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Caribbean
Saba Island

Mexico
Crocodiles

Sharks
Spurdogs

UW Photo
Drones

Wrecks
Kyarra

UW Photo
Fluorescence

Profile

Randall Arauz

CARIBBEAN
Grenada

DIRECTORY

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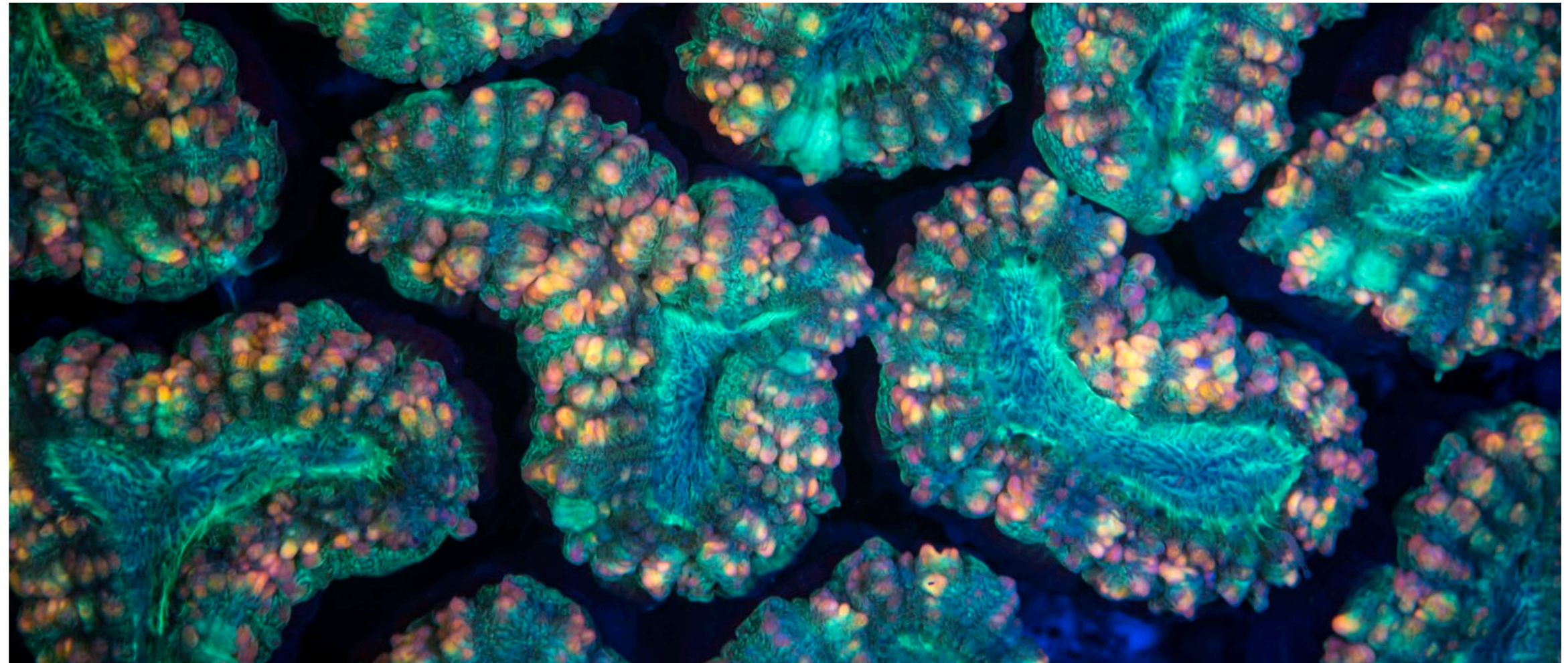
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Flourescent photo of coral polyps, Marshall Islands. Photo by Brandi Mueller



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COVER PHOTO: *Flourescent photo of stony coral, Philippines*
Photo by Brandi Mueller

Divers' dilemma



Are we hypocrites?

This summer saw searing temperatures across the Northern Hemisphere. Heat waves and persistent droughts even hit countries in which inhabitants usually flee the rain and cold, heading south for their vacations. People were dying from heat stroke, temperature records were broken and forest fires raged as far north as the Arctic Circle.

There can be no reasonable doubt that such extreme weather patterns, which now seem to happen with increasing frequency, do not represent statistical outliers but are due to, or exacerbated by, human-made emissions in the atmosphere. Scientific evidence for warming of the climate system is unequivocal, according to the Intergovernmental Panel on Climate Change.

Those who still believe otherwise can get properly educated about what science is really about. If you think education is expensive, consider the cost of ignorance. If you live in a free country, you are free to believe whatever and say whatever you want, but those who do not believe in scientific evidence should most definitely NOT be put in charge of the future of this planet. So, go vote as if your children's future depend on it, because it does!

One of the several contributing factors is emissions from transport, including the flights which take us divers to all the lovely destinations we feature so extensively in this publication. Transport represents about a quarter of the United States' and Europe's greenhouse gas emissions and is the main cause of air pollution in cities. If global aviation was a country, it would rank in the top 10 emitters. A new study says global tourism accounts for 8% of carbon emissions—around three times greater than previous estimates.

So, what do we do about it? I mean, many of us go on about caring so much about the environment, right? We sympathize with, or direct support to, some of the thousands of environmental organisations out there—wearing their slogans, joining demonstrations and so on.

I, for one, have been guilty of reasoning that as I would like to go on a dive trip involving air travel, say, once or twice a year, perhaps I could make concessions elsewhere in my lifestyle to keep my own personal contribution to emissions within some imagined "allowable quota." It is not like passenger airplanes are going electrical any time soon.

I had been luring myself into the belief that if only I cut down on eating meat substantially (which

is not good for my health anyway), choose electricity that is generated from renewable sources and be a conscientious consumer overall, the reduction of my fair share of indulgencies would justify—offset, that is—my next trip on a jet.

But, probably like any other average Joe, I did not really have a clue as to how big an impact my various efforts to reduce my carbon-footprint was having. As it turns out, I would need to reduce my consumption of beef by 50kg—or bicycle rather than take a car for 25,000km (15,534 mi)—just to offset one intercontinental flight.

In reality, this leaves us with the decision to purchase some carbon offset when booking a trip. Quite a few major airlines provide the option to remove that amount of carbon from the atmosphere for a fee. Sadly, it is an option that only about one in a hundred travelers exercise, according to Lufthansa and SAS. Dive travelers spend many thousands on their hobbies—on equipment, training and trips—but continue to opt out on remedying their part of the damage they cause to the environment.

C'mon!

— Peter Symes
 Publisher & Editor-in-Chief

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from the deep NEWS



Reefs migrate to get out of hot water, but probably not fast enough this time round

In the past 30,000 years, the Great Barrier Reef has adapted to sudden changes in environment by migrating across the sea floor as the oceans rose and fell.

A 10-year, multinational effort has shown the reef is more resilient to major environmental changes such as sea-level rise and sea-temperature change than previously thought but also showed a high sensitivity to increased sediment input and poor water quality.

The study, published in *Nature Geoscience*, led by University of Sydney's Associate Professor Jody Webster, is the first of its kind to reconstruct the evolution of the Great Barrier Reef over the past 30 millennia in response to major, abrupt environmental change.

The study shows the reef has been able to bounce back from past death events during the last glaciation and deglaciation.

As sea levels dropped in the millennia before that time, there were two widespread death events (at about 30,000 years and 22,000 years ago) caused by exposure of the reef to air, known as subaerial exposure. During this period, the reef moved seaward to try to keep pace with the falling sea levels.

During the deglaciation period after

the Last Glacial Maximum, there were a further two reef-death events at about 17,000 and 13,000 years ago caused by rapid sea level rise. These were accompanied by the reef moving landward, trying to keep pace with rising seas.

However, it remains an open question as to whether its resilience will be enough for it to survive the current worldwide decline of coral reefs. The study also found the reef is also highly sensitive to increased sediment input, which is of concern given current land-use practices.

Speed about 1m per year

It appears that the reef has been able to re-establish itself over time due to continuity of reef habitats with corals and coralline-algae and the reef's ability to migrate laterally at between 0.2 and 1.5 metres a year. It is not likely that this rate will be enough to survive current rates of sea surface temperature rises, sharp declines in coral coverage, year-on-year coral bleaching or decreases in water quality and increased sediment flux since European settlement. ■

SOURCE: NATURE GEOSCIENCE

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Plastic trash may also carry diseases

Besides strangling seabirds and sea turtles, poisoning fish and clouding the waters with unsightly debris plastic, pollution also stresses coral through light deprivation, toxin release and anoxia—and by giving pathogens a foothold for invasion.

Drifting plastic makes ideal vessels for carrying infectious disease across vast stretches of water. Common household plastic items made out of polypropylene has been shown to become heavily inhabited by bacteria—including those associated with the globally devastating group of coral diseases known as white syndromes—plus, it is buoyant and notoriously hard to break down.

When plastic meets coral

Cornell researchers surveyed 159 coral reefs in the Asia-Pacific region to assess the influence of plastic waste on disease. According to their estimates, about 11.1 billion plastic items were entangled in the reefs across the region. When plastic debris meets coral, the scientists found the likelihood of disease

increases 20 times—from 4 to 89 percent. Structurally complex corals are eight times more likely to be affected by plastic, suggesting that microhabitats for reef-associated organisms and valuable fisheries will be disproportionately affected. The more spiky the coral species, the more likely they were to snag plastic.

One of the diseases studied, skeletal eroding band disease, occurs when cuts into the coral tissue—something that is easily caused by stringy or sharp-edged plastics—become infected. Another condition, black band disease, is caused by bacteria that thrive in low-oxygen conditions such as under a plastic bag smothering a coral.

The clue

What researchers noted was that the prevalence of disease did not depend on how much plastic there was in the surroundings, but merely whether plastic was present. This was a clue that perhaps the bacteria had hitched a ride across the ocean on fragments of water bottles or polystyrene cups.

Dutch researchers studying microbial communities on plastic flotsam found drifting in the North Atlantic found that these communities were quite distinct from those normally found in the open ocean. More importantly, they also found traces of genes from bacteria linked to white syndrome in Hawaiian corals.

Furthermore, ongoing research is beginning to show that the microbial ecosystems are unique and uniquely dangerous. While the ocean is full of all sorts of bacteria, plastic waste may be concentrating pathogens that infect corals on impact.

Mismanaged waste

Plastic levels on coral reefs correspond to estimates of terrestrial mismanaged plastic waste entering the ocean. Plastic waste management is critical for reducing diseases

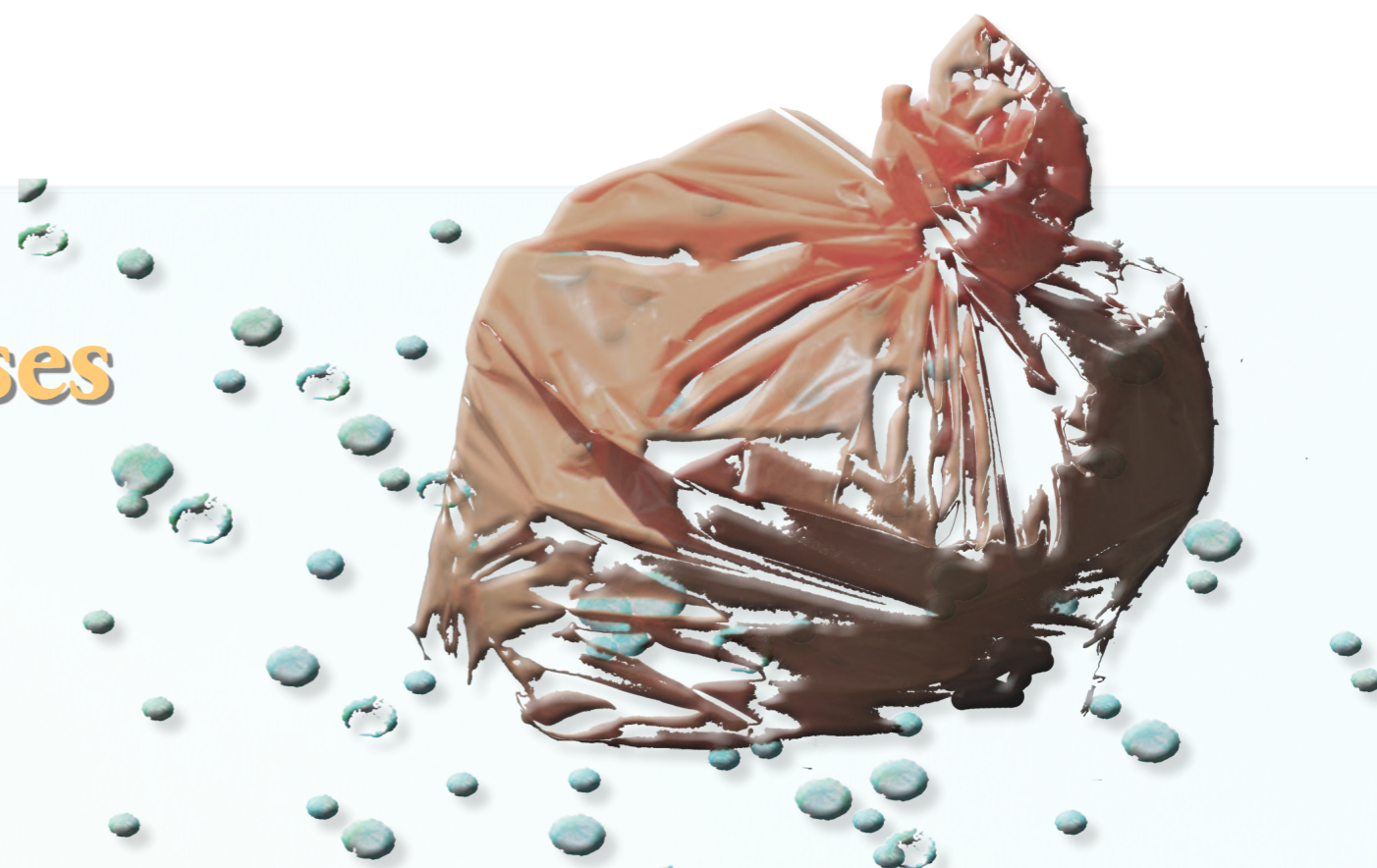
that threaten ecosystem health and human livelihoods.

The scientists forecast that by 2025, plastic going into the marine environment will increase to roughly 15.7 billion plastic items on coral reefs, which could lead to skeletal eroding band disease, white syndromes and black band disease. ■

SOURCES: SCIENCE, NEW SCIENTIST

This study demonstrates that reductions in the amount of plastic waste entering the ocean will have direct benefits to coral reefs by reducing disease-associated mortality.

— Joleah Lamb, Cornell University





Text by Rosemary E. Lunn
Photos by Rick Ayrton

Dateline: Saturday, 26 May 2018
Destination: SS Kyarra
Chart co-ordinates: 50°34,90N;
01°56.59W

“Crikey,” I thought, “one hundred years ago today that German U-boat was awfully close to the English coast.” I suddenly felt a bit vulnerable. World War I happened right here—just off the peaceful Dorset shore, not in some far-off French trench. A century ago today, I could well be on a sinking ship. Or dead.

In reality, I was sitting, fully kitted up, on *Spike*—a British dive charter boat—waiting for Pete, the Skipper, to yell, “It’s time to dive!” The journey out from Swanage Pier and across the bay had taken 20 minutes, and now we were bobbing up and down over the wreck site, waiting for slack water. I stared across the sea to land and Anvil Point, a mere mile away, thinking about the ship I was about to dive.

“Her name was taken from the aboriginal word for a small fillet of possum fur.”

Thirty metres (98ft) beneath me lay the once elegant *Kyarra*—a twin-masted, schooner-rigged steel steamer. She had been built at the start of the last century in Dunbarton, Scotland, by William

Denny and Brothers, to a high standard (her deck was made of teak). The *Kyarra*’s passenger accommodation was luxurious; she had 42 First Class Cabins, and her interior and exterior fittings

Kyarra Wreck Turns

100 Years Old



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Scenes from the wreck (above) of the *Kyarra* (left); Dorset coast (right)



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retrieve them and made the news."

"The Kyarra became known as the ship made of brass"

History

The *Kyarra* was launched on 2 February 1903, and she proved to be a profitable, successful, luxury liner for the Australian United Steam Navigation Company. The 127m (416ft) long ship also had the capacity to trans-

port 7,164 cubic metres (253,000 cubic feet) of general cargo in her fore deck and aft deck holds. She sailed between Fremantle, Western Australia (where she was registered), and Sydney, New South Wales, carrying both fare-paying passengers and cargo.

Her life changed on 6 November

1914. Eleven years after she had been launched, the *Kyarra* was requisitioned and leased in Brisbane by the British Government to be a WWI hospital ship. She became HMAT A55, or "His Majesty's Australian Transports." HMAT ships were used to transport various Australian Infantry Divisions to their respective overseas destinations. When they were not transporting military, HMAT ships would carry goods to Britain and France.

The *Kyarra* was painted white, and red crosses were added to her hull to indicate that she was a hospital ship. Her job was to transport Australian medical units to Egypt, and we know she carried a major contingent of Queensland nurses on one voyage.

Five months later, in March 1915, the *Kyarra* was converted yet again. This time, she served as a troopship and helped land ANZAC expeditionary troops in the Dardanelles. She also saw service in the Gallipoli campaign.

In 1917, the *Kyarra* became a casualty-clearing ship, and had a 4.7in quick-firing



gun mounted on her stern as a defence against U-boats.

On 4 January 1918, the 6,953-ton *Kyarra* was decommissioned—the Commonwealth control lease had ended. Captain Albert Donovan took command of her on 19 January 1918, and readied

the ship for a return to Britain.

In May 1918, the *Kyarra* was in London. She was fully loaded with general cargo worth GB£1,500 (about GB£100,000 in today's money), which was bound for Australia. Items included bottles of champagne, red wine, stout and vinegar, bales



UB-57 CAPTAIN LOHS

The captain of UB-57, Oberleutnant Johannes Lohs, died at sea, aged 29. Lohs sailed from Zeebrugge on 3 August 1918. The last contact he made with base was on the evening of the 14 August 1918. At the time UB-57 was homeward bound. She was believed to be in the area of the Sandiette Bank, east of the Straits of Dover. It is thought UB-57 hit a mine. Lohs' body subsequently washed ashore, and today he is buried in the Ysselsteyn Cemetery, Netherlands.

Between 25 March 1917 and 13 August 1918, Oberleutnant Johannes Lohs damaged 16 ships (89,369 tons) and sunk 77 ships (150,665 tons) during 13 patrols. ■

07.20, another 07.40, a third 08.00 and yet another 08.50. It would be reasonably fair to say she was torpedoed somewhere between 07.00 and 09.00.

There are conflicting reports over the fatalities. One states there were nine fatalities. Another states that six men in the boiler room were killed when it was flooded. A third states that five crew

of silk and cloth, French perfume, rolls of lino, sticks of red sealing wax, medical supplies, cigarettes, silver purses, men's big pocket watches and ladies gold wrist-watches. She was also carrying 35 civilian passengers.

Her captain, William Smith, had orders which stated that the *Kyarra* should sail to Plymouth and embark about 1,000 war-wounded Australian soldiers and repatriate them.

On 24 May 1918, she left Tilbury in Essex and zigzagged down the Channel heading for Devonport, Devon. It was to be her last voyage.

On the morning of Sunday, 26 May, the *Kyarra* had cleared the Isle of Wight and was moving fast through calm seas around Anvil Point (she could do about 15 knots). Sadly, her captain did not know his course was being tracked by German submarine ace Oberleutnant

Johannes Lohs, through the periscope of UB-57.

UB-57

UB-57 was part of the Flanders Flotilla, sailing from Zeebrugge. Her captain had some very good ideas on U-boat warfare and new tactics, and in April 1918 Lohs received the Pour le Mérite. Lohs was having a successful patrol. On 22 May, he had sunk the 423-ton steamer *Red Rose*, and on 23 May, he had sunk the P&O Liner *Moldavia* (she had been converted into an armed merchant cruiser of some 9,500 tons). Now the Oberleutnant was stalking the *Kyarra*.

We do know that Lohs torpedoed the *Kyarra* amidships, on her port side just forward of the boilers. There is, however, differing data regarding the time that she was torpedoed. One reference says



View of the deck (above) and interior (top) of the *Kyarra* wreck

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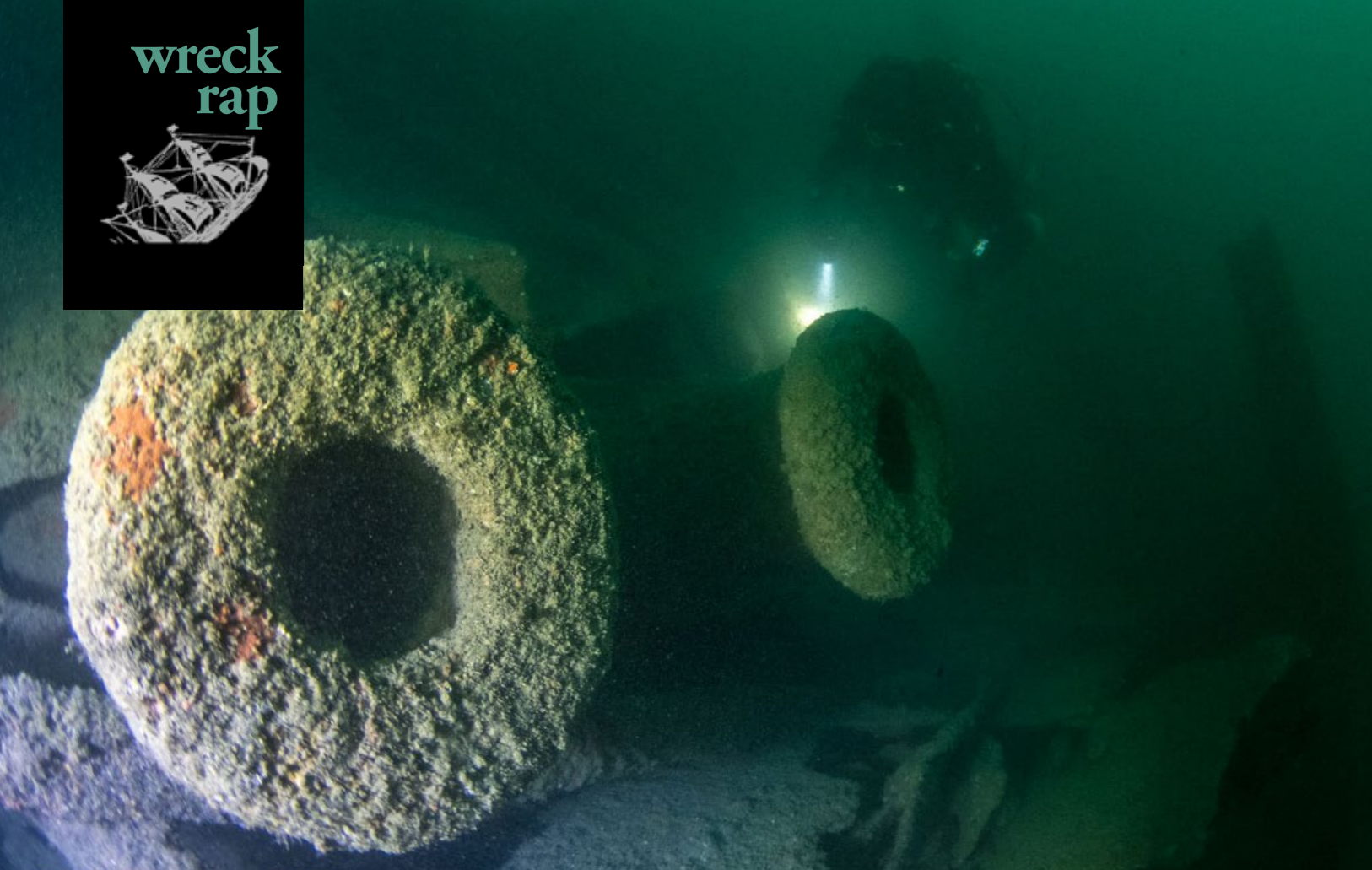
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THIS PAGE: Divers on the wreck of the *Kyarra*

that the *Kyarra's* position was 50°34,30N; 01°56.20W. The *Kyarra's* mast was showing but not considered dangerous to navigation.

The *Kyarra* was to lie undiscovered for 48 or 49 years. Again there are conflicting reports that she was found in 1966 and July 1967. At the time of her discovery, it was thought she had sunk closer to St Aldhelms Point. Her position was therefore marked on the chart as a shoal—"a place where a sea, river, or other body of water is shallow".

First dives on the wreck

She was first dived by two members of Kingston BSAC—husband and wife team, Ron and Linden Blake. Five members of Kingston (Ron Blake, Linden Blake, Adrian Bradley, Bill Foley and Dave Wakeman) and two members of Hounslow BSAC (John Coheagan and Charlie Stoltz) were diving out of Swanage on an inflatable boat looking for the wreck, *Carantan*. The divers picked up what looked like a wreck on the echo sounder



were killed in the engine room and an injured man later died at Swanage Cottage Hospital. Yet, another says that one engineer and four firemen were killed in the explosion, and a sixth man died on shore.

I have found evidence of six fatalities. It is possible that five died on board and one in Swanage. I am not making light of these deaths but it could have been so much worse if the *Kyarra* had been en-route to Australia with the war-wounded.

Again, there are conflicting reports about the attack. One states that a watchman shouted, "Torpedo!" and that it was less than 100 yards away from the *Kyarra*. Therefore, the order for "hard to port" did not have enough time to be actioned.

Another report says that a torpedo was seen, but the enemy vessel was not. A third report indicates that it was thought the

Kyarra had struck a mine, and Captain Smith turned her towards Swanage in a valiant attempt to try and beach her. But it was soon realised that she had been torpedoed.

Either way, the order was given to abandon ship, and the surviving passengers and crew took to the lifeboat.

It is reported that seven to ten minutes later the *Kyarra* nose-dived beneath the waves. From the time of the attack to her sinking, it took about 20 minutes. It is reported she sank at 09.08, but with four different torpedo times, it is hard to know if this is accurate. Either way, the beautiful ship was gone.

The survivors and

passengers, including a pilot, were all landed at Swanage. The W/T code books and confidential papers were sunk by the master.

Location

On 27 May 1918, it was reported

Kyarra

KYARRA LOSSES

Six crewmen died when the *Kyarra* was torpedoed. They are:

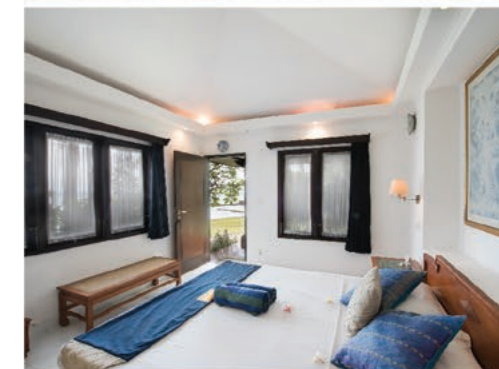
1. BROWN (33), Fireman, HMHS *Kyarra*, Mercantile Marine, †26/05/1918. Born in London. Memorial: Tower Hill Memorial.
2. MACKENZIE, DUNCAN (52), Fireman, HMHS *Kyarra*, Mercantile Marine, †26/05/1918, son of the late Murdo and Catherine Mackenzie. Born at Udrigle. Memorial: Tower Hill Memorial.
3. MCPHUN, LAURENCE ALBERT (16), Steward's Boy, HMHS *Kyarra*, Mercantile Marine, †26/05/1918, son of Mrs. Louisa McPhun, of 12, Tynemouth St., Hull. Born at Hull. Memorial: Tower Hill Memorial.
4. MORLEY, HENRY GARNET WARMLINGTON (28), Trimmer, HMHS *Kyarra*, Mercantile Marine, †26/05/1918, husband of Allison Trent Cook (formerly Morley), of The Shack, Calangir, Western Australia. Born in Australia. Memorial: Tower Hill Memorial.
5. NANLES, JAMES ABBOTT (28), Fireman, HMHS *Kyarra*, Mercantile Marine, †26/05/1918, son of Emily Nanles (nee Wiltshire), of 25, Trinity St. Barking Road, London, and the late Abbott Nanles. Born at Canning Town. Memorial: Tower Hill Memorial.
6. SMALL, WILLIAM, Fifth Engineer Officer, HMHS *Kyarra*, Australian Mercantile Service, †26/05/1918, son of Mr. and Mrs. A. B. Small, of Sydney. Memorial: Tower Hill Memorial. ■



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KYARRA ARTIFACTS

A vast array of different items have been recovered from the wreck of the *Kyarra*. These include brass padlocks, false teeth, a statue of Prince Albert, carved wooden beads, Sanitas Disinfectant bottles, Worcester Sauce, pens, pipettes and smoking pipes and Trench Art.

A small ceramic pot of Marmite was also found on the wreck. This was sealed with a lead lid. Today, Australians eat Vegemite. One wonders would this have been the case if the *Kyarra* had made it safely to Australia. Would Australia also be a nation of Marmite lovers too? ■



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so very similar.

In 1967, Kingston BSAC bought the ship for GB£120, but not the mixed cargo. On 6 May 1969, it was reported that the wheelhouse and the top superstructure had been swept away.

Today, the *Kyarra's* decaying remains stand 18m (59ft) proud of the rocky seabed, and she is probably the most dived wreck in Dorset. She has been adopted by divers under the Nautical Archaeology Society

"Adopt-a-Wreck Scheme," and she is owned by the Kingston and Elmbridge branch of the British Sub Aqua Club.

My dives on Kyarra

As some would say, "this was not my first rodeo," diving the *Kyarra*. That occurred on Sunday, 23 August 1992, as part of my PADI Advanced Open Water Course. I was, frankly, terrified before

and during the first part of my "deep dive" on the *Kyarra*. I calmed down a little when I got halfway down the shot line and was astonished to find the sea was emerald green, as I watched sunbeam shafts dance in the water and lighting up parts of the wreck. The visibility was amazing; I just did not know it at the time, because I had no frame of reference. "So this what wreck diving is all about," I thought, as I followed my instructor across the deck.

This wreck dive had such a profound effect on me that I was back down in Swanage the following weekend, again diving the *Kyarra*. My instructor said I was certified to dive to 30 metres, so I decided to put this into practice. This was the first dive I had ever done without an instructor present.

It was my tenth dive ever. Naturally I did it with someone vastly more experienced than I. He had 14 dives. And it was back in the day when octopuses were not mandatory kit. Between us, we had a primary regulator and

and dived it. Ron and Linden Blake descended first onto an unknown mark and experienced what every wreck diver dreams about—an unknown virgin wreck. She was largely intact—her brass portholes still had glass in them—and she was lying on her starboard side.

The divers formed a company called the *Kyarra* Salvage Association, to salvage the wreck. In 1974, the propeller was blown off with help from Fort Bovisand. The propeller was to lie on the seabed for two years, before it was subsequently raised by Dave Wakeman, and the funds were paid into the company accounts.

Identification

There are conflicting reports on how the *Kyarra* was identified. One says that the Blakes "read the brass name on the bow of the ship, which at the time was

still intact." Another report says that the *Kyarra* was identified by checking all the manifests of the ships sunk off the Dorset coast.

Eventually, a serial number on a stick of sealing wax matched one found in a hold on the wreck. A report also states the *Kyarra* was identified on 22 May 1966, but I cannot find whether she was identified because of the wax, the bell or the brass name (and if she was found in 1967, where does the date 22 May 1966 come from?)

We do know that the wreck was positively identified by the ship's name in brass letters from the bow and the recovery of the ship's bronze bell in 1977 by Julian Bamford and (again conflicting names) David Weightman or Dave Taylor. It is reported that the bell is held by Dave Wakeman, so one wonders if Weightman and Wakeman are one and the same person, because the names sound



Scenes from the wreck of the *Kyarra* (above and top left); Historical photo of the *Kyarra* (center)



"I must have dived the wreck hundreds of times over the years but she is still revealing her secrets. Every dive is different. Exploring the wreck is something I never get tired of."

— Pete Williams, owner of Divers Down and skipper of dive boat *Spike*

decompression sickness. We were very, very lucky.

Impact of Kyarra

That dive was forever seared into my soul. Its impact echoed across the years and into my diving career. When I became a PADI Pro, I would always ask myself before I signed a student's certification card off, "Am I signing your death warrant?" I never wanted a student of mine to go through what I went through on the *Kyarra*.

It took me a while to venture back and dive the *Kyarra* again. I dived it in 1996 with Mike Thomas. We had spent the Saturday caving on Mendip, Somerset. On the Sunday, we headed for Swanage. Mike was and is a meticulous

diver, but somehow he had left his hood behind and he ended up diving the wreck in a fleece balaclava.

At the turn of this century, I was the Dive Centre Manager at Triton Scuba in Portsmouth. I wanted a benign place to introduce my divers to British sea diving. Swanage beckoned, but not initially the *Kyarra*.

Although I was taken on the *Kyarra* as a trainee, I would not consider this wreck a raw-trainee

dive. Divers really ought to have something like 20 odd temperate water sea dives under their weight belt before tackling the *Kyarra* because the visibility, currents and narrow swim-throughs can make this a suitably challenging dive. It is a good wreck for building up depth experience, and it is a great, accessible and entertaining dive for experienced temperate water sea divers, especially if you are nitrox qualified.

Pete's voice drags me away from my wool-gathering. It is time to dive. It is 09.30, and we are more or less on slack tide. The pool is now open. Exactly 100 years to the day and several minutes after the *Kyarra* sank, I take a giant stride off *Spike* and head down the fixed shot line.

pressure gauge each, and we shared a watch, a depth gauge and the biggest knife we could lay our hands on.

We got down to the bottom of the shotline, and this time, instead of benign, sunlit, emerald green waters greeting us, there was a current running, and it was a pitch-dark night. Neither of us had a torch. Who knew that English wreck diving could be blacker than a black thing? We clung to each other not knowing what to do next, before moving away from the shotline. We promptly lost the safe, fixed line home.

At 15 minutes, we decided it was time to come up. We held each other's arms, Roman handshake style, and started to ascent. We kicked and kicked and kicked and his fins fell off. The next moment, we flumped onto the seabed. I jammed his fins back on. By now, we had done about 25 minutes at 30m (99ft). Our no-decompression time was well and



truly blown. We were off the PADI tables.

We started again. Within seconds, we were surrounded by bubbles, thousands of them. Our noses were almost pressed together, and I still could not see his face for the bubbles. I thought his regulator had gone into free-

flow. My BCD's over-pressurisation valve gunned loudly, rapidly and repeatedly, and suddenly, we were on the surface. We had made a very fast uncontrolled ascent from seabed to surface in a matter of seconds. To this day, I still do not know why neither of us did not have an embolism or get



THIS PAGE: Scenes from the wreck of the *Kyarra* (above and top left); Divers on their way to dive the *Kyarra* wreck (left)



Kyarra

Memorial wreath (left) for the souls lost on the *Kyarra* wreck (far left and below)



Their silver bodies look as though they are fresh from a BBQ grill. Strong black stripes run horizontally down each fish, as though their scales have been seared over hot coals.

If you care to look, there is quite a lot of life on the *Kyarra*. Patches of vibrant

ceptively begins to pick up. The *Kyarra* is a very tidal wreck and you can only get on her twice a day. It is almost time to head to the surface. A cheeky tompot blenny is in full-on cute mode, as we head amidships to find a quiet area to deploy our delayed surface marker buoys.

As I sit on my safety stop in the brisk current, I wonder when I will next dive the *Kyarra*. It seems I have visited her at key times in my diving career. Each of my dives has been unique on this big wreck—each dive different. And the more I explore her maritime history, the more I am beguiled by her. I surfaced with more questions about her sinking, wanting conclusive accurate answers. ■

ing forty years since the founding of their branch of the British Sub Aqua Club."

Parting thoughts

As we mooched over broken beams and deck plates, our torch beams picked up a school of bib.

jewel anemones and hydroids coat the structure. Interspersed, are odd clumps of light bulb sea squirts, cup corals, sandalled anemones and deadmen's fingers.

We have almost made it to the rudder as the current in per-

After diving the inland quarries over the winter months, the sea temperature is welcoming. It is a balmy 16°C (60°F) on the surface. This promises to be a good dive. A hint of the wreck begins to appear. As I fin down the line, the smudgy shadow gets stronger and the outline more defined. Three breaths later, we are over the bow area, and the temperature has dropped to 16°C (53.5°F). I am happy and snug in my O'Three drysuit.

This morning, we have good light and great visibility on the *Kyarra*. We have no goals for this dive—our mission is to bumble and enjoy the entire experience of the wreck. We cruise over the holds and the obvious swim-throughs, and fin along her plates. Ahead of us are rows of naked window holes, stretching out into the distance. The brass portholes were recovered long ago.

The once-beautiful ship is show-

ing her age, but then she has spent a century at the bottom of the English Channel, being swept by vicious currents. She is still largely intact and recognisable as a ship, although she has evolved into flat-pack wreckage.

Get your eye in and you can start identifying deck fittings from the jumble of metal. Obvious objects include various pairs of bollards, the mast, a large winch and a boiler, complete with a resident curious conger eel (*Kyarra* had four boilers). Some objects are less obvious—random bits of the engine mechanism, a capstan and the propeller shaft.

Memorial

A pair of divers pass us, mission-focused, heading for the boiler. Today, Divers Down (the oldest dive school in the United Kingdom) has teamed up with the Isle of Purbeck Sub Aqua Club (IPSAC) to lay a wreath on the wreck. Nick

Reed (Training Officer) and Chris Dunkerly (Chairman) of IPSAC will place the wreath to commemorate the six men killed a century ago today.

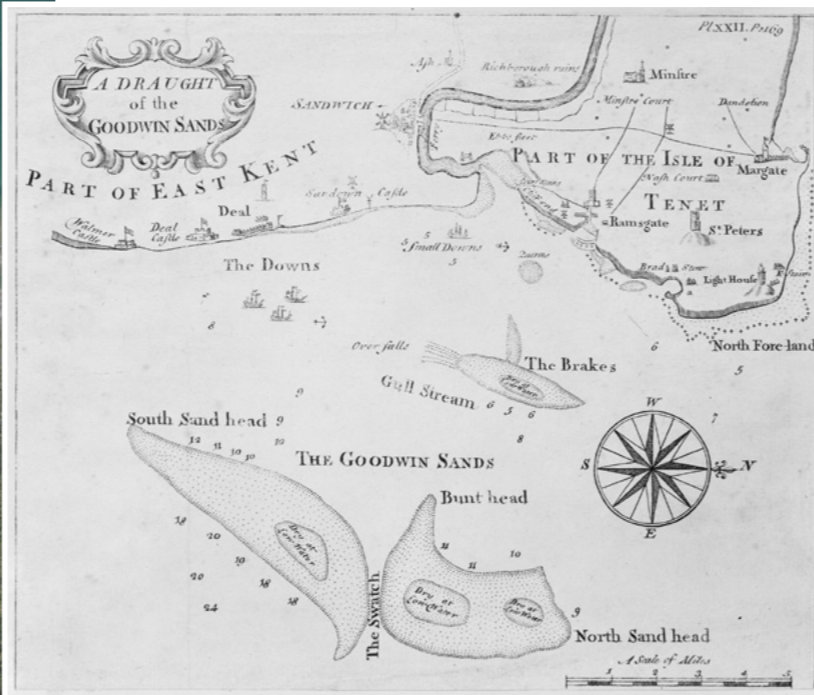
Pat Collins, co-owner of Divers Down and secretary to the Friends of Swanage Pier, said: "The *Kyarra* is one of the most iconic wrecks on the south coast. Divers use our boats to visit the wreck throughout the summer and we felt it was important to mark the 100th anniversary of her sinking by remembering the six men who died on that May morning in 1918. The *Kyarra* can only be dived at certain states of the tides due to the fast currents so we are lucky that we will be able to dive the wreck within an hour of the actual sinking time.

"The commemoration is even more special as this year we celebrate 60 years of Divers Down. Our friends in the Isle of Purbeck Sub Aqua Club are also celebrat-



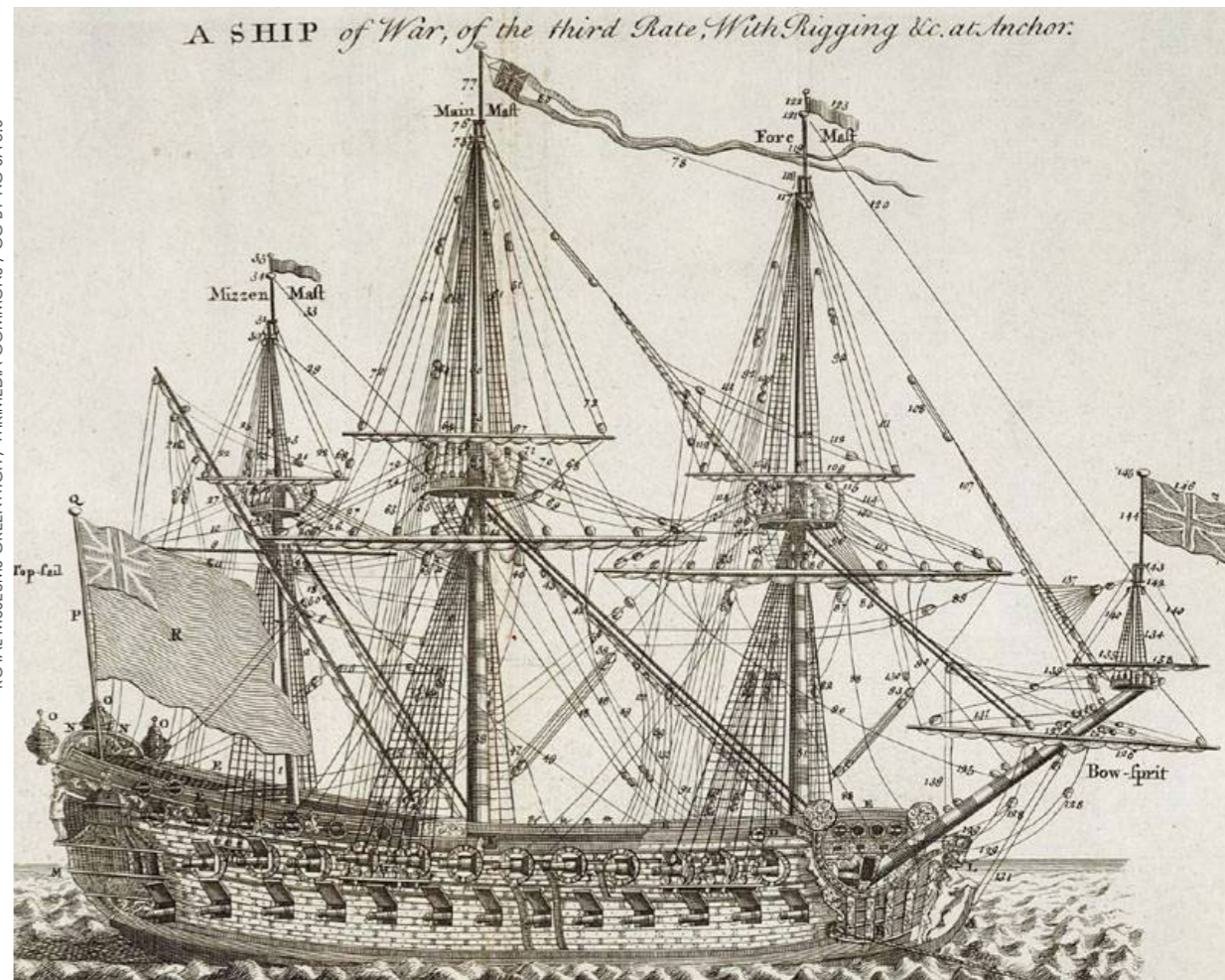


NASA / PUBLIC DOMAIN



ROYAL MUSEUMS GREENWICH / WIKIMEDIA COMMONS / CC BY-NC-SA 3.0

The Goodwin Sands (left) are one of the most important marine archaeological areas around England; Printed chart from 1750 of the Goodwin Sands (above); Historical illustration of a ship of the line (right)—or 17th-19th century warship—similar to the HMS *Restoration*



WIKIMEDIA COMMONS / PUBLIC DOMAIN

Historic wreck sites in the English Channel face eradication as controversial dredging project gains approval

The Goodwin Sands, a sandbank off the East Kent coast, have the highest density of historic wrecks designated under United Kingdom's Protection of Wrecks Act 1973.

The Goodwin Sands are located approximately 13 miles from the Dover Straits—the narrow, historical and important sea route. Hence, it is quite possible that the considerable expanse of shifting sand has claimed at least 2,000 ships over the centuries. The first documented ship wrecked upon the Goodwin Sands dates from 1298. The Sands have the highest density of historic wrecks designated under the Protection of Wrecks Act 1973.

Designation is not given lightly; each wreck must be of national or international significance. A good example of this is the *Rooswijk*. This armed Dutch East Indiaman was found in 2004. She had been wrecked in a storm in January 1740 whilst carrying a large cargo of silver. All 250 crew and passengers perished.

The *Rooswijk* has been very carefully excavated by Historic England, the Cultural Heritage Agency of the Netherlands, and a team of Dutch and British underwater archaeologists. In January 2007, the UK government announced that it was going to designate the *Rooswijk* as a protected site.

Other significant designated historic wrecks include HMS *Stirling Castle*, HMS *Restoration*, HMS *Northumberland* and *The Admiral Gardner*.

Souls lost

Ships are not the only victims of this hazard. Tens of thousands of mariners and scores of servicemen from both World Wars have lost their lives on the Goodwin Sands. In 1940 alone, research has shown that 60 planes and 80 aircrew from Britain, Poland and Germany perished in this area of the English Channel. Only one plane, a Dornier 17, has ever been recovered.

Sand and gravel

The Goodwin Sands are solid at low tide; in fact, cricket matches have been played on the sandbank since 1824. But as the waters return, the Sands become sticky

and cloying quicksand. At high tide, the Sands are covered by just a few feet of water.

At first glance, harvesting the Goodwins for sand and gravel for construction seems a sensible solution because it is a conveniently-placed, low-cost sand supply, ripe for exploitation. On 19 January 2016, *The Guardian* reported that Dover Harbour Board "was considering dredging for sand and gravel from Goodwin Sands", to expand cargo facilities and build a marina at Dover Port.

Following a two-year public consultation, the Marine Management Organisation (MMO) granted Dover Harbour Board (DHB) a licence to dredge three million tonnes of aggregate

from the Goodwin Sands on 26 July 2018. DHB proposes to extract a maximum of 3,000,000 dry tonnes of sand and gravel aggregate over a period of two years, using a trailer-suction-hopper dredge.

Strong voices say, "No!"

