Scuba Confidential :: Tech Talk – Idiot Buddies :: Portfolio – Erika Pochybova-Johnson

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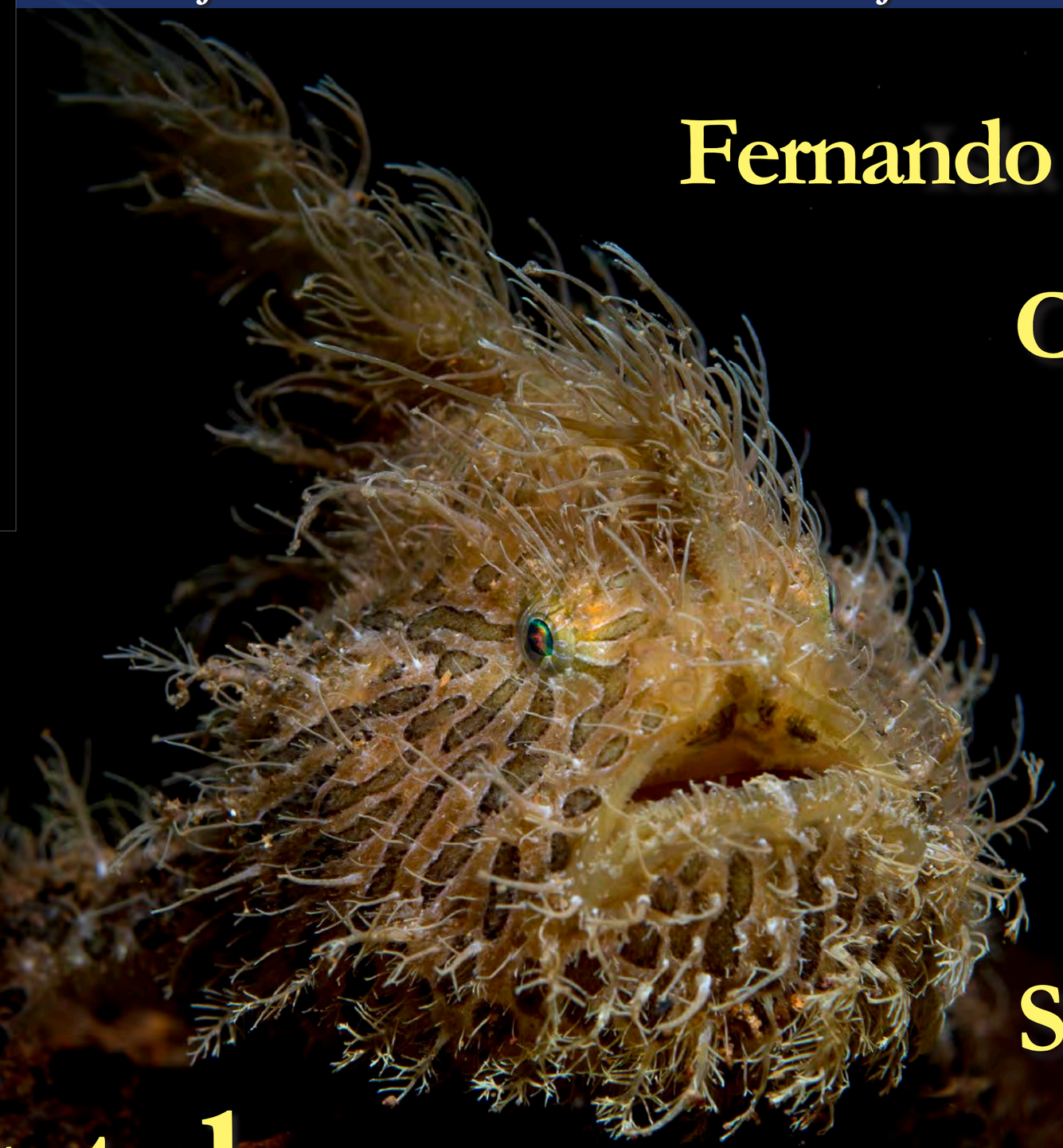

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COVER PHOTO BY MIKE BARTICK

DIRECTORY

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COVER PHOTO: Hairy Frogfish, Anilao, Philippines
Photo by Mike Bartick

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Lionfish on reef, Gorontalo, Indonesia. Photo by Steve Jones

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Progress

In old movies movies or documentaries from the 60's, it always stands out how different the thinking was back then. People smoked on airplanes. Drivers did not wear seatbelts, which sometimes weren't even fitted.

Not only did manufacturers not want to create any associations between their products and possible accidents, but the whole mindset was fundamentally different, and safety, as we know of it today with airbags, anti-lock braking systems and deformation zones, was still far into the future.

How odd it is to watch how people i.e. went about driving then. What was considered normal practice then, around the time of my early childhood, gives me the shudders now. If I was offered a ride in a finely restored vintage car, I would most probably take up the invitation just for experience sake, but I would certainly be mindful of the absence of seatbelts and airbags, too.

Safety features and principles—being active or passive, being built into the design, or being part of the procedures—have, thankfully, come a very long way, and accident rates have diminished accordingly. But, as we all are aware, not gone. While we may have come a long way, there is still a lot to be accomplished.

The same can be said about diving. I've been certified for about as long as I have held a driver's license, and methods, knowledge and procedures have surely changed over the years. In most cases in progressive ways, but sadly not without casualties either.

Fast-forwarding a couple of decades, I can't help ponder what the future will make of present day standards and procedures. I imaging they will seem both as antiquated and ill-informed as when we now look back in time on how we used to drive or dive in the last century. At least I hope so, because it will mean we have learned something in the interim and developed new techniques and practices to make diving safer, better and consequently more enjoyable.

One of the most important aspects will be 'human factors'—how we interact with the technology we employ. As mentioned before in this column, the human factor is the focus of much of the current research in both aviation and the automotive industry who strive to find new ways to make their products safer.

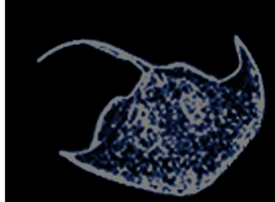
In a way, it is therefore logical, or fitting, that Gareth Lock, who will contribute a series of features in *X-RAY MAG* on human factors and safety cultures, including an article in this issue, works for the Royal Air Force.

It may not come across as very sexy science, and the strain of thinking about our present ways of diving in a new way, or new light, may put off one or two divers who could otherwise benefit from a new mindset. But I believe the research into this very field will be instrumental.

It is my prediction that the greatest improvements in future equipment and procedures will be built on its findings.

So now's a good time to pay attention.

—X-RAY MAG



News edited
by Peter Symes

from the deep

NEWS

Our results show both short-term acclimatory and longer-term adaptive acquisition of climate resistance. Adding these adaptive abilities to ecosystem models is likely to slow predictions of demise for coral reef ecosystems.

Can corals really adapt to rising sea temperatures?

Reef corals are generally highly sensitive to heat, yet some populations resistant to climate change have recently been identified. Stanford researchers show that some corals can adjust to hot water much faster than through evolutionary change alone.

FILE PHOTO: STEVE JONES

It has been known for some years that some corals resist bleaching by hosting types of algae that can handle the heat, while others swap out the heat-stressed algae for tougher, heat-resistant strains.

To investigate the biological processes that enable corals to adapt to higher temperatures a group of Stanford researchers led by biology professor Mike Palumbi conducted a unique experiment in the shallow reef pools of Ofu island in American Samoa.

The island offered a perfect laboratory setting with numerous corals hosting the most common heat-sensitive and heat-resistant algae symbionts. Ofu also has pools of varying temperatures that allowed the research team to test under what conditions the symbionts formed associations with corals.

Corals are certainly threatened by environmental change, but this research has really sparked the notion that corals may be tougher than we thought

Swapping corals

The scientists transplanted transplanted colonies from a warm pool to a nearby cool pool and vice versa.

The researchers found that, over time, cool-pool corals transplanted to the hot pool became more heat-tolerant. Although the transplanted corals were only about half as heat-tolerant as corals that had been living in the hot pool all along, they quickly—in less than two years—acclimatised and achieved the same heat tolerance that we would expect from strong natural selection over many generations for these long-lived organisms.

According to a Stanford University newsletter, these findings make clear that some corals can stave off the effects of ocean warming through a combination of adaptation based on genetic makeup coupled with physiological adjustment to local conditions.

The corals Palumbi's group studied adjusted themselves by switching on or off certain genes, depending on the local temperature.

Everything all well then?

Palumbi cautioned that corals' heat-adaptive characteristics do not provide a magic bullet to combat climate change. They can't respond to indefinite temperature increases and they could be compromised by additional stressors such as acidification and pollution. □ SOURCE: STANFORD UNIVERSITY NEWSLETTER, SCIENCE

Taking On the Lionfish

FILE PHOTO: PETER SYMES

Getting people to eat lionfish is proving to be a challenge, according to researchers at the University of Southampton.

Lionfish are an invasive species in the Caribbean, and researchers are keen to get people eating the fish to control its burgeoning populations. But the common misconception that the fish is poisonous continues to be an obstacle in some regions.

Is it edible?

According to PhD candidate, Fadilah Ali, who has dissected over 10,000 lionfish, said the fish is not poisonous and is safe to eat. While the barbs at the tips of lionfish fins do contain venom, it is not fatal to be struck by one, only painful. Ali said that education through media could help people understand the benefits of consuming lionfish, and put aside prevailing misconceptions. In addition, Ali suggested that lionfish tasting events be organized so more people could try the delicacy and overcome their fears of the fish.

There is proof that people are eating lionfish safely, said Ali, noting recent lionfish culinary competitions and a lionfish cookbook, as well as successful exporters of lionfish such as Belize and Jamaica. The cull, in Jamaica at least, seems to be having a positive effect. There are reports from Jamaica's National Environment and Planning Agency that in coastal waters there has been a 66 percent decrease in sightings of lionfish in depths up to 75ft.

Demand

While some vendors in Trinadad feel they will lose customers if they sell lionfish on their menus because people are wary of the venum in lionfish spines, other restaurants, in Florida for example, can't get enough of the fish, which are sporadically on the menu as catches come in, to satisfy a robust demand. Lionfish are difficult to catch by hand as they like to hide in crevasses in reefs, but they can frequently be found in lobster traps, as they like to eat lobster eggs. However, as voracious eaters with no natural predators in Atlantic and Caribbean waters, they will go after juvenile fish of just about anything from grouper to snapper to parrotfish, according to conservationists of NOAA's Florida Keys National Marine Sanctuary.

Saving sharks

Conservationists have another reason for promoting lionfish for consumption: saving endangered sharks. If more people eat lionfish rather than shark, it could help the recovery of decimated shark populations due to overfishing. Initiatives such as the first lionfish and bake taste-test at Maracas Bay in Trinadad and Tobago sponsored by Papa Bois Conservation and the Institute of Marine Affairs are getting the locals talking about and trying lionfish in place of the traditional local staple of shark and bake.

From spears to legislation

In Florida, the state is recruiting divers to combat lionfish. Fishery managers will urge Florida Fish and Wildlife Conservation voting board members to take more steps to allow divers to kill lionfish. Florida law bans the use of rebreathers for all spearfishing. An exception should be made for lionfish.

The state has already taken several steps to increase the harvest of lionfish, such as allowing divers to spear or capture lionfish without a saltwater fishing license. Anglers need a fishing license but can take as many lionfish as they want.

The Florida Fish and Wildlife Conservation cites Key Largo lionfish derbies as examples of how allowing the spearing of lionfish in waters normally closed to spearfishing proved to be "excellent opportunities to safely facilitate lionfish removal." □ SOURCES: ABC NEWS, TBO.COM, TRINIDAD & TOBAGO GUARDIAN ONLINE

Want to clean a fjord?

Call in Some Mussel

PETER SYMES

Dense beds of blue mussels, *mytilus edulis*, can filter vast volumes of water. They are edible, too

Blue mussel beds can clean fjords and bays.

Agricultural fertilizers leaching into aquatic environment can cause massive algae blooms leading to oxygen depletion. Banks of blue mussels can get the algae populations under control, Danish researches has demonstrated.

A project conducted by researchers from Denmark's Technical University showed that 18 hectares of blue mussels in Skive Fjord reduced the levels of algae low enough to prevent oxygen depletion.

The main issue with fertilization of coastal waters causing algae bloom stems from the massive amounts of dead algae sinking to the bottom in thick layers. As they rot, they consume and deplete oxygen, choking huge swathes of seabed, leading to widespread bottom death. This is a big issue along coasts of agricultural areas.

Shallow waters with a limited exchange of water such as deep fjords are in particular at risk but also bigger seas, such as the Baltic, are severely affected by oxygen depletion and huge areas regularly die off.

In an attempt to prevent algae to completely dominate the ecosystems researchers have looked into using blue mussels, which are effective filter feeders, to bring the blooming algae populations under control.

Normal feeding in *Mytilus edulis,* and many other suspension-feeding bivalves, depends on the cirri-trapping principle where bands of lateral cilia produce the main water transport through interfilamentary canals of the gill where suspended particles are separated. In experiments it has been demonstrated that the mean individual filtration rate of 21.5 mm shell length mussels was about 15 milliliter per minute. This equates to 22 centiliter, or a quarter liter per 24 hours, just for one small mussel.

Consequently, as many divers can testify, there is often a much clearer layer of water just above dense mussel beds.

The Danish researchers used 90km (56mi) of lines from which the blue mussels were suspended. After a year, the scientists saw significant improvement in water quality in a surrounding area that was ten times bigger than the mussel beds. This effect has been attributed solely to the blue mussels. □

Sargasso Sea gets international protection

Working together, the governments of the Azores, Bermuda, Monaco, the United Kingdom and the United States have formed an international alliance to protect and conserve the Sargasso Sea, located in the mid-Atlantic Ocean and unique for its floating seaweeds that are home to a rich biodiversity.

A first for international cooperation in protecting a marine area, the alliance signed a declaration in Hamilton, the capital of Bermuda, outlining the use of international organizations such as the International Maritime Organization, the Convention on Migratory Species as well as regional fisheries authorities to protect the Sargasso Sea's unique ecosystem.

Executive Director of the Sargasso Sea Alliance David Freestone said, "This is a truly historic occasion. It is the first time an international alliance has been formed to protect an iconic high seas ecosystem, using existing legal international frameworks."

The Sargassum seaweeds of the Sargasso Sea serve as an ecological crossroad in the Atlantic, where 30 species of cetaceans live or migrate through as well as other species such as sea turtles, sharks, tuna and eels.

Unfortunately, the area has been threatened by pollution, ocean acidification, climate change, fishing and harvesting of algae for biofuel production and fertilizer. □

SOURCE: WILDLIFE EXTRA

View from Akajima Island in the Kerama group of islands

Japan designates new marine park in Okinawa

Kerama Islands and surrounding waters in Okinawa Prefecture has become Japans 31st national park—the first such designation in three decades. In addition, surrounding waters shallower than 30 metres will become a marine park. The Kerama Islands are a group of 22 islands located 32 kilometres (20 mi) southwest of Okinawa Island in Japan

The designated area includes 30 islets and reefs, and covers 3,520 hectares of dry land and 94,750 hectares of ocean. It lies 35 kilometres west of Okinawa Main Island and is famous for its rich aquatic environment. It is home to 248 species of coral.

The government will restrict development within the areas, such as the extraction of sand. It also plans to build coral restoration facilities to counter the damage done in the past. □ SOURCE: JAPAN TIMES, JAPAN UPDATE

Oman protects two coral-rich bays

On the Musandam peninsula of Oman, the bays of Khor Najd and Khor Hablain are now off limits to all types of fishing, with the exception of handline fishing. In addition, all forms of nets and cages are prohibited. These measures have been put in place by the Ministry of Agriculture and Fisheries in order to protect and conserve the pristine coral reefs, marine life and resources as well as the natural beauty of these practically untouched areas.

The result of five years of research and campaigning by the international organization Biosphere Expeditions, the ban is hailed as "a wise and important step" by the group's founder, Dr Matthias Hammer. "This area has a high coral coverage at nearly 60 per cent of the underwater surface. This is greater than that of most reefs around the world, and the Musandam reefs are certainly the best in the region," said Hammer.

Oman Marine Sciences and Fisheries Centre which recommended the ban stated, "The destruction of corals means severe damage to the marine life in the area. So this measure not only protects reefs but also helps in sustainability of marine resources."

Aiming for the creation of a full marine protected area, Biosphere Expeditions hopes this measure is the first step toward a network of MPA's in the region. □ SOURCE: WILDLIFE EXTRA

Oxygen via pills?

Scientists have developed a new microparticle filled with oxygen that can be injected into the blood stream.

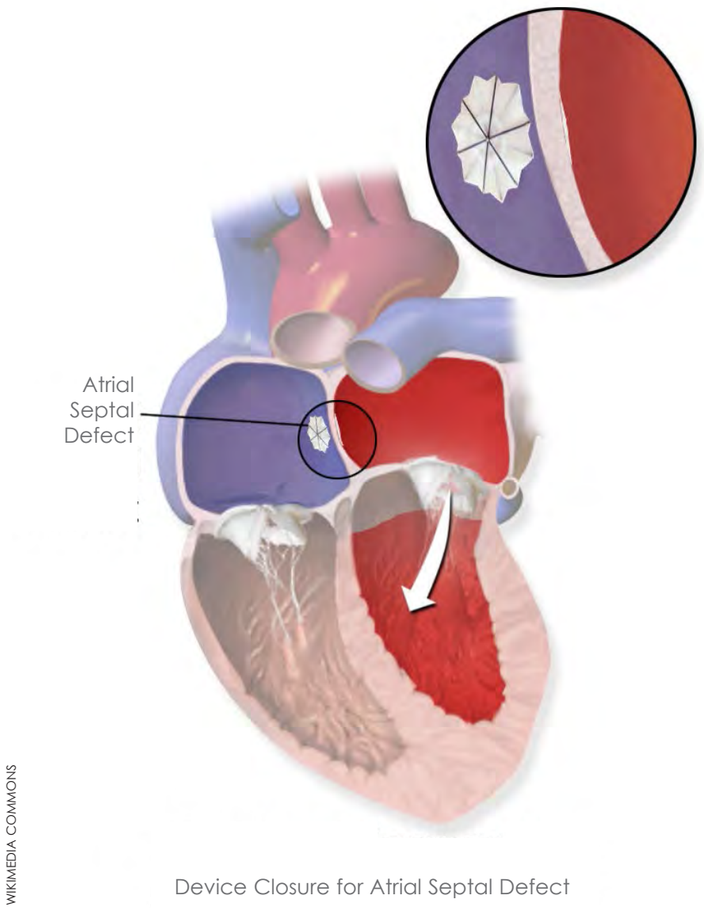
The microparticles are tiny capsules (2-4 micrometers) made of a single layer of lipids surrounding a small bubble of oxygen gas.

Upon injecting a capsule-filled liquid into the bloodstream, the capsules bump into red blood cells, transferring the oxygen to the cell in the process. About 70 percent of the oxygen injected successfully makes its way into the blood stream this way.

While the technique is primarily being developed for short-term resuscitation by boosting oxygenation during acute respiratory failure, it does give raise to some mind-boggling perspectives; Not only could this exciting new technique provide first responders attending dive accidents with better tools, but is it also a glimpse into the future were divers could have gases provided via particles in the bloodsteam?

Food for thought. □

Doctor recommends screening divers for PFO



WIKIMEDIA COMMONS

Device Closure for Atrial Septal Defect

Closure of patent foramen ovale (PFO) may alleviate decompression sickness. A small study in hyperbaric chamber finds arterial bubbles was detected in 12 percent of divers with PFOs and none in divers who had their PFOs closed. Serious divers should seek screening, said doctor.

Atrial septal defect (ASD) is a form of a congenital heart defect, such as a hole, that enables blood flow between two compartments of the heart called the left and right atria.

During fetal development a hole in the septum called the foramen ovale allows blood from the right atrium to enter the left atrium. This opening allows blood to bypass the nonfunctional fetal lungs while the fetus obtains its oxygen from the placenta.

In approximately 25 percent of adults the foramen ovale haven't entirely sealed after birth. In some cases elevation of the pressure in the pulmonary circulatory system can cause the foramen ovale to remain open. This is known as a *patent foramen ovale* or PFO. In many cases an ASD may not produce noticeable signs or symptoms, especially if the defect is small.

PFO in divers

However ASDs, and particularly PFOs, are a predisposing risk factor for decompression sickness in divers because a proportion of venous blood carrying inert gases, such as helium or nitrogen does not pass through the lungs.

The only way to release the excess inert gases from the body is to pass the blood carrying the inert gases through the lungs to be exhaled. If some of the inert gas-laden blood passes through the PFO, it avoids the lungs and the inert gas is more likely to form large bubbles in the arterial blood stream causing decompression sickness.

Czech medical researchers put two groups of divers through simulated dives in a hyperbaric chamber of either 18m for 80 minutes or 50m for 20 minutes. The 'divers' were categorized according to whether they had a PFO or not.

After the dives, using echocardiography, *venous* bubbles were detected in both groups with equal frequency.

"And then those patients come to me to get their PFOs closed because otherwise they would be classified as disabled and would not be allowed to dive again..."

Bubbles

However, *arterial* bubbles were detected in 12 percent of the PFO group but none of the closure patients. Furthermore, in 21 percent of divers with PFO and detected arterial gas bubbles, neurological symptoms of decompression sickness were present (ie. headache, unusual fatigue, and transitory visual disturbances). Conversely, none of the divers in the closure group reported decompression sickness symptoms.

The data should convince serious divers to seek screening for the presence of a PFO, Robert J. Sommer, MD, of Columbia University Medical Center stated to the medical industry website TCTMD.

Sommer notes that he has seen professional divers from organizations such as the New York Police Department and the New York Fire Department who have experienced symptoms on the job and subsequently been found to have a PFO. "And then those patients come to me to get their PFOs closed because otherwise they would be classified as disabled," and would not be allowed to dive again, he said. □

Diver on wreck of the *Oriskany*, Pensacola, Florida; Bay County Hathaway Bridge (below)

Florida's Artificial Reefs

— A World of Undersea Adventure

Text by Kathalyn Gaither, Florida Department of Environmental Protection. Photos by A. Emtiaz, Bill Horn; and Keith Mille of the FWC Artificial Reef Program

Miles of white sandy beaches, family vacation destinations, infamous spring break festivities and outstanding state parks attract millions of visitors to Florida annually from around the world. But there is so much more to see—especially for those who like to take their sightseeing down below the ocean and gulf waters—like the beauty and magic of thousands of artificial reefs that lie beneath the surface along Florida's coastlines.

Artificial reefs themselves cannot compare to the magnificent beauty of Florida's natural coral reefs. However, the spectacular marine species of all shapes, sizes and vibrant colors is of equal amazement.

And while Florida's coral reef tract lies in south Florida waters, divers and snorkelers can find more than 2,800 artificial reefs located off 34 of the 35 coastal counties.

Species such moray eels and sea turtles, red snapper and cobia, Atlantic spadefish and butterfly fish—and even goliath grouper reaching up to seven feet in length and weighing several hundred pounds—frequent the reefs as thousands of tiny fish spiral around them.

The artificial reefs vary from as little as one ton in size to in excess of 30,000 tons. These structures had varying roles before becoming a part of the vast underwater artificial reef community. There are former combat army tanks, barges, freighters, schooners, tugboats, box cars, airplanes and water towers.

Currently, these types of reef materials are no longer used since new permits require that reef materials be usable for long-term marine habitat and remain stable on the ocean floor.

Most new reef materials are prefabricated concrete and steel reef structures built specifically for artificial reef use.

Some of the older artificial reefs were even somewhat famous before their sinking.

Before its sinking off the waters near Looe Key in 1998, the 210-foot ship *Adolphus Busch* was in the 1957 film *Fire Down Below* starring Robert Mitchum, Jack Lemmon and Rita Hayworth.

In 2009, the USS *Hoyt Vandenberg*—a 520-foot long missile tracking ship and the star of the 1999 movie *Virus* starring

KEITH MILLE / FWC ARTIFICIAL REEF PROGRAM

Okaloosa Liberty Ship

Jamie Lee Curtis—was sunk off Key West.

Scrap army tanks and decommissioned old ships may not be thought of in terms of beautiful, but they do evoke a sort of intrigue and magic as artificial reefs.

