting the Morehead City area of North Carolina. Due to weather, being blown out is a real possibility. Fortunately, there are many other activities to do besides diving.

Topside activities

The North Carolina Aquarium at Pine Knoll Shores is worth visiting on a rainy day when the boats stay in port. There is even a large tank with local marine life and a realistic model of the U-*352* wreck. Other highlights include a touch pool and a large shark jaw. The hurricane simulator is fun for children and immature adults!

Other indoor activities for a rainy day include the North Carolina Maritime Museum where, you can learn about Blackbeard the Pirate. Artifacts of his ship, *Queen Anne's Revenge*, are on display. Exhibits about the early US Lifesaving Stations, which is the predecessor of the US Coast Guard, is extremely interesting.

Visiting downtown Beaufort is like taking a stepping back in time. Visitors can explore nine historic buildings, accompanied by tour guides in period costumes. Highlights include the 1796 Carteret County Courthouse (the oldest wooden courthouse in North Carolina), the 1829 "Old Jail," an 1850 doctor's office and apothecary shop (with adjoining herb garden), and the 1732 Russell House, which is the site of the oldest art gallery in North Carolina.

Oftentimes, the sun is shining, but the wind is blowing so strong that diving is out of the question. On those days, there are plenty of outdoor places to explore. Taking a hike in the Theodore Roosevelt State Natural Area is a delight. This area is behind the North Carolina Aquarium at Pine Knoll Shores and includes a maritime forest with shrubs and salt marsh. Here, birds, including white ibis and painted bunting, can be observed.

Even when the wind is too strong for dive boats to get offshore, the ferries from Beaufort still run to the uninhabited island of Shackleford Banks State Park. Here, you can comb the beaches and search for wild horses. These horses' ancestors are said to date back to the 16th century when European ships wrecked on the beaches. The horses then became stranded. Although wild, they are rather tame and make great photo subjects with the ocean in the background.

Another way to get wet is to take a paddleboard lesson with Carolina Kitesurfing in Emerald Isle. Even when the ocean is wild, the backwaters can be calm—the prefect place for a relaxing paddle.


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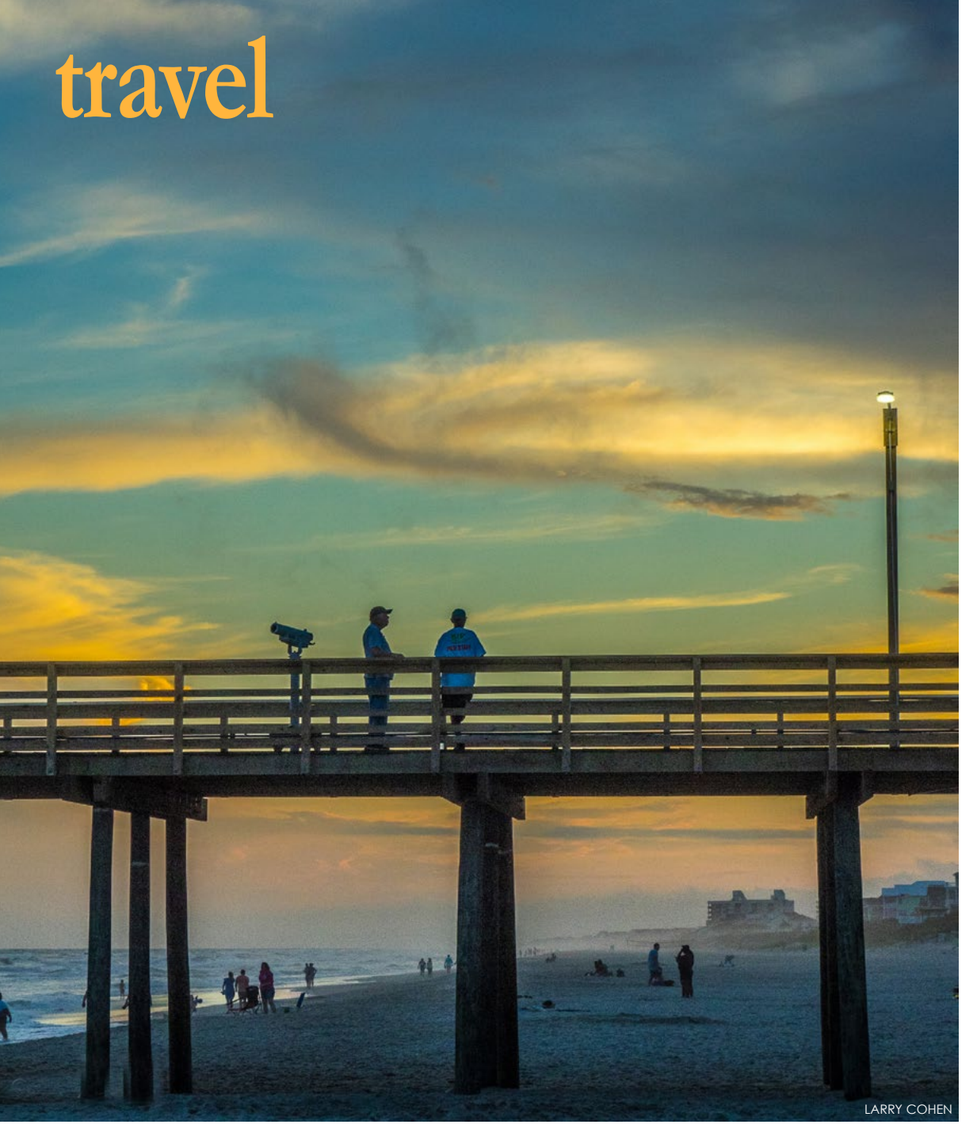
Olga Torrey paddle boarding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Bogue Inlet Fishing Pier (left); Canon at Fort Macon (center); Kayaking (top right); Wild horse at Shackleford Banks State Park (right)

Fort Macon State Park is a picturesque historic landmark on the ocean. Construction began in 1826. In the 1840s, Robert E. Lee initially engineered a system of erosion control. He later became the general of the Confederate Army. At the beginning of the Civil War, North Carolina seized the fort from Union forces. The fort was later attacked in 1862, and it fell back into Union hands. For the duration of the Civil War, the fort was a coaling station for US Navy ships.

Nowadays, the fort is home to the Coastal Education Center. There is a large exhibit hall featuring numerous exhibits about the natural history of the park, barrier island ecology and the interaction of natural and cultural history associated with the Fort. Museum rooms located in the fort casemates have displays about the fort's history. Restored quarters give visitors a look into the lives of the soldiers. The beach in front of the fort is a great place to go swimming (There is no swimming on the inlet side due to strong, dangerous currents) or to fish.

According to the North Carolina Division of Parks and Recreation, the fort is now home to the Coastal Education Center. In the large exhibit hall there are many exhibits about the natural history of the park, barrier island ecology and the interaction of natural and cultural history associated with the Fort. Museum rooms located in the fort casemates have displays about the fort's history. Restored quarters give visitors a look into the lives of the soldiers. The beach in front of the fort is a great place to go swimming (there is no swimming on the inlet side due to strong dangerous current) or to fish.

After a busy day of diving or exploring the area's many attractions, a sunset stroll on the Bogue Inlet Fishing Pier is a great way to end the day. The people are friendly, and it is fun to see the ocean and watch the locals fish.

Afterthoughts

A dive trip to North Carolina is an adventure. Conditions can be difficult to deal with, but the rewards are worth the trouble. Exploring the historic shipwrecks and spectacular marine life is worth the effort. When diving is not possible, there are still plenty of activities to enjoy. ■

Thanks go to Atlantis Charters and Olympus Dive Center.

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


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Graveyard of the Atlantic

— *Shipwrecks of North Carolina's Outer Banks*

Text and photos by Brandi Mueller

Sand tiger shark on the *Atlas* wreck (above). PREVIOUS PAGE: Diver and colorful sea fans and sponges on the *Atlas* wreck

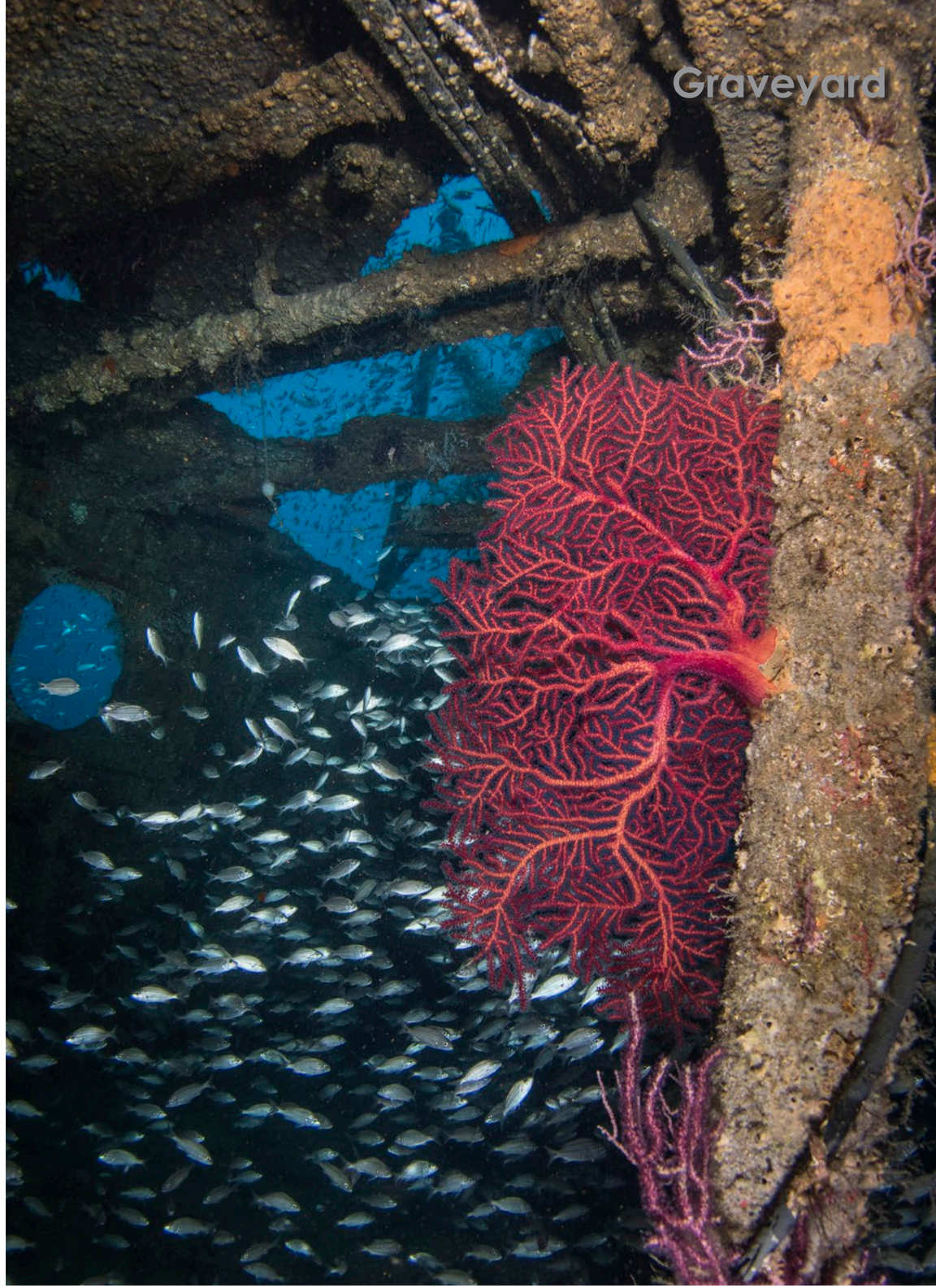
One of the problems with the proverbial bucket list is that whenever you tick a dive trip off the list, it seems that you add at least three more destinations to it. This is exactly what happened to me. I had never considered North Carolina as a dive destination, much less one of the top wreck diving locations in the world. But, after running across other wreck diving enthusiasts who frequented the "Graveyard of the Atlantic," yet another destination was added to my list.

Wreck diving is one of my favorite types of diving because I love the history of how the wrecks came to be underwater, and North Carolina has plenty of that. The history of more than 2,000 wrecks lie in the waters off this eastern state and the stories range from pirates, the Civil War, World Wars, hurricanes, storms and other maritime mistakes that took down good ships. The Graveyard extends along the entire North Carolina coast.

How the ships went down

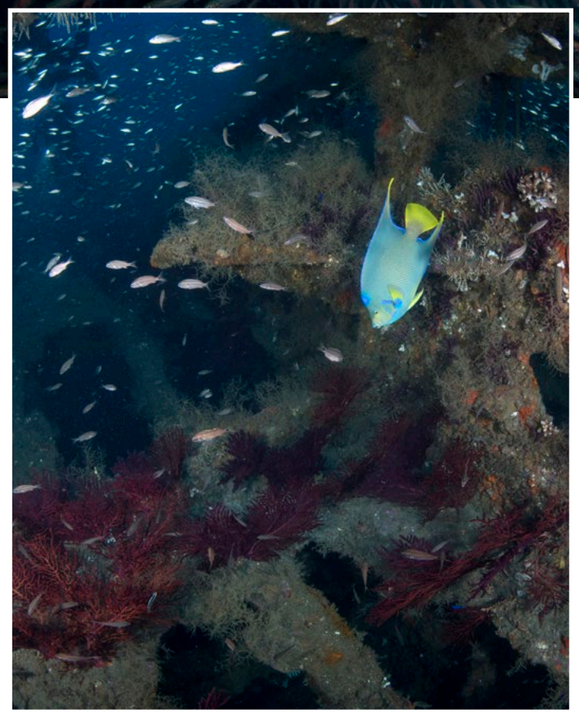
Over time, the coast of North Carolina has literally produced the "perfect storm" for captains and crew. The beautiful barrier islands, including the Outer Banks, sit offshore of the continent, along with shallow shoals that create sandbars miles off the coast. The flat islands and moving sandbars became (and still are) navigational hazards to sailors, particularly during the frequent bad weather and extreme storms common to the area. Underwater, strong currents run close to shore, which sailors would often take advantage of to increase speed, but this contributed to the risk of running aground on those islands and shoals. These conditions led to the demise of many ships and still do today.

The date of the first recorded shipwreck in these waters is debated but records go back as far as the 1500s. Early on, pirates frequented the area, attacking ships transporting goods. Probably the most popular pirate ship discovery in the world was *Queen Anne's Revenge*—Blackbeard's famed ship. The ship ran aground in



Colorful sea fan inside the Hardees wreck

Diver and sand tiger shark on the *Atlas* wreck (left); A queen angelfish (lower left) on the *Atlas* seems out of place this far north, but warm currents from the Gulf Stream bring Caribbean fish.



1718, and soon after, Blackbeard was killed in battle. Found in 1996 just off Beaufort, the remains were salvaged and many of the artifacts are on display at the North Carolina Maritime Museum. Much of the museum is dedicated to the discovery and salvage of the ship. It is nothing short of incredible to walk around and gaze at artifacts from the late 1600s and early 1700s.

In the past, not all the residents of the area had the sailor's best interest in mind. There were men known as "wreckers" who would walk horses with lanterns on their neck along the beach, thus causing an up-and-down motion of the light. This would confuse sailors to think there was clear water ahead and the captain would run his ship aground, then the wreckers would steal goods from the ships.

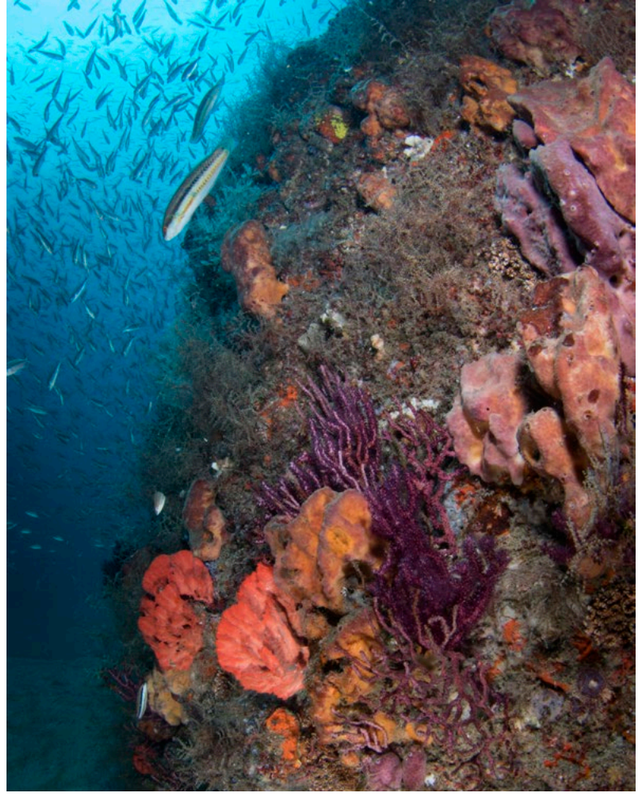
Heading out to dive the Graveyard of the Atlantic with Olympus Dive Center, we visited one such ship that ran aground in 1943. The *Portland* got caught in a storm and ran aground on the shoals. This ship sits quite shallow in the sand (16m; 55ft) and is broken into several pieces. It is prone to low visibility and currents. But on the day we visited, conditions were quite good. Several sand tiger sharks were circling the wreck, along with a small swell—a cloud of hazy, lower-visibility water, which hugged the ship only to dissipate and return later. It made for a sort of misty, almost spooky effect over the wreck, particularly with the sand tiger sharks moving in and out of the cloud of murky water. We saw lots of fish on the wreck, including sheepshead and even a toadfish sitting on one of the boilers.

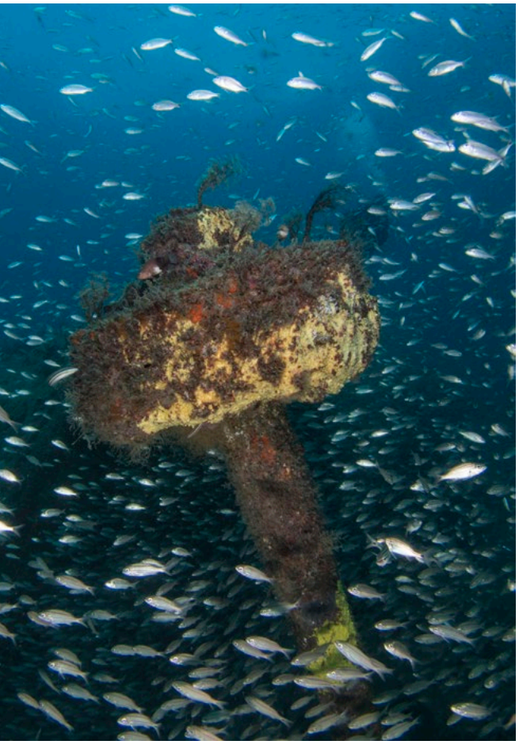
War

Humans also played direct roles in the sinking of these ships through war. Shipwrecks from the Civil War and both World Wars can be found (and are still being found) in

Toadfish on the *Atlas* wreck

Sheepshead and moray eel on the *Ashkhabad* wreck





Swarming fishlife on the *Ashkhabad* wreck

the Graveyard of the Atlantic. During WWII, German U-boats sat off the coast of North Carolina and looked at the lights on the shoreline. They would spot freighters going by when the ships blocked out the shore lights, and because so many ships were torpedoed, the area became known as Torpedo Alley.

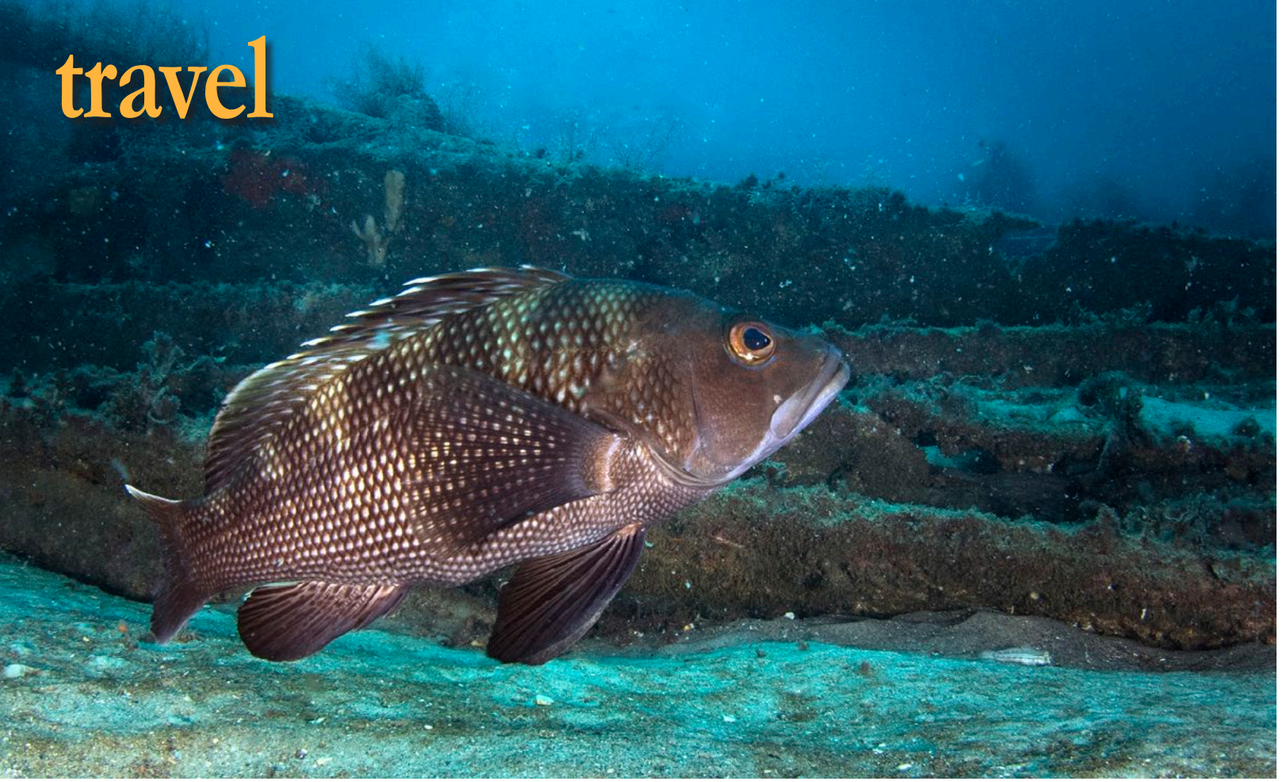
Atlas. We dived several WWII wrecks including the *Atlas*, which was a tanker torpedoed by the German U-boat *552* in 1942, and the *Caribsea*, which was also sunk by a torpedo in 1942. These two ships swarm with bait fish and are popular ships on which to see sand tiger sharks, which were numerous during the course of our dives.

Ashkhabad. We also visited the *Ashkhabad*, a Russian freighter sunk by a German torpedo in 1942. Most of the *Ashkhabad* has been reduced to debris in the sand, but the life it has attracted is incredible. The warm waters from the Gulf Stream push north past offshore North Carolina, bringing with them many unexpected Caribbean reef fish. I didn't expect to see arrow crabs, toadfish, and even a few queen angelfish on this wreck, along with sheepshead, triggerfish, and black sea bass, but there they were. The dive is quite shallow (20m/60ft), allowing for a long bottom time exploring the wreckage and seeing the fish life.

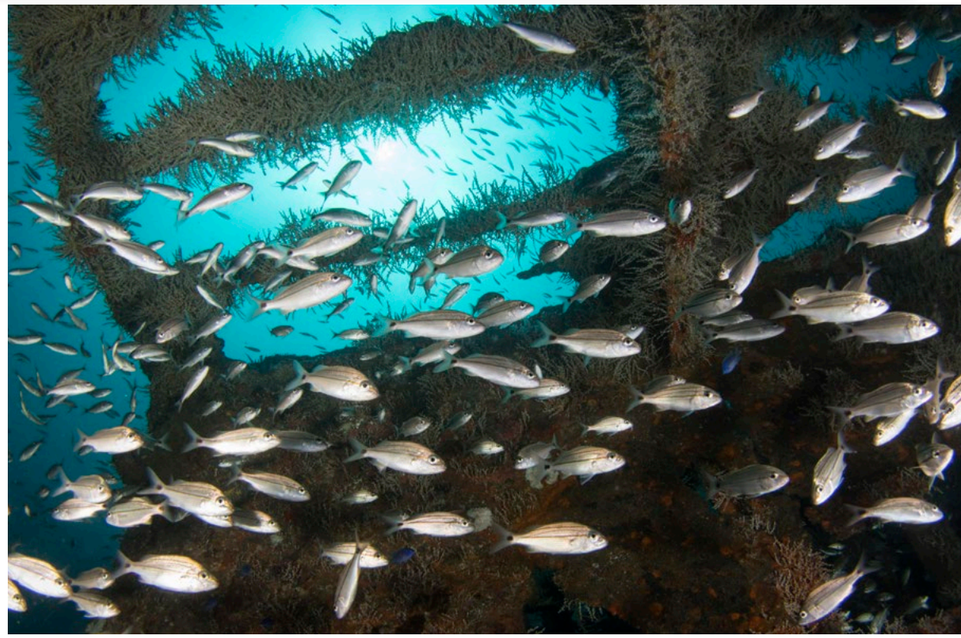
Artificial Reefs

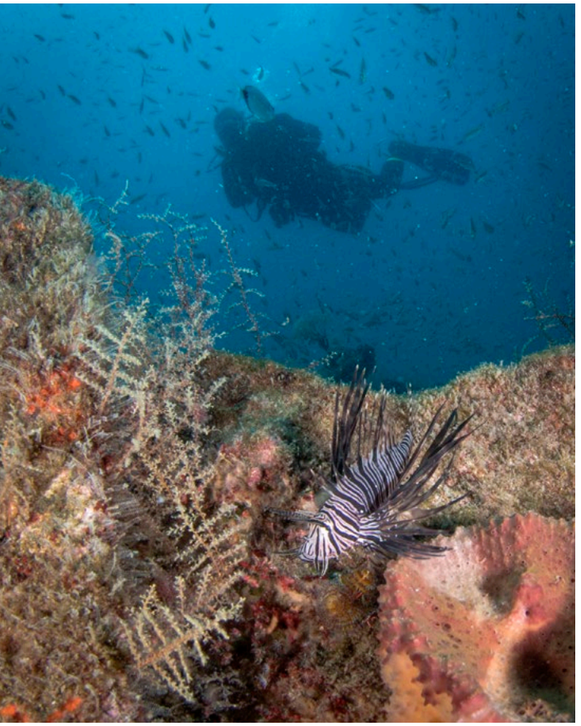
Wrecks continue to be sunk to this day, both accidently and

Colorful soft corals and sponges (top center) growing on the remains of the *Ashkhabad* wreck (above)



Black sea bass on the *Ashkhabad* wreck (left); Sunk as an artificial reef, the Hardees wreck seems to be doing a good job attracting fish (right); Divers on the bow of the Hardees wreck (below)

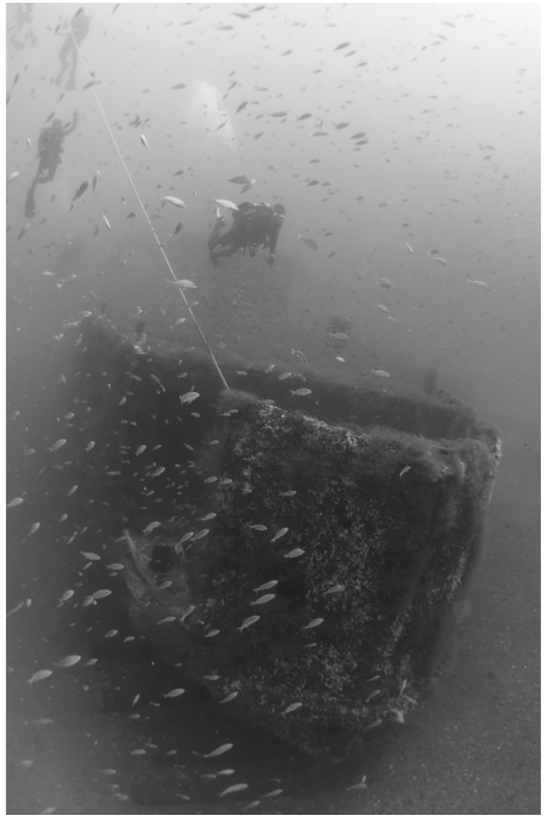




Invasive lionfish, seen here on the *Ashkhabad* wreck, have reached as far north as North Carolina. Divers hunt them from the wrecks.

on purpose. The Graveyard is also home to many wrecks sunk as artificial reefs, the most recent of which was sunk on 22 August 2018. The tugboat *Fort Fisher* joined 26 other vessels that have either been sunk by using explosives or by cutting holes throughout the vessel and having water pumped in. These ships are first cleaned up by having all pollutants removed before being sunk to serve as a home for marine life. Often, corals and sponges will take over the structure of the wreck, and fish will begin to amass around the ship, which of course then attracts larger fish. The artificial wrecks are popular with both fishermen and divers.