In August 2017, Jane Maddocks, Wrecks and Underwater Cultural Heritage Adviser to the British Sub Aqua Club, stated:

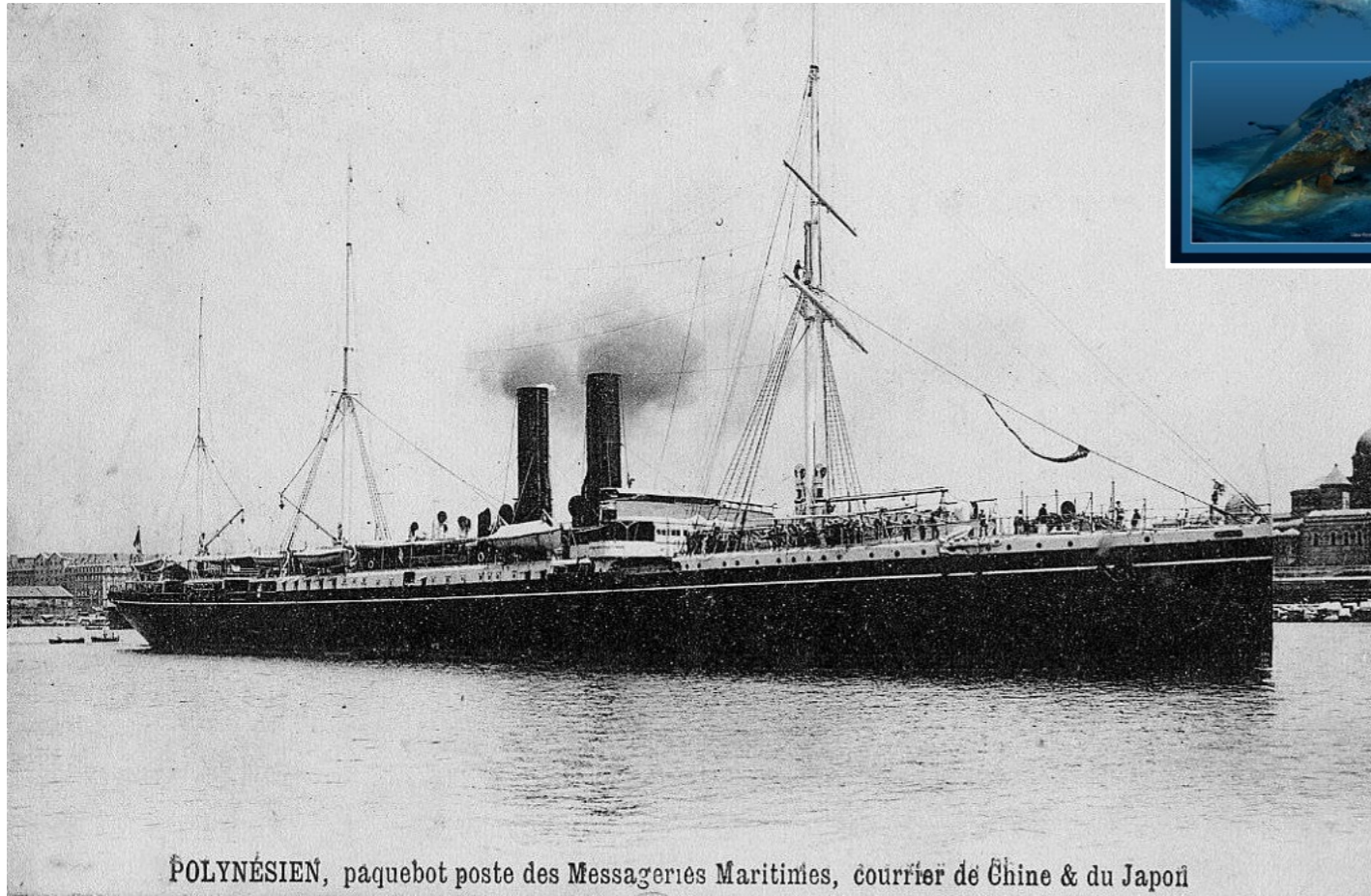
"As the governing body for the sport of sub aqua diving and snorkelling in the United Kingdom, we feel that part of our role is to support the protection of our underwater cultural heritage (UCH) whenever we feel it may be threatened. The dredging proposals for the Goodwin Sands concern us."

The Prince of Wales Sea Training School in Dover also voiced its concern about harvesting the Goodwin Sands to use as building materials: "For the thousands of seafarers and WWII airmen who lost their lives on these sands, the Goodwin Sands, through the timeline of our nation's seafaring history, 'is a known grave;' the evidence is overwhelming, as the charts and our history show, so let the sands become their memorial."

On 27 September 2017, Historic England—the government's statutory adviser on all matters relating to the historic environment in England—wrote to the MMO and said, "We recommend that you do not issue a marine licence for this proposed project (Goodwin Sands aggregate dredging project)." ■



A centenary should always be acknowledged and marked. Maltaqua, Marcus Blatchford and Steve Jakeway have therefore collaborated to create two limited edition fine art prints, and a full colour poster showing detailed 3D images of the wreck of SS *Le Polynésien*.



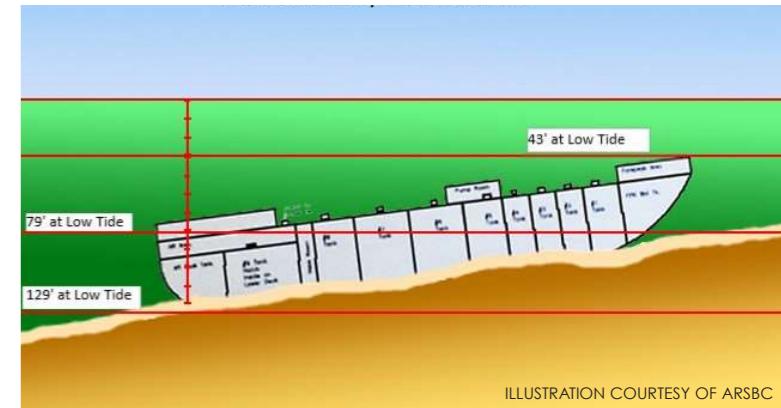
Built in 1890, SS *Polynésien* was a French passenger ship that served on the France-Australia line. She was sunk on 10 August 1918 in the Mediterranean Sea, seven nautical miles (13km or 8.1mi) off Valletta, Malta, and sent to a watery grave by a torpedo launched by the German U-boat SM *UC-22*, captained by Eberhard Weichold. In 15 patrols, *UC-22* was credited with sinking 23 ships, either by torpedo or by mines laid. *UC-22* was surrendered to France on 3 February 1919, and was broken up at Landerneau in July 1921.

WIKIMEDIA COMMONS / PUBLIC DOMAIN

British Columbia gets another artificial reef as ARSBC sinks YOGN 82

The Artificial Reef Society of British Columbia, Canada, partnered with local manufacturer Catalyst Paper to clean and sink the YOGN-82, a US Navy barge from WWII, creating a new artificial reef and dive attraction off the coast of Powell River.

Made of cast reinforced concrete, the vessel—which was built in 1943 by Concrete Ship Builders in National City, California—measures 112m long and weighs 4,400 tons. To clean and sink YOGN-82, Catalyst Paper contributed CA\$500,000.



Placement depth of YOGN-82

ILLUSTRATION COURTESY OF ARSBC

ARSBC Vice President, Rick Wall, said the sink went as planned: "It took 11 minutes to sink and go

down . . . She is on the bottom, fully intact and sitting upright."

Over the next five years, three more ships will be reefed, including *Emile N. Vidal*, *Quartz* and *SS Peralta*. Reached only via watercraft, these giant ships will be placed in a group formation at different depths from around 25 to 35m, within easy scuba swimming distance from one another.

■ SOURCE: ARSBC

SS Le Polynésien sank 100 years ago

One hundred years ago—on 10 August 1918—Captain Eberhard Weichold ordered the crew of SM *UC-11* (a minelaying submarine) to torpedo the *Polynésien*. The 152m (498ft) French steam- and sail-powered passenger liner was hit on the port side near the engine room and sunk within 20 minutes. A number of reports state that 11 crew members and six passengers died.

One century on, and this massive wreck now lists to port, in an area where salvage is illegal. The *Polynésien* is still very much intact and in great condition. She is deep enough to miss most storm surges; hence, it is possible to see exactly what is actually happening as the structure degrades.

"Plate ship"

Locally known as the plate ship due to the number of ceram-

ics visible on the wreck itself, this wreck is very much intact and easy to penetrate. However, not every diver will be able to visit this beautiful wreck—she is a technical dive because she lies at 43 to 65m (141 to 213ft).

Poster and models

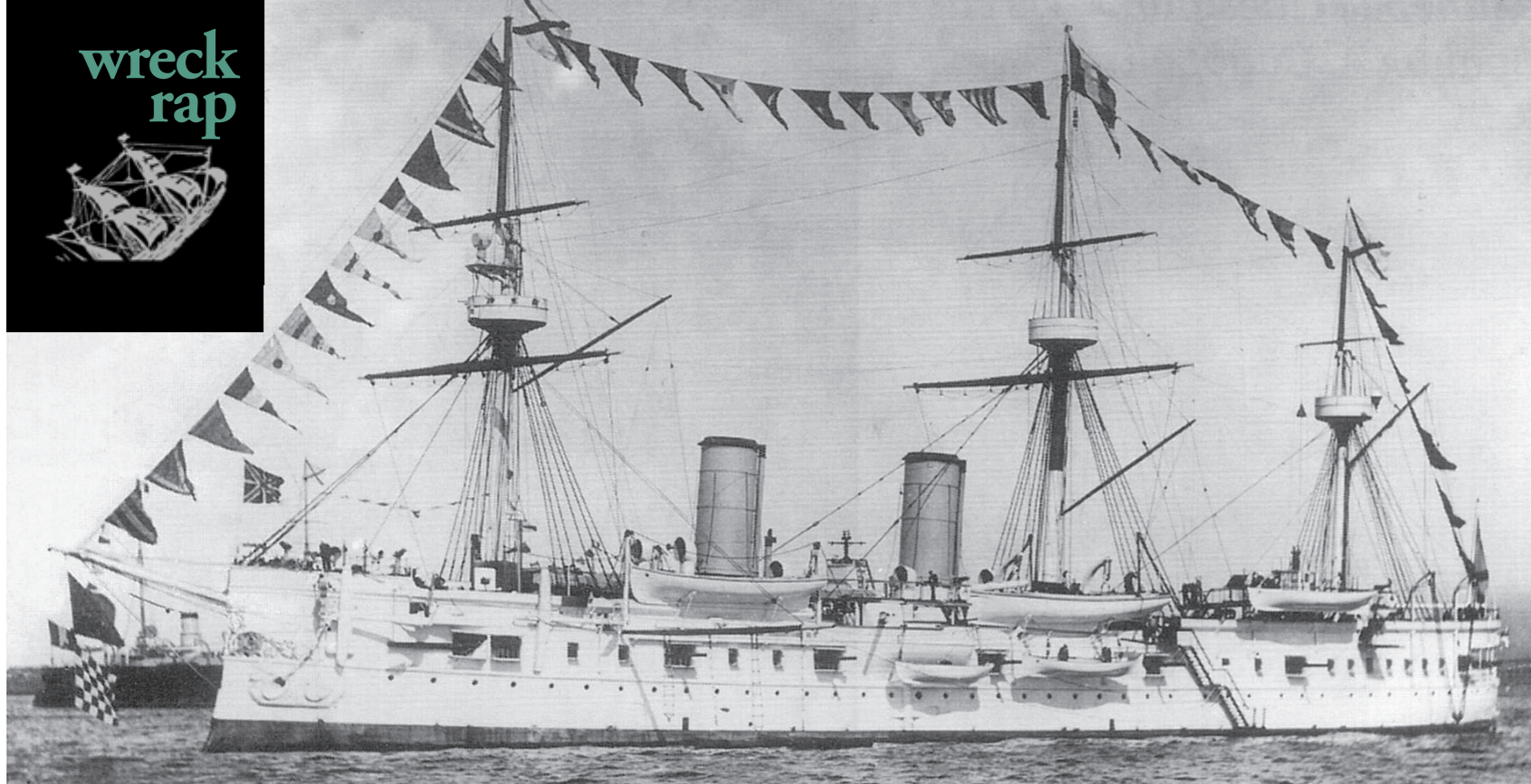
Marcus Blatchford, a British underwater photographer, has been using photogrammetry to document a number of Maltese

wrecks, including the MV *Rozi*, Schnellboot S-31, HMS *Hellespont* and the bow section of HMS *Southwold*. The most interesting Maltese wreck however is the mighty SS *Le Polynésien*, and Blatchford has been involved with a project to record this wreck in high definition 3D (if you click on this [link](#) you will see four models: the stern gun, the anchor windlass and two models of the complete wreck). ■



WWII-era US Navy barge YOGN-82 being sunk off the coast of Powell River, BC

PHOTO COURTESY OF ARSBC



Discovered by an international team comprising British, Canadian and South Korean experts, the Russian Imperial Navy cruiser *Dmitrii Donskoi* was found about a mile off the South Korean island of Ulleungdo.

Mystery surrounds wreck of Russian warship found off South Korea

Police in Seoul have raided the offices of a South Korean company, which declared it had found billions of dollars worth of gold aboard the sunken Russian warship and is now investigating the case as a potential fraud linked to a new cryptocurrency.

South Korean police also requested an international arrest warrant for the founder of a Singapore-based firm after launching an investigation into the Korea-based Shinil Group over false claims regarding the long-lost Russian "treasure ship".

The Shinil Group announced in July that it had discovered the wreck of the *Dmitrii Donskoi*, and that 200 tons of gold in bullion and coins worth US\$133 billion were likely still aboard.

The ship was damaged in 1905 during the Battle of Tsushima in the Russo-Japanese War, and a decision was made

to scuttle the vessel. The fact the *Dmitrii Donskoi* was deliberately sunk fuelled speculation that it was carrying gold. But the sinking of damaged warships by their own crew was and still is a common practice to prevent them and their secrets from falling into enemy hands.

The Shinil Group stated they intended to raise the wreck in October or November. It agreed to hand over half the gold to the Russian government, (which Russia is entitled to anyway!) with some ten percent to be spent on tourism projects on Ulleungdo Island and development in northeast Asia. Another ten per cent would be invest-

ed in a new cryptocurrency system that it would be establishing.

However, 200 tons of gold is nowhere near worth the reported US\$133 billion but less than US\$8 billion (gold price as of 22 Aug is US\$ \$38.41 per gram).

The Korea Herald reported Shinil Group has denied it has any ties to the cryptocurrency outfit, though it was apparently advertising the cryptocurrency on its website. Shinil has since shut down its own website and the Shinil Gold Coin cryptocurrency project has also vanished. ■

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Edited by
Peter Symes

Travellers from affluent countries prime factor in tourism emission growth.



PETER SYMES

CO₂ footprint of travellers rising significantly

Tourism, a booming global industry worth over \$7 trillion, employing one in ten workers worldwide, now contributes 8% of global carbon emissions, a figure that is three times higher than previously estimated, a new study finds.

The study, published in the journal *Nature Climate Change*, examined global carbon flows between 160 countries between 2009 and 2013, revealing the total closer to be 8% of the global total. Driving the increase are visitors from affluent countries who travel to other wealthy destinations. The United States has biggest footprint, both from foreign visitors and Americans travelling abroad, followed by China, Germany and India.

"It definitely is eye opening," said study author Dr Arunima Malik from the University of Sydney. "We looked at really detailed information about tourism expenditure, including consumables such

as food from eating out and souvenirs. We looked at the trade between different countries and also at greenhouse gas emissions data to come up with a comprehensive figure for the global carbon footprint for tourism."

Affluent people

While travel in the United States, China, Germany and India was predominantly domestic, travellers from Canada, Switzerland, the Netherlands and Denmark exerted a much higher carbon footprint outside their own countries. When richer people travel, they tend to spend more on higher-carbon transportation, food and pursuits said Malik. "If you have visitors from high income

countries, then they typically spend heavily on air travel, on shopping and hospitality where they go to."

Dive destinations in pinch

For particularly small island nations popular among dive travellers, the carbon footprint provided by international visitors makes a big difference. In some of these places, international tourism may account for as much as 80 per cent of their national emissions.

This presents a difficult situation for such nations, the researchers tell *Scientific American*, noting that "these islands benefit substantially from the incomes from tourists, so their governments face

Time for carbon taxes

"Given that tourism is set to grow faster than many other economic sectors, the international community may consider its inclusion in the future in climate commitments, such as the Paris Accord, by tying international flights to specific nations," coauthor Dr Ya-Yen Sun stated in a University of Sydney press release.

"Carbon taxes or carbon trading schemes—in particular for aviation—may be required to curtail unchecked future growth in tourism-related emissions."

Lead researcher, Professor Manfred Lenzen, stated that paying for carbon abatement could increase the price of a trip significantly, pointing to previous research indicating robust offset schemes did not amount to small change. "If I flew from Melbourne to the UK return, I would pay at least an additional AUS\$425 to offset my emissions; for a return trip between Sydney and Brisbane, about \$45 extra," Lenzen said. ■

SOURCE: UNIVERSITY OF SYDNEY

a challenge of how to impose national mitigation strategies without reducing tourism income."

Emissions on the rise

Due to its high carbon intensity and continuing growth, the researchers predict tourism will constitute a growing part of the world's greenhouse gas emissions. Some airlines have announced plans to begin or expand their use of biofuels on certain flights, or have begun offering carbon-offset programs. Still, projected increases in air travel underscore the need to reduce emissions further. ■

SOURCE: NATURE CLIMATE CHANGE.



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Grenada

— *Spice Isle of the Caribbean*

Text and photos by Scott Bennett



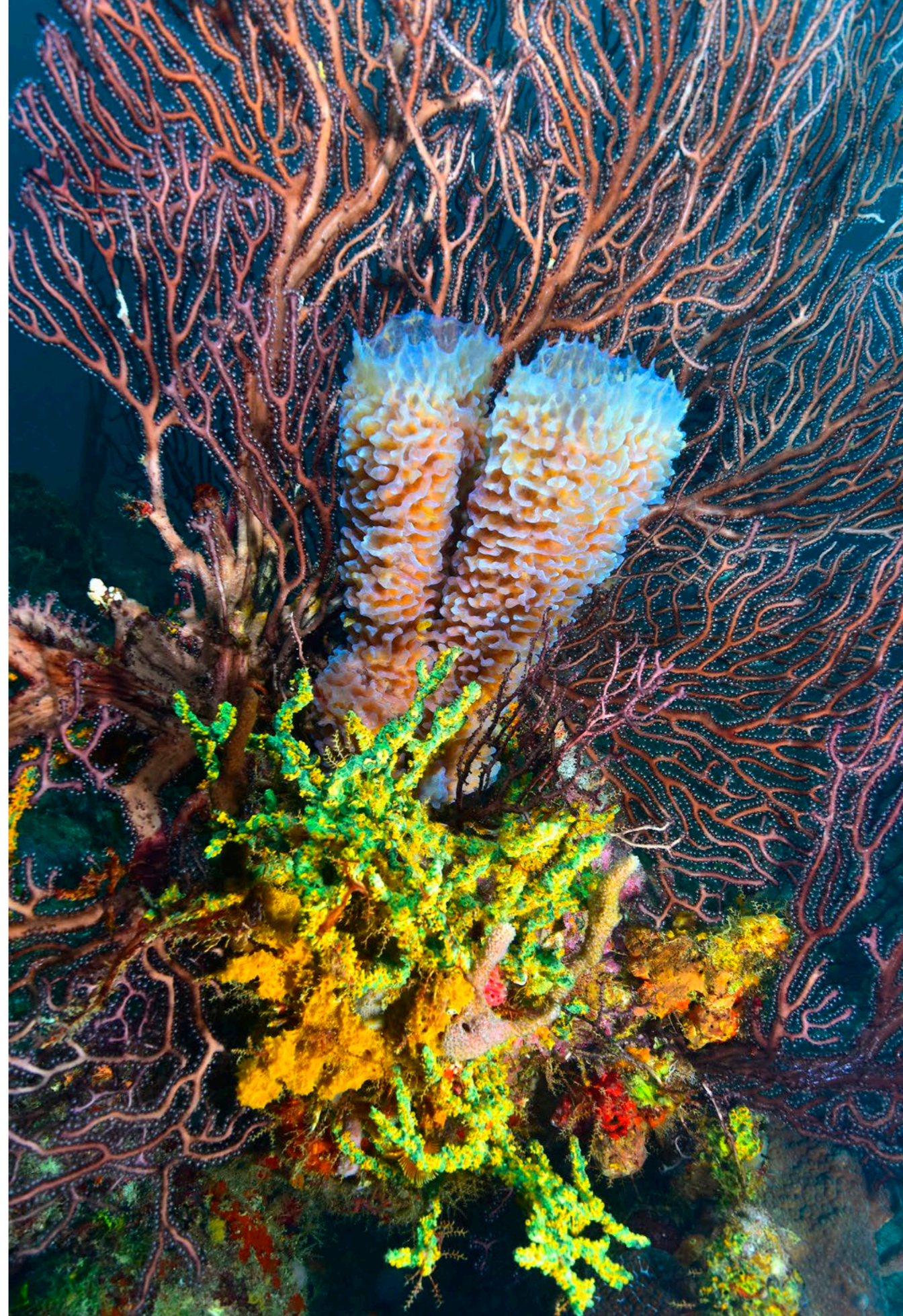
Anchored at the southern end of the Grenadines in the southern Caribbean, Grenada, known as the “Island of Spice” due to its nutmeg and mace production, has long been on my radar. Being tropical and scenic with good diving and a short flight from home, how could one NOT be enticed? Alas, circumstance always seemed to intervene, making it a destination for “next year.” But with a gap in my calendar before Christmas, I decided it was finally going to be “this year.” The impending Canadian winter provided added incentive!

Although Air Canada offers non-stop flights from Toronto on Mondays, the flight was nearly full and expensive. Instead, I opted to fly Caribbean Airlines via Trinidad, which offers daily connecting flights to Grenada's Maurice Bishop International Airport.

Despite being only a 30-minute flight, Grenada seemed light years away from the bustle of Trinidad. Landing at 8:30 a.m., mine was the only flight in the entire airport. Within minutes, I had my luggage and was out the door, where Peter Seupel, owner of Aquanauts Grenada, was waiting. “Welcome to Grenada!” he enthused, and with my bags loaded on his truck, we headed for Aquanauts' base at the True Blue Bay Resort, a seven-minute drive away.

Dive centre and resort

My home for the week, the True Blue, was a beautiful boutique hotel located on



Reef scene at Windmill Shallows (above); Flamingo tongue at Flamingo Bay (left); Diver on Veronica L wreck covered in cup coral (top left). PREVIOUS PAGE: Black Forest dive site





Grenada

LEFT TO RIGHT: Cacao pod; Chocolate with nutmeg; Typical Grenada breakfast; A hodgepodge of colorful houses cling to a hillside in St. George's.

True Blue Bay (and painted blue to boot). Near reception, an activities board announced the week's events. Every night featured a theme, from chocolate and rum tasting to Mexican/Caribbean food night and even a street food festival. I was already liking this!

As my room was not quite ready, I headed over to get some breakfast. A focal point of the resort, the



True Blue Bay Resort

Dodgy Dock restaurant was the essence of eclectic cool; open-air and spacious with delightfully quirky décor. Fresh fruit juice and an omelette was just the ticket. The nutmeg banana bread was amazing; then again, I was on the island of spice. An hour after landing, I had already checked in at my hotel and eaten breakfast. How cool is that?

Only metres from the reception, my room was a two-level affair, with living room/ kitchen on the main floor and bedroom/bathroom on the second. Each floor had a terrace, with views across the bay to St. George's University.

After unpacking, I ventured to the dive shop to get my gear sorted out. Peter and his wife Gerlinde founded Aquanauts back in 1997. After operating a dive centre in Curaçao, they wanted to move on. After some island hopping to find

another place, a short stopover in Grenada caught their attention. "Grenada was not really on our minds, but what got us immediately was the friendliness of the people and the beauty of the island. The diving was not much developed, so we saw a great opportunity there."

From wrecks to reefs, some 31 sites are located off and along the island's southern coast, with something for every skill level. Grenada is renowned as the wreck dive capitol of the Caribbean and that is no idle boast. Around 15 separate wrecks can be found off the island's southern coast, with three along the rougher Atlantic side. With a week at my disposal, I looked forward to seeing a broad spectrum of Grenada's dive sites.

Unfortunately, I was unable to buy a wetsuit before my departure and all the shop had available was a shorty. With

gear sorted, I met the Aquanauts crew. On hand were dive guides Bruce, Myron, Chrispin and Roland AKA Bugsy. Aquanauts predominantly uses nitrox, but those using rebreathers are also well-catered to.

Prior to departure, I had quite a shock. As I was about to immerse my housing in the rinse tank, DM Paul was beside me, inspecting his rebreather. As my housing hit the water, a loud "beep, beep, beep" froze me, google-eyed. Fortunately, it was only his rebreather, but it jolted me faster than a double espresso shot!

Above the dive shop entrance was a sign offering frozen lionfish fillets for sale. The fish had become the scourge of the Caribbean since their accidental release, and Aquanauts was doing its part to alleviate the situation. Chrispin was coming along with his trusty speargun to stock up the freezer.





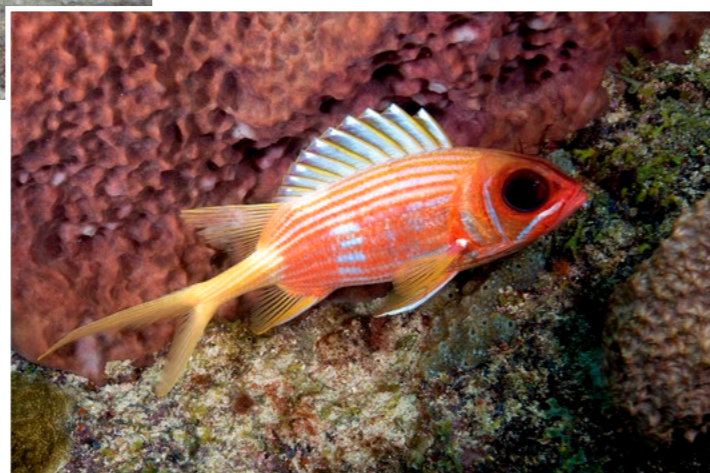
and strong currents. The site itself is over 3km long, averaging depths between 10-13m. Dives are generally done as drifts.

En route, conditions were unsettled, with wind and surface chop but the trip was less than 10 minutes. For the ensuing hour, the current moved us along, although it was possible to slow down to take photos. Aggregations of porous sea rods were interspersed with giant and netted barrel sponges, pillar corals, common sea fans and rough tube sponges. Within minutes, we found our first nurse



Diving

Shark Reef. Housing assembled, I headed back to the dive centre for the 2:00 p.m. departure. With Captain Larry at the helm and DM Myron as my dive buddy, we set out for Shark Reef, located off the island's exposed Atlantic side. In contrast to the sheltered Caribbean Sea, where most of the dive sites are situated, conditions can be more challenging, with rougher seas



shark resting on the bottom. I managed one shot before the current pushed me away. Many of the fish were species I had not seen before, including rock beauty angelfish, reticulate moray, longspine squirrelfish, stoplight parrotfish, the orange phase of a whitespotted filefish, blue-heads and a pair of purplemouth morays.

I also found a lionfish, but Chrispin promptly appeared and voila: one more for the freezer. A giant barrel sponge revealed a pair of banded coral shrimp, while a mixed school of French and Caesar grunt along with three great barracudas and a huge hawksbill sea turtle kept

COUNTER-CLOCKWISE FROM ABOVE: At Shark Reef, one can find hawksbill sea turtles; nurse sharks, schools of French grunts, stingrays, longspine squirrelfish and spotted drum









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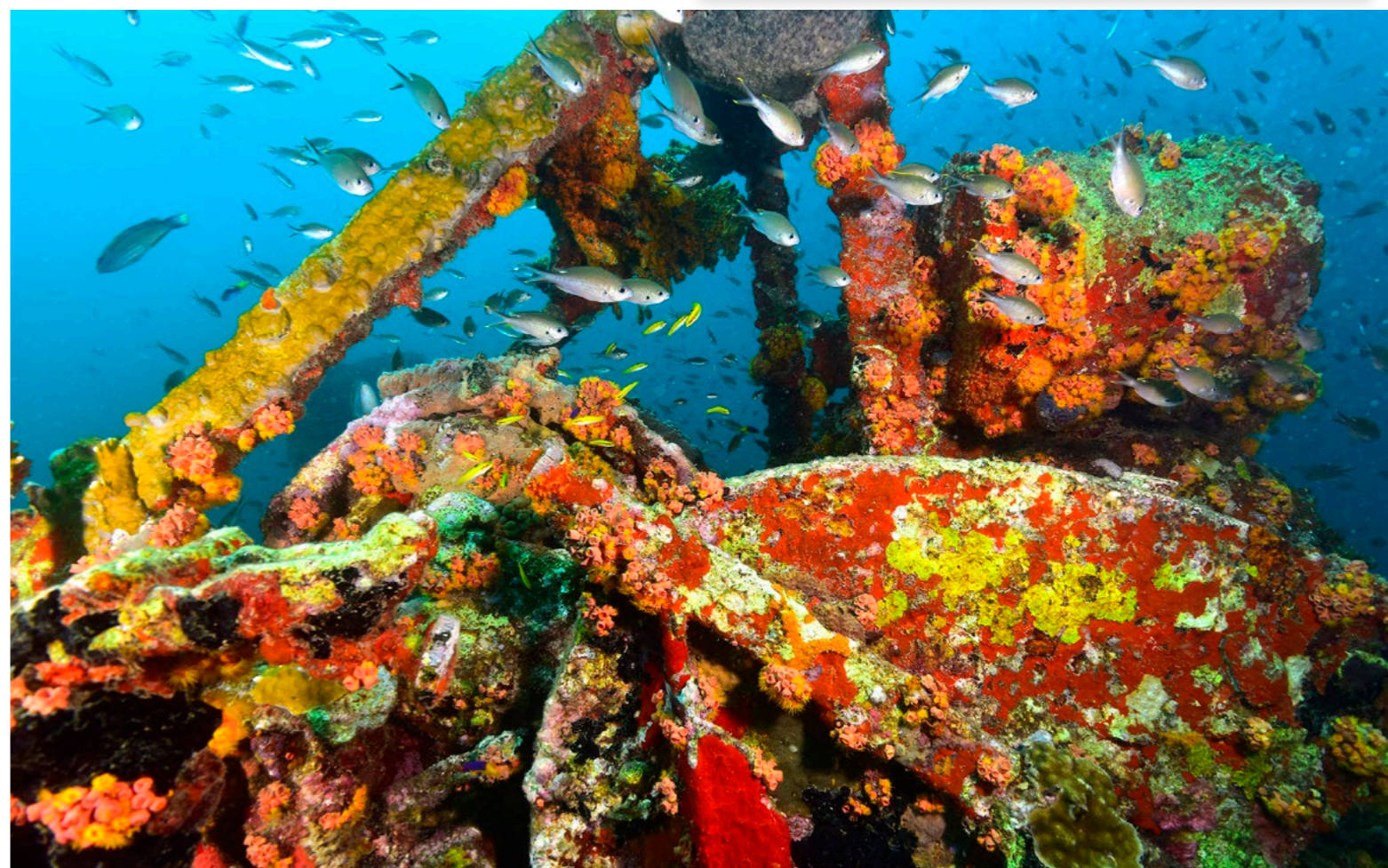


up was Windmill Shallows, a reef with drop-offs ranging from 18m to 32m. Consisting of a narrow ridge 9m wide, the seaward side featured a slope descending to 140ft before turning into a wall. Whip corals, gorgonians,

me enthralled. I also had my first run-in with branching fire coral (it won) and immediately regretted not buying a long wetsuit before leaving home. Regardless, it was a great dive to begin the week and I could not wait to see what else Grenada had in store.

Windmill Shallows. The next morning, I was rested, fed and eager for a full day's diving. First

vase, rope and barrel sponges thrived, while deepwater sea fans crowded the slope. Yet more barracuda appeared; I do not think I have ever seen so many in such a short time! Their claws outstretched, huge channel-clinging crabs peered from crevices as longspine squirrelfish, butterflyfish and creole wrasse swarmed in abundance. Great stuff!



Veronica L wreck site (above), where one can find resident parrotfish (top right)

Vase sponge (above), gorgonians (top) and channel clinging crab (right) at Windmill Shallows



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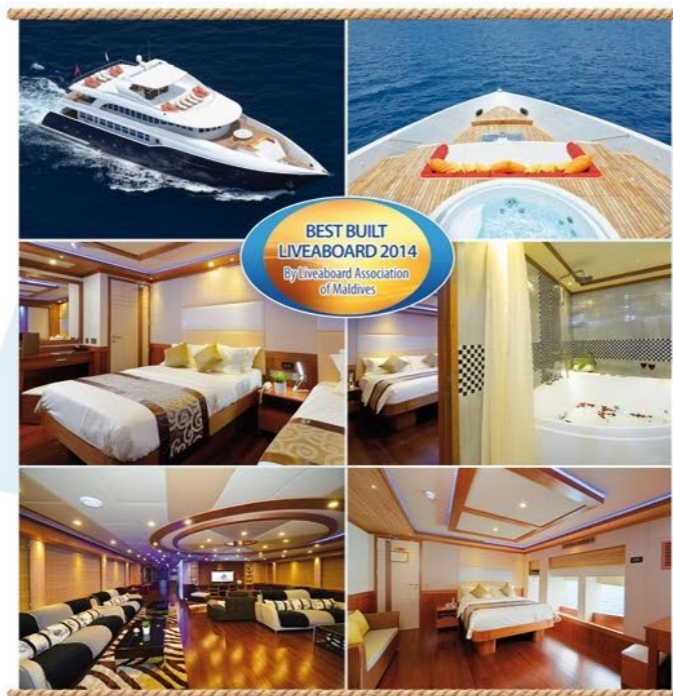


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Moray eel on wreck of *Veronica L* (left)

managed a couple of shots before it vanished into a nearby recess. The vessel was so encrusted with growth it bore the appearance of a ship sculpted from sponges, with virtually none of the original structure visible.

Veronica L. But things only got better. Next up was a site that quickly became a favourite: the *Veronica L*. A small cargo vessel that sank outside St. George's, the vessel was relocated to its current position near Boss Reef as the original site was prone to silting from a nearby river. A shallow dive no deeper than 12m, we headed straight for the stern, where a spotted moray was swimming out in the open. I

And then there was the marine life. The open hold housed congregations of French grunt, along with longspine squirrelfish, sergeant majors and the occasional Atlantic trumpetfish. On deck, coral-shrouded machinery included a crane with a 6m arm. The crane was a fish magnet, with large numbers of brown chromis, along with juvenile blueheads, striped parrotfish, banded butterflyfish, porcupine-

THIS PAGE: Scenes of *Veronica L* wreck site





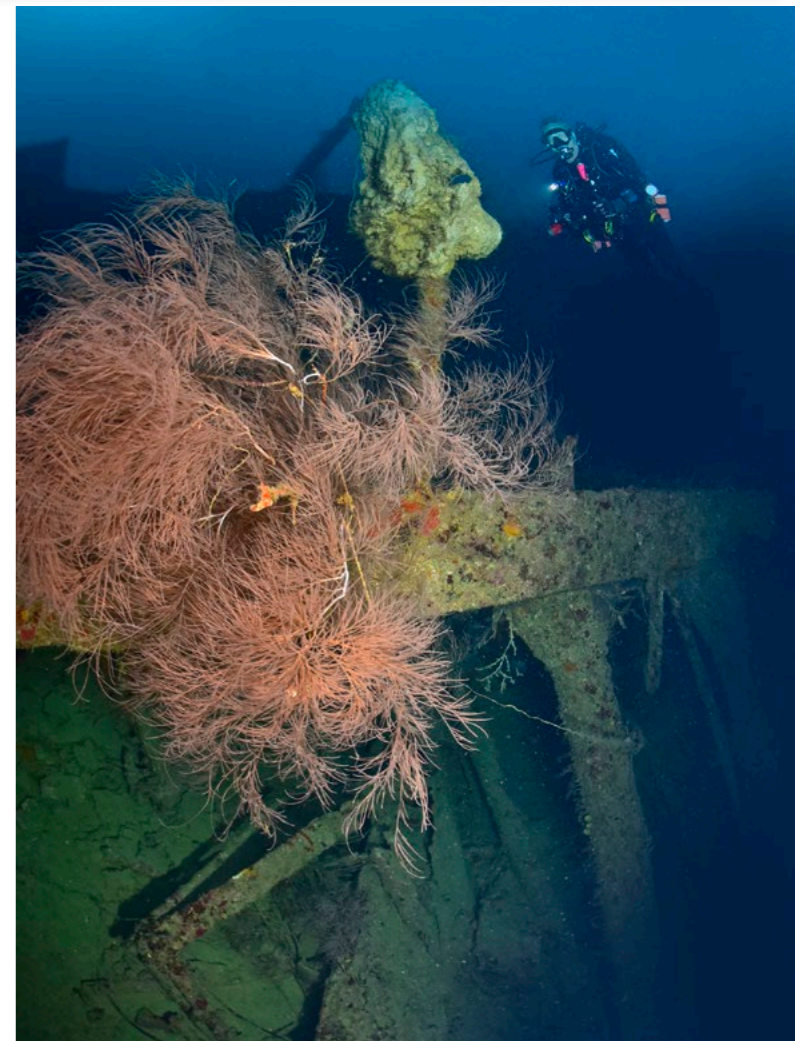
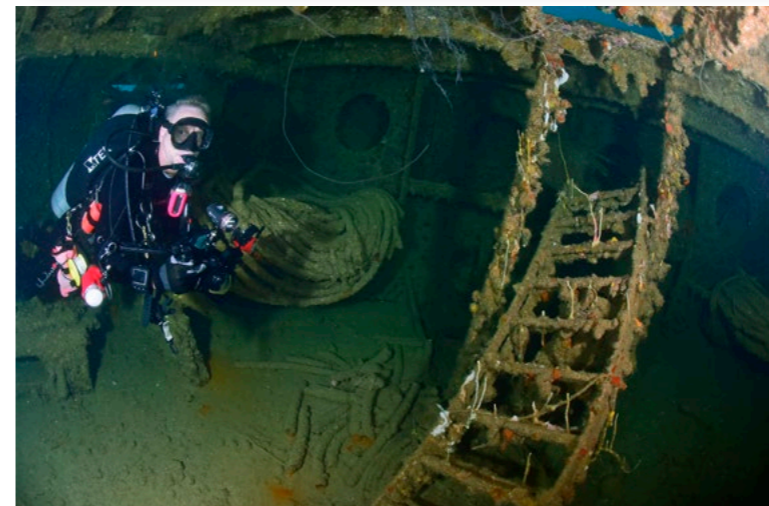
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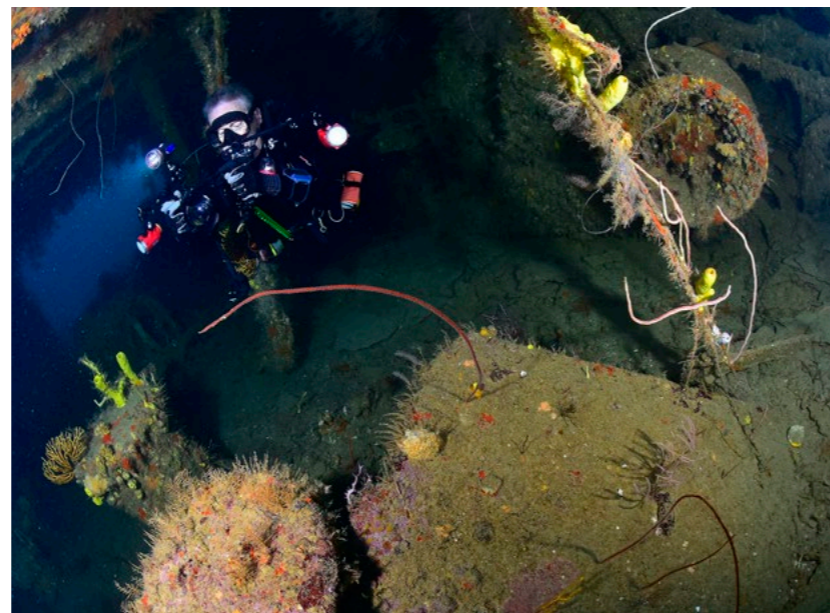
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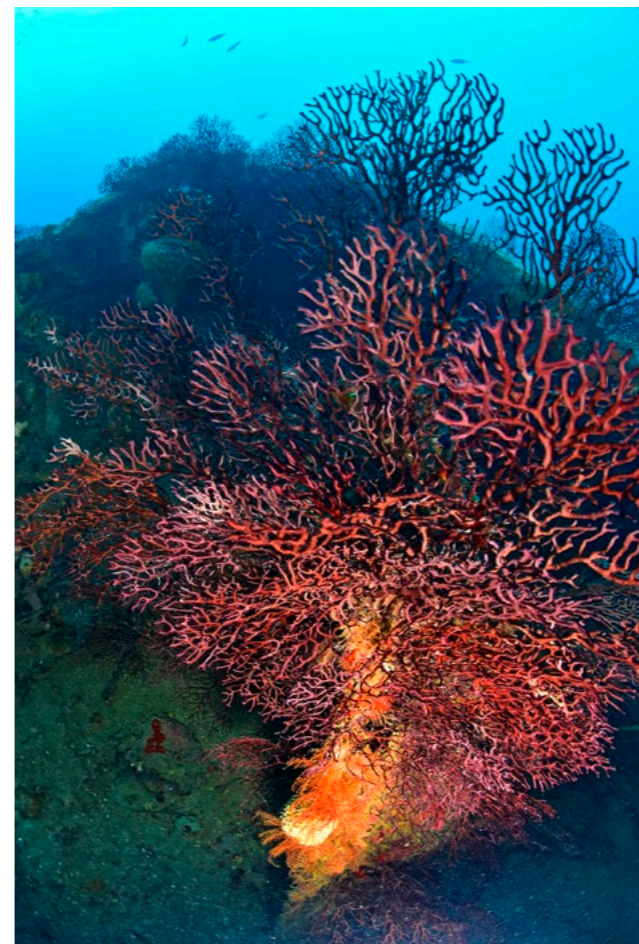


fish and yellowtail snappers. Mutton snappers kept their distance farther down the deck. The port side revealed dense congregations of cup corals as fireworms skittered about. With next to no current, this was one of the best wrecks I have ever dived. Shooting upwards in the shallow water insured a blue backdrop to the teeming fish life and vibrant growth; underwater photography does not get any better!

Bianca C. The next morning, our first dive would be at one of Grenada's most renowned sites. Calling the *Bianca C* the "Titanic of the Caribbean" is no exaggeration. At 180m in length,



the 18,000-ton cruise liner sank in St. George's Harbour on 22 October 1961 due to an explosion in the boiler room. The ensuing fire prompted the evacuation of over 400 passengers and 200 crew. Of those aboard, 672 of 673 people were saved by the prompt actions of the crew and numerous local boats that arrived to help. Af-



ter burning for two straight days, a tow line was secured to remove her from the local shipping lanes. However, a sudden squall severed it and she sank to the bottom, about 3km from Grand Anse Beach.

Resting upright on her keel at 50m, the vessel has been gradually collapsing in on itself over the last few decades. According to Peter, breaks in the hull have widened and decks have collapsed over the years as the vessel continues settling. Around 1994, the ship's rear third broke off and toppled onto its starboard side. One of the

THIS PAGE: Scenes of *Bianca C* wreck site



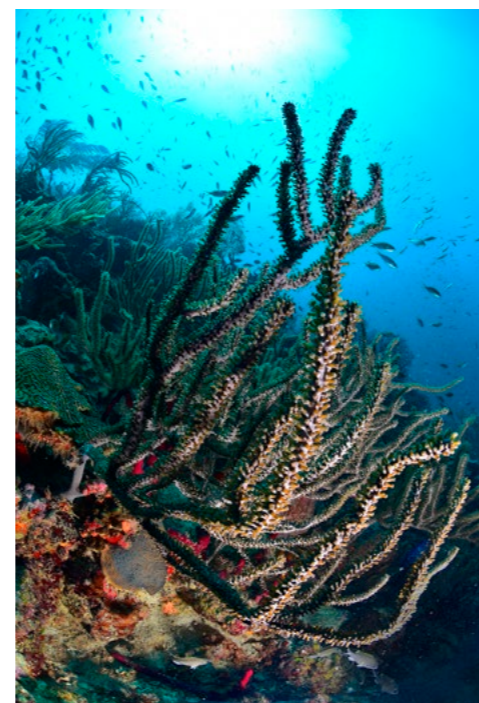
Barrel sponge (above) and reef scenes (right and left) at Purple Rain; Grand Anse Beach (far right)



swimming pools was destroyed, but the forward pool remains intact.

Strong currents and the depth ensure this is a dive for advanced divers only. Bruce recommended a negative entry followed by a quick decent. Fortunately, currents were mild, and it was an easy swim. The first sight of the *Bianca* was decidedly eerie. Descending into the blue, it only becomes visible around 25m, its silhouette emerging like an immense ghost. We headed for the stern, where a trio of great barracuda scattered at our approach. Even the stern's uppermost section was at 35m, so I was thankful for the nitrox.

Unfortunately, there was no



time to linger. Just swimming from the stern to the bow utilised a good chunk of bottom time. The biggest wreck I have ever dived,

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the scale was difficult to grasp. It is so big, it cannot be seen in its entirety; and in places, resembled a massive underwater plateau capped with sponges and corals. Photography proved a challenge and having a diver in the shot was necessary to show the immense scale. This was a dive that definitely warrants repeat visits.

Purple Rain. Our second dive was at another of Grenada's signature sites. Running parallel to the coastline, Purple Rain was not named after the late pop superstar, but for the profuse numbers of violet creole wrasse. Another beautiful reef, sponges in a plethora of sizes mingled with abundant fan and brain corals. Vase sponges proliferated in

hues of purple, pink and cream along with porous sea rods and those ever-so-pesky fire corals. Unlike other reefs impacted by coral bleaching, Grenada's reefs were healthy and thriving. It was difficult to know where to aim the camera.

Topside excursions
Grand Anse Beach. Back at the



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The Cathedral of the Immaculate Conception was built in St. George's in 1818.

St. George's harbor at dusk (above); Mega yachts in the harbor (right); Policeman directing traffic from an elevated box (far right)

resort, Peter had arranged for local photographer Arthur Daniel to take me out for some topside shooting. First stop was Grand Anse Beach, Grenada's most famous. Unlike on other islands where the best beaches are reserved for well-heeled vacationers, Grand Anse is open to tourists and locals alike. Even in late afternoon, the beach was thronged. Arthur's car, a sleek Toyota Altezza, quickly proved to be a local celebrity. Returning from the beach, we found a gaggle of school kids posing for selfies in front of it!