Many of the structures were just sitting in water or on land, aging away, until Florida's Artificial Reef Program was created in 1982, and once again, they were given a purpose.

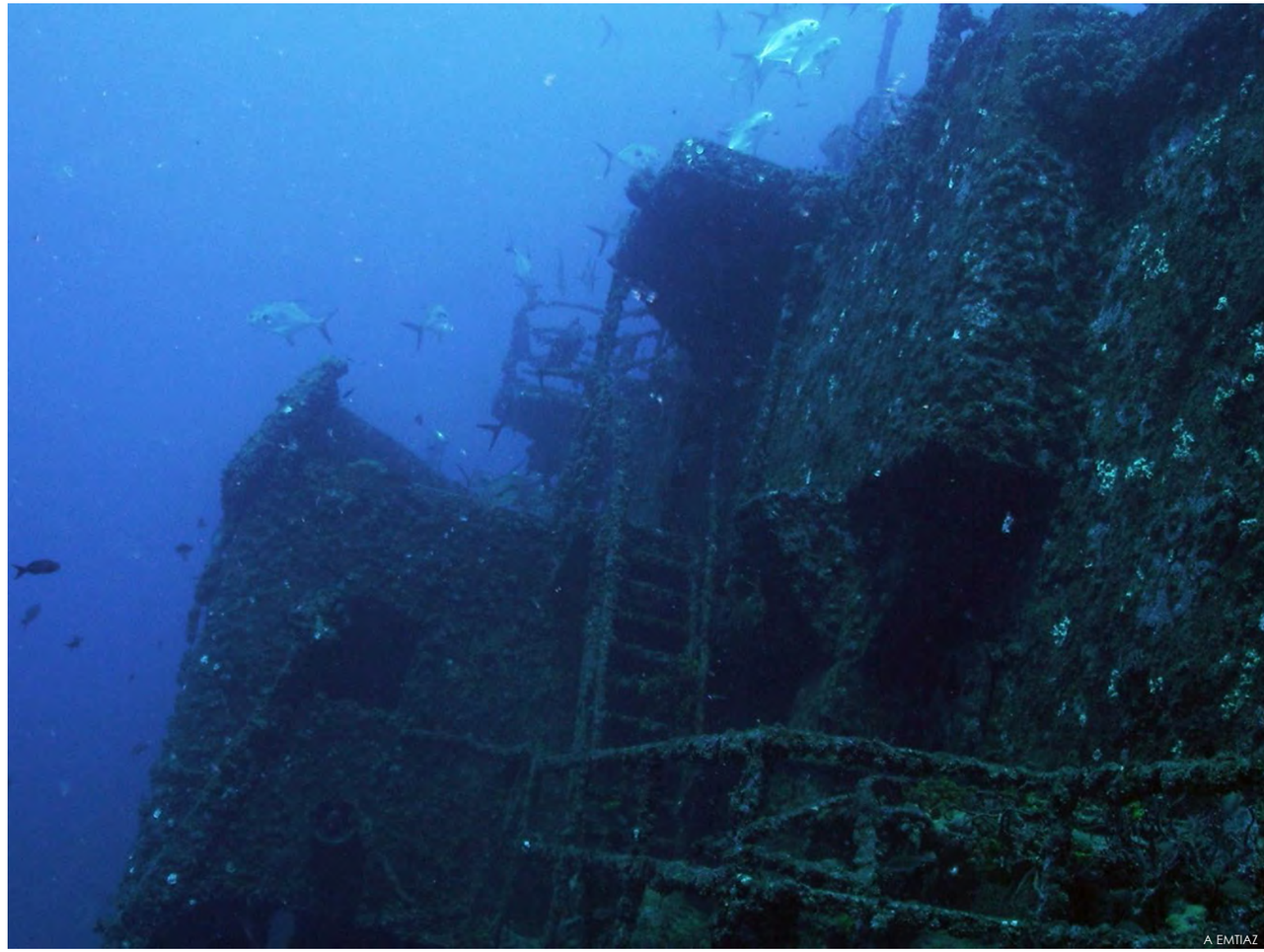
Several of Florida's artificial reefs have historical value. Some are registered with the Florida Underwater Archaeological Preserve and the U.S. National Register of Historic Places, such as the USS *Hoyt Vandenberg* that was sunk in the waters off Monroe County in 2009. It is the second largest artificial reef in Florida surpassed only by the USS *Oriskany*, which was sunk in 2006, about 22 miles from Pensacola Pass.

The USS *Oriskany*, measuring 888 feet in length and weighing 32,000 tons, was previously a Naval Air Craft Carrier used primarily in the 1970s and decommissioned in 1976. She is fondly referred to as the Great Carrier Reef.

The USS *Spiegel Grove*, named after U.S. President Rutherford B. Hayes' estate, was active in the military from 1956 through 1984. It transported troops and equipment thousands of miles and to many countries including Newfoundland, South Africa, Spain and Denmark during the Cold War era. In 2002, the 510-foot ship was sunk in waters off the Florida Keys and is located near the John Pennekamp Coral Reef Underwater State Park in Key Largo.

Especially common in gulf waters off Mexico Beach in Bay County are memorial reefs that honor those who have passed on. Some of the pre-fabricated reef structures actually hold the ashes of families' loved ones in many areas of the state, particularly off Sarasota.

Transportation was a theme for older reef materials in the waters of Escambia and Okaloosa coun-



A. EMTIAZ

USCG *Duane* (above) photo taken by Anoosh "Tony" Emtiaz—an employee at John Pennekamp Coral Reef State Park. Two of his favorite sites are sister shipwrecks, the USCG *Duane* and USCG *Bibb*, both sunk in 1987

Queen angelfish, Dade County Barge

ties. In addition to the *Oriskany*, there are an additional ten army tanks, some CSX boxcars, at least a dozen M-60 army tanks, some tugboats, several barges and old auto bodies that serve as a refuge and playgrounds for area marine species.

You can also see a little bit of America's past in Pasco County waters where nine army tanks have been sunk, and in Sarasota County there are ten of them.

Many of the artificial reefs have been fondly named by divers or family members, like the Stewart Unkles Jr. Memorial Reef, Red Sea Tugboat, Spirit of Hemingway, Culverts Guardian Reef and Poseidon's Garden—an underwater burial site off Sanibel Island.

There are some ex-smuggling ships, an old floating saloon and even a Rolls Royce off West Palm Beach.

No matter what it is made of—whether it's a concrete module or a massive retired military vessel—Florida's artificial reefs present awesome opportunities for those looking to explore life beneath the sea, from the novice diver to the most experienced.

Be cautious—there are certain dives that only experienced divers should attempt due to various conditions such as currents, underwater hazards and other variables.

Artificial reefs that lie within nine nautical miles of the coast in the Gulf of Mexico, and within three nautical miles of the Atlantic need permits from both the Florida Department of Environmental Protection (www.dep.state.fl.us) and the U.S. Army Corps of Engineers; any beyond those distances need permits only from USACE.

The Florida Fish and Wildlife Conservation Commission (www.myfwc.com/conservation/saltwater/artificial-reefs/locate-reefs) oversees a grants-in-aid program to assist local governments to help fund the planning, building and monitoring of artificial reefs in their local marine waters, as well as provide technical assistance and guidance for artificial reef projects statewide.

With so many different reefs out there to explore, divers and photographers will never need worry about becoming bored with the scenery. So plan your next excursion to Florida and experience the undersea world of adventure that Florida's artificial reefs bestow! □

Dalarö

— Marine Archeological Wreck Park

"Every dive we discover something new on the Dalaröwreck!"said Jim Hansson, Swedish Maritime Museums (above); Under wheel of canon hides handle of flint lock pistol (inset)

Text by Millis Keegan
Photos courtesy of the Swedish Maritime Museums

The Baltic Sea offers some very treacherous waters even under the best of circumstances. The price to pay for sailing the Baltic through the millenniums has been high, and traces of those costs are scattered over the bottom. At the time and up to a very short while ago in the big scheme of things, no one knew how valuable these wrecks would be.

The value is not measured in money, but in knowledge. Due to extremely favorable conditions, the wrecks and the remains found are virtual time capsules, waiting to tell their stories about people and their way of living in the past, about the countries and the cultures of Europe.

Nowhere else in the world are there as many well preserved wooden wrecks as in the Baltic Sea, and there is much to tell, but for now, we are going to zoom in on Stockholm's archipelago in Sweden. Over 20,000 islands made navigating through these parts extra challenging in times long before the Viking Era.

Through well-kept archives, we have information of over 20,000 wreck site locations in this region. Yet, only a few of them have actually been found and explored by divers. The wrecks are hard to find, even with modern technology. When a new find is presented, it is a big deal and very exciting.

Finding lost history

Strides in new technology have made it easier than ever to find wrecks lost for centuries. Note that I say easier than ever, not easy. Easy it is not, but with a 'little' bit of funding, a crew made of the right stuff, lots and lots of time and a pinch of luck, it can and is done. Not too long ago a team of Baltic divers brought attention to

wreck rap

Visitors can follow what happens in real time on the wrecks, dry and comfortable over a cup of coffee, by signing up for a full ROV experience

Dive platform used during early excavations on the Dalarö wreck provided the divers with a great base camp

some really spectacular and significant finds in the Baltic, among them, the wooden warship *Mars,* which sank in 1564 (read the story in *X-RAY MAG* #59). That discovery brought a bit of frenzy to the world.

Researchers and marine archeologists should have a field day, but there is always that tiny little hindrance called money. Excavating something from the bottom of the sea is a costly matter, so the wrecks are protected with a no-dive clause attached to the protection. Now no one can enjoy the wrecks, everything comes to a stand still, and no one is happy. How can we find a solution in which the wrecks can be enjoyed in the mean time?

The ROV pilot really needs to know what he is doing, navigating the fragile wrecks

Nordic Blue Parks

In 2012, museums and cultural and natural heritage authorities in Sweden, Finland, Denmark and Norway partnered up in a pro-ject called Nordic Blue Parks. The aim was to develop a sustainable marine tourism combining outreach with protection. They wanted to do so by opening underwater parks that combined cultural experiences with nature. Through the Blue Parks, all visitors, not only divers, were going to be able to experience even the most fragile shipwrecks. Perhaps tourists could be brought to the wreck sites by boat charter, with ROV (remote operated vehicle) capacity? Or through an interactive museum experience using computer animations? Ideas were tossed around, and tossed away.

Dalarö Shipwreck Preserve

Haninge Kommun, in cooperation with Swedish Maritime Museums (SMM), took the ideas and ran with them.
It is 2014, and the first ever Maritime Historical Underwater Shipwreck Preserve is about to open up in the Baltic Sea. Three wrecks have been chosen for the preserve, and there will be possibilities to dive the wrecks as well as opportunities to sign up for the full ROV experience.

It has taken eight years of hard work and the co-operation of the municipal of Haninge Kommun and the Swedish Maritime Museums as well as some private actors that just wanted this to happen, such as myself, to come to this point. The work has been ground breaking, a true learn-as-you-go experience, as nothing like it exists in the world. Anyone, scuba diver or not, can visit the location of the wrecks, and see what is going on in the deep, in real time.

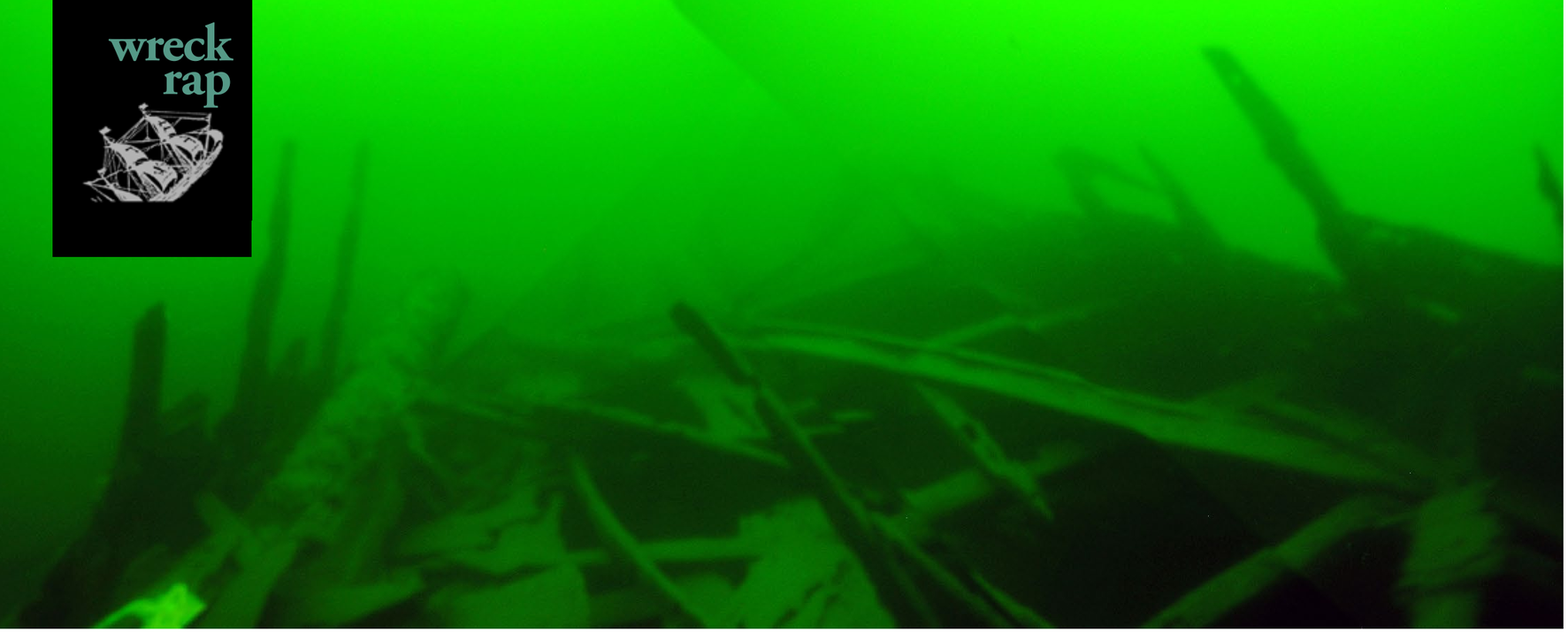
The wrecks

Of the three wrecks chosen initially, two are well known in the dive community, but 20-something years ago, dive restrictions were put on the *Jutholmswreck* and *Anna Maria*.

The *Jutholmswreck* is a small flute. She sank near the end of 1780. A flute is a ship type known for its loading capacities, and was mainly used for trading. There are still parts of the cargo left on the wreck, like barrels of tar and iron bars.

Anna Maria, another flute, but bigger, sank in the harbor of Dalarö in the harsh winter of 1709, after a fire broke out while the crew were downing some beers at a nearby

wreck rap



A mosaic of pictures shows the aft of the Dalarö wreck

establishment. Both these wrecks are well documented and excavated.

The third one is a wreck found only eight years ago, a magnificent wreck with a mysterious past from the mid-late 17th century. An immediate dive ban was put in place, so very few have seen this pristine and truly unique ship. She sits upright on the bottom with everything, and I mean everything, completely intact. Give or take some hundred years of wear and tear of course—she did go down about 350 years ago after all—but the location is so sheltered that even parts of the masts are still standing and pieces of the sail have been spotted.

The Dalarö wreck will be the signature wreck of the park. Even though she is extremely well preserved, she is the most fragile. Some excavation has been done, but so far, her story remains a secret. Spread out on the deck, artifacts from everyday life aboard can be found. Two flintlocks and one wheel lock pistol, Bartmann jugs from the city of Amsterdam in Holland, an open toolbox and more. All is out in the open, and that is how the authorities want it to remain, for everyone to see. That will be done through careful restrictions and regulations.

Dendrochronology suggests that the ships timbers were felled after 1613, possibly from Northumberland. A glass bottle found in the wreck bears the Crest of the Boynton or Ogle family from Northumberland in England, which is quite a significant clue, but more information is needed. There is a good chance that the answer can be found through future excavations, so stay tuned.

Restrictions & regulations

The cultural resources of the Baltic are under constant threat from pollution, looting and deterioration as it is. To avoid any undue and unnecessary damage, specially trained dive guides will be the guardians of the wrecks' well being.

As a diver, you will be allowed to dive the wrecks only if the wreck park rangers determine that you have the necessary qualifications.

It will be pretty straightforward in regards to *Anna Maria* and the *Jutholms* wreck, as long as you can prove that you can handle yourself, your equipment and have a clue about your buoyancy in cold water.

With the signature wreck, things will be a bit different. It will not be enough to just have a clue about your buoyancy control, you will need to know exactly what you are doing, and you will be judged during other dives, so you might want to plan more than a day at this destination to have a possibility to experience the Dalarö wreck.

A diver gets ready to investigate below deck (top and left); Taxi at Sea, M/S *Vindbådan*, takes non-diving passengers to the wreck sites

It took eight years and a lot of hard work to reach this point, to be able to visit these unique wrecks, but make no mistake, the permission can be taken away in less than a day.

Peter Norman from RAÄ, the Swedish National Heritage Board, explained that their mission is to play a proactive, coordinating role in heritage promotion efforts. Although they welcome the interest for historic remains under water, they have to ensure that the historic environment is preserved in the most effective possible manner. Any sign of unnecessary wear and tear, and they will reassess the permissions.

Looting, wear and tear

Bad buoyancy skills are not the only danger to the Dalarö Historical Ship Wreck Preserve. Looting is also a very real threat and will be even more so as the

wreck rap

The green water of the Baltic promises exciting and beautiful dives, as long as the visibility cooperates

park opens up and the location becomes more widely known. The coast guard and the Baltic Sea Police have been part of the project from the start, and are well aware of what is at stake. They are not the only ones, the society as well as the Swedish dive community are very protective of these gems as well, and will make sure that the coast guard and the Baltic Sea Police will be alerted to any suspicious movement around the wrecks.

Wreck Park Rangers

Diving will only be allowed in small groups, and with a specially trained dive guide, an underwater wreck park ranger. The Swedish Maritime Museums invited anyone with at least a level of dive master or equivalent certification to become certified as an underwater wreck park ranger for Dalarö Ship Wreck Preserve. That required two days of training, beginning with classroom training in the form of lectures, and a dive day in the preserve.

Training

The first part of the training was held at the world famous Vasa Museum in Stockholm. The lectures touched subjects of laws pertaining to the protection of the wrecks, and criminal activities such as looting and more. Also discussed were safety issues, and the importance of knowing about our past and the roll archeology plays in that.

Nina Eklöf, Jim Hansson and Trevor Draeseke were the marine archeologists and the representatives from SMM. They covered topics including what is marine archeology, how do they go about it on an everyday basis, and why marine archeology is such an important science. They spoke about research and the fact that there is not as much funding for research, so they have to spend it wisely.

The figurehead, a lion, was brought up to the surface, after being measured and documented (left and right) she was returned to her original place at the wreck site

"We rely on you to spread the right information about our historical wrecks, and it will be your job to enforce a positive attitude or change the attitude about them." They pointed out that the wrecks are vehicles for understanding a certain time period in the past, which is what makes them so interesting, and that we now have an opportunity through the wreck park to reach a larger audience with that message.

So what happens now?

The next step is the in-water training that will take place in mid-May. After that you can book your historical wreck dive with one of the Underwater Wreck Park Rangers. Unique to the park is also the non-diver program. Tourists with an interest in history, but with no intention of getting wet, can be brought to the wreck sites by boat charter. There are even opportunities allowing visitors to experience what happens on the wreck in real time, through ROV (remote operated vehicle).

By now I think I've managed to convey that the Stockholm archipelago really is a fabulous historical underwater maritime museum. It is a museum without real access to the public, unless you are a scuba diver. But times have changed, and the authorities' dream of Nordic Blue Parks, open to everyone, diver or not, is really happening. This is a big thing. Welcome to Dalarö Ship Wreck Preserve, and enjoy experiencing the past. □

QUICK FACT

THE BALTIC SEA: 10,000 YEARS
The Baltic Sea has existed for around 10,000 years, a product of meltwater from glaciers and salt water from the North Sea entering the straits between Denmark and Sweden. There have been human settlements along its shores through the millenia and inhabitants sailed, hunted and warred in the Baltic. □ SOURCE: WIKIPEDIA

NOAA

A survey by NOAA located the wreck of *City of Chester* at a depth of 66m (217ft)

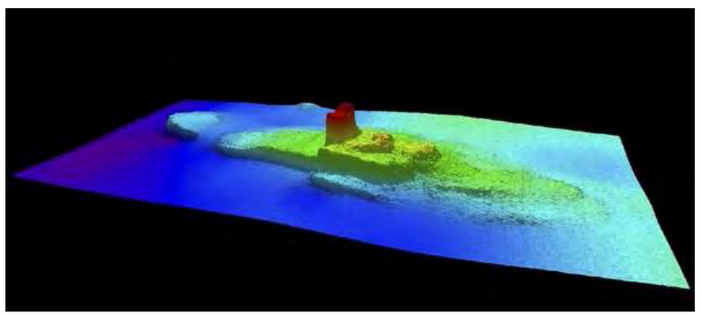
19th century shipwreck found near Golden Gate Bridge

The wreck of a passenger steamer that went down in 1888 has been found sitting upright on the bed of San Francisco Bay.

The 202-foot-long steamship *City of Chester* had just left San Francisco and was headed up the California coast to Eureka with 90 passengers on 22 August 1888, when at around 10 a.m. it was struck by the steamer *Oceanic*. Impaled on *Oceanic*, which was arriving from Asia, *City of Chester* remained afloat for six minutes before sinking. Sixteen people died in the accident, NOAA stated on its website.

The rediscovery of the wreck restores an important historical link to San Francisco's early Chinese-American community. Reports at the time initially criticized *Oceanic's* Chinese crew in the racially charged atmosphere of the times. Criticisms turned to praise, however, when the bravery of the crew in rescuing many of *City of Chester's* passengers was revealed. The wreck was then largely forgotten.

The wreck won't be raised, but a nearby museum exhibition will tell the story of the ship's sinking. □



A sonar profile view of the iron and wood steamship *City of Chester* sitting upright on the seabed of San Francisco Bay

HMCS *Annapolis* artificial reef project stalls over spat and funding

Plans to scuttle a decommissioned Canadian naval destroyer escort ship off Gambier Island in British Columbia have sparked opposition amongst local residents.

The Artificial Reef Society of BC (ARSBC) plans to sink the HMCS *Annapolis* in Halkett Bay to attract divers. The vessel is currently moored at West Bay on Gambier Island, which is located in Howe Sound north of Vancouver.

Gambier homeowner Gary MacDonald and members of The Save Halkett Bay Campaign are lobbying to prevent the HMCS *Annapolis* from being sunk in the bay. According to MacDonald, a recently released Environment Canada study reveals pollution levels in some of the ships components are more than eight times the allowable limit. Environment Canada recently issued a request for proposals from companies interested in stripping all insulation from the ship as it contains polychlorinated biphenyls (PCBs). "We've been calling for a thorough investigation of the ship's state for years," said MacDonald. "We're adamant that Halkett Bay is absolutely the wrong place to sink a ship. There is too much tidal action and there is a fair likelihood that the ship will actually come apart once it's sunk. It's simply the wrong place."

Howard Robins of the ARSBC is heading up the *Annapolis* project. He said the sunken vessel would bring marine biodiversity to Halkett Bay. "These are very good projects, they do a lot for the marine ecology and they certainly bring in a lot of tourism dollars to the province because it's based on eco-adventure dive tourism—but fundamentally artificial reefs help bring back biodiversity," said Robins. "It's needed and that's exactly why we've got it in Halkett Bay. It's all a good thing."

Robins stresses the ARSBC is suitably preparing the *Annapolis* and is in no rush to sink the vessel. The ARSBC needs to deal with environmental concerns and one more permit is required before the ship can be sent to the bottom of the bay. "They have to be done right, and they have to be done to code, and done to the standards," he said of artificial reef projects.