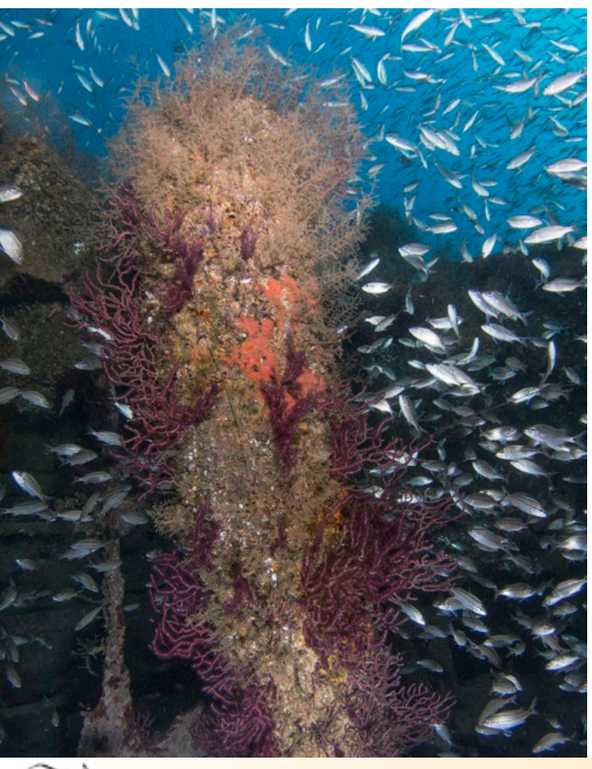
Hardees Wreck. During one of my dives, we visited the Hardees Wreck (Hardees helped fund the project to sink the ship). The beautiful wreck was covered in corals and sponges, and because it was sunk artificially and cleaned up prior to sinking, there were some easy penetrations to get inside the wreck. Many small fish take refuge inside the ship and beautiful purple fans grow on the walls inside the ship.

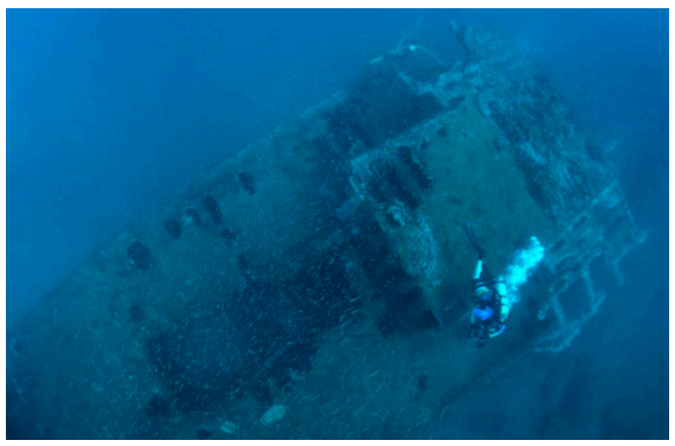


Dive conditions

The problem with North Carolina diving is also probably what adds to some of its attraction. I had been told over and over that conditions were variable—and not just some of the conditions, pretty much *all* of the conditions. My friends told me to expect everything from rough seas, strong wind and rain to bad visibility, extreme currents, and, of course, the wildlife (like the famed sand tiger sharks) not showing up.

However, the long weekend I spent diving with Olympus Dive Center and exploring the wrecks proved them all wrong. The conditions were perfect: The sea was like glass, the sun was shining, the water temperature was 28°C (82°F), the bait balls of tiny fish were swarming, and there were dozens of monster-





Sunk as an artificial reef, the Hardees wreck (above) seems to be doing a good job attracting fish (above and left); Sand tiger shark on the *Portland* wreck (right)

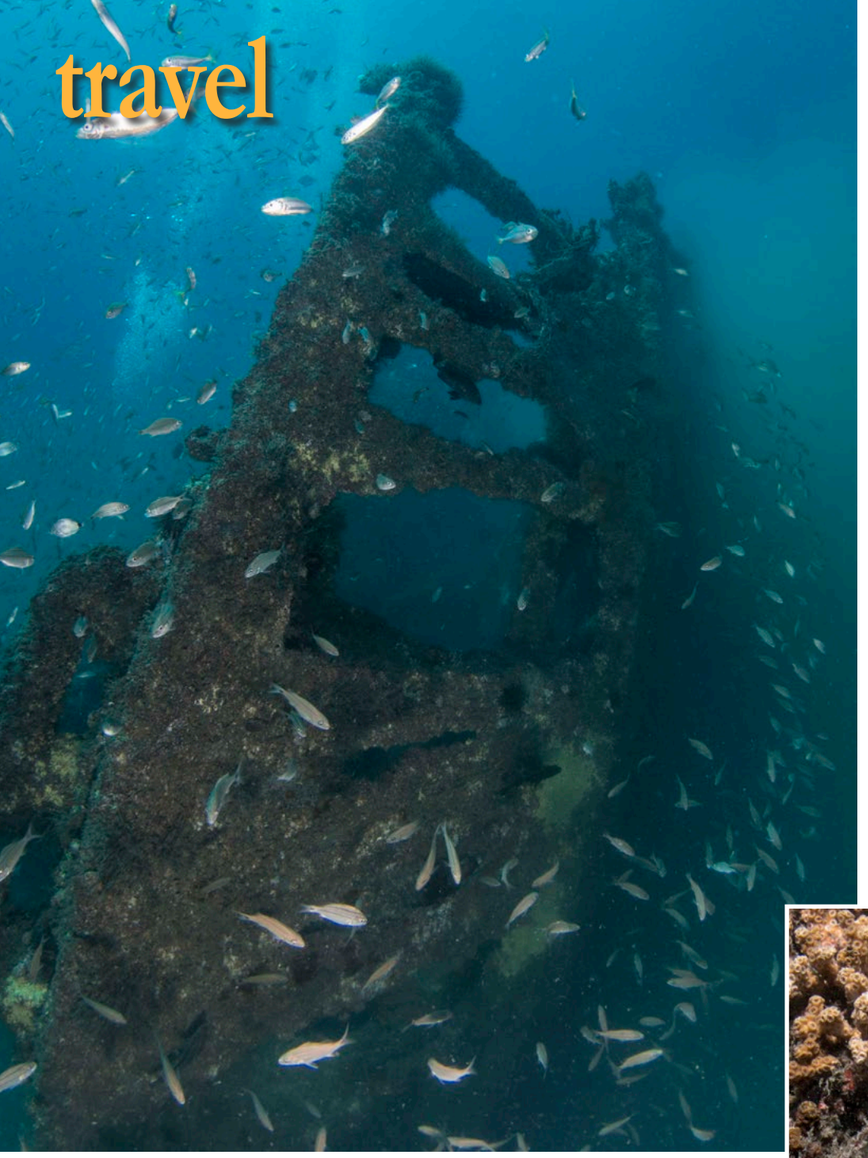
size sand tiger sharks gliding over the wrecks. But apparently, I was very, very lucky. That being said, our trusted captain and crew chose the wrecks we dived based on condition reports from other sites. (Always trust the captain.)

We did not go to the U-*352* German submarine because the visibility had been less than 15ft. The wrecks they chose had much better visibility of 20m+ (60+ft), and sometimes even better.

There are also many options for technical divers looking to dive deeper wrecks or just stay longer on the shallower wrecks (Many are in the 100 to 130ft range, which is fine for short recreational dives). Olympus offers special tech trips for those certified, and they can help divers get certified in technical diving.

Not just wrecks

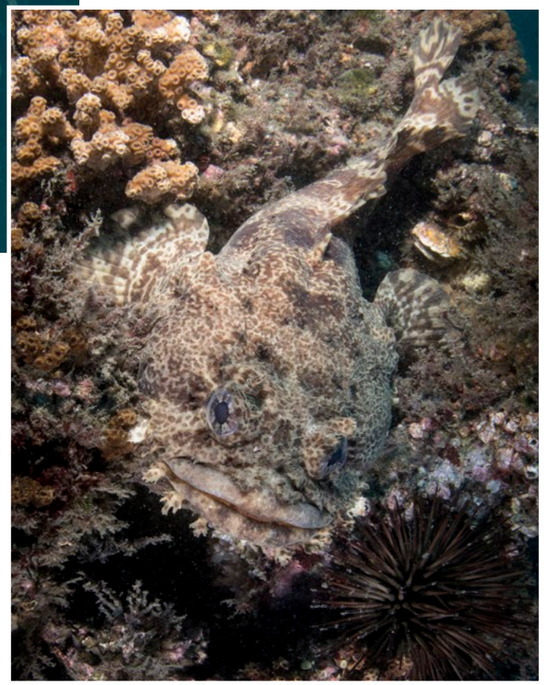
In the event of a rough day at sea where the dive boats do not go out (for



Fishlife on the *Portland* wreck(left); Wild mustangs on Shackleford Banks (above); School of spadefish over the *Portland* wreck (top right); Sunset on the North Carolina coast, a perfect end to a day diving wrecks (right)

diver safety), there are plenty of other things to do in the nearby area. The day before I flew out and could not dive, I took the ferry to Shackleford Banks, an island with a wild mustang population, as well as a very popular place for shelling, fishing, camping and just relaxing on the beautiful coast of North Carolina.

The 20-minute ferry ride from Beaufort dropped us off right on the beach, and as I started walking in the sand, I noticed two women taking photos into the brush. Getting closer, I saw two copper-colored wild horses grazing on the grasses. After snapping a few pics, we all moved on to give them some space. Continuing on my walk, it was not long before I came on two more horses laying on the beach. Before I left two hours later, I had seen at least eight of these beautiful wild horses.



Toadfish on the *Portland* wreck

The Beaufort Waterfront is also known for its excellent food options (particularly seafood) and is a great place to sit and watch boats come in and out. I visited the North Carolina Maritime Museum, which had an incredible amount of artifacts from Blackbeard's ship, *Queen Anne's Revenge*; and just a few miles down the road was the North Carolina Aquarium at Pine Knoll Shores, where I got to see a few more sand tiger sharks before leaving.

With over 2,000 wrecks just offshore, a diver could spend the rest of her life exploring the ships. Not to mention, more ships are being discovered and more are being artificially sunk. I cannot wait to go back and tick more wrecks off my (now even longer) diving bucket list. ■

Special thanks to Crystal Coast Tourism Authority and Olympus Dive Center.

Brandi Mueller is a PADI IDC Staff Instructor and boat captain living in Micronesia. 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****.*

Sand Tiger Sharks

of North Carolina

Text and photos by Brandi Mueller

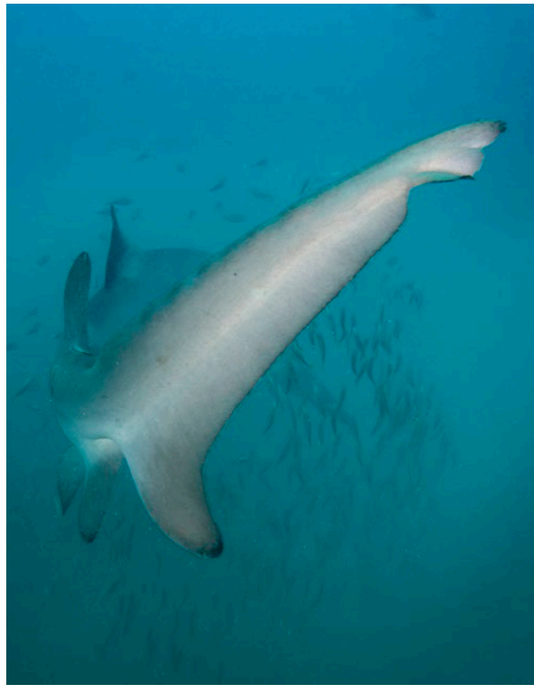
Sand tiger shark on the *Caribsea* wreck off North Carolina (above); A diver photographs a sand tiger shark on the *Atlas* wreck (previous page)

Sand tiger sharks have dark gray bodies with spots (top left), and bright white bellies (above)

There I was, off the coast of North Carolina at a depth of about 20m (60ft) when the shadowy shape of the WWII wreck *Caribsea* came into view—but it looked almost as if it was moving! Upon closer inspection, it turned out to be a cloud of tiny bait fish completely covering the wreck. As they moved, the ship seemed to move with them; and then, out of the swarm, a massive, tank-like, gray silhouette emerged. It moved at one speed and in one direction, not altering its course an inch. I smiled so much my mask began to leak—it was a sand tiger shark.

Sand tiger sharks (*Carcharias taurus*) look mean but in reality, they are quite docile. As I watched, at least 12 sharks criss-crossed the *Caribsea* wreck; they almost seemed to be in a perfect state of Zen. Easily identifiable by their pointy, cone-shaped heads (and also by their jagged and fierce-looking teeth, which show even when their mouths are closed), the tops of their bodies are a dark gray with darker colored spots, and their undersides are bright white. Their tails also have the unique characteristic of a notched upper lobe. At first glance, I thought perhaps the shark had a bite taken out of its tail, but I was wrong, they all have that.

The sharks, which can grow longer than 3m (10ft) and weigh up to 150kg (330lb), seemed to emerge out of the shadows, or out of a blindingly dense bait ball, moving in a straight line at the same depth, not diverting in any way. They would just traverse the wreck, almost like



Notched upper lobe of sand tiger tail fin

THIS PAGE: Sand tigers on the *Caribsea* wreck off North Carolina. These sharks can grow more than 3m (10ft) in length and weigh up to 150kg (330lb).

rubber toys on some sort of conveyer belt—albeit, very large rubber toys. Maybe a better description would be a semi-truck slowly moving directly towards you, and you better get out of its way.

Sand tigers can be found in warm or temperate waters around the world, but often in deep waters inaccessible to divers. North Carolina is a rare place where divers can consistently see them at recreational diving depths. This population seems to have taken up an interest in wreck diving (just like me) and many of the Graveyard of the Atlantic's wrecks are populated with sand tiger sharks. The most popular wrecks on which to see them include the *Caribsea*, *Atlas*, *Papoose*, *Spar* and *Aeolus*.

About the shark

Sand tigers have several other common names in different places, including gray nurse sharks and ragged-tooth sharks (or "raggies," due to their rows of intimidating, jagged, ragged teeth). The shark's name is often a source of confusion as it is not actually a tiger shark; and its scientific name directly translates to "bull" shark, although it is not a bull shark either (bull sharks are *Carcharhinus leucas*).

There are three additional species of sand tiger sharks: *C. tricuspidatus, C. ferox* and *C. noronhai*—all of which are generally found only in very deep water and rarely seen by divers. Even *C. taurus* can range in depth to almost 200m (656ft), making North Carolina a very unique place to be able to recreationally dive with them.

On my second day of diving, we ventured to the *Atlas* wreck, another WWII shipwreck. Upon arriving at the wreck, another diver yelled, "Dolphin!" and we all ran to the port side of the dive boat. We could see a large shadow departing the surface, and it did not return. Our captain informed us that it was actually a sand tiger coming to the surface because these sharks have swim bladders. They are the only shark species that comes to the surface for breaths of air, which help them control their buoyancy underwater. These gulps of air help them to maintain their motionless movement, which makes them look so cool underwater, as they move so stealth-like; they almost look as if they are not moving at all.

Sand tigers, similar to most shark species, can detect electric currents through receptive pores under their snouts. Prey (and divers) emit electrical signals that the sharks can sense in the water column, alerting the sharks of our presence. This helps the sharks to hunt in bad visibility, although sand tigers also have considerably good vision; they can see in low-light conditions and can detect the difference

Sand tiger shark in a baitball of fish on the *Atlas* wreck (top left); Sand tiger on wreck of the *Caribsea* (above and left); Despite their menacing appearance and sharp ragged teeth, sand tiger sharks are not aggressive towards humans.

between light and dark objects.

Nighttime is usually when sand tigers hunt, and they prey on small fish, crustaceans, skates and squid. They have been known to group hunt as well, and hunting usually occurs close to the sea floor.

Despite their big teeth and ferocious expression, sand tigers are not aggressive towards people. No documented cases of human deaths have been recorded, although incidences of human attacks have been recorded in association with spear-fishing and shark-feeding. They are sometimes known to be aggressive when trying to steal fish or bait from fishing lines.

A few times underwater, I heard a large cracking noise, which was the almost sonic-boom-like sound of a sand tiger diverting its path. Whether it was from an attempt to catch some bait fish for dinner or because they were startled by something (one time, it was two sharks colliding into each other), the lightning speed of these sharks moving sounded like a thunder boom, which I think I could feel in my chest.

Reproduction

Things get quite interesting when we look into the reproduction of sand tiger sharks. Due to their success in surviving captivity and aquariums, the reproduction of sand tigers is well known. In some sand tiger populations, including those from South Africa and Australia, a migration is associated with reproduction. Many will travel over 1,000km (620 miles) to mate in shallow waters during the winter and give birth in warmer waters in the summer. Young sharks are not seen on the migration, and it is thought that they may stay in deeper waters until maturity. Male sharks mature after five to seven years, and female sharks mature after seven to ten years.

Courtship has been seen in aquariums. When females are ready to mate, they are seen hovering just above the bottom, "shielding" themselves to help prevent unwanted approaches from males from underneath. Males compete with one other to see who can get closest to the female, with the largest, alpha male usually winning. He will intimidate the others by snapping his tail and trying to drive them away from the female. Courting can take several days of the male

Since sand tiger sharks survive well in captivity, much research has been done on the species. They can be seen on display in the North Carolina Aquarium at Pine Knoll Shores (above). Sand tiger shark on the *Atlas* wreck (left)

and the female superficially biting each other.

Sand tiger sharks are ovoviviparous, which means they give birth to fully developed, live young; but those young have been hatched from eggs inside the shark.

Females usually only breed every two to three years, and the gestation period is around nine months. Usually, 15 to 25 eggs are fertilized internally. An egg yolk provides food for the developing embryo until the young is around 17cm (6.7in) long. This is when things get interesting.

The largest embryo—often the first to hatch—will begin to feed on the other, less-developed embryos to survive. This is known as intrauterine cannibalism, and sand tiger sharks are the only shark species known to do this. Around nine months later, the female will give birth to one or two 1m (3ft)-long, fully developed baby sharks, which would have eaten the rest of their siblings.

Aquariums

Sand tiger sharks are one of the most popular sharks to have in aquariums because they have shown to survive quite well in captivity. The North Carolina Aquarium at Pine Knoll Shores has a large exhibit with a replica U-*352* boat and many large marine animals found in the nearby waters, including sand tigers. With so many sand tigers in captivity, a lot of research has been done, and that is partly why we know so much about these sharks. They have been shown to live 10 to 15 years in captivity, although we do not know how long they survive in the wild.

Keeping sand tigers in aquariums has had benefits to science, and the sharks may help inspire people about the ocean, but keeping large animals in tanks much smaller than their natural environment is not without problems. Sand tigers kept in captivity have been shown to develop

Sand tiger shark with baitball of fish (above); Divers returning to the surface from the *Caribsea* are surrounded by sand tigers (top right)

spinal deformities, probably due to tank size and from swimming in circles in one direction, causing asymmetrical stress on their bodies.

Threats

Population data on the sand tigers is sparse, so they are listed as vulnerable on the International Union for Conservation of Nature's Red List. Like so many ocean creatures, sand tigers face many threats, the largest being their slow reproductive rates—they have one of the lowest reproductive rates of all shark species. However, off North Carolina, it seems the sand tiger shark population is plentiful, and they are found throughout the world's oceans.

Sand tigers have also been targets for shark finning, and they are a highly prized food item in some parts of the world. Their ability to survive captivity has led to many individuals being captured for aquariums (and reproduction rates in captivity are also low). Sand tiger sharks are often after the same fish as fishermen, which has made them unpopular in some places. Fishermen have been known to kill them to protect their catch, and there are even specific fishing competitions targeting them in places like South Africa. Young sand tigers often reside in shallow estuaries, which can be susceptible to pollution and run-off.

Seeing these beautiful sharks underwater is a surreal experience. The way they move through the water and come so close to divers makes for an incredible dive; plus, off North Carolina, they are usually near some really amazing wrecks. Popular places beyond North Carolina to dive with sand tiger sharks include Aliwal Shoal in South Africa and off Western Queensland in Australia, as well as most of the southern part of the Australian continent. ■

Special thanks go to Crystal Coast Tourism Authority and Olympus Dive Center.

Brandi Mueller is a PADI IDC Staff Instructor and boat captain living in Micronesia. 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****.*

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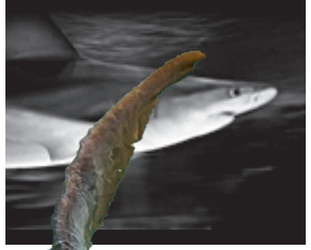
Sand tiger shark on the *Atlas* wreck

shark tales

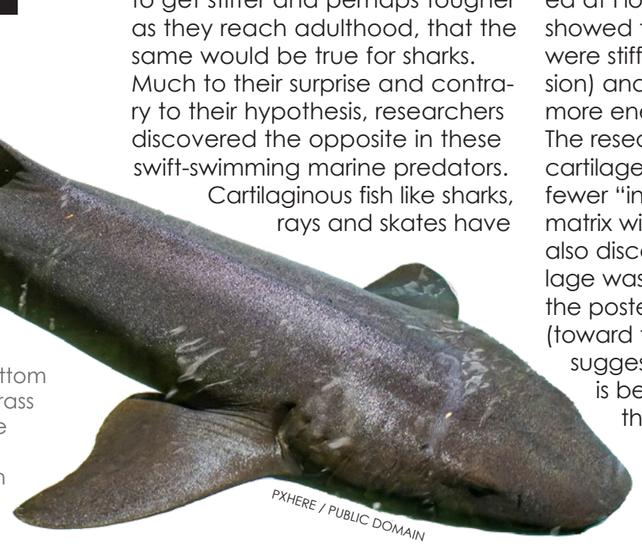


Older sharks are more flexible than young ones

One would assume that since humans and many animals tend to get stiffer and perhaps tougher as they reach adulthood, that the same would be true for sharks. Much to their surprise and contrary to their hypothesis, researchers discovered the opposite in these swift-swimming marine predators.

Cartilaginous fish like sharks, rays and skates have a skeleton composed entirely of cartilage. A recent study conducted at Florida Atlantic University showed that the youngest sharks were stiffer (able to resist compression) and tougher (able to absorb more energy) than older sharks. The researchers speculate that cartilage from younger sharks has fewer "interruptions" in the mineral matrix within the cartilage. They also discovered that the cartilage was stiffer and tougher in the posteriorly-located vertebrae (toward the back of the body), suggesting that this body region is better equipped to handle the mechanical loading that occurs during swimming. ■

SOURCE: JOURNAL OF EXPERIMENTAL BIOLOGY



PXHERE / PUBLIC DOMAIN

Nurse sharks are a typically inshore bottom-dwelling species. Juveniles are mostly found on the bottom of shallow coral reefs, seagrass flats, and around mangrove islands, whereas older individuals typically reside in and around deeper reefs and rocky areas.

Shark embryos can swim from one uterus to the other to feed on unfertilised siblings

New ultrasound data of captive tawny nurse sharks (*Nebrius ferrugineus*) revealed that their embryos frequently migrate between the right and left uteri during gestation. The tawny nurse shark is unique among orectolobiform sharks, in which the embryo develops by feeding on sibling eggs in utero.

Oophagy

Researchers do not know for certain why tawny nurse sharks would be able to swim around like this in utero, but they have a pretty good guess: to feed their not-yet-born young through a process called "oophagy." This means that the embryos gobble up unfertilized eggs inside their mothers as food—and sometimes, the nearest egg is in the uterus next door.

Cannibalism

In sand tiger sharks, embryos have been known to cannibalise their littermates in the womb, with the largest embryo eating all but one of its siblings. It is part of a struggle for paternity in utero, where babies of different fathers compete to be born. Researchers, who analyzed shark embryos found in sand tiger sharks (*Carcharias taurus*) at various stages of gestation and found that the later in pregnancy, the more likely the remaining shark embryos had just one father. That finding suggests the cannibalism seen in these embryos is a competitive strategy by which males try to ensure their paternity.

While 12 littermates may start out the journey, all but one is devoured by the biggest in the pack. That strategy allows sand tiger sharks to have much larger babies at birth than other shark species, making the little ones relatively safe from other predators. ■

SOURCES: ETHOLOGY, BIOLOGY LETTERS

YOUTUBE

Screenshot from SeaRover video posted on YouTube (**link**) showing dense schools of blackmouth catsharks over a seabed littered with egg cases

Shark nursery discovered in deep water west of Ireland

During the SeaRover survey undertaken last July, a rare shark nursery was discovered while exploring Ireland's deep-water coral reef systems. Very large numbers of egg cases, commonly called mermaids purses, were filmed on the seafloor at depths reaching 750 m.