St. George's. We then headed for St. George's, the island's capitol. Founded by the French in 1650 and named Ville de Fort Royale,



the town was built to replace the original settlement of Port Louis, as it proved to be subjected to flooding and malaria. Ceded to the British by the Treaty of Paris in 1763, it was renamed Saint George's Town after Britain's patron saint. One of the Caribbean's most picturesque towns, it occupies a dynamic location encircling a horseshoe-shaped harbour surrounded by the slopes of an old

volcanic crater.

En route, we stopped at a lookout well off the tourist path. After a steep, uphill hike, we came across a lookout offering splendid views across the harbour to the town. Looking like a miniature San Francisco, a delightful jumble of architectural styles and pastel hues cascaded along the steep hillsides. Fortunately, there was nary a high-rise or mega resort in

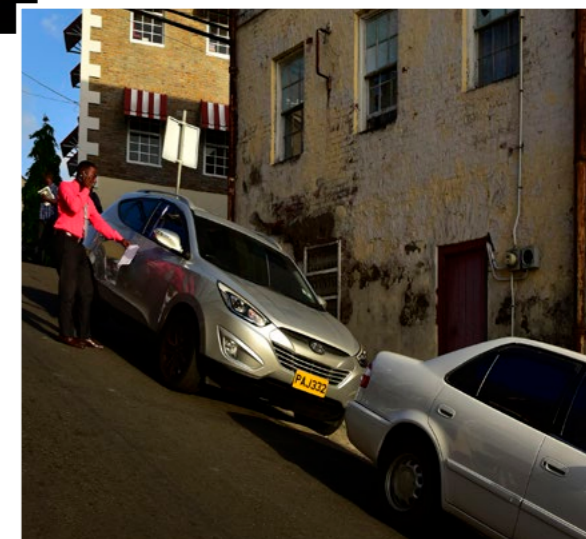


miraculously finding a parking spot, we set out to explore on foot. Some of the oldest buildings are churches, with the French built the St. George's Cathedral (1818) and the English St. George's Anglican Church (1825). At one intersection, a policeman directed traffic from an elevated box, like a human traffic light. The town was a photographic delight, with photo ops at every step.

However, what was appealing to the camera proved less so to the leg muscles. Ahead, the road plunged precipitously, with parked cars looking like they would topple over. "Please tell me we aren't

sight, although a six-star resort is under construction near Grand Anse Beach. Below in the harbour, mega yachts mingled with small fishing boats. One yacht had the tallest mast I have ever seen, towering above an adjacent cruise liner. Another was *The Maltese Falcon*, the world's most expensive sailing yacht, whose astronomical price tag exceeds the GNP of many countries.

We then headed around the bay towards the city centre. After



Steep incline in St. George's



Fort George (left); Sampling of cuisine from the Street Food Wednesday festival (lower left); Atlantic trumpet fish (below) at Black Forest (right)

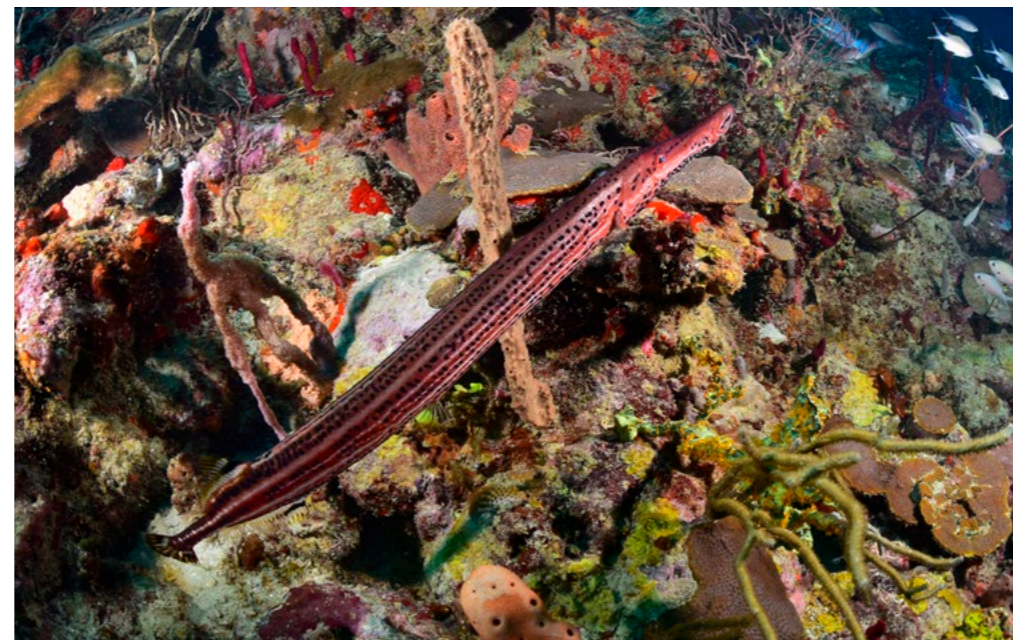
was intrigued by the local dishes, many of which were unfamiliar. Oil down, Grenada's national dish, is a one-pot meal of salted meat, chicken, dumplings, breadfruit, callaloo (made from young dasheen leaves) and other vegetables

remain clearly visible in the walls. Watching a glorious sunset as the city's lights twinkled to life, a siren wailed. "That's the 6:00 siren," explained Arthur. "Every day at both 6:00 a.m. and p.m., the fire department sets off the siren. It's been a tradition since I was a boy."

Street Food Wednesday. We made it back to True Blue in time for Street Food Wednesday, when local eating establishments set up to offer a selection of street foods from Grenada, the Caribbean and Mexico. Arthur knew each vendor and, after introductions, provided me with a full rundown on the dishes offered. With each offering up to a dozen dishes, that was upwards of 60 different choices. As a die-hard foodie, I was in culinary heaven!

After purchasing tickets in various denominations at the door, I could trade these for the food, which came in a variety of prices depending on whether they were meat, seafood or veg. We decided to share, so I could sample as many different items as possible. I

stewed in coconut milk, herbs and spices. With my brain over-saturated with choice, I presented Arthur a handful of tickets and asked him to choose.



Shortly afterwards, we feasted on a mouth-watering spread of oil down, mutton curry, pilau rice, macaroni pie, steamed fish, grilled chicken and lionfish. Accompanied with a Dockside Ale from the West Indies Brewing company, it



day, visiting a variety of sites from reefs to wrecks. Frequent squalls would come and go, with torrential rain quickly followed by blue skies. Due to the unsettled conditions, diving the Atlantic wrecks proved impossible, but there was no shortage of outstanding sites to explore.

Black Forest. Black Forest was another luxuriant reef, resplendent with deepwater sea fans and a variety of sponges including rope, pillar, vase, elephant ear and giant barrel sponges. Foureye butterflyfish, stoplight parrotfish, brown chromis and maddeningly shy barracudas were joined by a French angelfish and a huge green moray.

Spice Island Reef. Spice Island Reef featured a sandy area bordered by a reef of finger and brain corals. It was a hard-coral



Brain coral at Spice Island



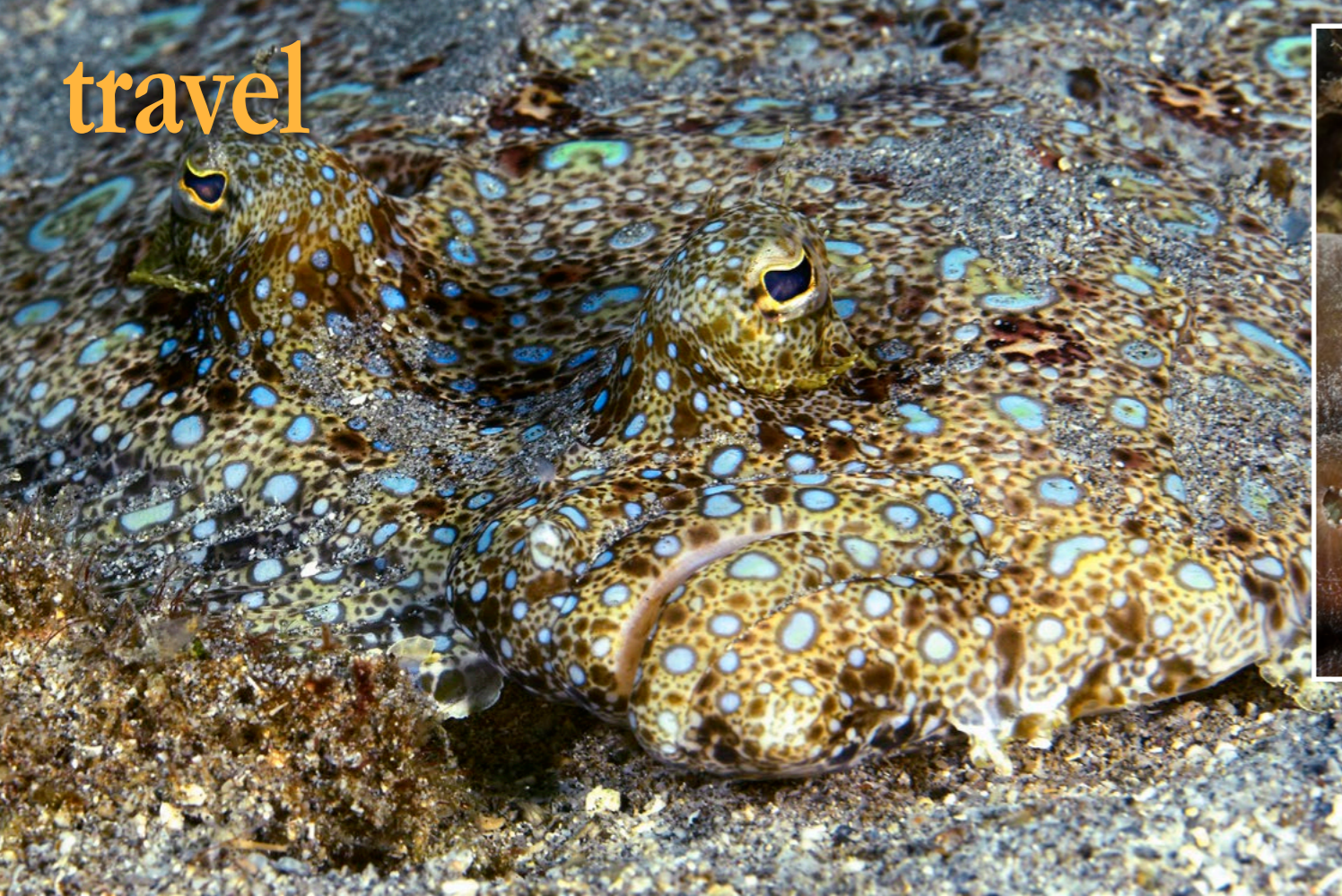
walking back up this hill," I said to Arthur with thinly veiled trepidation. Laughing, he assured me we would not. Instead, we took a circular route to end up at Fort George and then back to the car.

Fort George. Strategically positioned overlooking the harbour, Fort George has seen many events in the island's history, but a recent one stands out. It was here in 1983 that Prime Minister Maurice Bishop was executed, prompting the American-led invasion several days later. To this day, bullet holes

was an amazing meal. Remarkably, I had room left for some nutmeg ice cream. Barely...

More diving

The remainder of the week was spent doing two to three dives a



CLOCKWISE FROM LEFT: Peacock flounder; Yellow-nose goby; Great barracuda; Sailfin blenny; Brown garden eel; Pederson cleaner shrimp; Banded jawfish



Flamingo Bay. Fortunately, bad vis proved no hindrance to macro. First up was Flamingo Bay and it did not take long to find obliging subjects. Right away, we found a tiny blenny peering from a burrow, which I initially thought was a secretary blenny.

Exceedingly tolerant, it allowed frame-filling portraits with my macro lens. Checking a Caribbean fish guide later, I realised it was a sailfin blenny, a species I had never seen before. We found three more, along with Pederson cleaner shrimp, harlequin bass, flamingo tongue molluscs and banded jawfish.



Grenada Marine Park. After several days shooting wide-angle, I was eager to concentrate on the smaller picture. Located past St. George's, the Grenada Marine Park featured a pair of superb macro sites. Permits were required, which Peter handed out as we geared up. The reef's innermost section is also home to Grenada's Underwater Sculpture Park. Unfortunately, poor visibility meant we had to give it a miss.

reef, the small bommies providing an ideal habitat for juvenile fish as well as yellowtail snapper, blue chromis and numerous sea plumes.

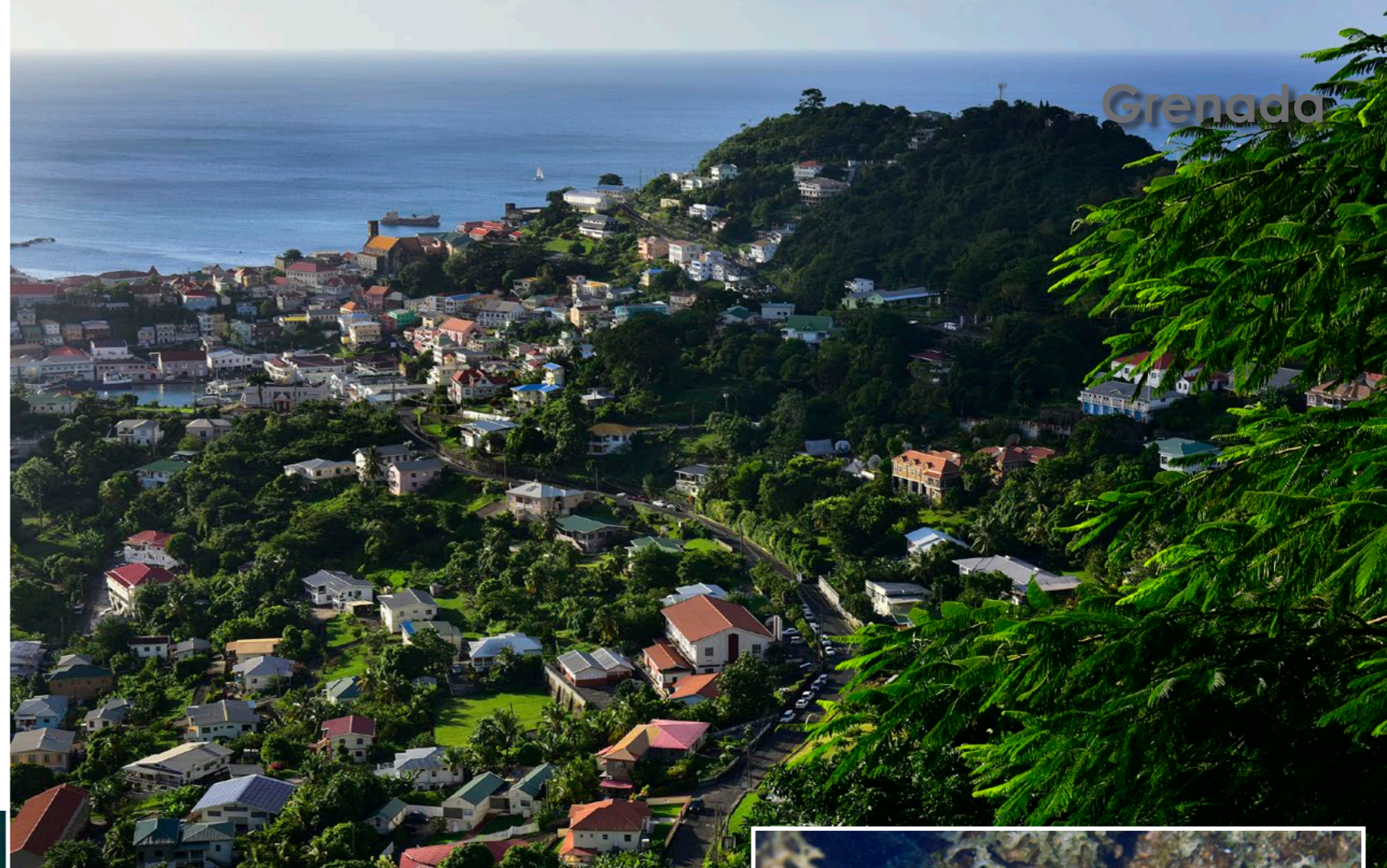
I then noticed a great barracuda, which appeared

more curious than normal; Bruce had to swat it away after it came a bit too close for comfort. In a classic case of Murphy's Law, this was the week's sole instance where I was within touch-

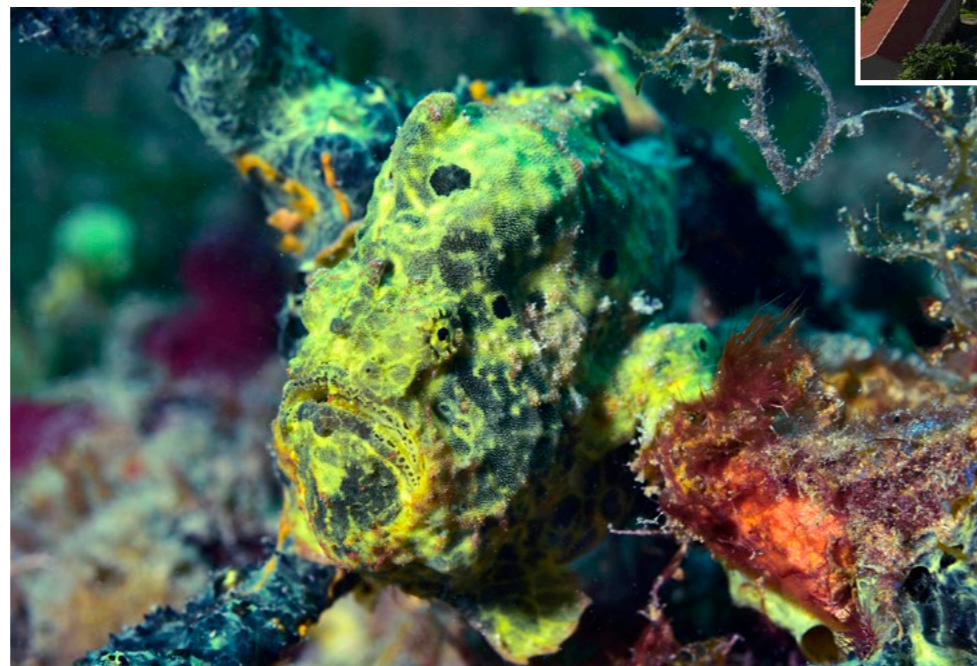
ing distance of a great barracuda and I had a macro lens on the camera! Large colo-

nies of brown garden eels thrived in the sandy areas and with a slow approach, I was able to get close enough for photos.

Molinere Reef. Descending from 6m to 28m, Molinere Reef proved to be equally photogenic. Interspersed with a succes-



Yellow-head jawfish with brood of eggs in its mouth at Molinere



sion of gullies and sand channels, hard and soft corals thrived along with a colourful medley of sea rods and sea plumes. Lying on her side near the wall's base, I could just discern the silhouette of the *Buccaneer*, a 12m steel schooner. Alas, I was so engrossed with macro photogra-

phy, I did not quite make it. With the daily tally of burns and contusions on my legs multiplying, I was really attempting to be more careful. Spotting a yellowhead jawfish, I analysed my surroundings before settling on a sandy patch. Suddenly, my knee felt a familiar burn. Winc-

View over St. George's (above) from Fort Frederick (top left); French grunt (right) and longlure frogfish (left) at Molinere

ing, I promptly found the culprit; a mere sprig of fire coral protruding from the bottom. Naturally, I had to brush against the only specimen in the immediate vicinity!

Observing the jawfish, the irritation was promptly forgotten. Although I missed a shot of him out of his hole, I discovered something even better. His mouth was chock full of eggs! Moments later, Bruce yielded another surprise: a longlure frogfish. It was the first one I have ever encountered that was green. Back on the boat, Bruce said it had been six months since a frogfish had even been seen.

Return visits

A return visit to the *Bianca C* saw Peter as my dive buddy and we

descended the stern to 41m, where clusters of black coral could be found. Swimming to the bow, we headed for the swim-through beneath the upper deck, where I came uncomfortably close to decompression limits. Another visit to Shark Reef revealed a trio of southern stingrays along with hawksbill sea turtles, barracudas, spotted drum and a half-dozen lobsters.

More topside activities

Fort Frederick. On another afternoon, Arthur took me out again for some land photography. Our first stop was Fort Frederick, the



best-preserved of St. George's trio of forts. Occupying a commanding position atop Richmond Hill, it was constructed by the French in 1779. Commandeered by the British, it was ironically used in defence against the French, although a cannon was never fired in anger.

Chocolate Museum. Back in St. George's, we stopped in at the Chocolate Museum. The equiva-



MV *Shakem* wreck site (above); Fireworm on *Shakem* (right); Chocolate Museum in St. George's (left)

beckoned, from chocolate bars and raw cacao nibs to chocolate chili sauce, nutmeg and ginger BBQ sauce, flavoured coffee and spice packets of nutmeg, mace and cinnamon. My instincts were proven correct, as I departed with a few bags of goodies. After all, how could one refuse Forbidden Chocolate flavoured coffee?

Heading back to the car, Arthur wanted to show me some scenic viewpoints, this time facing towards Fort George. We finished up at another outstanding sunset location just in time for the 6:00 siren. The light was exquisite!

MV *Shakem*

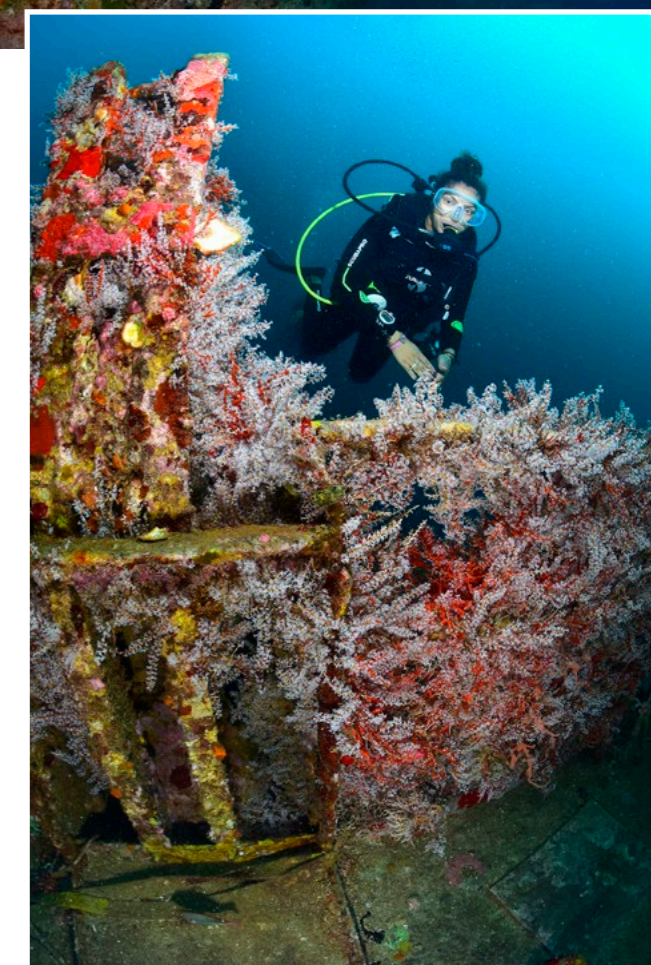
With another wreck, MV *Shakem*, on the agenda, Peter had arranged for former Aquanauts employee, Grenadian-born Tatiana

Costantini, to join us. She was an experienced model, who has worked with many other photographers.

A 55m freighter, the *Shakem* capsized in May 2001 after its cargo of cement shifted during a storm. Virtually intact and resting upright at 32m, the decks are situated at around 25m. A dense mantle of marine life has since enveloped the vessel, including spectacular swathes of white Telesto soft coral. Massive bags of cement remain strewn across the open cargo hold, while deck machinery and a crane

played host to an abundance of fish, including French grunts and sergeant majors. Tatiana proved to be a superb model, instinctively posing in all the best spots. Shots of her looking down the ladder and peering from behind the Telesto were quick favourites.

Back in the room, I had unexpected company.



Diver on *Shakem* wreck site

lent of the mothership calling me home, I knew my wallet would not make it out unscathed. Arthur had designed the museum's interior and I was impressed. The displays

were informative and attractively presented, lots of interesting info about the island's chocolate production. And then came the gift shop. A cornucopia of products



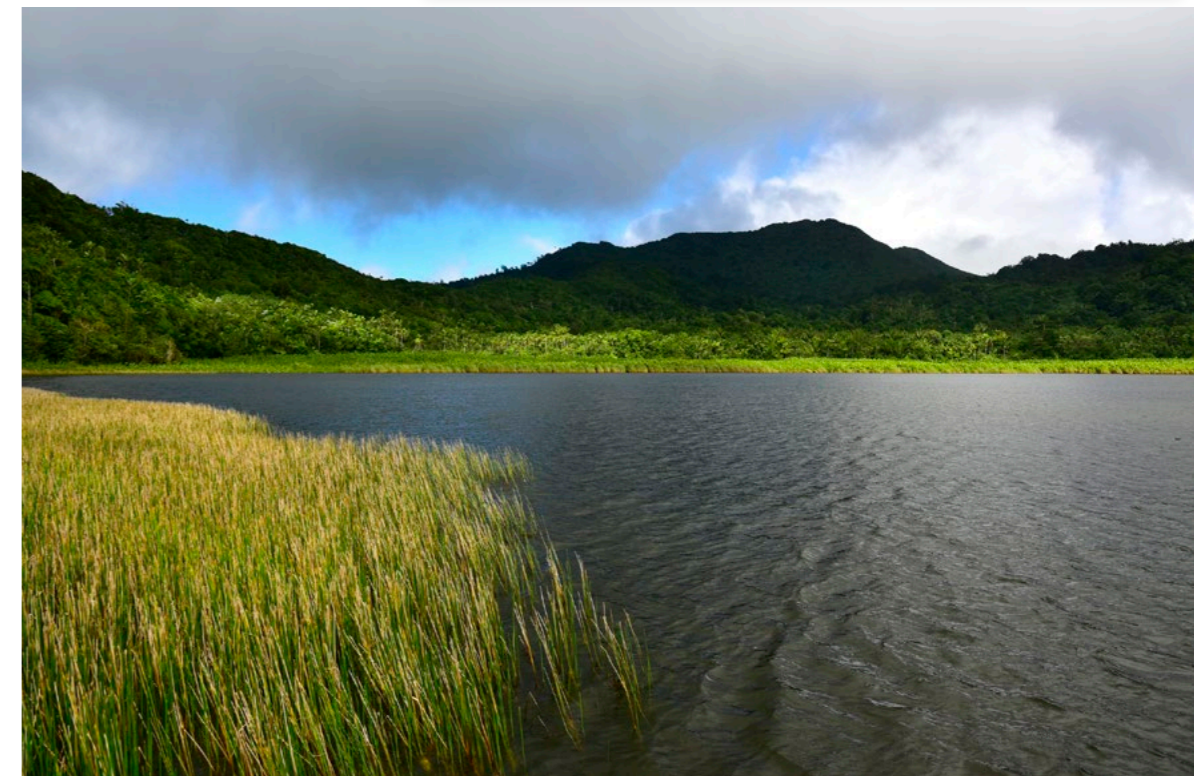
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Love the Water

Mona monkey (above) in Grand Etang National Park (left); Grand Etang Lake (right); Curious lizard (lower left)



der before scurrying up a nearby tree!

River Antoine Rum Distillery. For the remainder of the tour, I got to visit two of the island's mainstays: rum and chocolate. It is

remarkable that an island of just over 110,000 people has five rum distilleries and River Antoine is the island's oldest, dating back to 1785. Although rum tasting was closed, we were able to freely wander around observing the

"Excuse me, can you remove this lizard from the top of my head?"

Land excursion

With diving (sadly) finished for the trip, Peter had arranged for Buggy to take me for a land excursion on my final day. I quickly discovered the island's compact size of 306 sq km has absolutely no bearing on how long it takes to get anywhere. Grenada is one of the hilliest places I have ever seen.

Not far from True Blue Bay, Buggy pointed out Calivigny, the world's most expensive private island resort. The entire 10-suite island can be yours for a mere US\$120,000 a night (then again, it does sleep 50 people). Passing the turnoff to St. George's, we headed up the island's rugged spine. "Everyone has a view on Grenada," enthused Buggy, and he wasn't kidding. It seemed every house had

a million-dollar view. I realised the island's longest stretch of straight road was from the roundabout to the True Blue Resort.

Grand Etang National Park. After a brief stop at Annandale Falls, the road rapidly gained elevation, with lush rainforest enveloping the landscape. Ascending to 582m, we entered the Grand Etang National Park. A 1,000ha swathe of mountainous forest, the name translates as "large lake" in French, referring to the 12ha crater lake within the park boundaries.

Prior to the Grand Etang Lake turnoff, Buggy mentioned there was usually a fellow with a Mona monkey posing for photos. I normally avoid such touristy things, but I really did want a monkey photo. Found in West Africa, they were likely introduced during the

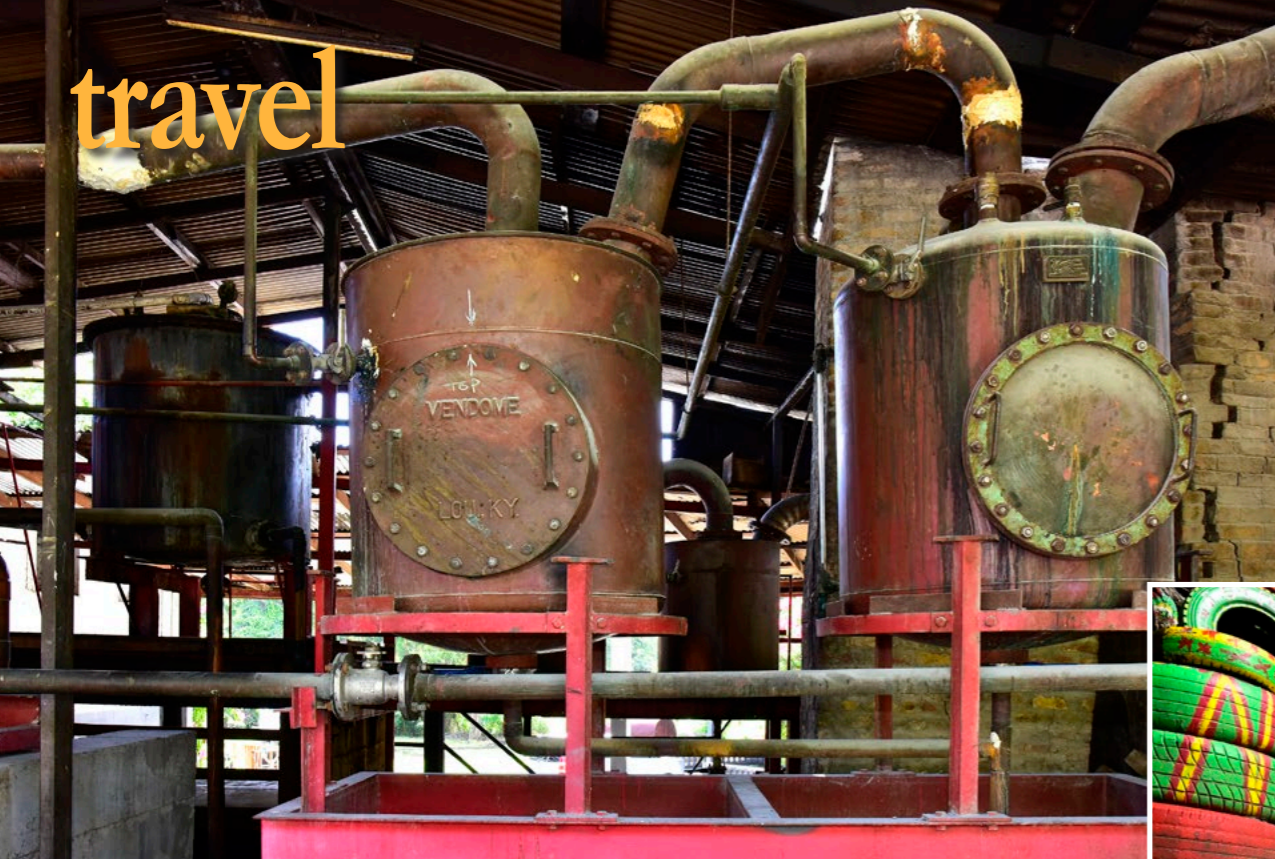
years of the slave trade. Sadly, being a Sunday with no cruise ships in port, he was not there. Instead, we headed to the crater lake for a photo stop.

Heading back to the main road, a van blocked our way, with a group of tourists standing alongside it. Suddenly, I glimpsed a tail. Mona monkeys! Even better, these were wild. Well, not entirely wild, as one was perched atop a lady's shoulder eating a banana. At the best of times, monkeys are not my favourite creatures, especially those used to people. Amazingly, these were different. Colourfully patterned with round furry faces, they were very gentle. Banana finished, it then jumped from the lady to me, clambering down me like a lad-



While reaching into my toiletry bag, a tiny lizard jumped on to the rim. Naturally, I ran for my camera. After snapping a few images, I tried coaxing him onto my hand, so I could take him outside. Instead he jumped onto the side of my head! Not wanting to hurt it, I headed outside where I intercepted a passing staff member.





River Antoine Rum Distillery (above); Jouvet chocolate (top center); Charlie's Bar wall of tires (right)

almost). At 70 percent, Rivers Rum is so potent, it is not allowed out of the country!

Diamond Chocolate Factory. At the Diamond Chocolate Factory, makers of Jouvet chocolate, I had a plantation tour during which I was able to see the ripe cacao pods growing. Although the factory was closed, the gift shop beckoned. The nutmeg and ginger varieties were especially delicious. And yes, I bought more chocolate.

Charlie's Bar Wall of Tires. The drive back revealed scenic coastal views and one quirky man-made one. Outside of St. George's, Charlie's Bar had constructed an enormous wall of tires, all painted in Grenada's national colours of red, green and yellow. Originally made to entice customers, it is now an attraction in its own right, with many tires inscribed with facts about the country.

Christmas market. Back at the resort,

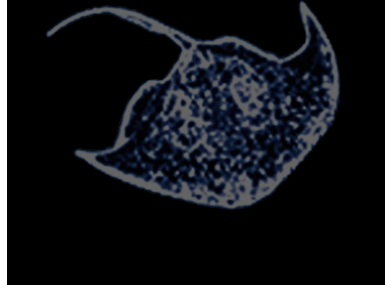
I made it just in time for the annual Christmas market, with vendors selling a wide variety of crafts and products. A great finish to a great day (but no more chocolate).

Final thoughts
My trip at an end, I was equally sad and happy. Sad to be leaving, but happy for the privilege of visiting such an extraordinary place. Even in a week, there simply was not enough time to experience everything on offer. Along with the outstanding diving, the myriad of topside attractions makes the island an ideal destination for those travelling with non-divers. Having missed out on the Underwater Sculpture Park and the Atlantic wrecks, I knew a return visit was in order. I could see why many of the guests at True Blue are repeat visitors; I intend to be one myself! ■



Duquesne Bay (above); Scenes from the Christmas market at the resort (top right and far left)

fact file



Grenada



SOURCE: CIA.GOV WORLD FACTBOOK, CDC.GOV, XE.COM, STATE.TRAVEL.GOV

History Carib Indians first inhabited Grenada when Columbus “discovered” the island in 1498, but it remained uncolonized by Europeans for more than a century. The first attempt to do so was by the British in 1609, but they were routed out by the native population. In 1650, Frenchmen tricked the local chiefs into selling them a portion of the Island for next to nothing, and over the next year, constant skirmishes had decimated the Caribs. Over the next 90 years, the British and French fought constantly for ultimate possession of the island, and today, there are still several forts dotting the landscape. At that time, sugar and tobacco were Grenada’s main exports, but cocoa, coffee and cotton crops were soon being cultivated as well. In 1783, the island was ceded to Britain, which began bringing huge numbers of African slaves to extend their sugarcane production. The plantation system reigned until the emancipation in 1834. A few years later, nutmeg was introduced to the island—a commodity nearly as precious as gold at the time due to its healing, preservative and flavoring qualities. The local soil proved so perfect for the spice that Grenada is now the world’s second largest nutmeg producer. The island gained independence from Britain in 1974, but only five years later was taken over by a communist group, which had financial and political ties with Cuba and the Soviet Union. The United States, Jamaica and several Eastern Caribbean states jointly responded with the now famous “rescue mission” and restored order. In 1984, a general election was

held, reestablishing a democratic government and ensuring free elections for the future. Capital: St. George

Geography

Grenada is located a few hundred miles north of Venezuela, where the Caribbean Sea meets the Atlantic Ocean. The terrain is dominated by lush mountains densely covered in every conceivable variety of spices and fruit trees, including nutmeg, cinnamon, cocoa, starfruit, orange, banana, breadfruit, mango, guava, clove, mango, cashew, almond, avocado, grapefruit, palm and bay trees. Coastline: 121km of white sandy beaches and small volcanic cliffs. Lowest point: Sea level. Highest point: Mt. Saint Catherine, 840m (2,520ft).

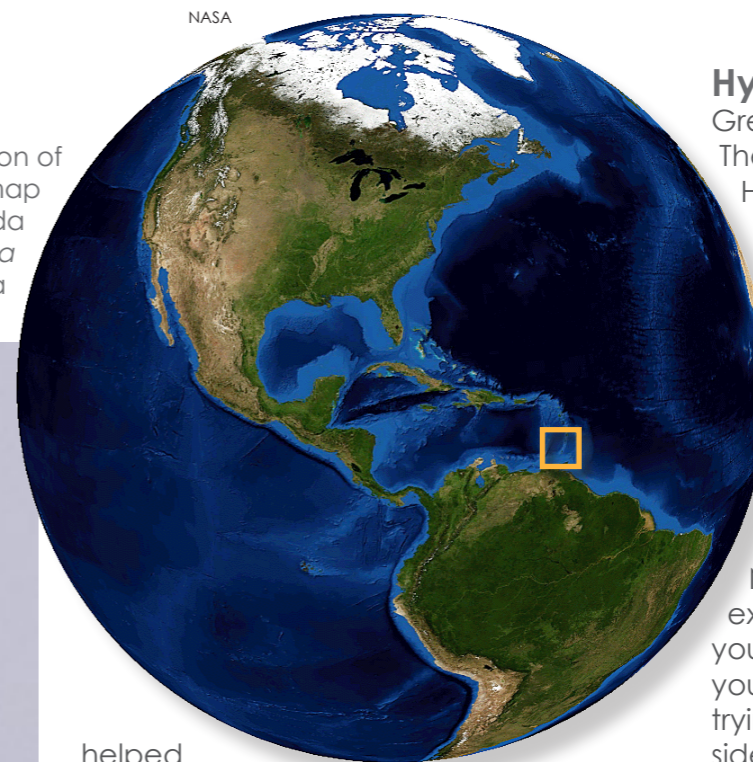
Climate Of course, Grenada has a tropical climate with an average temperature in the low 80s F (around 27°C). The dry season runs from January to May, and the rainy season from June to Dec. Natural hazards include hurricanes. Although Grenada lies on the edge of the hurricane belt and they occur less frequently here than on other Northern Caribbean islands, they do happen—witness Ivan in 2004 and Emily in 2005. The season lasts from June to November.

Environmental issues All of Grenada’s power comes from diesel burning generators, and currently, there is no recycling program in place. Hurricane Ivan wiped out 83% of all agricultural crops, and the soil is still recovering. The nation is party to several international agreements: Biodiversity, Climate Change, Climate Change-Kyoto Protocol, Desertification, Endangered Species, Law of the Sea, Ozone Layer Protection and Whaling.

Economy Grenada relies on tourism as its main source of income, followed by agricultural products—namely nutmeg, cocoa and other spices. Hurricane Ivan caused massive economic problems and, while the island is recovering, the country is saddled with large debts from its rebuilding efforts. Tourism growth has



RIGHT: Location of Grenada on global map
BELOW: Map of Grenada
BOTTOM RIGHT: Diver on Bianca wreck off Grenada



helped Grenada make a comeback, but the world’s economic problems over the last two years have stagnated that industry as well, making current growth difficult at best. Currently, the unemployment rate is at 12.5% with 32% of its citizens struggling below the poverty line. One of the biggest challenges facing the agricultural economy is the strikingly few young adults working in that sector—90% of all farmers are over 55 years of age, and the number of young farmers has done nothing but decline over the last decade. Tourism, it seems, is Grenada’s biggest hope for the future.

Currency East Caribbean Dollar (ECD). This currency is pegged to the US dollar. USD1.00 = ECD2.70

Population 107,818 (July, 2010)
Ethnic groups: black 82%, mixed black and European 13%, European and East Indian 5%, and traces of Arawak/Carib Amerindian. Religions: Roman Catholic 53%, Anglican 13.8%, Protestant sects 33.2%. Internet Users: 24,000 as of 2008.

Language English is the official language, but some locals also speak French patois (French mixed with local slang, abbreviations and accented colloquialisms). The literacy rate is 96%.

Hyperbaric Chamber

Grenada does not have a chamber. The closest facility is Roxborough Hyperbolic Facility, TLH Building, Milford Road, Scarborough, Tabago. Phone: 868-709-5655

Transportation

TO RENT OR NOT TO RENT? Unless you are from the United Kingdom or a Commonwealth nation and you are comfortable driving on the left side of the road, I strongly recommend that you DO NOT rent a car here. Just bring some extra cash and hire taxis. Chances are you will spend less money this way, and you will save yourself the headache of trying to learn how to drive on the other side of the road, while simultaneously trying to figure out Grenada’s confused, hurried and seemingly lawless traffic system. If you choose to rent a vehicle, e-mail me and tell me if you survived.

Websites

Grenada tourism
www.grenadagrenadines.com
Grenada hotel and tourism association:
www.gogrenada.gd ■

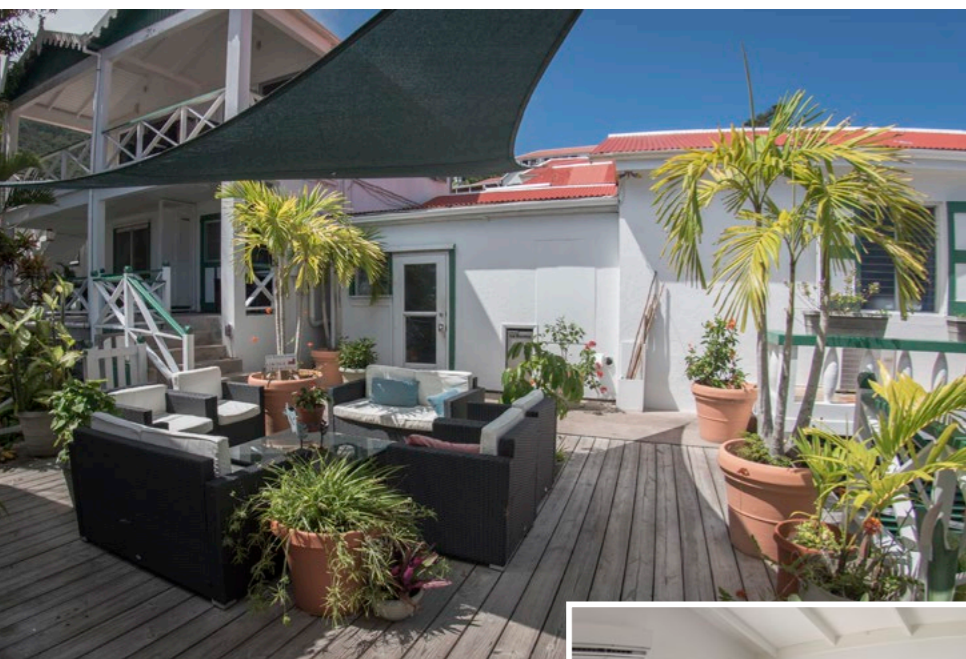




Saba

— *Pristine Gem in the Caribbean*

Text and photos by Brandi Mueller



I loved Saba before I arrived. Throughout my dive travels, I had occasionally heard about this mythical island of which not many knew. Tales of a small dormant volcanic island with healthy reefs, hiking trails crisscrossing its eight square kilometers, and excellent food. Those who had been there raved about the “Unspoiled Queen,” the name islanders and visitors had given the island, and it was added to my bucket list with a few stars next to it.

Being in the general vicinity of Saba and having a little free time, I decided to finally make my way to this island, which has lingered in my diving dreams. Officially a special municipality of the Netherlands, Saba is part of the Leeward Islands and Lesser Antilles with St. Maarten to the north, St. Barthelemy to

the northeast, with St. Eustatius and St. Kitts to the southeast.

A week prior to my trip, I received a fantastic email from Sea Saba—the operation with which I would be diving—that had all the details I needed (and some I had not considered) to prepare for my trip. It included packing suggestions (with a YouTube packing video link included), underwater photography tips, current water temperature, location tips including currency (US\$), internet access (expect it to be slow), and airline weight rules (see packing video to reduce your luggage weight). I clicked over to the website and was blown away with the amount of information on it; it is probably the most thorough dive operation website I have ever seen.

Juliana’s Hotel

After arriving in Saba, I was taken to Juliana's Hotel in Windwardside, the small village where most of the visitor accommodations and restaurants are. After being shown to my room, the first thing I loved there was the fact that there are no keys at Juliana's. Each room has a keypad on the door, so there is no need to carry around (and often in my case, lose) keys. My room was very nice and clean, had everything one might



need, including a mini refrigerator and coffee-maker, but the best part was the balcony with a view. I spent my free time sitting outside enjoying the sunshine and cool breeze while admiring the ocean view. I could have spent hours out there relaxing and reading, but there was exploring and diving to be done.

After a full day of travel, I arrived quite late at the hotel. My first stop was to check in at Sea Saba, which was just a short walk from the hotel, to confirm my diving plans for the next morning and then I headed back to Tropics Café (the

View of The Bottom, the capital city of Saba (top); Lounge at Juliana's Hotel (above); One of the bedrooms at Juliana's Hotel (right); A pathway through Windwardside on Saba Island (far right); PREVIOUS PAGE: Diver with school of creole wrasse at Third Encounter dive site



View of Diamond Rock (above) and flowers (left) on Sandy Cruz hiking trail

Getting around

I woke up my first morning in Saba and set up my camera, while enjoying a coffee in my room. It took longer than normal though, because I could not help being drawn to the ocean view out my sliding glass doors where I was about to be diving.

Making my way to breakfast at Tropics Café, I enjoyed homemade granola and yogurt with fruit and honey while anticipating my upcoming dives. I also had my eye on the Saba Spice-drenched French toast on the menu. Saba Spice is a rum-like liquor made with locally grown spices.

At 8:45 a.m., a mini-bus taxi arrived to pick up me and two other guests staying at Juliana's. As we headed out of town to the harbor, we stopped at the Sea Saba shop, where owner Lynn greeted us and checked to make sure

everyone was doing okay, asking if we needed dinner reservations made or anything else. I was pretty impressed with the service already. This would occur every morning on the way to diving and on the way back, and they were happy to help with spa reservations, restaurant recommendations and any other needs we had.