The HMCS *Annapolis* was launched in April of 1963 and removed from service in 1998. The ARSBC purchased the ship in 2008. □

BBAUMGARDNER / WIKIMEDIA COMMONS

HMCS *Annapolis*

industry news

News edited by Peter Symes

Rebreathers USA becomes US distributor of JJ-CCR

Rebreathers USA, which is based in Everett, Washington State, has been designated exclusive distributor of the JJ-CCR for the United States. Rebreathers USA is a certified JJ service center, offering a complete stock of replacement parts and supplies. While they do not conduct training on the units, a list of JJ-CCR instructors is available by contacting Rebreathers USA. □

UK's Will Goodman descends to 290m on JJ-CCR rebreather

After a year's training and preparation, Will Goodman, a technical diving Instructor Trainer, and Guinness World Record holder for the longest scuba dive, descended to a recorded depth of 290m off Gili Trawangan, Lombok Indonesia using an unmodified JJ-CCR. □

Manta Industries and Sartek team up

The partnership of these two great companies gives you the best sales, service and design team in the diving industry with over 43 years of combined design and manufacturing experience. The members of Manta-Sartek team are all avid cave and wreck divers and can answer all of your diving equipment questions. For more information, please contact:
Richard M. Simon,
President Manta Industries
Rick@mantaind.com
1(800) 397 3901 □

Huish Outdoors acquires Liquivision

"By combining Liquivision and Atomic Aquatics' design and engineering teams, it instantly gives us unparalleled expertise in dive computer design and manufacturing, along with an appetite for innovation and amazing technology," wrote Mike Huish, president of Huish Outdoors, in a press release.

Founded in 2004 by former freediving World Record holder and inventor Eric Fattah, Liquivision has made itself noted by its series of compact but innovative dive computers, which were often the first on the market to embrace and incorporate new technologies such as OLED display. Other notable computers include the X1 trimix CCR computer that featured a novel tap based user interface, and in 2013, the company unveiled the world's first long range wireless dive computer, the Lynx with a 100 meter range. □

Halcyon and Santi join forces

In April, Halcyon Dive systems and Santi Diving Equipment launched their cooperation, bringing together two of the technical diving industry's most innovative brands. The joint venture will mean that customers will get better access to products, sales support and service.

Jarrod Jablonski of Halcyon and Tomek Stachura of Santi are reknown, experienced divers, who, together with partners, developed businesses to further their passion for diving and achieve their ambitions in the field, as well as make diving safer and more easily accessed by others.

"The dive industry continues to grow, as well as our desire to discover more and more, and yet [there are still] undiscovered corners of the underwater world," said Jablonski in a press release. He said he'd known Stachura for many years and that they had worked well together on the *Mars* wreck project in Sweden. "[It] became obvious to me that Tom and Santi share fully in my vision for the future of diving, and that together, we will create the ideal for work on new products and common diving projects around the world," said Jablonski. □

British manufacturer launches new apres dive clothing collection

British manufacturer Divesangha has launched their inaugural collection of apres dive clothing: www.divesangha.com. This garment range is aimed at divers and sea enthusiasts alike who want comfortable, practical and fashionable 'surface gear'.

The resulting collection is functional and smart and individualistic. (Each t-shirt is individually numbered). There is huge care and attention to detail in the manufacturing of these clothes, down to the logo'd buttons and high quality stitching.

Divesangha garments feature the unique Hung Dry system, which is currently being patented. Hung Dry is a simple system that allows clothes to be securely hung to dry or air on a rail or a line, without the need for pegs, and more importantly, with no risk that the wind will blow them away.

The word *sangha* means *association* or *community,* and it expresses something of the unique and uniting harmony divers experience with nature in the marine environment. The environment is something that Divesangha takes very seriously. They are committed to ethical manufacturing. All of Divesangha products are exclusively designed and manufactured in the United Kingdom. And their packaging is fully recyclable, too. □

Divers raise funds for a documentary about ancient underwater forest

The 50,000-year-old forest is a half-mile-square area of 50,000-year-old cypress stumps perfectly preserved under the ocean floor off the coast of the U.S. state of Alabama. As of Sunday, April 20, the fund-raising project on Kickstarter has passed the critical $15,000 mark, but the divers can definitely use more than the $15,000 with which they know they can get a film made. The fundraising runs until May 1.

The forest's existence has generated intense interest around the world since its discovery was announced a couple years ago, said team member Ben Raines

Thousands of stumps dot the seafloor, carpeted with anemones and providing homes to fish, crabs and octopi. Some of the trees are more than ten feet in diameter, relics from the prehistoric woods before people lived in America, when the Gulf Coast was covered in trees the size of redwoods.

They contain invaluable information about the prehistoric climate, when sea levels were 60 feet lower. Swim over the ancient river channel that meanders through the site and you are instantly transported to a strange, fairylike world. It is among the most magical spots in the sea. When the wood is cut, it has a "cypressy" smell, and sap oozes out of it, Raines said. □

New guidelines for divers in England

A guidance for divers in England has been issued by the following agencies in a joint statement: BSAC, GUE, PADI, PSAI, SSI, SAA and TDI / SDI. The new guidelines are endorsed by all diver-training agencies active in England. Instructors, members and divers are seriously encouraged to follow them.

On behalf of all divers and diver training agencies, the BSAC, acting as the National Governing Body for Scuba diving, with SAA and PADI, has been negotiating with the Marine Management Organisation (MMO) in regards to the interpretation of the legal requirements for divers pursuant to the Marine and Coastal Access Act 2009 (MCAA).

After long discussions, there is now an accord on a set of guidelines for all divers diving in English waters. These guidelines allow divers to go about their standard usual diving and training activities without the need for a licence. Divers should refer to the guidelines to be sure that they follow the law.

Activities not requiring a licence include:

- Deploying and recovering temporary shot lines for divers
- Using delayed or permanently inflated SMBs
- Using a lifting bag to recover items which have been underwater for less than 12 months
- Conducting surveys of shipwrecks by hand
- Using lifting bags for underwater litterpicks.

For other specific activities, the MMO still requires either previous notification or a licence application; Please consult the MMO for direction in these cases. Similar guidelines will soon be made available for the waters of Scotland, Wales and Northern Ireland.

For more information, please see *Marine Licensing: Guidance for Recreational Divers* information sheet at www.bsac.com/marinelicensing.

For all other inquiries regarding these new guidelines, contact the Marine Management Organisation (MMO) directly at telephone: 0300 123 1032, or email: marine.consents@marinemanagement.org.uk

This update has been issued by: British Sub-Aqua Club (BSAC), Global Underwater Explorers (GUE), Professional Association of Diving Instructors (PADI), Professional Scuba Association International (PSAI), Scuba Schools International (SSI), Sub Aqua Association (SAA), Scuba Diving International; Technical Diving International (TDI / SDI). □

Florida dive operators face charges of illegal shark feeding

Florida Fish and Wildlife Conservation Commission (FWC) have filed charges against four men linked to the illegal feeding of sharks and fish within state waters. The investigation started after the FWC received several complaints that shark feeding was taking place off the coast of Palm Beach County during dive charter trips.

One complainant told dispatchers she was on a dive trip where sharks were being fed. The person said the sharks had become so aggressive she had to get out of the water.

"This is a public safety issue," said FWC Maj. Camille Soverel. "The FWC's Division of Law Enforcement wants to ensure these beautiful coastal waters remain safe for divers."

FWC investigators and the Palm Beach County Sheriff's Office (PBSO), working jointly, conducted two separate investigations involving two northern Palm Beach County dive charter operators.

Caught on video

On February 8, deputies from the PBSO dive team took part in a dive trip on board Emerald Charters of Jupiter. During the dive, video was taken of Randall Jordan feeding sharks by hand while within state waters. He also used a milk crate filled with fish chunks to lure sharks to his location. Thomas Smith was operating the vessel during the dive.

On February 22, the deputies took another dive trip on board the vessel *Miss Jackie*, which is owned by Luis Roman of Orlando and operated by Toni Crumrine. The boat was used by the Lake Park-based company Calypso Dive Charters.

During this trip, deputies took video of Roman feeding a goliath grouper and a lemon shark. Video also shows Roman trying to lure sharks to his location by shaking a milk crate filled with barracuda chunks. Both feeding incidents happened in state waters.

Illegal since 2002

FWC investigators and PBSO divers used several GPS devices and other methods to confirm these activities were occurring in state waters, which, in the Atlantic, is within (or up to) three nautical miles from the nearest point of Florida coastline. Fish feeding in Florida waters has been illegal since 2002.

Charges pressed

The FWC presented results from the joint investigations to the Palm Beach County State Attorney's Office, which charged Jordan, Smith, Roman and Crumrine with operating a vessel for hire within state waters to allow passengers to observe fish feeding. Jordan and Roman were also charged with fish feeding. These are second-degree misdemeanors, punishable by up to 60 days in jail and a fine of up to US$500. □

travel news

Edited by
Scott Bennett

ANDREY BIZYUKIN

India to develop dive tourism on Andaman, Nicobar and Lakshadweep Islands

In a push to "augment country's beach and diving tourism", the Indian government plans big upgrade to infrastructure and better airport facilities.

"We have identified [four] islands for development. A large number of tourist attractions exists across the Andaman and Nicobar Islands, but we are planning to do more to attract tourists," said AK Singh, lieutenant governor of the Andaman and Nicobar Islands.

In addition, the government plans to build beach resorts and water sports facilities on three uninhabited Lakshadweep islands located in the Arabian Sea. "Thinnakkara, Suheli Par and Cherium are the three islands in Lakshadweep where we are planning to build tourism infrastructure at a cost of Rs6 billion (US$99.8 million)," said AM Hussain, assistant director of Lakshadweep Tourism. Other islands in the cluster offer scuba diving, snorkelling and windsurfing.

Tourist-friendly infrastructure offering scuba diving and water sport options should be completed by 2016. Night landing facilities would be developed at Andaman and Nicobar's Port Blair airport by the third quarter of 2014 to allow the stopover of international flights. Currently, 96 flights pass the airport every day but none land there. □

New Zealand reigns in shark diving operators

Shark cage-diving operators in New Zealand will now be regulated after fears that lives were being put at risk.

Conservation Minister Nick Smith said a permit system under the Wildlife Act was needed to ensure cage diving was done responsibly.

The move comes after locals on Stewart Island accused the island's cage-diving firms of operating in a way that has led to a change in the behaviour of sharks, leading to more interactions between the predators and divers.

Shark cage diving is becoming a still more popular thrill. This image is from Guadaloupe Island off the Mexican coast

Stewart Island is the third-largest island of New Zealand. It lies 30 kilometres (19mi) south of the South Island, across Foveaux Strait. Every year between December and June, 100 great whites travel to the Foveaux Strait to feed off a large colony of fur seals.

Viewing the predators underwater has become a major tourist attraction for the little island, which has a population of less than 400, most of which live in the island's only town Oban. Companies offering tourists the opportunity to dive with great whites will need to apply for a permit and follow a code of compliance by the end of the year. Both Stewart Island shark cage diving operators are said to have welcomed the rules.

Owing to an anomaly in the magnetic latitude contours, this location is well placed for observing Aurora australis. □


PETER SYMES

Taba Heights in the Northern Sinai—an area which is now affected by travel advisories issued by a number of Western governments—was a peaceful and pleasant location to vistit

Rising militancy in the Sinai becomes an issue for Red Sea dive operators

Egyptian government has stated Islamist militants in the Sinai Peninsula are becoming a threat to foreign tourists.

Egyptian officials say they are taking seriously a reported ultimatum by Islamist militant group Ansar Beit al-Maqdis for tourists to leave the country.

Ambigous reactions

Meanwhile and following the deadly bombing of a Tour bus that in February killed three South Koreans and an Egyptian driver in Taba near the Israeli border, a number of western nations such as Germany have amended their travel advisories to also advise against all but essential travel to all of Sinai including the resort areas around Sharm el Sheikh. Other countries such as the United Kingdom still give a green light for travel to Sharm el Sheikh. Meanwhile the resorts along the Red Sea's west coast such as Hurghada, Safaga, El Quesir, and Marsa Alam are *currently* in the clear, as this issue goes to press, but all travellers are advised to stay updated and check the latest advice before travelling.

It is certainly not the first time the country, which is massively dependent on its tourist industry for revenue, has been in the grips of terror threats and forced to find ways to both protect tourists and reassure the general public that it is safe. Since the 1997 attack at the temples at Luxor, which killed 62 people, mostly tourists, the authorities have deployed a massive security apparatus—in particular around tourist attractions and resort areas —an effort which was ramped up further following the 2005 Sharm el-Sheikh attacks and the 2006 Dahab bombings.

Despite of these incidences, the Red Sea resorts have generally been safe—and felt safe, as far as our own experiences go.

So what has changed?

Sinai, being primarily resort areas and located across the Gulf of Suez far from the Nile Valley and any main population centers, used to be an area that was exempt from disturbances and risk, even during times of major troubles and unrest on the mainland. However in the latter years, militants in the Sinai have become a growing issue and the security issues have shifted eastwards.

Who cares?

To some extent the predominantly European tourists who have taken to the Red Sea for its affordable holidays at nice hotels, guarantee of sunshine and short flights, seem to have largely reconciled themselves with these occassional disruptions and disturbances, and the country still remains a very popular destination. However and somewhat unsurprisingly, many travel agents have seen a significant dip in bookings over the last year. Sources in the travel industry tell *X-RAY MAG* that customers do not seem so much to hold back out of concerns for the security situation per se. Rather what seem to be at play are the uncertainties surrounding government travel advisories, which may change at a later stage forcing families—who are often limited to go on vacation during public school holidays—to either outright cancel their holiday all together or find other options at a stage where the alternatives may be sold out or come at a premium rate. Consequently to err on the side of caution, they book vacations to alternative destinations.

Meanwhile the Egyptian hospitality industry and with it, the many Red Sea operators, are left high and dry, seeing their livelihoods dry up for lack of customers.

Insurance may be void

It should also be noted that while-flights, hotels and operators appear to remain readily available for online bookings and some nationalities are still in the green to go, travel insurances will often become void if one chooses to disregard an official travel advisory and venture into an area contrary to a warning, however peaceful and safe it may appear and probably be.

As Egypt and the Red Sea offer some of the best diving on the planet, we can only hope that matters once again settle down, as they always seem to do, and we can get back to some sort of normalcy in this regard. In the meantime, do check with the offical travel advisories.

When X-RAY MAG did a report from Taba Heights in 2012 (published in issue #45) it was entitled Tranquility in Taba. *It was peaceful, relaxing and offered some really good shore diving and macro photography opportunities.* □

Cayman Islands gets new underwater attraction

Bronze sculpture placed on the bottom off Grand Cayman.

Divers lower and position the new sculpture, *Guardian of the Reef* by Simon Morris, to the sea bottom in West Bay, Grand Cayman. All photos this page by Ryan Canon

Guardian of the Reef is a new bronze sculpture by Simon Morris, located in West Bay off Lighthouse Point on Grand Cayman Island.

The 13-foot-tall statue is a representation of a mythological creature, the top half of which is a warrior-guardsman in Ancient Greco-Roman armour and decorated breastplate. The figure carries a circular shield and a staff atop of which is a globe representing the world's oceans.

The figure's helmet is fashioned into a stylized seahorse head, and from the back of the breastplate, a dorsal fin protrudes. In the same way that a mermaid has both human and fish elements, the sculpture transforms from human to seahorse at the waist. The seahorse tail is wrapped around a heavy bronze ring, which is attached to a Roman column. This column acts as the guardian's sentry post.

The column is shattered and aged, with several open spaces that reveal an inner cement column, which will attract encrusting marine life, and over time, will actually become part of the natural reef.

The symbolism in the sculpture reflects the fragile state of the oceans, which are in need of our protection, but have been sorely neglected.

The sculpture was created in a global limited edition of four signed, dated and numbered castings. The first of the numbered castings was bought by Jay and Nancy Easterbrook, owners of Divetech, a full-service dive resort on Grand Cayman. □

Now, where did your bag go!?

We've all been there at one time or another—arriving at your holiday destination, euphoria turns to aggravation upon the discovery that your bags are missing in action. According to the International Air Transport Association (IATA), about one percent of luggage worldwide was mishandled last year, costing an estimated US$2.6 billion. Fortunately, a number of apps have arrived on the scene to help alleviate the situation. The question is, just how useful are they?

Apple's solution is iBeacon, which can be placed in your suitcase for short range tracking. However, maximum range is only 20m and can be hampered if it is packed too deeply in your luggage. See: itunes.apple.com/us/app/travel-radar-luggage-tracking.

An option with greater range capabilty is the Trace Me Luggage Tracker. Airline baggage services staff worldwide can enter the unique serial identification number into the airline's SITA WorldTracer unclaimed baggage record. Once found, the owner will be notified by SMS and email that the luggage is being held at a specific airline and location. The owner can then contact the airline for appropriate action. See: www.tracemeluggagetracker.com.

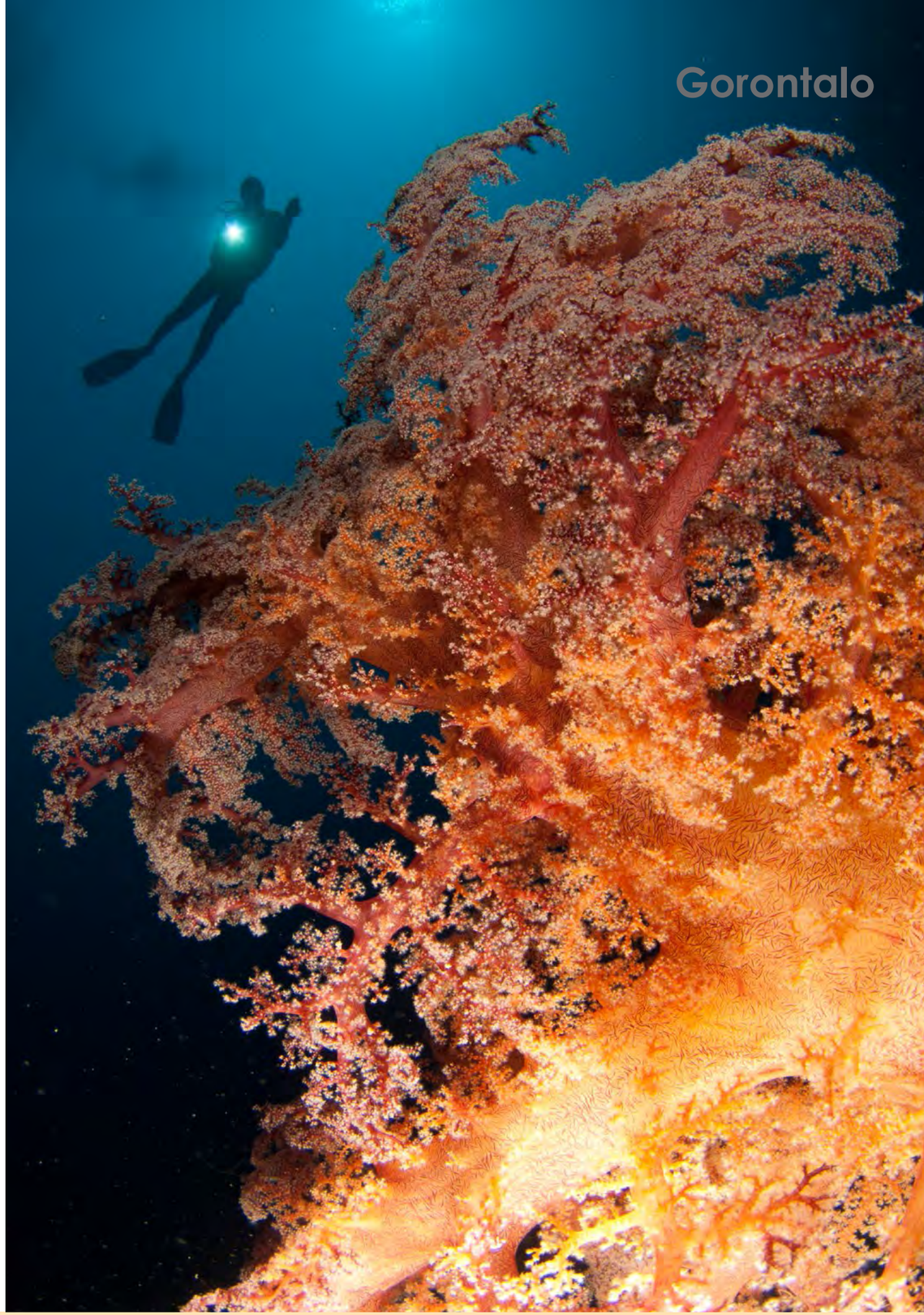
SuperSmartTag features a code that reports your bag online. Once the bag code is submitted, an e-mail or phone call will be received to notify you that your luggage has been found. Enter your itinerary on the SuperSmartTag site and airport staff will be able to view your travel plans and forward your luggage to your next destination. See: www.supersmarttag.com.

Delta passengers can download Fly Delta, a free smartphone app that enables passengers to track their bags, even while in flight. Upon entering the bag receipt number, the number on your bag receipt, or scanning with the barcode with your phone, passengers can follow luggage from departure to arrival. The app is available for iPhone, Windows Phone, Android and BlackBerry. Download at: www.delta.com. □

The Surreal Shores of Gorontalo *Indonesia*

Text and photos by Steve Jones

Scenes from Gorontalo, Sulawesi, Indonesia. Spotted porcelain crab, *Neopetrolisthes maculatus*, in anemone (left); Side view (above) of squat anemone shrimp, *Thor amboinensis*; Close-up detail of tree soft coral, *Dendronephthya sp.*, with diver (right). PREVIOUS PAGE: A very rare blue sea fan, *Acanthogorgia sp.*, found below 45 metres depth, with diver, Gorontalo, Indonesia



Text and photos by Steve Jones
www.millionfish.com

Barely beaten tracks are an increasingly rare find for travellers in this ever more accessible world. Yet on the shores of Tomini Bay on the Indonesian Island of Sulawesi, one such place still exists. Here the lesser explored waters teem with the intensity of the biodiversity found in this part of the world. The name of this place is Gorontalo, an oasis often bypassed as visitors descend on the world famous destinations of Bunaken and Lembeh Strait further up the Sulawesian coastline.

Gorontalo Province lies on a peninsula extending from the northeast of the flower-shaped island of Sulawesi, reaching out towards the Philippines. This peninsula, known as the Minahasa, is bounded by the Celebes Sea to the north and the Gulf of Tomini to the south, and it is on this southern ocean boundary that the provincial capital, Gorontalo City, lies. The term *City*, however, is deceptive, since Gorontalo is more akin to a rural town, where chickens risk all as they cross roads that are traversed by overladen scooters and motorised rickshaws, known locally as *bentor*.

Along the main streets, double-parked horse-drawn carts contrast sharply with shops that hint at influences of the modern world—the mobile phone accessory outlets that fuel Indonesia's fascination with mobile communications. This is an obsession that has led the country to become the world's fourth largest user of cellular phones. Yet, despite these few signs of the emergence of modern day culture, Gorontalo City remains distinctly traditional and a world away from the usual hustle and bustle you expect to find in an Indonesian city.

Legend has it that when the seas subsided, Gorontalo appeared on a plateau amongst three surrounding mountains. Whether the legend is true or not, there is no denying that the landscape here is ruggedly beautiful, comprising steep cliffs and valleys that channel fresh water on a downward journey toward the sea, cutting swathes through the soft limestone on the way. It is at the coastline where the vulnerability of limestone to natural erosion is most strongly evident and the impact on the underwater topography is dramatic.

To the east and west of Gorontalo City, steep cliffs plummet vertically into the sea and underwater channels and gulleys lead the way to the extreme depths of the bay. These are

Diver (left) looks into cavern at sponge; Diver (above) with one at the Salvador Dali sponges (*Petrosia lignosa*) which only grow with this intricate swirling surface pattern in Gorontalo waters. These sponges grow to up to 3m in length. Anemonefish in anemone (right)

Gorontalo

often beautifully interlaced with catacombs of chimneys, caverns and tunnels, providing refuge for some of Gorontalo's numerous species, some of which are endemic.

Peacock mantis shrimp

Tomini Bay is over 4,000 metres deep, and the seabed drops so rapidly that it is common to see open ocean species such as whales, dolphins and strange pelagic invertebrates close to the shoreline. A plummeting seascape so close to land also has other benefits, in providing a near-shore habitat for sessile species that would otherwise be vulnerable to shallow water wave action and therefore in the depths they can thrive.

Giant sponges

Descending past 20 meters, you enter the domain of the giant sponges, firmly gripping the porous limestone while the nutrient rich currents wash over them. Simple multi-cellular animals rather than plants, there are around 8,000 described species of sponge, with the total number of species thought to be upward of 15,000[1], classified collectively under the scientific phylum Porifera, which means "pore bearing".