Such large concentrations of egg cases, are rarely recorded and indicate females may gather in this particular area on the seafloor to lay their eggs.

Blackmouth catshark (*Galeus melastomus*)

While no shark pups were seen swimming around, there were hundreds of adults—mostly the fairly common blackmouth catshark and some sailfin roughsharks, a normally solitary creature currently listed as near-threatened. It is believed the egg-laying was done by the catsharks, and the roughsharks may have been feasting on the egg buffet.

Within its range, the blackmouth catshark is one of the most abundant sharks over the upper and middle continental slope. It is an active, generalist predator that feeds on both bottom-dwelling and free-swimming organisms. It often cruises just above the sea floor, perhaps taking advantage of the ground effect (a reduction in the drag on a wing when close to the ground) to save energy. It has also been seen resting motionless on the bottom. ■

SOURCE: MARINE INSTITUTE

Whale shark's swim across the Pacific is the longest migration ever recorded

Researchers from the Smithsonian Tropical Research Institute (STRI) and colleagues tracked a female whale shark from the eastern Pacific to the western Indo-Pacific for 20,142 kilometers, the longest whale shark migration route ever recorded.

A female whale shark (*Rhincodon typus*) named Anne was tagged near Coiba Island in Panama, the largest island off of the coast of Central America, a National Park, World Heritage Site and marine protected area. The tag only communicates with the satellite when the shark swims near the surface. Anne remained in Panamanian waters for 116 days, then swam toward Clipperton Island (France), nearing Cocos Island (Costa Rica) en route to Darwin Island in the Galapagos (Ecuador), a site known to attract groups of sharks. Two hundred sixty-six days after she was tagged, the signal disappeared, indicating that Anne was too deep to track. After 235 days of silence, transmissions began again, south of Hawaii. After a nine-day stay, she continued through the Marshall Islands until she arrived at the Marianas Trench.

Whale sharks have been tracked for shorter distances along similar routes, but this report is the longest-recorded migration to date and the first evidence of a potential trans-Pacific route. Large females can swim an average of 67 kilometers (about 40 miles) per day. ■ SOURCES: MARINE BIODIVERSITY RECORDS, SMITHSONIAN TROPICAL RESEARCH INSTITUTE (STRI)

Seeking the Dugong

In Marsa Alam

Text and photos by Kate Jonker

Dugongs

A dugong settles in and starts enjoying a meal of seagrass (lower left); After taking a breath at the surface, the dugong soon returns to feed with its entourage of golden kingfish (left); Always a golden kingfish is close by to pick up the spoils left behind by the dugong (above). PREVIOUS PAGE: Our dive guide Bassem patiently watches over me as I take my time photographing the dugong.

Many years ago, whilst learning to scuba dive, I came across an article on manatees and dugongs. I was entranced. Not only were they cute, according to the article, they loved hugging divers, and once they held on to you, they did not want to let you go. The image of this human-hugging, underwater teddy bear remained with me and I was determined that one day, I would find one and hug it.

I started to research these creatures and discovered that manatees and dugongs were not actually the same animal. Although they belong to the same family (*Sirena*), they are actually quite different.

Manatees have a large, horizontal, paddle-shaped tail, whereas dugongs have tail flukes with pointed ends like a whale. The dugong has a short, broad, downward-facing, trunk-like snout with an undivided lip, whereas manatees have a divided upper lip and a shorter snout. Manatees are larger than dugongs and can weigh between 400kg and 500kg, and grow to a length of 3.6m. Dugongs rarely grow larger than 3m, and their average weight is 420kg.

Upon further reading, I was disappointed to discover that manatees live in the Caribbean and the Gulf of Mexico and, as I live in South Africa, the possibility of my ever travelling there to see one was pretty slim. However, I did read that dugongs could also be found much closer to home in Mozambique and in the southern Red Sea. All was not lost, and I was determined to go and find a dugong instead!

A couple of years ago, whilst on a liveaboard trip to the southern Red Sea, our dive guide took us to look for the dugongs. We spent an hour swimming very fast on scuba over a huge seagrass bed, but our search was unsuccessful, and we returned to the boat feeling exhausted and disappointed.

Marsa Alam

Before returning to the Red Sea this year, I asked my friends on social media for advice and was directed to a dive centre in Marsa

Dugongs

The friendly staff who looked after us at the dive centre (left); The beach at Marsa Alam, with our zodiac waiting for us close to shore (above); The dive centre's lovely cool and shady kitting-up area (lower left)

Alam. I promptly booked a couple of days of diving with them before joining a northern Red Sea liveaboard safari.

As soon as we arrived at our hotel in Marsa Alam, my husband, Deon, and I popped into the dive centre to meet with Mirjam who had helped me with my booking. She said that if I wanted to find the dugongs, I would have to be back at the dive centre in an hour's time. I asked if we could go out the following day instead as it usually took me an hour to put my camera together and I did not want to hold them up. Mirjam said that the following day would be too windy, and that if we wanted to see the dugongs, we would have to do it that afternoon.

We rushed back to our hotel room to set up our cameras for wide-angle and managed to be back at the dive centre with all our diving gear and cameras within the hour. I must admit to having felt pretty stressed and hot and bothered, but by the time we had put on our gear in the cool, shady kitting-up area and been given a very thorough and professional briefing by Bassem who was training to be a dive-master, I was very excited and raring to go!

Spotting dugongs

The plan was for skipper Abdo to take a small zodiac boat out to a nearby reef where the dugong's favourite food, seagrass, was plentiful.

As we walked across the beach, our

Our hotel grounds—a lush and vibrant oasis between the desert and the Red Sea

Searching for the dugong in 2017 (above); A dugong makes its way to the surface for another breath of air (right)

dugong spotter Biso told us that the best way to find a dugong was from the boat as, being air-breathing mammals, dugongs have to come up for air every three to six minutes, and he could then see them on the surface quite easily. He told us that if the dugong was there, we were to wait on the boat until it had taken a breath, descended and started grazing—and only then would we enter the water and descend slowly close by. He added that it was important not to frighten the dugong as it swims very fast and once spooked, it would swim away and we would never catch up.

Just as skipper Abdo helped us onto our little zodiac, Biso pointed to another small boat just beyond the reef, "It's here!" he exclaimed excitedly. When I asked him how he knew, he pointed to a group of snorkellers next to the boat, all frantically swimming in the same direction. "They're following the dugong!" he replied. I could not believe my luck and hoped that the snorkellers would not chase it away.

As we slowly came alongside the snorkellers and their boat, a large white shape surfaced next to us. It was a dugong! It came right to the surface between our two boats and I could clearly see its big snout as it broke the clear, turquoise water for a huge breath of air.

I was in awe and could not believe that the creature I had only ever dreamt of seeing was actually there! It was a real goosebump moment and I think I might have shed a couple of tears whilst nobody was looking my way.

The dugong swam lazily amongst the snorkellers before taking a final breath and making his way downwards to the seagrass bed below us.

Dugongs

The perfect dinner guests, a dugong and golden kingfish both enjoying a meal from the sea floor (left); The dugong rolls over for a back scrub before swimming off and leaving us behind (above).

I finally get my dugong hug!

Diving with a dugong

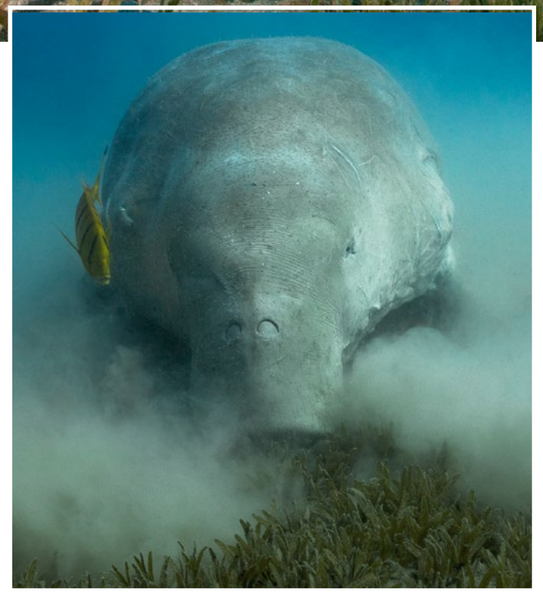
Mirjam told us to get ready and I quickly put on my mask and grabbed my camera. My hands were shaking with excitement! Biso had a quick look into the water and confirmed that the dugong was grazing, and we all rolled back into the water and started our way towards the sea floor about 10m below us.

As I descended, I could not help but marvel at the sheer size of this creature. I had known they were big, but nothing had prepared me for how long it actually was. As I settled down next to him, I was amazed at how relaxed he was in our company and how much he was eating! It was incredible to watch how he munched through metres of seagrass, completely ignoring us.

He allowed us to take a number of photos of him as he continued grazing. He was joined by some juvenile golden kingfish, which snapped up tiny creatures that were dislodged from the sea floor as he grazed. He stirred up huge plumes of fine sand as he mowed across the seagrass, and it looked as if he was floating amongst the clouds. I was enthralled by his whiskers, his tiny eyes and what looked like eyelashes. What an incredibly endearing creature!

We were lucky to spend about 30 minutes with him as every time he went up for air, he came back down to us and just carried on grazing. Eventually, he must have eaten his fill, as he rolled over onto his back and gave himself a leisurely back scrub before swimming away.

We spent the rest of our dive exploring the beautiful reef, which



THIS PAGE: A dugong stirs up clouds of fine sand as it munches its way through the seagrass—it looked as if he was floating amongst the clouds.

was teeming with life, juvenile fish and pristine coral. What a perfect way to end such an incredible dive! As soon as our heads broke the water, I started laughing, cheering and thanking my buddies. It had been an experience I would never forget.

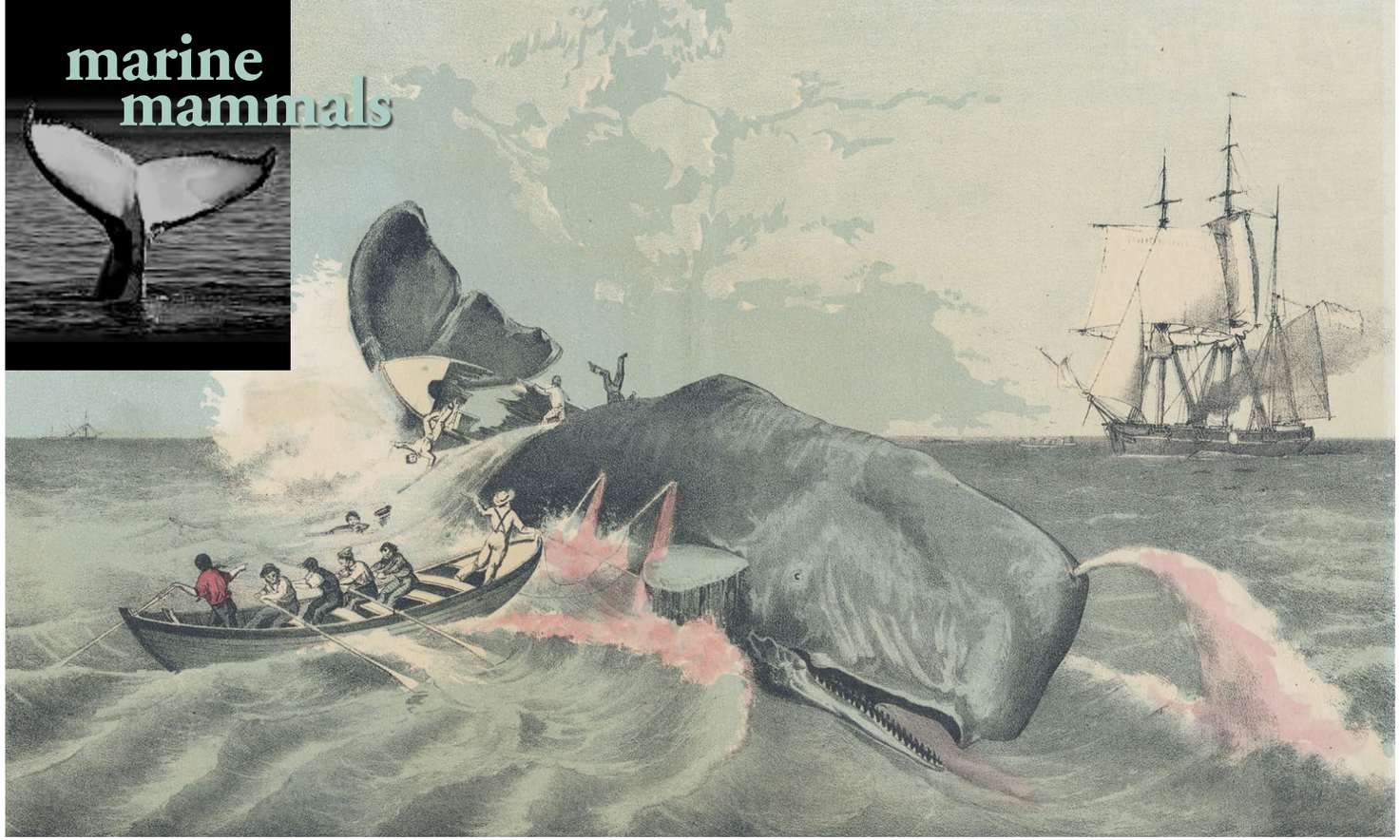
Dugong etiquette

Back at the dive centre, Biso and Mirjam told me that the dugong we had seen was a young male and one of two that sporadically visited the reef. I had been very impressed with their considerate "don't-chase-give-it-space-and-don't-touch" approach, and not once did I feel we were invading this incredible creature's personal space. This is probably why he stayed with us so long.

I know of divers who have searched for dugongs for over 17 years and never seen one. It really is all about being in the right place at the right time, and finding people who are passionate about what they do and who are willing to help you reach your dream. Had Mirjam not insisted we do the dive that afternoon, we would not have seen the dugong, as the following day, the wind was howling and the visibility had dropped—we would not have found him. This is why we, as scuba divers, should live by the saying, "Carpe diem!" or "Seize the day!"—you never know what you might miss! ■

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

The reef at Marsa Alam was pristine, vibrant and teeming with life (above); I am convinced that the dugong was watching me out of the corner of its eye! (top right)



1856 advertisement depicting a whale hunt

Japan withdraws from International Whale Commission and intends to resume whale hunt

Japan's decision to leave the International Whale Commission and resume the whale hunt draws widespread international criticism. Japan's argument is that the commission was set up in 1946 to manage commercial whaling, not to ban it. Commercial whaling was banned by the IWC in 1986 after some species were driven almost to extinction.

Japans announcement that it is withdrawing from the International Whaling Commission and will resume commercial whale hunting next year, have sparked swift condemnation from other governments and conservation groups.

For many years, Japan has hunted whales for what it calls "scientific research" and to sell the meat, a programme widely criticised by conservationists.

After failing to reach an agreement at a global conference in Brazil in September to resume commercial whaling, Wednesday's announcement had been expected, but conservation groups warned the move will have serious consequences.

Officials in Japan, an IWC member since 1951, say eating whales is part of the country's culture, and it has accused the IWC of being focused only on the aim of conserving numbers. In reality, Japan always flouted the moratorium, using a loophole that allowed "scientific research" to continue slaughtering thousands of minke, fin and sperm whales far from its shores and selling their meat on the domestic market.

"Regrettably, we have reached a decision that it is impossible in the IWC to seek the coexistence of states with different views," Chief Cabinet Secretary Yoshihide Suga said in a statement, adding the decision was based on "sound scientific reasoning" and in the interest of "sustainable use of marine resources".

Hunting restricted

Going forward, Japan's commercial whaling will be restricted to Japanese territorial waters and economic zones. As a result, Japan will cease taking whales from the Antarctic Ocean and Southern Hemisphere, a prospect conservation groups had welcomed before it was formally confirmed. Suga stated the hunt would respect catch limits based on IWC calculations, "to avoid negative impact on cetacean resources".

This portion of Japan's decision was welcomed by Australia, which has supported sanctuaries to protect Antarctic whale populations and which challenged Japan's "scientific research" in the International Court of Justice in 2014. But even if Japan did remain bound to the whaling conservation agreement, there is no world power that would stop Japan from whaling in its own waters, specifically Japan's "Exclusive Economic Zone," which stretches 200 miles from its coast.

In a joint statement, Australia's Foreign Minister Marise Payne and Environment Minister Melissa Price said they were "extremely disappointed" with Japan's decision. "Australia remains resolutely opposed to all forms of commercial and so-called 'scientific' whaling," the statement added. Canadian Prime Minister Justin Trudeau took issue with Japan's plan to resume commercial whaling in a telephone call with his Japanese counterpart Shinzo Abe. According to a statement from his office, Trudeau said he "raised the important issue of whale conservation and committed to working with international partners to protect whale species". New Zealand Foreign Minister Winston Peters was also among officials to object to the move, calling whaling an "outdated and unnecessary practice".

Conservation groups also condemned the decision. "By leaving the International Whaling Commission but continuing to kill whales commercially, Japan now becomes a pirate whaling nation killing these ocean leviathans completely outside the bounds of international law," said Kitty Block, president of Humane Society International. The organization also expressed concern that Japan may recruit other pro-whaling nations to leave the IWC, "leading to a new chapter of renegade slaughter of whales for profit".

Domestic discourse

According to Bloomberg, a Japanese foreign ministry official told reporters in Tokyo that whalers were also upset with the plan, and the move to end "scientific" hunts near Antarctica was opposed by the local whaling industry. The official who declined to be identified according to ministry policy called the decision to end hunts in the Southern Ocean—where Japanese whalers have sometimes clashed with environmental activists—a "painful" one.

But Masayuki Komatsu, a former fisheries official and chief negotiator who represented Japan at the IWC from 1991 to 2005, questioned if Japan gains anything from withdrawing and called the decision a misjudgement and it would not stem the steady decline of Japan's whaling industry.

"I doubt if a withdrawal improves the current situation. Japan will lose the right to conduct scientific research under the IWC without gaining any guaranteed rights to continue whaling, potentially leaving itself open to legal challenge," Komatsu said. "Japan's position will become weak. If Japan is taken to an international court, it may suffer and lose ground. If I were in a responsible government position, I wouldn't want to take such risks. Rather, I'd stay with the IWC convention and make the best use of its obligations and duties." ■

SOURCES: BBC, BLOOMBERG, IRISH TIMES, JAPAN TODAY, WASHINGTON POST

AMY VAN CISE, WOODS HOLE OCEANOGRAPHIC INSTITUTION

A group of pilot whales off the Hawaiian coast has been found to have come up with its own dialect.

Pilot whales "speak" in dialects

Researchers studying pilot whales off the Hawaiian coast have discovered that they have developed their own dialects.

Short-finned pilot whales off the coast of Hawaii have their own vocal dialects, according to a study by the Woods Hole Oceanographic Institution (WHOI).

This discovery came to light after researchers from the organisation spent several years identifying individual whales and recording their calls with a specialised underwater microphone. After the data was collected, Amy Van Cise (a postdoctoral scholar at WHOI) and volunteers categorised individual types of whale calls and sorted them into distinct groups.

"That let us effectively make a map of vocal repertoire that we could superimpose onto a map of the whales' social structure," she said.

"If two social groups sound similar to each other acoustically, that likely means that they're communicating with each other regularly, using similar habitats or hunting grounds and foraging habits. This gives us a better sense of the social ties between whale groups. In the long term, that could help us understand both their genetic diversity and their evolution." ■

"The fact that they have different vocal repertoires means that they're purposely not associating with each other.

"They identify themselves with certain speech to maintain that separation.

"It's sort of like if you've got hipsters and prep kids in the same high school—each group has different slang."

— Amy Van Cise, postdoctoral scholar at WHOI

PIXABAY

While many birds use song complexity to assess male fitness, the role of complexity in humpback whale song is uncertain, owing to population-wide conformity to one song pattern.

Humpback whales change their tune every few years

Whale songs exhibit minor changes over time and experience a "cultural revolution" to a more basic version every few years.

Over 13 consecutive years, researchers from the University of Queensland (UQ) studied the structure and complexity of songs sung by the eastern Australian humpback whale population as they migrated off the coast of southeast Queensland from 2002 to 2014.

They discovered that the whales sang increasingly complex songs, perhaps as a result of embellishments by individual males whales in a bid to distinguish themselves from their peers.

The song patterns gradually evolved through small changes each year, gradually becoming longer and having more parts added to them. Then, after several years, the whales would suddenly change their tune. "Every few years, the songs are replaced—always by something simpler—suggesting there is a limit to the whales' capacity to learn new material," said Jenny Allen, from UQ's Cetacean Ecology and Acoustics Laboratory.

Describing this as "cultural transmission on a scale comparable to what we find in people," she added that "by learning more about culture and social learning in animal species such as humpback whales, we can gain a better understanding of what led to its development, and what evolutionary value it holds." ■

SOURCE: PROCEEDINGS OF THE ROYAL SOCIETY B: BIOLOGICAL SCIENCES JOURNAL.

The Octopus

A Friend

Text and photos by Francesco Turano

The common octopus, *Octopus vulgaris*, is a solitary cephalopod found in coastal areas on the sea bottom.

Talking about this animal is simply a pleasure, almost as much as meeting it and relating to it underwater. It is satisfying to spend some time putting my thoughts into words about the octopus, as I am a diver in love with this extraordinary creature—a mollusc that reasons.

Photography has helped me to document the life of an octopus, immortalizing many aspects of this creature's behavior in pictures: its poses, its liveries, its ways of doing things. Always fascinated, I observe the octopus with an awareness that appreciates every single attitude, every little nuance of its way of being—a magic cephalopod, indeed!

Among the living molluscs, cephalopods are certainly the most evolved. Literally, "cephalopod" means "with the feet on the head" (from "*kepahalè*," meaning "head"; and "*podus*," meaning "foot"). It is a name well-suited for these sea creatures, born with arms (or tentacles) that are directly attached to the head.

Of all the cephalopods, the octopus is definitely the most well-known. However, it is always difficult to talk about one of the best-known sea creatures without falling into the banal. I will therefore try to use my human brain, squeezing it properly, just like the octopus itself, which is among the most intelligent invertebrates in nature.

What draws me to the figure of this animal is its unique and unmistakable appearance, combined with its formidable and endearing nature. I am talking about an emotional bond between a sea lover and a sea creature, a profound link between a person and an animal, which often represents one of the great joys of life.

In my native Italy, the octopus is called *polipo* (or "polyp"), despite that in Italian, the term indicates the fixed stage of coelenterates (red coral, anemones, etc). This cephalopod lives in coastal areas on the sea bottom—whether it be rocks, sand or reef—up to a depth of about 100m. On the menus of many Italian restaurants, we often see dishes called *insalata di polipo* (or "polyp salad"). This demonstrates that the correct term still has difficulty getting into common use. Its scientific name is *Octopus vulgaris*, which means roughly "common octopus."

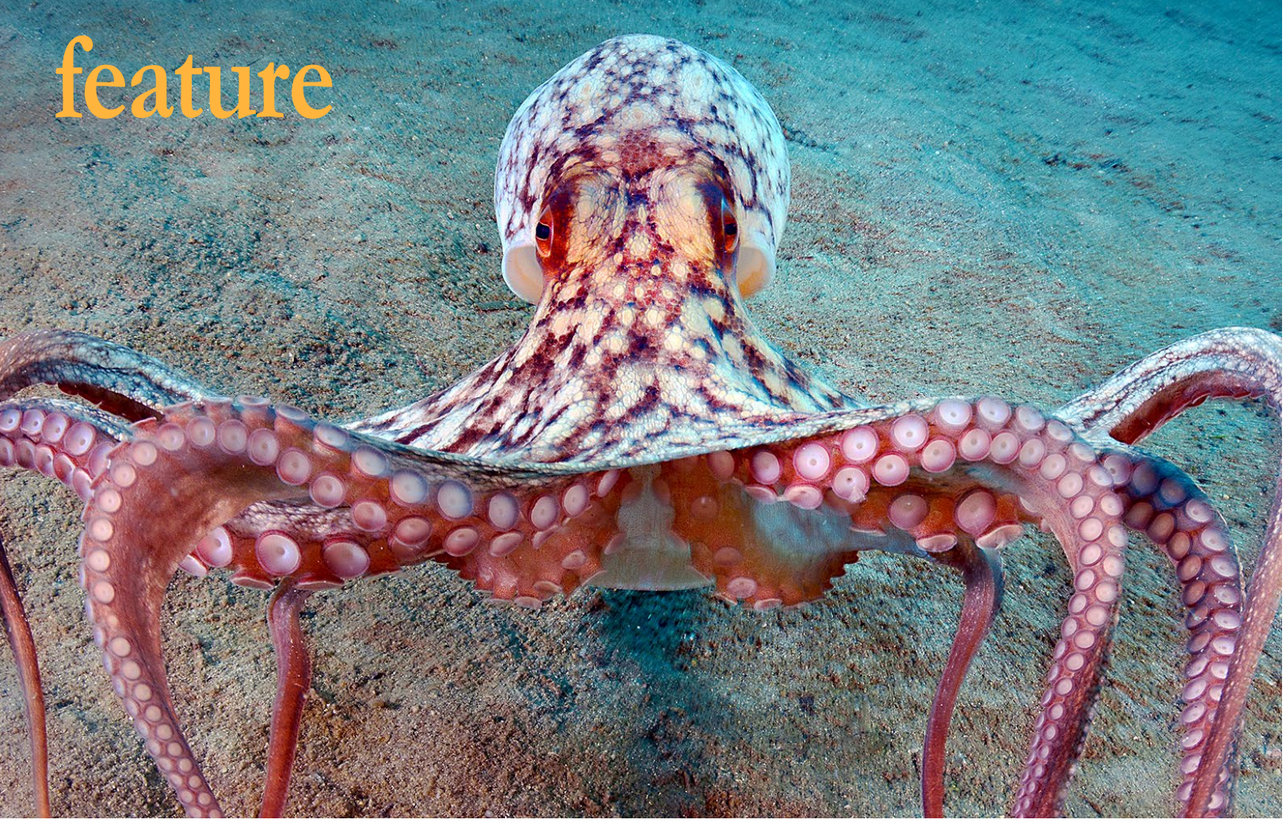
Migration and mating

Eight is indeed the number of its long limbs, arms or tentacles. A substantially solitary animal, very tied to its territory, the octopus makes small seasonal migrations in response to temperature variations. However, it is inactive at temperatures below 7°C (45°F). Adults move to deeper waters at the beginning of autumn, followed later by younger individuals.