The journey from Windwardside, through The Bottom, and to the harbor takes 10 to 15 minutes. There is only one road on Saba, known as "The Road" which has an interesting history of its own. The extreme terrain of Saba—think jagged cliffs, no flat patches, rainforest and rocky landscape—made it difficult to develop the island. This also led to it being a favorite hideaway for pirates who would escape into the jungle where no one wanted to pursue them.

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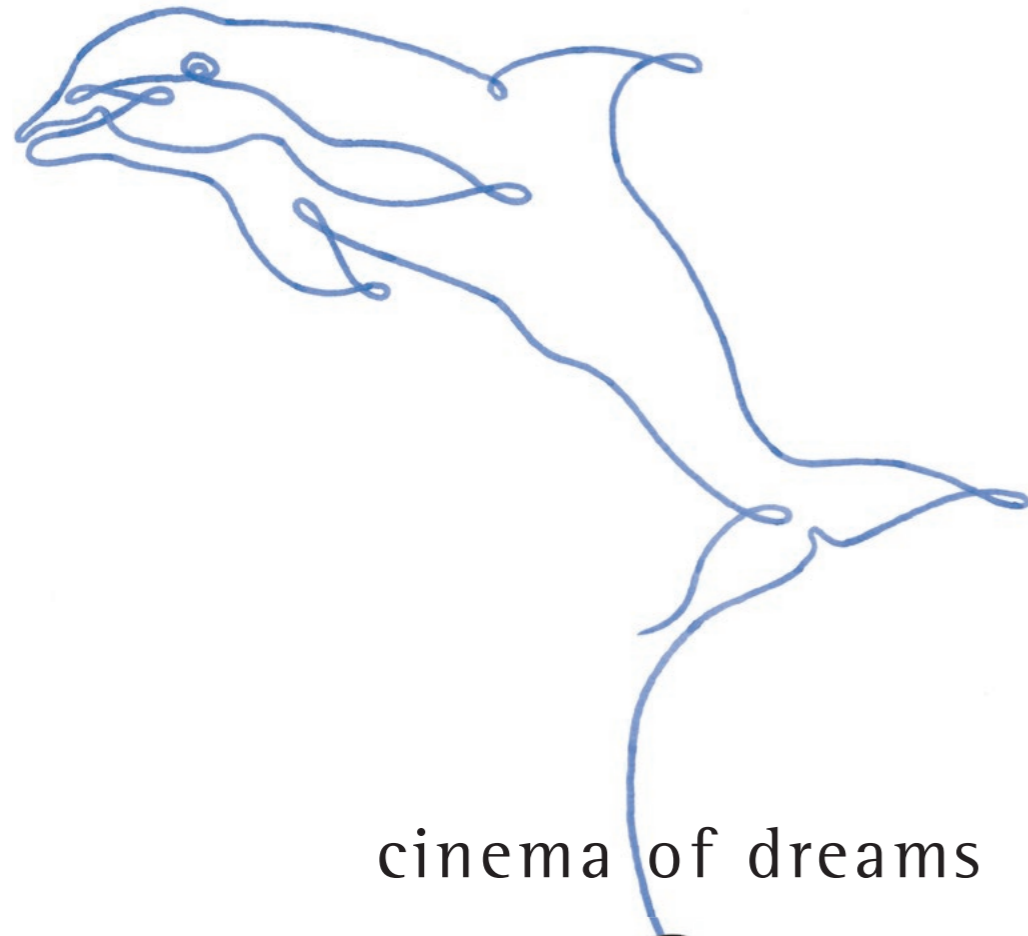
- Goran Ehlme Underwater photographer and head of Waterproof R&D

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Saba

View of Saba Island (above) from Sea Saba's dive boat (right)

the early 1900s claimed a road just could not be built, but a Saban resident, Josephus Lambert Hassell, took a correspondence course in civil engineering and started building the road in 1938. It took until 1958 before it was completed, and driving on the winding, cliff-edge, twisting-and-turning road is an adventure in itself, and provides gorgeous views, which we happily photographed with our smartphones each morning and afternoon, as we made our way to the dive boat.

Our kind and helpful taxi driver, Peddy, not only got us to and from the dive boat each morning, he also would slow down to let us take photos whenever he noticed one of us trying to capture the view on our various forms of photography gear. I believe he told me he was seventh-generation Saban, which is

pretty cool, and he was a wealth of Saban history if you asked.

Arriving at the harbor, we made our way to Sea Saba's boat; they have two 12m (40ft) vessels—the *Sea Dragon* and the *Giant Stride*—both customized for scuba diving with tank racks, plenty of storage space, a swim platform right at water level for easy entry and exit into the water. My favorite aspect of the dive boat was that they provided individual cooler bags for cameras, already filled with fresh water to help protect delicate camera gear.



Dive sites

Customs House. Our first dive was at a site called Customs House in Ladder Bay, which is just below 800 stairs cut into the side of the cliff where supplies were once carried from ships up to the Customs House, which is still there. It was often women who carried goods up these stairs because the men





Three juvenile spotted drums at Mon O'War (above); Lettuce leaf slug (left)

at one point. Today, it is popular to traverse these steps down to the beach (and back up again).

Glad to not be accessing this dive site via 800 stairs, I took a giant stride (off the *MV Giant Stride*) into my first dive at Saba. Underwater, the conditions were perfect. No current, the water was around 27°C (80°F), and there was marine life everywhere. Right below the boat was black sand—all of Saba's dive sites have dark, volcanic sand. Swimming away from the boat, we came upon a huge coral garden loaded with life. Sea fans and sponges colored the area as fish swam around. A small hawksbill turtle emerged seemingly out of nowhere and came to swim among us for a while, and a

few reef sharks made themselves known as well.

Man O'War. Going a bit farther around the island, our second dive was at Man O'War. Before each dive, a detailed brief was given, along with a map of the site and a "Fish of the Dive." The guides told us they had been seeing a lot of juvenile spotted drums, so that was our fish to find. Although this fish is one of my favorites, I was using a wide-angle lens, so I was not trying too hard to spot them.

However, halfway through the dive, our guide gave me the signal for spotted drum (picture someone pretending to play the drums), and then he showed me

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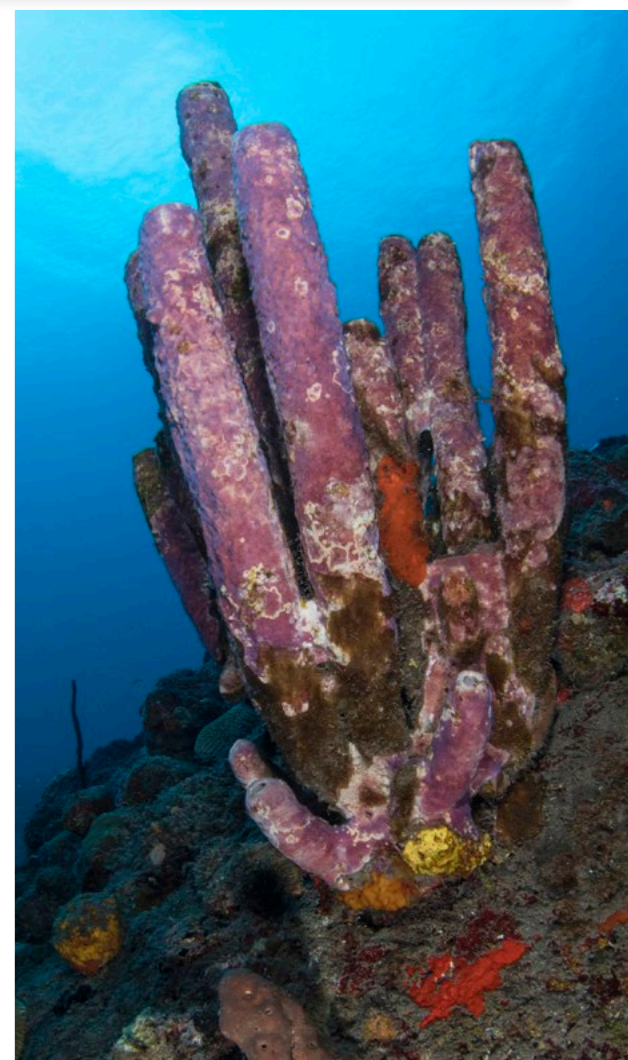
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Hawksbill sea turtle on reef

three fingers. I had to go over and look, and there they were: three perfect baby spotted drums, with their tiny dime-sized bodies and extended black and white dorsal

fins. Even though they were too small for my lens, I could not swim away without at least snapping some proof. Back in my room, I was surprised to have gotten a



Aplysina archei tube sponge on reef

few shots where all three were in focus.

Babylon. On day two of diving, we visited a site called Baby-



Diver in canyon-like formation (above) and hawksbill sea turtle (right) at Diamond Rock (far right), with Saba behind

lon, so named for overhanging volcanic rock formations that give the illusion of swimming under the Hanging Gardens of Babylon. Saba itself is entirely volcano-formed, and so is much of the underwater terrain. Rocky formations make the dive sites interesting, with canyon-like swim-throughs, mini walls and deep-water pinnacles.

Diamond Rock. Our second dive was at the famous Diamond Rock, which is a lava-formed pinnacle that emerges from the seafloor around 33m (110ft) and out of the water. A popular resting place for birds, their presence has coated the rock with a white substance, making it look diamond-like from a distance. I saw Diamond Rock from the airplane when I flew in,

so it was exciting to dive it.

Moored a little way off the rock, we swam underwater towards the structure. The sandy seafloor was patrolled by stingrays. Upon reaching the pinnacle, we started circling it at the deepest point, moving shallower with each subsequent rotation. I had a moment in this dive when I was trying to photograph a school of goatfish when I saw a turtle swimming close on the other side of me. Bringing my gaze back to the fish school, there was now a



reef shark in-between the turtle and the fish, and I saw a large grouper too. There was too much amazing marine life that I did not know where to point my camera (see: #SabaProblems).

We went out for a night dive, leaving the harbor just as the



sun was beginning to set. We watched the sky turn orange and pink, and the island itself turn blood orange in the sunset. I was happy I went just to see that. Underwater did not disap-

point either. The cryptic teardrop crabs were out in full force. After about ten minutes, I had taken so many photos of them I had to start ignoring them. I also found a flamingo tongue feeding on

what looked like the spawn of a sponge. I spent almost 20 minutes watching this mollusk slowly eat its dinner. There were also sleeping parrotfish and bearded fireworms; and while I had my nose glued to



Bearded fireworm (above) and flamingo tongue (left) feeding on a sponge on a night dive at Diamond Rock

these pinnacles, with its shallowest point at 25m (85ft). Descending onto these seamounts is really neat because you descend into the open blue without being able to see the bottom until around 30m (65ft). We continued down and down, until we could make out the pinnacle's shadow with fish flitting about.

Sometimes, people argue that there is no fish this deep and not much color, but the seamounts of Saba defy that idea. Coral and sponges carpeted the rock pinnacle and flashlights (or in my case, strobe lights) lit up the deep hues of ginger-orange and deep violet. Eels peeked out from crevasses in the rock, small fish found homes in the serrated rock, and bigger fish swarmed the pinnacle. The only downside



of this dive was that our no-decompression time was too short.

Queen's Gardens Resort
Midway through my week on

Saba, I moved to Queen's Gardens Resort and Spa located in The Bottom, which is the capital and largest village of Saba. This lovely property sits hillside with a



Gray snapper at Diamond Rock (above); Parrotfish feeds on reef, with boxfish (left); Healthy reeflife, even at deep-water seamounts like Twilight Zone (top right)

the flamingo tongue, other divers saw several sharks cruise by.

Twilight Zone. Saba diving is known for its submerged volcanic seamounts, and on day three, we went to Twilight Zone—one of





THIS PAGE: Scenes from Queen's Gardens Resort & Spa. Outdoor dining at the resort (above); The view from the "Birds Nest" table (right); Delicious eggs Benedict (far right) and the Flaming Wheel of Parmesan pasta dish (left) are served at the resort's restaurant; Saffron artisanal gin cocktail (lower right) made by famous mixologist Duco, at the lounge bar.

spectacular view of red-roofed, white houses that are nestled within the green valley and ocean beyond. The luxury boutique resort consists of 12 one-floor suites, many with semi-outdoor plunge pools with views of the mountains, valley and ocean.

While checking out the property before dinner, I found myself in their lounge bar, which also had a glorious view of the valley and ocean. Sitting down, I noticed a gin menu. Gin is my post-dive-in-moderation cocktail of choice, and I soon found myself talking



Airy and elegant bedroom at Queen's Gardens Resort & Spa



with Duco—Queen's resident artisanal gin creator. While telling me about the 50-some choices of gin available at the small bar on this tiny island in the Caribbean,

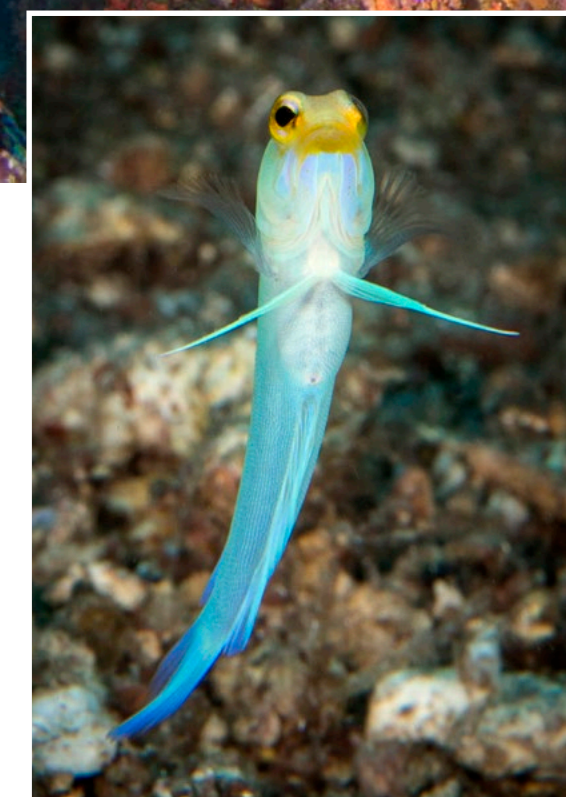
he put together a spicy chili pepper and basil gin and tonic for me. As if I was not already in love with the island.

After also sampling a lavender gin and tonic, which included an ice cube of infused lavender water, I finally made my way to dinner in the lush garden setting at the center of the resort. I enjoyed all my meals outdoors, which seemed to always be the perfect temperature with a slight breeze blowing, but meals were also available indoors at the elegantly decorated restaurant in case of rain.

The menu changed daily with only a few offerings each night,



but with choices like local lionfish and lamb couscous, I pretty much wanted to try them all and stay for several weeks. The restaurant is known for its "flaming wheel of parmesan" pasta parmigiano, which is prepared tableside and includes putting just-cooked pasta into a 72lb wheel of parmesan cheese. I can confirm it was amazing.



Reef scene at Third Encounter (above); Divers at the seamount known as The Needle (right); Yellow-headed jawfish (left)

be reserved several days or even weeks in advance.

I am not usually one who sleeps well my first night in a new place, but I woke up my first morning at Queen's feeling like I was at home (after realizing where I was, I thought it was even better than home). Soft light and a gentle breeze filtered through the open windows, and I made a Nescafe in my room. I could not remember the last time I felt so relaxed as I sat on my couch overlooking the valley (through sliding glass doors that opened to let in the ocean air).

I slowly made my way to breakfast and enjoyed a lovely eggs Benedict, listening to the sounds of the forest waking up around me. Soon, it was time to be picked up to go diving. I was now closer to the harbor, so Peddy just picked

me up as they passed through The Bottom and took me down to the boat with everyone else.

More dive sites

Third Encounter / The Needle. This was an exciting day because we were diving Saba's most famous dive site, Third Encounter (or The Needle). This site is actually two seamounts next to each other, with one being the narrower (needle-like) of the two. We descended into the deep and first came to the larger of the two, but immediately headed to the needle. After a three-minute swim in open blue, we could just make out the shadow of the needle.

We were greeted by a massive school of creole wrasse, which tried to seek shelter around us from a giant trevally that was

actively hunting them. As it would charge in like lightning, the school would move in unison so quickly we could hear the whoosh sound the school made when moving out of the trevally's striking range. With the shallowest point being 27m (90ft), we only had a few minutes before having to leave the action. The larger seamount was at 24m (80ft), so we had a few more minutes to explore before having to return to the surface.

Hot Springs. Our second dive of the morning was at Hot Springs, which reminds one that while Mount Scenery has not erupted in almost 400 years, there is still volcanic activity occurring below. In certain areas, divers can bury their hands in the sand and feel



Grouper photo-bombs shark; the fishlife in Saba is so great that even when photographing a nurse shark, other fish show up in the photos!



Saba

Basketstar on sponge (left); Coney grouper in barrel sponge (above); Peppermint goby (top right); French angelfish on reef (below)



Cryptic teardrop crab on night dive (right); Secretary blenny (left)



the warmth, and some rocks are hot as well.

Dive operation

Sea Saba is a PADI 5-Star Dive Resort and SSI training facility and their dedication to conservation is a great example of what every dive operation should be. I was impressed by the knowledge of all of their staff, from guides to boat captains to those who worked in the office; they are an amazing source of knowledge of all things Saba, ocean and conservation. I found out later Sea Saba is a Reef Field Station, and the staff is trained to at least Level 3 and can help do field surveys; they help with a coral nursery and participate in other research.



Dining

Juliana's Hotel and Queen's Gardens both have excellent onsite dining options, but Saba's dining culture is set up to make it easy to explore the island's food options. Currently, there are around 13 options, many within walking distance in Windwardside (and from Juliana's) or a short taxi ride between Windwardside and The Bottom.

Overall, I was very impressed with everywhere I ate. Food was local and fresh; there were options for everyone, including vegetarian and vegan; and always,



Diver photographing a friendly green sea turtle



Saba

Rugged, rocky coast of Saba Island (above); View of Diamond Rock from Sandy Cruz trail (top right)

the menus were exciting with a certain Saba flare.

On more than one evening, I found myself at the Brigadoon, which was a lovely open-air fine dining restaurant that seemed to be everyone's favorite. It also hosts Sea Saba's Monday evening presentations, where you can enjoy a cocktail and learn about the history of Saba, its conservation projects, some fun fish facts and a lot more. After listening to the presentation, I stayed for an amazing teriyaki mahi-mahi and chocolate mousse, which was to die for. Later in the week at a fantastic dinner with Sea Saba owners John and Lynn, I also had the fish (which is often locally-caught lionfish) in a white wine sauce, which was brilliant.

Both Windwardside and The Bottom have several surprisingly

well-stocked grocery stores. There are many cottages one can rent on Saba, with kitchens, and the grocery stores have anything anyone would need to cook meals on their own or to re-supply a sailboat before continuing to the next island.

Beyond diving

Saba's diving was some of the best I have seen in the Caribbean, but Saba is not just about diving. There are great hiking trails for all levels of hikers from easy or moderate walks to the steep climb to Mount Scenery, with over 1,000 steps straight up. I settled on the mostly flat Sandy Cruz trail one afternoon after diving. It is not recommended to partake in strenuous activity after diving (or at least, that is my excuse for choosing the flat trail, but definitely do not at-

tempt Mount Scenery after a day of diving).

Sandy Cruz Trail.

The Sandy Cruz trail, which takes around two hours, stretches from Hell's Gate to Troy's Hill, which was right up the road from Queen's Gardens. So, I opted to take a taxi to Hell's Gate and start from there, making just a one-way trip and ending up just in time for a gin and tonic at sunset.

One of the friendly Saba taxi drivers picked me up and told me about being born and raised in Saba. Yet again, the friendliness of the island was remarkable; people would tell me their life stories on a whim and genuinely inquired about mine. It was lovely. The taxi driver



made sure when he dropped me off that I knew exactly where to go.

I took off in a cloud. Misty fog was all around me, giving the forest an enchanted sort of feeling. The higher-altitude areas of Saba are often called the Elfin Forest, and I could see why. I would not have been surprised at all to see an elf hop out of the foliage at any moment.

The trail was quite easy to follow and maintained, but



Excellent Mahi mahi dish (center) at Brigadoon Pub & Eatery in Windwardside (above).





Every Monday night, staff members from Sea Saba give a presentation at Brigadoon Pub & Eatery about Saba, its history, marine life, conservation and more (above); Trumpetfish (center); Web burrfish (right); Yellow goatfish (far right)



Diver on The Needle at Third Encounter

still rugged enough to make it a little challenging. Different types of trees, vines and flowers were everywhere, and along the way were benches, some of which I

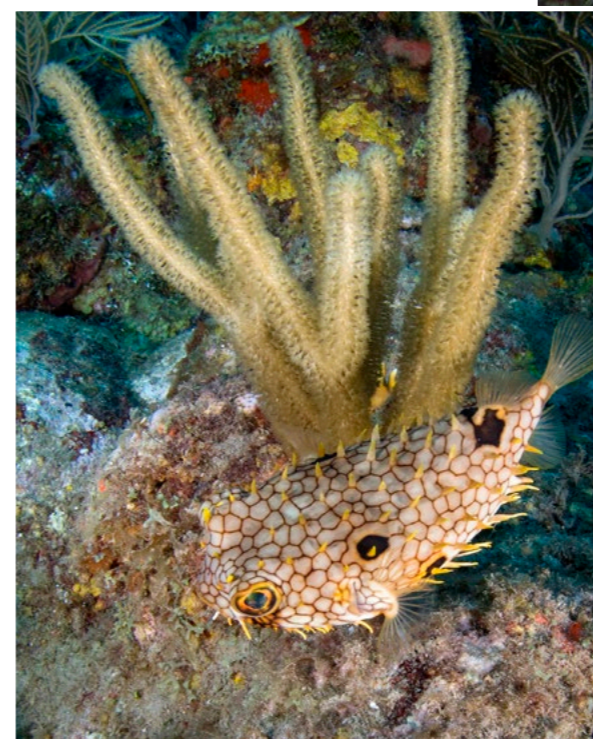
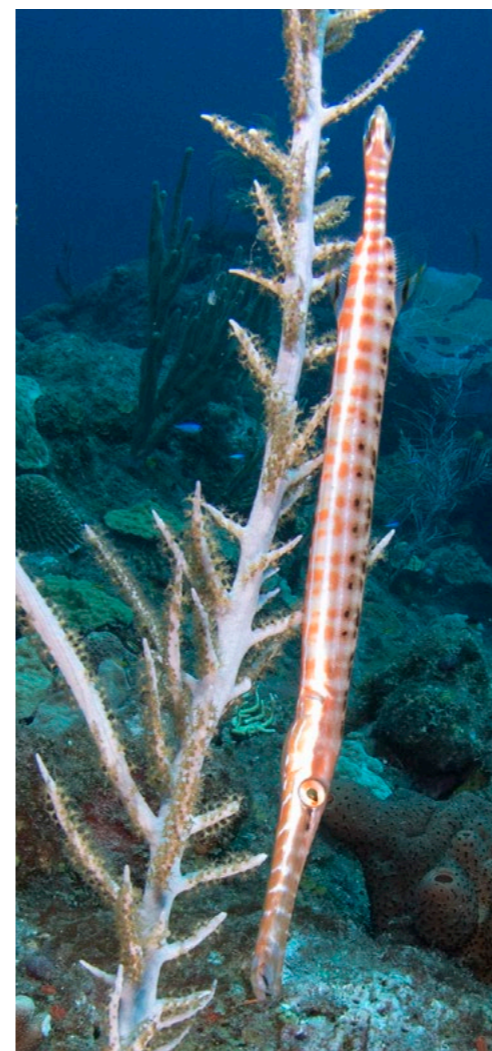
am sure had fantastic overlooks from them, but I was still in a cloud and could only see white.

By the time I got about halfway through the trail, I was at a slightly lower altitude and could start to see through the cloud shadowing the top of the island. I rounded one corner and stopped in my tracks. I could see Diamond Rock, which we had dived a few days earlier. Conveniently, there was a bench to sit and take in the ambience, so I stopped for a moment and took some photos.

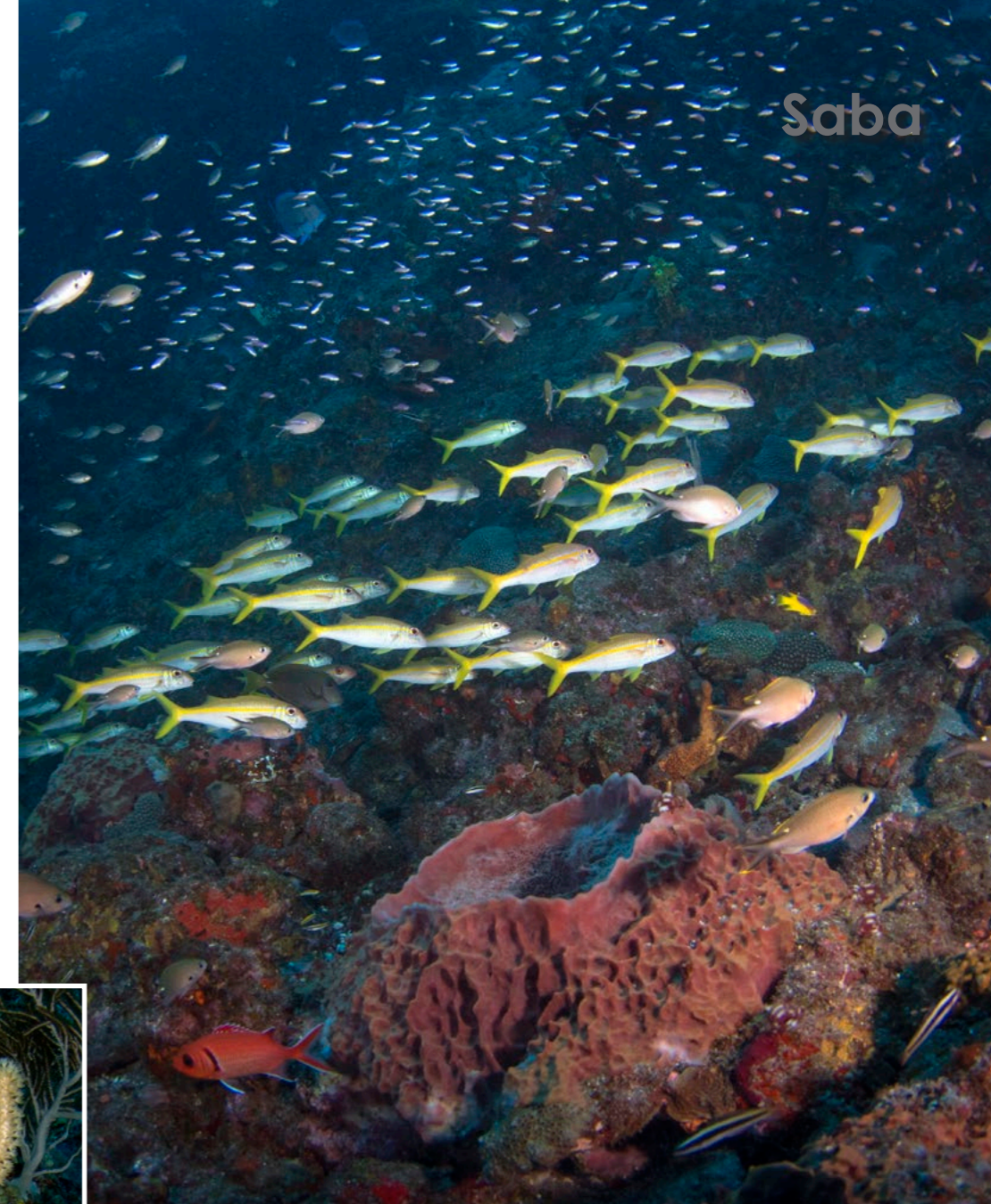
Kakona. Saba also has an impressive art scene that embraces the talents of the island residents. Next door to Sea Saba is Kakona, a shop dedicated to providing Saba visitors with interesting and unique keepsakes and gifts

made mostly by local artists. From hand-crafted knives made by Sea Saba's John, to soaps and lotions made with indigenous and locally-grown ingredients, this shop ends up being a one-stop shop for Saba souvenirs. Ocean lovers will appreciate hand-blown glass mermaids and sea creatures by Jobean Glass Art (Jobean also does demonstrations and classes), dishes hand-painted with marine life, bamboo carvings, mosaics and jewelry made from lionfish spines and Saba sand.

The shop also has Saba lace, which was a major industry on Saba in the early 1900s. A Saban woman had gone to a Venezuelan convent and returned having mastered lace-making needlework. She shared the skill with the women of Saba, and they began



a successful mail-order industry. This lovely needlework is demonstrated once a week at Kakona. Kakona also aims to inspire the



rest of the community (and Saba's visitors) by providing occasional classes and live demonstrations. This year, they started an annual month-long "Create & Learn" program with workshops and art lessons taking place all month.

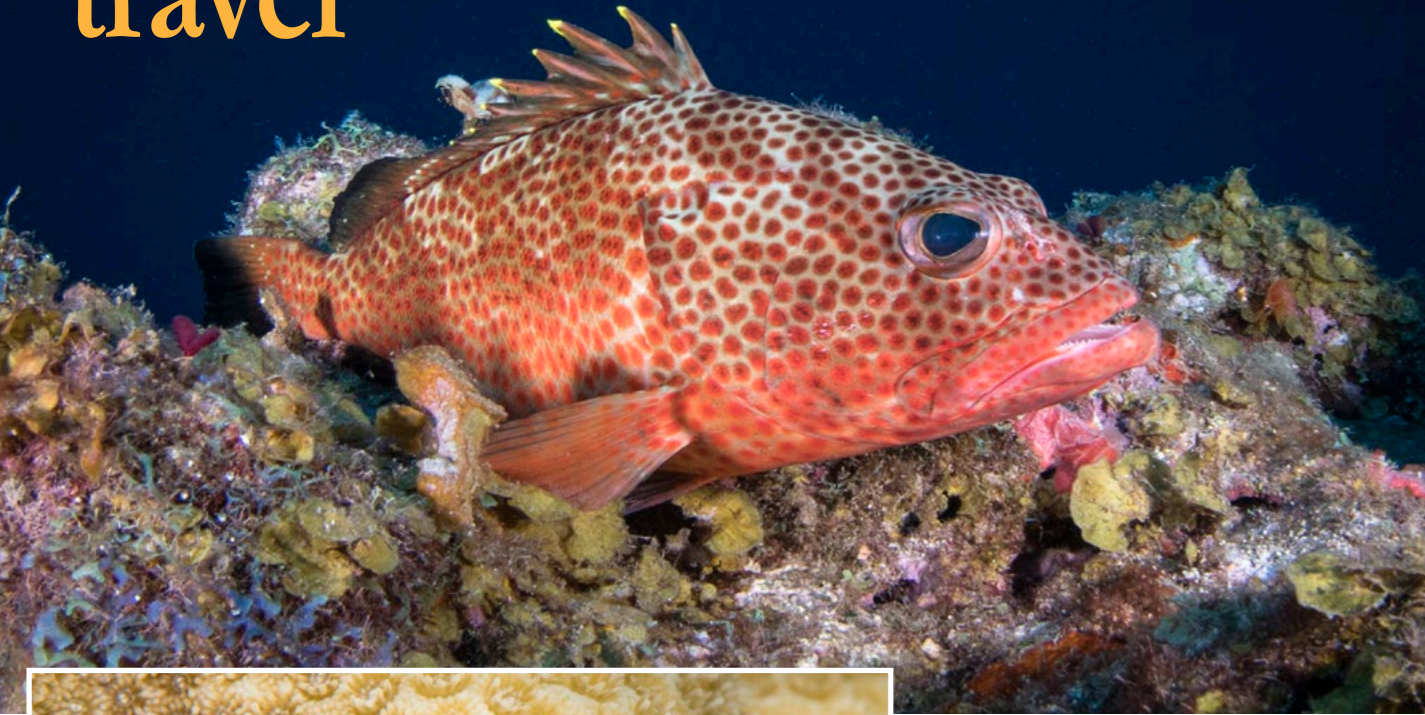
Sea & Learn. If you happen to be in Saba in October, be sure to check out "Sea & Learn." This non-profit, month-long event is sponsored by Sea Saba as well as other island and regional businesses. They bring in world-renowned

nature experts to share knowledge and conduct research with the people and visitors of Saba. There are free nightly presentations (at happy hour, of course) and volunteers can participate in field and research projects around the island.

Conservation

Throughout my trip, I spent a lot of time nodding my head and thinking, "Yes, this island gets it." As our environmental situation gets more and more dire, we as divers need to support the diving operations and places that take care of and support the oceans. Saba





yachts (Saba is a popular place for sailors). They also maintain the hiking trails and operate the island's recompression chamber. Revenue to carry out projects is raised through diving fees (US\$3 per dive), donations and souvenir sales.

Altitude

Some people express concern about the altitude of Saba. I will admit I was curious and checked out the research before my trip. Most of the accommodations on Saba are around 300m (1,000ft), and Mount Scenery is 887m (2,910ft). Studies have shown that

there have not been any cases of decompression illness (bends) due to diving and staying on Saba or even flying directly back to St. Maarten the same day; the Winair flight usually cruises at 760m (2,500ft) or lower, for less than 15 minutes.

Vigorous activity such as hiking after diving is always discouraged (particularly the steep climb to Mount Scenery) as strenuous exercise has shown to increase risk. But as far as taking a day trip to Saba to dive or returning to your resort on Saba after diving at 300m, you should be fine.

Final thoughts

As my week on Saba came to an end, someone said, "You have to leave to come back."

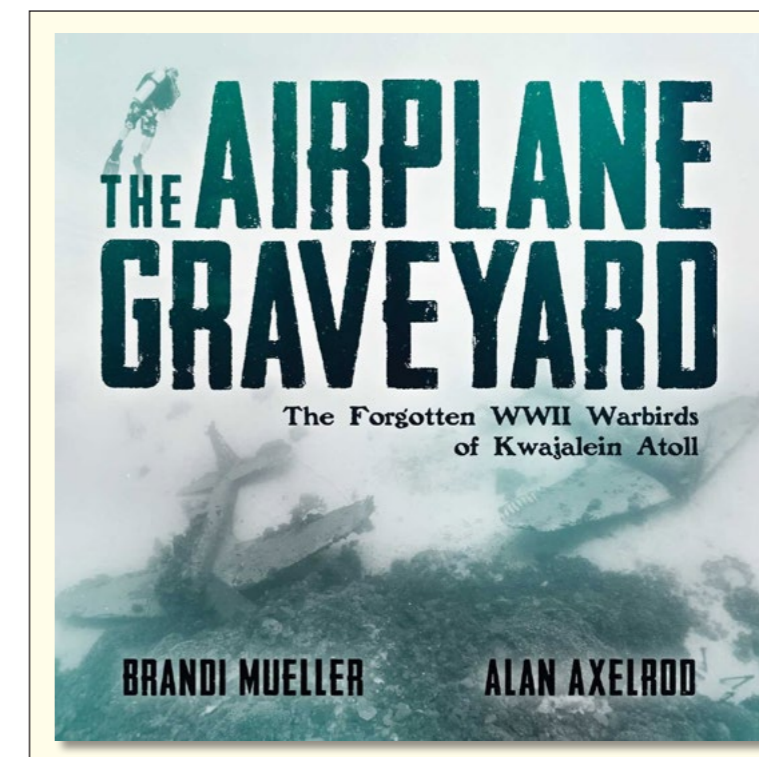
I will be back. Between the fantastic diving, the beautiful island and excellent food, it is a hard place to resist. When you add in the lovely people of Saba who take you in as family from the moment you arrive, you start to miss it before you even leave. And if that is not enough to sell you on Saba, have I mentioned the gin bar? ■

Special thanks go to Sea Saba: seasaba.com.

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.

SOURCES:
SABAPARK.ORG
SABATOURISM.COM
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Yellow goatfish school (top right); Red hind grouper (top left); Secretary blenny (left)



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Saba, Netherlands



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History Saba has a unique history and anthropologists have found evidence of Carib and Arawak natives living on the island as far back as 800 AD. Columbus sighted the island in 1493, but did not land because of the steep and rocky shores. The first Europeans to land on Saba were from a shipwreck in 1632; the island was found inhabited. From the 1600s to the 1800s, the Dutch, English, French and Spanish vied for the island with much conflict; the Dutch won in 1816, and Saba remains a part of the Netherlands to this day. While the Europeans squabbled over the island, Caribbean pirates used the impenetrable coastline and thick vegetation as a safe haven and hideout for many years. Government: parliamentary constitutional monarchy; Saba is part of the Kingdom of the

Netherlands. Capital: The Bottom

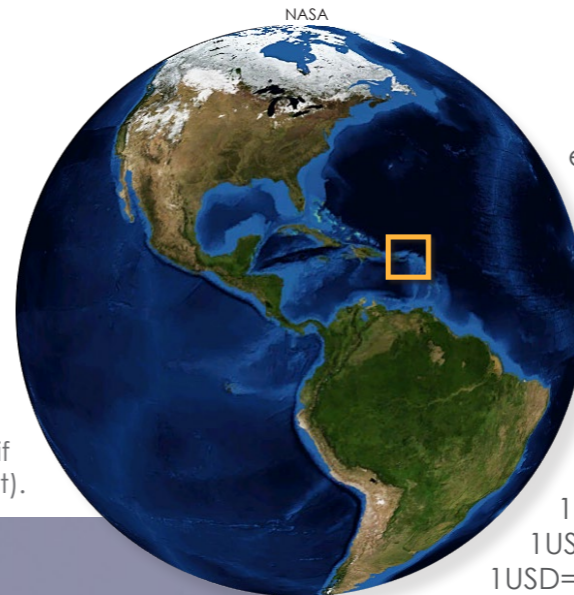
Geography Only 13.2 squ km (5.1 squ mi), the small island is a dormant, but potentially active, volcano that has not erupted in over 5,000 years. Mount Scenery is 887m (2,910ft) high. Woodland forests covers most of the island, and the Saba Conservation Foundation maintains 18 trails in the Saba Walking Trail Network. The underwater geography of Saba has been shaped by the same volcanic activity that created the island. Parts of the underwater landscape have been shaped by lava, creating unique swim-throughs, canyons, tunnels and walls. A short distance offshore

are several seamounts caused by lava rising up from the sea floor. In certain areas, hot sand and rocks occur, confirming continuous volcanic activity.

Climate

Temperatures above water average 23-29°C (75-85°F) year-round, with the northern hemisphere summer months being

Location of Saba Island on global map (right) and in the Leeward Islands on a regional map of the Caribbean (below); A parrotfish sleeping in its translucent sleeping bag made by secreting mucus, which serves to disguise its scent to predators and as an alarm system if a predator gets too close (bottom left).



warmer and more humid. Most of the hotels and cottages are above 300m (1,000ft), so night can be cooler and breezes are common year-round. August through November has the potential for hurricanes. Water temperatures vary from 26-28°C (77-84°F) with winter being cooler.

Environmental issues Saba is a great example of how conservation efforts work. The Saba Marine Park and Saba Conservation Foundation were established in the 1980s to protect the water, land and cultural heritage of the island, and the residents take great pride in their island, both above and below water. There are permanent moorings for dive sites (and for

yachts) to protect the reefs, hiking trails are maintained, and every October, the island hosts conservation and educational awareness activities called Sea & Learn for both residents and visitors.

Economy The Saba University School of Medicine plays a role in Saba's economy, providing jobs and contributing to the GDP. Tourism is the major component of Saba's economy, although it still remains quite small. There is a small agricultural contribution as well as Saba lace production.

Currency US Dollar. Although some places do accept Visa and Mastercard, cash is generally preferred, and some smaller

establishments only accept cash. There are two ATMs on Saba and a bank that will exchange money, but has limited hours. Exchange rates: 1USD=.86EUR; 1USD=.77GBP; 1USD=1.35AUD; 1USD=1.36SGD

Population 2,000

Language The official languages are Dutch and English, but many other languages can also be heard, including Spanish, French and "Saba English," which is a creole form of English.

Phone/Internet: Saba has WiFi at most resorts and restaurants, although due to the mountains, it can be difficult to connect in some places and is generally a slow connection. Many cell-phones will work on Saba (but with roaming/international charges); local SIM cards are available.

Voltage 110 volts, American-style plugs.

Cuisine Saba has excellent dining throughout the island. Resorts and hotels have their own dining establishments, and there are around 10 restaurants throughout the island. The island has several well-stocked grocery stores for those wanting to cook on their own.

Tipping Tips of 10-20% is generally expected at restaurants and for diving. Some restaurants automatically apply a service fee. Cash tipping is preferred as Dutch tax laws translate to the recipient losing 49% in government tax on credit card tips.

Travel/Visa A valid passport is required to enter St. Maarten and Saba. Most European and North Americans do not require visas. Always check for latest requirements before flying, and remember, the first point of entry is into St. Maarten.

Transportation Diving and accommodation packages usually include transportation to and from the airport and from accommodation to the dive boat. A network of taxi drivers exists on the island, several of whom you will probably get to know personally during your stay. Rental cars are available.

Getting there International flights from the United States, the Netherlands, France, Canada, South American and other Caribbean islands fly into St. Maarten. From St. Maarten, Winair flies into Saba, or there are several ferries departing St. Maarten every day. The Juancho E. Yrausquin Airport on Saba is the world's shortest commercial runway.

Health & Security Saba is very safe. Take the normal precautions you would anywhere, but there is little to worry about. Saba has no major health concerns and very few bugs. In some resorts, water is safe to drink from the tap; in others, bottled water was recommended. Check with your accommodations provider.

Decompression chambers Saba has a hyperbaric chamber at the Saba Hyperbaric Facility in Fort Bay.

Websites
Saba Tourism
Sabatourism.com



American Crocodiles

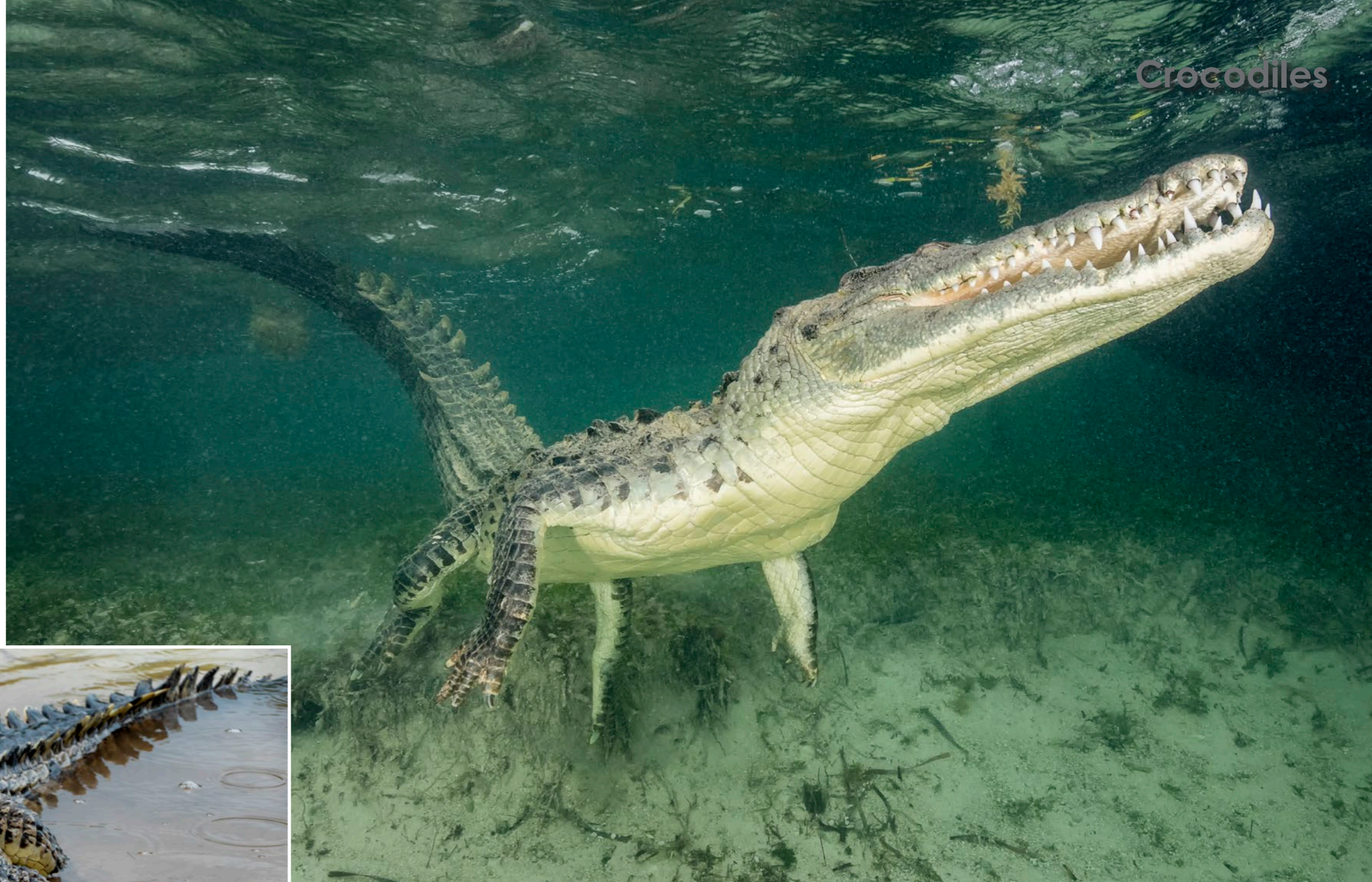
of Banco Chinchorro, Mexico

Text and photos by Don Silcock



The American crocodile (right, below and previous page) is considered a "Vulnerable" species by the IUNC Red List and prefer to hang out in warm shallow waters. The extensive mangroves of Cayo Centro at Banco Chinchorro offer a nearly perfect environment.

The pursuit of unusual and compelling photo opportunities has led me on some interesting journeys over the last few years, but few come close to the raw excitement of photographing the American crocodiles of Mexico's Banco Chinchorro! I have come to realise that photographing big and charismatic animals underwater actually borders on the addictive, because the more of those trips you do, the more encounters you hear about and the "must-do list" just keeps on growing. So it was when a conversation over an après-dive adult beverage led to the subject of in-water encounters with crocodiles.



Crocodiles



Being an Australian citizen, my thoughts were immediately drawn to the saltwater crocodiles of the Northern Territory, an animal that hits the headlines quite regularly because of its deadly attacks on humans. In the animal's defence, it must be said that those attacks are often on either foreign tourists, who have completely ignored the very prominent "No Swimming" signs, or local guys out fishing who fail to understand the basic link between excessive alcohol and poor judgement around dangerous wild

animals.

"Salties," as we affectionately refer to them Down Under, take their name from the fact they are not limited to murky freshwater rivers and lakes, which most crocodiles are. Instead, they have developed a tolerance for salt water, which allows them to prowl coastal waters and occasionally swim quite far out to sea.