Filter feeders, they also lack any distinct digestive system and rely on their collar cells to force water through their structures, bringing in nutrients and oxygen and taking away carbon dioxide. Here in Gorontalo's depths they are able to grow to enormous sizes.

Amongst Gorontalo's healthy sponge population, a phenomenon has occurred that illustrates perfectly how local conditions can influence evolution. The sponge in question is *Petrosia lignosa*, a species found only in Sulawesi and the Philippines and first described by renowned zoologist Henry Van Peters Wilson in 1925.

In Gorontalo waters it grows with an intricate, deep swirling pattern etched on its surface, which so far has only been observed here. Local dive pioneer Rantje Allen was the first man to document this unusual morphology and has christened the species with a name befitting the bizarre patterns—"Salavador Dali"—named of course after the surrealist Spanish painter.

These sponges come in various shapes

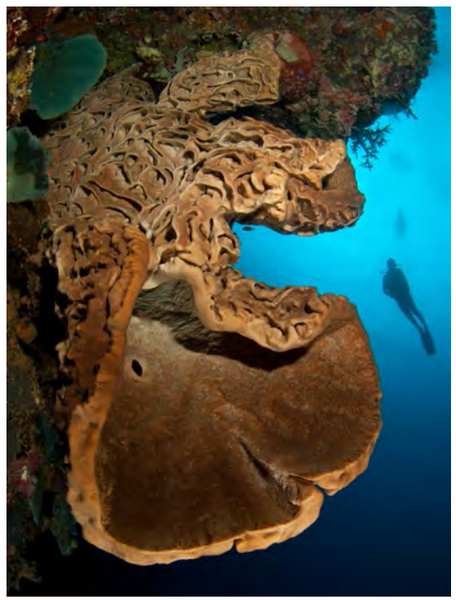
and sizes, the largest can be over three metres in length. All of them display the distinctive patterns, from juveniles of only 20cm in length to those that have reached gargantuan sizes. The Salvador Dali's have been observed in two colours, a dark shade of brown, sometimes with a green tint, or light grey for the ones that dwell out of direct sunlight. Allen has christened this variety the albino Salvador.

The larger sponges extrude into the bay from Gorontalo's ocean facing walls in a seeming act of defiance against the currents, however living in such an exposed location is not without its hazards. Occasionally even the mighty Dali succumbs to the rigours of ocean life, lose their grip on the wall and tumble away to the depths.

Sadly, once fallen onto the sea floor, these giants can no longer filter enough nutrients to survive. Within a few weeks the once rock-hard sponge begins to crumble, dissolve into dust and disappear without a trace.

Emphasising just how unexplored these waters are, no one has yet documented how far along the coastline this phenomenon occurs on this species. However, it is known that by the time you reach Lembeh Strait or even the nearby Togian Islands, the morphing of *Petrosia lignosa* cannot be observed.

Allen recalls in his highly acclaimed book, *Gorontalo: Hidden Paradise,* of when he first



THIS PAGE: Several versions of the huge Salvador Dali sponges, with their unique swirling patterns, only found in Gorontalo

"When I paint, the ocean roars. Others merely paddle in their bath."

Salvador Dali

TOP LEFT TO RIGHT: Diver and giant stonefish; Diver and ornate ghost pipefish on volcanic debris; Rare Coleman's coral shrimp

Broadclub cuttlefish

confirmed the identity of the species.

"Even though I was calling it the 'Salvador Dali sponge,' I suspected it had to have a proper name. So, we sent samples from two sponges to Nicole J. de Voogd of the Institute for Biodiversity and Ecosystem Dynamics, Zoological Museum, University of Amsterdam. After looking at the maze of spicules under a microscope, she was able to identify it as *Petrosia lignosa*. Our sponge expert says that the genus is aptly named since petrosia means 'stony hard' and all Petrosid sponges are hard and rock-like. This particular sponge species is peculiar to vertical walls in Indonesia. The wildly carved surface is a morphology only known to Gorontalo. Divers can only see the Salvador Dali sponge here."[2] said Allen.

Spinecheek anemonefish

Local stewardship

The steep drop of the seabed has had another significant benefit, in helping to preserve Gorontalo's pristine reefs and coastline. The fishermen here are able to deploy handlines from their traditional outrigger canoes and wrestle with species normally found offshore, such as the yellowfin tuna. Coupled with a lack of horizontal reef

Gorontalo

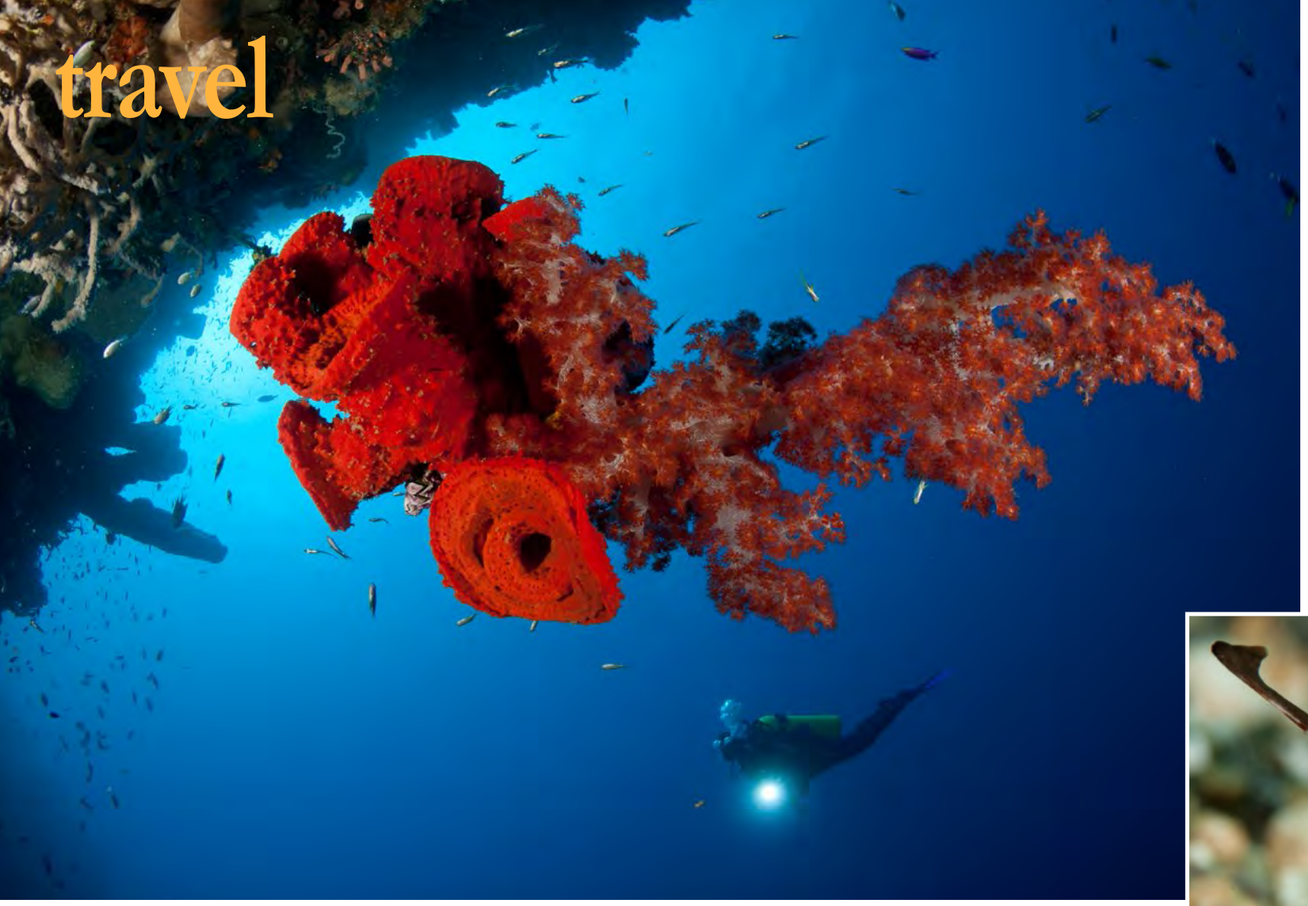
Diver and grand sea whip (above); Shorthead sabretooth (fang) blenny peering from a discarded plastic bottle (left)

surface area, this has negated the appeal of enormously destructive practices such as blast fishing, a scourge of reefs in some parts of Indonesia.

The fish stocks are also protected by the huge waves that come when the winds change from westerlies to easterlies between May and October, imposing natural no-take zones as much of the coastline becomes inaccessible.

Finally, the reefs of Gorontalo have found ally in a group of forward thinking individuals who recognize that education is the best long-term defence against poor fishing practices. For the last ten years this group, which comprises representatives of the local government, students, and staff from Miguel's Diving Centre, have conducted regular public education campaigns to deliver one simple message: "No coral, no fish, your choice." The message has hit home with many of the villages now showing evidence of a deep-rooted respect for the marine environment on which they are so

Pair of robust ghost pipefish on volcanic sand



Peacock razorfish

Gorontalo

CLOCKWISE FROM ABOVE: Ornate anemone shrimp in anemone; Diver and bright red soft coral and sponge hanging from roof of cave; Sarasvati anemone shrimp; Diver and cabbage coral mountain

dependent.

Nowhere is this more evident than in the villagers of Olele who have really taken governance of the reefs to their hearts. Having already established a village level Marine Park, they guard and police their own reef, driving away any unwelcome visitors, sometimes even confiscating their equipment.

The recent expansion of the parks boundaries has been observed to have led to a noticeable rise in the number of large groupers, particularly coronation lyre-tailed and tiger, plus large midnight snappers. Populations of schooling fusiliers have increased also, further re-enforcing the value of good marine stewardship.

Finding a balance between long term sustainability and short term gain will continue to be a challenge for many other parts of Indonesia, yet the developed world has failed on a far grander scale to get to grips with this dilemma. Whilst modern fishing fleets efficiently vacuum the oceans, industry policing groups all too often prove ineffective in leading positive change. Often heavily influenced by commercial agendas, their mandates are frequently distorted by those pushing for short term profit rather than leaving a world that is fit for our descendants to inhabit.

Curiously, the human race continues to behave in a way that is at complete odds with one of our strongest individual natural instincts, that of protecting our children at all costs. Yet on the surreal shores of Olele village in Gorontalo, the enlightened community has taken a huge step towards finding that balance. □

*The author wishes to thank Rantje Allen, the staff of Miguels Diving Centre, Gorontalo, (**www.miguelsdiving.com**) and the people of Olele village. More of Steve Jone's work can be seen at **www.millionfish.com***

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[1] HOOPER, J. N. A. & VAN SOEST, R. W. M. (2002) SYSTEMA PORIFERA. GUIDE TO THE SUPRASPECIFIC CLASSIFICATION OF SPONGES AND SPONGIOMORPHS (PORIFERA). PLENUM, NEW YORK.

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fact file

Indonesia

SOURCES: U.S. CIA WORLD FACTBOOK, NORTH-SULAWESI.ORG, D. SILCOCK

History Moslem merchants from Persia began visiting Indonesia in the 13th century and established trade links between this country and India and Persia. Along with trade, they propagated Islam among the Indonesian people, particularly along the coastal areas of Java. In 1511, the Portuguese arrived in search of spices after their conquest of the Islamic Empire of Malacca. They were followed by the Spaniards. Both began to propagate Christianity and were most successful in Minahasa/North Sulawesi and Maluku, also known as the Moluccas. However, it wasn't until the arrival of the Dutch in the early 17th century that Christianity became the predominant religion of North Sulawesi. From 1942 to 1945, Japan occupied Indonesia. Shortly before Japan's surrender in WWII, Indonesia declared its independence. However, it took four years of often brutal fighting, sporadic negotiations, and mediation by the United Nations before the Netherlands finally agreed in 1949 to transfer sovereignty. Strife continued in Indonesia's unstable parliamentary democracy until President Soekarno declared martial law in 1957. Soekarno was removed from power following a fruitless coup in 1965 by alleged Communist sympathizers. President Suharto ruled Indonesia from 1966 until 1988. Suharto was toppled in 1998 following a round of riots, and in 1999, free and fair legislative elections took place. Indonesia is the world's third most populous democracy, Government: Republic. Capital: Jakarta.

Geography

Located in Southeastern Asia, Indonesia is an archipelago situated between the Indian and Pacific Oceans. Coastline: 54,716km. Terrain consists primarily of coastal lowlands, with interior mountains on larger islands.

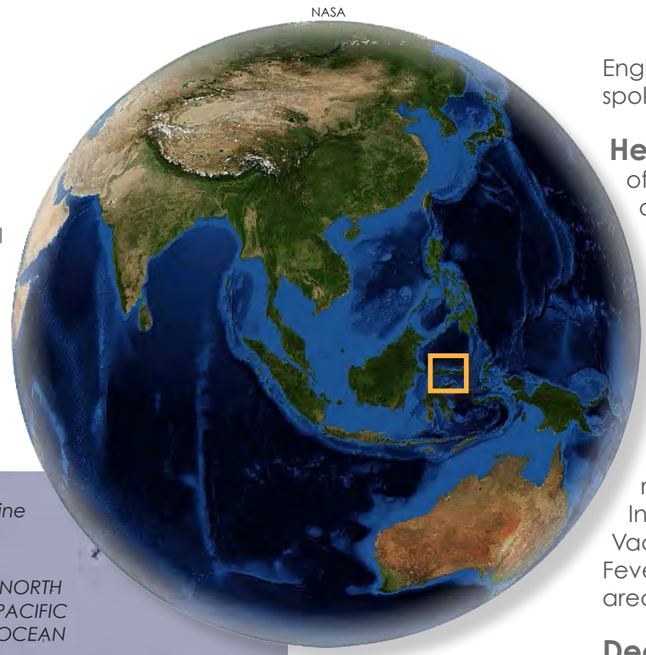
Climate Tropical, hot and humid, with more moderate climate in the highlands. The water temperature is normally 28-29°C (84-86°F) year round, with an occasional "chilly" 27°C (82°F) spot. Most divers use 1mm neoprene suits. However, some people prefer 3mm.

Environmental issues

Challenges include industrial waste water pollution, sewage, urban air pollution, deforestation, smoke and haze due to forest fires. Logging—the rainforests within the combined West Papua/Papua New Guinea land mass are second in size only to those of the Amazon, making it 'the lungs of Asia'. In 2001, there were 57 forest concession-holders in operation around the country and untold other forest ventures operating illegally. Mining—tailings from copper, nickel, and gold mining are real threats.

Economy A vast polyglot nation, Indonesia has experienced modest economic growth in recent years. Economic advances were made with significant financial reforms. In 2009, when the global financial crisis hit, Indonesia fared well compared to its regional neighbors. It was one of the only G20 members posting growth in 2009, alongside China and India. However, the government still faces ongoing challenges of improving the country's insufficient infrastructure, labor unrest over wages, and high oil prices affecting fuel subsidy programs.

Currency Indonesian Rupiah (IDR). Visa cards, Euros and U.S. Dollars (large bills issued after 1999) are widely accepted. ATM machines in tourist areas offer the best exchange rates, Travellers cheques are becoming quite difficult to use except at banks. Exchange rates: 1EUR=12,723IDR; 1USD= 9,737IDR; 1GBP=15,127IDR; 1AUD= 9,972IDR; 1SGD= 7,908IDR



NASA

RIGHT: Global map with location of Gorontalo
BELOW: Location of Gorontalo on map of Indonesia
BOTTOM RIGHT: Lionfish, Gorontalo, Indonesia

Population

251,160,124 (July 2013 est.) Ethnic groups: Javanese 40.6%, Sundanese 15%, Madurese 3.3%, Minangkabau 2.7%, Betawi 2.4%, Bugis 2.4%, Banten 2%, Banjar 1.7% (2000 census). Religions: Muslim 86.1%, Protestant 5.7%, Roman Catholic 3%, Hindu 1.8% (2000 census). Note: Indonesia is the largest Muslim country in the world. Visitors are encouraged to respect local traditions and dress modestly. Internet users: 20 million (2009)

Language Bahasa Indonesian is the official language, plus English, Dutch and local dialects are spoken. In tourist areas, English, Spanish and German are spoken.

Health There is a high degree of risk for food or waterborne diseases such as bacterial diarrhea, hepatitis A and E, and typhoid fever, as well as vectorborne diseases such as chikungunya, dengue fever and malaria. Check with WHO or your dive operator for prophalaxis recommendations. Larium is not effective. Bring insect repellents containing DEET. International Certificate of Vaccination required for Yellow Fever if arriving from infected area within five days.

Decompression chamber

Manado: Malalayang Hospital
tel: +62 0811 430913
Makassar: Rumah Sakit Umum Wahidin Sudirohusodo
tel: +62 0411 (584677) or 584675

Travel/Visa/Security

Passport valid for six months beyond intended stay is required. There is a Visa-On-Arrival for 35 countries including USA, UK, most European and Asian countries. It is US$25 for a stay of up to 30 days. Although there is an active independence movement in Papua, tourists have not been impacted.

Web sites

Indonesia Travel
www.indonesia.travel/en

The Best Shore Diving

Cayman Brac

In The Caribbean

Text and photos by
Lawson Wood

Diver with sea turtle resting on reef. PREVIOUS PAGE: Diver and wall with large sponges; Flamingo tongue (center inset)

Text and photos by Lawson Wood

First visited by Christopher Columbus in 1503, his reports tell of incredible numbers of fish, turtles and crocodiles hence their original name of Caimen or The Cayman Islands. This British Crown Colony is located south of Cuba in the central Caribbean and consists principally of three islands: Grand Cayman, which has the capital George Town and hosts her main airport; Little Cayman Island and Cayman Brac, which lie around 145km (90 miles) to the north-east of Grand Cayman.

Whether entering these waters as a novice or as a more experienced diver, what is obvious is that Cayman waters have some of the clearest waters in the Caribbean, with very few currents they are the ideal destination for virtually guaranteed results. The group of islands sit atop three huge submarine mountains and have incredibly deep water all around, resulting in any sedimentation or particulate in the water to sink into the depths, keeping the coastal waters nice and clear all year round.

Cayman Brac, Grand Cayman's farthest sister island is known affectionately as "the island that time forgot" and at only 20 km long (12 miles) by just over 1.6 km wide (1 mile) and with a resident population of only around 1500 people you can easily see why. There are only two hotels on the island: The Brac Reef Beach Resort and the Alexander. The Brac Reef is home to the famous Reef Divers dive business, but there is a new dive centre, The Brac Scuba Shack run by the very experienced Martin & Liesel van der Touw that is now catering to the larger number of shore divers who are coming to stay on the island. Offering private boat charter and twin tank boat dives, they are perfectly suited for hiring and collecting your dive tanks for all the shore dives available, if you want to cater for yourself without the limits of time.

The Brac is roughly split into two, with the flat area to the west of the island where the airport and dive shops are located and the steep bluff with its remarkable ancient coral limestone cliff and caves at North East Point which rises to 42 metres (140 feet). The word "Brac" is Gaelic for "Bluff". The locals are known as Brackers and the island is

Diver on reef with a variety of coral growth, sponges and anemones, at Cayman Brac

Diver on wall with large sponges at Cayman Brac; Captain Charlie's Barcadere (right)

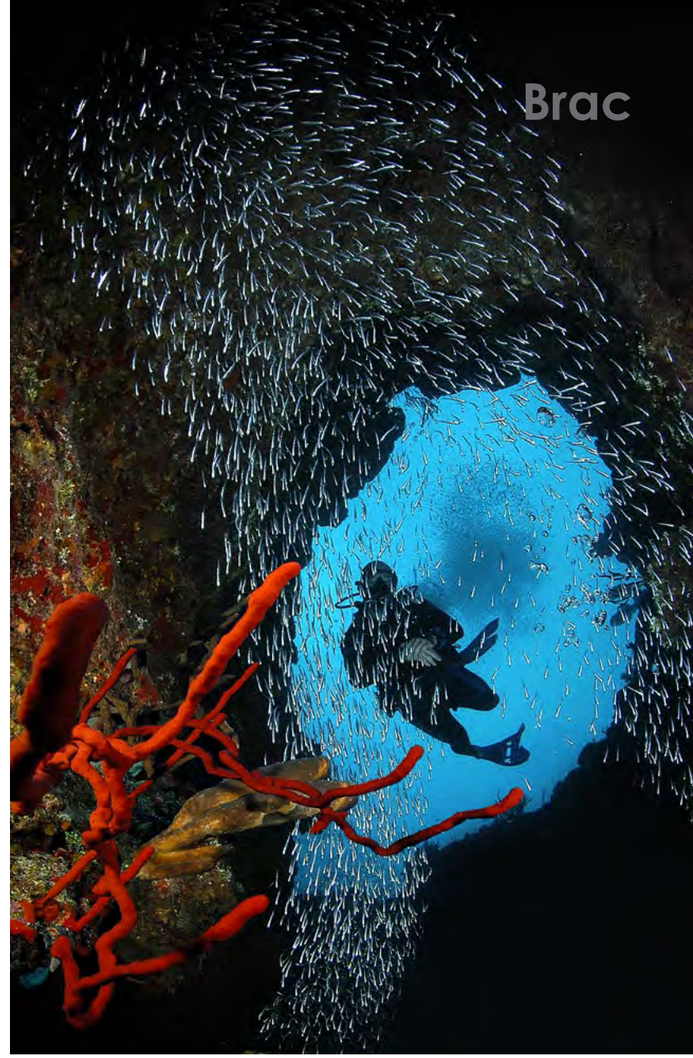
Peacock flounder; Diver in swim-through with silversides and sponges (right)

the smallest in the Caribbean to host a full jet service.

With direct jet flights from Miami into the Charles Kirkconnel International Airport and a large number of small B&B and rental apartments as well as the two resort hotels, Cayman Brac has rapidly earned its reputation as the top shore diving island in the entire Caribbean. (Bonaire used to hold this accolade, but a number of the sites are often off limits and several are quite difficult to undertake).

North shore

The beauty of Cayman Brac is that virtually the entire north shore has small 'barcaderes'—or boat slips dating back several hundred years, where the famous Cat Boats were built and launched. These small slipways are perfect for easy access onto the shallow fringing and barrier reefs, plus, of course, the larger concrete slipways and stepped entries for more modern craft. Toilets and picnic tables can be found at a number of the shore sites, making things that bit more comfortable and with an almost total lack of diver pollution, the shore diving to be found off Cayman Brac is second to none. Weather dependent, the south shore also has a number of boat ramps and



slipways as well as direct access to all of the inshore reefs and the main sheltered lagoon at the west end.

The isolation of the Island has served it well. The corals are in good condition and there is a vast variety of marine life recorded in the registered 49 dive locations with mooring buoys, including seven wrecks. Now a new local initiative has placed markers at many new shore diving locations. Marked with a small red stone and a number, these sites are dotted all around the island and certainly expand the variety of dives on offer to around 100 accessible dives, each with their own particular attributes and are not necessarily the same as any other along on the same bay.

LEFT TO RIGHT: Banded coral shrimp; Dive boat over reef with sponge; Tarpon and school of silversides; Diamond-backed blenny

shore. This means that there are large areas of sand flats with small but very good quality coral growths on the lower slopes. Lots of elk horn coral as well as numerous large sponges. However the area tends to be ignored as many visiting divers opt for the boat dive option of crossing the short distance to Little Cayman Island, this results in the reefs being relatively under dived.