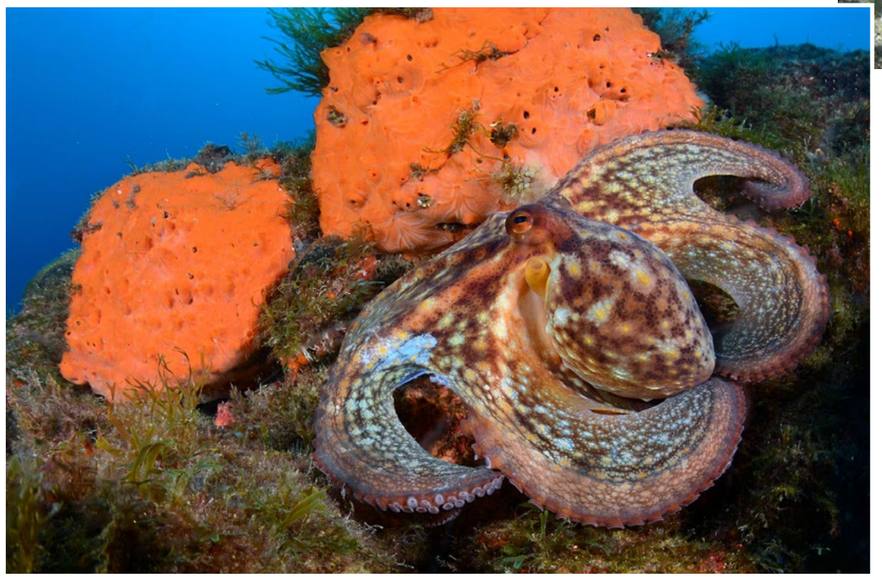
Octopuses are invertebrates with separate sexes, the male octopus being greater in size than the female. The male has a specialized arm, called a hectocotylus, modified at the end in a sort of spatula shape, which has a reproductive function: It is used to introduce sperm contained in bags (called "spermatophores") into the female's body.

Reproduction

The octopus's reproductive period takes place in the spring. The females produce from 50,000 to 100,000 eggs, each about 2mm in diameter. They deposit the eggs in gelatinous cords, which attach to solid supports. Upon hatching, the larvae are



The octopus can change its collors for camouflage or communication.



pelagic, and only after 40 days do they make contact with the bottom.

I have often seen an octopus with eggs, intent on brooding inside its burrow. It is an unparalleled spectacle, seeing this creature assisting its young—at once incredulous and extraordinary. The female does not feed while waiting for her eggs to hatch. She defends her eggs strenuously, does not move from her place, and is willing to give up her life for her offspring. How many things nature teaches us!

Feeding and behavior

But what does our dear friend feed on? The octopus's diet is mainly composed of bivalve molluscs and crustaceans, even if the animal does not disdain fish and other prey—it adapts well to the strangest situations.

With an oval, globe-like body, almost the shape of a sack, it has a head and a body, which is both robust and muscular, fused in a unique structure called a mantle, which is clearly distinguishable by an evident narrowing. On the sides of the head, which is the strongest part of this animal, are its protruding eyes, which are small, placed laterally and surmounted by two protuberances. The lively and restless behavior of this bizarre cephalopod is linked to the possession of these visual organs.

Locomotion

In the back part of the mantle, there are seven to 11 gill lamellae (not visible from the outside) and a siphon from which water is violently expelled for different purposes: moving or swimming quickly and, in case of danger, expelling the contents of the gland ink. This pocket contains a dark substance that muddies the water, disorienting the assailant and allowing the octopus to escape undisturbed.

Thanks to the siphons and its extraordinary system of locomotion, the octopus can suddenly rise from the bottom like lightning and swims like no other animal species. In reality, there are very few times that an octopus will swim, and when it does, it makes short trips so it can rest on the bottom again, hiding itself with its unbeatable camouflage.

However, it is a very modern propulsion system that the octopus employs—a jet engine, if you will—that launches water against water, advancing the animal forward in jerking steps, making the bag that is its head throb, as it opens and closes its arms, which begin to look a bit like long flowing locks of hair.

Tentacles and mouth

From the mantle of the octopus, eight tentacles extend, equipped with two rows of suckers, radiated and without denticles. The suckers are used to retain prey, and as mentioned above, to move on the sea bottom, allowing the octopus to attach itself to the substrate. At the center of the crown of tentacles is its mouth, with a robust horny beak similar in shape to that of a parrot. The octopus' tentacles are more or less of the same length, except for the male's modified arm (or "hectocotylus"), which is about 25 percent longer.

Camouflage and communication

Master in the art of mimicry, this mollusk can change color through specialized cells called chromatophores, which are used for the transmission of signals (in courtship, coupling and fighting) and to blend in with the environ-

The common octopus will squirt black ink to confuse and evade opponents or predators (right) and will swell and display its bigger suckers if it perceives a threat (below).

ment. The coloring of the body takes different shades, ranging from gray to brown, with reddish or greenish spots—while the ventral surface is whitish and iridescent. The colors of the octopus do not change only in relation to the external environment, but they even manifest the animal's mood. On its skin, there are sometimes different colors, and also different structures, ranging from smooth to grainy, from swollen to warty.

Underwater, everything is different if you surprise an octopus in its den or when it is free outside on the sea bottom. Its appearance varies greatly depending on the situation. An octopus in a burrow moves little if it feels safe within its shelter, but it will swell a little if it perceives a threat, showing its bigger suckers and withdrawing within its cave, if necessary.

An octopus running around the sea bottom, if surprised, at first tries to blend in a way that best suits it. When it realizes that a diver's gaze has not released it, the octopus bleaches and starts to move sideways cautiously, gaining ground towards its den. In some cases, it gets up and swims to get away first, but then it rests on the bottom and, if it understands the diver is still nearby, the octopus can also resort to the use of black ink to confuse the opponent.

Growth and shelter

Regarding the size of octopuses, legends aside, the maximum length reached by an octopus is about one meter or so, and its weight rarely exceeds 10 to 12kg.

Habitual frequenters of fissures between rocks, octopuses barricade themselves in their dens with stones, empty shells and other objects found on the sea bottom. While not disdaining areas of mixed substrate, octopuses can also be found on sandy and muddy sea floors.

In these environments, the octopus builds its burrow by collecting stones and shells and digging a sort of hole on the sea bottom, which is easily identifiable. The entrance of the den, in general, is recognizable even in cliff environments due to the presence of the numerous remains of prey upon which it feeds (shells of bivalves, carapaces of crabs and much, much more).

Final thoughts

What a thrill it is to see an octopus swimming in the sea, while frantically trying to follow it in order to photograph it as it moves along its tentacles; and then, when it stops, lost, in front of a diver observing it, to watch the octopus suddenly push against the sea floor, opening its arms up, almost like a parachute, just as it hears the diver's exhaled bubbles.

This bizarre, shapeless animal assumes a constantly changing countenance. The tentacles are so alive and mobile that they seem endowed, each one, with a life of their own. Even the suckers move independently of each other, adhering to individual stones with shrewd, measured, very delicate movements. When it opens its arms, the octopus shows its radial structure, but only for a short time before it closes its arms and collects itself.

Meeting an octopus underwater gives more meaning to one's immersion, especially when the animal interacts with you almost as if it were domestic. When an octopus interacts with you, allowing itself to be held in the palm of your hand—you being very mindful and careful not to cause it too much stress—it is not uncommon to see it huddling in on itself, protecting itself with its own tentacles, which are arranged to create a roundish cluster, with suction cups that hold some stone for further defense. Inside this "octopus ball," one can have a fleeting glimpse of the tiny place from which its eye timidly scrutinizes the outside world. ■

Francesco Turano is an underwater photographer and writer based in the province of Reggio Calabria in southern Italy. He is the author and co-author of several books, including Viaggio in fondo allo Stretto (Journey to the Bottom of the Strait) *published by Laruffa Editore; Sott'acqua in Mediterraneo* (Underwater in the Mediterranean) *published by SSI; Enciclopedia Illustrata degli Invertebrati Marini* (Illustrated Encyclopedia of Marine Invertebrates) *published by Arbitrio Editori; and the large photo book with over 250 photographs, Calabria, Mediterraneo sconosciuto* (Calabria, the Unknown Mediterranean) *published by Iiriti Editor. For more information, please visit:* ***francescoturano.it****.*

Edited by
Rosemary E. Lunn

POINT & CLICK ON BOLD LINKS

Equipment

Serenity Concept

French manufacturer Serenity Concept has devised a dive computer with a two-part geolocating system—a wrist-worn digital compass and a beacon—that has been designed to help divers navigate back to their boat. The beacon is deployed beneath the boat, and the water actuated compass communicates with it. Serenity states that the beacon has a range of 1km (1,093 yards). Apparently, the compass screen is brightly lit, which should make it easier to read in dark conditions. The compass displays the direction to the boat, how far away it is, the current depth and safety stop information. **Serenityconcept.com**

CE for X-CCR

The Czech-based manufacturer of the X-CCR rebreather has reported on social media that the unit has received its CE certification. Tim Moran of iQsub stated, "The X-CCR has passed all tests in accordance with EN 14143:2013 and with a sufficient reserve, without any need for design changes, without reservations and without limitation in use in any diving position." A standard X-CCR is equipped with a Shearwater DiveCAN Petrel2 Controller on the left hand and with DiveCAN Head-Up Display placed on the BOV. A diver has the option of adding a DiveCAN or analog Petrel2 Monitor (as a secondary computer) and/or a DiveCAN or analog NERD. **IQSub.com**

CX1

Dive Rite unveiled the CX1—a powerful, compact, handheld light—at EUROTEK.2018. This lightweight torch (312g / 11oz) will be great for a travelling diver, and an ideal backup for a techie. The high capacity rechargeable 5200 mAh 26650 li-ion battery produces 1,000 lumens at the touch of a button, with a useful 3.5 hour burn time on the high-power setting. It has four power modes, a strobe function, and a flange on the base of the torch so that the diver can tie a bolt snap to it, to clip it away when not in use. Dive Rite has also included a sleeve so that divers have the option of using a 18650 battery if they wish. **Diverite.com**

Tech Hoodie

Fourth Element states its Tech Hoodie is "exceptionally warm and keeps the cold at bay". It certainly does. I have a reputation for being a "Froz Roz" and discovered to my delight that when I donned this, I could ditch my winter coat and wear just the hoodie during autumn and into winter. This "responsibility sourced" hoodie is lined with a soft recycled polyester fleece. The outer layer is a combination of organic ring-spun combed cotton and polyester. The garment has two hand pockets and one internal pocket, which is big enough to take a large smart phone. It is easy to wash and wear. Just set the washing machine to 30°C (86°F), do not use conditioner and put it on the line to dry. **Fourthelement.com**

Waterproof W30

Waterproof's W30 Sport Series has been designed for topical water diving where you need protection against scrapes and stings as well as the sun. The 2.5mm steamer sleeves, ankles and neck are finished with a piping of rolled neoprene. The high neck has been designed to reduce BCD "rub" and pads have been fitted to the shoulders to help protect against wear, and to provide "anti-slip" properties to help keep the BCD or harness in place. The male and female cut wetsuits come in black with silver flatlock nylon stitching and green accents. This suit is fastened at the back with a YKK zip, and it is available in ten sizes. **Waterproof.eu**

At DEMA, Poseidon announced that the SE7EN is now ready for Poseidon's digital Solid State Oxygen Sensor.

POSEIDON - VIA NEWSLETTER

Poseidon SE7EN, now ready for digital Solid State Oxygen Sensor, ditches pre-packed scrubber

Poseidon announced at the 2018 DEMA Show that it will phase out its pre-packed scrubber cartridge for the MKVI Discovery and SE7EN rebreathers.

It would be fair to say that seasoned rebreather divers were not that keen on this scrubber canister for a number of reasons.

Poseidon stated that its single-use canister could only be used (once opened) within 12 hours, and needed to be thrown away after diving had ceased for the day, no matter what diving had (or had not) been done. Whilst I am not advocating that anyone should push a scrubber, to bin the contents of a scrubber seemed daft when you had only done a 30-minute dive, and you had planned to dive the next day—especially when you were tracking your scrubber usage.

The pre-packed canisters were more expensive than buying loose Sofnolime 797, and there was also the environmental issue. The one-time-use canisters were made from plastic, and there was no mechanism to recycle or return them. Finally, not every rebreather centre stocked the Poseidon canisters. The solution for many Poseidon divers was to buy a refillable scrubber canister from a third-party manufacturer.

Positive News

Now Poseidon has stated that it has taken the decision, together with Molecular Products, to phase out the one-time-use canister in favour of a diver-repackable scrubber. This move will certainly be warmly greeted by divers and dive professionals alike. It is believed that the new pack-your-own scrubber will have a two-hour duration.

Poseidon will have sufficient pre-pack canisters in stock to cover demand in January and February. It is thought that the new canister will be coming on line in February or March 2019. Poseidon has advised that it will be providing information and videos on how to pack its new scrubber soon. This may well be an invaluable resource in the future, because Poseidon's marketing is pretty slick.

We do know that the new scrubber canister has been through independent third-party testing and and was conducted to the CE standard covering rebreathers: EN14143. ■

Edited by
Rosemary E Lunn
& Peter Symes

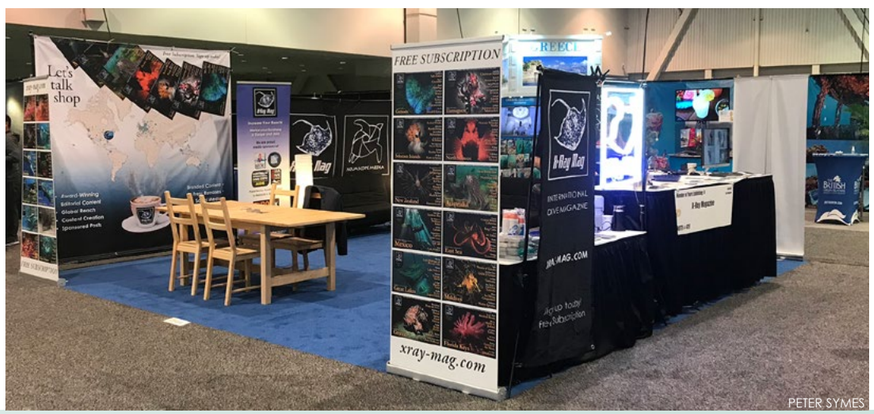
"10, 9, 8..." Traditionally, DEMA has been opened by the DEMA Board.

Glimpses from DEMA

Upon returning from recent DEMA shows I have often got comments about how the show was good but also "lightly attended." Yes, the attendance has steadily declined over the past one or two decades, but last century is already a very long time ago, and I find the significance of trade shows have evolved profoundly over the years.

A good while back, they used to be events one had to attend for two main reasons: One, was to see new equipment being unveiled and haul back trunk loads of press kits and photos. This was in the days where the internet was in its infancy, and the instant sharing of high resolution images and video via Dropbox or WeTransfer was still a far-fetched technology one could only dream of. Attending in person was simply a must if you were to get the latest news, while it was still news, or risk being left in the dark. Being members of the press, we also got to see and touch stuff that was still under embargo, so we had a jumpstart to write up news and even reviews before the news broke to the public. In the present day where information and images are so easily shared at any given time, there is much less need to fly across oceans and continents to go see items for yourself.

The second reason to attend is to network and meet clients and associates face-to-face. As technology has not yet come up with a better solution, we still travel to trade shows such as DEMA



A still tidy *X-Ray Mag* booth looks ready before the flood gates are opened to the public.

Mark Caney from PADI and the RTC

to be able to sit around the same table and discuss matters in person. Which is all good because as far as we were concerned, we were all busy just with talks throughout the show. That is not to say that various new equipment and resorts were not presented at the show—some of this new kit is presented elsewhere, i.e. in our New Equipment section—and assorted news from training organisations and operators have been posted on our website.

RESA and RTC

A productive meeting was held between Rebreather Education and Safety Association (RESA) and the Rebreather Training Council (RTC) about industry-wide rebreather training standards. "The key item to come out of this meeting was an agreement for a joint committee to look at standards issued by both organisations, and work objectively towards a harmonisation of standards," Mark Caney from PADI and the RTC stated. "In the interest of all parties in the dive industry, if we can agree on standards between all the major players, this will benefit not only the dive professionals involved, but current and future divers."

PADI and GoPro partnership

PADI's CEO and President, Drew Richardson, confirmed at the Las Vegas show that PADI and GoPro

are joining forces "to help millions of divers share their stories of underwater exploration and ocean encounters". This collaboration will facilitate superior shooting and editing techniques. Whilst details of how this partnership will work are yet to be revealed, we understand that divers will be provided with tips, tools and training to create great video content. The ultimate goal will be an easy process for divers to show others their underwater adventure videos. Kristin Valette-Wirth, Chief Marketing and Business Development Officer of PADI Worldwide, stated: "GoPro and PADI have a common vision to enable exploration, push boundaries, forge new paths and share experiences through imagery, video and technology."

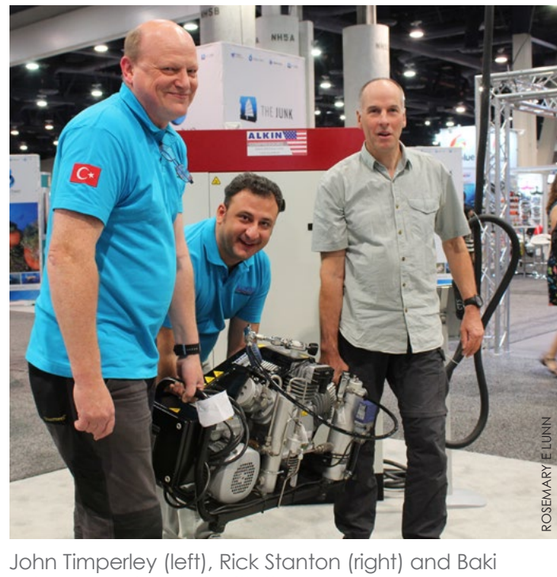
Compressor for the cave rescuers

We all know that the Tham Luang cave rescue was highly successful. What is less well known is that there were a number of logistical difficulties along the way for the British divers. When Rob Harper, Rick Stanton and John Volanthen arrived at Tham Luang cave after having flown overnight from the United Kingdom, they found the site in utter chaos. Stanton and Volanthen decided that they should conduct a reconnaissance dive to get a better understanding of the situation. Both men had flown with empty 7-litre cylinders. Now, they urgently needed to get them filled. This should have been a straight forward process, but it wasn't. Eventually, Stanton and Volanthen found a small compressor that the Seals used. It was located next to the press conference area.

"The media were not impressed when cylinder filling coincided with a press conference," Volanthen recalled. The obvious solution was for Stanton and Volanthen to "liberate" the compressor to a better location. It did not take long for the Seals to recover their compressor, but luckily, they did it after the Brits had filled their cylinders.

Stanton later recounted his Thailand compressor adventures to Tracy and John Timperley during the PADI Social at the 2018 DEMA Show. The Timperleys run C&R Testing in the UK, and they work with Alkin compressors. "It was clear to me that Rick needed an up-to-date lightweight compressor," stated John Timperley. "It had to be something suitable not only for expeditions, but a compressor that could be packed up and flown to a remote destination for use on a future rescue. I spoke to Alkin and they kindly gave Rick a W31 compressor at the Las Vegas show."

I asked Stanton what this compressor would mean to the cave diving community. "This is going to be very useful to the British Cave Rescue Council cave divers. We now have a centrally located compressor in the UK (Coventry) that will make domestic and international rescue logistics so much easier. No more hunting for air! The W31 is small and light so we will be able to take it with us, and know our cylinders will be filled with quality breathing air. It will also enable us to continue certain cave diving projects in Europe. A few of us would like to get back to the Doux de Coly in Dordogne one day. At present, the cave is shut to diving, but we live in hope this won't be a permanent situation." ■



John Timperley (left), Rick Stanton (right) and Baki Boke Topac (center) with the new compressor, which Alkin donated to the cave rescue team

Edited by
Peter Symes

Twelve divers and cavers were recently reunited at EUROTEK. LEFT TO RIGHT: Chris Jewell, Erik Brown, Mikko Paasi, Jim Warny, Craig Challen, Richard Harris, Rick Stanton, John Volanthen, Jason Mallinson, Josh Bratchley, Connor Roe, Rob Harper

Cave divers recognised by Her Majesty The Queen

Six British divers and one caver involved in the 2018 Thai cave rescue were recognised by Her Majesty The Queen in the 2019 New Year's Honours List.

Rick Stanton, John Volanthen, Jason Mallinson and Chris Jewell were the core recovery divers in the team, i.e. they dived the boys out. They were soon nicknamed "the awesome foursome" by fellow Thai cave rescue diver Dr Richard Harris. Because of their crucial dives in the Thailand cave rescue, these four Brit divers received a civilian gallantry award—these medals recognise the bravery of people who have sought to save the lives of others.

Stanton, who was already appointed a Member of the British Empire (MBE) in 2013 and Volanthen received the George Medal "For demonstrating exceptional bravery—putting [himself] in danger to protect others." Jewell and Mallinson received the Queen's Gallantry Medal "For gallantry of a high order in the rescue of 12 junior footballers and their coach, trapped in a cave in Thailand." In addition, two support divers and a caver—Josh Bratchley, Connor Roe and Vern Unsworth—were appointed Members of the British Empire. ■

The George Medal (GM)
Just over 78 0years ago, on 24 September 1940, the George Medal was instituted by Royal Warrant. It was the time of the Blitz, when Germany was actively bombing Britain's cities, and King George VI believed that there was a need to formally recognise outstanding individual acts of civilian bravery by men and women of the Commonwealth.

The Queen's Gallantry Medal (QGM)
Awarded for "exemplary acts of bravery" by civilians and members of the Armed Forces where purely military honours are not normally granted.

Member of the British Empire (MBE)
The Most Excellent Order of the British Empire is a British order of chivalry, rewarding contributions to the arts and sciences, work with charitable and welfare organisations, and public service outside the civil service.

A tribute to Alan King

On 12 January 2018, Alan Charles King passed away from cancer. He was 68. You may not have heard of Alan King, but he had a profound effect on UK scuba diving. Forty-one years ago—on 19 January 1978—Alan, along with his wife Kay, his friend Harry Chapman and Alan's father, Frank, bought a quarry in Leicestershire. The quarry, of course, is Stoney Cove.

Text by Rosemary E. Lunn

Alan was a friendly colleague who loved being outside and talking to anyone. As a child, he developed the skill of always finding something of common interest to discuss with anyone he met, and he carried this through into his adult life. Alan was able to strike up a conversation about anything with anyone.

Alan learned to scuba dive in 1970 when he joined the Leicester Underwater Exploration Club. Two years later, he became a commercial diver—a high risk career in the early '70s—with his "office" primarily being the North Sea exploration rigs.

Angry eel

One story he fondly told was about trying to dislodge a conger eel happily ensconced in a 12-inch drill pipe on the sea bed. His surface crew thought they would be helpful and sent a heavy weight down the guide wire to dislodge it. Instead this hit the eel on the head and made it a very angry 12-inch-wide conger eel.

Alan was delighted when he got the opportunity to commercially dive off Brazil and came back full of stories about water visibility that North Sea divers could only dream of, and grouper the size of cars. Alan said these inquisitive fish would look over one's shoulder all time, chasing away any other fish that might dare to want a peek. This would make the job more difficult because the grouper would bump into him, knocking him away from the job he was supposed to be getting on with. And with nothing to grip onto underwater, there wasn't much he could do.

And then he got to dive the River Humber, checking pipelines in zero visibility. Everything was done by touch. On one particular dive, he thought he had found a body and passed it to the boat crew with his eyes closed. One of the crew said, "Oh, that's brilliant, Alan. Are there any more down there?" Alan thought, "How could you be so heartless?" But upon opening his eyes, found it to be a lost diving cylinder and harness.

Stoney Cove

In the winter of 1977, during a pleasure dive at Stoney Cove with a friend, Alan was asked if he was interested in running the site as it was up for lease. A few months later, Stoney Cove Marine Trials Limited was formed to cater for amateur scuba diving and commercial underwater activities. The Cove was under new management.

The Cove has been thoughtfully developed over many years. When I did my first dive in Stoney in spring 1992, some of the main features that you see today were in place: the changing rooms, the pub, the bus stop, the concrete ramp by the shed, and the smaller building by the main entrance.

It was good to hear Alan discuss future plans to enhance Stoney Cove. These included the sinking of the *Stanegarth*, expanding and extensively refurbishing the diving terrace (located by the concrete ramp), and building the new mill. The *Stanegarth* was a steam-powered tugboat built in 1910 for service with the British Waterways Board. On 6 June 2000, she was scuttled at Stoney Cove to produce an artificial reef in 20m and is now the largest inland wreck in the United Kingdom.

The team took inspiration from architecture in Bristol and the London docks to create a building that looked as though it had been at Stoney far longer than it really had (if you look closely, you will see a "window" bricked up because of the 1696 Window Tax).

No crayfish on the menu

Alan told me a story that still makes me smile when I think of it. Commercial dive teams used to

Alan King became a commercial diver in 1972, primarily working on the North Sea exploration rigs but also off Brazil.

STONEY COVE

Stoney Cove is located in Stoney Stanton. In the 1800s, the village had a number of granite quarries: Clint Hill, Little Pit, Top Pit and Lane's Hill (granite has been extracted from the area since Ancient Roman times and microdiorite from Stoney Stanton was used in the construction of the Ancient Roman road, Fosse Way—part of the A5). There was a perennial problem with spring water at Lanes Hill Quarry and pumps were used to stop flooding.

In 1957, Top Pit and Lanes Hill Quarry closed and the quarry workings vanished as the sites naturally flooded and Stoney Cove was created. There are anecdotal stories that suggest that divers were diving the Cove as early as 1958.

In 1963, the British Sub-Aqua Club named the flooded quarry Stoney Cove—The National Dive Centre. The North Sea oil industry was also developing, and the first commerical diving centre opened at the Cove in 1964. Stoney provided ideal conditions for commercial divers to learn and practice their skills, and develop and test underwater equipment for the oil fields. In later times, ROVs and one-atmosphere suits were dived at the Cove. ■

THIS PAGE: Scenes from Stoney Cove used by divers for training since 1958. Above: A rare photo of the *Stanegarth* before she was scuttled on 6 June 2000 at Stoney Cove. Lower left: You often bump into friends at Stoney Cove. The author is pictured here catching up with Mike Burley, former Chairman of the Sub Aqua Association.

"In our first year we had 365 sports divers through the site, Alan's father told us on paper we should be bankrupt! Alan got a job lorry driving to earn some money and would finish his drops then come to the Cove and service regulators and serve in the shop, before working in the pub until late in the evening.

At that time Alan, Harry Chapman and I worked pretty much 18 hour days. We then started clearing and tarmacing the site and building a safety wall which made a huge difference to the appeal of the site."