Thoroughly dangerous, there appears to be no way to safely photograph salties underwater, or even get close to

them, except perhaps by using some form of motorised cage. As I was to learn, the less well-known American crocodile, is in fact a cousin of the Australian apex reptilian predator, which has also developed a tolerance for salt water. But unlike its antipodean relative, they are not considered to be aggressive to humans and only a few (unverified) cases of fatal attacks have been reported.

As its common name suggests, *Crocodylus acutus* can be found all the



Crocodiles

THE BANCO CHINCHORRO BIOSPHERE

UNESCO describes biosphere reserves as “learning places for sustainable development”. In practice, that means strategies are developed and then tested in the specific reserve to allow a degree of development that does not destroy the original biodiversity and to manage potential conflict between stakeholders—the “developers” and the “incumbents”. It does that by establishing three zones within the overall area of the biosphere, consisting of a core area, a buffer zone and a transition area.

The core area, as the name suggests, has the most sensitive biodiversity, is strictly protected and is a research-only zone. While the surrounding buffer zone can be used for ecologically sound activities, including tourism, recreation and human settlement. Finally, the transition area seems to be somewhat of a “grey zone” that provides some wriggle room during difficult negotiations between the stakeholders.

The Banco Chinchorro biosphere is formed by rings of coral reef, with shallow lagoons on the inside with steep drop-offs on the outside, and is part of the Mesoamerican Barrier Reef, which extends from the southern half of the Yucatan Peninsula to the Bay Islands of Honduras. The area was declared a reserve in 1996, with the specific aims of protecting the coral reefs and marine biodiversity, while also enabling fishing cooperatives to maintain their livelihoods based upon the sustainable extraction of lobster, conch and scalefish. ■

way from the Everglades on the southern tip of Florida, throughout the Caribbean and Central America, down to the northern end of South America in the countries of Ecuador, Columbia and Venezuela. In addition, its largest known population inhabits the land-locked hypersaline Lake Enriquillo in the Dominican Republic. But, by far the best place for reliable and up-close underwater encounters with the American crocodile is Banco Chinchorro in the southeast of Mexico, near the border with Belize.

Some 12 months on from that après-dive adult beverage, a lot of Googling and flurries of emails saw me sitting in a van driving south from Cancun International Airport on Mexico's Yucatan peninsula (after the obligatory marathon journey from

Asia) with a small group of like-minded characters I would come to know quite well over the next few days.

Banco Chinchorro

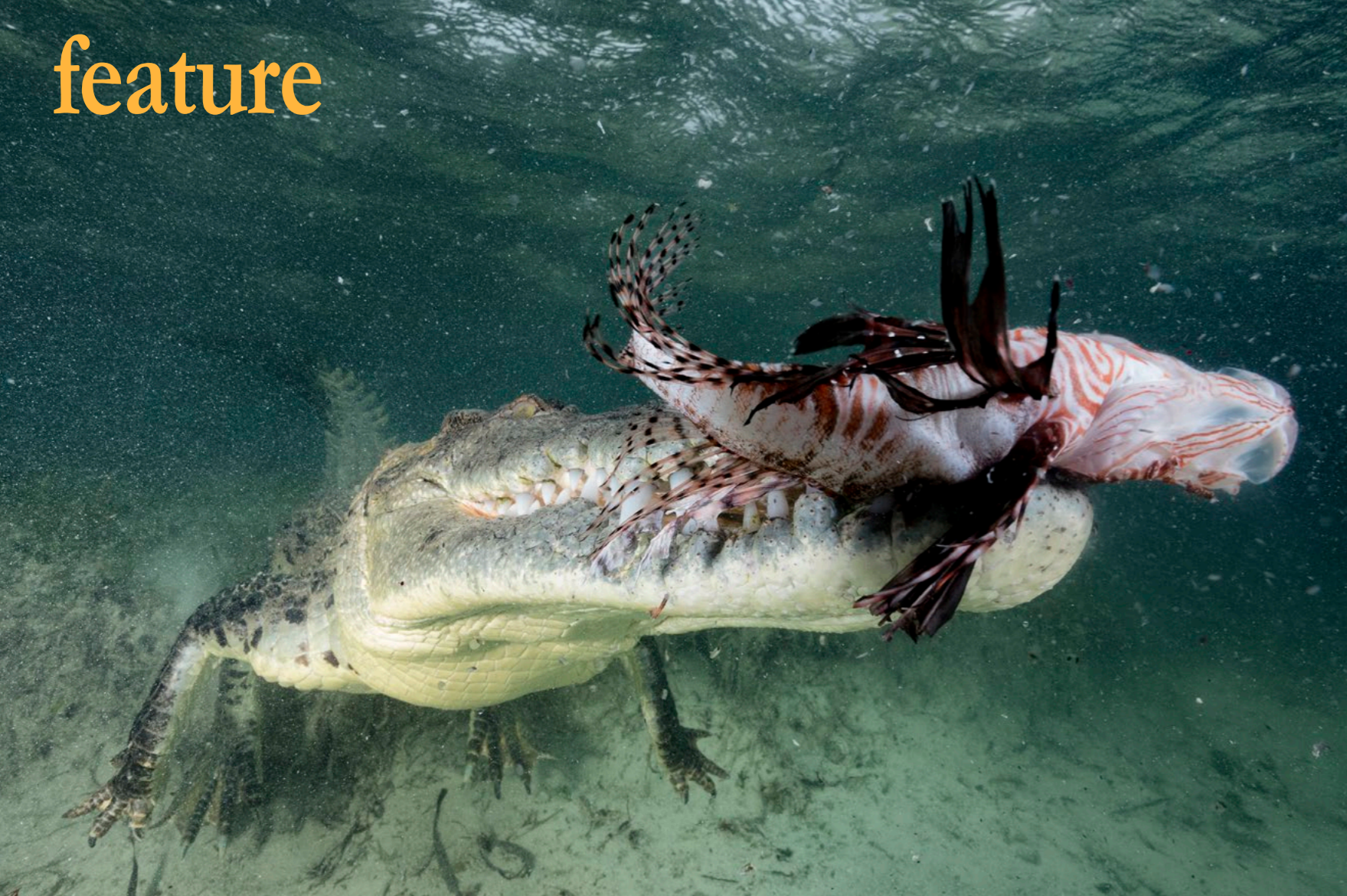
Although hardly a household name, Banco Chinchorro is, in fact, one of the largest coral atolls in the Northern Hemisphere and a UNESCO Biosphere Reserve (see sidebar). Covering an area of almost 800 sq km, and located some 35km offshore, the reefs of Banco Chinchorro are very healthy and a real joy to dive.

But if it's the crocodiles you are after, Cayo Centro is where you need to be. Although only just under 6 sq km in size, Cayo Centro is the largest of the three islands on the atoll and is home to a permanent estimated population of between 300 to 500 American



Small fishing huts called *palafitos* dot Banco Chinchorro (above); Croc at surface (top left) and resting on seagrass bed (top right)





Dive boat moored at a small fishing hut, or *palafitos* (above), while divers in the water photograph a croc on the seagrass bed; Croc eating lionfish bait (left); Croc raising its head for a breath (right)



crocodiles. It also hosts a small, seasonal population of local fishermen who have built a scattering of about 10 huts on stilts, called *palafitos*, above the shallow waters of the lagoon on the eastern shore of the island and a similar number onshore called *cabañas*.

Quite how and when the crocodiles took up residence is not clear, but the dense mangroves of Cayo Centro offer the perfect habitat for them, with the rich waters around the island providing plenty of sustenance. The crocodiles and the fishermen have an almost symbiotic relationship, tolerating each other's presence in this remote location with the main signal for interaction being the noise of the chopping tables.

The fishermen fillet their catches on tables above the lagoon at

the *palafitos* (and at the water's edge at the *cabañas*) and the crocodiles will immediately gather when they hear the knives on the chopping boards. For the crocodiles, it is snack time, while for the fishermen it is automated waste disposal.

How it works

In-water encounters with the American crocodiles of Banco Chinchorro are done on snorkel, as it is too shallow for scuba near the *palafitos*, plus it is easier to manoeuvre when unencumbered. Positioning and visibility are the key to safe encounters and our *palafito* had some prime real estate just in front of its main porch in the form of a large sandy patch that stretches out to the left of the hut.



Local fishermen rest inside their fishing hut at Banca Chinchorro



Most of the lagoon has a rich coating of seagrass on the bottom, with which the crocodiles blend in perfectly when they submerge, making them hard to spot from the surface. The sandy patch makes it very easy to see who or what is there, and the basic concept is to keep the humans on the sandy patch and the crocodiles on the seagrass.

By mooring the boat alongside the palafito, one direction is blocked, and the sandy patch means that any crocodiles sneaking in can be spotted. By feeding them from the front of the boat, the “encounter zone” is quite well-defined and controllable. The actual control in the water is done with a wooden stick—albeit a large one—but a stick none-the-less. It is used by the wrangler to warn and calm the crocodile when it gets excited or aggressive, and as a vertical barrier if it advances on to the sand. Despite my initial doubts on its usefulness, it turned out to be remarkably effective.



American crocodile on seagrass bed (above); Profile of croc at the surface (top right); Divers photographing crocs at Banco Chinchorro (top left)

Crocodiles

THE AMERICAN CROCODILE

The American crocodile is categorised as a relatively large species, with males reaching maximum lengths of 5 to 6m when fully mature, while females are generally smaller at around 3 to 3.5m. Like all reptiles, they are cold-blooded and breathe air, so they are most comfortable in warm shallow waters, and the extensive mangroves of Cayo Centro at Banco Chinchorro offer an almost perfect environment.

American crocodiles are currently on the IUCN Red List as “Vulnerable” principally because its skin is a commercially viable product, which led to significant hunting of the animal from the 1930s through to the 1970s. It has been estimated that their overall population declined by at least 20 percent during that period, but times have changed, and habitat destruction is now considered their greatest threat. ■

Eyeball to eyeball

Of course, all those eminently sensible logistics were far from my mind as the time came to get in the water for the first encounter, and I was very nervous as I descended the ladder at the back of the boat that first time. Then, suddenly in front of you is a serious-looking piece of reptilian hardware that is watching you as intently as you are watching it. Inscrutable is the word that comes to mind.

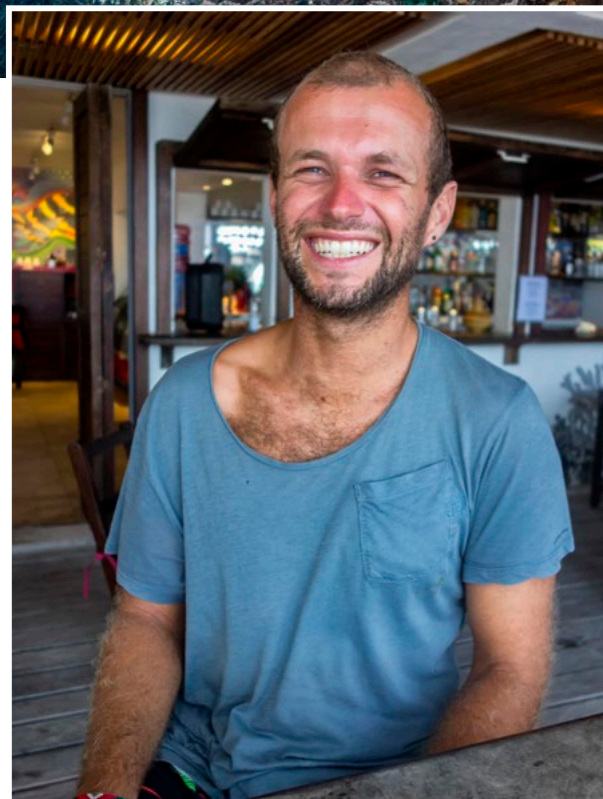
Underwater encounters with big animals are rarely, if ever, static—they move, often constantly and occasionally very fast. In contrast, the American crocodiles of Banco Chinchorro remain completely still, but with a coiled-up energy that is unleashed when they attack.

The problem is that there is virtually no way of knowing when they will attack, so there is an intense tension as you manoeuvre closer to get good images knowing that should that trigger happen, you are very reliant on that wooden stick and the reaction time of the crocodile wrangler.



Crocodiles

Crocodile resting on seagrass bed (above); Banco Chinchorro reef scenes (left and right); Lionfish bait (lower left) are the crocs' favourite food



Mathias Van Asch, the croc whisperer

The crocodile whisperer

So how do you become the “guy with the stick” who is responsible for keeping guests safe and ensuring no harm comes



to the animal—even PADI has yet to come up with a speciality course for that. In the case of Mathias Van Asch from Belgium—not a country normally associated with large and potentially dangerous reptiles—it was a case of being in the right place at the right time. Arriving in Xcalak as dive instructor, it turned out that the incumbent had decided to move on but stayed around long enough to provide

some very hands-on initial training in the not-so-gentle art of crocodile wrangling.

With some three seasons under his belt now, Mathias freely admits that he was hyper-nervous the first time he got in the water with the Chinchorro crocodiles, but over time he has clearly identified certain key behavioural patterns—starting with the young ones, which are by far the most dangerous because they are unpredictable. The big crocodiles may look fierce and very threatening, but they are

not particularly aggressive and tend to be much calmer than the young ones.

The golden rule is to never take your eyes off the crocodile—allow them space, but do not allow them to command that space by using the large wooden stick as a vertical barrier between them and the guests. Mathias believes that attacks do not happen because the guests, with their cameras

and dome ports are the biggest things they have seen underwater, and their reflections in the dome ports basically confuse the crocodiles—so they are very wary.

Final words

Is it dangerous? Probably and possibly are the best descriptors, as there is no doubt that they could inflict serious harm, but nobody has been attacked. Is it special? Yes, for sure it is—being so close to such large and potentially dangerous reptiles is something else. Plus, the whole experience of staying in the fishermen's palafito hut with no running water and just a small generator for power is very different. Was it worth the marathon journey? Australia is a long way from everywhere, and a really long way from Banco Chinchorro—but yes, it was



Location of Banco Chinchorro, Quintana Roo, on map of Mexico

definitely worth the long haul. Would I do it again? Probably. ■

Asia correspondent Don Silcock is based in Bali, Indonesia. For extensive location guides, articles and images on some of the world's best diving locations and underwater experiences, see his website at: Indopacificimages.com.

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Fluorescent Photography *Underwater*

Text and photos by Brandi Mueller



Coral, which would otherwise be off-white, is an array of fluorescent colors (above); An eel glows neon green as it scurries across the sand (top right). PREVIOUS PAGE: Fluorescent photograph of muschroom coral in the Marshall Islands

On a night dive in the Philippines several years ago, I had an opportunity to do a "fluoro" night dive. Atlantis Dive Resort rented blue underwater flashlights and yellow filter shields that went over divers' masks. Geared up, I set off into the night. The blue light was very dim and the dive was much darker than a normal night dive. After a few moments of wondering what exactly I was doing underwater in the blackness of night, my eyes started to adjust and the first fluorescent colors started to show up.

I suddenly felt like I was in a neon video game with the underwater world transforming into vibrant greens, reds and yellows. A bright, glowing light snaked across the sand, and on closer inspection, it was an eel that was vivid green. Later in the dive, I saw the outline of a red fish in the sand. It turned out to be a scorpionfish with only the outline of its body glowing red-pink while its lacy appendages along its body did not. Hard corals, which during the day were a bland ivory color, were now dazzling green and yellow, with tinges of maroon. The ocean as I knew it was suddenly changed, and I could not wait to come back with a camera and start capturing these amazing, unexpected colors.

Science

Fluorescence is a process wherein light is

absorbed as one wavelength or color and then emitted as another. Examples of this have been seen in nature, particularly in the ocean, but the easiest example of it is the use of a blacklight, or ultraviolet light. Shining this light reveals colors not seen with other lights. An eel seen under normal light may be brown, but under a blue light, day-glow green can be seen.

Various creatures have been documented to fluoresce. Some of the most common include hard corals and anemones, but divers have also shown fish, seahorses, nudibranchs, fireworms, sea turtles and even sharks fluorescing. What is interesting is that individuals of the same species may not all fluoresce, you may see one octopus glowing green and red, but not another. Sometimes even with coral of the same species, side-by-side, only one of the two



A jeweled anemone crab carries glowing anemones on its shell

feature



A fish, which would otherwise be disguised by the darkness, stands out.

as a new photon of light (in our case, perhaps, neon green). A small amount of energy is lost in this process, so the photon going in has less energy than the one coming out, and less energy means a longer wavelength of light (different color). Basically, one light color goes in and comes out as another.

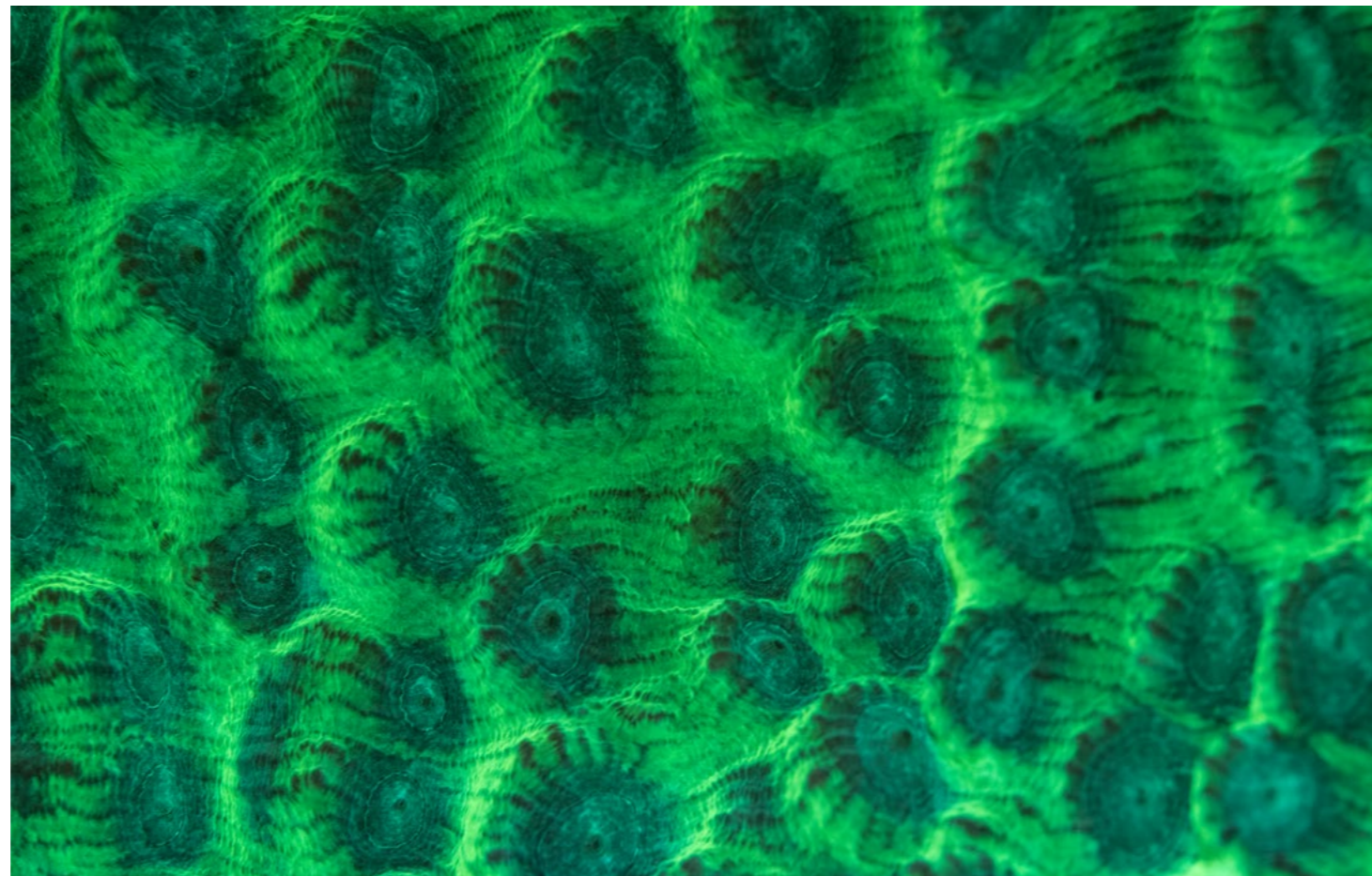
Recently, researchers have found that some fish species have eyes with yellowish lenses and cornea that may help them see fluorescence (similar to the mask barriers we use). This helps support the hypothesis that fluorescence is important in the marine world.

Fluoro dives are always an adventure, and it is exciting to see marine organisms in a new light. Divers can also contribute by being citizen scientists. While research is ongoing, divers' photographs

individuals will fluoresce. There is still much to learn about fluorescence in the ocean.

Scientists have some suggestions of what might be happening, including fluorescence being a means of communication, used for reproduction, or even as sun protection. But keep in mind that fluorescence is different than bioluminescence. Bioluminescent organisms—such as fireflies, jellyfish and dinoflagellates—produce energy to make their own light; these are organisms that divers see on night dives, which light up in the water column when we kick our fins or wave our arms. Fluorescence, on the other hand, is when the electromagnetic radiation of one wavelength is absorbed and the light of another wavelength is emitted.

To get technical, a photon from our light source (UV or blue light) strikes a protein (i.e. green fluorescent protein in the cells of an organism), which absorbs the light energy. This energy causes electrons to jump to a higher electron shell and it becomes unstable. To return to stability, it quickly returns to the lowest energy state, and the release of energy may be



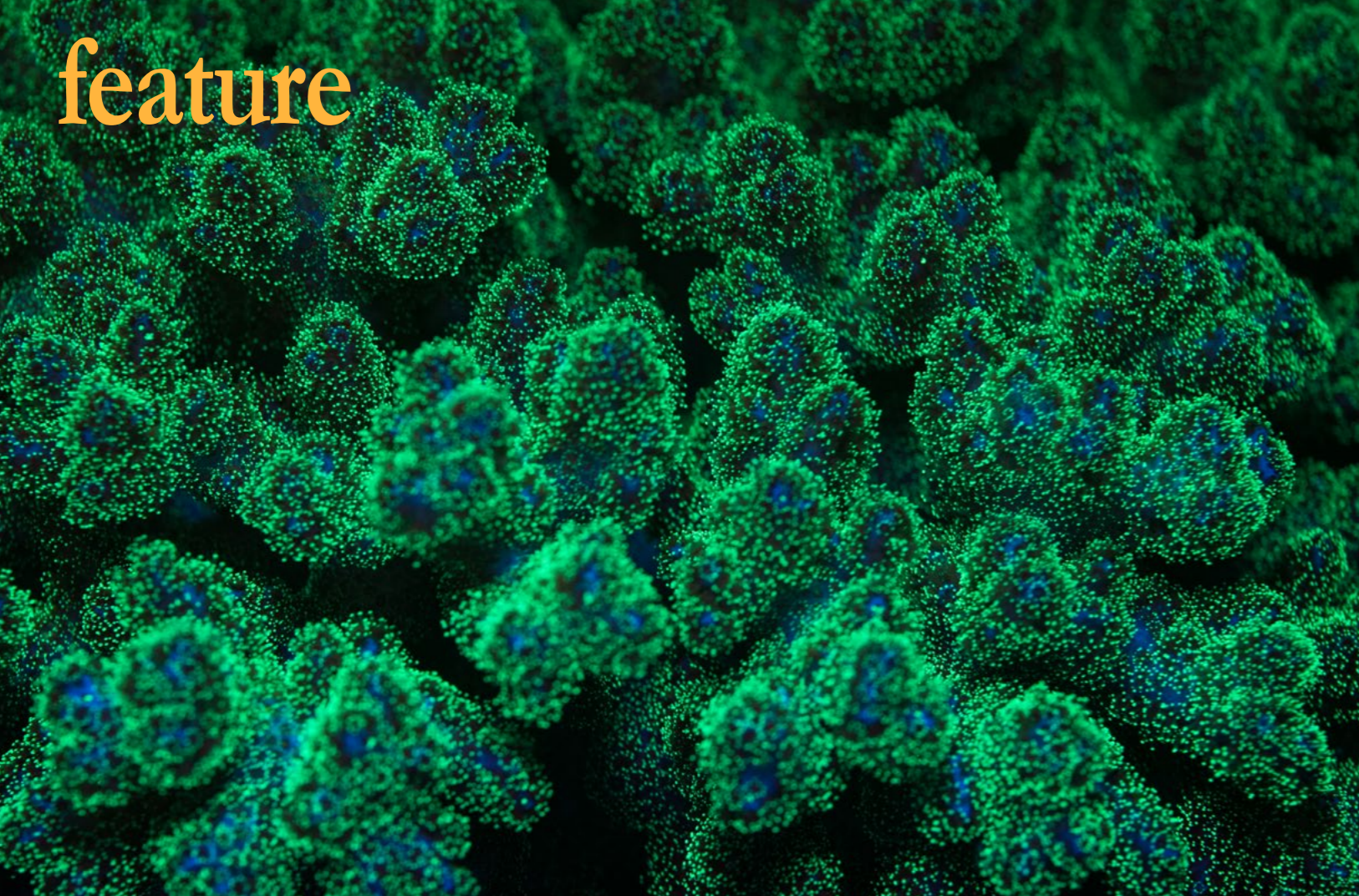
Hard corals glow green and yellow, with a slight hint of purple.

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Fluorescing coral

can (and have) shown new organisms fluorescing that had not been seen before.

Equipment

Fluoro dives and photography require specialized equipment. For divers, special UV or blue lights are needed, which are the right wavelength for exciting the electrons and triggering fluorescence. Divers must then wear a barrier mask or shield (usually yellow) which filters out the blue light, revealing the fluorescence (otherwise, we would just see blue). Some companies make blue or UV lights, and others make filters that go over a normal light. Barrier shields are usually worn like glasses over a mask. Blue light is far more popular with divers than UV, because UV has the potential to cause harm if accidentally directed into other divers' eyes.

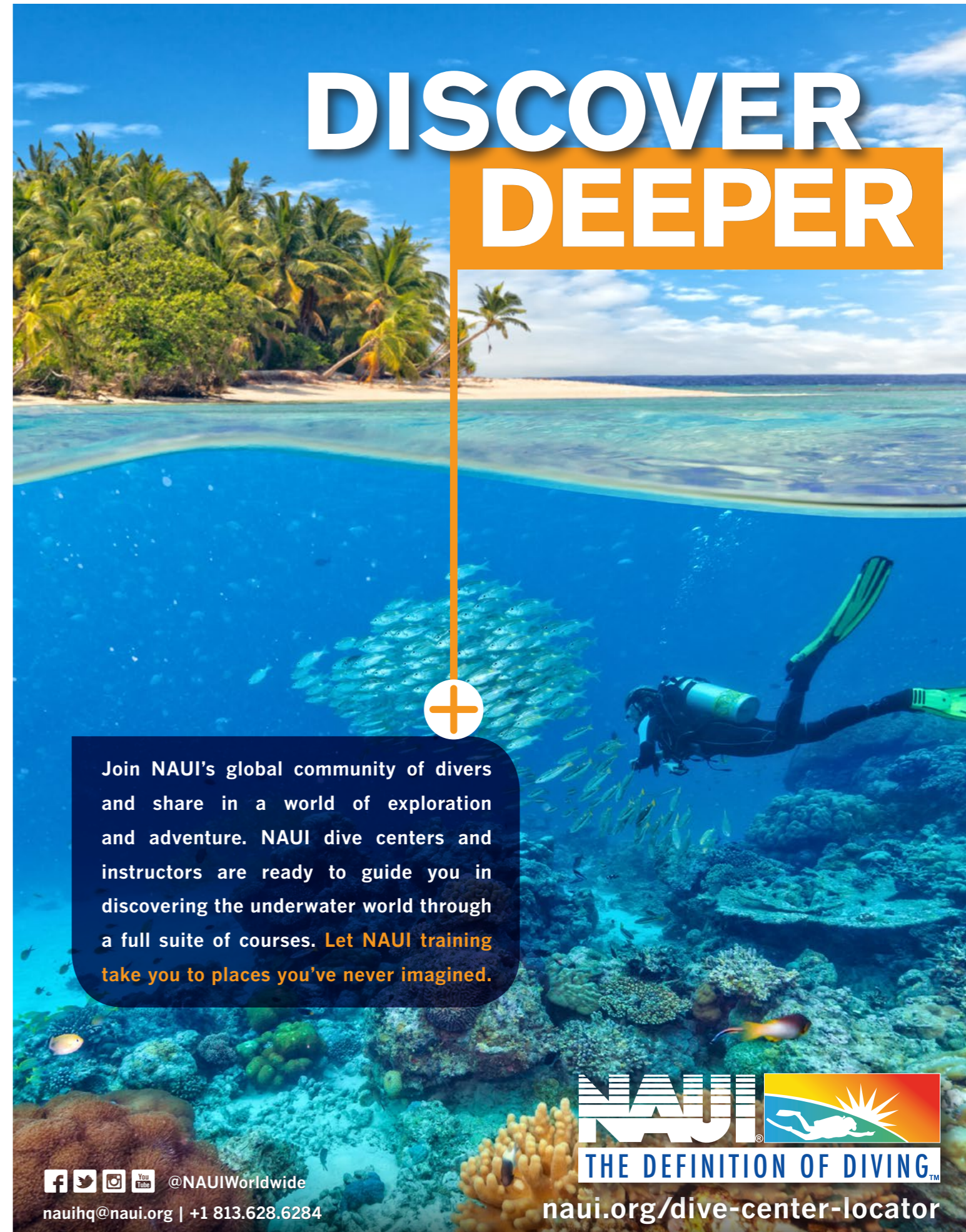


My Ikelite fluoro set-up. Filters are easily taken on and off underwater to allow for normal photography too.

Taking photos of fluorescence requires a camera to have the same items. The lights or strobes of the camera must be outfitted with UV or blue light capabilities, and the camera lens port (like the

diver's eyes) must be covered with a barrier filter. I use Ikelite's dichroic excitation filters and yellow barrier filters, which easily attach and detach over strobes and ports. They are wet-mounted, so can be

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Scorpionfish glowing red (above); Moray eel glowing green (top left)



A mantis shrimp with red eyes and yellow accents

removed to do normal photography on the same dive.

Capturing fluorescence underwater is not easy. Low-light situations and lack of contrast make it difficult for cameras to focus. The brighter the blue light, the easier the camera will focus, and more light will allow for a smaller aperture to get the desired depth of field. It is easy in these low-light situations to use a wide aperture and slow shutter speed to let in the most amount of light, but then the photos are often blurry. Increasing the ISO can help, but depending on the camera's capabilities, high ISO may introduce noise and reduce the photo quality. It is possible to capture fluorescence during the day, but very bright lights are necessary, so it is generally easier at night.

Safety

UV or blue lights are considerably dimmer than normal night diving lights. It is very

important to have a backup white light, or to have a UV or blue light that can either switch to a normal white beam or a filter that can be easily removed. While underwater, it can be difficult to see parts of the reef or objects underwater that do not fluoresce, as they will appear black and may be hazardous for divers.

Fluoro night diving is probably best for divers already experienced in night diving, as adding any extra tasks to a dive can lead to issues. However, for divers with the right experience, comfort level, proper equipment and a desire to see a dive site in an entirely new way, fluoro diving is a great way to do so. ■

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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Equipment



APD RB Cover

AP Diving has updated its rebreather handset protective cover. The latest cover fits snugly over a left-hand handset. This flexible rubber case will help prevent the handset LCD display from getting too hot, when it is exposed to direct sunlight. The cover also protects the wet contacts. This should stop the rebreather from automatically switching itself on should the rebreather be splashed or sprayed during a bumpy boat transit.

APDiving.com



Red and responsive

It is quite possible that you will first don a set of fins during your open water training, and several years later, you are still diving the same pair, but you are now doing a deep technical dive. You therefore need your fins to be robustly constructed, to be able to propel you through the water with minimal effort and not cause leg and foot cramps. You also want fins that will respond accordingly when you "power up" your legs in a fast or hard current. The last thing you need strapped to your feet at that moment is a pair of fins that perform like limp lettuce leaves. This is one thing you will never need to worry about with Dive Rite. The company's test bed—a series of flooded cave systems—is located about 20 minutes from its headquarters in Florida, and the caves are dived every week. The XT fin is stiff, with plenty of snap, and it weighs less than a traditional rubber fin. This means that legs and feet will not cramp, even after hours of finning. Dive Rite has also looked at the way we secure our fins to our feet, and developed a unique stainless steel buckle, which is guaranteed not to crack or break. **Diverite.com**

Look behind you

A Polish manufacturer—360observe—has launched the latest iteration of a dive mirror. Their solution is a lightweight, convex mirror that comes in an ABS plastic housing to protect the mirror face from being scratched. The housing is secured across the back of the hand by a soft fabric strap. There is some merit with diving with a mirror. It allows working dive guides to simultaneously look ahead while watching their guests behind them. And technical and rebreather divers will use a mirror to perform a "bubble check"—i.e. see if anything is leaking gas—or to help deal with an entanglement. 360observe suggests that various sports will benefit from their mirror, including cycling, skiing, paintballing and go-karting. **360observe.com**



FE Poncho

Fourth Element has augmented its OceanPositive range of clothing with the launch of a UV-resistant poncho. The unisex garment is quick-drying (200% faster than cotton) and has been made from S.Café technology. This is a low-temperature, high-pressure, energy-saving process that produces a recycled yarn from coffee grounds. The resulting fabric is soft, light and flexible. It has also been impregnated with "activated" carbon, derived from coconut, which binds to sweat to eliminate unpleasant odours. The Storm Poncho has side-seam poppers, making it easy to don or doff, as well as an adjustable peaked hood. It comes in four sizes (XS/S, S/M, L/XL, XL/XXL) and two colours: burgundy and black.

Fourthelement.com





Text by Simon Pridmore
Underwater photos by Brandi Mueller

You are chatting with a diving friend and the conversation turns to mutual acquaintances. “Do you know Bob and Carol?” your friend asks. “Oh yes, good divers!” you reply. We will usually refer to someone as a good diver when they are not around. We will rarely say it to their face. And it is something that we all rather hope people say about us behind our backs. And of course, the politically correct response when someone says, “so-and-so is a good diver” is to nod sagely in agreement, rather than object.

But what does it mean? What are the qualities that make someone a good diver? This is the first of two articles aiming to provoke discussion on the topic. Suffice it to say, before I go any further, being a good diver does not just come down to amassing a wallet full of cards and a garage full of cool kit.

I am sure you have one or two characteristics in mind already, but here are a few that are on my list.



What Does It Take to Be
A “Good Diver”?
— Part One

A good diver...

Is independent

There is a maxim that says that if you could not do the dive on your own, you should not be in the water. This does

not mean that you should always dive on your own, but it does mean that you should embark on every dive prepared to take care of yourself, whatever arises. In the technical diving world, divers are taught to perform as independent parts

of a mutually supporting team. This is the kind of approach divers really should take at all levels.

Has mastered the basic skills

It may seem obvious but, sadly, we live

in a world where money and enthusiasm can move a diver up the learning ladder fast—too fast sometimes. It is not hard to find instructors who will turn a blind eye to the prerequisites in their training standards. Good divers recognise their true





abilities and take their time mastering skills at one level before moving on to the next.

Exercises self-discipline

Good divers adopt a disciplined approach to their diving. If there is a plan, they stick to it and they always make sure they have a plan. Experienced divers might claim they do not need a dive plan, but they still have one. It is just ingrained in their DNA, rather than written on a slate. The advent of technical diving, especially rebreather diving, has further reinforced the importance of preparation and planning for successful scuba dives.

Is meticulous

Divers who do not prepare adequately and regularly jump in without turning their air on or without attaching their BCD to the cylinder properly are unlikely to be spoken of by others in glowing terms. Rest assured, if this is you, you do not have to worry about people referring to you as a good diver behind your back.

Is environmentally aware

Good divers are always aware of the impact they can have on the marine environment and act to minimise the adverse effects of their presence there. They do this by maintaining good buoyancy and control skills to ensure they do not come into contact with marine growth or habitats. They also refrain from touching or interfering with marine life, ensure that they wear ocean-friendly sunscreen and produce as little trash as possible, knowing that much of the rubbish we generate ends up in the ocean.

Is considerate

Good divers are spatially aware. They know where other divers are on the beach, in the boat, on the surface and underwater, and give them room. They also respect other divers, no matter how much experience they themselves have.

Is conservative

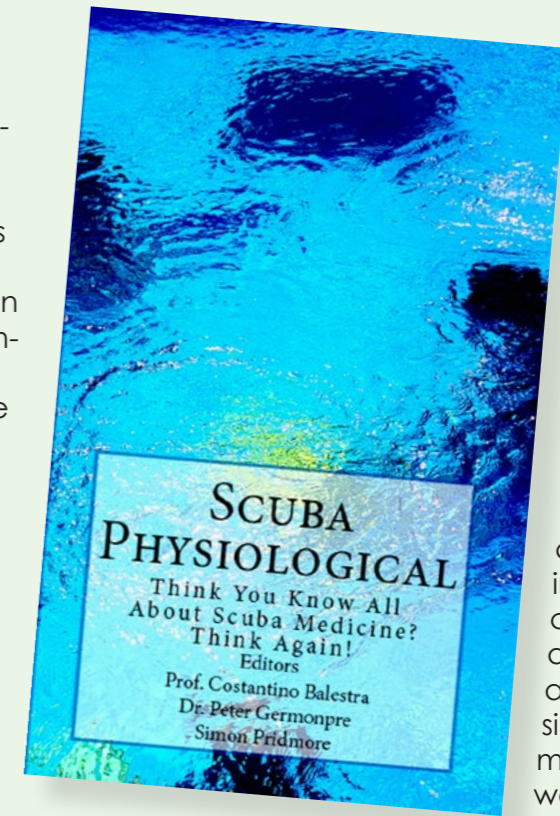
Good divers dive conservatively, making sure that they add safety factors to the dive plan whenever they can. They know that any item of equipment can fail, and that if a piece of kit is essential to the successful completion of a dive, they would do well to have a second one or a viable backup plan. Good divers know that dive computers are limited in their ability to assess the risk of decompression sickness, so they never just follow the computer blindly and always give themselves buffers or cushions. They understand that a computer cannot predict decompression sickness risk accurately, primarily because it does not have access to some of the necessary information—information such as the diver's level of hydration, physical fitness and surface activity between dives.



A New Book for Scuba Divers!

If you are a diver, much of what you learnt about topics such as decompression sickness and narcosis in your scuba diving class is over-simplified and some of it is just plain wrong, as diver training agency texts have not kept pace with the science. Despite 170 years of research, the nature of decompression sickness and decompression stress remains unknown. Great advances have been made to make diving safer, but there are still glaring gaps in our knowledge. *Scuba Physiological* provides us with a good summary of what we know, a glimpse of where current science is taking us, and some good tips to make us all safer divers now.

The chapters in *Scuba Physiological* were originally written by scientists in



to the general population of divers. They thought it was a great idea and *Scuba Physiological* is the result.

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

Takes health issues seriously

The diving population in Europe and America is ageing and gaining weight. Heart attack is becoming an increasingly common cause of diver death, and the victims of fatal diving incidents are often overweight. Although it is true that our sport does not require that participants be fit, athletic and built like racing whip-pets, nevertheless a good diver stays in good physiological and physical shape.

This involves following a basic fitness regime, getting regular medical checkups, being aware of one's limitations and not diving if one becomes ill, injured, incapacitated or has recently had signifi-

cant surgery. As we do more diving, we gain in experience, but no matter how much we learn, the laws of nature still apply. As our bodies age, they become weaker, we become more susceptible to ailments and our chances of dodging a physiological bullet decrease. When good divers do not feel right, they do not dive.

Does not take shortcuts

As the cliché goes, familiarity breeds contempt. Complacency in diving is often the counterbalance to experience. The problem is that we are human, and by our very nature, we are always looking for an easier way to do things. This is one of the primary drivers that generate progress in our species.



opinion

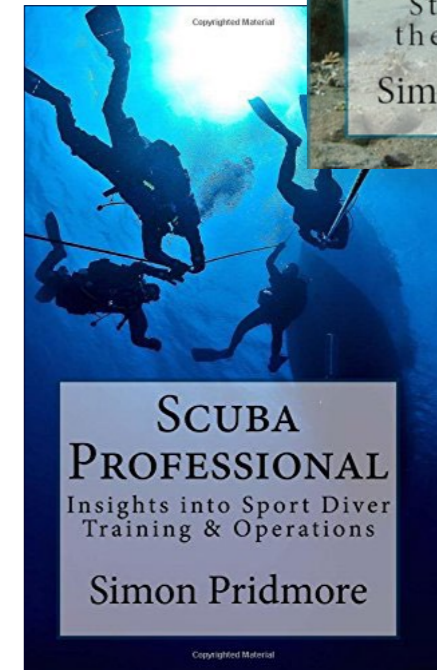
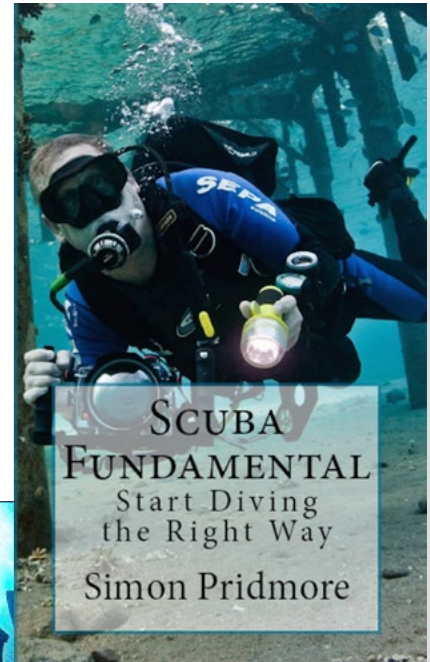


Good Diver

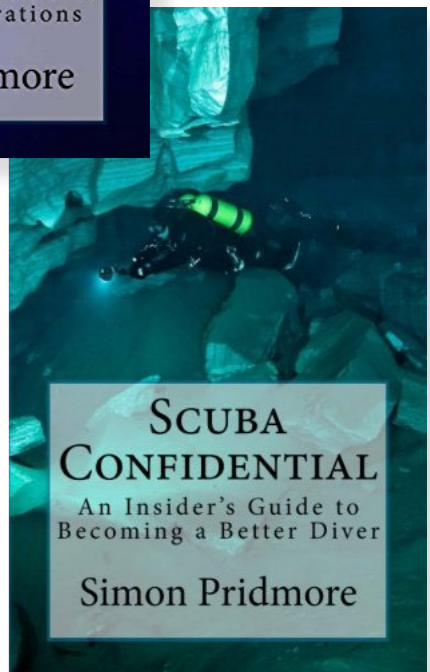
Simon Pridmore is the author of the international bestsellers, *Scuba Confidential: An Insider's Guide to Becoming a Better Diver*, *Scuba Professional: Insights into Sport Diver Training & Operations* and *Scuba Fundamental: Start Diving the Right Way*. He is also the co-author of *Diving & Snorkeling* guides to Bali and Raja Ampat & Northeast Indonesia and a new adventure travelogue called *Under the Flight Path*. He recently published two new books, *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.

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Fear is another primary driver, and when we start diving, fear is a key motivator that makes us more careful and keeps us safe. But the more dives we make without incident, the less we fear, the more we become convinced that the risks are smaller than we thought and the greater is the temptation to make life easier for ourselves.

We start asking ourselves questions like: "Do we really need a spare light on a night dive when the main light has never failed?" and "Why shouldn't I do my second dive on a partially full cylinder? It's only shallow." I am sure you can think of many more examples.

All of us reach the point where these thoughts bubble up from the deepest reaches of our consciousness. Good divers resist them and send them back down where they came from.

Resists peer pressure

Good divers resist other forms of pressure too. Pressure can come from a variety of sources. Some are obvious; others are not. One of the levers that can affect divers and cause them to change the way they dive is peer pressure.

Sometimes this is exerted directly—for instance, when someone lays down a challenge. Other times, it is merely perceived. In either case, it can be powerful enough to lead a diver to take unnecessary risks. The history of scuba diving includes a number of tales of divers who went beyond their comfort zone, dived beyond their limits and took unnecessary risks in order to prove something to themselves or others, and ended up getting hurt or worse.

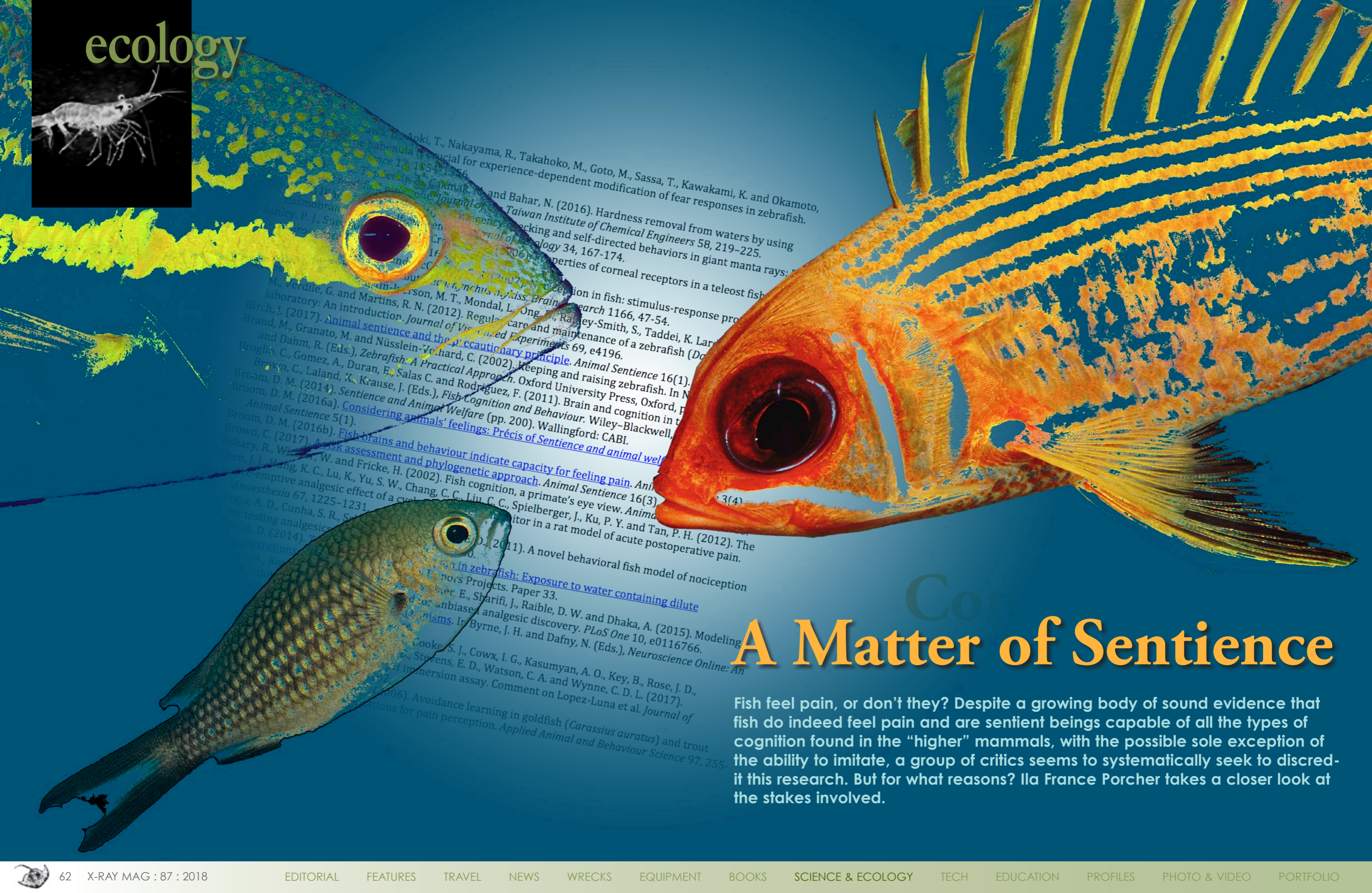
Sometimes says "No!"