Spotted butterflyfish

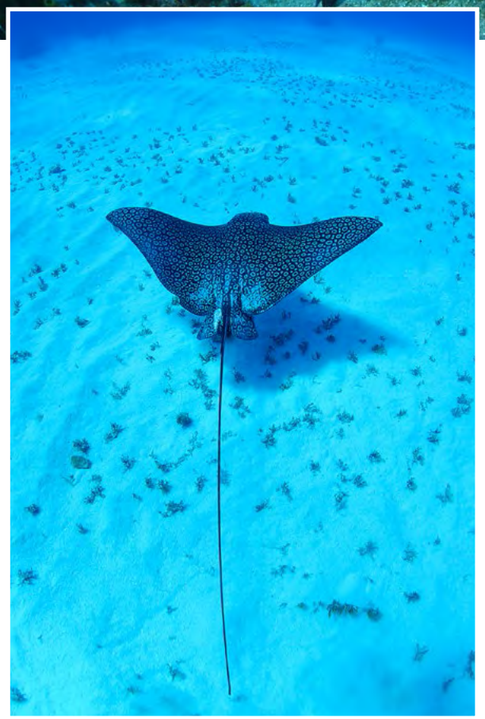
Fry Cove. One of the best dives is Fry Cave, located off Salt Water Point. Weather dependent and with a moderate swell, the cave is on the same type of rugged spur and groove reef and mini wall cut by many different gullies and canyons. Lots of elk horn and pillar corals in good structure and form make this a delightful dive. Snapper and sergeant majors make a nuisance of themselves. The fry of Fry Cave name are Silverside minnows comprising of four different species of juvenile fish which congregate together to make one huge mass of moving fish, found in the summer months. This is a very interesting area for invertebrates including file clams, nudibranchs, arrow crabs and good quality sponges and sea fans. Pistol shrimp can be found amongst the coral rubble as well as jawfish and yellow sting rays. This is similar to the reef off Public Beach where there is a three tier reef structure starting in the shallows and ranging down to over 30m (100ft).

***Prince Frederick* wreck.** When the sea is calm, the wreck of the *Prince Frederick* which sunk in 1888 can be accessed from the shore. It is situated about half way down the south shore and is easily identified as it is directly out from a curiously shaped building known as the 'Bubble House' and offers a shallow dive with easy sight of the remnants of the ship quite visible as there are a handful of superb Trotman anchors, a steel mast, anchor winch, 'ribs, hooks and knees'—are all identifiable with good

South side

The southern sites on Cayman Brac also resemble those on Grand Cayman, with a classic spur and groove reef system, but here it is more pronounced and the wall starts around 20 metres (66ft). The wall is more gently sloping in this area and starts much further out from the

Stern (above) of *Captain Keith Tibbettes* wreck and mooring line (right) on *Topsy* wreck nearby; Horse-eye jacks and wreck



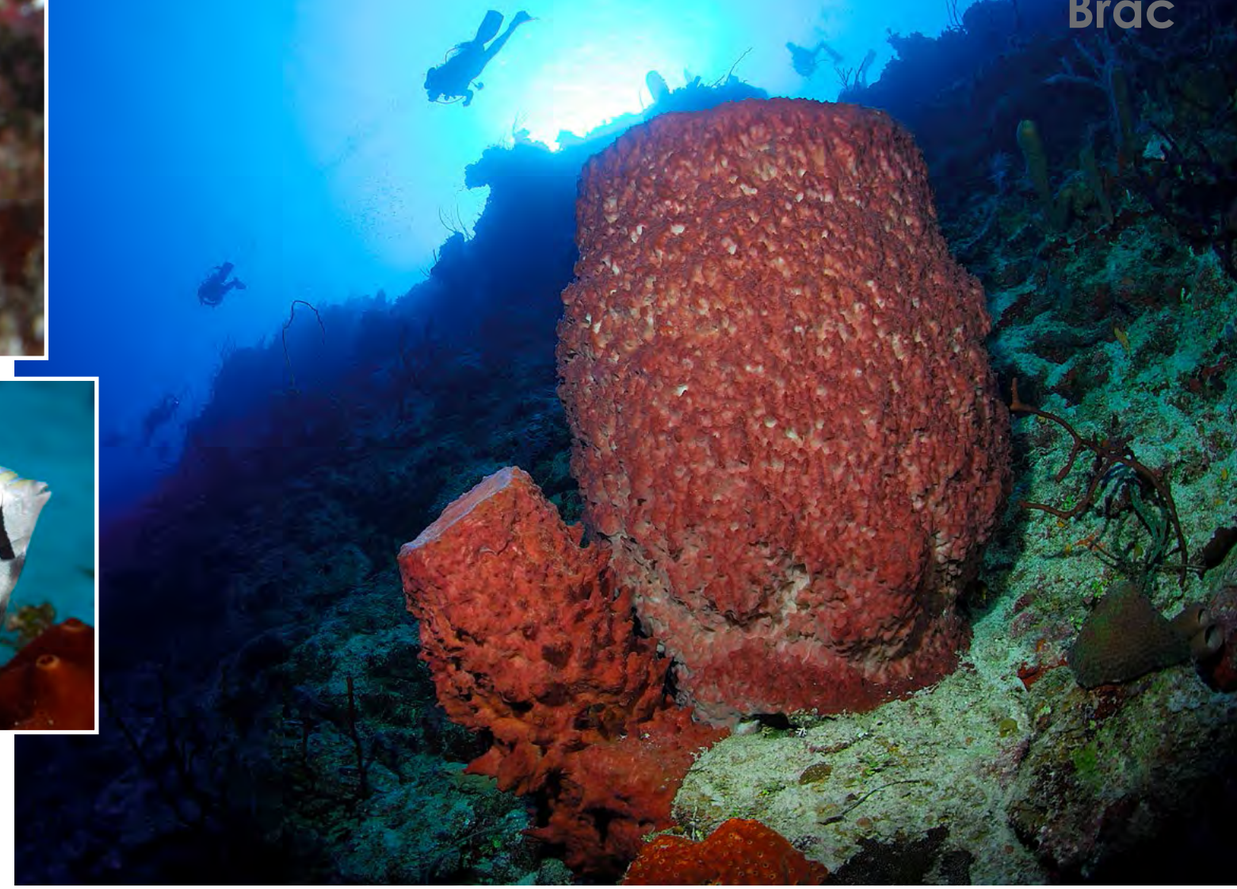
Eagle ray gliding over sandy bottom

coral growth and many varieties of fish. The entire south shore coastline is accessible with some entries being made off the ironshore edge and others with easy access over a sandy beach. The coast further to the east has more difficult entry, but the results are superb as these sites are rarely, if ever, dived.

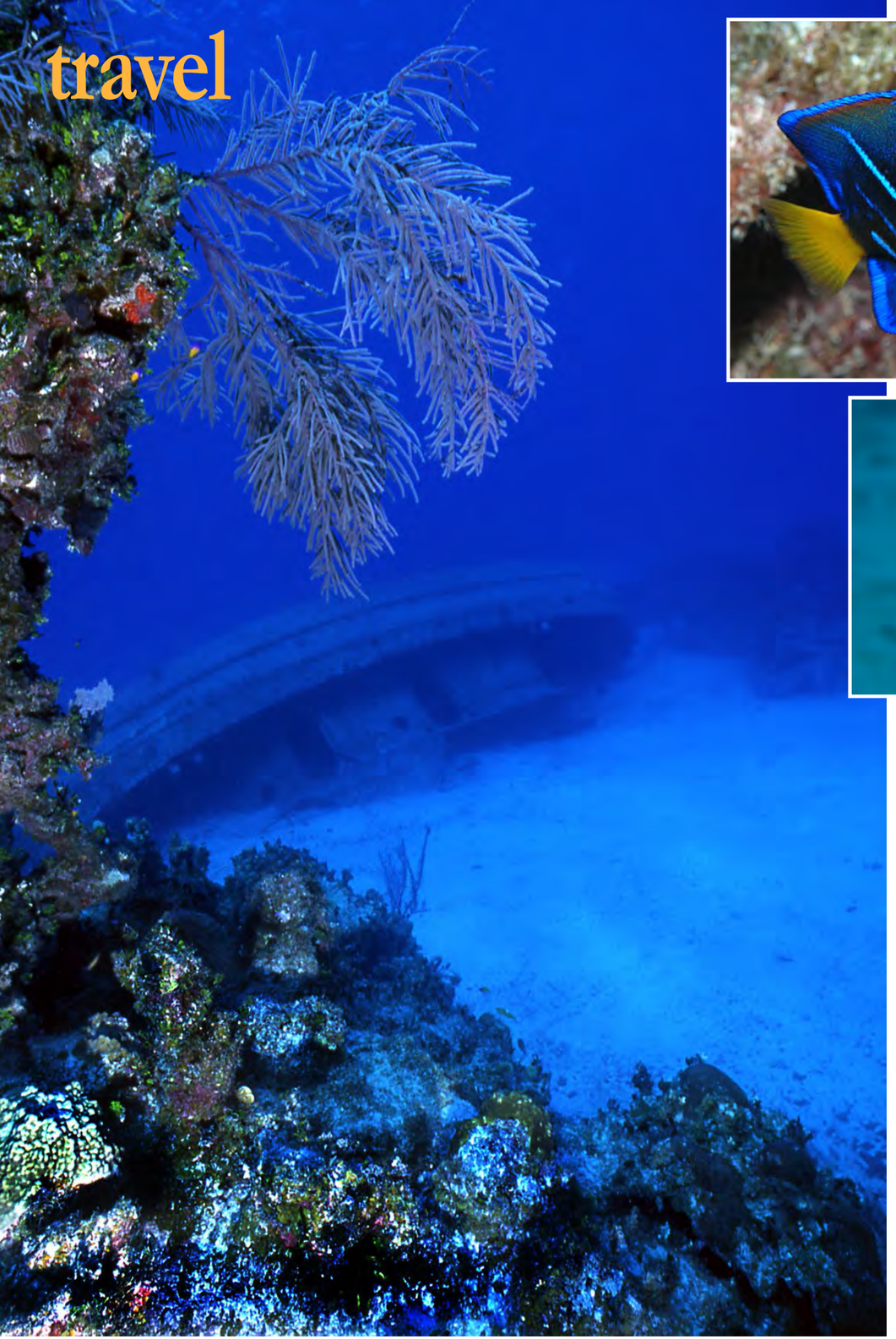
***Captain Keith Tibbetts* and *Topsy* wreck**. The majority of all dives are undertaken along the north shore of Cayman Brac. Virtually all of the wreck sites are here, as well as some absolutely cracking reef dives, both down the wall and in the shallows for your second dive each morning. Along the northwest shore can be found the wreck of the Russian Frigate #356, renamed the *Captain Keith Tibbetts* after one of the islands notable men, is a must to dive. It is the largest shipwreck on all three islands that can be reached from the shore. Now referred to simply as the "356" this shipwreck is superb for all levels of diver.

The shore entry for this dive is from the sea pool at Buccaneer with very easy entry and exit. This shoreline is perfect for snorkelers, too, as they will come across the wreckage from the *Topsy* in only a metre (3ft) of water. The *Topsy's* anchor is used as a mooring for the day dive boats but is also handy as a visual aid for diving the site at night.

Charlie's Reef. Charlie's Reef is another shore dive that can easily be accessed, leaving your vehicle on the concrete dock; you are able to enter the water either by a fool hardy leap, or a more sedate entry from the stainless steel steps. The wall here starts fairly close to shore and whilst many people are quite content to spend their time amongst the excellent spur and groove reef formations, most quite often opt for the longer swim out to the wall and a better chance to see large jacks, eagle rays and sharks.



Queen angelfish (top); Banded butterflyfish (above); Huge barrel sponges (right) on reef; French angelfish (low right)



Kissimmee wreck rests almost upside down in 12m

***Kissimmee* wreck.** Nearby is the Kissimmee wreck, located just northwest of Scott's Pier, nearby the airport; it sits in 12m (40ft) of water and is almost upside down. This retired tug boat was deliberately sunk in 1982 as an addition to the reef system and provides an interesting start to a shore dive that can take you out to the edge of the reef wall, as this is the closest point on the island to undertake this type of dive. The wreck is a favourite site for photographers, and during the summer months, large numbers of rays can be seen. This location is also superb for night dives as there is easy access and the rock pier has overhead lights, which makes things easier for navigation. Here, we always find octopus, squid, juvenile spotted drum fish and many species of shrimp.

***Barbara Ann* wreck.** The wreckage of the *Barbara Ann*, a former landing craft, is well spread out in the shallows, but it is superb as it has become its own little eco-system and is stuffed full of incredibly colourful sponges, sea fans, and tons of invertebrates and small fish species such as pufferfish, wrasse and various blennies and gobies. This is one of the few sites where you can always find juvenile queen anglefish and painted lady cleaning shrimps.

Stake Bay. Further east along the coast at Stake Bay are more superb shore diving sites. Stake Bay is where the island's government administration buildings and museum are located, and there is a huge ramp and stepped slipway to make access nice and easy. This region of the north coast is quite protected,

and there are some simply massive barrel sponges and ginormous seafans and soft corals. This site also has two sculpture structures, the first is of dolphins and rays, and the second is a local artist known as Foots and his rendition of his

idea of Atlantis. There are statues, columns a huge sun dial and other artefacts. These are now all covered in sponge growth and make for an interesting photographic backdrop.

Cayman Brac Dock. The Cayman Brac Dock is off limits whilst it is open, but as you can imagine, when it is closed, it is accessible from either side and large schools of big barracuda can be found hanging out in the shade. The construction spoil is well overgrown, and you can always find a huge variety of tropical fish and invertebrates.

Burt Brothers. One of the best of the shore dives along the northeast is Burt Brothers, located opposite a small shop called NiM Things (Native Island Made). A concrete boat ramp is great for access, and from here, it is just a short swim to some massive coral structures edged with deep-water gorgonians and their usual spider crabs. Hammerhead sharks are seen here in January and February, but really it is the colourful and very good corals that make this dive special.

Bluff. Under the ancient Bluff is always the feather in a diver's cap, as it is very rare that the sea conditions are so perfect to allow this diving in an otherwise pristine diving location. Scoured by storms, there are very few robust seafans or sponges as everything is low lying. However, there are kazillions of featherduster worms, small nudibranchs, blennies and gobies and an otherwise undived terrain of huge boulders, with interesting swimthroughs, various shipwrecks' parts and simply staggering visibility, as there are no sandy areas to get kicked up by rough waters.

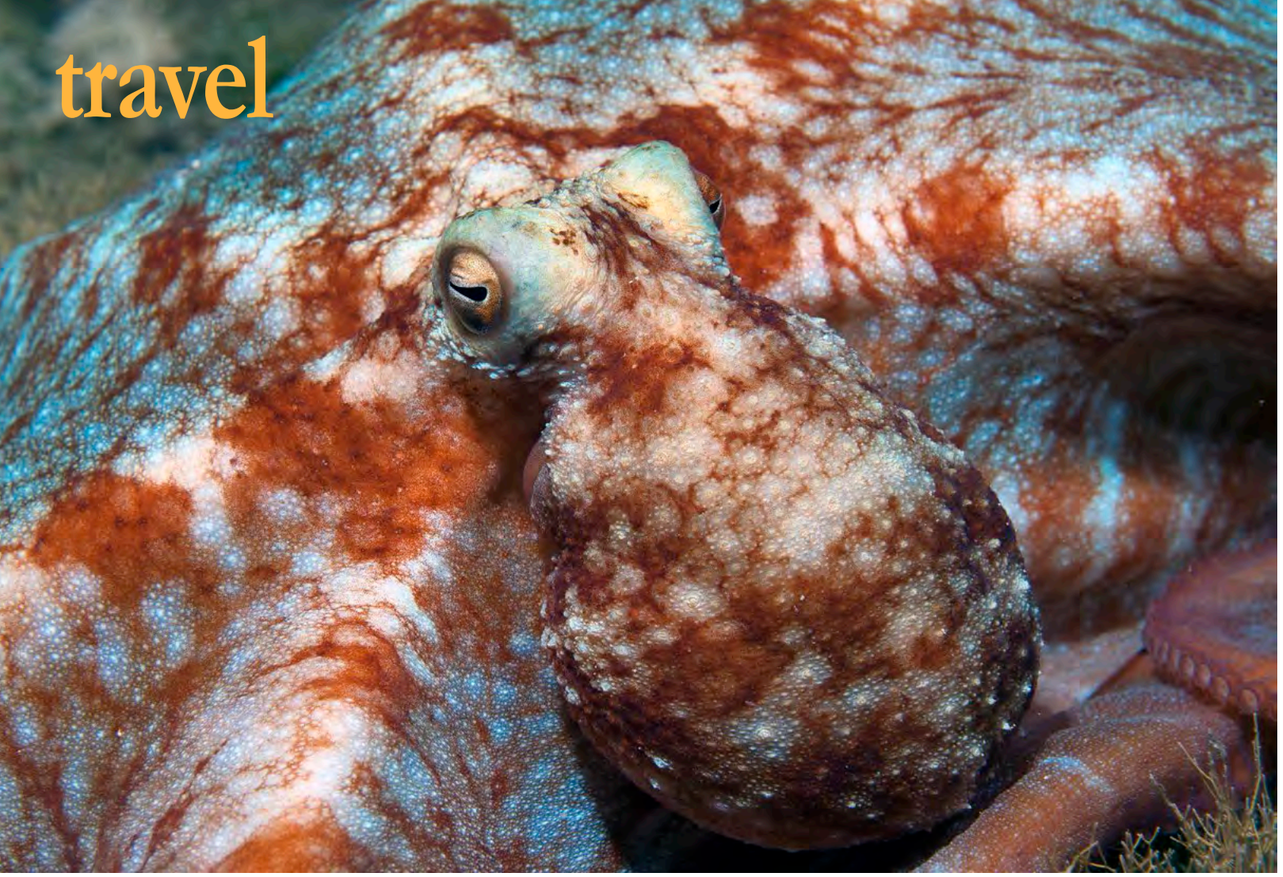
Benefits of Brac

Great emphasis has always been placed on the diving on Grand Cayman and the North Wall is outstanding, plus everyone raves about Bloody Bay Wall on Little Cayman Island, but many fail to appreciate the facts that Cayman Brac has much smaller diver numbers; more shore diving sites making for unlimited shore and night diving; four major wreck sites as shore dives and diving conditions and reefs that more than match all the other islands in the Caribbean.

With the island being only 20km long (12mi) long, everything is so close by that it makes the shore diving and snorkelling that much easier. There is, in fact, very little else to do on the island, other than exploring the historic caves and caverns; visiting the museum; birding; rock climbing; snorkelling; kayaking; windsurfing; fishing or generally laying back and enjoying the superb beaches along the south shore; rockpooling or having fun getting drenched at the blowholes.

Each of the major families has a provisions store of some sort and

CLOCKWISE FROM TOP LEFT: Arrow crab; Gaping grouper on reef; Hawksbill sea turtle; Barred hamlet; Darkheaded blenny



all will sell homemade jams and chutneys (in season) as well as the usual goods. I would recommend that you buy the local (very rare) Caymanite Rock jewellery; the island craftsmen are excellent. The local residents are some of the friendliest I have come across.

If you are not diving, then you are thinking about it, or getting your cameras ready, or travelling to or from a dive site. Cayman Brac diving is similar to Grand Cayman, without the numbers of divers, and for that reason, it has become a great favourite with the world's diving fraternity—particularly those who prefer to dive away from the madding crowd.

Best time to go

With air temperatures averaging 30-40°C (80-90°F) in the summer, it can be hot and humid, and as always in the Caribbean, hurricane season is from June to November each year. However, some of the best diving is also done in these same months as the sea is generally at its most calm, there are less tourists and better opportunities for marine life encounters. You can dive all year round, as the island has plenty of great dive sites that are always available depending on wind and weather.

One point to make here is that the underwater visibility is very rarely less that 30m (100ft). The temperature ranges from around 22°C (72°F) in December to 29°C (84°F) in July.

CLOCKWISE FROM LEFT: Octopus on reef; Diver and sea turtle on reef; Blue-striped grunt; Boxfish; Pygmy filefish

Brac

Where to stay

All of the accommodation is similarly priced and styled. Apart from the individual self catering apartments and villas, the hotels have good restaurants attached, particularly the Brac Reef Hotel, which is superb.

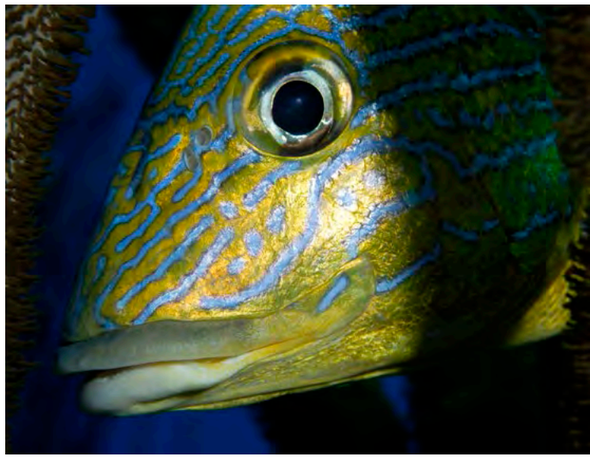
Meals are generally buffet style and there is plenty of it, more than enough for the active diver. Lunches tend to be a local spicy dish of fish or chicken, soup, salad and a sweet of some kind as well as fruit and soft drinks.

Many visiting divers keep the last afternoon free to off-gas and explore the caves and caverns and obviously the local gift shops for a piece of Caymanite jewellery, or perhaps go exploring along the shore to perhaps find your own piece of Caymanite rock or up on the outer Bluff edge to catch those spectacular sunsets.

Brac Scuba Shack is a great dive shop with excellent, qualified staff and catering for those who prefer shore diving or private charter. They also offer advice on all types of accommodation.

Brac Reef Beach Resort is a newly refurbished hotel with comfortable rooms, complete wifi throughout the complex, with a swimming pool, a raised deck area and a great bar right on the beach. Its own dive centre is situated next to the jetty. Reef Divers has a well-stocked shop, and the local photo pro, Ed Beaty, is on hand to guide you through the many and varied steps of digital underwater photography and videography. Barbecues are common on the grounds and at night downwards facing flood lights attract tarpon, squid and stingrays into the shallows, a perfect end to the day's diving.