— Kay King

often train at the Cove. They tended to drive large specialist vehicles because significant amounts of equipment was dived. One particular dive team invited Alan into their vehicle for lunch one day. It had been fitted out with a mini-kitchen and a crew seating area. On the menu? Fresh water crayfish ala moules marinière. Alan said they were delicious. As he left, he spoke to the dive supervisor to thank him for the lunch, and mentioned if the team ever removed a single crayfish from the Cove in the future, they would be banned for life.

One of the many highlights Alan appreciated was winning the first-ever Dive Centre of the Year Award in 1998 (it was the first-ever DIVER Magazine Award). At the time, this was an extremely prestigious thing.

In 2000, David Jones set up Triton Scuba and headhunted me to manage the dive centre. Alan King came down to Portsmouth and kindly helped stock the shop with drysuits, regulators and fins on a sale and return basis. This generous act was exceedingly helpful and meant that the dive centre did not have to take out a large loan to buy in stock. I saw first hand that Alan had a kind heart, and if he could do you a good turn or help out with anything, he would go to extraordinary lengths, whatever the task.

Spanish armada wrecks

Away from Stoney Cove, Alan continued his love of diving. In 1985, he was part of a team that discovered three Spanish Armada shipwrecks off the coast of County Slingo in southern Ireland. Alan was proud of this, and would enthusiastically regale people with stories of the adventures he had whilst finding these wrecks. From flipping the boat over when a rogue wave hit it to being amazed at finding the dive kit washed up on the beach the next morning. It did not matter whether you had heard it once or ten times, you would still laugh with him because you could not help but get carried along with the excitement and enthusiasm he had.

Alan loved giving talks and slide shows on his commercial diving days or the Armada wrecks to local dive clubs, women's institutes or anyone else who asked him.

Alan was also a family man. He was very proud when his son Matt was born, but he was not able to see him for five days. Alan had mumps! When Alan became a grandfather, he wanted to spend as much time as possible with his grandson, Theo, and was one of the first in line for a cuddle.

Although Alan was born and brought up in Leicestershire, he had a special place in his heart for the Isle of Skye. Alan's family had holidayed on the island for 25 years, and the plan was to retire there and invite all his friends from south of the border to come for holidays, with the proviso that you make sure you bring some work clothes! Unfortunately, it wasn't to be. Alan became ill with prostate cancer.

He leaves a remarkable legacy. For me, personally, Stoney Cove is my favourite inland site, but then I am biased. I did my first dive at Stoney, and I passed my PADI instructor exam at the Cove. The Cove has been a nursery for thousands of divers who have taken their first fin steps in the fresh spring water.

Thank you for making such a positive impact on our diving world Alan! ■

John Womack, Sr.

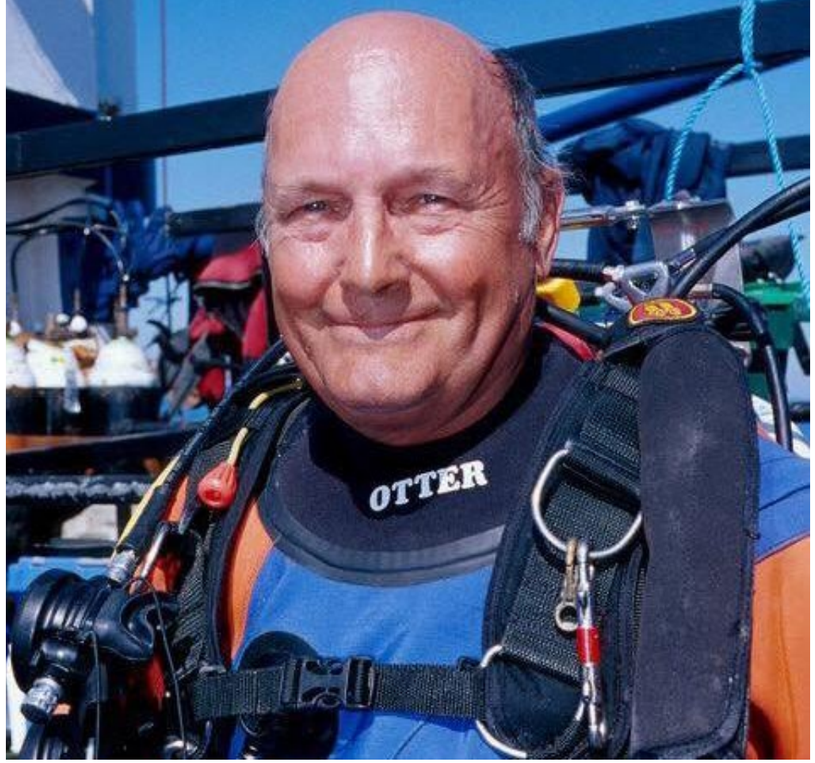
Text and photos courtesy of Rosemary E. Lunn and the Womack Family

UK diving industry stalwart, John Womack senior—founder of Otter Watersports and Divers Warehouse—passed away peacefully in his sleep in the early hours of Friday, 30 November 2018, following a long illness.

The sad news broke during the "Get In" for EUROTEK.2018, and tears were shed as exhibitors built their displays. It was ironic that John died as we got EUROTEK underway. John loved this event and he backed it from the beginning. He was one of the very first exhibitors to book in 2008. When I phoned him and explained my plans for the specialist exhibition, he instantly said he would take a space. This big-hearted gesture was typical of John.

Doing field repairs

John had sponsored both Carl Spencer and I with Otter Britannic drysuits. But his sponsorship did not stop with providing a suit. He came out to Greece when Carl led the ground-breaking 2003 HMHS *Britannic* expedition. (This was the first time the wreck had been solely dived by a team of rebreather divers). I watched John on *Loyal Watcher* (the expedition dive vessel) doing field repairs to team drysuits—it did not matter if it was an Otter suit or not—all



he cared about was ensuring the diver stayed dry. Although the water was 16°C (61°F), the team typically had a six-hour run time, and a leaking suit would have been bad news for divers. Their decompression stop would have been miserable and not as safe as it should be.

John learned to dive in 1972 with the Bradford Sub Aqua Club and was an ardent supporter of BSAC. He progressed up the ladder and became a BSAC First Class Diver (1979) and an Advanced Instructor, and over the years, served as the club diving officer and chairman. In 1976, he was appointed a trustee of Bradford SAC, a position he held until his death.

Bradford SAC is one of the few dive clubs in the United Kingdom that has its own clubhouse. (It is a former pub). In 1974, John was instrumental in obtaining a mortgage for GB£7,500 to buy The Finn Inn, and he used his house as security.

From cars to drysuits

Originally, John was a car mechanic before he managed Robin Hood Watersports. In 1986, he founded Otter Watersports, and the company began life in a room in an old Bradford mill. When it came to making drysuits, John was self-taught, but he was obviously doing something right because Otter gained a great reputation for made-to-measure drysuits.

John quickly grew the business, and within two years Otter had taken over the whole building. Otter relocated to an old refurbished wool mill, again outgrew the premises and relocated a third time in 2004 to a refurbished 19th century Chapel. As the business grew, so did Otter's reputation, and now, leading explorers dive Otter drysuits around the globe.

My fondest memory of John was on the 2003 *Britannic* expedition. He told me about a lot of stories and one in particular made me giggle. John manufactured trilam or membrane drysuits, and he described the material as "otter skin." News of these "otter skin" drysuits spread, and he was contacted by a trapper based in Alaska stating that he had 200 magnificent otter pelts and did John want to buy them for his drysuits? What was less amusing was that animal liberation people did not do their homework and targeted Otter because they also thought the drysuits were made from real otter skins. John soon told them the truth.

Family meant everything to John, and Marlene (John's wife), daughter Tracie, and sons Paul and John junior all worked at Otter Watersports and Divers Warehouse. In 2012, Divers Warehouse was sold, whilst Otter remains a strong family business. Today, John's vision continues in Jonathan, a third generation Womack. Jonathan is learning from the bottom up the art of making great Otter drysuits. ■

Sabine Kerkau to be inducted into WDHOF and awarded the SSI Platinum Pro 5000

Text by Rosemary E. Lunn

Sabine Kerkau will be the first German woman diver to be inducted in Women Divers Hall of Fame since it was founded almost two decades ago in 1999. It is rare that a non-American diving woman's work is acknowledged by this non-profit organisation.

Kerkau is a diving journalist, more specifically, a technical diving journalist, contributing to *Divemaster*, *Tauchen Magazine, WetNotes, Underwater World, Unterwasser Magazine* and *X-Ray Mag*. There are very few of these specialist reporters, and even fewer female technical diving correspondents. Kerkau is an intelligent author. She keeps the wreck or cave centre stage, and gives it maximum exposure. In the past 13 years, she has joined key expeditions around the world, and has dived iconic wrecks such as HMHS *Britannic* (Greece) and HMS *Victoria* (Lebanon). Kerkau was also a member of the MINEQUEST 2 project in Newfoundland, and worked alongside WDHOF member Jill Heinerth. It should be noted that this was an Explorers Club Flag expedition.

PETER SYMES

Sabine Kerkau at Eurotek.2018 in Birminham

Awards

Kerkau's exploration and dive journalism have been recognised by DIWA (Diving Instructor World Association), and she was given an award at Boot Show in Dusseldorf, Germany, for her feature stories on technical diving. One comment by a DIWA spokesperson about Kerkau really resonated with me: "Articles written by Sabine always have rich content. Incredible reports. It makes me feel that I'm there too."

In 2016, Kerkau was a EUROTEK Media Award nominee. At Eurotek.2018, Kerkau was presented with the SSI Platinum Pro 5000 Award.

Baltic Sea Heritage Rescue Project

Kerkau recently co-founded the Baltic Sea Heritage Rescue Project. This is based in Lithuania, and it has two roles: firstly, to detect and recover ghost fishing nets and ensure that they are properly disposed of; and secondly, to search, identify and protect wrecks. This is a joint visionary project with fisheries associations and local fishermen to protect the ecosystem of the Baltic Sea. Kerkau is therefore working with the Ship History Department and the Klaipeda University Institute of Baltic History and Archeology. ■

Amos Nachoum wins prestigous SIPA Award

Text by Peter Symes

I have known Amos Nachoum for about a quarter of a century, but I have never seen him as glowing as when he, at the recent DEMA show, told me about winning a Siena International Photo Award—an honour that is truly well-deserved. I know of few, if any, other wildlife photographers who have consistently been putting out quality work for so many years.

Through his BigAnimals.com, he has been offering an ever growing range of specialised photo expeditions to select destinations and sights all over the globe, including both Poles. It is not just diving expeditions but also trips to see polar bears in Greenland, cheetas in the Serengeti and anacondas in Brazil. Some of his expeditions are led by frequent contributors to *X-Ray Mag*, Amanda Cotton and Jennifer Idol. Groups are kept small so that each participant will have better encounters with the animals, and longer, more rewarding experiences and photo opportunities. ■

The winning image of the wildlife category

Facing Reality: Leopard Seal and Gentoo Penguin

Amos Nachoum writes:

"Behavior, preparation and passion—are the basic building blocks for working successfully with the camera in any wilderness and underwater in particular, since we are limited to only one camera and one lens at a time.

"The predation behavior of the leopard seal is long and elaborate—from the ambush in shallow water by a colony of young chicks, moving back to the open water, the drowning of the penguin process is involve in a play time of catch and release. Culminated in this apex moment of the already-drowned penguin and still hungry leopard seal, it took days of observation to pinpoint the action and about six hours of actual time onsite from the start to end—in the freezing cold of the Antarctic, and in and out of the water." ■

Alex Mustard awarded MBE

Text by Rosemary E. Lunn

Alex Mustard was awarded the MBE medal by fellow scuba diver, HRH Prince Charles, in recognition of his award-winning underwater photography. Mustard later remarked on social media that HRH Prince Charles had told him to keep taking pictures of plastic in the ocean so we can beat the problem.

Several divers congratulated Mustard on social media. Two comments echoed HRH Prince Charles' words: "Alex, you're an ambassador for the whole underwater community—photographers and wildlife alike," and "I agree with the Prince. You've inspired me to take some plastic photos too."

When I spoke to Mustard after the ceremony, he told me: "This was totally unexpected, but a wonderful surprise when it was announced in the Queen's Birthday Honours list. Officially, it was given for Services to Underwater Photography, which certainly raised plenty of interest in the Investiture Ceremony. Prince Charles is an experienced scuba diver, so took a real interest in what I do, asking me about the advances in photographic equipment in recent years and also stressing the importance of raising awareness of the problems that the oceans face." ■

Alex Mustard with Eleonora Manca at Buckingham Palace

Text by Simon Pridmore
Photos by Andrey Bizyukin

We are all involved in the same great sport. Whether you are a recently qualified open water diver or an experienced diver who has travelled to the farthest oceans of the world, there is a bond that connects us. We are all divers. One notable feature of this bond, one that connects even the most occasional diver with the pioneers who push the frontiers of underwater exploration, is the way in which those at the cutting edge of the sport influence how the rest of the world dives.

In the automobile industry, technologies such as ABS braking, air bags and push-button ignition were originally developed for racing cars but have now found their way into family saloons. Similarly, significant developments in scuba equipment and diving practice that were initially devised by the technical diving community have been passed on to the sport diving community at large and are now universally accepted and adopted.

Here are five things that we should thank technical divers for:

Innovations

— Things to Thank Technical Divers For

Alternative diving gases

It may be hard to believe now but there was a time, not so long ago, when many of scuba's most influential organisations and periodicals forecast that to introduce nitrox to the recreational diving community would lead to disaster. They dubbed it the "Devil Gas" and forbade all exhibitors at dive shows from advertising anything to do with nitrox. One major tourist destination, the Cayman Islands, initially issued an edict banning nitrox diving from its waters completely.

However, technical divers had been using higher oxygen mixes safely to extend bottom time and conduct safer decompressions for years. In a demonstration of people power, divers all over the world decided that they would ignore the warnings of the entrenched conservative scuba establishment and flocked in their thousands to the technical training agencies to see for themselves what nitrox was all about. This

forced a dramatic about-turn from the mainstream organisations, which all now espouse nitrox wholeheartedly and even offer it as an option on beginner diver courses. Today, nitrox is everywhere and, whereas, in the early 1990s, divers with nitrox tanks on their backs raised heckles, in 2018, the sight of the green and yellow bands does not even raise an eyebrow.

Octopus hoses

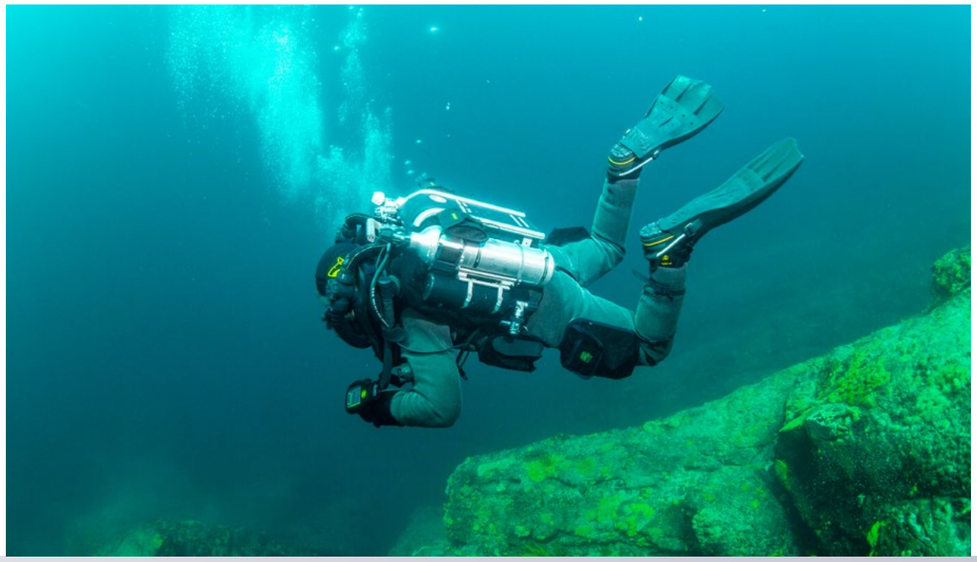
For a long time, divers carried only one second stage regulator and learnt to "buddy breathe" in an out-of-air emergency, with two people sharing a single second stage. However, cave divers trying to exit together following an air-supply crisis found it very difficult to buddy breathe through narrow sections of a cave and solved this problem by adding another second stage to their regulator set-up. This was attached to a hose long enough to permit two divers following each other to breathe from the same cylinder. Eventually, this practice found its way out of the caves into mainstream diving, via the wreck diving community. Sport divers immediately saw the advantages of each air-sharing diver having his or her own second stage and being able to move relatively freely while breathing from the same cylinder, thereby reducing stress.

Configuration/snaps and D-rings

Divers used to just allow their hoses and accessories to hang down freely. That was in the days before configuration, a concept developed out of necessity by divers operating in confined spaces and at extreme depth. They had to work out ways of stowing equipment so that it would not get caught up and damaged, and yet still be easily accessible in an emergency. Using stainless steel and brass snaps and D-rings allowed accessories and hoses to be attached closely and securely. It also made the divers more streamlined and allowed them to move more easily through the water, particularly against a contraflow.

Recreational divers noticed what the technical divers were doing and saw the practical value. Manufacturers took note of diver demand, and D-rings and snaps started appearing everywhere. Not all the products that appeared were an unqualified success, however. Some manufacturers just did not understand the concept. They added D-rings to loose chest straps that looked deceptively functional when a diver was vertical and standing, but just allowed any object attached to swing back and forth like miniature wrecking balls when the diver was horizontal and swimming. At the lower-budget end of the market, manufacturers economised by painting plastic D-rings silver instead of using metal. These, of course, just snapped and were rendered useless as soon as any pressure was applied to them.

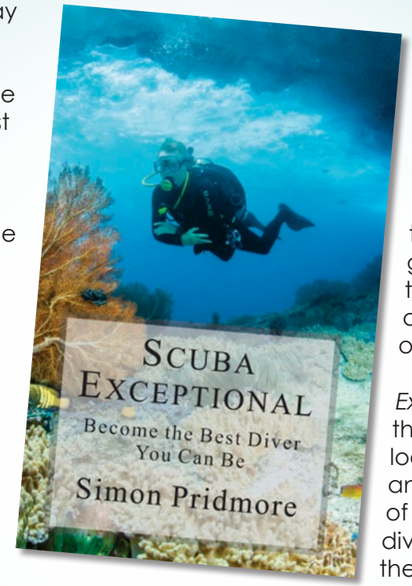
Nevertheless, the overall trend has been positive, and divers at all levels are now able to set their equipment up much more efficiently and effectively than before. But the configuration revolution is still a work in progress. You still see many divers with hoses dangling free and with accessories hanging pendulously from lanyards. It would be good to see more emphasis on configuration in beginners' courses.



Delayed surface marker buoys

Delayed surface markers buoys (DSMBs) were initially popularised by technical divers, who used them as an aid to main-

A New Book for Scuba Divers!



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

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

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

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

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

taining control of their depth during long decompressions and to enable the dive boat to follow the dive team as they drifted. Divemasters all over the world, particularly those operating in areas with lots of boat traffic, saw the safety advantages of inflating and sending a DSMB up from depth to identify the location of divers who were about to ascend. Now, even new divers are being taught how to raise an inflatable buoy from their safety stop. This is another trend, however, that has yet to be universally adopted. But it is a vital skill for a diver to have and deploy. It not only tells the pick-up boat where the divers are, but it helps ensure that other boats keep clear too. If every diver on every dive ending in the open sea always came up under either their own marker buoy or someone else's, scuba diving's safety record would improve enormously.

Harness and wing BCD systems

Like nitrox, harness and wing BCD systems were another innovation that was developed by technical divers, initially greeted with disdain by the mainstream dive industry but adopted enthusiastically by the general diving population. The claims, usually made by industry "gurus" that had never used them, were that the systems would "throw you onto your front at the surface" and that it was "difficult to vent air from them."

Of course, all that was required was that divers adapt their technique slightly. Then they could benefit from a design that held a diver's head higher above the water on the surface, was easier to control than a wraparound BCD and did not squeeze the diver's ribcage and inhibit breathing when the air cell was inflated. Divers loved the lack of encumbrance and freedom of movement permitted by having just a harness instead of an inflatable jacket around their torso. They also liked how much easier it was to swim horizontally when your air cell was all behind you. As with nitrox, divers voted with their wallets and drove the change in the industry. Now, with most BCD manufacturers offering harness and wing options, ever more divers are gravitating towards them and people are even being taught to use this style of BCD right from the start.

Famous last words

The way we dive has changed considerably in the last couple of decades, thanks in great part to the advances in technique and equipment made by those at the sharp end of the sport, those who continue to push the boundaries and draw us all behind in their wake. To channel Monty Python: Yes, you may say, but, apart from nitrox, wings and harness BCDs, octopuses, D-rings and DSMBs, what have technical divers EVER done for us? What, indeed? Say "thank you" next time you meet one. ■

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

media

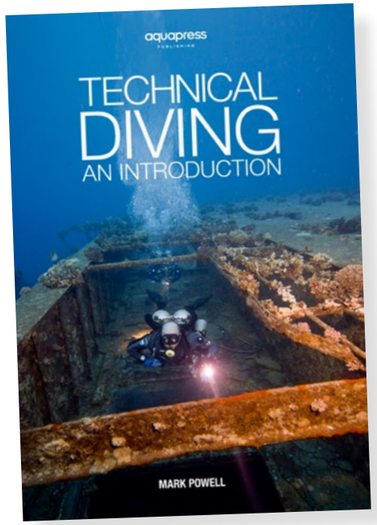
Wreck Diving

SS Thistlegorm, by Simon Brown, Jon Henderson, Alex Mustard and Mike Postons

For many divers, the *SS Thistlegorm* needs no introduction. This famous wreck is possibly one of the world's best wreck dives, and it is now presented here in a 3D digital guide, in the iBooks format. With nine 3D models and 320 illustrations/images—along with historical images, archival documents, underwater photography, 3D photogrammetry and digital reconstruction—the book takes advantage of the digital medium to bring the best wreck diving experience to its readers, albeit while on dry land.

Publisher: Deep3D
iBook: 113 Pages
Date: 11 October 2018
Available on iTunes

Technical Diving

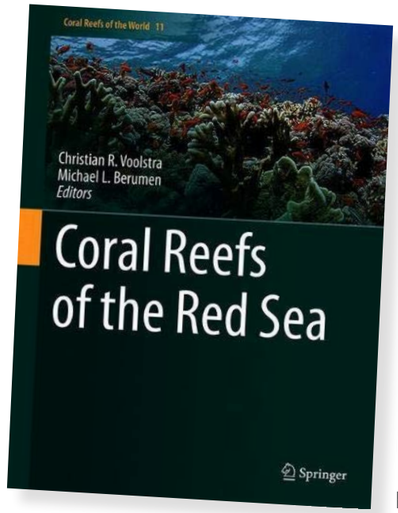


Technical Diving: An Introduction by Mark Powell

This book first explains what technical diving is and how it differs from recreational diving. And for readers keen to find out more, the author gives a comprehensive overview, explaining how to get started, and the specific equipment and skills needed. It also delves into rebreather diving and technical dive planning, as well as wreck, cave penetration and mixed gas expedition diving. Although ideal for recreational divers moving on to technical diving, this book is also a handy guide for tech divers looking to brush up on their skills.

Paperback: 240 pages
Publisher: AquaPress
Date: 5 March 2018
ISBN-10: 1905492316
ISBN-13: 978-1905492312

Red Sea

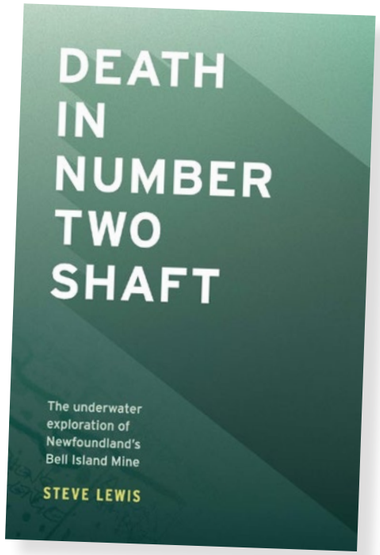


Coral Reefs of the Red Sea, by Christian R. Voolstra and Michael L. Berumen

This book is a complete and updated guide and reference work for scientists, engineers and students with an interest in the coral reefs in the Red Sea. It covers the geology, ecology and physiology of the coral reef ecosystems there, including data from the most recent molecular studies.

Hardcover: 168 pages
Publisher: Springer Nature Switzerland AG
Date: 28 February 2019
ISBN-10: 303005800X
ISBN-13: 978-3030058005

Mine Diving

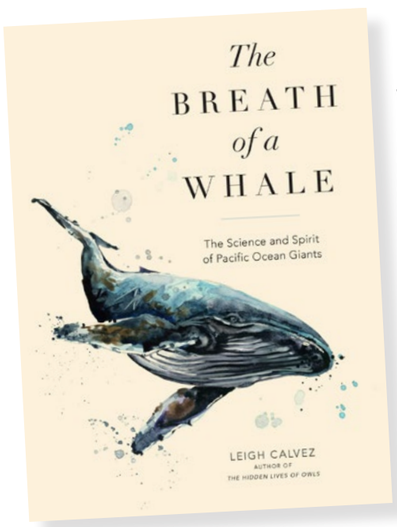


Death in Number Two Shaft: The Underwater Exploration of Newfoundland's Bell Island Mine by Steve Lewis

On one level, this book relates the tragedy that befell a group of cave divers when one of them died during an expedition in Bell Island's flooded iron-ore mine in Newfoundland, Canada in 2007. On another level, it tells of the personal journey of the expedition leader, who was also the deceased's roommate: the effect his friend's death had on him, and how he was finally able to let go of the heartache and guilt associated with it.

Paperback: 178 pages
Publisher: CreateSpace Independent Publishing Platform
Date; 28 July 2018
ISBN-10: 1724493248
ISBN-13: 978-1724493248

Whales



The Breath of a Whale: The Science and Spirit of Pacific Ocean Giants, by Leigh Calvez

Take an intimate and insightful journey into the fascinating world of whales. Read about the orcas of Washington State and British Columbia, migratory humpbacks and deep-diving blue whales in this book, among many other species. Their stories are told through the work of dedicated researchers who have spent decades tracking and observing the behaviour of these ocean giants for thousands of miles.