Everyone knows that it is not

wise to dive if you are feeling unwell or tired, but it can be hard to sit out a dive when you are part of a group. It is even harder when you are one of a group of two and your refusal has an adverse impact on your buddy's dive. Good divers know that they are doing nobody any favours if they press ahead with a dive despite the fact that they do not feel well, as a sudden medical emergency or lack of concentration through fatigue can put the safety of the whole team at risk. Of course, good divers also do their utmost to prevent ill health or fatigue affecting their dive plans, but sometimes such things are not easily controlled.

In the next issue of *X-Ray Mag*, I will continue this theme with a few more of the characteristics that make a good diver. ■





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A Matter of Sentience

Fish feel pain, or don't they? Despite a growing body of sound evidence that fish do indeed feel pain and are sentient beings capable of all the types of cognition found in the "higher" mammals, with the possible sole exception of the ability to imitate, a group of critics seems to systematically seek to discredit this research. But for what reasons? Ila France Porcher takes a closer look at the stakes involved.



Text by Ila France Porcher
Illustrations by Peter Symes

It was in 2003 that Dr Lynne Sneddon of the University of Liverpool found through rigorous scientific research that fish are sensitive to pain and suffer. In the years since then, many other researchers around the world have confirmed her findings and expanded on them.

Yet, each new discovery is fiercely opposed by a group of critics who systematically deny that fish have the capacity to suffer, no matter what form the evidence takes.

This is not a case of intellectual discussion of contradictory findings. The papers published by the deniers are not studies presenting new evidence, but reviews that cite only favourable references to promote the interests of the fishing industry. They misquote the researchers' papers, claim that things are suggested that were not, and make incorrect statements that discount both the findings and the researcher. All evidence that contradicts their beliefs is ignored.

No brain, no pain!?

The deniers' main claim is that fish cannot feel pain because

they lack a human brain, but the sole reference for the idea that humans are that unique is the Bible. The group¹, led by James Rose, have coauthored a variety of papers that argue against fish sentience. Their writings have a creationist feel as they ignore all evidence provided by the evolution of the brain in vertebrate animals from fish to humans, as well as evolution in general.

Pseudoscience

But the idea that fish cannot feel pain is nothing but an old wives' tale—it comes from the pool of information that is believed by the public but is not solidly based on

“What can be asserted without evidence can be dismissed without evidence.”

— Christopher Hitchens

facts. By definition, claims that are not based on evidence fall in the category of pseudoscience.

Science requires evidence, and no evidence has been produced to support the possibility that fish, or any animal, could live successfully and survive without the ability to feel pain. Though the deniers claim that pain sensitivity is a higher mental ability, in fact it is an essential warning sensation. An inability to feel pain, and thus recognize bodily damage, would result in inappropriate behaviour, and the animal would go straight into evolution's garbage can.

Thoughtful behaviour

Further, observations of fish behaviour do not support the idea that they are insensible robots. Fish appear cautious and careful, and will display complex, thoughtful behaviour in their efforts to eat food, such as sea urchins, that could sting them. Indeed, the evolution of such animals, as well as a host of other oceanic stingers, seems to have depended specifically on the sensitivity of fish to pain.

Furthermore, in terms of cognitive (thinking) ability, fish are capable of all the types of cognition found in the “higher” mammals, with the sole exception of the ability to imitate. Their nest building capabilities, for example, are superior to primates with the exception of humans. And many humans would produce quite slipshod nests compared to those of certain fish, without the help of a builder.

The evidence as a whole indicates that fish are sentient. In other words, they are aware of the external environment and of their own internal emotional states. Yet, as a result of the systematic criticism of papers published on the subject, including fish pain and suffering, many scientists have become reticent to speak out on the subject and promote fish welfare through fear of being targeted by vicious reviews slandering their work, and making it more difficult to be published and get grants.

The evidence is solid

Since we cannot ask animals what they are feeling, and they cannot answer in a way we can understand, scientists have searched indirectly for evidence about how they experience physical harm in the studies of neuroanatomy, neurophysiology, and behaviour. Strict criteria have been developed, all of which need to be met, before it can be concluded that an animal can feel pain.

Pain pathways exist

First, there must be *nociceptors*, sensory neurons that respond to tissue damage by sending nerve signals to the spinal cord and brain. This process is called nociception, and causes the sensation of pain. There must be neural pathways from the nociceptors to higher brain regions, and the signal from the nociceptor must be processed in the higher brain, not in the reflex centres in the hind brain or spinal cord. There must

be opioid receptors within the nervous system, and opioid substances produced internally. Pain-killing drugs should relieve the symptoms of pain that the animal displays, and it should be able to learn to avoid a painful stimulus.

Fish react similarly

This should be so important to the animal that it avoids the threat of pain right away. The painful event should strongly interfere with normal behaviour, and the animal's reaction should not be an instantaneous withdrawal response, but long-term distress. Fish comply with all of these criteria, as has been shown in a wide variety of experiments. The whole brain of the fish is active during painful events, not just the hind brain.

Evidence indicates that fish are sentient, aware of the external environment and of their own internal emotional states.

Furthermore, certain genes that are crucial to the experience of pain in humans are also found in fish, and they are active throughout the fish's brain during painful

events. This activity of the brain at the molecular, as well as the physiological level, indicates that the fishes' responses to tissue damage are not reflex reactions. If they were, such activity would not be seen in the higher brain.

Though humans can over-ride pain at times in certain heightened mental states, and particularly when they are in danger, it seems that fish cannot do so.



Studies have shown that after being hurt, fish become far less alert to danger, as if their pain is too overwhelming for them to ignore it, even to escape a predator. It is thought that due to their simpler neural design and mental states, they lack the ability to think about their pain, and put it in perspective as humans can. This suggests that pain for them is always an intense experience, and that fish may actually feel pain more intensely than humans.

Muddying the waters

Yet, in spite of all the evidence, the deniers continue to claim that fish show reflexive responses only, and that they are incapable of true cognitive abilities. They are using the authority of science to manipulate public opinion while weakening the voices of true researchers.

So Sneddon, with several colleagues² whose results have been twisted and criticized, recently published a paper directly addressing the situation entitled, *Fish Sentience Denial: Muddying the Waters*. She and her coauthors describe how each criticism of their evidence has been rebutted with sound scientific points that identified the fallacies in the arguments, not only by the authors, but by other researchers as well.

For example, Brian Key, with the same group of coauthors, wrote a criticism of Sonia Rey's work pretending, among other things, that she and her coauthors³ had stated that the expression of emotional fever in zebrafish proves that fish are conscious. But, in fact, Rey had found that zebrafish exhibit emotional fever and had

stated only that its absence can no longer be used in support of the idea that fish are not conscious.

Medical models

Coauthor Culum Brown writes: "Medical science increasingly uses zebrafish as an alternative to lab rats to understand human physiology and to test drugs and so on. The reason this is so widely accepted is the high degree of similarity between fish and human physiology. Of course this brings with it further emphasis to be certain that fish are given the appropriate ethical treatment when used in medical research."

Indeed, sequencing the zebrafish genetic make-up revealed that 70 percent of the human genes that code for proteins, and 84 percent of genes associated with

human disease have counterparts in the zebrafish.

Culum continues:

"An interesting question raised in response to our article is the question as to whether the lives of fishes would change if it was broadly recognised that they are sentient and capable of suffering. Here, we have the age old problem: Fish are a commodity worth a lot of money, and when there is money to be made, there will always be pressure to keep using fish in the way we currently do (i.e. with little thought to their welfare). This is really a question of shifting human behaviour, and the analogies with our response to climate change are rather obvious."

A matter of cost

Sneddon and her coauthors make the point that sentience is being denied to fish because of the current laws in place in the European Union, which demand that sentient animals must be treated humanely. This point is confirmed by the deniers. In one of his arguments, Ben Diggles lays out his reason for denying fish sentience:

Sentience is being denied to fish because of the current laws in place in the European Union, which demand that sentient animals must be treated humanely.

"Accepting the premise that fish are sentient and experience pain and suffering has had a pervasive impact on recreational fishing, particularly in Germany and Switzerland. In Germany, risk assessments weighing the presumed suffering of fish against the benefits to anglers, and to local economies and fish conservation from angling, has led to severe constraints or bans on competitive fishing, put-and-take fishing, and the use of live baitfish and keep nets."

Follow the money

The purpose of the deniers' arguments, therefore, is to promote business as usual for the fishing industry. Diggles goes on to make the point that it is acceptable for fishermen to treat wild fish as cruelly as they wish without regard for their suffering.

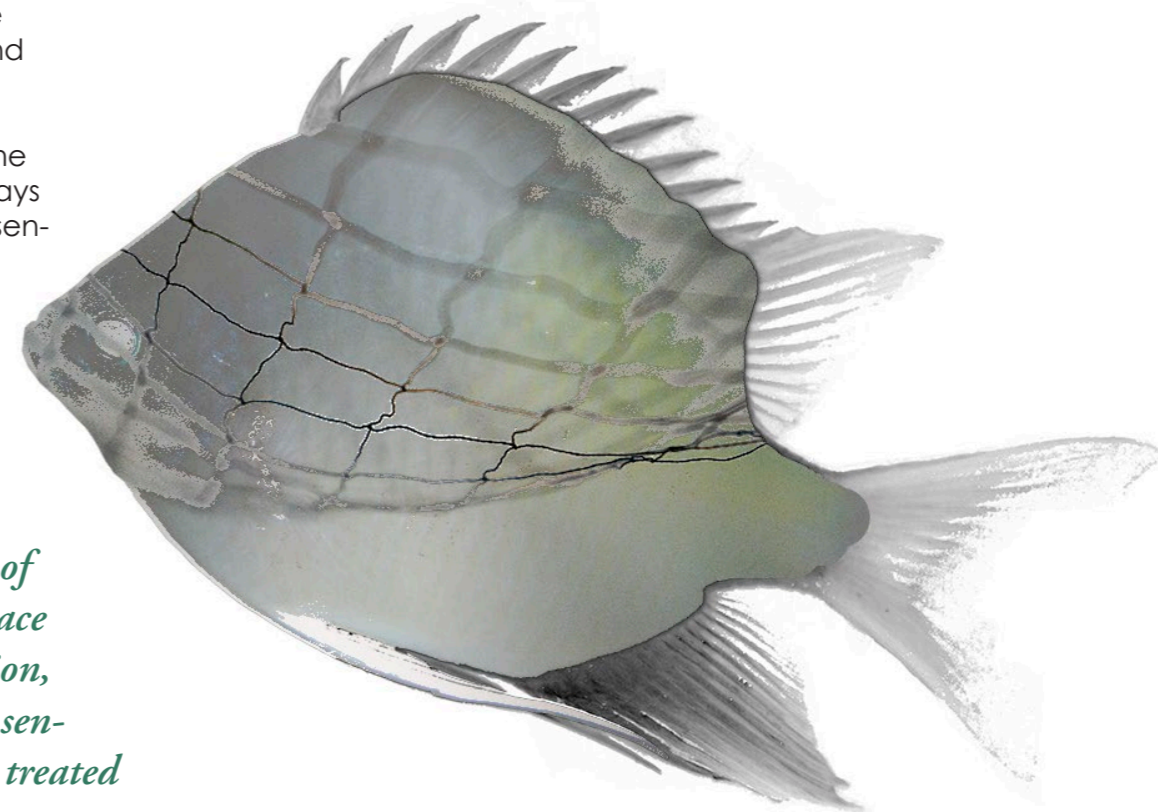
A Matter of Sentience

Veterinarians observe pain

In contrast, veterinarians are fully aware that fish feel pain through direct experience in treating and performing surgery upon them daily. They systematically use pain relieving drugs and consider that the pain system in fish is virtually the same as in birds and mammals.

Industry lobby at work

It is now a matter of record that industry will use science to support a political platform for favoured and often paid researchers to influence public opinion and its perception of the science. This was done successfully for decades by the tobacco industry in its efforts to influence public thinking about the effects of smoking, and the oil industry to discredit the findings of global warming.⁴ Such denialism has been ana-



lysed in several social science studies as forms of pseudoscience.

Sneddon and her colleagues have made it clear that the fishing industry is doing the same thing. Indeed, the fishing industry is a multi-billion dollar power that has taken control of both the wild fish populations, and the way these animals are viewed by the public. Like the tobacco and oil industries, the fisheries industry is actually creating uncertainty and doubt where none exists, using rhetoric, cherry-picked ideas from the literature, incorrect facts and personal opinions to reach conclusions that always favour fishermen.

Scientific truth

But the establishment of scientific truth should be independent from the interests of industry. If fish feel pain, that should be accepted as part of the truth about the world in which we live.

Sneddon writes: "As humane, ethical, educated beings, we must minimise any negative situation into which animals may be placed, and seek to reduce any damage that is likely to lead to some sensation of a negative welfare state in the interests of building a moral society. To deliberately cause injury and suffering is unethical, and as moral beings, we have a duty of care to the animals

that we place in the completely unnatural environment of fishing equipment."

Sneddon and other researchers have published guidelines for handling fish to minimize their suffering, for concerned fishermen. However, with industry muddying the waters, this valuable information is not being recognised.

Shameful reality of fishing

It is now known that, in spite of all of its pomposity, the fisheries industry is responsible for much of the destruction of the aquatic ecosystems around the world. Whatever measures fisheries authorities have taken to conserve their target species have failed.

Forty-three percent of fish species are considered in danger of extinction. Ninety million tons of wild fish are taken globally through fishing, and half is fished by only one percent of fishing

The establishment of scientific truth should be independent from the interests of industry. If fish feel pain that should be accepted as part of the truth about the world in which we live.

boats—the factory ships. Some trawling nets measure 40km in length and drag the sea floor to a depth of three kilometres. Trawlers rake the continental shelves entirely every few years, destroying the ecosystems upon the sea floor. Many fishing methods take the whole wild community and throw away all but one or two

of the species so that 80 percent of the living things that were killed are wasted.

Ninety percent of the biomass of the predators has disappeared and 80 percent of global fish stocks have been declared over-exploited or fully exploited.

The Atlantic bluefin tuna is on the verge of extinction, yet is still fished legally in the Mediterranean. A top quality tuna can be sold for 500,000 Euros. Solely because of its commercial value, this species will be extinct within a few years.

Fish are the only wild animals commercially taken to supply the world market, and given the over-population of humans, it is self-evident that it is ecologically unsound to expect a wild ecosystem to feed us all. In the case of large-scale and middle-scale fishing, the wild fish taken mostly supply the industrialized nations, where people are already eating too much protein, and would buy something else if fish were not available. Fish are also devalued by use in pet food, fish farming and fertilizer.

Small-scale fishermen, on the other hand, need the fish to fill their protein requirements, but large- and middle-scale fisheries have driven millions of traditional fishers, often among the poorest people on earth, to hunger, both by taking all the fish, and by driving up the local prices to export levels.

Given the current ecological oceanic crisis, deep-sea fishing should be stopped permanently, gov-



ernments should stop subsidizing industrial fishing, and small-scale fishing only should be allowed.

More MPAs needed

More key regions should be set aside as Marine Protected Areas (MPAs) where fish populations can recover and eventually replenish the surrounding areas.

As divers, we appreciate how the intricate community of interlacing species, which we find on our underwater excursions, is nothing like the one on land. It is clear to see that fish and their companions, the invertebrates, are very different from the

low, cold creatures with binary brains, which have always been described based on fishermen's tales. So, the increasing popularity of recreational diving is important because it provides another point of view to contrast the one expressed so often by fishermen.

It is curious to see how many people continue to wax expansive when describing their efforts to outwit fish. They do not seem to see the irony in claiming that fish are too simple-minded to feel pain, while being proud of their ability to outwit them. ■

It is ecologically unsound to expect a wild ecosystem to feed us all.

NOTES AND REFERENCES

1. The fish sentience denial co-authors: Robert Arlinghaus, Howard Browman, Steven Cooke, Don Stevens, Ben Diggles, Brian Key, Alexander Schwab, Anne Berit Skiffesvik, and Craig Watson.
2. Coauthors: Javier Lopez-Luna, also of the University of Liverpool, UK; Culum Brown of Macquarie University, Australia; David C.C. Wolfenden of the Blue Planet Aquarium, UK; Matthew C. Leach of Newcastle University, UK; Ana M. Valentim of the University of Porto, Portugal; Peter J. Steenbergen, European Molecular Biology Laboratory Heidelberg, Germany; Nabila Bardine, Holistic Life Coach, Heidelberg, Germany; Amanda D. Currie of Macalester College, USA; Donald M. Broom of the University of Cambridge, UK.
3. Coauthors: Felicity A. Huntingford, Toby G. Knowles, and Simon Mackenzie
4. The tobacco industry link: <http://www.ncbi.nlm.nih.gov/pubmed/12791525> <https://www.ncbi.nlm.nih.gov/pubmed/15313097> The oil industry link: <http://www.okepsc.org/sites/default/files/u6/Dunlap%20%26%20McCrigh%20Routledge%20HB%2C%202010.pdf>



Text by Mike Ange

In my previous two articles, I discussed the importance of building a comfort zone and improving the diver's ability to anticipate problems. As divers' skills continue to develop, they will venture into deeper water and perhaps more hazardous conditions. The more variables introduced into any given dive, the more likely it is that divers will encounter an unanticipated problem. Extended bottom time and deeper depths also increase these probabilities. This article will discuss methods of building a safer and more comfortable diver at the more advanced levels by preventing the diver from anticipating issues before they occur. While this may sound contradictory to the earlier articles in this series, in reality, it is taking those skills to the next level.



Transferring Anticipation Skills to **Problem Resolution**

ANDREY BIZYUKIN

Scripts

Perhaps the largest safety issue in training diver responses is the use of a script, which is shared with the diver for training, especially when no off-script reinforcement is completed. By the time a diver reaches advanced or rescue training, he or she should have spent significant time

learning to deal with out-of-air emergencies, buddy out-of-air emergencies, flooded mask, free-flowing regulators and other commonly encountered issues. However, for the vast majority of students, these are panned scenarios.

"Hover just off the bottom and I will swim up to signal that I am out of air."

Every experienced instructor has done these drills a million times. In fact, many instructors have done the drills so many times that even they are ill-equipped to deal with the real-world scenarios that occur. At the risk of stating the obvious, real-world issues rarely arrive with warning or use a ready-made script. The student

diver sucks in, gets nothing to breathe and is on you for air in a split second, or worse, off to the surface in a death-defying sprint, which may not defy death.

Adding realism

So, adding some realism to your training protocol also requires adding spontane-





ANDREY BIZYUKIN

ity, distraction and surprise. This is not as hard as it seems, but it can be dangerous for instructor and student if not well-controlled. For recreational divers, I recommend building these skills in 1 to 1.5m of water, never deeper. With this hard bottom control factor, the worst case is that the diver simply stands up and the lungs will generally be pressurized to no more than 0.8 to 1m of water depth or 1.2 to 1.45 psi gauge (pressure above surface).

Historically, I began adding the "respect for the unexpected" at the open water level. Most agencies require that divers experience an out-of-air situation. Frequently, this is completed by having the diver kneel in 1m of water; the

instructor then turns off the air; and the diver watches his pressure gauge fall before either standing up or reaching back and turning his or her own air back on.

As a follow-up, to introduce the idea of the unexpected, brief your divers that in the next out-of-air drill, they will swim to their dive buddies, keeping their regulators firmly in place and exhaling continuously. When they reach their dive buddies, they are to signal out-of-air, secure the alternative air source, clear it by taking four to five breaths, and then stand up slowly. After standing, have the divers orally inflate their BCDs to create and improve muscle memory.

Position the divers in a sort of

spoke-and-wheel configuration, so that the divers who will be out of air are kneeling very close together and facing toward their dive buddies. The buddies should be 5m or so away and spread out a bit so the configuration forms a semi-circle, and all of the divers should be kneeling in no more than 1 to 1.5m of water.

The instructor will randomly select a diver and gently turn off the air. The idea is to prevent the divers from knowing which diver will be out of air next. This works best if you have three to four buddy teams participating in the skill at the same time. When the diver detects he or she is out of air and begins the mad dash to the dive buddy, the instructor should move

with the diver and remain in a position to prevent a breath hold and be ready to turn on the air if necessary. After the diver successfully commences sharing air, move back for the next diver.

At the advanced level, complete this same skill, but to further enhance the effect, have the divers assemble an underwater puzzle, or do something similar, to provide a distraction while completing the drill. It is critical that you limit the depth for this skill and maintain close contact with your diver during this drill.

Risk level in drills

It is difficult to complete true out-of-air drills without introducing an unacceptable level of risk.

Problem Resolution

Over the years, many different methods have been tried, such as using submersible pressure gauges (SPGs) that do not read accurately or using minimum fills in cylinders to create an out-of-air situation. NONE of these are recommended, because the out-of-air situation in these scenarios cannot be anticipated by the instructor, allowing him or her to be in a position to prevent diver injury.

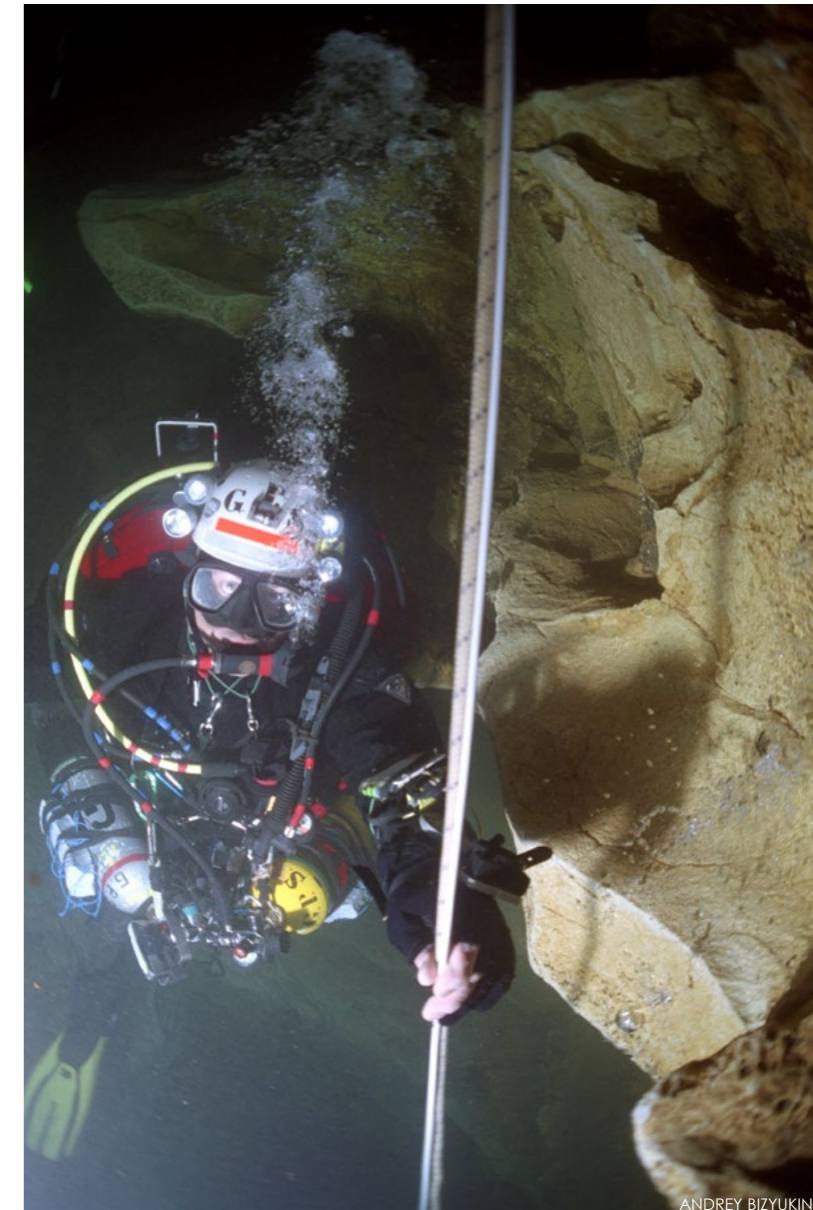
However, beginning at the advanced diver level, I do make it a habit of surprising my student divers with urgent requests to share air, and I continue that process all the way through the most advanced instructor classes that I teach. In the words of one technical instructor candidate, "Once a set of twins barrels at you at light speed, trying to drag the regulator from your lips that first time, your whole perspective and outlook on life changes. It makes you suddenly mortal—I don't care how many dives you have."

Unexpected entanglement

In public safety and cavern training courses, another drill used frequently by instructors is unexpected entanglement. This skill can also be intro-

duced at the rescue diver level. In the typical scenario, the divers are asked to follow a navigation line while wearing a mask that either limits or completely restricts vision. Lenses coated with petroleum jelly will distort the view and simple cloth covers, or duct tape, can be used to completely restrict vision. (Safety note: If these skills are completed in open water, then covers that can be quickly and easily removed are required for safety).

As the diver swims along the navigation route, the instructor will



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opinion

use either the primary guideline, or another line on a reel, to create entanglements. In the cave- and wreck-training world, it is typical to use this drill to drive home the importance of equipment rigging and streamlining. Dangling gear easily becomes entangled gear (with just a little help from

the instructor)—hence, the frequently heard term in cave and cavern classes: “Every dangle is a tangle.”

In overhead environment courses, cutting the line is a true risk to safety due to the potential “spring back” of stretched line, the resulting loss of the line and therefore the loss of the pathway to exit. So, divers are encouraged to reduce entanglements without cutting. The process of working out of an entanglement reinforces problem-resolution skills and improves panic resistance in divers.

As with all of these skills, safety concerns are paramount. Restricting a diver's movement and navigation ability underwater is a risk that must be managed. The instructor should only use lines that are the size equivalency of a cave or wreck reel line (#24 or #36 braided). A sharp and well-maintained line cutter, or a pair of shears—not a knife—must be readily available to the instructor. You should also use a sacrificial reel, so there is no hesitation in cutting if necessary.

Blind trust

Perhaps the second most deadly trend we see in diving today is the reliance on technology, especially blind trust. The truth is that modern diving equipment rarely ever fails, statistically. However, it is truly a bad day for your friends

and family when the tiny statistic becomes a major tragedy, because you are not equipped to respond.

We see this failure most commonly in forms of diving that use advanced technology like closed-circuit rebreathers (CCRs). This is not surprising as the newer technology is more complicated, has more failure points, requires more training for sufficient responses, and finally, due to the fact that reactions are not merely reflexive, they require a higher level of situational awareness.

Whether you are diving standard tried-and-true open circuit gear at 20m or doing 100m helium diluent dives on a CCR, you must add practice for malfunctions to your training regimen if you want to be as safe as possible. Most divers have never practiced for malfunctions like blown hoses or blown O-rings, and few continue to practice those failures covered in initial training, like free-flowing regulators. Not only should responses to these issues be practiced, they should be practiced with as much spontaneity as possible—which can be accomplished by employing a good dive buddy at a shallow-



water dive site, but more on this in a bit.

The more complex the dive type, the more difficult it is to train divers for responses. It is horribly dangerous to assume an open circuit technical diver, even with thousands of dives, can immediately move seamlessly to a CCR, and unfortunately, industry accident statistics clearly show a number of failures where this has been attempted.

In these more complex dives, responses will frequently require multiple steps. An out-of-air situation at 20m requires one to reach one's buddy, share gas and complete a controlled ascent. With a decompression obligation at 50m, this process becomes much more complicated.

Response time

We used to teach a technical diving rule which states that every atmosphere below five cuts the time to respond in half and adds 50 percent to the complications in responding. This rule is obviously stating the impossible, but the underlying concept is well established.

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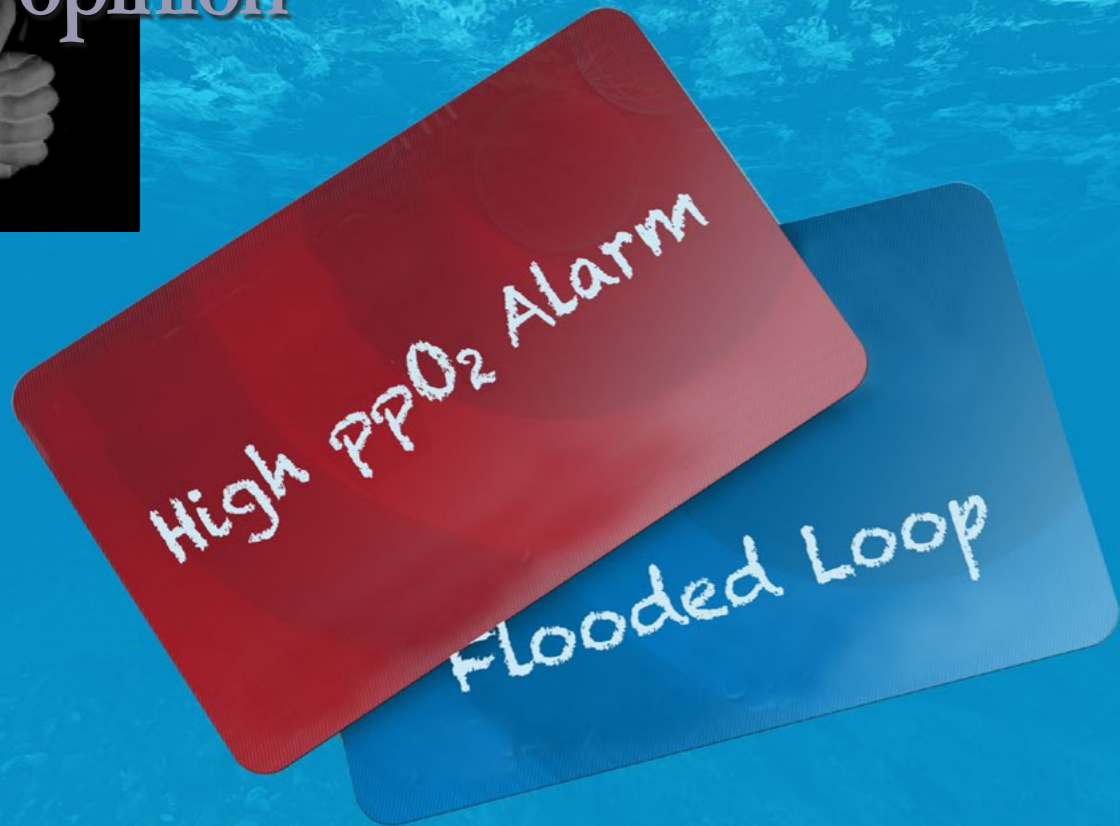
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I teach my advanced technical divers to have two types of response—an immediate reaction (muscle memory) and a rationale checklist response. The immediate response is to get good gas to breathe. Every technical diver should have a bail-out source that is safe to breathe at every phase of the dive (in some limited cases, this could be a buddy's gas), and once the diver is on the gas, he or she has time to deal with other issues. Divers may only have 15 seconds or so before blacking out due to "bad" gas in a CCR or a cylinder, so this step is critical.

Checklists

The second phase—AFTER the diver has gas to breathe—may include a checklist. For CCRs, it may look something like: Signal my buddy, loop purge, O₂ pressure, diluent pressure, etc. For an entangled cave diver: Signal buddy, gas pressure check, slow

controlled breathing, move each part of the body slowly to determine what's entangled, think about how to reach the entanglement without exacerbating the problem, etc.

These checklists should be written down—even though you cannot carry all of them on a dive—because the process of writing and refining the checklist builds memory retention and forces the diver to think about the efficacy and order of each step. I have long encouraged my technical, military and public safety dive students to do "dirt dives" with problem simulations.

Anyone who dives frequently at popular cave diving sites has probably seen cavern students with towels or blindfolds around their heads doing line drill "dirt dives." These drills are complete with added problem resolution, after action reports (i.e. what went wrong, what went well, how

do we improve, etc.) and checklist test.

When a problem is "encountered," work the checklist. Does it let you live to dive another day? If not, modify the checklist.

I encourage my students to do visualization exercises as an extension of the dirt dives. These are essentially mind dives, and if you complete them over dinner with your dive buddy, you have the added benefit of being able to test each other on your checklist.

Flash cards

Take this process diving. Nearly two decades ago, when I was a training director with the ITI group, we developed underwater flash cards that simulated CCR failures during the course of a dive. The card would simply say something like high ppO₂ alarm or flooded loop. The instructor would use these from the beginning of training to teach divers how to run

Underwater flashcards simulating CCR failures during a dive are used by instructors from the beginning of training to teach divers how to go through gear failure drills in a controlled way.

through gear failure drills in a controlled manner.

Better instructors would continue to use the cards throughout the course to throw surprises at the divers when they least expected it. Imagine swimming through the cave in your cave CCR class when over your shoulder appears a high ppO₂ alarm card—will you purge the loop? Bail out to open circuit? Or, as many divers do the first few times, freeze in indecision?

Primary takeaway

Here is the primary takeaway from this series of articles: As an instructor, I consider indecisiveness a threat to every diver's safety and what I must ferret out of my students at all cost. From the most basic level to the most advanced,

I tell my divers: "Do something and make every step of that something a slight improvement of your situation." In this manner, and only in this manner, do you improve your probability of surviving a dive gone bad.

All of the drills and conceptual ideas in this series of articles have been oriented toward the goal of determining what makes my situation better through the building of a better conceptual understanding of what must be done to solve even an unknown and unanticipated problem. With that well-ingrained understanding, every diver is more likely to "do something" and therefore survive, even when a good dive goes horribly wrong. As an added benefit, this process improves the diver's

Problem Resolution

risk benefit analysis process and may serve to prevent an accident before the diver ever enters the water.

Panic is the primary killer of divers and perhaps, depending on the source you reference, swimmers too. Unfortunately, panic is not always the screaming, thrashing fight that we all think of when we hear the word. It is frequently silent and frozen, doing nothing as life quietly slips away. Either way, if you can break the cycle of panic, you increase your odds of survival.

Anticipate the unexpected, improve your understanding of both why and how things work underwater, and practice responding to every conceivable failure—and you have a good start. ■

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Barotrauma	44%
Decompression Sickness	28%
Marine Envenomation	9%
Other	9%
Motion Sickness	2%
Non-Fatal Drowning	2%
Pulmonary Edema - IPE	2%
Fatality	2%
Arterial Gas Embolism (AGE)	2%

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Randall Arauz: The War for Sharks

Text by Ila France Porcher

Biologist Randall Arauz has worked for nearly 30 years for the protection of the marine life off the shores of Central America and his native Costa Rica.



PHOTO COURTESY OF RANDALL ARAUZ

In 1997, sea turtles were highly endangered by the rampant international trade in their parts and as part of his effort to protect them, Arauz founded the Association for the Restoration of Sea Turtles (PRETOMA). The organisation soon captured footage of high numbers of sharks being finned and filmed a Taiwanese vessel bearing 30 tons of fins at a private dock under the cover of night. The electrifying footage stirred Costa Ricans and the international community, and jump-started Arauz's war to put an end to the shark fin trade in his beleaguered nation.

The shark fin racket began in the 1970s as a result of increasing demand by the rapidly-growing, wealthy Asian countries, called *tiger economies*. By the 1990s, Costa Rica had become one of the world's most prominent locations for the slaughter of sharks.

It was during those years that the shark highway up the western coast of Central and North America was being fished out. Costa Rica, ideally placed as a rallying point for the Taiwanese mafia, became a major cargo-unloading point for international factory fishing and shark finning fleets. Rob Stewart's film *Sharkwater*, documented an incident that revealed the depth of the problem in the country, which also has a huge long-line fleet of its own.

Arauz, who was voted one of the planet's 100 Angels in 2003 for his work for nature, has been an Angel at war ever

since as he used every means at his disposal to try to gain protection for sharks. He alerted Costa Ricans to the slaughter that was ongoing in their waters, filed lawsuits against the government, and organised educational campaigns, petitions and collaboration with international shark conservation organisations.

In 2010, he was awarded the Goldman Environmental Prize for leading the campaign to halt shark finning in Costa Rica, making his country a leader in shark protection. He was also awarded the Gothenburg Award for Sustainable Development. That same year, he founded the Rescue Center for Endangered Marine Species (CREMA), a Costa Rican NGO with the goal of "halting the extinction of highly migratory species in the eastern tropical Pacific."

But Costa Rica has not been consistent in its efforts to protect sharks. Though the nation has an international reputation of being environmentally conscious, the shark finning market yields profits nearly as high as that of the illegal drug trade, and the current government puts commercial interest first and will not protect

Finned hammerhead shark (left); The "fins attached" requirement in Costa Rica, which says that a shark's fins must stay attached to the animal, resulted in fishermen bringing in the fins attached to just the spine (below); Shark fin identification chart (center); Randall Arauz (bottom right) is pressuring the Costa Rican Fisheries and Aquaculture Institute to publicly destroy fins.



PHOTO COURTESY OF RANDALL ARAUZ



PHOTO COURTESY OF RANDALL ARAUZ

Laura Chinchilla, led the international campaign to have three species of hammerhead sharks listed in Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). In a celebrated move that

made Costa Rica a global leader in marine conservation, it banned the export of hammerhead sharks and their parts.

However, there was a change in government and the gains that had been made were overturned. Costa Rica's support for listing more species of sharks in CITES ended, and it refused to support proposals to grant Appendix II listings for silky and thresher sharks. Furthermore, the administration under the former president, Luis Guillermo Solís, permitted the shark fin industry to continue fishing for hammerhead sharks without restrictions. Ten tons of endangered hammerhead shark fins are now stockpiled in the port city of Puntarenas, and are awaiting export when the ban is lifted.

Arauz states that fins taken during an export ban should always be illegal to export and is pressuring the Costa Rican Institute for Fisheries and Aquaculture (INCOPECA) to publicly destroy the fins. A petition supporting this may be found at this link: <https://www.change.org/p/costa-rica-don-t-export-that-stockpile-of-hammerhead-shark-fins>.

According to CITES, a positive "non-detrimental finding" is needed before the fins can be exported, and two inde-

any shark species that bring in a profit. Nor will it enforce the laws already in place to protect the marine environment, but permits the use of a variety of loopholes that serve to enable the shark finning racket.

Hammerhead duplicity

In 2013, Arauz, working with President



PHOTO COURTESY OF RANDALL ARAUZ

profile

Divers with hammerhead shark



pendent scientific studies have confirmed that it will be detrimental to the hammerhead shark to resume the exportation of its parts. Thus, it remains illegal to export the fins. But the authorities continue to allow fishermen to catch them, land the sharks and stockpile the fins while working on getting the non-detrimental finding changed in such a way that it will be retroactive. Then, the fins may be exported in spite of being taken at a time when their export was illegal.

The situation violates the CITES listing which was intended to protect an endangered species. The problem is that while the Appendix II listing bans export, it still permits the

endangered species to be caught and killed.

Arauz explained, "The bottom line is that working as hard and as extensively as we have been here in Costa Rica, we have not had an impact on hammerhead shark mortality." He explained that sharks are the main target of Costa Rican fisheries, and with the price of fins as high as it is, a variety of loopholes are exploited to profit from them.

For example, the "fins attached" requirement, which specifies that a shark's fins must remain attached to the animal, resulted in fishermen bringing in the fins attached to just the spine. In other cases, fisheries licenced for other

species may still bring in sharks and declare them as incidental catch. The mahi mahi season, for example, only lasts for four or five months, yet a mahi mahi fishery catches sharks all year around and claims them to be "incidental." But when sharks comprise 80 or 90 percent of the catch, it is actually a shark-targeted fishery posing as a mahi mahi fishery.

Arauz is working for more protection for hammerhead sharks since they are already listed on CITES and are banned from international commerce. He has launched a court case concerning the stockpiling of their fins and is trying to get a court order to ban the landing of hammerhead

sharks.

But he has become disappointed with the whole CITES approach, which requires each species to be listed separately, while the shark finning fleets take them all. Furthermore, his efforts are now being fought by the Food and Agriculture Organization of the United Nations (FAO), which opposes such listings. Though an Appendix II listing provides very little protection to a species, even that is extremely difficult to get. The FAO is a huge power to fight.

Small-scale fisheries


Costa Rican small-scale fisheries support thousands of Costa Rican families who depend upon the health of its coastal waters. These fishers still remember how good the fishing was in the 1980s, and report that now, in spite of a much

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Silky shark (left and bottom right); Arauz (below) has been working on getting the protected area around Cocos Island National Park enlarged to a rectangular area of 4,000 sq mi.

Ending long-line fishing

There is currently an initiative from the Inter-American Tropical Tuna Commission's (IATTC) Scientific Committee that recommends a long-line closure in the eastern Pacific Ocean for three months. Based on his own published study of long-lining, Arauz found that a six-month closure is needed, but was glad to accept three months. But the closure has been discussed at meetings for three years in a row, and Costa Rica always blocks it.

"Imagine," Arauz said, "a three-month closure of all long-line fishing in

degree of protection and Arauz has a lot of support from the people of El Salvador and Guatemala where he and his colleagues have been going for years to do sea turtle work and train activists. But they have not been able to have any effect on putting policies in place. "It's really tough in those countries," he said.

Cocos Island's birthday

Cocos Island National Park, which is also recognised as a United Nations World Heritage Site, turned 40 years old on 22 June. The island has a 12-mile no-take zone around it, and for the last four years,

Arauz has been working on getting the protected area enlarged to a rectangular area of 4,000 square miles. He and his colleagues have been negotiating how to protect it and working with the fishermen, with the intention of having it included in the park to increase its area of protection. Other nations that have been hard hit by the shark fin racket—including Brazil, Easter Island and the Galapagos—are working on establishing and increas-

ing their marine protected areas (MPAs); it is the next step to take.

"What I want to see is fewer dead sharks," Arauz said, as he described this new campaign. "Let's take areas away from the fishermen."

Arauz wants total protection from international commerce for sharks and their parts, and to find a way to reduce the power and extent of fisheries. It is well known that factory fishing not only takes away the fish on which the small-scale fisher depends, but also drives up the price to export prices, so that the local people lose out in two ways.

In the meantime, he continues to fight for sharks, to try to get more species listed by CITES, and to make the CITES regulations work. For now, they are the only tool he has. Arauz remembers that, like sharks, sea turtles were once threatened, but were brought back from extinction's horizon through global conservation efforts and an international ban on their trade. He still dreams of such protection for sharks. And perhaps through the sheer power of his efforts and influence, and in spite of all corruption and opposition, the deadly trade in shark fins will finally be repulsed from the shores of Costa Rica and forced into retreat. ■



PHOTO COURTESY OF RANDALL ARAUZ

greater investment of effort, they can scarcely make ends meet.

The depletion of fish stocks is partly responsible for the large consumption of sharks for meat all over Central America, which began in the '80s. Before then, in Costa Rica and other South American countries, sharks were considered a bad type of fish and they were not targeted—no one ate shark. But under the influence of the shark fin trade, all that changed. Now, Costa Ricans alone are consuming about 2,000 tons of shark meat a year.

Arauz did a study to determine how much the long-line fishery had declined and found that not only had the mahi mahi fishery declined but so have the numbers of silky sharks, which is the one mostly caught by local fishers.

To help restore the health of the coastal waters, Arauz filed a lawsuit against the shrimp trawling industry, which was responsible for much of the destruction. Trawlers are fishing vessels that drag a weighted net over the bottom and effectively destroy the intricate and delicate habitat of the sea floor. The trawlers invade hammerhead nurseries and the pupping grounds of rays and silky sharks.

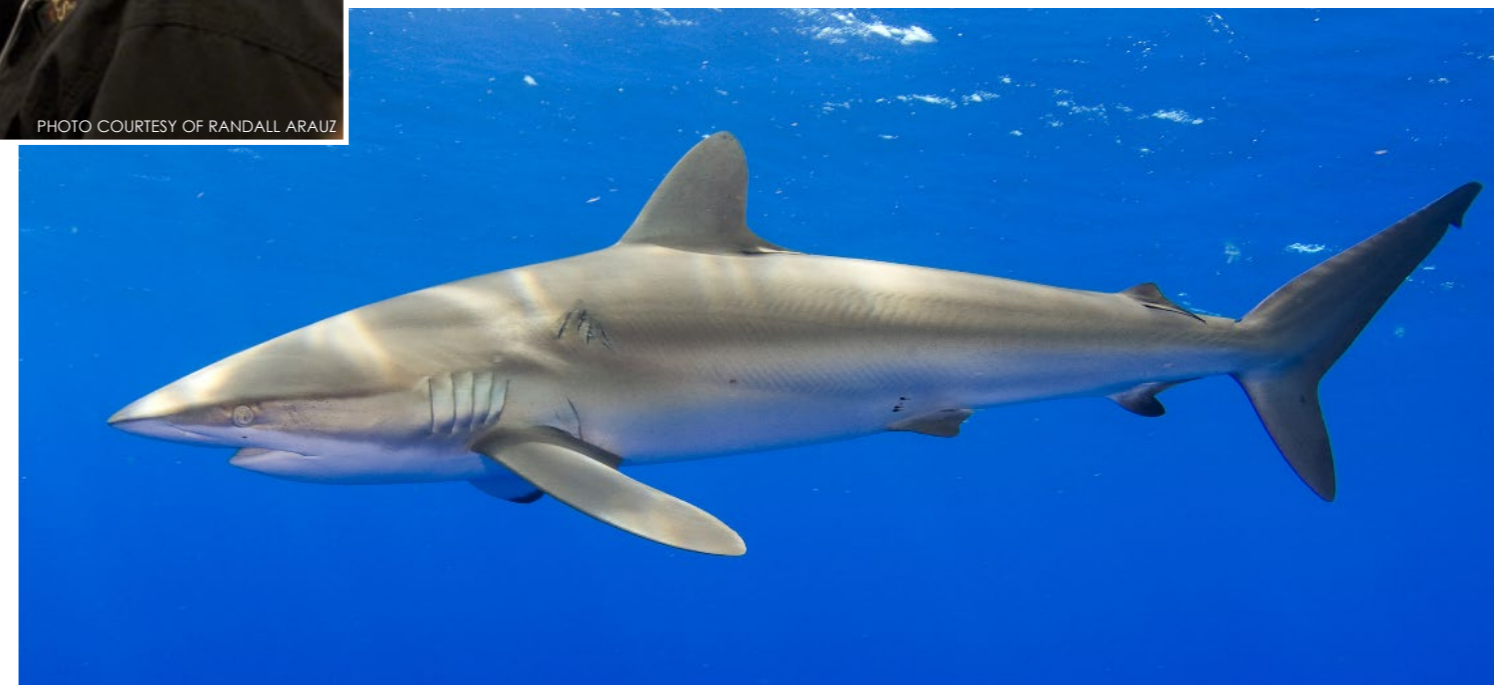
Shrimp trawling banned

The lawsuit succeeded and shrimp trawling was banned. The problem with the commons, Arauz explained, is that it is everybody's and nobody's. Though Costa Rican fishermen understood the need to protect the reef, as long as the shrimp trawlers were coming through and killing everything no matter what they did, they were reluctant to cooperate in protecting it. Now that shrimp trawling has been stopped, progress is being made through helping the fishers to protect their reef.