The Alexander Hotel is located near the beach at the west end of the island. Rooms are modern with wifi access, and the bar looks to the east over a large brackish pond popular with wild fowl. □

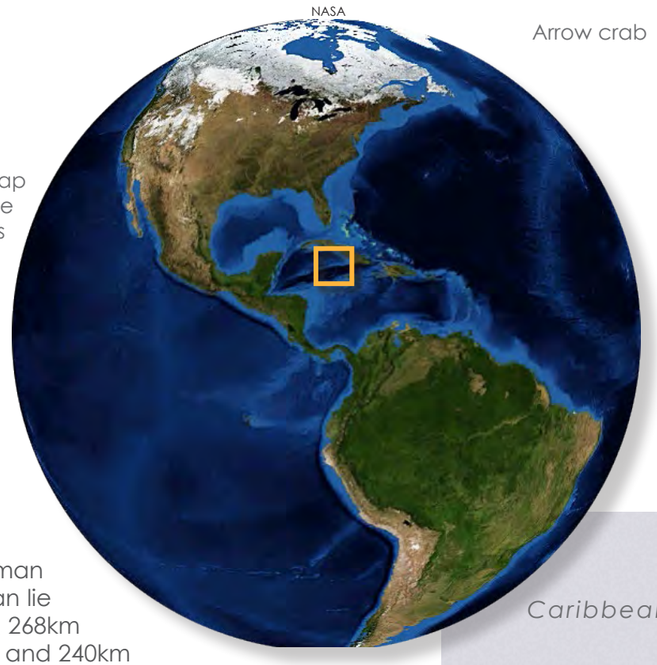


Lawson Wood is a widely published underwater photographer and author of many dive guides and books including The Cayman Islands: Complete Guide to Diving and Snorkeling. *For more information, visit:* ***www.lawsonwood.com***

fact file

Cayman Islands

SOURCES: U.S. CIA WORLD FACTBOOK, CDC. GOV, LONDONDIVINGCHAMBER.CO.UK



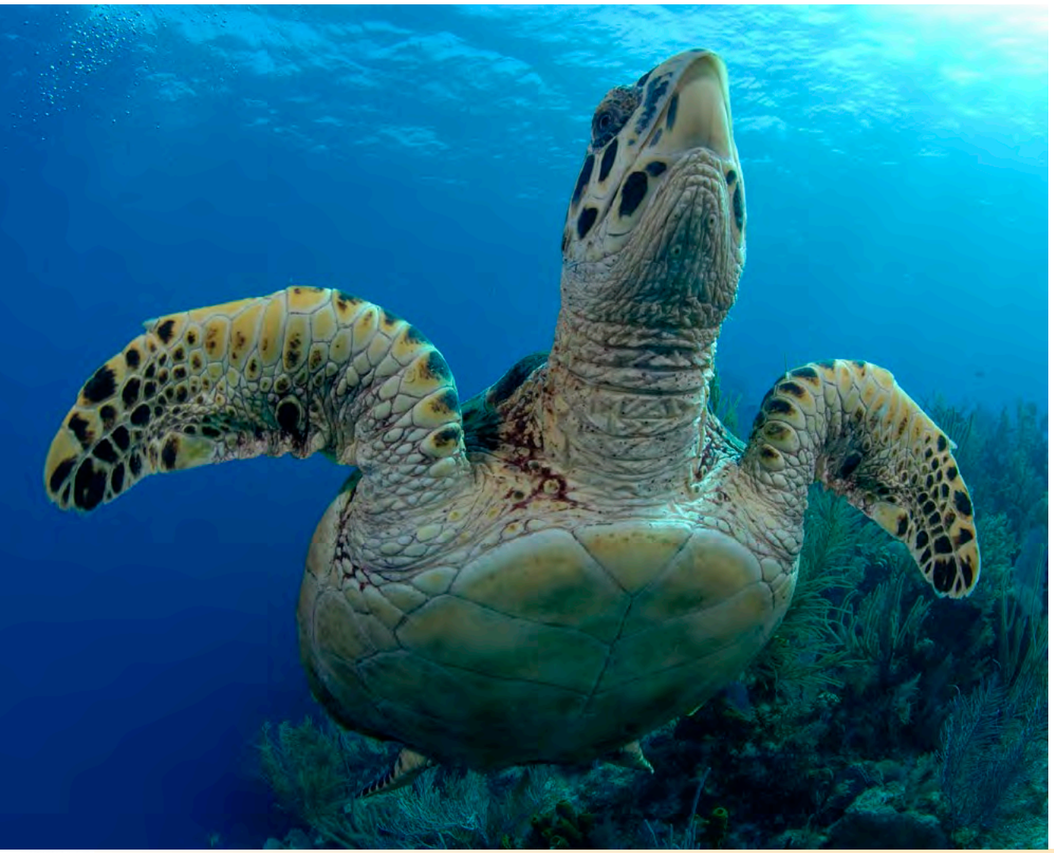
NASA

RIGHT: Global map with location of the Cayman Islands LOWER RIGHT: Location of Cayman Brac on map of the Cayman Islands. BELOW: Hawksbill sea turtle, Cayman Brac

Arrow crab

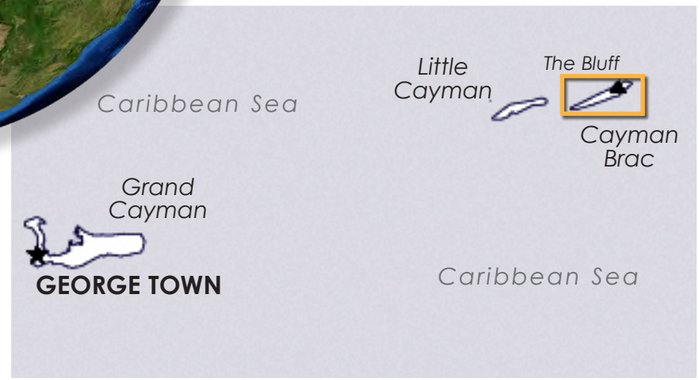
History During the 18th and 19th centuries, the British colonized the Cayman Islands from Jamaica whereby they were administered after 1863. The islands became a part of the Federation of the West Indies in 1959. In 1962, the Federation dissolved and the Cayman Islands decided to stay a British dependency. Government: Parliamentary democracy. Capital: George Town, Grand Cayman Island.

Geography The three-island group of the Caymans are located in the Caribbean. Grand Cayman, Cayman Brac and Little Cayman lie in the Caribbean Sea, 268km northwest of Jamaica and 240km south of Cuba. They are situated in an important location between Central America and Cuba. Coastline: 160km. Terrain is comprised of a base of low-lying limestone ringed by coral reefs.



Climate The Cayman Islands have a tropical marine climate, which is warm and rainy in the summer from May to October, cool and relatively dry in winter from November to April.

Environmental issues There are no natural freshwater resources, so drinking water is supplied by rainwater catchments.



Economy There is no direct taxation on the Cayman Islands so it has become a prosporous offshore financial center. As of 2008, over 93,000 companies were registered in the Cayman Islands, including nearly 300 banks, 800 insurance companies and 10,000 mutual funds. In 1997, a stock exchange was opened. Tourism is the main industry, with 70% of GDP and 75% of foreign currency income. The luxury market is the main focus of the tourist industry, catering mostly to North American travellers. In 2008, there were over 1.9 million tourist arrivals, half of them from the United States. While the locals enjoy a high standard of living, much like the Swiss, almost 90% of the Cayman Islands' food and consumer goods have to be imported.

Currency Caymanian dollars (KYD). Exchange rates: 1EUR=1.13KYD; 1USD= .82KYD; 1GBP=1.38KYD; 1AUD=.77KYD; 1SGD=.65KYD

Population 251,160,124 (July 2013 est.) Ethnic groups: mixed 40%, white 20%, black 20%, expats of various ethnic backgrounds 20%. Religions: Protestant 67.8%, Roman Catholic 14.1%, Jehovah's Witness 1.1% (2010 est.). Internet users: 23,000 (2008)

Language English is the official language. Other languages include Spanish and Filipino.

Health
In the Caribbean, in general, there is a risk of food and water borne diseases suah as Hepatitis A, as well as disease from insect bites such as Dengue fever and Rabies. Please check with your doctor about Tetanus shots and updates on health risks and required vaccines at least 4-6 weeks prior to your trip to the Caymans.

Decompression chambers
On Grand Cayman:
Cayman Hyperbaric Services
Cayman Islands Hospital
24-Hour Phone: (345) 916-1198

George Town Hospital
Phone: (345) 949-8600

Travel/Visa/Security
Visas are not required for entry for U.S. and Canadian visitors—just proof of citizenship, such as a passport or official birth certificate, as well as a photo identification such as a driver's licence. Visitors from other countries should check with the nearest British embassy or consulate for entry requirements.

Websites
Cayman Islands Tourism
www.caymanislands.co.uk

Edited by
Rosemary 'Roz' E. Lunn

POINT & CLICK ON BOLD LINKS

Equipment

Scubagear SG

The new SG regulator line from Subgear is equipped with a OFD valve (Optimal Flow Design) which the manufacturer states reducing air flow resistance by directing the flow of air around rather than through the spring resulting in a higher flow rate. As there is no venturi vane in the mouthpiece area either, the air can flow directly to the mouth, without obstruction. The Venturi effect is eliminated due the angle of inflow. The SG regulator range comes in three 1st and 2nd stage combinations, SG10, SG30 and SG50 (shown). **Subgear.com**

Waterproof D6

The D6 LITE ISS is a front-donning, light weight, nylon-based trilaminate drysuit primarily designed for the travelling diver. We suspect this material will easily fold down into a small bundle for packing. Waterproof really understands anatomy, and the D6 LITE ISS is designed and cut with pre-bent legs to give the diver a better fit when diving. Knowing how meticulous the folks at Waterproof are, it is no surprise that this is quite a pretty suit, with lots of attention to detail. The D6 LITE ISS comes with adjustable braces, reinforced shoulders and seat, double stitched seams, silicone neck and wrist seal system, zip cover and cordura knee pads and crotch panel. Waterproof has fitted Exlite boots that are apparently extra light, flexible and have a ridged heelstrap. **www.waterproof.eu**

Stingray

The StingRay utilises a solid state switch, which has no moving parts, and therefore, no chance of flooding! The StingRay has Cree XM-L2 LEDs, which are the brightest and most efficient bulbs on the market. The torches are all double hard anodized, come with a lantern-style handle and most importantly have an anti-reflective/anti-fog coated lens. All of these improvements have resulted in the best torch I have come across to date. **sealantern.com**

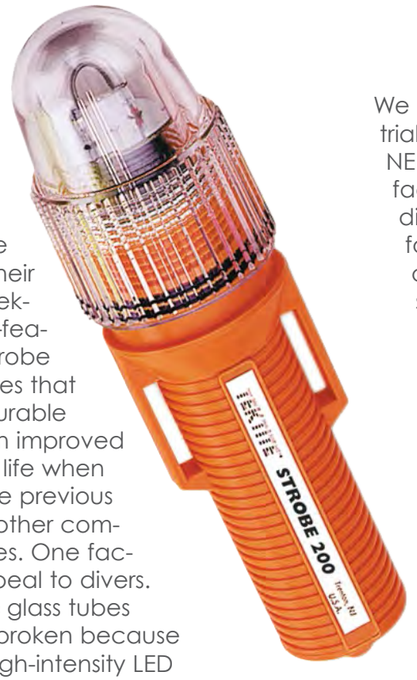
DiveRite QRM

This Quick Release Mount is rather clever, and I am not surprised that there is a patent pending on this. The QRM gives you various options for mounting your Dive Rite lights. Dive Rite states it can be fitted to any of its lights and is available in two versions: a soft handmount or a Goodman handmount. I suspect that you can also fit the QRM to lights from other manufacturers, too. The QRM uses a system of rollers and bands to easily clip a light head into the mount. Once you have played with it a couple of times, it is easy to use. You can fit additional QRM receivers on your equipment, giving you the option of moving a light from your handmount onto a helmet or DPV. And you can fit QRM strikers onto backup lights, giving you the option of using them with the same handmount or receiver. **diverite.com**

Oceanic Omega

The unhanded Omega regulator is back! Oceanic has recently launched its ambidextrous, side-venting Omega 3 FDXi demand valve. The environmentally sealed, balanced, lightweight First Stage has four Low Pressure Ports, two High Pressure Ports, and the reg can be dived with up to 40% Enriched Air Nitrox (EANx) straight from the box. Oceanic states that it offers high performance regardless of depth or tank pressure. Apparently, the in-line design of the first stage helps to improve flow efficiency by limiting the directional changes that gases must navigate during its journey to the second stage. In other words, the fewer right angle turns, the better the flow. Available in all black, or a black and white body. **oceanicworldwide.com**

Tek-Tite 200 LED Strobe



Tek-Tite strobes are popular with recreational, technical and military divers and fire fighters worldwide. Their latest offering—the Tek-Tite 200 LED Strobe—features a 7-Watt LED strobe module. Tek-Tite states that this strobe is more durable and benefits from an improved flash rate and lamp life when it is compared to the previous Xenon version and other competing Xenon strobes. One factor will certainly appeal to divers. There are no fragile glass tubes that can easily be broken because this strobe uses a high-intensity LED strobe module. It is rated to 150 metres (500 feet) and the two C-cell alkaline batteries should burn for approximately 30 hours. The strobe itself is meant to last 10,000+ hours or 36+ million flashes. I wonder who counted them all? **Tek-tite.com**

Nerd

We first saw the Shearwater NERD (Near Eye Remote Display) during field trials at Divetech's Inner Space last year and were pretty impressed. The NERD ticks all the boxes for the 'kit monster' diver. It has that 'shiny toy' factor and it performs. What makes the NERD attractive to rebreather divers is the sheer amount of information it conveys in an easy to read format. Instead of a basic HUD (head up display) that shows a series of different coloured LED lights (primarily green or red) that flash or are static, you get the useful data you really want. It seems as though the data is displayed on a 32-inch TV screen a mere 12 inches away from your eye. Crucially, the display is unobtrusive, so it virtually disappears when you look straight ahead. The Shearwater NERD displays the same information as the Petrel diving computer, with key warnings displayed in a different colour. **shearwaterresearch.com**

Masterdry

Seac's latest neoprene offering is called the Masterdry. Perhaps it is a drier suit because of the location of the zip? The Titex zip on this 7mm semi-dry suit runs across the shoulders, with the "mastersealzipper" protected by two rows of stitched binding that meet. Suit protection doesn't stop there. Key areas such as the knees, shoulders and seat are reinforced with Supratex, whilst the back benefits from a large padded spine pad. Seac has ultised ultra-elastic Smooth Skin for their wrist and ankle seals. The suit comes with complete with a roomy zipped pocket on the leg and a separate hood. **Seacsub.com**

SUB-30

SUB-30 is specifically formulated liquid detergent for use at low temperatures, hence the name (30 degrees centigrade and under). It should help eliminate sweat, bacteria and unpleasant odours from technical fabrics, and you can have the option of hand or machine washing. It is good to see that the environment and packaging has also been considered. SUB-30 not only looks after your technical garments, it is gentle because it does not contain optical bleach, phosphates, zeolites or fabric softener. Fourth Element states the 480ml bottle will do approximately 12 washes. Once empty, you can cut the shrink-wrap off and recycle the bottle. **Fourthelement.com**

Safety Culture

What Is It & Do I have it?

Text and photos by Gareth Lock

In August 2012, I wrote an article which discussed *just culture* and what this meant in the context of recreational and technical scuba diving, and using this concept, how we can improve diving safety. The main thrust behind the article was that everyone makes mistakes, irrespective of who we are in the diving community, what our experience levels are or what qualifications we hold. To improve learning, we need to stop throwing rocks at those who have the courage to discuss their incident in a public forum or report it to DAN, BSAC or DISMS. Sure, many people make silly mistakes or poor decisions, which ultimately cost them their lives. But those individuals didn't get up that morning thinking, "I know, today appears to be a good day to die."

But just culture is only one part of a *safety culture*, a term which is being promoted by a number of organisations and individuals as something that needs to be developed by individual divers to improve their safety. The funny thing is that a culture is something that is at the core of a community or group; it is 'the way things are done around here'. (Williams et al, 1994).

Whilst a culture can be developed and influenced from the bottom up, the main influence comes from the leadership, top down. Ironically, developing a safety culture means that you are improving other divers' safety as much as your own.

What is a culture?

"Shared values (what is important) and beliefs (how things work) that interact with an organisation's structure and control systems to produce behavioural norms (the way we do things around here)." Bro Uttal (1983)

"Culture is not the product of communication, as culture is affected by more than the organisation's contribution including social background, history, society and education." (Horbury 1996)

A culture, therefore, isn't just about communicating ways of improving things, it is about demonstrating, influencing, behaving in a manner which shows that the community has the 'right way of doing things' at its core, not just talking about it. Part of the problem we have within the diving community is that there are a number of 'right ways' of doing things, and we all believe we are right!

So what is a safety culture?

A safety culture is made up a number of component parts, and over the next three issues of *X-RAY MAG*, I am going to expand on these concepts in a manner that allows the global diving community to address each of them, to ultimately make diving safer, and as a result, more enjoyable. These component parts were developed by Professor James Reason (of 'Swiss Cheese Model'

fame) when examining High Reliability Organisations (HRO), such as civil aviation and air traffic management. Whilst these are heavily regulated environments and many would argue we don't need that in scuba diving, the premises are the same, culture is culture, how we do things around here.

As an aside, I would violently agree that we don't need any more regulation. Whilst they provide a framework, I believe they also introduce a reduction in personal responsibility for our own actions. An area that can be developed further is that of risk perception and acceptance, but more of that in another article looking at the psychology of incidents and safety.

All divers should take personal responsibility for their actions, and not rely on someone else; you do your checks, you get in the water, you dive, you check your gas, you end the dive ascending as per your decompression plan, all with your buddy or team mate if that was the plan.

All the agencies provide guidelines for best practice, and provide standards for their instructors to follow, but unfortunately there is evidence to show that group behaviour tends towards more risky behaviour if there isn't a strong positive influence or culture; this is known as risky shift.

I am sure you have been on a trip where, at the start of the week, all the checks are done correctly. But as time ticks on, the checks get more lax, minimum gas limits are extended, and by the end of the week, it is almost 'grab the cylinder and get in the water, it will be okay'.

Therefore, if we can improve group behaviour towards a safer outcome, then safety will be improved. Furthermore, when positive peer pressure is introduced, safety can be improved by challenging poor decision making such that we feel wronged when we don't conform—e.g. buddy checks are not the norm on some commercial dive operations and we feel odd doing them when no-one else is, yet we shouldn't feel this way.

Main components

The five main components of a safety culture are outlined below:

Just Culture – a culture of 'no blame' where an atmosphere of trust is present and people are encouraged or even rewarded for providing essential safety-related information—but where there is also a clear line between acceptable and unacceptable behaviour;

Reporting Culture – a culture in which people are willing to report errors and near misses;

Learning Culture – the willingness and the competence to draw the right conclusions from its safety information system, and the will to implement major reforms when the need is indicated;

Informed Culture – one in which those who manage and operate the system have current knowledge about the human, technical, organisational and environmental factors that determine the safety of the system as a whole;

Flexible Culture – one which can take different forms but is characterised as shifting from the conventional hierarchical mode to a flatter professional structure.

This article will cover safety culture in general, the next will discuss just and reporting cultures as they inextricably linked, and the final article will cover learning and informed cultures.

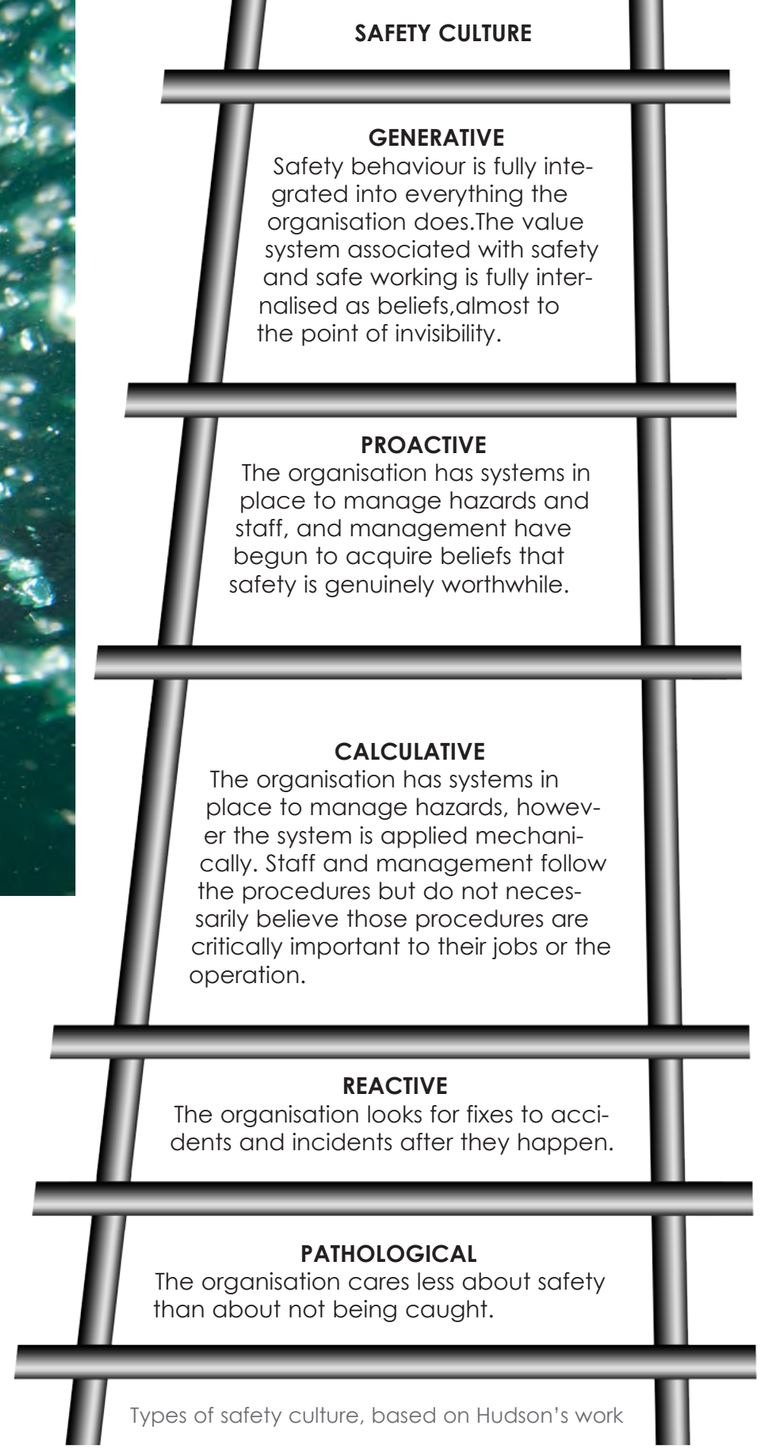
Types of safety culture

Consider the diagram (right), which is based on Hudson's work on safety culture. Where do you think you are on this step-ladder? Where do you think your dive centre is? What about your favoured training organisation?

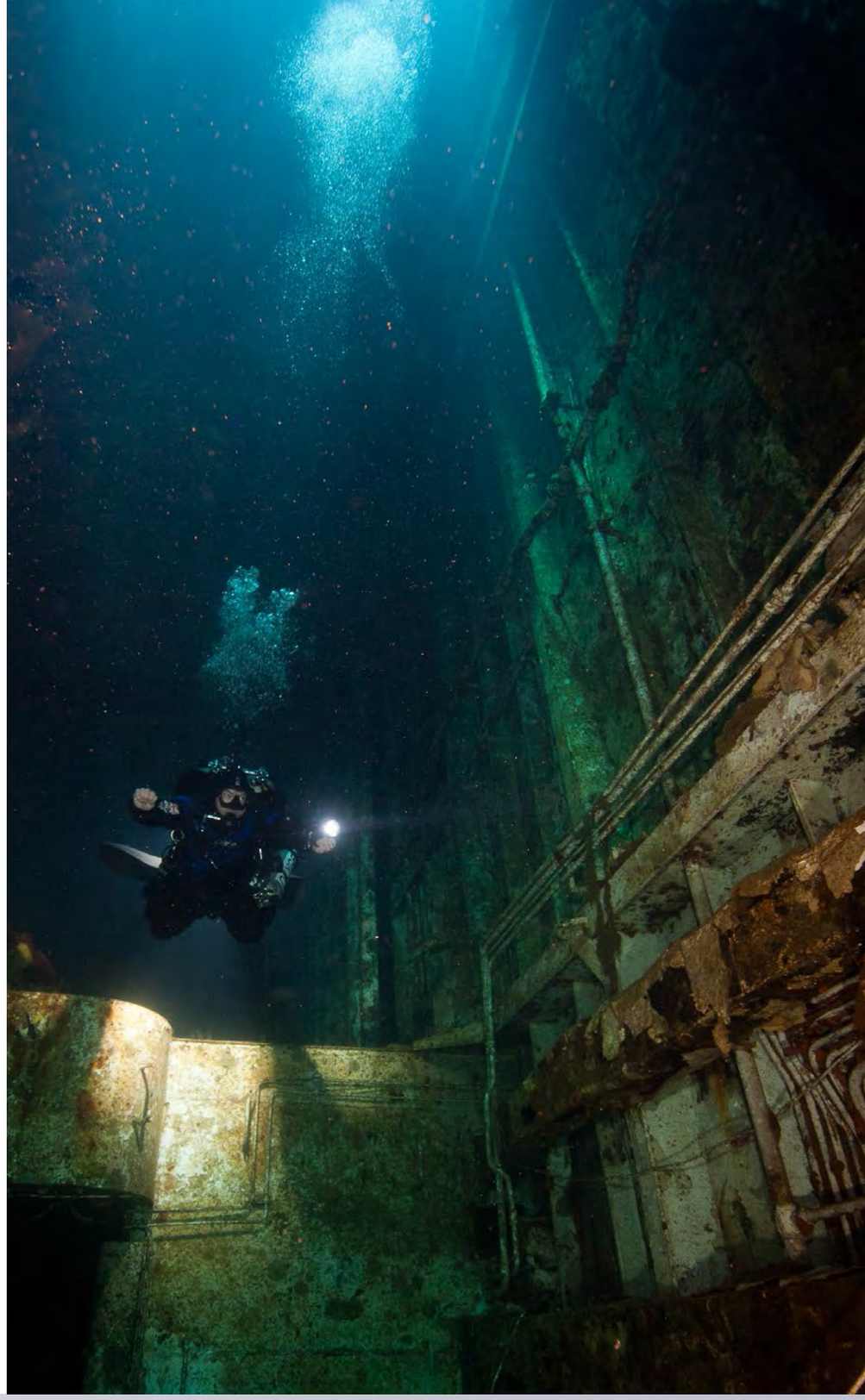
Just because there are quality management systems in place to ensure that instructors are teaching the correct skills, or even a safety policy at work which shows compliance with the local Health and Safety regulation, it doesn't necessarily mean we have a good safety culture as shown by the descriptors in the diagram. Whilst Hudson's work was focussed on formal organisations and their approach to safety, clubs, groups or groups of friends are all organisations, too, albeit loosely associated organisations.