Paperback: 240 pages
Publisher: Sasquatch Books
Date: 26 February 2019
ISBN-10: 1632171864
ISBN-13: 978-1632171863

Technical diver in Chrstine slate mine of Willingen in Sauerland, Germany

Diving the Christine Slate Mine *of Germany*

Text and photos by Sabine Kerkau

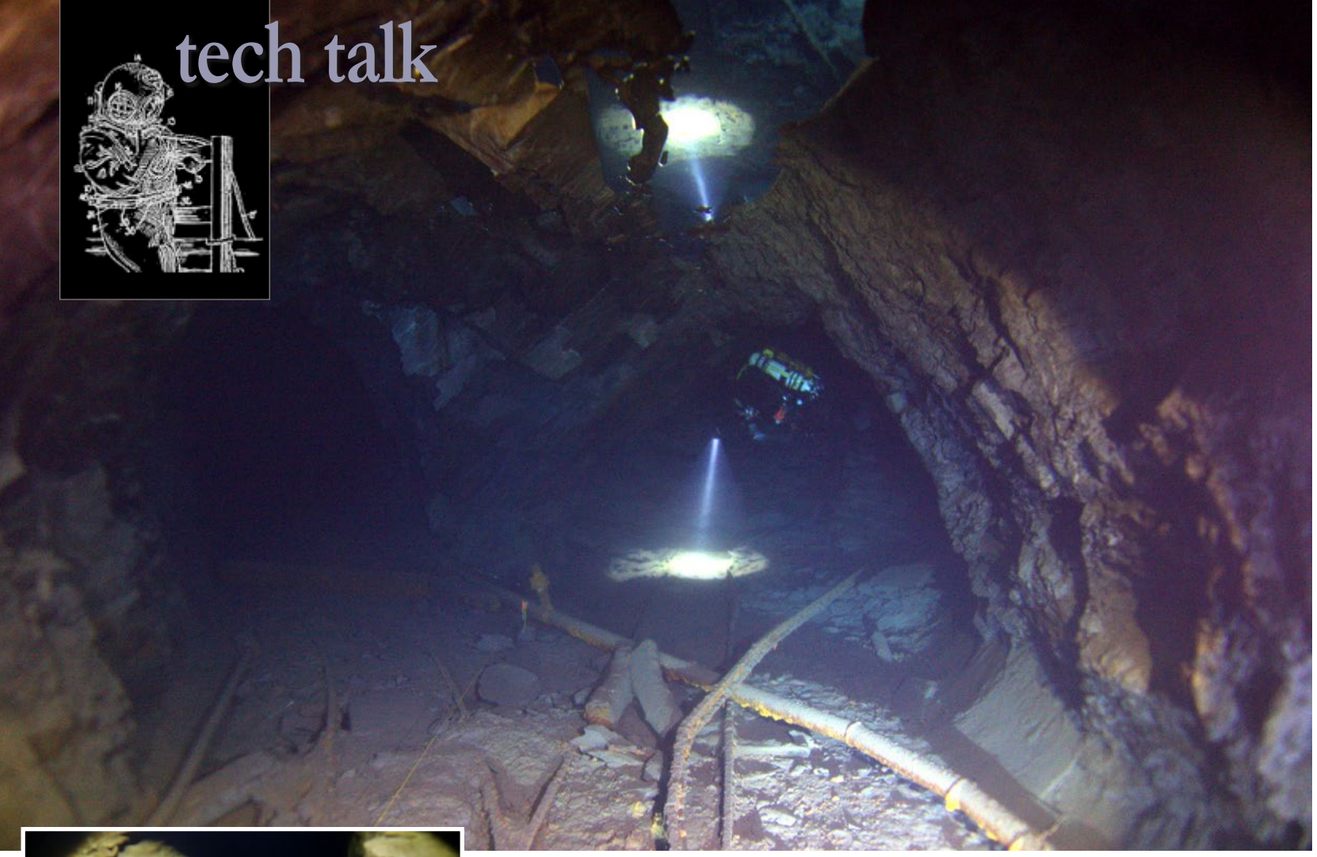
Diving is one of the most varied sports one can imagine. In the beginning, it is the colorful fish and warm waters that inspire new divers. But after some years, for many divers, this is not enough. For these divers, wreck diving and cave diving offer exciting alternatives. If you are interested in both, a whole new exciting world can also be found in mines and mine diving. Indeed, throughout Europe, there are various mines that have been opened up for mine diving.

Personally, my real passion is diving deep wrecks; however, due to weather, most wreck expeditions only take place between May and October. So, some years ago, I came up with the idea of pursuing cave diving. It's pretty nice, but for me, in the long run, it's too boring. For me, there's just too few scraps of things to discover in caves.

I was about to give up cave diving when I received an invitation from Sweden to write an article about a disused iron ore mine in which a group of ambitious technical divers made a very interesting dive project. This first mine diving experience was so impressive that I am now looking forward to the cold season with several mine dives, in addition to some wreck expeditions in the summer months.

The Christine slate mine

One of my absolute favorites is the Christine slate mine of Willingen in Sauerland, Germany. At least once a year, I am drawn here, and each time, it is as excit-



There are many tunnels to explore and artifacts to find in the Christine slate mine.

ing and impressive as the first.

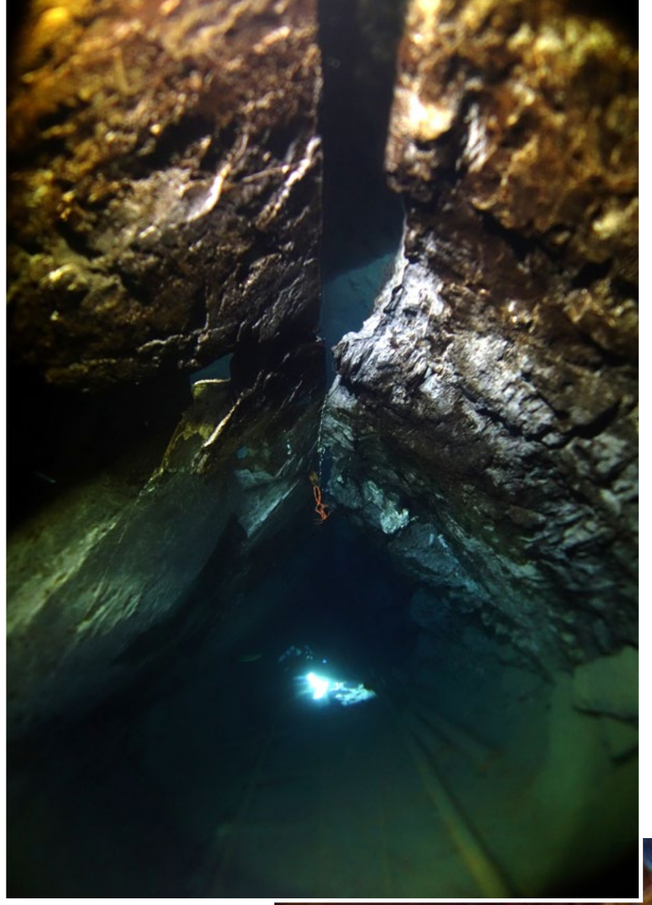
The Christine slate mine was shut down in 1971. Until then, the mine supplied slate for nearly 100 years. Even today, in some parts of the surrounding area, you can still see churches, houses and walls built with or covered by slate. The old slate mine has now become a tourist site. Guided tours regularly take place in the dry part of the mine. The air temperature is 8°C all year round.

The second and third levels of the mine are flooded. The second level is at 23m, the third at 41m. Both levels are well-drained. Covering a distance of 1.2km, trained cave divers can explore the impressive underwater world of the mine. Shoes, bottles, tools, minecarts, rails and much more can be found in the long corridors and tunnels. The visibility is usually good.

Diving the mine

The first challenge a diver new to the Christine has to face is finding the entrance to the mine. This is because it is quite hidden behind a row of buildings on the outskirts of Willingen. With a map in hand showing the mine's location, you walk along a narrow path that ends in front of a massive door, which looks a bit like a cellar door. Inside, in a small vestibule, there are tables for storing the equipment. From there, the path goes a few steps down to the entrance of the mine.

Running alongside the steps are rail tracks that follow ramps, which descend to the surface of the water. At the end of the ramps, there are old minecarts. Depending on how many divers have already dived that day and how well they have kept from stirring up silt, it may be that the visibility is not that good up to this point. But visibility usually changes abruptly for the better when you arrive at the first level. The passages of the first level are



wide and there are no bottlenecks that cannot be overcome, even when fully kitted up with dive gear.

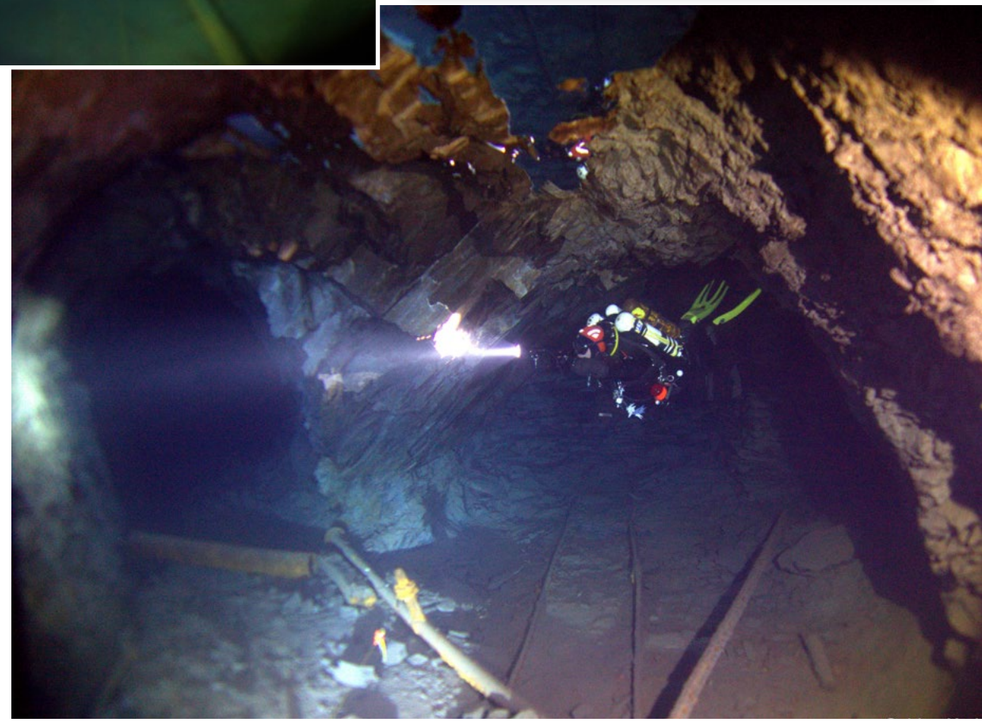
Guidelines

Much of the mine has a permanent dive guideline. But, unlike most caves, there are many corridors in mines, and one has to pick one or the other. The great thing about the Christine mine is its fantastic scenery, and the many artifacts that can be found left in the mine from the days when slate was mined there.

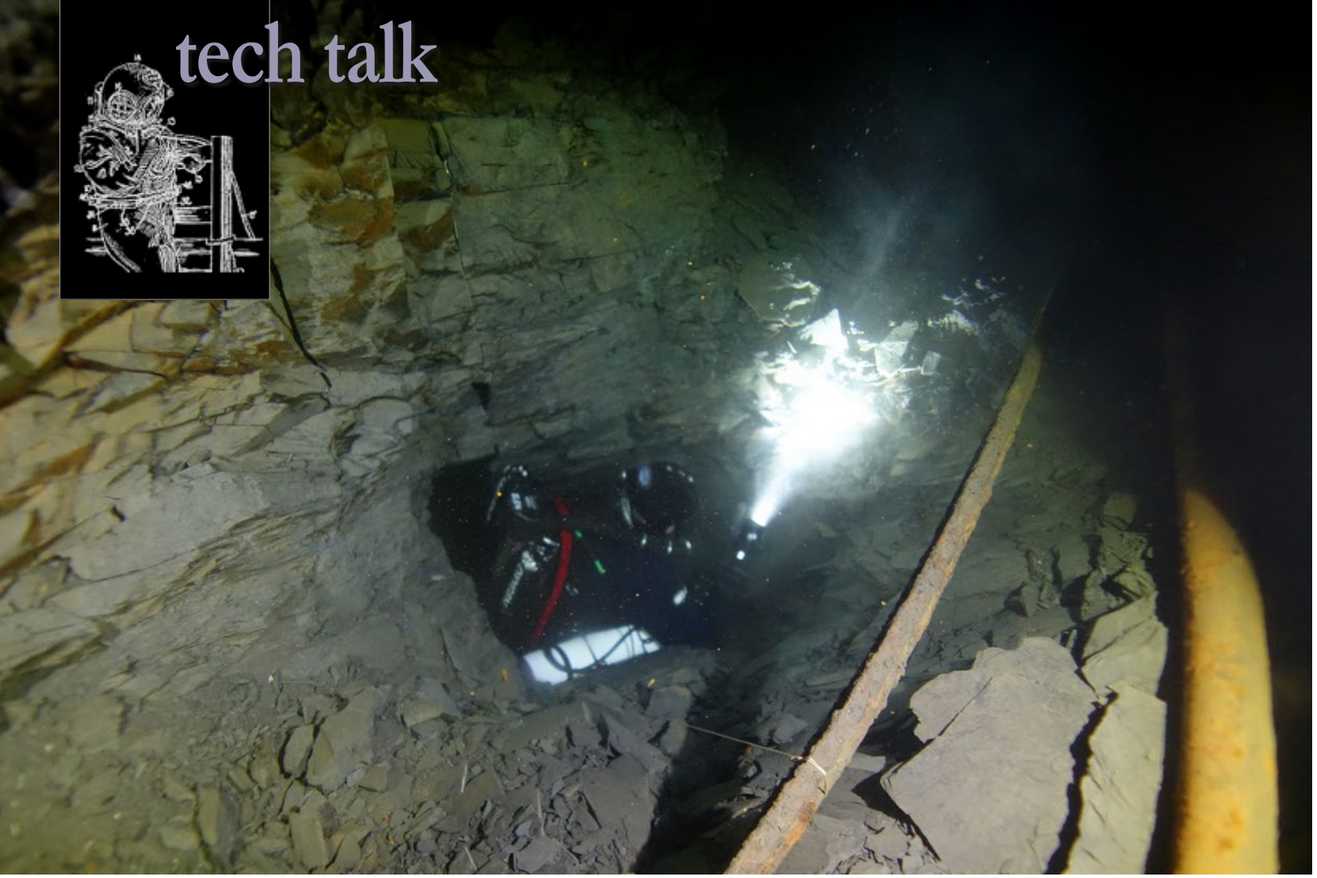
If you stay in the first level, then with a good dive plan, there is no problem in doing a non-decompression dive. In most cases, the first dive will be a guided dive, which will add to the diver's safety and ensure that one has seen the best spots. With the right guide, I can guarantee that everyone who dives here becomes a repeat offender.

Safety tips

Here's a bit of advice acquired through recent experiences. I love mine diving and look forward to my next visit to one of these wonderful time capsules; however, in order for such unique dive sites



THIS PAGE: Non-decompression dives can be safely done on the first level of Christine slate mine, where there are dive guidelines to follow in the corridors and tunnels .



as the Christine mine to remain open, pristine and inspiring to many a diver, it is important that we all abide by the rules.

A mine should only be dived with suitable equipment and training. Even if mine diving operators try to do everything in their power to make sure that only properly trained, prepared and equipped divers get diving permits, only each one of us can decide for herself or himself whether she or he really is in the best physical health and mentally prepared enough for such a demanding dive.

If you descend into the depths of mines and caves, you should be able to master your equipment while you are asleep and completely blind; and, in any situation, you should be able to control your buoyancy. You would not climb Mt. Everest in bedroom slippers and without any preparation, would you? If an emergency occurs underwater, the way out may be long. Every diver should know how to react in such a situation.

In the Christine mine, courses for the practice of emergency scenarios are offered. Mastering these saves lives, which has recently proven itself on my own trip to the mine. Use the opportunity then to learn from my own experience.

Approved full cave certifications include GUE, NACD, NSS-CDS and IANTD. Cave divers with a certification from other associations can obtain a special permit to dive the Christine mine upon successful completion of a practical and theoretical examination. ■

More information is available at: toms-tauchshop.de.

Sabine Kerkau is a German technical diver, dive writer and underwater photographer based in Switzerland. Kerkau was inducted in the Women Divers Hall of Fame in 2019. For more information, please visit: ***Sabine-Kerkau.com****.*

Artifacts such as shoes, bottles, tools, minecarts and rails can be found in the long corridors and tunnels of Christine slate mine in which visibility is usually good.

DAN Safety

Hypothermia & Diving

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Cold can mean a lot of things—a too-thin wetsuit on a tropical dive, a 200g undergarment when a 400g would have been more appropriate or a flooded drysuit under a layer of ice on an Arctic expedition. No matter what your idea of cold is, it is important to understand exactly when discomfort meets danger.

Diving on a blistery morning can be fun, but shivering your way through an hour of decompression can put you on a fast track to the local chamber. It is up to you to make sure that you are adequately prepared for your dive, and for the aftermath. It is easy to end up cold on a dive through no fault of your own, but knowing the signs and symptoms of hypothermia before you dive will help you know when you might be pushing things just a little too far.

What is hypothermia?

You have likely had exposure to the concept of hypothermia in some of your certification courses, if not your diving. The condition is the result of a drop in core body temperature. It can happen in the Arctic or in the tropics, anywhere that your body is exposed for a length of time to a temperature low enough to sap the heat from your core. That time of exposure will be much longer in warmer water than in a frozen lake, but both situations can make for a hypothermic diver.

As a baseline, a typical adult maintains a core temperature of about 97.6 to 99.6°F. About half of women will run slightly cooler, but it is a useful universal approximation. As a diver's core temperature drops below 95°F, hypothermia will begin to set in, and the body will begin to lose function. To keep the core warm, the diver's body will begin to shunt blood to her core, causing initial symptoms that typically include shivering, dizziness, nausea and feelings of hunger. If that core temperature continues dropping, most individuals will stop shivering at about 86°F and their pupils will dilate. At 82°F, their muscles will become rigid, and the risk of serious cardiac complications becomes considerable.

These symptoms worsen as core temperature continues to drop, so it is vital that individuals suffering from hypothermia be identified and brought to qualified medical care as rapidly as possible. Once significant symptoms of hypothermia have begun to present, the risk of medical complications becomes significantly greater and treatment requires more than gently re-warming.

Note that many individuals suffering from hypothermia will not recognize their symptoms until they are pointed out, and the confusion caused by the condition can result in impaired decision-making and lapses in judgement. Cases like this are more common in mountaineering incidents, where climbers suffer from "paradoxical undressing" and shed their clothing in extreme arctic temperatures due to a perceived (and incorrect) sensation of heat, often resulting in injury or death.

STEPHEN FRINK

Plan your dive, dive your plan

Hypothermia can be serious, but it is something that experienced divers can prevent in almost all situations. Plan ahead for your dive with appropriate and conservative exposure protection, heat sources (in-water or on the surface for after the dive), and a well-thought-out emergency plan for if a drysuit floods, a dive goes longer than expected or a diver begins to show symptoms of hypothermia. Bringing hot water to make a warm drink (or fill your wetsuit between dives) is one way to keep yourself comfortable and warm on a day where there is more snow than sun in the forecast.

If you or your buddy begins shivering before or during a dive, terminate your dive as quickly as reasonably possible. The exception to this advice is in situations with significant decompression obligations—hypothermia can markedly increase your decompression stress, and a balance may have to be struck between cold and added conservatism in decompression planning. In situations like these, light exercise at your stop to keep blood flowing and your extremities warm may be your best bet. ■

For more information on hypothermia and diving, visit ***DAN.org/Health****.*

DECOMPRESSION STRESS

Decompression stress is a somewhat ambiguous term because it can mean so many things. The number of factors that can affect your risk of DCS as a diver are innumerable, and decompression stress is one way we discuss and manage those factors as a group. Your thermal status is one of those factors, but you do not have to be hypothermic to increase your risk. Know the three most common causes of decompression stress and keep yourself safe this season:

Exercise

The timing and intensity of exercise during or around the time of your dive can make a great deal of impact on your decompression safety. Studies have shown that light to moderate exercise before a dive, and during the ascent and decompression portions of a dive, can decrease your risk. The same is not true for vigorous exercise or exercise done on the bottom. Exercise done during the bottom portion of your dive can increase inert gas uptake, and very vigorous exercise performed during the ascent or following a dive can promote bubble formation and contribute to an injury. Work out the night before a dive, but not after, and remember to minimize the amount of work you do at depth during your deep dives to minimize your decompression stress.

Dive profile

The profile of your dive is one of the most critical factors in your risk of a decompression injury. Excellent planning and management of all your other decompression factors can be thrown to the wind in the face of an inappropriately long dive with inadequate stops or a dive planned with an algorithm lacking appropriate conservatism. Appropriate conservatism is both a personal choice and dependent upon your other decompression factors, but remember that you can manage the aggressiveness of your decompression profile with almost any of the common modern algorithms. Adding time to your shallowest stops is a reasonable way to minimize your risk of bubble formation.

Thermal status

We have already discussed hypothermia and diving, but what about heated undergarments? They are becoming increasingly common, but used incorrectly, they may pose a hazard to diver safety. A US Navy study from 2007 (and several more recent but unconfirmed studies) indicated that dives that started cold and ended warm were significantly less likely to contribute to a decompression injury than dives that were warm throughout or warm to start and cold to finish. Warm and cold are subjective terms used by the study, but it can be reasonably recommended that divers with heated undergarments leave them off until the ascent portion of their dive to minimize their gas uptake but maximize gas elimination. These divers should avoid high-intensity exercise during decompression, as their heating systems are already promoting gas elimination—the goal here is to aim for a warm core temperature with mild exercise while decompressing. ■

How I Got The Shot

— Backstories on Our Contributors' Favorite Picks

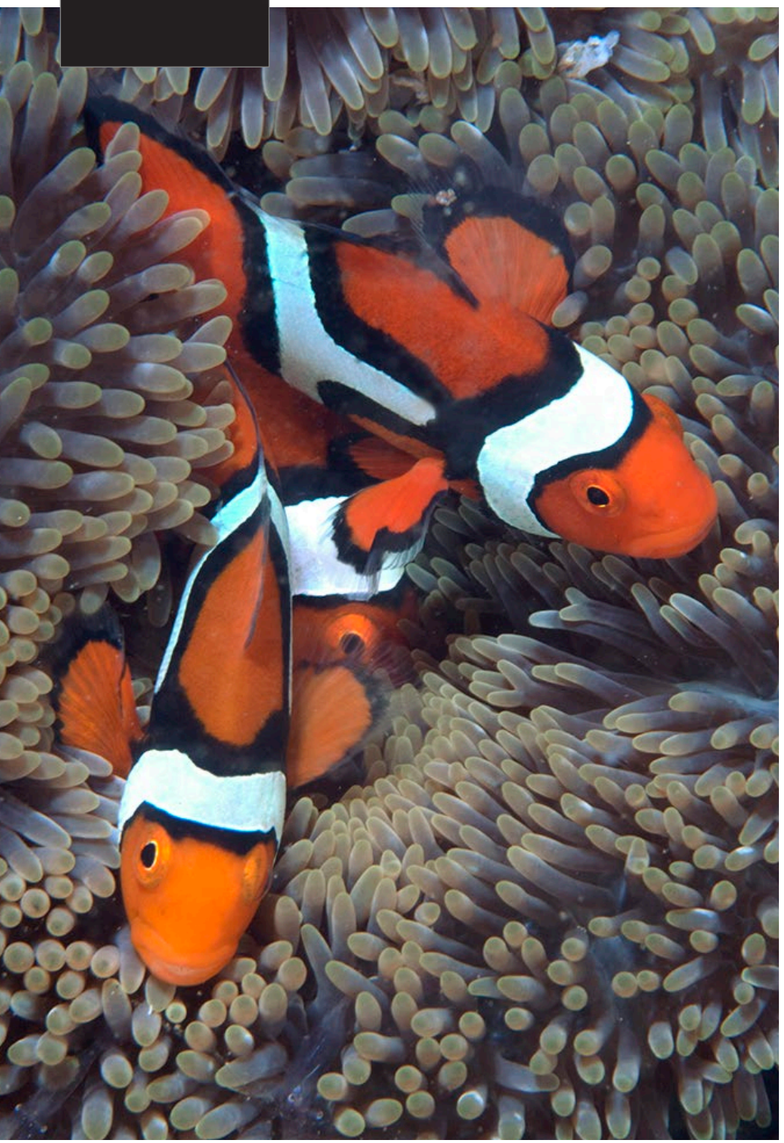
Text and images by Scott Bennett, Andrey Bizyukin, Larry Cohen, Amanda Cotton, Andrey Gorbunov, Jennifer Idol, Steve Jones, Matthew Meier, Brandi Mueller, Andrey Shpatak, Peter Symes, Don Silcock, Olga Torrey and Beth Barklage Watson

Ever wanted to know how a photographer captured a fantastic, unique or strangely weird shot? Well, here are the favorite image picks and their backstories from several of our featured contributors, as we celebrate the new year and look back on dive adventures past.

Peter Symes

— Light-Painted Corals
Marsa Alam, Egypt

This is quite an old picture, taken over 15 years ago. It shows how film was used, which had far less low-light sensitivity than the sensors in present-day digital cameras. It was shot handheld on a night dive with the full moon illuminating the surface and dive lamps light-painting the corals from behind. I picked it as an example of how an image can be envisaged and planned. I sat on the beach of the Red Sea one fine moonlit evening and came to wonder whether it was possible to push the envelope and do night photography underwater without a strobe. This was in the days when ISO 100 color slide film was the norm for serious underwater photography, and I happened to also have some rolls of a rather unique slide film: the Agfa Scala, which was an ISO 160 black-and-white slide film that could be "pushed" to ISO 1600 or 3200 with decent results. But even at these high ISO settings, the required shutter speed would be counted in seconds, resulting in blurry images as I had no tripod or support for the camera. The solution: I used a rebreather and swam out about five minutes ahead of my buddies and laid down flat on the sand, supporting the camera with my elbows, resting directly on the seabed facing the beach. I got my breathing calm and steady. Since I was on a rebreather, my buoyancy did not fluctuate, and I was able to lie very still. I composed the image and steadied myself, waiting for my buddies to appear to light-paint the corals. I then squeezed the trigger VERY gently. I believe the indicated shutter speed was about two seconds, but it came out decently sharp. Nowadays, it is nothing special, and modern technology can produce much better results. But back then, it required thinking out of the box to get the desired results—and that is what this image now represents. This image was captured on a Minolta 700si with a 16mm fisheye in a Seacam housing.