But now, the FAO is supporting the Costa Rican government in an effort to get shrimp trawling restarted, and Arauz has had to fight them for the past three years. The FAO has actually begun funding the Costa Rican government to do studies to try to make shrimp trawling sustainable.

the eastern tropical Pacific. Imagine everything that would be saved." Costa Rica got a new president in May and Arauz hopes that he will help this to come about. He will be meeting with the IATTC again, hoping to find a way to make the long-lining closure a reality.

Many sharks travel widely, including in adjacent countries where they are not protected. Panama has some



shark tales



Spurdog in Loch Etive, located near Oban on the west coast of Scotland

Text by Lawson Wood
Photos Shane Wasik

Over a number of years, the actions of fishermen and sea anglers have attracted the attention of marine scientists at the Dunstaffnage Marine Laboratory who quickly became aware of these fishers catching spur-dogs in the Loch Etive area near Oban on the west coast of Scotland. These small sharks were always on a catch-and-release scheme, and the researchers thought that this little British shark deserved a bit more interest in order to discover what they were up to, trying to learn more about their habitat and habits, and why Loch Etive was so important to the Scottish population of these fascinating sharks.

Glen Coe and Glen Etive cradle Loch Etive all the way to the western shores of Scotland and was used as a through-road by our ancestors. Indeed, much of the

valley can still only be reached on foot, but there is a small and rarely-used road that runs most of the way down Glen Etive to the old pier at the head of the

loch (the pier was once used as a stopping-off point by a small ferry, where passengers would disembark to a horse and carriage to explore Glen Coe).

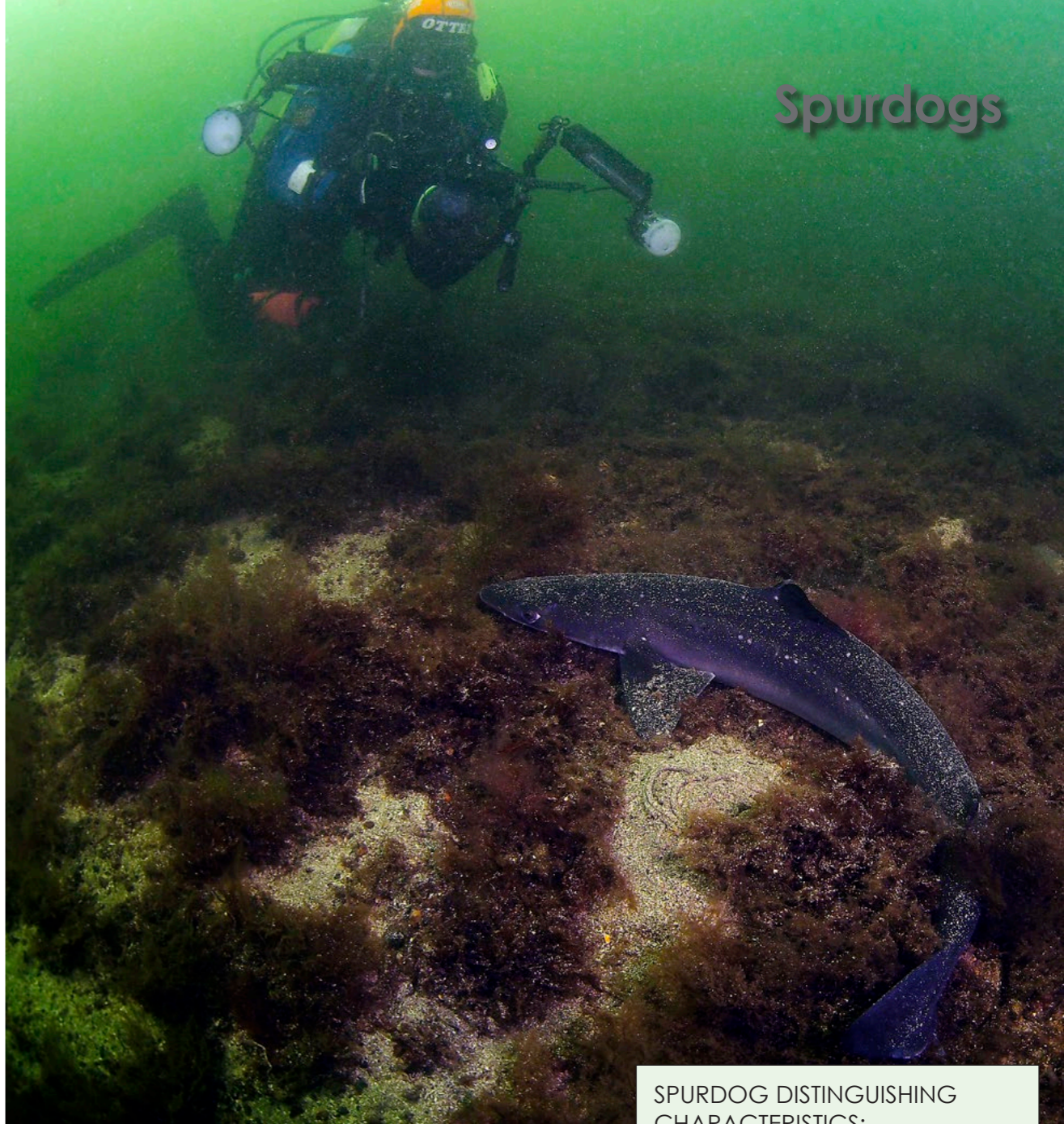
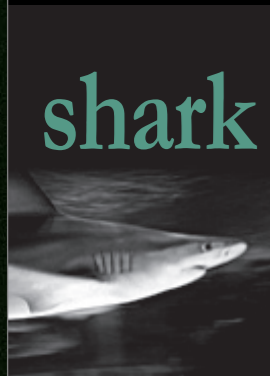
This sea loch is one of the most picturesque sea lochs on the west coast of Scotland and is around 27km (17miles) long, starting at the ancient ruined pier and joining

the Firth of Lorn where its dramatic entrance and exit to the open sea at Connel is framed by the incredible Connel Bridge overtopping the dramatic Falls of Lora. There



The Loch Etive **Spurdogs** *of Scotland*





Spurdogs

The spurdog has small white spots along the lateral line (left); Diver with spurdog resting on sea loch floor (right)

SPURDOG DISTINGUISHING CHARACTERISTICS:

1. Dorsal fins are both preceded by a single spine.
2. The first dorsal fin is obviously larger than second dorsal fin.
3. The anal fin is absent.
4. Its body is dotted with small white spots, mainly along the lateral line.

er a distinctive migration pattern linked to breeding behaviour in and out of the loch. As the plankton growth increases in

are three deep basins in the sea loch, with depths reaching around 150m (490ft); but for the most part, it is a typical west coast sea loch with steep muddy slopes, interspaced with small islands surrounded by mudflats.

About the shark

The spurdog (*Squalus acanthias*) is a small species of shark found in a number of temperate locations around the world. *Squalus acanthias* has several

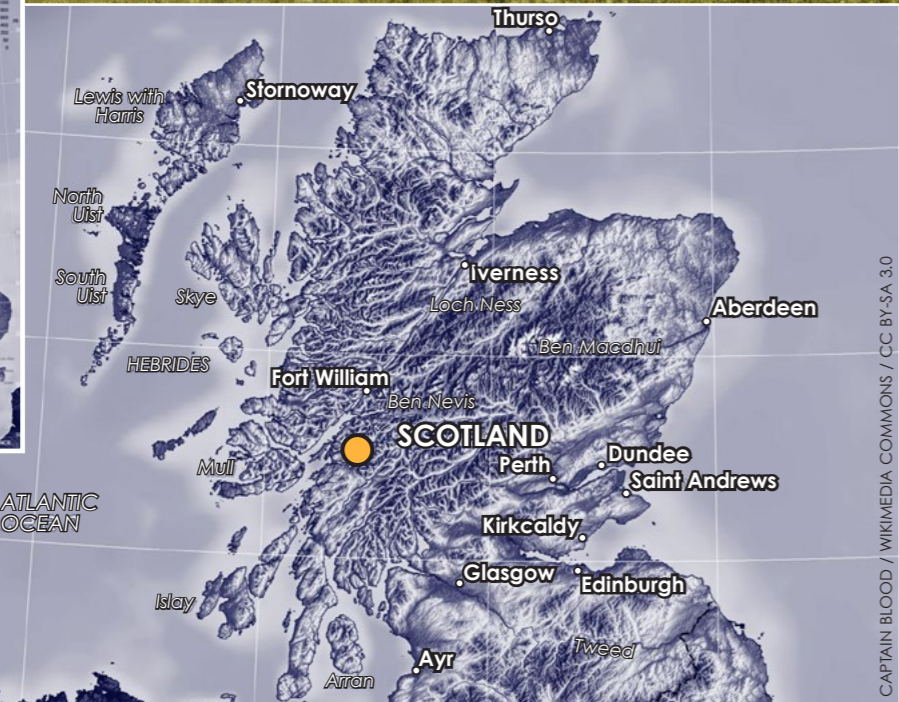
common names such as spurdog, spiny dogfish, piked dogfish, spotted dogfish, rock salmon and white-spotted dogfish. It is considered "Vulnerable" by the International Union for Conservation of Nature (IUCN) due to the fact that the species is prone to migrate in large numbers, and entire schools of them can be caught in one cast of the net by commercial fishing fleets. This small shark can grow to around 2m (6.5ft), but is more commonly around

1m (3.25ft) long. It is found in coastal waters, often close to the surface at night but can also be found as deep as 200m (660ft). The sharks are more commonly spotted on or near the seabed and are regarded as scavengers, as they are often attracted to oily-smelling and dead fish.

Researchers discovered that there was a resident population of spurdogs in Loch Etive, and after capturing and tagging a few, they were able to discover



Location of Loch Etive in Argyll and Bute on map of Scotland (right) and United Kingdom (above)



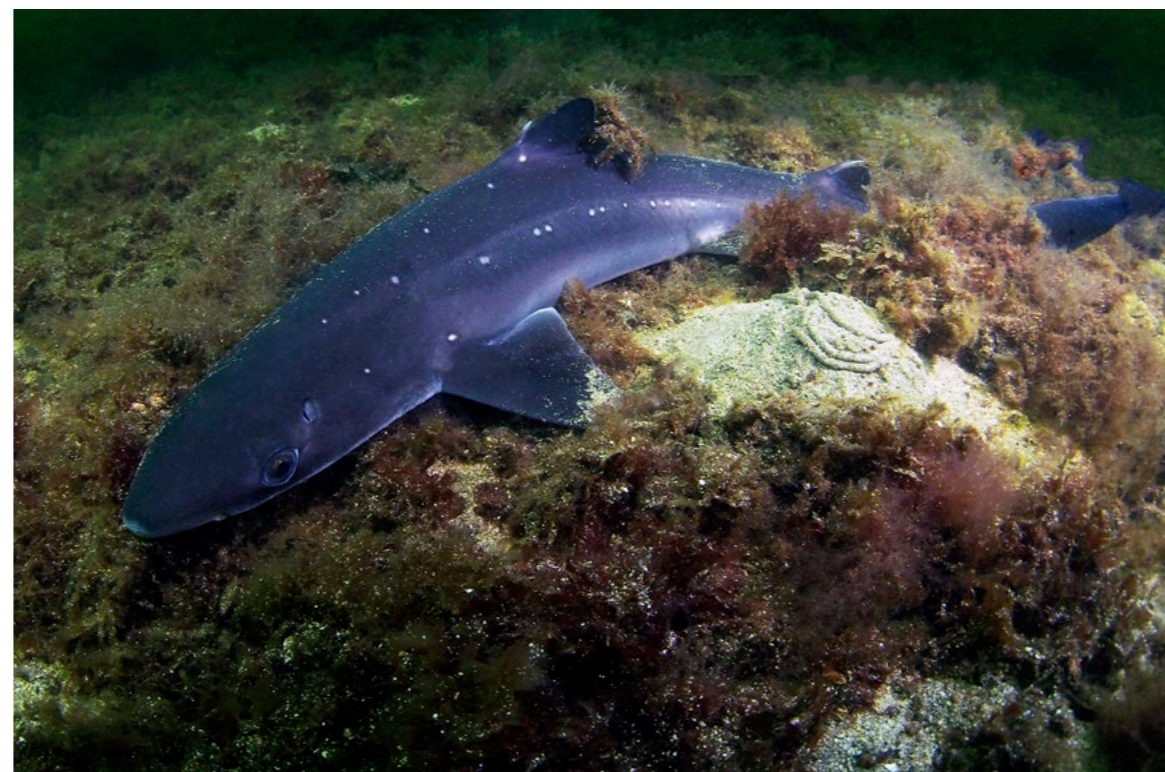
CAPTAIN BLOOD / WIKIMEDIA COMMONS / CC BY-SA 3.0



the spring and autumn, there are more movements, and tagged sharks have been discovered to travel a fair distance. It appears that they stick quite close to their respective areas of site association, possibly to breed. Spurdogs are found in the Mediterranean too, but again, these populations appear to stay within easy distance of their home zone.

Research collaboration

Shane Wasik of Basking Shark Scotland was aware of the work being done at the Marine Lab in Dunstaffnage as Basking Shark Scotland is at the forefront of the research done on basking sharks found in huge congregations on the west coast of Scotland. Shane asked the researchers how they could help and if they could be involved in the research programme. Currently, sharks were only being caught by



Spurdogs' migration patterns are linked to breeding behaviour in and out of Loch Etive

Spurdogs

THE FALLS OF LORA:

The Falls of Lora are a tidal race created where a narrow hard stone sill comes to just below the water's surface and the strength of the tide actually creates a type of waterfall as the tide level in the Firth of Lorn drops below that in Loch Etive, creating a waterfall. Similarly, on an incoming tide, when the tide level is greater on the outside of the rocky ledge at Connel, there is a massive waterfall into Loch Etive where thousands of tons of water infused with plankton are funnelled into the loch and its inhabitants.

NAME: Loch Etive, Argyll and Bute (PA35 1JT)

PLACE TYPE: Tidal Water

LOCATION: Grid Ref: NN 0697 3875
 • X/Y co-ords: 206975, 738750 • Lat/Long: 56.5011,-5.1377924

COUNTY/UNITARY AUTHORITY: Argyll and Bute

REGION: Scotland

COUNTRY: Scotland

HEIGHT: -1.2m

OS EXPLORER MAP: 377: Loch Etive & Glen Orchy

baited lines, to collect information on size, sex, characteristics, distinguishing marks, etc. Shane figured that by placing a baited basket near the seabed, it should also attract the small sharks; the first trials have proven to be very successful, as well as served as a gauge to see how diver and photographic observations could help to prepare a project plan to further any research on these curious little sharks.

Shane approached me and a fellow



CLOCKWISE FROM LEFT: Spurdog resting on sea loch floor; Connel Bridge, Loch Etive, Oban, Scotland; Lesser-spotted cat shark; Spots on the side of a spurdog can be seen in this lateral view; Thornback ray



an earlier trial had half a dozen of these zippy little sharks. However, we were treated to a huge array of west coast Scotland sea loch critters, including thornback rays (*Raja clavata*).

As there was an ebbing tide, it was thought that there would be a fair chance of the sharks having moved out of the sea loch into more open water in search of food, so a second location was chosen near the home base marina where the tide swept into a sheltered bay. The bait bag was duly lowered, and an hour later, we were treated to several sharks swimming around the bait or resting on the seabed. The scent of oily fish in the water also attracted lesser-spotted dogfish (or cat sharks), various rays, flounders and an army of spider crabs, hermit crabs and other small critters.

The sharks were very skittish and came close to the bait bag, making photography rather difficult, but those sharks that rested on the seabed were incredibly docile, allowing very close encounters, even to the point of getting extremely close to the subject. One of the sharks

had a small spider crab wandering across its back. Perhaps this was a kind of cleaning station for spurdogs.

Final thoughts

Undoubtedly, these are just early days for the endeavour, but the preliminary work carried out by Shane and head guide Luke Sadler of Basking Shark Scotland will lead to the next big—or little—shark

encounter to be enjoyed in British waters.

You may or may not agree with shark baiting for tourism and underwater photography, but shark baiting for science or tourism in many areas of the world is tried, tested and trusted, as well as very successful and beneficial to the econ-



omy, including blue shark encounters off the coast of Cornwall and basking sharks off the Isle of Coll; clearly this type of baiting was working for the Scottish spurdogs too! ■

For more information on this new and exciting venture, contact Shane Wasik at Basking Shark Scotland: BaskingSharkScotland.co.uk.

Lawson Wood is a widely published underwater photographer and author of many dive guides and books. For more information, visit: oceaneyefilms.co.uk.





Whale sharks prefer to stay put

Whale sharks feeding at three disparate sites in the Western Indian Ocean (Mozambique and Tanzania) and the Arabian Gulf (Qatar) rarely swim more than a few hundred kilometres north or south from these areas, a new study finds.

Ratios between the heavier and lighter isotopes of these elements vary naturally across different habitats in the marine environment. These ratios stay consistent as they are passed up through the food chain, from tiny marine plants to top predators, and therefore provide a record of the animal's feeding and movement behaviours. Stable isotope analysis thereby provides a "biological passport" for whale sharks.

Values of both carbon and nitrogen stable isotopes differentiated at each site. Only two sharks moved between sites, both swimming around 2,000km north from Mozambique to Tanzania. Taken together, these findings indicate that there are limited movements between these major aggregation sites over months to years. These results have implications for the conservation of this endangered species. ■

SOURCE: UNIVERSITY OF SOUTHAMPTON



SIMON THORROLD / WOODS HOLE OCEANOGRAPHIC INSTITUTION

Little is known about the movements of whale sharks.

Juvenile whale shark aggregation discovered in the Red Sea

Hundreds of juvenile whale sharks gather on coral reefs near Al-Lith on the central coast of the Saudi Arabian Red Sea.

Little is known about the movements of whale sharks on a daily basis or over years. However, the discovery of an aggregation of juvenile whale sharks off Saudi Arabia is giving researchers a rare glimpse into the lives of these gentle giants. Adult whale sharks were not seen at the site, which may serve as a "staging ground" for juveniles before they move on to regional aggregations of larger sharks. To date, 12 whale shark aggregation sites have been identified globally. While all other juvenile whale shark aggregations are dominated by males, a sex ratio of 1:1 was found at the site in the Red Sea.

"The fact that there were so many whale sharks in such a small area gave us an opportunity to begin an unprecedented study to an-

swer some of the basic questions," said Simon Thorrold, a biologist at WHOI and coauthor of a paper in the journal *PLOS ONE*.

Diving data from satellite transmitting tags revealed the sharks made frequent deep dives to at least 500m (1,640ft). Three of the tagged sharks made excursions below 1,000m (3,281ft), with a maximum-recorded dive depth of 1,360m (4,462ft).

Most of the sharks remained in the southern Red Sea throughout the time the tags were on, while some individuals headed into the Indian Ocean, which may have been motivated by an abundant food supply related to seasonal upwelling. ■

SOURCES: WHOI AND PLOS ONE

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Photo by Cem Gazivekili

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For Divers

Neurological DCS

Sponsored content by DAN

Cases of decompression sickness (DCS) that involve neurological symptoms are fortunately rare, but advanced and mixed-gas divers in particular should be aware of the signs and symptoms and know how to respond if they or one of their buddies experiences a dive injury. Whether you have the skills and training to care for a diver yourself or you want to be prepared to help until a more experienced caregiver is available, learn the basics of assessing post-dive symptoms.

Articles like this one are no replacement for training, but they are a good way to refresh or build your awareness of the importance of emergency-response skills.

What are the symptoms?

The symptoms of neurological DCS are easy to recognize on paper but are often missed on a rocking boat, or attributed to some unrelated condition. In the real world, confusion, dizziness and nausea can easily be mistaken for post-dive exhaustion or seasickness. It can be very difficult to discern whether a diver's symptoms are the result of DCS, a long stressful dive or an unrelated medical condition. In any case involving a possible dive injury, it is OK to hope for the best but smart to plan for the worst. If a symptom is suggestive of neurological DCS (or something even more serious such as a stroke or cardiac problem)

assume the worst and respond accordingly. Some symptoms of neurological DCS are:

- Confusion
- Numbness
- Loss of hearing
- Paresthesia (a "pins and needles" sensation, for example)
- Muscle weakness
- Difficulty walking or problems with physical coordination
- Bladder control problems
- Dizziness or vertigo
- Nausea or vomiting
- A dry cough or difficulty breathing
- Chest pain behind the sternum

If you or another diver experiences any of these symptoms, you should assume the injury is serious, activate emergency services and initiate your response and evacuation accordingly.

How should I assess the symptoms?

Neurological examinations begin as conversations and progress to a series of tests of physical ability and mental acuity. It is possible for an injured diver to be wholly unaware of their symptoms, and you, the caregiver, may have to identify them. An on-site assessment guide is a useful tool to have in these situations. You can create your own or use DAN's neurological assessment slate. The priorities are to quickly determine whether an injury occurred, activate your emergency-response plan and local emergency services, quickly assess the severity

of the injury (and thus the level of urgency required) and, if appropriate, begin conducting a neurological exam. As you perform the exam, document everything. Pertinent medical history, the dive profile, time of onset and a list of symptoms are critical pieces of information that can improve both the quality and speed of care once the patient reaches qualified aid.

Ask how the diver is feeling and when each symptom began. Go through a checklist of possible symptoms, but be

careful to pose questions in a way that does not suggest symptoms that do not exist. Record the diver's answers along with the profile of the last dive, gases breathed and any pertinent medical history. Next you will want to assess the diver's mental awareness and physical condition. Identify whether the diver is alert and oriented; if he or she has an impaired level of consciousness, your priorities shift to basic life support, monitoring the airway and supporting breathing as necessary. If the diver is alert and oriented, ask simple questions such as "What day is today?" and "Where are we?" to identify possible confusion. In most situations, this exam will be interrupted by the arrival of qualified medical care or the next step in the evacuation. If time and the diver's condition allow, however, extend the exam to include assessment of bilateral physical strength, the presence of any numbness and the ability to walk and balance.

The most important takeaway from this article is that all divers should be able to recognize the symptoms of a dive injury and activate an emergency-response plan. Whether your training and experience equips you to call emergency medical services, help move an

injured diver, perform a neurological evaluation or provide medical care during the evacuation, your assistance may dramatically improve the outcome for an injured dive buddy.

For more information about responding to dive injuries, visit: DAN.org. ■

TRAIN LIKE YOU DIVE

An important but often missing element of first-aid and emergency-response courses is realistic practice. While practicing CPR in a classroom, watching videos and reading articles is important to student learning, effective training must include frequent and realistic simulations. This is particularly critical if your dive travel takes you to an unusual setting, whether a jury-rigged fishing vessel you have chartered as a dive boat, a cave several hundred miles from the nearest city or a local quarry you have never been to before. Regularly run through a full simulation of a realistic emergency with your dive buddies—you may realize you cannot get to your emergency oxygen, your first-aid kit is half empty, or the way you planned to transport an injured diver is not as quick as you thought it would be. ■



August 31 — September 2, 2018

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NAUI Course Director Butch Hendrick

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-Cheryl Thacker, Course Director

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Direct questions to training@naui.org or +1 813-628-6284.

Leadership Rescue Training

An industry wide call to action

By NAUI Worldwide



Take a moment to **watch** NAUI's video explaining more about the workshop:

www.youtube.com/watch?v=eBVx-KdF-28



“ The point is, how can we make the entire world of scuba leadership take diving to the next level so we can collectively take better care of our students? ”

Alarmed by what they perceive as the deteriorating quality of leadership-level rescue skills across the industry, combined with a rising number of students who sustain an injury during a scuba rescue, Course Directors Butch Hendrick and Andrea Zaferes of Team Lifeguard Systems approached NAUI Worldwide with the concept of a comprehensive, real-world rescue skills workshop for diving professionals.

“Step one,” says Hendrick, “is to avoid a problem altogether. The way you do this is by perfecting the art of observation. What does a victim really look like? Dive professionals need to see where problems might occur by observing a diver’s change of breathing rate, the attitude of their body, hand motions, etc. Some instructors might pick this up on their own over the years, but why not provide them with this knowledge up front? **It could save someone’s life.**”

It’s for the entire industry – to help fix problems at the instructor level. You take this class, you pass it and walk away with a NAUI instructor level certification.”

With that, the Leadership Rescue Workshop was born. The workshop is a three-day event open to diving professionals from any agency and is designed to hone a professional’s rescue and supervisory skills. The workshop practices realistic emergency scenarios in and around the water at real-life speed, retraining the dive professional from the ground up on rescue scenarios.

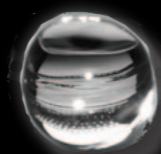
As you might expect, the workshop tackles dozens of other real-world scenarios to help prepare dive professionals for actual rescues, but one interesting aspect of the workshop is that it’s open to any dive professional from any training agency. “When I suggested that we open this up to other agencies, NAUI immediately agreed,” says Hendrick. “The workshop isn’t just a NAUI thing.

NAUI’s Training Director, Terrence Tysall, agrees. “We hope that the workshop will get a good conversation going that will improve the quality of dive training overall. We need to get over being divided as different agencies. We need to get back to the little things, like sharing information, gear and techniques. We need to find that again, and the Leadership Rescue Workshop is the perfect forum to do so.”

**Next Leadership Rescue
Workshop
Cebu, Philippines
Aug. 31 – Sept. 2**

www.naui.org/events/leadership-rescue-workshop-philippines





Getting the Boys Out

The inside story

Tham Luang Cave Rescue

Text by Rosemary E. Lunn
Edited by Peter Symes

On Saturday, 23 June 2018, a football team of boys in Thailand, aged 11 to 16, finished practice under the watchful eye of their 25-year-old coach, Ekkapol Chantawong. The group then cycled to and entered a popular tourist attraction, Tham Luang Cave. Some of the boys had never visited it before and were curious to know what it looked like. They explored the cave for about an hour before turning around and retraced their steps. They could not get out.

At around 9:00 p.m., Sungwut Kummongkol, leader of the Mae Sai Rescue Unit Team, received a call that some of the children had disappeared.

It prompted a search to begin.





tech talk

At 10:00 p.m., Kummongkol led the first responders into the cave. The team of 14 local rescue workers set up a light and found the boys' bicycles and sports equipment, which had been left near the entrance to the cave.

The next day, shoes and bags were found inside the cave. However, the search was temporarily suspended because continual heavy rain thwarted access to Tham Luang cave. The rescuers could still enter the first part of the cave, but the small hole leading farther into the cave was flooded, so they went back and contacted the Sirikorn Rescue Team because they had diving equipment. A team of 22 local rescue workers and divers then entered the cave but found their diving cylinders got stuck during the dive.

"I decided to reach out to the Royal Thai Navy to send the Thai Navy SEALs to help us because they would have specialist equipment. They confirmed they would come," said Narongsak Osottanakorn, Governor of Chaing Raed.

The Thai SEALs arrive
Twenty Royal Thai Navy SEAL divers arrived and entered Tham Luang Cave at around 2:45 a.m.

on Monday, 25 June, and headed for Chamber 3 in the cave. It took them about an hour to get to the chamber.

SEAL Captain Anan Surawan told Channel NewsAsia: "After Chamber 3, there was a T-junction. One section was under two metres of water. There was a small hole in which we could dive through. On the other side, there would be a small sand bank on the right, and it was thought the kids would be there."



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The Thai Navy SEALs were brave but not equipped, nor trained for a nil-visibility overhead environment in which you cannot go up if you have a problem, and they found the caving and cave diving challenging.

"A diver felt his way through with his hands in the dark. He found a hole that he could push through with his foot. The more he pushed, the further in it went. The diver emerged after diving for some time to tell us that they could get through the hole. The divers came back and told us that they did not find the kids. We were worried. Where were the boys?"

The Royal Thai Navy later posted on their Facebook page that the team had stopped diving around 1800hrs because it had been raining all day and the water level in the cave was rising. They stated, "Handprints were found around the cave wall, but we still cannot locate the children."

A SEAL diver said that the water was so murky that even with lights, they could not see where they were going underwater, so they needed to be able to lift their heads above the water.

Anupong Paojinda, the Interior Minister, told the media that the divers could only proceed when enough water was pumped out so that there was space between the water and ceiling to make it safer to work. Pumping the water from the cave and the surrounding area would prove



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to be a mammoth and vital task for the agencies and volunteers.

Very brave men but ill-equipped

It needs to be pointed out that SEAL divers across the world are specialist military personnel, trained to deal with unusual and unconventional warfare, i.e. reconnaissance missions and underwater demolition. Their training is tough and conducted in harsh and extreme environments. There will, however, be very little, if any, training done in dry and wet caves, because this is not an environment a SEAL will tend to encounter in their career. Therefore, the SEALs were not equipped nor trained for this specific rescue location—i.e. a nil-visibility overhead environment, where you cannot go up if you have a problem, and they found the caving and cave diving challenging.

The international cave diving team had nothing but the utmost respect for the Royal Thai Navy SEALs, and considered them very brave, because they were operating in such a harsh, alien situation. The rescuers discussed the situation and agreed that they needed help from experts.

British cave diving

Britain has a long history of cave rescue, with some of the teams being in existence for more than 70 years across the United Kingdom and Ireland. Caving and cave diving rescues require specific skills and equipment to safely extract injured or trapped explorers. Methods include confined space, mountaineering and rope techniques that work in a difficult and demanding environment, i.e. somewhere pitch black that is frequently muddy, cold and wet. This can include small passages and low or no-visibility conditions.

British cavers also have a long history of overseas cave exploration and surveying, and this is certainly the case in Thailand. In particular, members of the Shepton Mallet Caving Club, Mendip have helped catalogue, survey and describe a number of Thai caves over several years, including Tham Luang cave. When the news came through that the boys were trapped, the archives at the Shepton Mallet Caving Club were raided, and surveys and information on the Tham Luang Cave were sent to Thailand to help the rescuers.

The first foreign caver on the scene was also a Brit—more specifically, Vern Unsworth, an active, experienced caver of more than 40 years standing. Unsworth learned to cave whilst exploring systems in the Yorkshire Dales. In recent years, he has been extensively exploring Tham Luang



"I got called out at 02.00 Sunday morning (24 June) saying that children were missing in Tham Luang. Can I come and help?"



Cave. Unsworth therefore splits his time between the United Kingdom and a village in Chiangrai Province, situated about 15 minutes away from the cave system. Unsworth had been involved in cave rescue operations in the United Kingdom, but "nothing on this scale."

"Tham Luang has been my third home for the past six years," said Unsworth. In 2014 and 2015, Unsworth was part of a British caving team that conducted further surveys of the cave. Other members included Martin Ellis, Phil Collett and Rob Harper.

On 24 June 2018, Unsworth had planned to visit the Tham Luang system to see what the water levels were like and had prepared all his equipment ready for a solo cave trip. Instead, he received an early morning phone call. Unsworth told CNN, "I got called out at 02.00 Sunday morning (24 June) saying that children were missing in Tham Luang. Can I come and help? I drove straight to the cave and I was there for the whole 17 days."

Unsworth suggested that the boys would not have gone into a part of the cave called Monk's Series. "It is not a very nice section of the cave," said Unsworth. "Most people go left and head for a section called Pattaya Beach. It is a big sandbank. Once I knew the way on to the far end was blocked, then it wasn't going to be a job for normal cavers. We needed people with diving experience."

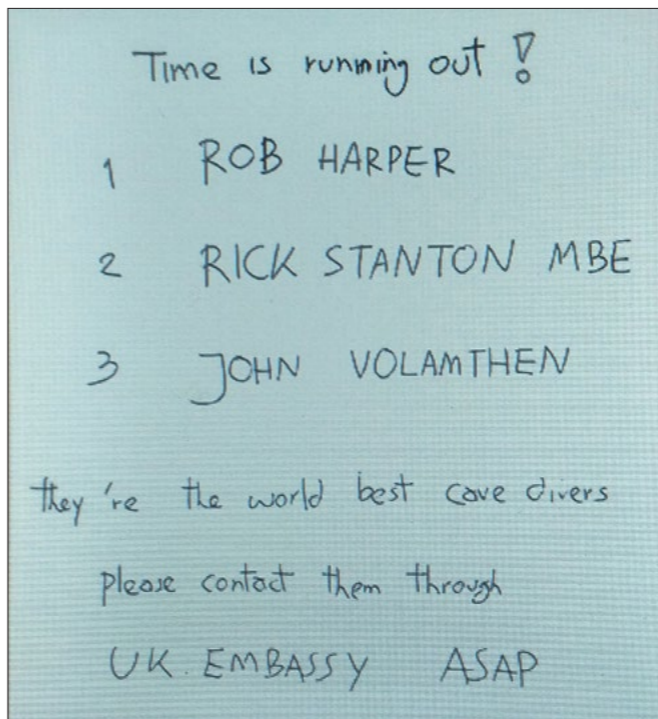
Unsworth writes a note
Unsworth understood that whilst the Thai SEALs were doing their

very best, they were not used to diving in water the colour of strong, black coffee. He knew that specialist cave diving expertise would be urgently needed at Tham Luang Cave. The conditions were pretty much identical to British cave sump diving—a constricted, low or no-visibility, flooded environment. It was important to get the experience there to support the Thai Navy SEALs. Unsworth told CNN, "It was a race against time. They needed world-class divers, and that's what we have got."

On Tuesday, 26 June 2018, Unsworth handed a note to Weerasak Kowsurat, Thailand's Minister of Tourism and Sports (Kowsurat then re-wrote the note in his own handwriting, so there are now two notes in existence). According to Unsworth, his note to the minister said: "Time is running out! 1) Rob Harper; 2) Rick Stanton MBE; 3) John [sic] Volamthen—they're the world's best cave divers. Please contact them through UK Embassy ASAP."

Later that evening, Kowsurat made a WhatsApp video call to British caver Rob Harper. This request was not unexpected because there is a small team of British extreme cave diving explorers who assist in these intense rescues.

Experienced, respected cavers
Harper is a respected caver with



over four decades of experience. He has explored and surveyed caves in Somerset, Panama, Peru and Thailand. In addition, he is Cave Leader for Dan Yr Ogof Cave in South Wales (a Cave Leader has a set of specialist skills in order to safely lead others underground). Harper has done a lot of caving in Thailand. In fact, he had only just returned from a caving trip in the country when he got the phone call that he was needed.

A British caver told me: "Rob would only say he was doing what any caver would do in that situation. No drama. No fuss. Just get on with it. Rob is cool, calm and collected—the one to have on your side in a crisis."

Stanton and Volanthen are experts in low-visibility cave dives within small passages. "Rick is the quiet man who quietly and continuously, with incredible determination, starts at A and gets to Z, and achieves things. Nothing stands in his way. He is one of those individuals who is going to get there," said cave explorer and author Martyn Farr.

"At 3 p.m. I received a call telling me I was booked on the evening flight to Thailand. I was told to expect the unexpected."

The British Cave Rescue Council therefore co-ordinated the UK response (throughout the whole rescue) and phone calls were quickly made. Volanthen told a BBC journalist that he was at work that day when he got a telephone call. "At 3 p.m. I received a call telling me I was booked on the evening flight to Thailand. I was told to expect the unexpected."

Now that an official request had been made, the three men duly packed and headed for London Heathrow and boarded the 21.25 flight to Thailand. "A cave rescue is never where you want or expect it to be, nor is at the time of year that you would prefer it to be," said Stanton.

Stanton, Volanthen and Harper arrive

"Nobody normally goes diving in a cave that is usually dry. When a cave like that floods, it is not a nice place to be. Certainly not a place for recreational exploration. We were only there because of what was going on," said Dr Richard Harris, an anaesthesiologist and diver from South Australia involved in the rescue mission. It was hoped that the boys and their coach were still alive, and had somehow found a dry space to shelter, that would remain clear of the rising water. The search had therefore escalated into a major military operation. Whilst Harper, Stanton and Volanthen flew to

Thailand, the mainstream media reported that ongoing heavy rainfall and the flooded cave were causing difficulties for the rescuers.

The three Brits arrived at Tham Luang Cave late on Wednesday, 27 June, and inspected the cave. It was still raining. The mainstream media asked the divers for a comment. Volanthen duly obliged with one sentence, "We've got a job to do."

Belgium cave diver Ben Reymenants also arrived onsite to assist with the rescue. Various articles in the mainstream media reported that, initially, the Brits had their doubts, because they felt that diving conditions were unsafe. They had therefore decided to pack their bags and leave (rescuers should never place themselves in a situation that can put them in danger).

Whilst the Brits wished to help, neither Stanton nor Volanthen wanted to end the rescue mission, not diving, and then stay onsite for many weeks whilst the children inevitably died. Reymenants, however, felt it was possible to get in the water and did just that. By doing so, he convinced the Brits that diving operations, although tricky, could go ahead. The three divers got on with diving and started to lay line.

Reymenants was assisted by fellow Thailand-based technical divers Maksym Polejaka



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of France and Bruce Konefe of the United States. I do not know if these two got upstream of the dive base in Chamber 3. Amongst the other Thailand-based foreign divers who helped the SEALs (but not on the actual rescue dives) were Rafael and Shlomi Aroush of Israel, Fernando Raigal of Spain, and Tim Acton of the United Kingdom. I think most of these guys left the scene after the football team were found.

Just over 24 hours later at 01.00 on the 28 June, men and women from the 353rd US Special Operations Group landed in Thailand and joined the international operation. The skills of the search and rescue team were to prove useful. They were soon briefed by the Brits.

Derek Anderson, Master Sergeant, told reporter Mark Willacy that the Brits feedback was invaluable.

“They were saying in cave diving, you have to be able to lay line. You have to be able to have a way out, if you’re going in, and the currents right now are not manageable. We’re battling, trying to move forward. The rains are still falling, the flows are getting higher, the visibility is zero, the water’s cold. Let’s take a minute and come at this from a collective perspective of how we can tackle a really complex problem.”

“It’s when Rick Stanton uses the term ‘sporty’ that you want to get worried.”

— Martin Parker, AP Diving

Gnarly diving

Stanton and Volanthen would later describe the open circuit dives as “gnarly”. Between them, they have over 60 years of hardcore, extreme

cave diving experience under their belts. In this instance, “gnarly” is being used in a very understated British way and can be translated into everyday language as “dire, horrendous, grim and atrocious.”

Sunday, 1 July, dawned, and there was finally a break in the weather, which allowed the rescue dive team to set up an operating base in a chamber about 700m into the cave complex. Equipment and air cylinders were bought in using a pulley system, whilst water pumps continued to drain the rising flood water. Stanton and Volanthen laid 800m of line from the Chamber 3 dive base to Sam Yaek.

On 28 June, men and women from the 353rd US Special Operations Group landed in Thailand and joined the international operation.

“Obviously it was dark, flooded and there was poor visibility underwater, and a lot of debris in the cave from previous attempts. There was wire, electrical cable, pumps, tubing, all sorts of things.”

— John Volanthen

The first miracle

On Monday, 2 July, Stanton and Volanthen were once again diving ever deeper into the cave, and laid 750m of line as they travelled through the system. “We had been laying a line, path finding, and we were right at the very limit of our last piece of line ... we were actually under an airspace, so we could talk,” said Stanton.

Procedure, not luck

“It has been mentioned by some members of the press that it was luck we found the boys. I would say that was absolutely not the case. We have a procedure for this situation. Whenever there was an air space, we would surface,

we would shout, and we would also smell. In this case, we smelt the children before we saw them or heard them,” said Volanthen.

It was not surprising that Stanton and Volanthen could smell the boys. They had been trapped in the same location for nine days, and their bodies continued to function normally. There would have been a strong stink of sewage. No wonder the cave divers could smell the football team.

Brilliant! You are very strong

“They heard us. We heard them,” said Stanton. “The ledge wasn’t really as described. They were around the corner out of sight,



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“We smelt the children before we saw them or heard them”

John: Raise your hands.
BOY: Thank you. Thank you.
John: How many of you?
BOY: Thirteen.
John: Thirteen?
BOY: Yeah, yeah.
John: Brilliant.
No, not today. Just two of us. We have to dive.
BOY: [IN THAI] Diver says not today.
John: We are coming. It's okay. Many people are coming.
Rick: Many, many people. We are the first. Many people come.
BOY: What day?
John: Tomorrow.
Rick: No, no, what day is it? They are asking. Monday. Monday. Okay, but one week... uh, Monday. You have been here for 10 days. You are very strong.
BOY: [IN THAI] Who knows English? Translate for us.
BOY 2: [IN THAI] I can't catch up with the words.
John: Let's go up. Okay, go back. We come, we come.
BOY: We are hungry.
John: I know, I know. I understand. We come, okay? We come.
BOY 1: [IN THAI] Go up the top together. They will take our photos first.
BOY 2: [IN THAI] Tell them we are hungry.
BOY: [IN THAI] I've told them. They know. What day you come to help me?
John: We come here, we have been diving here for what...tomorrow, we'll help tomorrow.
Rick: The Thai Navy, the Navy, Navy SEAL will come tomorrow. With the food, the doctor and everything. Today, a light? You have a light. We'll give you more light.
John: You go up, okay? Up, up.
BOY: [THAI]: Come up. Brother, rush up.
John: That looks fun!
BOY: Yeah, yeah. I am very happy.
John: We are happy too.
BOY: Yes, thank you so much. Thank you.
John: Okay
BOY: Where you come from?
John: England, UK.

and they started coming down the slope, one by one. As they were coming down, I was counting them—one, two, three—until I got to 13. So, when John asked, 'How many of you are there?' I had already counted them all in. They were all there. Until we had the fact that we had all 13, I was a little concerned. But once we got 13, that was fantastic."

Stanton told me later that Volanthen climbed out of the water to talk to the boys. The boys were all barefoot, and they easily scampered up the muddy slope. The divers found the going a bit slippery in their welly boots. Stanton said there was a small, welcome moment of humour when a boy looked at his feet, then Stanton's Wellington boots, and you could see the think bubble: "Why don't you take your boots off and walk in your bare feet up this mud bank?"

"Given the volume of water that we had seen come out of the cave in the preceding couple of days, it was unbelievable that we found the boys, and they were all healthy," said Volanthen. "We were very pleased, and we were very relieved that they were all alive. Cold was an issue. Some of the children were quite small, so we were quite concerned how well the small children would hold up." Stanton added, "Of course, there was excitement, and relief that the



An Aga Divator full-face mask used during the Thai cave rescue mission. A plan was conceived to dive the boys out one-by-one, with each boy wearing a full-face mask. But how do you make a full-face mask fit a very small Thai face?

“... 'alive in a cave' and 'alive outside a cave' are two very different things.”

mity of the situation, and that's perhaps why it took a while to get them out. I was completely confident we would see them again. Having said that, 'alive in a cave' and 'alive outside a cave' are two very different things."

“All we could think about was how we were going to get them out.”

— Rick Stanton

children were still alive. It was unbelievable."

In good spirits

What was also unbelievable was that the boys were in good spirits, and they still had some working flashlights. Modern batteries have long burn times, but for the coach to manage the torches so that after nine days, the team still had light, was extraordinary. Stanton handed off one of his lights to the team. It was time leave. "I made them a promise that I would come back, and we did. We came back with food runs," said Volanthen.

Massive relief tempered with uncertainty

"Of course, I was thinking OK, this is just the start. How on earth are we going to get them out?" said Stanton. "I was already on the next stage. Great to have found them, but it was no means certain what the outcome would be." Volanthen added, "We realised the enor-

and the cave system is successfully pumped clear of water, this will positively aid the rescue."

The group could be "dived out"; however, this is a high-risk solution. It is a very long swim of 90-odd minutes and counting, in cold water, tight passageways and very poor or no visibility. A British Cave Rescue Council spokesman said, "Although water levels have dropped, the diving conditions remain difficult. Any attempt to dive the boys and their coach out will not be taken lightly because there are significant technical challenges and risks to consider."

The team in Thailand conceived a plan to dive the boys out one-by-one, with each boy wearing a full-face mask. They liaised with the Cave Diving Group, more specifically Gavin Newman, to get things moving in the United Kingdom. Stanton said, "We opted to use positive pressure full-face masks because it was the best solution to protect the airway of the unconscious boy. We didn't have to worry about a regulator falling out or getting dislodged from a boy's mouth."

Newman had a very busy few days. He sourced, co-ordinated and collected equipment from various places in the United Kingdom and got them onto short notice outbound flights to Thailand (it has to be said that Thai Airways was very supportive—this is not always the case with the airlines). Newman also delivered key members of the

The amazing news broke in the United Kingdom at approximately 16.30, that the football team had been found in a relatively small, dry air space south of Pattaya Beach. As the chimes of Big Ben died away, newscaster Alan Smith announced in quiet tones, "The authorities in Thailand say that 12 children and their football coach that have been missing in flooded caves for more than a week have been found alive." There were a lot of confused reports and figures published such as "2.5 miles / 4 km from the entrance" because the US press did not understand metric measurements. The team was found 2,250m from the entrance of the cave.

What happened next?

At the time, I wrote, "This is a challenging rescue, and it has not been helped because it is monsoon season. The weather factor cannot be underestimated. If it stays dry

NEIL BROCK

Dr Richard Harris and Craig Challen flying home on a Royal Australian Air Force flight. Challen and Harris received the Star of Courage. Rick Stanton and John Volanthen (far right) received awards from the Royal Humane Society at Buckingham Palace when they received Royal Humane Society bronze medals, which are among the United Kingdom's highest civilian bravery awards.



Dr Richard Harris stayed in the cave until the last boys were out.

British rescue team to London Heathrow, and he worked with Neil Brock of Bristol Channel Diving Services to problem solve for the Brits already out in Thailand.