Consider two groups, one a loose group of friends who dive together, the other a dive centre in a busy location. The group of divers knows the 'rules' of best practice: they always analyse their gas and mark the results on the cylinder; they decompress together using the same computers using the same decompression model and safety factors; they practice skills and drills on most dives; they debrief and learn from events on the dive; if they have an incident, they report it to their parent organisation, or another body, so that others can learn from the error/mistake/incident.

They have a culture amongst them, which is positive towards maintaining or improving safety. Importantly, they expect certain activities to be completed in a certain way, and when they are not, there is no shame in challenging that person; rules provides a baseline to operate from and make the normalisation of devi-



Types of safety culture, based on Hudson's work



ance harder to accept.

A dive centre where: they are very worried about profit and foot-fall; they are trying to get people through the door and certified to generate revenue; students are passed at the absolutely minimum level of standards; they do not have equipment serviced regularly because there are no local regulations requiring it; they might have a number of divers who have been injured or suffered DCS but never reported them because it is 'bad for business'—this dive centre has never had a bad QA report because all of their students loved their experience, although they are not sure that diving is for them.

Rules

'Rules' can be developed within whatever construct or environment you are diving in. A dive centre, a training organisation, an expedition, a small team or regular group of divers all have their own cultures, and if you are part of that group, you are part of that culture. If you feel strongly enough about improving the safety culture, you need to help develop it.

If you see something which doesn't look right, stand up and be counted. If you are on a liveaboard and things aren't right, speak to the organiser or the tour operator. If enough people critique the situation, something will be done, because ultimately, clients won't come back if things don't improve. However, for safety culture to really flourish, it requires significant commitment from the senior players in the community, and organisational change is hard and takes time. That doesn't mean we shouldn't stop trying though!

In the next article, we will look at the role of a Just Culture and a Reporting Culture and show how it is so important to develop both of these in parallel. However, because these are subsets of the wider safety culture, there is need for commitment from the higher organisations for these sub-cultures to develop. □

Gareth Lock is an accomplished technical diver based in the United Kingdom. Currently serving in the Royal Air Force, Lock is undertaking a part-time PhD examining the role of human factors in scuba diving incidents. For more information, visit the Cognitas Incident Research & Management website at: ***Cognitasresearch.wordpress.com***

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Japanese whaling shut down by International Court of Justice

In late March a U.N. court made a monumental ruling that the Japanese government must immediately halt its whaling activities in the Antarctic.

The International Court of Justice agreed with Australia, which brought the case in May of 2010, that the program was not for scientific research as originally claimed by Tokyo.

Australia argued that the program, known as JARPA II, was just commercial whaling in disguise, claiming that Japan had killed around 3,600 minke whales since 2005.

Japan, in turn, protested that the suit brought by Australia was an attempt to impose its cultural norms on Japan.

After much deliberation, the court declared that while JARPA II could broadly be characterized as "scientific research", the actual scientific output from the program was severely limited, and Japan had not sufficiently justified the whaling quotas it had set.

Australia delighted – Japan disappointed

Reading the court's judgment, presiding Judge Peter Tomka announced the court had decided, by a vote of 12 to 4, that Japan must withdraw all permits and licenses for whaling in the Antarctic seas and disregard any new permits already issued.

Following the ruling, former Australian Prime Minister Kevin Rudd (whose labor government originated the case) said he was "delighted by the result", while Australia's Attorney-General George Brandis stated that relations between Australia and Japan would not suffer as a result, and current Prime Minister Tony Abbott is still planning trade talks in Japan later in April.

Conversely, Japanese spokesmen told reporters that their government was "deeply disappointed" in the verdict, and Tokyo would consider its response "after carefully examining the contents of the ruling".

Japan accepts

Foreign Minister Fumio Kishida said, "We want to accept this from a position that respects the international legal order," but Agriculture, Forestry and Fisheries Minister Yoshimasa Hayashi stated that whale meat was "an important source of food, and the government's position to use it based on scientific facts has not changed".

Japan signed a moratorium on whaling in 1986, but continued whaling in the north and south Pacific under provisions that allowed for scientific research and by law can still continue whaling if it revises its scientific program or withdraws from the International Whaling Commission.

If Tokyo does so, they will join both Norway and Iceland, who have vocally rejected the International Whaling Commission and continue their commercial whaling activities—mostly selling its whale meat to Japan who contends that minke whales and a number of other species are plentiful and that its whaling activities are sustainable.

As expected, anti-whaling activists Sea Shepherd were overjoyed. Their official statement said: "We've been saying for ten years that this is an illegal whale hunt and the court has proven that case." □ SOURCE: BBC NEWS

FRITZ GELLER-GRIMM / WIKIMEDIA COMMONS

Female humpbacks stick to shallow water to avoid sexual harassment

According to a new study, female humpback whales with calves purposefully keep to shallow waters to avoid sexual harassment.

Dr Alison Craig, a marine mammal specialist from Edinburgh Napier University, led the research with colleagues Prof. Louis Herman and Dr Adam Pack from the University of Hawaii and The Dolphin Institute.

The study data, gathered around the Hawaiian Islands, showed females with a calf were often pursued by males in deeper waters, meaning the mother and calf had to increase their swimming speed by 75 percent and causing new mothers to head for shallower waters.

The scientists concluded that avoiding amorous and aggressive males assisted the females in energy conservation, helping their offspring to survive.

"Our study suggests that unwanted male attention causes females and calves to increase their swimming speed, so mothers need to supply their calves with more milk to compensate for the extra energy they've used," said Craig. "Females don't eat while they're in tropical waters, which means that they need to break down their own blubber to produce milk. Their milk is the only food source for the calves at this time, so you can see why saving energy is so important to females with a young calf. It could potentially increase the calf's chances of surviving the migration from the breeding grounds to the feeding grounds."

Previous research has shown that groups containing a calf tended to be found in shallower water, however, Craig's study is the first to specifically question whether this is due to mothers actively avoiding passionate males rather than just avoiding common predators.

Craig said there was no definite explanation as to why humpback males were less likely to pursue new mothers into shallower waters, although a reduced number of suitable mates is the likely reason.

"There are no long-term social bonds between male and female whales, and the males approach lots of females in the hope that they will get the chance to mate," she said. "Females who don't have newborn calves are more likely to ovulate than new mothers, and these females without calves occur in deeper waters. So if males follow mothers into shallower waters they will be less likely to encounter ovulating females and so will have less chance of fathering a calf." □ SOURCE: BBC NEWS

Australian researchers track pygmy blue whales

For the first time in recorded history, scientists have tracked the route taken by pygmy blue whales during their annual migration.

Researchers from the Australian Antarctic Division tagged 11 whales in April 2009 and March 2011and identified the previously unknown migratory route from the Australian coastline into Indonesia.

The study results, published in *PLOS ONE* , will allow scientists to assess how human activities might impact the whales during their 10,000 kilometer migration.

Dr Mike Double, Australian Antarctic Division marine scientist and lead author of the research, said the study data could be used to identify and manage various risks within the pygmy blue whale range—things like boat traffic, oil and gas platforms, as well as increased ocean noise from commercial shipping and fishing.

"This is particularly important," Double said. "Pygmy blue whales were targeted by commercial and illegal whalers prior to the moratorium on whaling, and we don't know if the population has recovered."

Curt Jenner, a study collaborator from the Centre for Whale Research in Western Australia, said the study brings to light the importance of international cooperation with ongoing conservation and management efforts in both Australian and Indonesian waters.

"When migratory animals routinely cross international borders, international cooperation is needed to implement conservation strategies that use information on habitat use and movement patterns," he said. "A combined approach by industry and managers when accounting for the movements of the pygmy blue whale utilising Australian and Indonesian waters will allow the recovery of this previously exploited species." □ SOURCE: WILDLIFE EXTRA NEWS

Polar Diving

Antarctica

Text by Yoland Bosiger. Photos by Yoland Bosiger and Jerry Sutton
Addition photos by Erin McFadden and Chris Thrall

JERRY SUTTON

Iceberg palaces glimmer in the sun. PREVIOUS PAGE: Diver bubbles rise against a back-ground of ice

Antarctica

YOLAND BOSIGER

On our journey north of the polar circle, my fellow adventurers and I were greeted by an astonishing spectacle. Over 20 orca were hunting an animal so rare that few people have seen them in the wild, let alone had the chance to study them. Using immense strength, agility and cunning intelligence, the orca worked as a team to hold the Arnoux's beaked whale under water to drown it. This was a story of nature at its most raw, untouched and unforgiving—a story that encapsulated wild Antarctica.

According to the Norwegian explorer Roald Amundsen, Antarctica is as desolate as no other country on our globe. In my case, Antarctica had taken me about as far away from my North Queensland, Australian home as remotely possible. Hot steaming rainforests had been replaced with ice palaces and blue green glaciers; kangaroos and cassowaries had been substituted with penguins and seals; and my beloved shorts and singlet had been passed up for down jackets, heavy-duty waterproof overalls and beanie. About the only thing that was consistent was the intensity of the sun, which had proceeded to turn me the color of a diner plate-sized Antarctic isopod—not a good look, I assure you.

YOLAND BOSIGER

The M/V *Plancius* at Hovegaard Island

OWUSS Rolex Scholar

Yet, despite the apparent severity of my situation, facing challenges like these was not new. I was nearing the end of a year-long journey, which had taken me far outside my comfort zone, exposed me to new places, and taught me new skills. Antarctica was the tip of the iceberg at the end of my exciting and adventurous year as an Our World Underwater Scholarship Society Rolex Scholar.

The Our World Underwater Scholarship Society Rolex Scholarship provides young people with the chance to explore marine fields from diving to science, engineering, medicine and media—providing these individuals with invaluable career-deciding opportunities. With the help of Expedition Leader and past British Antarctic Survey diver, Kelvin Murray, I


JERRY SUTTON

YOLAND BOSIGER

The southernmost town in the world: Ushuaia, Argentina; Mixture of Gentoo and Chinstrap Penguins at sunset (top right)

was able to experience Antarctica with Oceanwide Expeditions. My role onboard was threefold: to uncover the ins and outs of life aboard an expedition vessel, take pictures for Google Ocean and gain polar diving skills. This was an opportunity like no other.

Departing for southern seas

I made my journey from Australia to Ushuaia in Argentina—a picturesque town set at the foothills of the Martial Mountain Range and bounded at its edge by the Beagle Channel. Ushuaia and its surrounding wilderness are so beautiful that they make for an impressive tourist destination in themselves. In fact, I had been here three years previously for this very reason, hiking in the Terra Del Fuego National Park and getting my fill of empanadas (Argentinian pasties) and dolce de leche (caramel like spread).

Yet, as a result of its southern location, Ushuaia is of course best known as the taking-off point for a large number of passenger cruise ships headed for Antarctica. The streets of this little town are chock-a-block with warm clothing outlets and camera stores for those who might have forgotten something critical.

Departure day arrived and Murray took me to see my new home for the next three weeks—the 89-meter-long, 114-passenger cruise vessel M/V *Plancius*. It didn't take long to be thrown into the thick of things, and if you have ever wondered how ten days worth of food is transported onto a large cruise vessel like this one, then you're in for a treat.

Boxes were winched onto the boat via crane and then manually transported via a long chain of crewmembers to the galley. I counted over 200 bottles of juice and got to move everything from dry food and vegetables to entire wheels of cheese and foot-long salamis.

We then toasted the voyage and got ready for what we hoped would be a "Drake Lake", rather than a "Drake Shake". Well known for delivering giant waves and powerful winds, the Drake Passage has on occasion stymied even the most intrepid traveller. Luckily, we managed a relatively calm crossing and I spent my time attending onboard lectures and learning as much as I could about Antarctica's geology, wildlife and history.

Antarctica

Antarctica is the coldest, windiest and harshest place on our planet. In terms of size, Antarctica is the fifth largest continent (larger then both Oceana and Europe) and is dominated by the Antarctic Ice Sheet. At its thickest point, the Antarctic Ice Sheet is 4.7km (2.9mi)


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Exploring the penguin colonies at Couverville Island


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Humpback whale at Hovegaard Island (above); Antarctica at sunrise (top left); Gentoo penguin feeding chick, Aicho Island (top right; Spotting penguins at Cuverville Island (lower right)

deep, averaging a whopping 2.2km (1.4mi). An incredible 90 percent of all the world's ice and 70 percent of the entire world's freshwater is contained within this ice sheet. To put this in perspective, if the Antarctic ice sheet was to melt, world sea levels would rise by approximately 60m (197ft) everywhere.

Yet, Antarctica has not always been so heavily covered by ice. Fifty million years ago, Antarctica had a temperate climate with evergreen forests and many land animals. Nowadays, however, very little life can survive in the ice-covered Antarctic interior, except for algae and microbes.

Antarctica underwater

In contrast to life on land, Antarctica's marine environment is undoubtedly one of the most productive in the world's oceans. In summer, 24-hour sunlight combined with rich upwelling causes phytoplankton to bloom, which in turn feeds small semi-transparent crustaceans called krill. These super-abundant and unusually large phytoplankton feeders allow Antarctica to support a great diversity of whales, seals and birds.

The waters of the Southern Ocean are also important for transporting essential nutrients all around the world. Icy cold, highly salty water known as Antarctic Bottom Water drips into the ocean from the surrounding sea ice, and in doing so, pushes warmer water upwards. This upwelling is so strong that it is responsible for driving all the oceans' currents.

Stepping onto dry land

After two days of extravagant dinners, steamy hot chocolates and albatross photography, I seemed to be settling into my new environment quite nicely. Calm weather meant that we were able to make great time, and before long, we had crossed the Antarctic convergence and were within view of our first stunning sphinx-like icebergs. On the afternoon of our third day at sea, it was time to make landing at Aitcho, a tiny rocky island in the South Shetlands group. Eager to stretch our legs, we all made our way out onto the gangway and stared in wonder at the pink-tinged snowy mountains and pastel blue ocean.

Aicho Island is home to three different spe-

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Antarctica

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cies of penguin: the gentoo, Adélie and chinstrap. On shore, we were greeted by a flurry of activity as both gentoo and chinstrap penguins intently went about their business not the slightest bit disturbed by our presence. At one point, I stopped to take a picture of a gentoo penguin feeding her chick only to find that a new chick had adopted me and was sitting obediently between my legs.

Google Ocean

Penguins have got to be some of the most photogenic animals on the planet. They are also intensely curious, so much so that they often waddle too close to one's camera and cause photographs to be out of focus. My purpose behind all this camera snapping was to help Murray collect and generate content to be uploaded to the Google Ocean Layer (for which Murray is a formal contributor) in the form of photos and videos.

Google Ocean was inspired after Dr Sylvia Earle, legendary ocean researcher and National Geographic Explorer-in-Residence, made a 'wish' for influential organisations and individuals to make a concerted effort to protect the planet's life support system—the oceans. By using Google Ocean, you can take a visual journey from shallow coral reefs to the depths of the deep sea and can learn about important research discoveries.

JERRY SUTTON

Recovering dive tanks after a snowy night; Transferring into zodiacs for a land excursion (top left)

Reaching the Peninsula

Getting to our destination of Neko Harbour on the Antarctic Peninsula took us first through the Gerlache Strait. With my camera ready, I stood upstairs just outside the ship's bridge and tried to decide on what to photograph. Everything was so immense, so raw, and yet so delicate and magical that I decided to do the opposite—just watch and take it all in.

As we continued through the channel, huge craggy mountains rose

JERRY SUTTON

Leopard seal underwater at Petermann Island; Orca hunting an Arnoux's Beaked Whale (top right)

JERRY SUTTON

Antarctica

JERRY SUTTON

JERRY SUTTON

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THIS PAGE: Scenes from ice diving at Neko Harbour; Anemone at Vernadsky Wall (left)

abruptly out of the infinite abyss of blue and green. Icebergs in the shapes of cathedrals and castles glistened and shone under the sunrays. It was like being in paradise, yet I was aware of the irony in this statement. Certainly from the comfort of the M/V *Plancius*, Antarctica seemed romantic and beautiful, but at that moment, my mind went to those early explorers who—using man-hauled sleds, with limited food supplies and primitive clothing—fought their way through this harsh and unforgiving terrain. What different opinions they must have had.

Ice diving

Although initially thought to be the exclusive dominion of documentary dive teams and specialised technical divers, Antarctica has been made accessible to recreational diving by Oceanwide Expeditions for the last 15 years. Provided conditions are favourable, divers on the M/V *Plancius* have the opportunity to experience the majesty of ice underwater as well as a great variety of benthic marine life, penguins, fur seals and even leopard seals.

Dive sites in Antarctica vary from shallow ice diving to wall diving and even wreck diving. Diving can be from the beach or from the zodiac, and the maximum depth is 20m (60ft). Given the remoteness of Antarctica (there are no decompression chambers or hospitals) safety is of utmost concern. The diving is not for beginners, and it is crucial to be experienced with cold water diving before embarking on a trip.

The epitome of polar diving for many underwater enthusiasts is getting to dive on an iceberg. With 90 percent of their mass underwater, it's only logical that these masses of floating ice should be explored from below.

The first time I propelled myself into the -1°C waters, I was glad my regulator was in my mouth for a couple of reasons. The first and most obvious reason was to stop myself from swallowing water. The sec-

JERRY SUTTON

YOLAND BOSIGER

CLOCKWISE FROM LEFT: Pair of red starfish; Marine invertebrates just outside Vernadsky Station; Shipwreck heavily encrusted with sponges and sea urchins; Intact wooden beams of the *Gouvernøren* wreck

ond and arguably as vital purpose was to stop myself from shouting the most perverse profanities I didn't even know I was capable of. Thankfully the elaborate textures and beauty of the iceberg provided a welcoming distraction, and as my face and lips went numb, the pain eventually subsided.

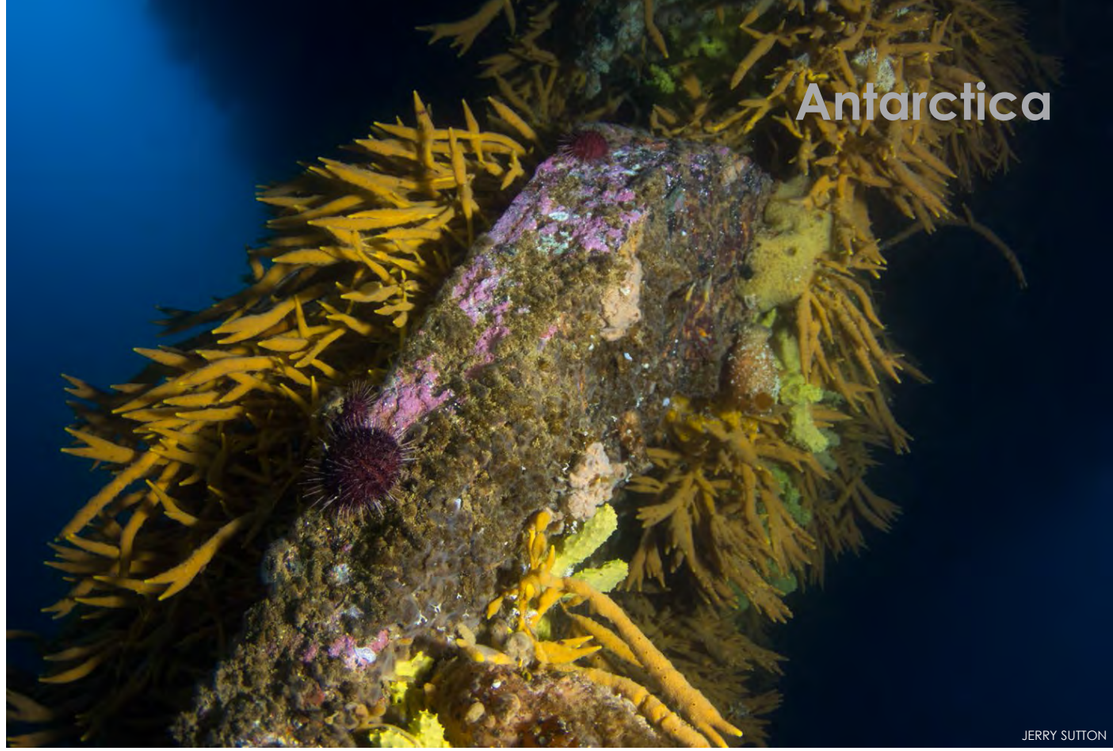
Diving near ice was a novel concept, overloading the senses with new sights, sounds and textures. Below water, the iceberg looks like a colossal dimpled golf ball, its pattern produced through a combination of melting freshwater and saltwater corrosion. Swimming deeper, we began navigating the gullies, steep columns and sculptured pillars from a seal's-eye-view. We could see the faint white mist hanging next to the ice and could hear the corresponding fizzing sound as trapped air bubbles escaped into the salt water. With aggressive determination I made my freezing fingers work the shutter button—my own dive bubbles making for interesting subjects against the background of white corrugations and shades of turquoise.

At the surface, fringes of icicles hung off the edge of the berg and enclosed a gallery of emerald crystals. I was frozen, but delighted. Antarctica had just delivered one of the most awesome dives of my life.

Gouvernøren wreck

While humans have never permanently inhabited Antarctica, they have certainly left their mark here. It's thought that over a million whales were killed between 1904 and 1987 to supply humankind's thirst for oil. Breaking the surface just ahead of us was the bow of *Gouvernøren*, a Norwegian whaling transport vessel that burned and sank in 1916. This was the first time any divers on our vessel (including the divemaster), had dived a wreck in Antarctica, and we were super excited about what surprises might lie ahead.

My first view of the wreck was a gigantic, slightly ominous superstructure. As the gloom began to separate, the upper



Antarctica

JERRY SUTTON

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Steel barrels (left) and main deck at entrance to the forward holds (above) on *Gouvernøren* wreck; Antarctic limpet (top right); Entering Vernadsky Station (right)

Antarctica

Swimming along the submerged ship revealed tell-tail signs of the ship's past life in the whaling industry, including numerous winches for hauling the whales on deck. As I adjusted my buoyancy to avoid stirring up the sediment, I couldn't help wonder what life must have been like for these early whalers and how terrifying it must have been to be stranded and sinking in this icy wasteland.

As we approached the stern of the vessel, the amount of marine life increased dramatically. Overhangs created by the hull formed ideal spaces for kelp, sponges and starfish, the intensity of which culminated under the stern and around the rudder. It was like diving in a room full of ornate candelabras except that in place of candles were bright yellow, flinger-like sponges.

Vernadsky Station

Apart from whales, birds, seals, penguins, and the occasional tourist, Antarctica's other main resident is the "research scientist". As a result of the International Geophysical Year (IGY) and the need to defuse competing territorial claims, countries ratified the Antarctic Treaty in 1961, formally setting Antarctica aside for peaceful, scientific purposes.

One research outpost that we were able to visit during our journey was the Ukrainian Station of Vernadsky, a former British Base that was sold to the Ukraine in 1996 for the bargain price of one pound! The scientists at Vernadsky conduct many experiments, most of which relate to atmospheric science. We also visited Wordie deck became visible revealing intact wooden decking. The cold Antarctic waters had preserved these antique timbers, and invading icebergs had kept them clean of encroaching marine life.

Antarctica

View of steep mountains and glacier from the safety of the M/V *Plancius*; Penguin (lower left) feeding its chick at Aitcho Island; Leopard seal (below)


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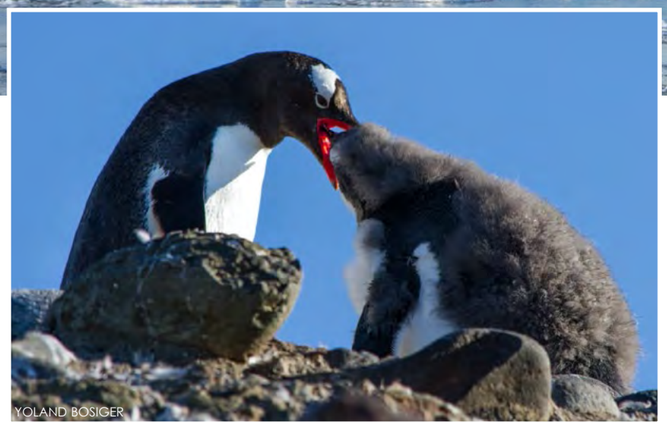
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House, an abandoned British station that had everything from pans, books, stove and typewriter still in place.