Scott Bennett
— False Clownfish Trio
Witu Islands, Papua New Guinea

During the daytime, clownfish have attitude to spare, nipping divers who get too close to their host anemone. Yet, the moment a camera is positioned nearby, they promptly retreat into the undulating tentacles. However, on a night dive, it's a different story. At Papua New Guinea's Witu Islands, a slow approach enabled a frame-filling image of this trio of false clownfish. However, getting the right composition required some patience. Although they did not retreat, the fish did squirm about, obstructing each other's bodies or moving partially out of frame. After some perseverance and six attempts, I managed to capture all three fish in a pleasing composition of diagonals enhanced by the vertical format. Although the rear fish is partially obscured, I like that its eye is just visible, peering out. This image was captured with a Nikon D200 camera with a Nikon 105mm lens in a Seacam housing. Camera settings were *f*/29, 1/80, ISO 100. **Bennepix.com**

Andrey Bizyukin
— Curious Brown Booby, Darwin's Arch, Galápagos Islands, Ecuador

I came up from a dive in a strong current at Darwin's Arch near Darwin Island in the Galápagos Islands. All the other divers in my group were in a hurry to get back onto the dive boat, so as not to get lost in the endless ocean. I decided to skip all that and gave myself up to the current. The current took me quite a distance away, attracting the attention of local birds, which became quite interested in me. Animals are driven by curiosity. For them, there is always a chance to get some extra food or learn something new. This is probably why they became interested in one lonely diver, drifting in the open ocean. They swooped down to me and began diving into the water right next to me. I wasted no time. I forgot about the boat, my friends, the dangerous currents, and began to entice the birds with my camera and play with the boobies, taking pictures just at random. It just so happened that the birds liked this process, and I got some very funny photos with these curious diving birds. After about 15 minutes of being late returning to the dive boat, my friends and the crew finally found me and picked me up. Upon reflection, I realized how useful it can be sometimes not to push oneself and rush to get back onto the dive boat, but to take the time and use any opportunity to play with our small curious brothers. This photo was taken with Canon 5D Mark II camera with a Canon 15mm lens, Subal housing, and two Inon Z240 strobes in manual mode. **Xray-mag.com/contributors/AndreyBizyukin**

photo & video

Amanda Cotton

— Humpback Whale Calf
Vavau, Tonga

Young humpback whales can be quite inquisitive and this calf was no exception. While leading a group for BigAnimals Expeditions in Tonga last season, I encountered this youngster with its mother resting just below the surface. While mom was happy to hover calmly around ten meters below our group, her young calf could not contain its enthusiasm, bolting to the surface and coming in close to our snorkelers time and time again. Photographing these large animals is always exciting; knowing these encounters are initiated by the animal and end when the whale is ready to move on makes these long encounters that much more memorable. This image was captured while the calf was at the surface, using ambient light only. The photo was taken with a Nikon D800 with a 24mm Nikon lens in a Isotta housing. Camera settings were ƒ/16, 1/1000, ISO 320.
Acottonphoto.com

Larry Cohen

— Outrigger Canoe, Witu Islands, Papua New Guinea

I was diving with MV *FeBrina* in Papua New Guinea off Witu Island. While underwater, a group of locals visited the liveaboard. At the end of the dive, I glanced towards the surface and saw the perfect image. An outrigger canoe was silhouetted against the blue sky. The lighting was perfect, the water smoothly changed from dark indigo to middle sky blue, and then to a light blue as the sunlight streamed through the water.

The person in the canoe turned into an abstract figure because of the ripples of water, and the paddle in his hands added to the composition. Sometimes the perfect photograph just happens.

This image would visually say Papua New Guinea, merging the culture and underwater world. Unfortunately, there was one problem. I had a 60mm macro lens on my Olympus OM-D E-M1 and a flat port on my Aquatica AE-M1 housing! I knew before leaving PNG, I had to create the image.

The following week, I continued my adventure at Tufi Resort. I discussed creating the image with resort manager Brian Boustridge. Two days before leaving Tufi, I traveled an hour offshore to Veale's Reef. I was in one dive boat, which was followed by another boat that had a few people from a local village and their outrigger canoe. As we arrived on site, the sky turned gray, the wind picked up and the seas rose to 1.5m. Today was not the day to get my shot.

We needed to stay close to the dock area on the last day of diving in PNG. The sun was shining, but this close to shore, the water had a greenish cast. Still, a green photo would be better than no photo. We swam out a little distance; on the surface, we were followed by the police chef's son in his outrigger canoe. I had my Olympus M. Zuiko ED 9-18mm f/4-5.6 wide-angle lens on my camera and a dome port on my housing. I positioned the canoe to get the same lighting effect I saw the week before. Diving down, I was able to lay on the sandy bottom in 5m of water and shoot upwards.

To get detail in the shadows, I fired my two Olympus UFL-3 underwater strobes on low power. The camera was set at ISO 200, shutter speed at 1/250 and aperture at ƒ/13. I got the image I wanted but was not happy with the green cast on the RAW file. Using Adobe Lightroom, I was able to adjust the color to a pleasant blue.
Liquidimagesuw.com

Andrey Gorbunov
— Stone Flower, Orda Cave (the largest cave in Russia)

Every pupil in Russia knows the ancient legend about the master who created a masterpiece of stone called "The Stone Flower." Divers who dive Orda Cave often get to see a unique natural object: a giant column, 15m high, which looks like the huge "stone flower" of legend. When I saw this column, I wondered how I could take a picture of it to show all its beauty. It is not easy to take photos in an underwater cave, in a huge underwater hall with a width of about 80m, in cold water with a temperature of 6°C (43°F). One has to solve the problem of lighting such a huge underground space. Fortunately, a solution came to me when a group of experienced cave divers from different cities simultaneously gathered to dive the cave. I was lucky that they all agreed to help me and take part in the photo shoot.

It was not easy to organize and coordinate the actions of 15 cave divers all together. Clearly, we had to have a detailed briefing, but not all the divers were able to swim with creative direction. It would take luck to get the shot. I tried to find the right camera angles for over an hour. The 15 divers underwater were constantly moving and going in different directions. In total, we had about 400 thousand lumens of light per group. I changed positions and depth in search of an interesting shot, waiting for divers to be in the right place. The water in this underwater cave tends to be turbid, so when the whole crowd of 15 divers were actively breathing, their bubbles raised even more silt.

With the dive time coming to an end and the visibility quickly dropping, I ascended up to the ceiling. Suddenly, everything fell into place: the transparency of the water, the divers and the light, and the beautiful perspective. It is worth remembering that in caves, photographic success is a huge team effort. One photographer does not take a good picture. Therefore, I want to say thank you to all the members of our team. I hope we continue to dive the cave together and capture more new and interesting images. **Ordacave.com**

Jennifer Idol

— Lamna ditropis, Port Fidalgo off Prince William Sound, Valdez, Alaska, USA

Our best images are not necessarily the most technically correct or complex. Sometimes, they are our favorites because of our intimate relationship with the subject. Alaska captured my heart the first time I visited and ran away with it completely when I saw a salmon shark for the first time.

This first visit was filled with days of waiting, punctuated by a split second of joy as a salmon shark chasing our herring rushed past me. While I used strobes, they are tricky for adjusting to the fastest shark in the world. Keeping shutter speeds fast and f-stops as sharp as allowable helps reduce blur. Rectilinear wide-angle lenses keep the whole shark in the frame with as little distortion as possible. While the sharks can come very close, a fisheye generally shows too much water and reduces the shark in the frame too much.

This moment inspired me to return again and again, with me now leading a limited trip to visit these shy sharks. They are terrified of people, so we hide beneath a boat and try to keep as still as possible, even when presented with lightning-fast encounters. The salmon shark is also a shark species that may have diminished in population astronomically, with records showing numbers as great as 100,000 killed in a single year. By visiting these sharks each year and documenting them, I can share their story and educate people about the differences between various shark species, their behaviors and their needs. This image was taken with a Nikon D5 camera with a Nikkor 16-35mm lens in a Nauticam housing, using two Inon Z240 strobes. Camera settings were ƒ/8.0, 1/250, ISO 1250. **uwDesigner.com**

How I Got The Shot

Steve Jones

— Tunnel Vision
National Diving and Activity Centre (NDAC), Chepstow, United Kingdom

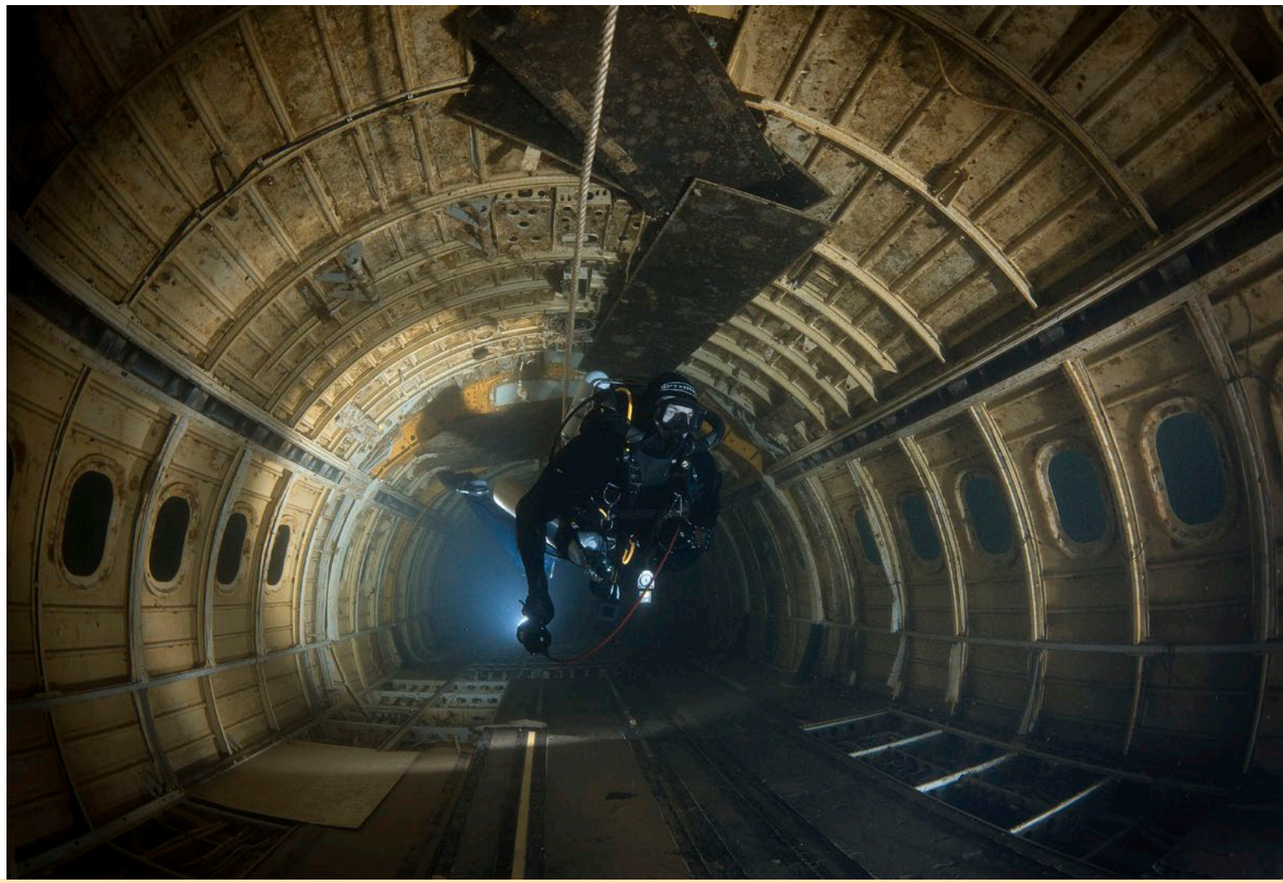
Wrecks present vast areas to light and can prove a challenge if you choose the wrong technique. Generally, there are three light sources in use by wreck photographers that can be used in a variety of combinations: ambient light, strobe light (flash) and continuous light (LED). The latter two sources can be mounted on or off the camera, placed near or afar, and you can use as many as you like! This image of BBC Natural History Unit filmmaker Doug Anderson swimming through an aircraft wreck is a good example of using off-camera LED lights to illuminate an image.

Our light source was the mighty Orcalight, a canister lamp available in several versions, including an ultra-powerful 22,000 lumen and an almost-nuclear 30,000 lumens! Due to the length of this aircraft, one lamp would not have been enough to illuminate both the foreground and background, so we used two Orcalights to give the image the necessary depth.

Doug was carrying one pointing backwards, set on full power and lighting everything behind him. The second Orcalight was positioned to the right of me to light the foreground. I turned this one down to one-third power to balance the light and not overexpose Doug.

One of the most creative and fun forms of wreck photography, off-camera lighting allows you to bring out colour and highlight details that are too far away for lights mounted on-camera. Experiment with this type of lighting and you will find that even though it requires a bit more effort, the possibilities are endless!

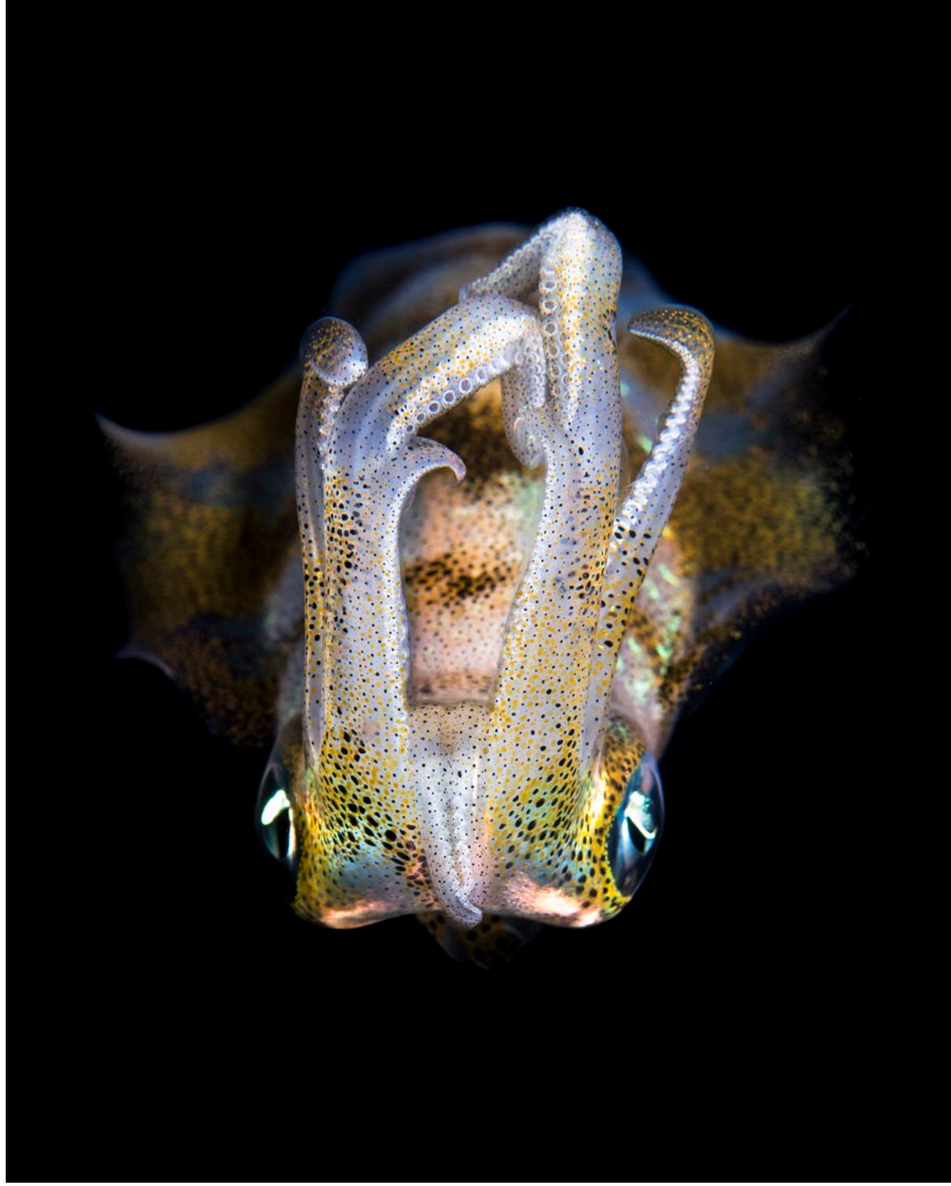
This photo was taken with a Nikon D4 camera with a Nikon 16mm fisheye lens in a Seacam housing. Camera settings were ƒ/8, 1/60, ISO 3200. Special thanks to Orcalight.co.uk. **Millionfish.com**



Matthew Meier

— Weedy Scorpionfish (Rhinopias frondosa), Great Barrier Reef, Australia

During a recent liveaboard trip to Australia's Great Barrier Reef, I was lucky to discover this weedy scorpionfish hiding under a plate coral on a pinnacle called Steve's Bommie. Also known by their scientific name, *Rhinopias sp.*, these fish are rare finds and on the bucket list of almost every underwater photographer. Lucky for me, we had two dives on this site, as I had a wide-angle lens on my camera when I found this beauty during my first safety stop. For the second dive, I swapped over to my 105mm macro lens and headed straight to the spot where I last saw the rhinopias. These fish are ambush hunters and do not move around much, so it was still in the same general location but had turned around to face away from the outside wall of the pinnacle. What would have been a fairly easy photograph now involved a bit of contortion work and delicate buoyancy to avoid damaging the surrounding coral. Happily, there was enough room to see under the plate coral from the other side but not enough room to maneuver and include the entire fish in the frame. Using my one strobe on the right, along with a homemade snoot, I feathered the light to avoid illuminating the busy background and created this portrait, silhouetted against a black background. This image was captured on a Nikon D810 in a Subal Housing, with a Sea&Sea YS-250 strobe, shooting at *f*/13, 1/125, ISO 200.
MatthewMeierPhoto.com



Brandi Mueller

— Squid on Bonfire Dive Lembeh Strait, Indonesia

Recently on a trip to Indonesia, I was given the opportunity to do a bonfire dive in Lembeh Strait. I did not know what that was, so of course, I said yes. Sort of inspired by blackwater dives, a bright light is set up on the seafloor pointed upward on a night dive to try and attract free-swimming ocean animals such as plankton, larval-stage animals and other critters, which may come up from deeper depths at night. The difference is that bonfire diving is shallow, whereas blackwater dives are in open water.

We headed out to Lembeh Resort's house reef, which has a simple shore entry. It was a short swim to around 20m (60ft) where our dive guide set up the light, and we let it "burn" for about 15 minutes while we checked out the area like a normal night dive. Coming back to the light, we saw it was swarming with plankton, marine worms and other critters. This squid (*Sepioteuthis lessoniana*) and several others were among the marine life chaos in the light. As I swam a bit closer, this squid left the bonfire and swam right to my camera in-between the beams of my two focus lights.

It spent several minutes swimming right in front of me, giving me lots of time to try different shots and get the squid at different angles and to adjust my strobes. I particularly like this angle where you can see both its eyes, but the arms are centered. I wondered if it was upside down, but I guess the real question is, "What is upside down for a squid?" I also really like that you can see individual suckers on its arms. This image was taken with a Nikon D850 and a 60mm lens at *f*/11, 1/160, ISO 200. I was using two focus lights to light up my subjects and two Ikelite DS161 strobes.
Brandiunderwater.com

Andrey Shpatak

— Walking Giant Pacific Octopus (Enteroctopus dofleini), East Sea, Primorskij Kraj, Russia

In the East Sea, it is quite rare to find a giant octopus walking underwater these days. We have quite a large number of larga seals here, which hunt and eat octopuses. But our local fishemen also like to catch giant octopuses. Most often we see octopuses in burrows, where they come out to walk the sea floor only at night. I found this very large and calm individual walking on the sandy bottom about 20m away from some rocky underwater reefs. Octopuses of this size are probably the best photo models; they hold themselves with the inherent strength and composure of giants. We spent about 20 minutes together, but I captured my best shot at the very beginning of our interaction, when the octopus passed through some bright green seagrass (*Zostera marina*). This photo was taken with a Nikon D800 camera with a Sigma 15mm lens, Sea&Sea housing, and two Inon Z240 strobes in manual mode. **Shpatak.livejournal.com**

Don Silcock

— Florida Manatee
Crystal River, Florida, USA

The very best place in the world to see and photograph the unique Florida manatee is without a doubt the Three Sisters Spring (3SS) in Crystal River, Florida. The manatees gather there every winter because of the warm waters of the many freshwater springs in the area. And the 3SS is the biggest and very best of those springs. The "three sisters" refers to the three large lobes (areas) of the overall spring. In the right circumstances, it is an amazing and incredible place to see the manatees because the spring waters are crystal clear, and it feels like you are immersed in gin. In the wrong circumstances, you could be sharing the springs with dozens of tourists and schoolchildren who kick up the bottom and transform that gin into a muddy cocktail!

So, you just have to be there, be patient and hope for that special moment. Mine came one afternoon when I found myself alone with a snoozing manatee in one of the lobes. I knew that within the next 10 to 15 minutes it would have to rise to the surface to breath. And I also knew that when it did, it would be quite quick, and that the best angle would be from down low.

So, I made 100 percent sure I had all my settings correct and waited. At the first signs of movement, I prepared to exhale and sink to the bottom so I could capture my visualized image of the floating manatee. Underwater breath holding is not my forte, but I managed to stay on the bottom long enough to capture what is one of my all-time favourite images! This photo was taken with a Nikon D800 camera with 16-35mm lens in a Nauticam housing with a Zen 230mm dome, using two Ikelite DS160 strobes. Camera settings were *f*/13, 1/60, ISO 640. **Indopacificimages.com**

photo & video

Olga Torrey

— Diver in Cenote Jardin del Eden Ponderosa, near Playa del Carmen, Mexico

A few years ago, I went cavern diving in Cenote Jardin del Eden Ponderosa, near Playa del Carmen. I wanted to show the magic of this spectacular underwater location. Crystal clear water, with light penetrating the surface, creates the feeling of being on another planet. I had our dive guide pose at the location, which added to the composition.

I turned the power down on my strobes to fill in the shadows on the overhead ceiling so one can see the soft brown color in contrast to the blue and green.

This time, I used the Panasonic Lumix G Vario 7-14mm f/4 ASPH lens on my Olympus OM-D E-M5 camera in a Nauticam housing. Two Sea&Sea YS-D1 strobes were used for lighting. Camera settings were ƒ/6.3, 1/40, ISO 1250.
Fitimage.nyc

Beth Barklage Watson

— Barracuda (Sphyraena), Tubbataha, Philippines

Tubbataha lies in the middle of the Sulu Sea. This amazing dive destination offers great wall diving and the opportunity to see a variety of pelagic fish. It was a gorgeous day, the sun was shining and the seas were calm and flat. On this dive, we were making our way along a steep vertical wall. Out in the blue, I noticed a large school of barracuda. They were lined up in a long, narrow and compact group. Working my way out towards the fish, I contemplating in my mind the image I wanted to create. Shooting the image in a vertical format was an easy decision given the formation of the fish. Dialing in the camera settings and strobe positioning was the next step. Then came the tricky part, hanging patiently in the water column, waiting for the fish to come as close as possible. Chasing them would have only pushed them further away. Eventually, the fish lined up and came very close. I was able to capture this shot. In post-production, the image was de-saturated allowing the details and highlights of these amazing fish to be revealed. This image was taken with a Canon 5D MKV camera with a Canon 8-15 4.0L fisheye lens in a Nauticam housing using Ikelite strobes. Camera settings were ƒ/13, 1/125, ISO 640.
BethWatsonImages.com

Two in one

When I-Divesite launched the Symbiosis SS-2 system in which an LED light and flash is combined in one smallish body, it quickly proved to be very popular. Now a younger sibling, the SS3, is being launched, which is far more compact, combining a 2800 lumen LED light and a flash with a guide number of 20 under the same dome. It is also much lighter, weighing only 520g on land (half that of the SS2), something the travelling photographers will appreciate. It is powered by two 18650 Li-ion batteries, which are standard rechargable batteries. LED burn time is rated at 55mm and number of flashes is 700 with 3400mAh batteries. Its depth rating is 60m. **i-Divesite.com**

Upgraded models from Retra

Slovenian flash manufacturer Retra always placed much emphasis on producing a wide and very even beam without unsightly hotspots. As they put it: "It's not all about guide numbers." Based on feedback from photographers who are using the original Retra Flash, the company has now launched two new models—the Retra Flash Prime and PRO. The improvements include an optimised user interface to make the use of the flash more intuitive and precise. The new models now come with 13 power levels—as compared to nine in the original—and a colour temperature of 4900K, down from 5600K in the older version. The Retra Flash PRO features 50 percent higher flash power and 65 percent brighter pilot light compared with the Retra Flash Prime. Battery indicator and leakage detector are built-in. Housing dimensions and controls are identical on both variants. **Retra-uwt.com**

Variable colour

The two new Venom lights from i-Divesite, the 50 RGB and 60 RGB models, which we were presented with at DEMA comes with a feature that we have not seen before. The little knob on the top of the housing changes the colour temperature of the beam and thus is used for creative lighting or casting the background in a different tone. The Venom 50 RGB outputs 5000 lumen with a CRI* value of 90. The Venom 60 RGB is slightly more powerful with an output of 6000 lumen but with a smaller CRI value of 80. **i-Divesite.com**

* "A colour rendering index (CRI) is a quantitative measure of the ability of a light source to reveal the colours of various objects faithfully in comparison with an ideal or natural light source. The CRI is expressed on a scale from 0 to 100 percent, indicating how accurate a 'given' light source is at rendering colour when compared to a 'reference' light source. The higher the CRI, the better the colour rendering ability. Light sources with a CRI of 85 to 90 are considered good at colour rendering." — Wikipedia

Splashproof backup

The rugged SanDisk Extreme Portable SSD has been designed to stand up to rain, spills, dust and drops—all of which are part of the environment when going on a dive trip. High-speed transfers with up to 550MB/s read speeds makes it well suited for saving and editing hi-res photos and videos on the go. Thanks to the housing, the drive can withstand operating temperatures ranging from 0°C to 45°C (32°F to 113°F), as well as storage temperatures ranging from -20°C to 70°C (-4°F to 158°F). The drive comes in capacities of 250Gb, 500Gb, 1Tb and 2Tb. The pocket-sized drive is lightweight at only 79g (0.17lbs) and compact enough to fit in the palm of your hand. The drive comes formatted exFAT for PC and Mac compatibility, and will work with both PCs and Mac computers out of the box—no drivers needed. The SSD comes with a 3-year limited warranty. **Sandisk.com**

Be aware of counterfeit memory cards on Amazon and eBay

Fstoppers—the online photography community—citing numerous reports, warns that Amazon still has massive problems in particular with memory cards when it comes to weeding out counterfeit goods, even when selling via its Prime service. Reviews on Amazon itself suggest that some customers are losing images as a result of being scammed.

Fake cards may mount all right, reporting the correct capacity written on the package, and never report an error when the capacity of the original card before modification has passed. These cards may even format correctly to the fake capacity. However, once they reach capacity, they will no longer function and any images cannot be read. Effectively, the cards become unmountable.