A number of UK companies quietly supported the rescue mission from

Prepping equipment

Meanwhile, Brock spent Thursday, 5 July, prepping the OTS Guardian full-face masks, so that they were ready to be flown out to Thailand. Twenty-four hours later, there was a change of plan because it was felt these masks would not fit a small Thai face. Newman had received a request from the Brits in Thailand that they wanted positive pressure full-face masks. Brock consequently serviced and prepped two Aga Interspiro Divator full-face masks. British police drove these to Heathrow with blue lights flashing, to make sure they made the overnight flight to Thailand.

A full-face mask does not have a traditional mouthpiece. You simply breath in to take a breath. The majority of full-face masks are negative pressure masks; therefore, if there is a leak, the diver could also breathe in a fine spray of water. Hence, divers will not dive a negative-pressure full-face mask in polluted water, because if the mask leaks, there are potential health issues. The Aga Divator mask is a high-flow

positive-pressure mask, so the gas is fed into the mask and this helps prevent the mask from leaking. The air pressure is higher than the surrounding water pressure. If the mask leaks, air leaks out, water does not leak in. This was especially important for this rescue mission.

The Brits also needed an oxygen booster pump. Brock sent his oxygen booster pump to Thailand.

It should be noted that all the above companies who donated equipment did so with the expectation that they would never see their gear again. No invoices were raised. No money changed hands.

It was done to support the Brits to get the football team out alive.

Newman said mid-way through the rescue mission, "The support has been really impressive. Everyone is really pulling together and helping us with offering us any equipment that we need. Thank you."

Equipment, including full-face masks, were rushed from England to Thailand on an overnight flight



An "Apollo 13" moment

In April 1970, there came a moment during the Apollo 13 NASA moon mission that it was realised that the Command Module was fitted with square filters whilst the Lunar Module used round filters. These vital filters removed carbon dioxide. A ground team at NASA was charged with making a square peg fit in a round hole using only items and equipment the astronauts would have in space. NASA came up with a working solution, which was relayed to the astronauts, who were very relieved they would be able to take up breathing again.

Newman and Brock's "Apollo 13" moment related to the full-face masks: "Just how do you make a full-face mask fit a very small Thai face?" You simply cannot just

gaffer tape or cable tie one of these masks onto the head of a small child and hope it works.

Brock worked using materials and equipment he knew the Brits would have access to in Thailand. He looked at bulk-ing out a 5mm diving hood by adding a ring of extra neoprene to make a 10mm seal. Newman knew that Interspiro produced an insert that could be put into the mask seal to make the mask fit slimmer faces, i.e. female fire fighters. Between them, they liaised with Chris Jewell in Thailand so that the masks would fit the children's faces. ■



Stretcher similar to the ones used in the Thai Caves

afar. Peter Wilson at Miflex opened his stock room and donated Miflex hoses, OmniSwivel fittings and quick disconnect Swage Locks. These were collected by Newman, and the stock was flown out with Jason Mallinson and Chris Jewell.

Dave Blackham of Spirit Film and Television also opened his cupboards, and Newman collected several Ocean Technology Systems Guardian full-face masks. Richard Major and Wraysbury Dive Centre became the "rescue post office". Wraysbury received deliveries, donated every single A-clamp adaptor they could lay their hands on, and provided very necessary subsistence (mugs of tea and bacon rolls) to a tired Newman.



photo & video

This photo of a humpback whale mother and calf in Japan was taken with a Mavic Pro drone camera

Text and photos by Don Silcock

One of the things I learnt quickly when I first started writing for *X-Ray Mag* was that it is often the images that *were not* taken underwater that can make an article about a specific location really stand out. As was pointed out to me, one ornate ghost pipefish looks pretty much the same as another. As proud as you may be of the images from your last trip, are they *that much* different from those of the one before?

Maybe yes, maybe no... does it even matter? Well, I think it really does if you are trying to get your stuff published or even just "liked" on social media. People enjoy context around the images they

like. Building that up by showing more about the destination is a great way to engage. One of the very best ways to do that is an aerial image of the location, which, just a few years ago, was way beyond the reach of most of us, but drones have changed that dramatically.

DJI
I have been involved with China for over 16 years now—travelling there regularly and living in Shanghai for a couple of years. In that time, I have seen the country grow and emerge as the factory of the world, on a scale that is simply incred-

ible. The Chinese were able to achieve this scale with a combination of working hard and some risk-taking, plus a lot of copying. And if you had asked my opinion on the future of Chinese technology just three years ago, I would have said they were stuck in that "copy" mode and

were simply not innovating.

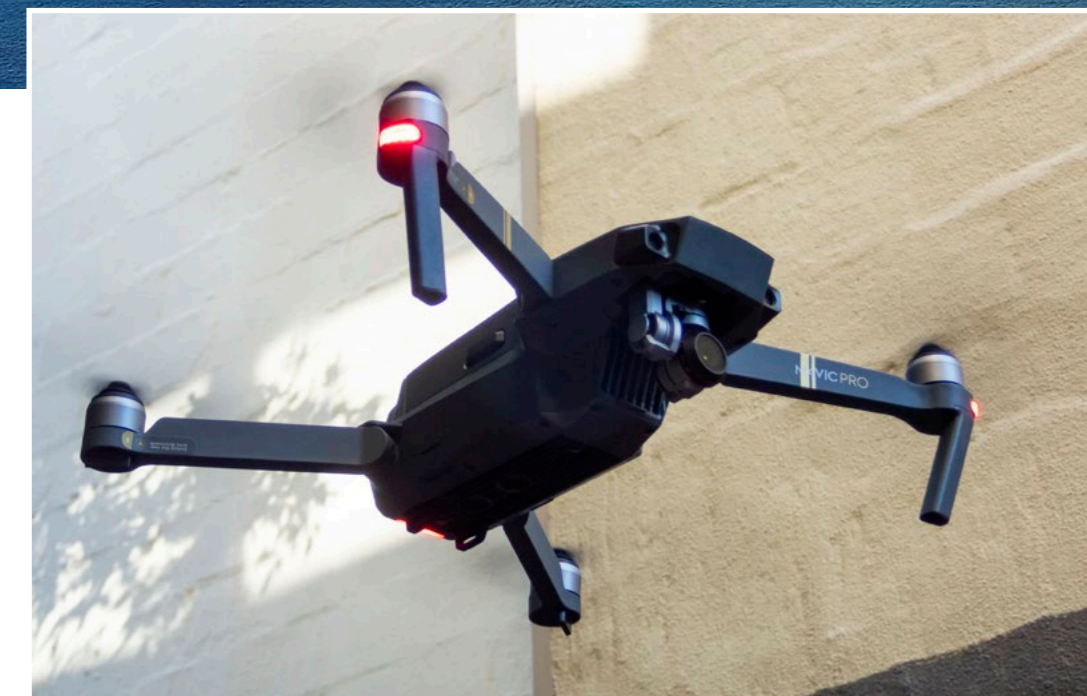
But that is changing dramatically, and in the last couple of years, we are seeing several Chinese companies emerging as true innovators, with the drone company Dà-Jiang Innovations (DJI) high on that list. I am now on my third DJI drone and



Drones

& Underwater Photography





Mavic Pro drone in flight (above); Panorama shot of Japan (top)

love it. I bought them all myself, by the way.

My current one, a Mavic Pro, has tremendous functionality, great technology, is small, takes good photos and video, is incredibly stable and is great fun. Simply stated, it allows me to take significantly different images when I am on a dive trip, which really lets me put where I have been into context.

The Mavic Pro

DJI is based in Shenzhen, just north of Hong Kong, in southeast China. Shenzhen was one of the first Special Economic Zones (SEZs) created by Deng Xiaoping and has become known as China's Silicon Valley. It is a very dynamic place, which looks and feels a lot like Singapore.

DJI seems to model itself on Ap-

ple and has a very structured, systematic and innovative approach to business, which is very impressive. At the consumer end of their technology, they made their name with the Phantom drones, which have basically dominated the market.

My first drone was the Phantom 4, and I was stunned with what it could do. But, like many other people, I did not like the size, which after you include extra batteries, etc, could easily take up half a suitcase—precious space and weight for the travelling diver. But it was worth the extra hassle for the images and video it provided, and besides, there was no alternative.

Then, DJI released the Mavic Pro, a foldable drone that took up less than a quarter of the overall space consumed by the Phantom. Plus, the controller was much smaller, the functionality was better, and the batteries were smaller and stronger. An upgrade was a no-brainer, and I am now on my second Mavic Pro, after the first

one was unfortunately stolen. That said, I did not even look at alternatives, and simply swallowed and bought another Mavic Pro.

What you get

If you buy the standard Mavic Pro, you get the drone with one battery, the controller and a battery charger. That will get you in the air, but only for about 20 minutes or so, because flying a drone is all about the conditions, the location and the battery. The battery is what powers everything, and if you run it flat, the drone will fall out of the sky—possibly not as dramatic as that, because of the built-in safety features, but my most nerve-wracking “drone moments” have been trying to land the Mavic back on a boat in a swell with the battery almost done. A much better package is the More-Fly Combo, which gets you two spare batteries, a charging “hub”, spare propellers and a carrying case that is great for travel.

How it all works

Besides the actual hardware of the drone and its flight controller, there are three other areas of technology you need to be

cognisant of: the firmware, the software, and the GPS. DJI seems to be constantly updating the firmware that controls the drone and controller, which at first was



The Mavic Pro drone's compact size makes it easy to pack for travel.



photo & video

very annoying, and then I realised why they were doing it, which I will explain in a minute.

The software is the DJI Go app, which you download to your Ap-

ple or Android phone and GPS. It is what DJI is using to stay ahead of potentially restrictive regulations. As I understand it, what happened a couple of years ago

was that a local guy in the megacity of Chengdu in central China hacked his DJI drone somehow and flew it into the airport area to take some video. That is not something I would do anywhere, but particularly not in China where punishment can be

swift and disproportionate.

DJI saw the danger and responded incredibly quickly to “get ahead of the game” by introducing information on where you can and cannot fly at the app level—enabled by GPS. Basically, you must have the latest updates installed to avoid being grounded. But once you have those updates, the app can stop you flying anywhere you should not.

Learning to fly

Most countries have rules about what you can and cannot do with drones, and you really need to check them out for where you live and where you are going. For example, in Australia, where I live



Mavic Pro drone and controller (right); Mavic Pro controller updating (left)

part of the time, there are very specific rules that you have to follow, and you cannot get around them because GPS knows where you are.

In Bali, where I live most of the time, there are also rules, but they seem significantly looser. Then in Morocco, where I am going later

this year, I have just learnt that drones are not allowed at all and will be confiscated if you sneak one in.

With regards to how you learn to fly, you can do a formal course, which is quite expensive, or you can go the YouTube route and watch some of the hundreds of

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Panorama shot of San Benedicto Island, third largest island of the Revillagigedo Islands in Mexico





photo & video

videos that are available there, which is what I did.

Camera

DJI seems to be evolving into a camera company as much they are a drone company. In January 2017, they acquired a majority stake in Denmark's Hasselblad—quite ironically really, as Hasselblad first got started by making specialized aerial cameras.

The camera in the Mavic Pro has a fixed 26mm f/2.2 equivalent lens and a 1/2.3" 12.35MP CMOS sensor, which produces nice quality RAW images and 4K 30P video for that size of sensor. My experience with both the still images and the video output from the

Mavic Pro has been very positive, and generally, I am more than happy with the results.

Panoramas

Probably, the thing that most surprised me about the Mavic Pro is its in-air stability and capability to do panoramic shots stitched together in post-processing from a series of images. On land, this technique typically requires stable ground, and at least a tripod, so I really doubted that a drone would be stable enough to replicate that technique. Then, earlier this year on a trip to Socorro—the group of volcanic islands some 470km to the southwest of Mexico's Baja peninsula—I was trying

Mavic Pro More-Fly Combo (right); Aerial shot of Roca Partida (far right), the smallest of the four Revillagigedo Islands in Mexico



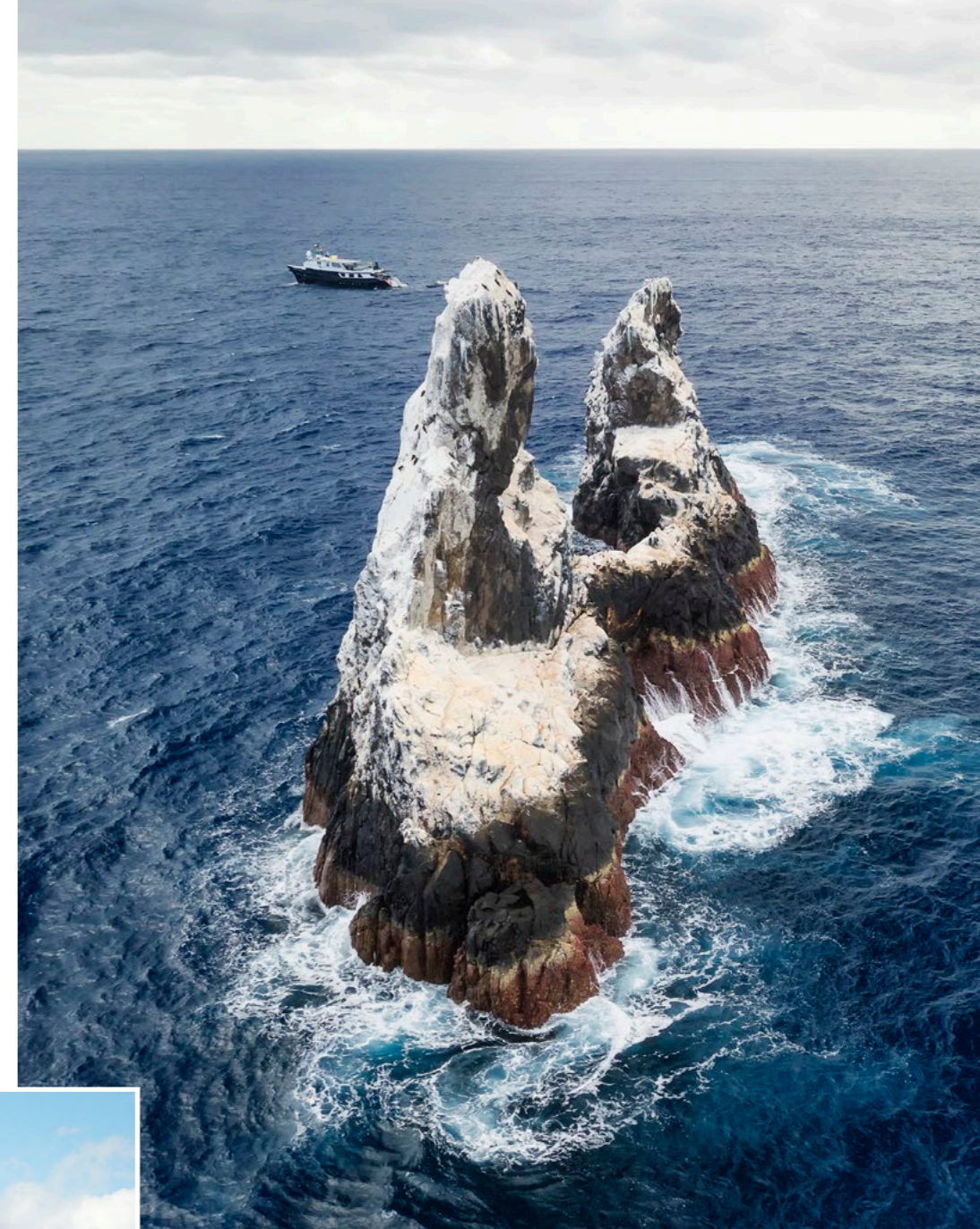
to get an aerial image of the island of San Benidicto.

It is a quite large island, some 4.8km long by 2.4km wide, with an overall area of 10 sq km, and I flew the drone up to 500m altitude and about 1km away but still could not get all of the island in the shot. So, I tried panning the drone to take a series of overlapping images, all with the same f-stop and focus, then stitched them together that evening using PTGui software. To my great surprise, it worked very well—not 100% perfect, but good

none the less—and then again, what is the alternative?

In summary

You could say that I am now a true believer in both drones and DJI. The drones are fun, easy to fly, have great functionality and enable really special images while DJI continue to innovate with the successor to the Mavic Pro about to launch. The Mavic 2 will apparently come in two flavours—the



Mavic 2 Pro and Mavic 2 Zoom. Both will have the same better batteries, improved flight time and overall functionality—plus, a 1-inch CMOS sensor Hasselblad camera. But the Mavic 2 Zoom will have a 24-48mm equivalent optical zoom. These are major steps forward, as the bigger sensor and the zoom lens have

basically what most people own or are interested in acquiring—a drone for which most have been asking. That DJI has been able to move the needle so quickly further establishes the manufacturer as a true innovator. I had better start saving. ■

Asia correspondent Don Silcock is based in Bali, Indonesia. For extensive location guides, articles and images on some of the best diving locations in the Indo-Pacific region, visit his website at: Indopacificimages.com.

Panorama shot of Isla Socorro, Revillagigedo Islands, Mexico



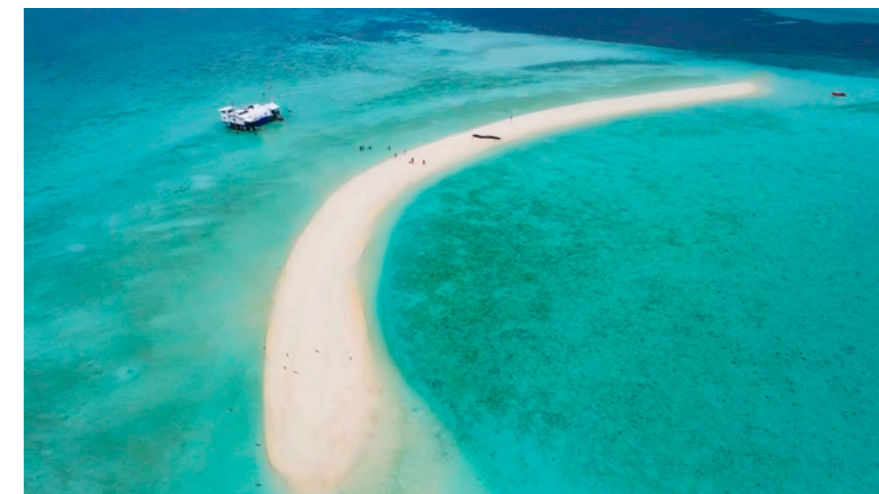
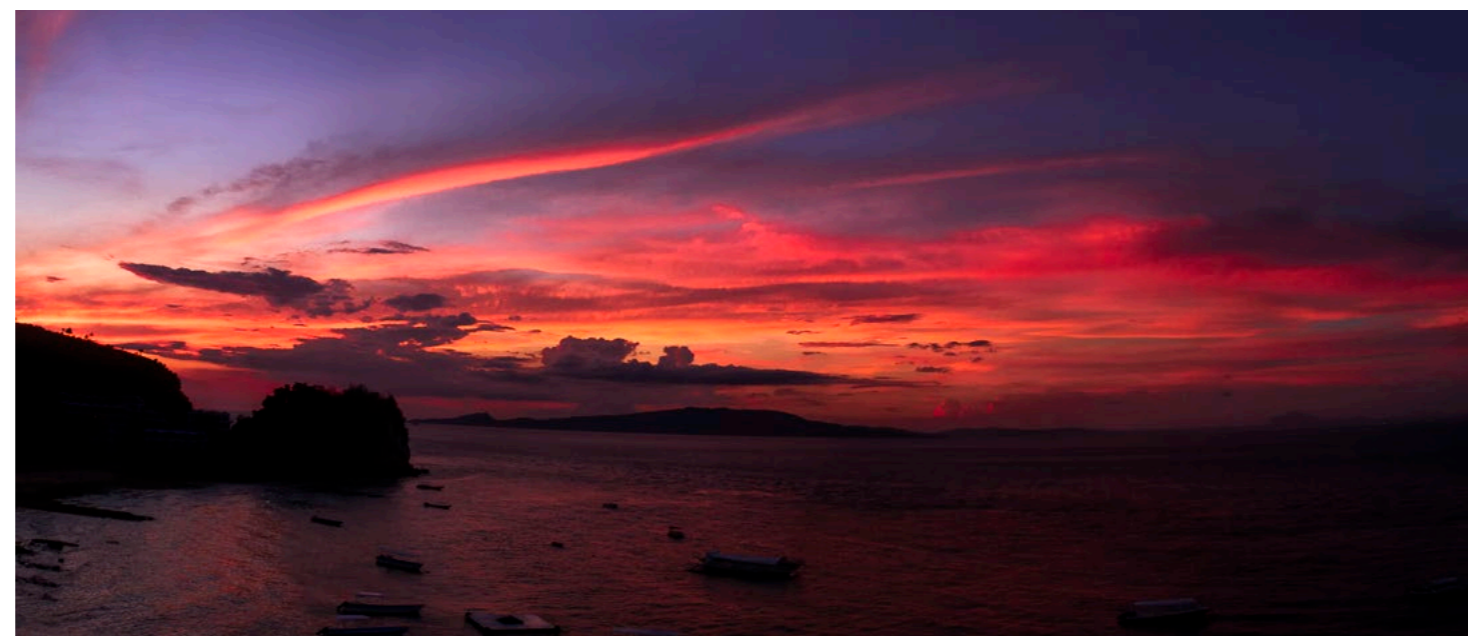
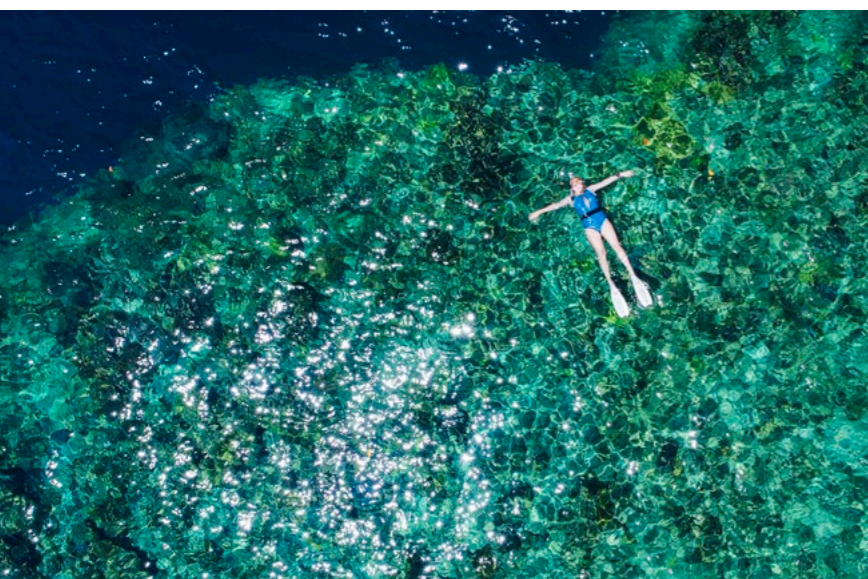
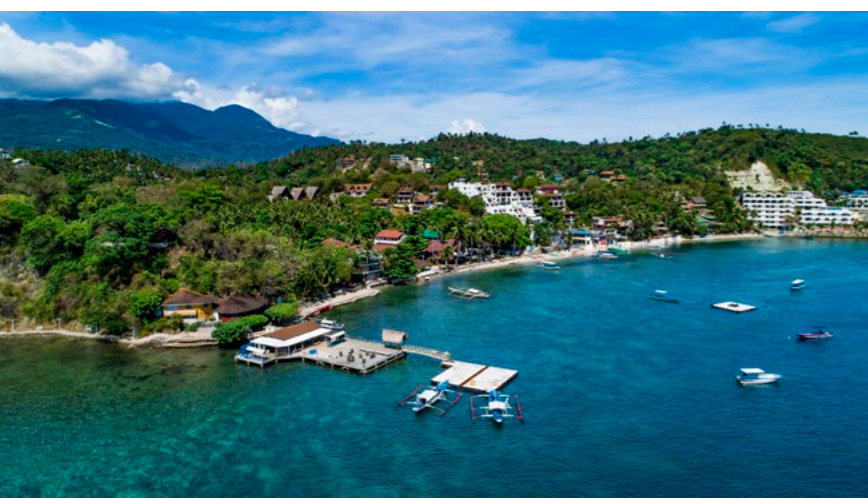


Aerial view of Raja Ampat, Indonesia, taken with drone camera by underwater photographer Beth Watson

Tips: Drone Photography for Dive Travel Stories

Text and photos by Beth Watson

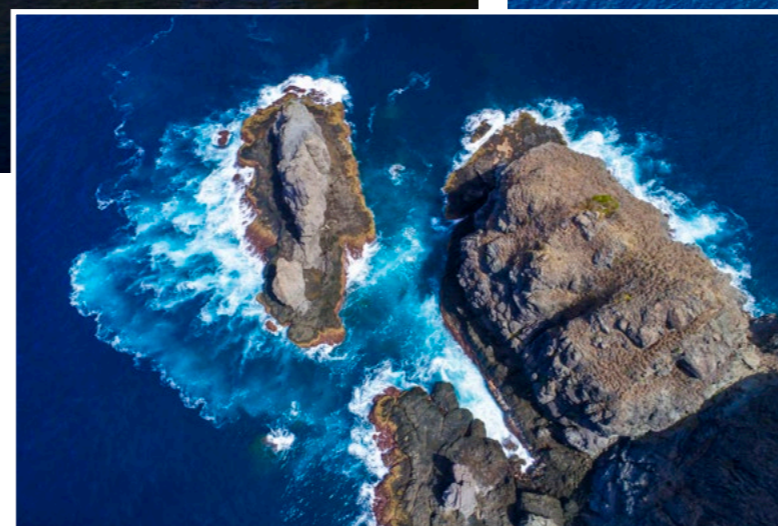
Drone photography can really spice up a dive travel photographer's portfolio. It adds another element, dimension and a unique perspective. Safety is a primary concern with drone photography. Preparation, precaution and planning is very important. Become quite familiar with the aircraft, software and controller before taking it to a travel destination.



Raja Ampat coast and snorkeler at Derawan, Indonesia

Sunset over Puerto Galera, Philippines

Indo Siren in Raja Ampat and Tubbataha Reefs Natural Park



- Plan your still shot as well as video clips. Think ahead. Avoid shooting random images and video clips.
- Capture still images in DNG or RAW format if your system allows.
- Use the grid overlay in the drone app to line up horizons and aid in composing the image.

can be quite challenging to transport. All drone batteries should be taken out of the aircraft and placed into carry-on luggage. Drone batteries are not allowed in the cargo hold of any aircraft.

Gear and accessories

- DJI Phantom 4 Pro
- DJI controller
- Battery charger/cables
- 3 batteries
- Hardshell backpack
- Sun shade hood
- Ipad

Local regulations

Research the rules and regulations of drone usage in the country or municipality you plan to fly. For example, in Tubbataha Natural Marine Park, Philippines, the park requires drone operators to apply for a permit to fly a drone at least two weeks prior to visiting the marine park.

Transporting drones

Drones come in many shapes and sizes. Some are very lightweight and compact, making traveling with them fairly easy. However, larger drones

Beth Watson is an international, multi-award-winning photographer, a judge for international photo competitions, and invited guest speaker at dive exhibitions. Her images have been published in books, magazines, newspapers, brochures, websites and selected for juried art exhibitions. For more information, visit: BethWatson-Images.com.



THIS PAGE: Drone photography of Atlantis Resort, Dumaguete, Philippines (top left); Bonito Island, Philippines (top right); night shot of Asia Divers/El Galleon Resort, Puerto Galera, Philippines (above); Komodo Island (center); Selfie with drone (left)



photo & video



White Balance

Text and photos by Peter Symes

A while back, our good colleague Joe Tepper at DivePhotoGuide.com wrote a good article (below) about setting the white balance when editing underwater photos, which I recommend you check out by following this [link](#) or clicking on the screenshot below. I use the very same technique of looking for something in the image, say an object or an area fish, which I know has a neutral colour.

Unpainted scuba tanks or lead weights with their neutral gray colour work best, as you can never be sure whether the pale underside of a shark, which may appear light grey, is actually neutral. My remedy is to bring my own reference in the shape of a set of small plastic white balance grey cards, which I clip on to a strobe arm or carry in a pocket. Typical price points seen in web stores seem to hover around 10 USD or Euros. In any case, it is a rather minor expense, and they do not weigh or take up much space—and can be used on land too, so what is there not to like?

When I am going on a planned shoot, I just start by taking some test shots wherein I include the cards in the first image. Depth is one factor that affects colour balance but so does the distance to your subject. So, where possible, place the cards at the same distance as your main subject, i.e. you could have your dive buddy or model hold them up. The cards are not needed in the images once we start shooting for real as long as the intensity and quality of ambient light does not change, say if you go deeper or cloud cover moves in. In the image editor, the test shots can then be used to dial in the settings for other images in the same series. ■

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WHITE BALANCE IN EDITING UNDERWATER PHOTOS

© Joseph Tepper

Knowing how to adjust white balance in post-processing is a critical editing tool

By Joseph Tepper

There are lots of reasons to shoot in RAW format: High quality, dramatic dynamic range, and non-destructive editing are just a few. But for underwater photographers, perhaps the greatest advantage of shooting in RAW is the ability to customize white balance during post-processing.

White Balance Makes a Difference

Ideally, white balance achieves realistic color temperatures for your images so that subjects and the background appear natural. However, shooting underwater presents a number of challenges because of the way water absorbs light—too often we see images that have an unnatural blue or green hue caused by improper white balance.

Your camera has a number of white balance settings, depending on the model. However, these are the most common: Auto White Balance, Custom, Tungsten, Fluorescent, Daylight, Flash, Cloudy, and Shade. Each of these situational white balances has a corresponding Kelvin temperature value that determines the hues in the image, ranging from 1000K to 9000K. Typically, underwater photographers keep the camera set to Auto White Balance or Shade, because the latter tends to reproduce colors more accurately when reviewing images underwater.

A good article about setting the white balance when editing underwater photos, by Joe Tepper, DivePhotoGuide.com

Paralenz Dive Camera+

The Paralenz dive camera just got upgraded to a Plus version. The housing has been strengthened to a depth rating of 250m (820ft).

Better anodizing has made the surface more corrosion resistant, and screws are changed to titanium.

The design of the selector ring has been improved to make it simpler and exclude any small parts. The new end-cap is CNC-milled from aerospace-grade aluminum, with a scratch resistant glass window.

Paralenz.com



Slave converter

Ever wanted to use a spare flash, perhaps a semi-retired one, as a distant remote to create some interesting lighting? Say, for back-lighting in wrecks or caves?

But what if it doesn't connect because the ambient light is too high and/or the distances between your remote strobe and the primary flash is too large? Try Ikelite's High Sensitivity Optical Slave Converter, which simply attaches to the strobe's electrical bulkhead in place of a sync cord connector. The enlarged slave window provides approximately 90 degrees field of view for remote triggering. The Converter supports manual exposure modes, and TTL exposure mode is not supported. An optional three-foot extension cord may be added for more flexible positioning of the sensor window. Ikelite.com

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NIGEL MARSH PHOTOGRAPHY

Nigel Marsh is an Australian photojournalist, underwater photographer and author. Working with New Holland Publishers, Nigel has produced a number of guide books for divers and snorkellers, and also a series of children's books with marine related themes.

Dive guide books

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- UNDERWATER AUSTRALIA
- MUCK DIVING
- DIVING WITH SHARKS
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Kelly Clause



P O R T F O L I O

PREVIOUS PAGE: *Ocho, Two-Spot Octopus*, by Kelly Clause. Watercolor on paper, 20 x 30 inches



Giant Kelp, by Kelly Clause. Watercolor on paper, 22 x 30 inches. Inspired by photography by Matthew Meier.

Kelly Clause

California Sea Lion, by Kelly Clause. Watercolor on paper, 20 x 30 inches



Text edited by Gunild Symes
All artwork by and photos courtesy of Kelly Clause

American artist Kelly Clause is a California native and avid scuba diver who creates elegant and sublime water color paintings of marine life—from giant humpbacks and sperm whales to curious sea lions and octopuses to fronds of graceful sea kelp. *X-Ray Mag* interviewed the artist to learn more about her artwork and perspectives on the underwater realm.

X-RAY MAG: Tell us about yourself, your background and how you became an artist. Are there mentors or artists or other sources of inspiration that have influenced you, your art or artistic process?

KC: I attribute much of my love for art, the outdoors and the ocean specifically to my upbringing. I was born in Santa Barbara, California, into a family of naturalists, fishermen and marine biologists, with a grandmother and great grandmother who were both artists. Creativity was always valued in our household—from painting on rocks in the yard with red dye from crushed berries to sledding

down hills on boogie boards—our parents encouraged us to think outside the box. I never felt pressure to color inside the lines, both literally or figuratively, which I know has contributed to the sense of freedom I feel with art. An appreciation for natural beauty and the complexity and order nature displays, but an artistic translation of it that is spontaneous and free—this is what has shaped my art. From winning a coloring contest at the grocery store at age five to entering my art into a local fair and expo every year, art has always been an inevitable part of my life. I tell people I had an early retirement, deciding just a year ago at age 28 to quit my job as a teacher and pursue art full time. It has been nothing but fulfilling and edge-of-my-seat thrilling all at once.

I have a background in international development and elementary teaching; no doubt international

travel and philanthropy, paired with a passion for youth and teaching, have influenced me in countless

ways. Something about art, though, really brings me alive in an unexplainable way.

Looking back now to my education, I realize I spent many of my college lectures sketching in the margins of my notebook, rather than on the content of what was being taught. I took a couple of art classes in school, but I am largely self-taught. My love for watercolor specifically, was more of a fortunate accident, when about a year ago I received an inherited set of beautiful watercolors from my great grandmother, who had passed it to my Grammy, who passed it to me.

In more of an effort to just spend good times together than create anything worthy of hanging on a wall, my mother and I signed up for a watercolor class together a couple of years ago. Rather than paint-



Indigo, Humpback Whale, by Kelly Clause. Watercolor on paper, 40 x 26 inches

ing the pumpkin still life that I was largely uninspired by, to say the least, I brought in a photo of a whale, painted my first humpback ("Humpback King") in the span of our hour-long class, and so began my obsession with the medium. It's quick, decisive, daring and unpredictable—all qualities I admire. I had tried oil in the past, but I hated the obsession with perfectionism it catered to; the ability to return again and again to a painting over the span of months overwhelmed me.

I am fortunate to be living in a town that values creativity and is surrounded by natural beauty, and thus, is a happy haven for artists and photographers. I am constantly gaining knowledge from picking the brains of those who are further down the road than me, to mention a few: wildlife artist John Baran, photographer Will Pierce, fine artist Paul Panossian, and illustrator and fine artist Peter Horjus. I guess I have the genes of creative family members and their indelible support to thank as well.

X-RAY MAG: *Why marine life? How did you come to this theme and how did you develop your style of painting?*

KC: I was born and raised in Santa Barbara, California, which if any of you have visited before, is not a shabby place for an upbringing. We are beautifully sandwiched between the ocean and mountains, which made for plenty of exploring as young kids. My parents met at the University of California – Santa Barbara.

They were both marine biology majors.

My mother worked as a diver and researcher in South America for the Peace Corp and the Smithsonian Institute during much of her twenties. As a result, while some families chose to spend their Saturdays going to the movie theater, we often spent time poking around low tides, playing in the surf, or fishing with my dad. My father is an avid fisherman, and I have several close family members who are commercial divers or marine mammal specialists. All that to say, the ocean has al-

ways been both a teacher and a playground to me, and my appreciation and love for all it contains has done nothing but grow.

It is nice to have a bit of the scientific background passed on to me through my family members. If I ever need input on the

length of a caudal peduncle or the placement of an

anal fin, I have quite a good board of advisors to reference.

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

KC: It's a simple process. I take some photos myself, but often hunt for photos that inspire me, or ask professional photographers for the opportunity to paint from one of theirs. Ideally, I will someday take all my reference photos myself, when I get that fancy underwater housing and hook-ups on all the dive boats around the world.

First, I usually sketch a rough, freehand rendering of my subject material in pencil, then I put my brush to paper. I have never had formal instruction in watercolor technique, so sometimes this leads to the demise of some of my pieces, I feel like I am constantly learning as I go.

Sometimes I finish in one sitting, and sometimes I revisit the piece over the span of a few days, depending on factors that range from caffeine intake to my immediate personal connection with what I am painting.

I am a minimalist at heart, and love a clean aesthetic, which has resulted in most of my artwork hosting plain white backgrounds, with crisp contours and watery interiors. I am lucky enough to have my father, who is a local contractor in town, build me some of my custom frames, which he has me sand and finish myself. Creating a piece from start to finish is always a really satisfying process for me.

X-RAY MAG: *What is your relationship to the underwater world and coral reefs? How have your experiences underwater influenced your art?*

KC: I got scuba certified a few years ago on a trip to Roatan, Honduras, and then spent a couple months in Thailand and Bali on some more diving expeditions. I am enthralled by the underwater world; for me, a rim of salt in my eyebrows and maybe a piece or two of kelp in my massive hair is evidence of a day well-spent. From studying the movement of a tiny, brightly-decorated nudibranch to swimming into a giant school of chevron barracuda, I can easily get lost in the moments I spend under the surface, a sort of vortex where time seems

Bluesy, Blue Whale, by Kelly Clause. Watercolor on paper, 30 x 22 inches



Kelly Clause



Lingcod, by Kelly Clause. Watercolor on paper, 22 x 16 inches

to halt. Not it the direct for the material art, but continu-me, hum-allows of "re-refreshes

X-RAY ship where favorite

KC: A couple of places and experiences come to mind. In my month-long stay in Thailand, we took a boat out a ways in the Koh Samui archipelago to a beautiful iceberg-shaped rock pinnacle called Sail Rock. As we were arriving, there was a lot of commotion coming from the other boats about a recent

only is inspira-subject of my the ocean ally grounds bles me, and me to hit a sort set button" that my whole being.

MAG: In your relation-with reefs and the sea, have you had your experiences?

whale shark sighting. It felt like a bit of a competitive rat race to get in the water first in order to catch a glimpse of the graceful giant, notorious in the Gulf of Thailand. Of course, by the time all our gear was sorted and we were in the water, the illusive whale shark had disappeared, so several boats sent their divers to swim to the other side of the rock in search of it.

My divemaster, whose quiet demeanor and seeming lack of energy I came to find was just a humble kind of wisdom, told us to remain exactly where we were. He was almost irritatingly confident that it would return to the exact place it was spotted almost an hour earlier. Sure enough, about 15 minutes after descending, the lovely lady made her way towards us just as he said.

It was a pretty magical experience to just be still, suspended in the floating expanse of deep blue and watch as such a wonderful creature again and again returned to us, swimming in a figure-eight pattern, which de-

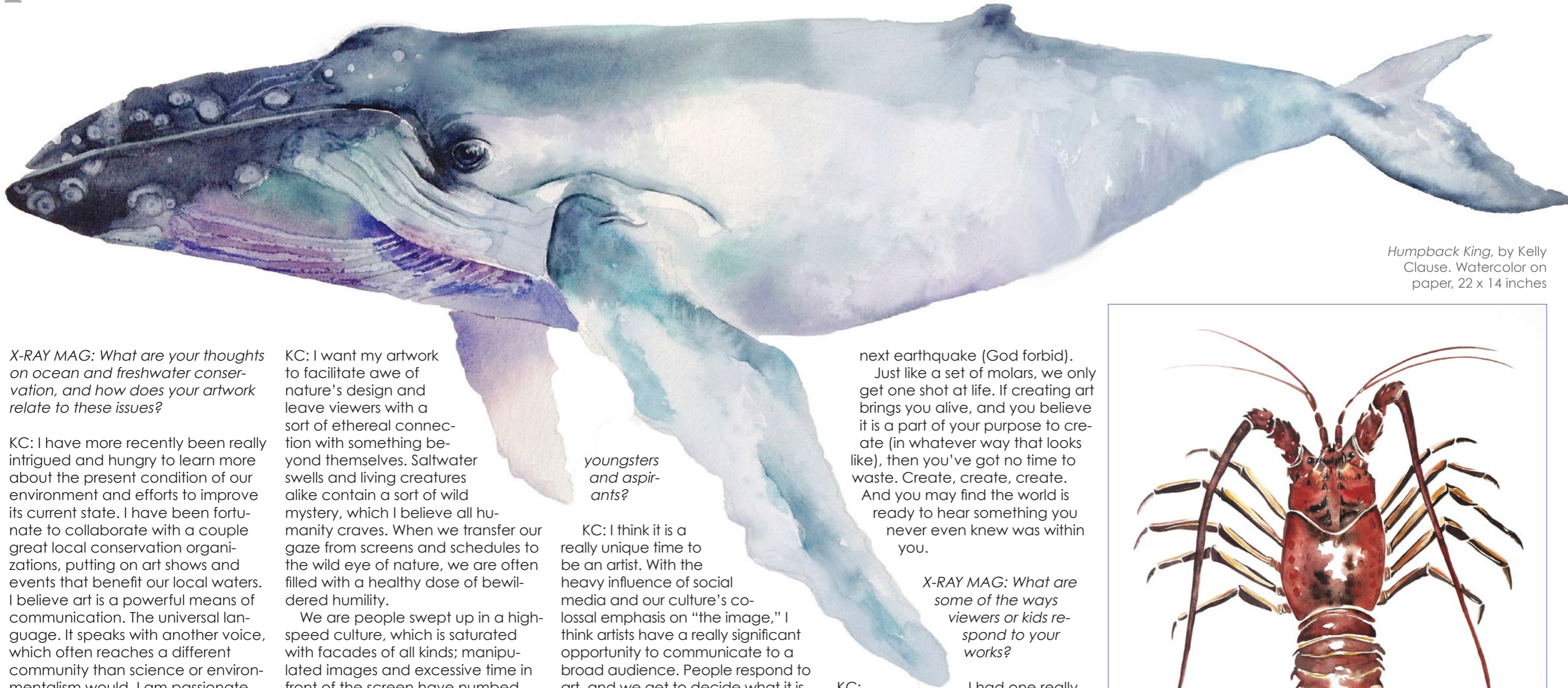
lightly coin- with our space in cided time. At one point, I was about a foot from her white belly; if you have ever been belly-to-belly with a 35 foot beast, it is something that is beautifully humbling.

Another unforgettable experience was off of Nusa Penida at the famous Manta Point. The sloped seafloor makes for excellent viewing grounds to watch the resident population of reef manta rays go about their business at their relatively shallow cleaning station. We were lucky to hit it on a great day. Conditions were perfect: There was good visibility and about 30 manta sightings in the span of our dive. To watch them swooping effortlessly through the water above and below and all around us, I felt like I was in the middle of a life-sized snow globe. Pretty majestic.



Hawksbill Turtle, by Kelly Clause. Watercolor on paper, 11 x 14 inches





Humpback King, by Kelly Clause. Watercolor on paper, 22 x 14 inches

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

KC: I have more recently been really intrigued and hungry to learn more about the present condition of our environment and efforts to improve its current state. I have been fortunate to collaborate with a couple great local conservation organizations, putting on art shows and events that benefit our local waters. I believe art is a powerful means of communication. The universal language. It speaks with another voice, which often reaches a different community than science or environmentalism would. I am passionate about pairing art with local conservation and restoration as I know the more awareness created about our environment, the more effort will be put forth to protect and sustain the beauty of its present state and the unique creatures it hosts.

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

KC: I want my artwork to facilitate awe of nature's design and leave viewers with a sort of ethereal connection with something beyond themselves. Saltwater swells and living creatures alike contain a sort of wild mystery, which I believe all humanity craves. When we transfer our gaze from screens and schedules to the wild eye of nature, we are often filled with a healthy dose of bewildered humility.

We are people swept up in a high-speed culture, which is saturated with facades of all kinds; manipulated images and excessive time in front of the screen have numbed us to what is true of our existence and purpose. I think returning to the simple awe of nature brings us back to what's important about ourselves and others and the world. If my art can play any part in that, I would consider it successful.

X-RAY MAG: *What are the challenges and benefits of being an artist in the world today? Any advice to*

youngsters and aspirants?

KC: I think it is a really unique time to be an artist. With the heavy influence of social media and our culture's colossal emphasis on "the image," I think artists have a really significant opportunity to communicate to a broad audience. People respond to art, and we get to decide what it is they are responding to.

In terms of financial challenges, being an artist is no quick path to buying a mansion on the beach (at least in my opinion). But hey, I think most of us can admit that pursuing something you are passionate about while effecting a change for good in the world, definitely holds a bit more value than a fancy chandelier, which could fall and shatter in the

next earthquake (God forbid).

Just like a set of molars, we only get one shot at life. If creating art brings you alive, and you believe it is a part of your purpose to create (in whatever way that looks like), then you've got no time to waste. Create, create, create. And you may find the world is ready to hear something you never even knew was within you.

X-RAY MAG: *What are some of the ways viewers or kids respond to your works?*

KC: I had one really special encounter at a recent local art event out at the university. It was a graduate student-led interdisciplinary art and science event, open to the public. I was selling some of my greeting cards and prints, chatting with some fellow lovers of the marine world, when I noticed a small visitor below my table.

He had grabbed a sperm whale



Spiny Lobster, by Kelly Clause. Watercolor on paper, 15 x 22 inches

Sperm Whale, by Kelly Clause. Watercolor on paper, 23 x 15 inches



card of mine and proceeded to draw a strikingly similar version of his own whale in his sketchbook. He ran back to my table repeatedly, grabbing more of my sea creature cards as bits of inspiration for what became an entire underwater mural on the side of a nearby wall.

For a five-year-old who probably couldn't even tie his own shoes, his artistic talent was unbelievable. A mural composed of an octopus larger than himself, a sperm whale, sea anemones, and a small school of fish... little Ryder quickly became the prized showman. Seeing a little chap like this get inspired by my art gave me a fuel to the fire like no other. There is something really beautiful about watching a child's response to art.

Some of my favorite visitors at art shows have been young kids. They never cease to stop in their tracks to admire things they love, with no concern for appointments or agendas or schedules. I think we can learn a lot from how a child observes the world—to slow down and appreciate the beauty around us.

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

KC: I am focusing on some upcoming commissioned work that ranges in scope from a painting of a northern pike, to artwork and design for a local wine label, to a mural of a swordfish for a new restaurant in town. I hope to continue to pair art with conservation, and in doing so, continue to protect the very creatures and coastline that bring my work to life.

What that looks like and where my art may take me, I am not entirely sure. But I love the unpredictable, exciting ride that it has taken me on thus far. A recent dream of mine is to pursue a partnership with a liveaboard or research boat, acting as a sort of visual journalist or artist-in-residence while aboard the vessel.

It would be a really amazing opportunity to interact directly with my subject matter, and then inspire a kind of environmental dialogue for people aboard the ship and beyond. ■

To contact the artist directly with any inquiries regarding available artwork, prints and products, please visit: artbykel.com.



Mambo, Two-Spot Octopus, by Kelly Clause. Watercolor on paper, 40 x 26 inches