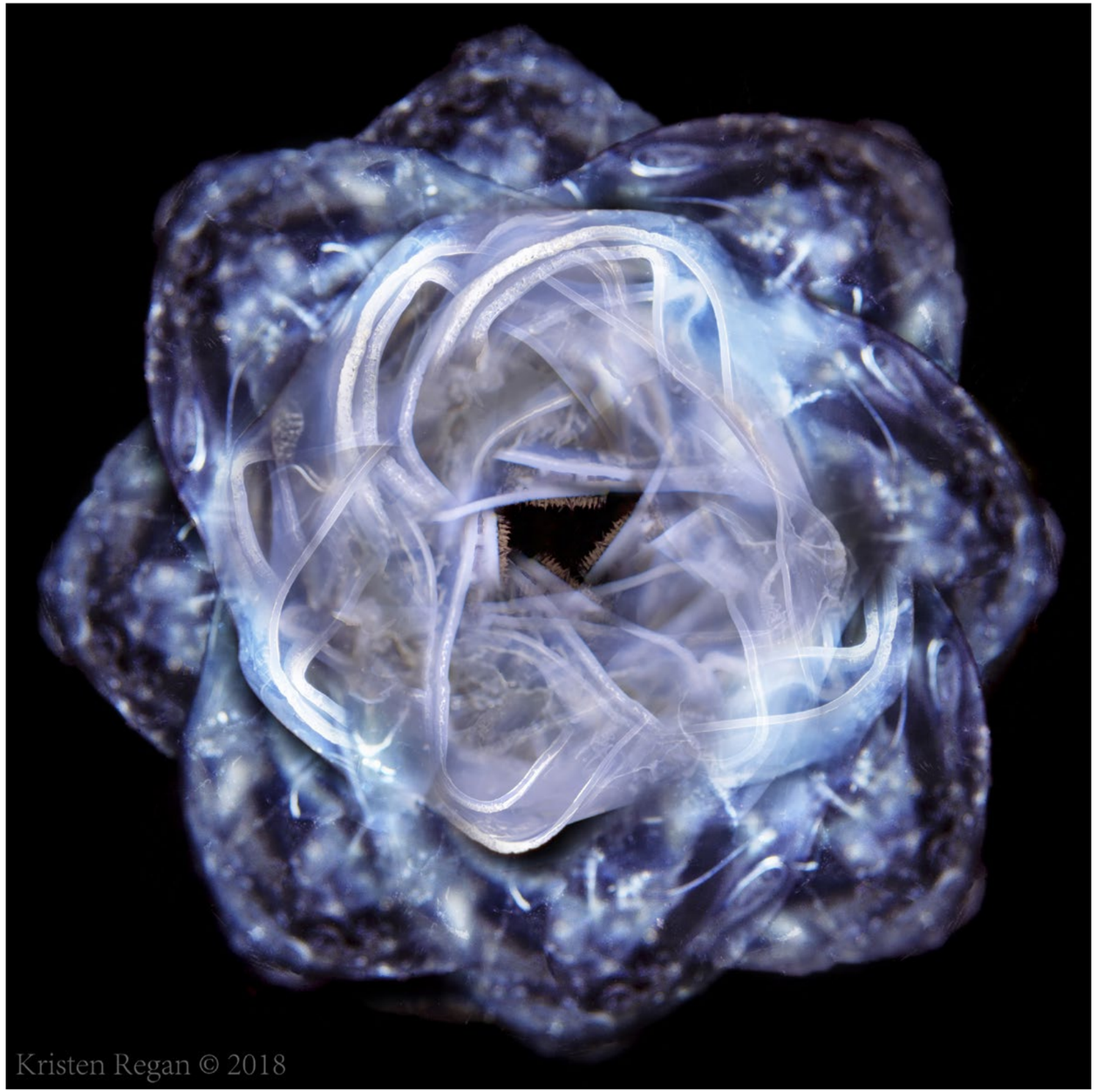
If you are curious about how memory cards can be faked, have a look at this **YouTube video by Linus Tech Tips**. (**link**)

In 2011, Petapixel (another big online photography resource) cited a SanDisk engineer who said that "at any given time, approximately a third of the SanDisk memory cards . . . in the world are counterfeit. As in, not SanDisk memory cards at all—some other kind of cards dressed up as lookalikes."

Giveaway signs include a yellow locking tab (it should be gray) and a lack of a serial number on the reverse.

Amazon is quick to replace counterfeit goods, but this does little to make up for one's images that are lost as a result of using the fake items without realising it. Buy memory cards from large chains or authorised dealers, and consider the rest suspicious. Use your computer to test the card immediately after purchase because you might miss the window to return it. ■

Kristen Regan



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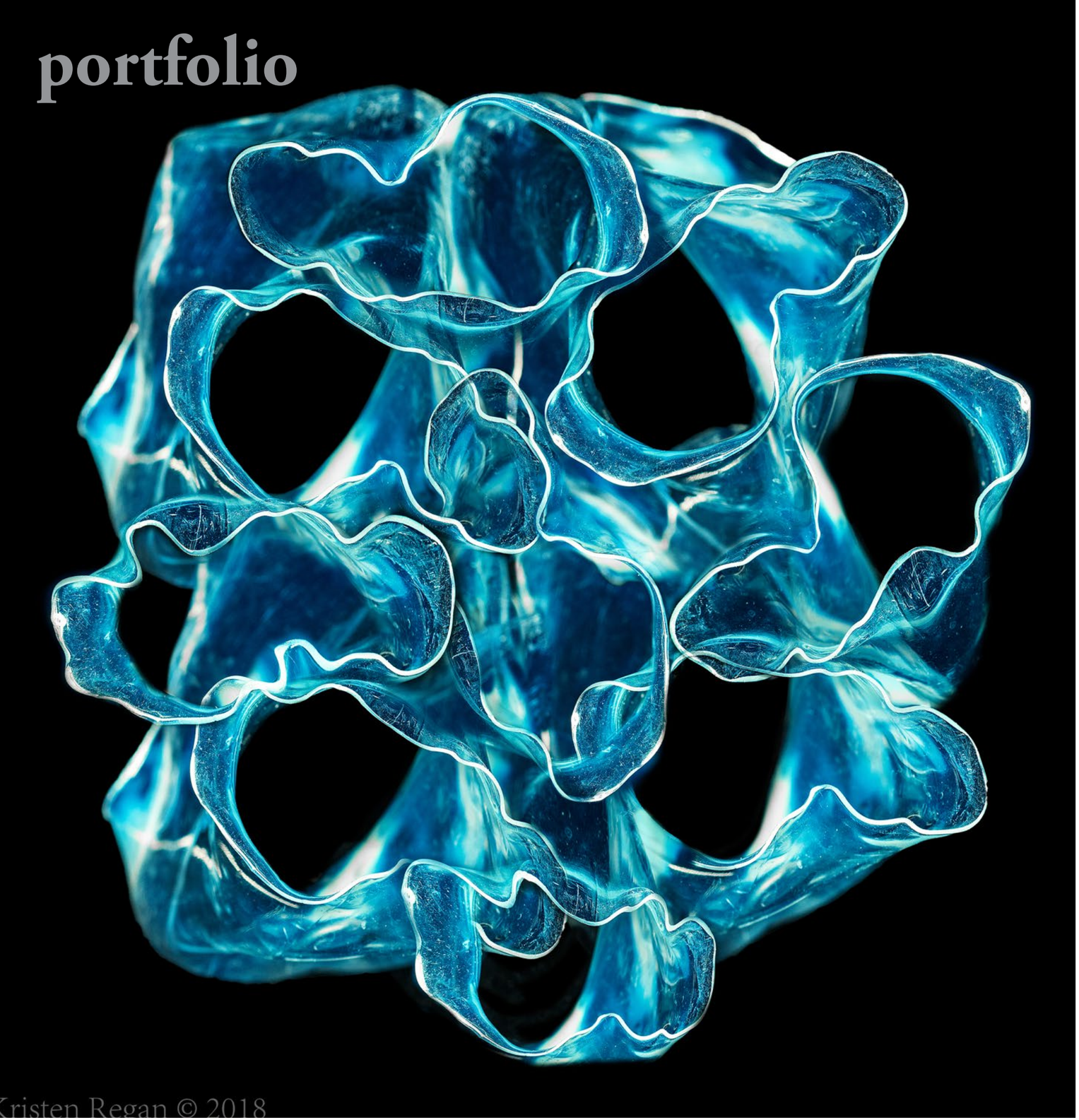


Volvicus radiolarian (above) and *Ctenophora aquafinas* (previous page). Digital composites of repurposed plastic by Kristen Regan

Kristen Regan

In her *Plastisphere* series, American artist and photographer Kristen Regan has created spell-binding photographs of plankton forms, inspired by microscopic ocean life, using repurposed plastic materials. *X-Ray Mag* interviewed the artist, currently based in Pensacola, Florida, to find out more about her artwork, creative process and efforts to raise awareness of the problem of plastics pervading our oceans, marine life and food chain.

Text edited by Gunild Symes
All artwork and photos by Kristen Regan

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

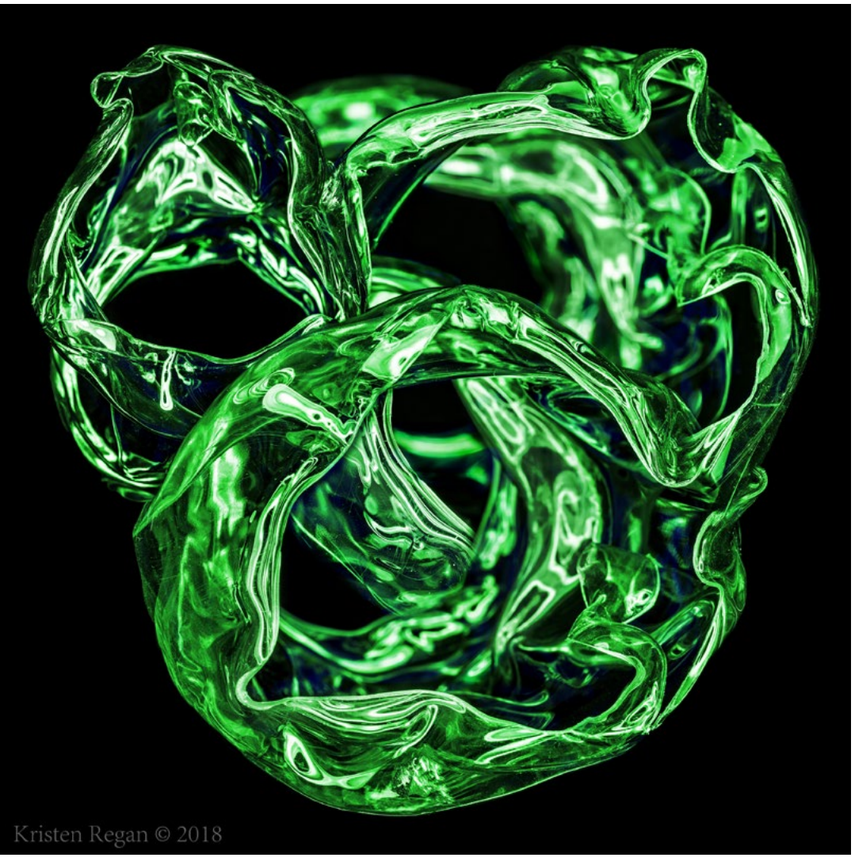
KR: I grew up in Pensacola, Florida, and art was an essential element of my education. My mother is an artist, and my parents fully supported my decision to pursue a career in art and education. Travel has been a driving force in my work, with numerous trips throughout Europe as well as to India, Egypt and Venezuela. I received my Master of Fine Arts degree at Savannah College of Art and Design and a Bachelor of Fine Arts degree in photography from the School of Visual Arts in New York. Currently, I am Associate Professor of Photography at Pensacola State College.

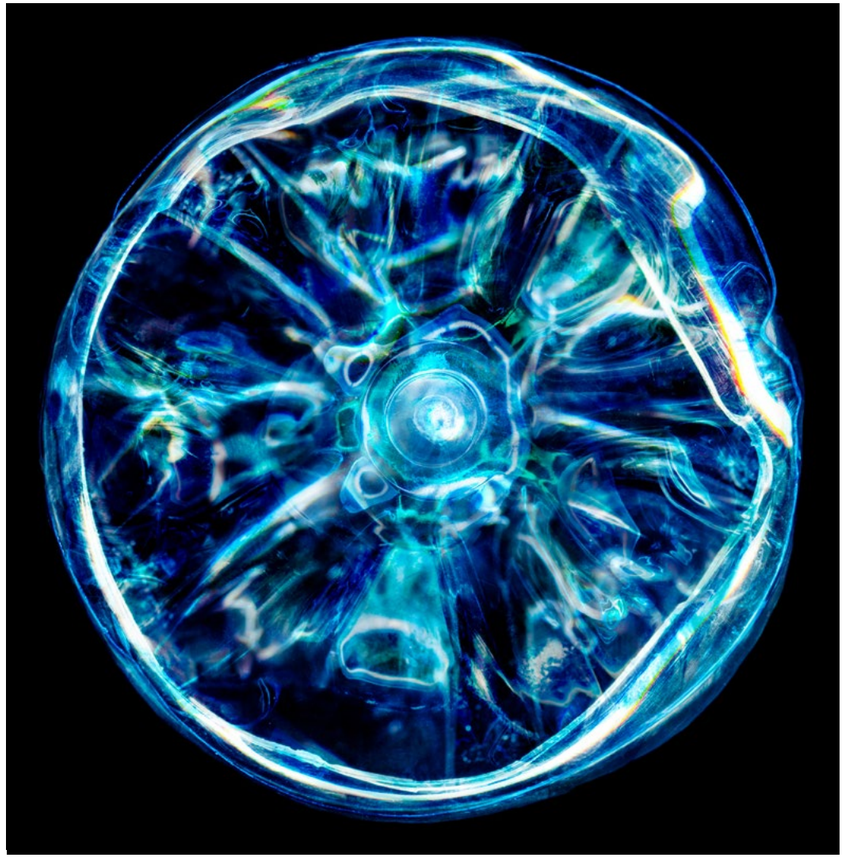
X-RAY MAG: Why plastic and plankton? How did you come to these themes and how did you develop your style of photography?

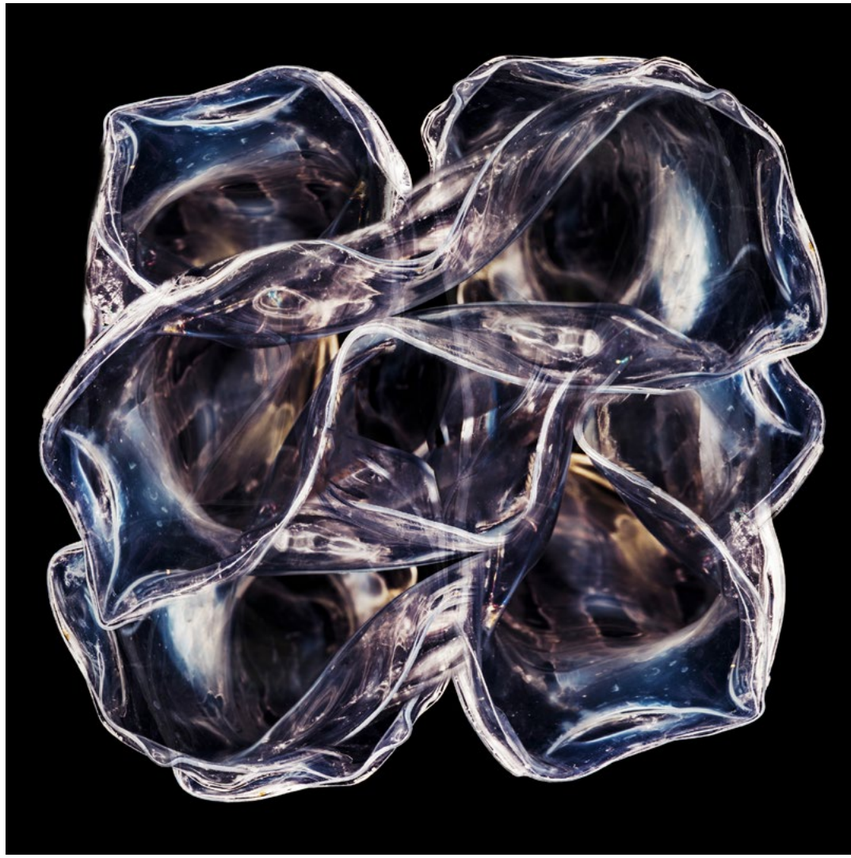
KR: Over the years, my work has utilized ephemeral materials and organic forms to reference the cycle of life, while my newest series explores the antithesis of the cycle of life. Plastic is engineered to last forever and the overabundance of single-use plastics has created a ceaseless tidal wave of trash. I was motivated to create the *Plastisphere* series after watching a video of plankton eating microplastics, proving that tiny bits of plastic have been introduced into our food chain through bioaccumulation.

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

KR: After researching various types of plankton, I was inspired by the stunning







Foraminifera spritea (left), *Aurelia eviana* (center) and *Nassellaria heinzia* (right). Digital composites of repurposed plastic by Kristen Regan

delicate structures to create my interpretation of these creatures using plastic. During weekly beach cleanups, I collected discarded water bottles, some clean, some dirty and weathered. A blowtorch was used to melt the plastic, which produced some surprising results. The thin translucent plastic looked like liquid glass, and I fell in love with the new delicate sculptural qualities of the transformed plastic bottles.

I photographed the bottles on black velvet with a ring light strobe and macro lens to emulate the look of dark-field microscopy. After photographing the plastic, Photoshop was used to combine multiple photos into a variety of composites.

My creations are new "specimens" complete with scientific-like names that incorporate the brand name of the product with the plankton that inspired it. The image, *Sapphirina dasania* (next page), references the type of water bottle photographed, "Dasani," and "Sapphirina," a tiny crustacean known as a sea sapphire. The males of the species flash a brilliant iridescent blue color that scientists think plays a role in communication and mate recognition.

Another example would be *Ctenophora aquafinas*, named for the Aquafina bottle used and the resemblance to a comb jelly. Ctenophores (Greek for "comb bearers") have fused cilia arranged along the sides of the animal. Many ctenophores, like various other planktonic organisms, are bioluminescent. In a way, I am inventing a species of plastic plankton.

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

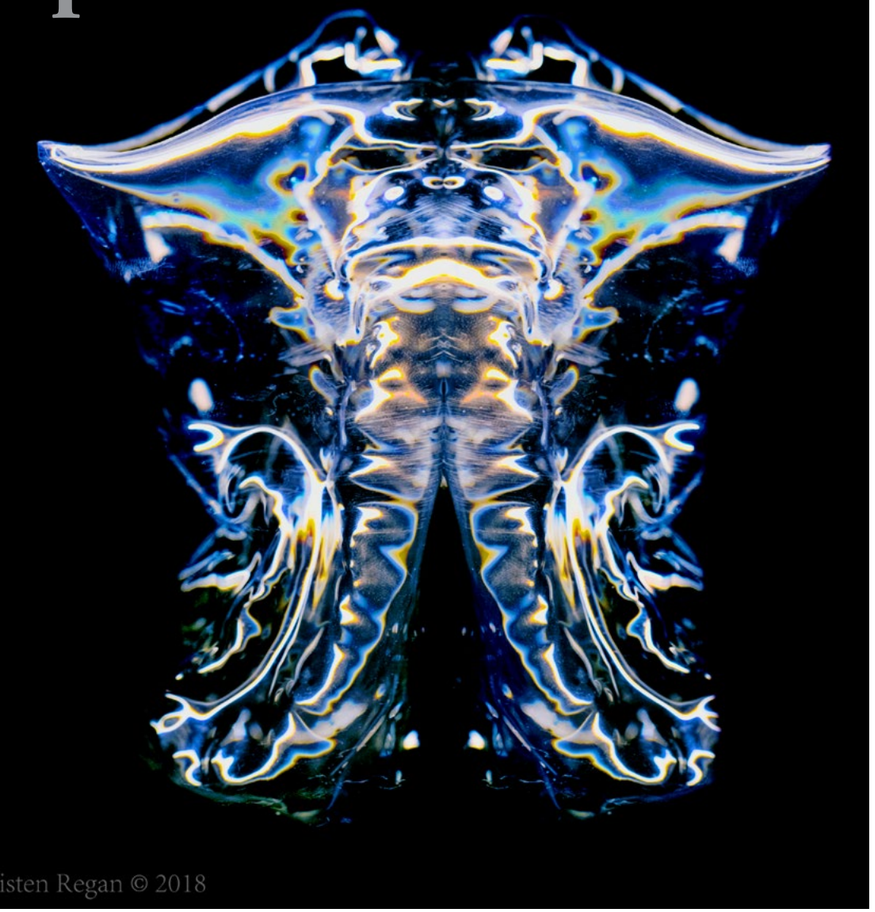
KR: I grew up very close to Pensacola Beach and enjoyed sailing, kayaking, swimming and exploring the beach. I have only been scuba diving once with my father in the Bahamas, and I would love to pursue diving in the future.

My fascination for the underwater world has grown from reading books and watching documentaries about alien-like creatures—some visible, some invisible. The abundance of life beneath the waves seems foreign, untouchable, bizarre and beautiful. To see the unseen, from microscopic grains of sand to the largest creatures on earth, is widely inspiring and humbling.

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

KR: Plastic pollution is an epidemic, and the facts about global warming, rising water temperatures, coral bleaching, and offshore drilling are grim. I am passionate about trying to minimize

portfolio



Larvacea nestlea (left), *Sapphirina dasania* (below) and *Hippopodius fijiopus* (bottom right). Digital composites of repurposed plastic by Kristen Regan

Kristen Regan

my impact on the environment. Change lies in our hands, and the more educated we are about the negative effects that plastic poses in our environment, the more power we have to reduce plastic waste.

Following my last exhibition of *Plastisphere*, a friend that owns a restaurant vowed to eliminate bottled water from his business. My students began bringing reusable water bottles to class rather than buying bottles of water from the vending machine.

I know that my work can influence people to change their habits and think more about how their actions impact the environment. I want to continue educating my students, friends and community through art.

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

KR: The most important message is acknowledging the problem and vowing to make changes. We can become numb to the facts and numbers regarding plastic pollution, but visual art can allow people to see the problem in a different light. Art can facilitate a dialogue about the issue and contribute to real changes.

I want the viewer to question a culture of consumerism and sustainability with regards to our environment. Most importantly, I want to educate the public about the small steps that can be taken to reduce or eliminate single-use plastics in our environment.

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

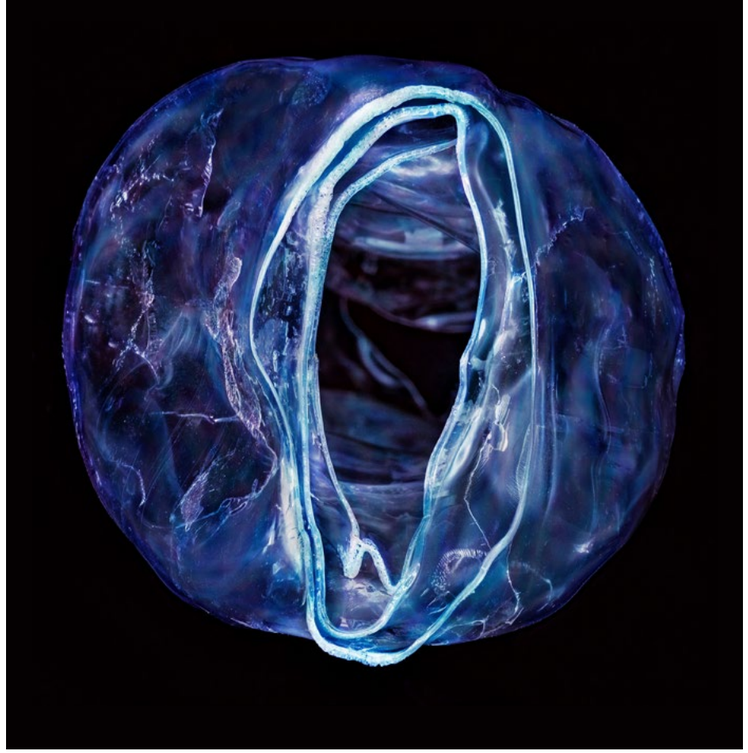
KR: The biggest challenge for me is funding my projects and finding time to create work. I am a mother of a two-year-old, and I teach full time. I want to get my work in front of as many people as possible, and it is time-consuming to produce art, market yourself and make a living as a teaching artist.

My advice for an aspiring artist is to make sure you love what you do. If you are an environmental artist, be sure to practice what you preach and take every opportunity to educate your community about ocean conservation.

X-RAY MAG: How do people respond to your works?

KR: The most common reaction I get from those viewing my work is disbelief that these images are of plastic bottles. I really look forward to showing my images to children and getting them excited about conservation.

I am scheduled to present my work to at-risk youth students attending Dixon School of the Arts and Sciences. I will educate the students about plastic pollution in the ocean through the creation of plastic sea creatures. We will col-



Kristen Regan

Velutinid aquafinas (left), *Polycystine heinzia* (far left) and *Pyrosome polandia springus* (below). Digital composites of repurposed plastic by Kristen Regan

lect discarded plastic to promote the importance of recycling, and I will show my work and talk about reducing their use of plastics.

Introducing environmental education to young children can change their attitudes about the environment, and can influence their behaviors and that of their family and friends. Connecting knowledge with hands-on activities can promote a lifetime of positive environmental stewardship.

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

KR: My work is currently on view for PhotoNOLA at Luna Fine Art Gallery at The Mercantile Hotel in New Orleans. PhotoNOLA is an annual festival of photography currently in its thirteenth year, with exhibitions taking place in venues throughout New Orleans. Several images from the *Plastisphere* series were purchased by Innisfree hotels for their private collection to be displayed in their Executive Boardroom at the Hilton on Pensacola Beach.

My work will be on view at the Pensacola State College faculty exhibition from January 21st to March 13th. I am scheduled to give a presentation of my work at the Long Island Dive Association (LIDA) film festival in New York on February 9th, 2019. My work can also be seen on my website at: **KristenRegan.com**.

X-RAY MAG: Lastly, is there anything else you would like to tell our readers about yourself and your artwork?

KR: Honestly, I want to reach out to the dive community to collaborate on new images. Lately, I have spent a lot of time contacting people who have photographed plankton to ask for permission to use their images. I want to display my images along with the marine creatures that inspired their creation. If any photographers, divers, or scientist have images of plankton and are willing to permit me to use their images (with credit, of course), please contact me.

My goal is to educate people about marine conservation, and I know that seeing actual photographs of plankton alongside my fictitious "plastic plankton" will aid in their understanding of my series *Plastisphere*. ■

For more information or to order prints and commissions, please visit the artist's website at: ***KristenRegan.com****.*