Our diving challenge at Vernadsky Station was to find a particularly elusive wall just outside the base. Twenty minutes into the dive and we were still following a shallow gully over the ice—the wall nowhere to be seen. Eventually, the gully led to slightly deeper water and all of a sudden the rocks dropped off to an obvious wall plunging vertically to below 20m.

Compared to the icy white surface, the rock wall presented a kaleidoscope of colour and animal life. Antarctic isopods, colorful anemones and nudibranchs occupied the flat outcroppings and many species of urchin hid in the numerous crevices.

Predator and prey

Antarctica is one of the rare places where large predators still dominate the ecosystem, and where both predators and prey are relatively unafraid of human beings.

Our dive at Vernadsky was followed by one of the highlights of our trip—a leopard seal hunting a penguin. Leopard seals are bold, powerful and curious animals that grow to up to 3.5m. When hunting penguins, leopard seals patrol the waters near the edges of the ice, almost completely submerged, waiting for the birds to return from hunting.

From our zodiac, we watched the gentoo penguins swim obliviously towards the leopard seal. As the seal made its surprise attack, penguin pandemonium ensued with groups of up to 20 flying in every direction, porpoising madly to escape the seal's deadly jaws.

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Leopard seal hunting a penguin just outside Vernadsky Station


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CHRIS THRALL

Antarctica at sunrise on the M/V *Plancius*; Surface interval on an iceberg at Neko Harbour (right)

While I certainly wouldn't say I'm a lover of gory killing scenes, observing the leopard seal was mesmerizing.

The seal grabbed the penguin by its feet and shook it violently, repeatedly beating its body against the surface of the water in an attempt to kill it. At one point the leopard seal even threw the penguin in the air like it was playing a game of catch, triggering a crescendo of squeals and camera snaps. While leopard seals can consume a number of penguins a day in the summer, this extravaganza will not last, and many will be forced back to a diet of krill during the winter.

An unforgettable journey

My trip to Antarctica was a journey of education, exploration, adventure and discovery. I'd experienced the challenge of diving underwater, indulged in stunning, icy scenery and photographed spectacular species of wildlife —many of which are found no where else on the planet. Perhaps most importantly though, I had begun to learn firsthand, and from passionate and dedicated Antarctic enthusiasts, about the importance of protecting this vital ecosystem.

Antarctica bursts with life, and for the most part, this is found underwater. Diving in Antarctica revealed an abundance of marine creatures in all shapes and sizes. Even from the comfort of the ship, the importance of the ocean for foraging seabirds and marine mammals, such as killer whales and leopard seals, was clear. Hopefully with continued protection, this stunning wilderness will continue to be enjoyed by individuals who no longer want to conquer this frontier continent, but rather wish to be inspired by what it is—a truly unique and fragile ecosystem. □


YOLAND BOSIGER

Antarctica


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Gentoo penguin alone on the ice; Icy wilderness at sunset (top right)

*Yoland Bosiger is a marine biologist and avid diver based in North Queensland, Australia. She was the 2012 Our World Underwater Scholarship Society Rolex Scholar. The author extends special thanks to Oceanwide Expeditions (**Oceanwide-expeditions.com**), Silvertip Expedition and Diving Management (**Silvertipworld.com**) and the Our World Underwater Scholarship Society (**Owuscholarship.org**) for making this trip possible.*

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SCOTT POLAR RESEARCH INSTITUTE UNIV. OF CAMBRIDGE

fact file

Antarctica

SOURCES: U.S. CIA WORLD FACTBOOK, NATIONAL GEOGRAPHIC ANTARCTICA EDUCATION

History Captain James Cook discovered Antarctica in 1772 when he first crossed the Antarctic convergence. Sealers were next to enter the region, and during the mid 1780s the search for virgin seal grounds drove much of the early Antarctic exploration. The Heroic Age of Exploration began in 1895 and is best known for the journeys of Robert Scott, Roald Amundsen, Ernest Shackleton and Douglas Mawson. With the onset of the 20th century, the race was on between Amundsen and Scott to secure the South Pole. The race ended in Amundsen's favour and saw the tragic loss of Scott and his four comrades on the return journey.

Whaling in the Southern Ocean was occurring as early as the 1700s, but improved technologies allowed the industry to flourish in the 20th century. Thousands of whales were slaughtered annually eventually driving whale numbers close to extinction and making the industry nonviable. With the signing of the Antarctic Treaty, Antarctica is now set aside as a place of peace and science. There are currently 42 research stations operated by 17 countries.

Population The population of research scientists varies throughout the year. The number increases from approximately 1,000 in winter to around 5,000 in summer.

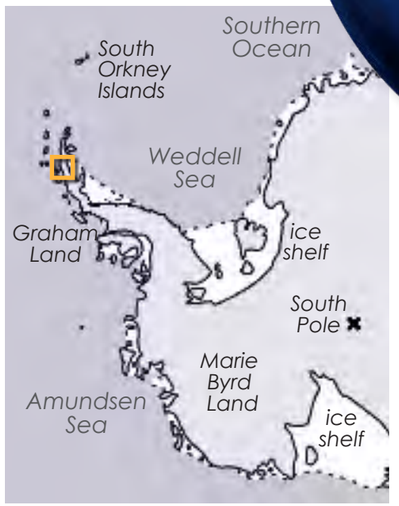
Geography Antarctica is located in the Earth's southern hemisphere and is centered asymmetrically around the South Pole. The continent of Antarctica encompasses an area of over 14 million squ km (5.5 million squ mi) and is surrounded by the Southern Ocean. If ice were removed from Antarctica, it would reveal a single large landmass about the size of Australia (known as Greater Antarctica) and an archipelago of mountainous islands known as lesser Antarctica. Lesser Antarctica is a tectonically active area with active volcanoes such as Mount Erebus (the southern most active volcano on earth). The highest mountain in Antarctica reaches 4,500m (14,764ft).

ERIN MCFADDEN

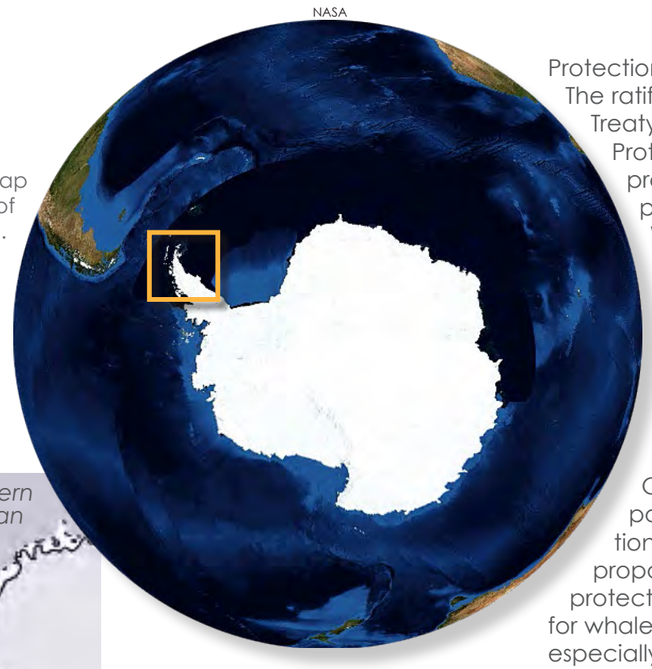
Divers surfacing from a dive at Neko Harbour

Climate During the summer months temperatures around the coast of Antarctica are generally close to freezing although temperatures as high as 8°C have been recorded. In 1983 the coldest naturally occurring temperature on earth was recorded at Vostok Station of □89.2°C. Tourists do not visit Antarctica in winter.

RIGHT: Global map with location of Antarctica Peninsula. BELOW: Location of Neko Harbour on map of Antarctica Peninsula BOTTOM RIGHT: Gentoo penguin having a scratch, Aicho Island



NASA



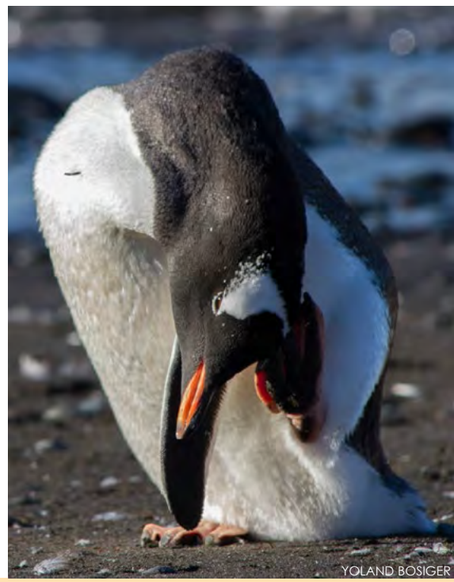
Environmental Issues
Scientists of the British Antarctic Survey first announced the loss of ozone over Antarctica in 1985. These scientists discovered that compounds such as chlorofluorocarbons and halons take part in catalytic reactions that destroy the ozone layer. This discovery led to implementation of the Montreal Protocol, which controls the production and use of chlorofluorocarbons and other ozone depleting chemicals. The protocol is having a clear positive effect, and the amount of ozone destroying substances in the atmosphere is gradually declining.

Climate Change
Global warming is having a major impact in Antarctica, particularly the Antarctic Peninsula. In the last 50 years, temperatures have risen by almost 3°C—as much as five times the world average. This temperature increase has correlated with a total loss of 25,000 squ km of ice shelf from the Antarctic Peninsula. The warmer temperatures have resulted in more moisture in the atmosphere resulting in more frequent and heavier snowfalls. Scientists fear for the Adélie penguin because it needs land that is free of snow and ice to raise its young.

Fisheries
Antarctica is has long been a site of exploitation for human profit. While commercial whaling and sealing has ceased for the most part, commercial fishing of the long-lived toothfish and all-important krill continues in Antarctic waters and could have devastating impacts if not controlled.

Protection
The ratification of the Antarctic Treaty and subsequent Madrid Protocol were intended to provide comprehensive protection of Antarctica. While they were certainly important for protecting Antarctica's terrestrial environment, more progress is needed to protect the Southern Ocean, which drives the cycle of life in the region. The Antarctic Ocean Alliance is supporting greater protection of Antarctic waters by proposing large scale marine protected areas—sanctuaries for whales, seals, penguins and especially fish like the Patagonian toothfish that continue to be hunted by commercial fishing fleets.

How to get there
In 2007-2008, approximately 58 vessels (including 17 yachts) travelled to Antarctica, each catering to a variety of travel needs and vacation expectations. Oceanwide Expeditions is one of the few operators to offer recreational diving in the Antarctic region.



YOLAND BOSIGER

Going 'Recreational'

Taking the SE7EN for a spin

The nascence of recreational rebreathers was just waiting to happen. Spurred on by rapid advances in technical diving, new materials and technology, coupled with cost reductions, the allure of long and quiet dives, with vastly improved non-deco times, had to seep from the technical communities to recreational diving, leading to the design of a new generation of closed circuit rebreathers aimed primarily at recreational divers. But how far have we come to making closed circuit rebreathers a common sight along our shorelines?

Text and photos by Peter Symes

There is probably no point in denying it was with no small measure of boyish anticipation that I showed up at Poseidon's premises on the outskirts of Gothenburg, Sweden, to go through a course on their SE7EN closed circuit rebreather, which is an upgraded and meaner looking version of the MkVI they fielded a few years back.

Coming up first on the agenda was taking a closer look at the innards and getting familiar with all the components and how they came together.

Looking at the unit as it was laid out gutted on the table, it struck me how compact everything was. The breathing hoses, for example, of which there are four short identical ones, are each just about a foot long. The counterlungs, which detach easily for rinsing, just looked liked a couple of small bladders, but as the manual states, they are "sized to be about half the volume of a full breath for an average individual", and as I should learn later taking it in the water, they had indeed all the volume necessary.

On assembling the unit, nothing felt flimsy or inaccurate; build quality seemed solid, the manufacturing precise, and the design came across as thought through. Not that I expected otherwise, as the Se7en is the improved younger sibling of the MkVI, which already had many years of development, debugging and refinement behind it. It showed in the details and nice finish.

Boot sequence

Once the unit had been assembled and checked, it could be fired up. During start-up, the unit automatically performed a sequence of system checks, the progress of which could be followed on the handset.

During the sequence, there were a few prompts, such as to open or close the mouthpiece, and confirmations to make, such as verifying that a scrubber cartridge had been inserted. In case of any issues or failed tests, an alert would be displayed on the handset along with a diagnostic code number that could be looked up in the manual (which can be downloaded to a smartphone or tablet and thus kept handy.)

It was all fairly straightforward. I won't delve too deeply into the technical specs or the philosophies underlying the design other than to point out that the Poseidon series of rebreathers, in constrast to most other CCR's currently on the market, was conceived as a clean-slate design aimed primarily at the recreational divers from the onset as opposed to a paring down of a pre-existing technical rebreather as a number of other manufacturers have opted to do.

In what has been probably the most radical deviation from the prevailing dogma, Poseidon's engineers opted to use only one oxygen sensor—rather than the usual set of three coupled with a voting logic—to monitor the gas in the breathing loop.

There is a second sensor but this is used, in what Poseidon has dubbed "Active Sensor Validation", only to validate the first and primary sensor raising the alarm if there is a discrepancy in the readings between the two.

As the sensor has direct access to both oxygen and the diluent (i.e. air)—each of which has a known oxygen content—a burst of each of these pure gases will provide a set of data points that can be used to accurately calibrate the primary sensor.

As counter intuitive as it may seem that a system using only one main sensor can be less prone to error than a design that rests on three, the principle does rest on a sound mathematical foundation, as i.e. Nigel Jones, principal at RMB Consulting, demonstrated at Rebreather Forum 3. Leaving any further elaborations of this side of the matter to the geeks, what is the significance of all this to the user?

This design allows for a significant level of automation and reduction of user task load.

It makes for a system that is both capable of precisely calibrating itself, using only a very small volume of gas, without any user input and able to continually monitor sensor performance at depth. As such this design allows for a significant level of automation and reduction of user task load.

Having been originally trained on a technical rebreather, it even came as a relief to me. I would almost compare to the difference of driving a vehicle with a double clutch manual gearbox to one with automatic transmission and cruise control.

Mind you

While rebreathers, also the latest recreational and most automated models, still require a good deal more preparation and diligence when assembling and pre-dive testing the units; the ease of use and reduced task loading felt both more reassuring and safer—a statement that will probably leave me open to flak from the old-school fraction in the CCR-community, but so be it.

High levels of automation don't, however, imply that you are now freed up to go dive more or less mindlessly. Lessening the task and stress loads primarily translates directly into safer diving, and it also means that I can enjoy my subsurface adventures to higher degree, focus on the experience and possibly other tasks, such as photography, which is my main interest and primary cause for diving a CCR.

Training

As with most other courses, training on the SE7EN takes you through the familiar sequence of theory, with an exam at the end, followed by practice sessions in confined water before moving on to open water lessons.

In all rebreather diving, using and adhering to checklists becomes a mantra and instilling this mindset permeates the whole course. As tedious as it may seem, it is for good reason such lists are slavishly followed by pilots, highly trained and experienced as they may be. Open circuit gear can more or less be donned and dived after a few and simple tests.

Rebreathers not so. Since something as banale as a dislodged or pinched o-ring may not only compromise your dive but put your life at risk, you would want to go over your kit at least as patiently and meticulously as when you assemble that fancy camera housing of yours.

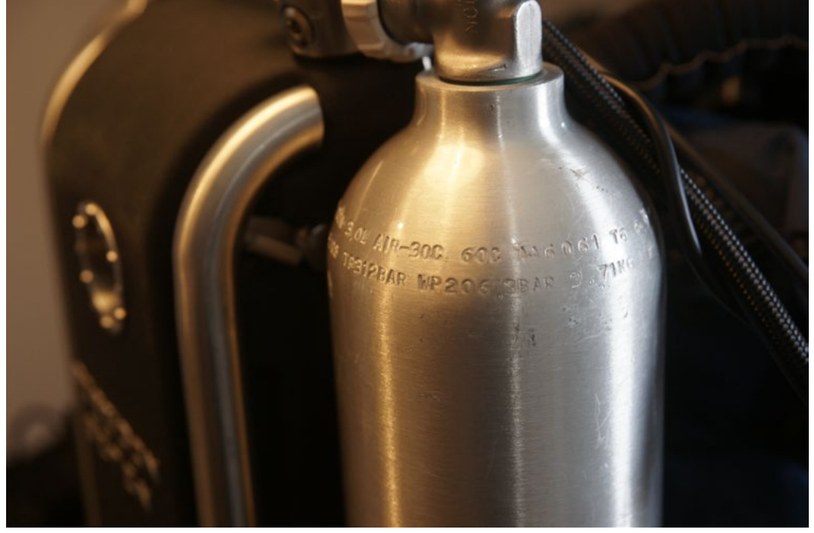
Everything laid bare and ready to be assembled

Consequently, diving rebreathers is not for the impatient. But what is the hurry anyway? Going methodically through the checklists both when assembling the unit and doing the pre-dive checks is of the essence and, in fact, a mindset that all rebreather divers are required to adopt. Students are repeatedly grilled about this aspect and the question will pop up at the exam!

During the in-water training, the primary focus was on buoyancy control, which has to be managed somewhat differently than on open circuit, and on bailout procedures.

On a rebreather one cannot, for example, use a deep breath to slow down a descent or use lung volume to fine tune a hover since the combined volume of the breathing loop and the diver's airways and lungs remains constant. Thus deep exhalations or inhalations make no difference to buoyancy, a habit which many open circuit divers being trained on closed circuit often struggle to break.

Other old habits that die hard but must be killed off include fre-



The standard tanks contain three liters each

Barrel rolling onto my right side, the drysuit valve on my left overarm would vent, and by rolling left, the valve on the right counter-lung would vent. Rock and roll does the trick.

quent mask clearing and exhaling through the nose, both of which are practices that waste gas, counter to the main point of using a rebreather in the first place.

In order to manage buoyancy on a rebreather correctly, the diver must acquire and maintain what is called minimum loop volume. As the attentive reader will have guessed already, that is the amount of gas that just allows for a full inhalation. One should feel just a slight tad of resistance at the top of a deep inhalation. If there is too little gas in the loop, an automatic diluent valve (ADV) should open and add some more. If there is too much gas in the loop from the onset—as is usually the case—this excess needs to be vented.

This is accomplished by a simple procedure. First, the diver keeps partially exhaling through the nose releasing bubbles around the mask until this sweet spot is acquired. Then, the diver leans onto the left side causing the overpressure relief valve on the right counter lung to open and vent. While in this position, the valve is then slowly tightened until the bubble stream stops, pretty much as one would adjust the shoulder valve on a drysuit. This little exercise usually take some repetitions to get right, but just as well, as it is part of the standard procedures when diving the unit henceforth.

When in doubt, bail out!

Bailing out means going from closed to open circuit and is arguably the most basic and elementary procedure trained on both technical (type t) and recreational (type r) rebreathers. It is essential that performing this procedure becomes second nature and routinely practiced.

"*When in doubt, bail out*" for whatever reason, no questions asked. It applies not only to obvious cases, such as equipment malfunction, but any dodgy feelings or nagging suspicions also qualify.

On a rebreather, having a gas to breathe is not the only concern. Knowing what gas you breathe at any given time is also important. So if you are not sure, better be safe than sorry and switch to open circuit.

One of the aspects that sets recreational rebreathers apart from their technical dittos is a requirement to come pre-equipped with a Bail Out Valve (BOV). Basically, it is just a fancy expression for the open circuit regulator, which has been mounted onto or integrated with closed circuit in such a manner that the diver can switch forth and back from one circuit to the other, without having to remove the mouthpiece.

On some rebreather models, such as AP Diving's Inspiration range for example, this switch is accomplished by twisting and turning the whole mouthpiece 90° with respect to the breathing hose. The Se7en, on the other hand, has this big lever on the mouthpiece housing.

Since this design enables switching using only one hand and without having to let go of i.e. a camera or a downline, I like this better. When the lever is in a vertical position, the closed loop is open (mind you, there is some confusing jargon to observe there), and when it is flipped horizontally and pointing forward and away from the diver, the closed loop is closed, with breathing done off the open circuit from a regulator exhaling bubbles into the water.

During bail-out, the open system draws breathing gas from the diluent tank via a first stage as in any open circuit configuration. Only snag here in this otherwise nice idea is that the said diluent tank only contains a volume of two or three liters, the same as a small pony-bottle.

So even when the tank is still close to full, there is only a quite limited amount of gas available for a safe ascent, and if any significant amounts of gas have been lost due to sloppy technique, matters may even get outright dicey if bailout is required on a deeper dive.

For the same reason, it is a requirement that an additional bailout tank with a regulator must be carried for dives below 18m (60ft) i.e. in the form of a side-mounted tank clasped onto the diver's left side.

Rock 'n' roll

For the Advanced Rebreather Diver course, it is therefore also a requisite to practice bailing out and surfacing while breathing from this separate tank.

This procedure entails closing the loop, a switch to breathing off the bailout tank while being able to maintain correct buoyancy on the ascent. To avoid blowing up and shooting to the surface in an uncontrolled ascent—this is where the minimum loop volume procedure comes in real handy; with the overpressure valves set correctly on the counter-lung as well as the drysuit I had to wear, I just 'wriggled' my way up to the surface in a controlled and orderly manner. Barrel rolling onto my right side, the drysuit valve on my left overarm would vent, and by rolling left, the valve on the right counter-lung would vent. Rock and roll does the trick.

The verdict

Having only gone through a course with some pool-dives and a day of open water dives, this report can only be a reflection of some first impressions and preliminary observations. So while an indepth test where we will take the Se7en thoroughly through its paces is in the works, what can we conclude on the current basis?

Being trained on the SE7EN was

How's this for a training site? In early April the Swedish archipelago could still be snowbound but during our open-water training the sun was out and the water smooth as glass. This is Gullmars fjorden at a location called Skår.

a novel but straightforward experience and the machine was always compliant, comfortable and easy to operate in water. Its compactness and snug fit made it easy to dive, and in terms of weight, resistance through water and freedom of movement. it was just as good as my regular open circuit rig. In particular, I fancied the flat and compact assembly of the mouthpiece and BOV, which did not get in the way of getting my eye close enough to the camera.

Holding the SE7EN to its apparent design criteria, being primarily designed with recreational rather than technical divers in mind and to let technology do as much monitoring and control as possible, Poseidon has clearly taken huge strides towards eventually making rebreathers somewhat mainstream, or at least not reserved to a privileged few.

I liked its relative ease of use, which however, must not be confused with simplicity, as it clearly packs a lot of technology under the bonnet. Existing rebreather users crossing over to the Se7en may initially not find themselves immediately at ease with not having their usual sort of diagnostic information displayed, such as having the PO_2 readings for three sensors read out and just having dive information displayed along with system integrity. But all others I trust will find the display and operation logical and straightforward. Put technology to good use, I say, like in cars, where I don't really know or worry about oil temperature either.

Type-r rebreathers are required to use prepackaged scrubber cartridges, and if there is a possible Achilles' heel, this may be it. The rules stipulate they only have a lifespan of maximum 24 hours once the seal of the packaging has been broken, or maximimum three hours of diving, whatever comes first.

While I initially had to overcome the reluctance to discard the cartridges every night, even when they have only been used very little and otherwise seemed good for another dive or two, I conceded the expenditure was not a major issue. When bought in bulk, such as in 8-packs, current list prices on the web as this article goes to press are about €30 / $25 / £20 pr. cartridge, which is comparable to the price of air or nitrox fills for the same amount of provided dive time. While a stash of such canisters can surely be stored in an attic or garage, the sticky bit comes when taking the unit on a trip when each cartridge weighs 2.7kg. As this equates to 16 extra kg to carry just for six days of diving, you are either limited to going with operators who stock these cartridges on location, or bite the bullet, pay the extra luggage fee and haul the whole load along.

In all fairness, all makes of rebreathers are somewhat hampered with such issues, but thankfully still more operators are becoming rebreather-friendly and capable of servicing the growing community of recreational rebreather dives so cartridges should just be yet another consumable to be purchased on location.

Poseidon is also addressing the growing issues of luggage restrictions and fees on airlines in other ways; the company is setting up a network of operators where divers can bring just their personalized battery and can have it plugged right into a rental unit on location.

Meanwhile there's no such issues standing in the way of putting your kit in the trunk of your own car and driving off for a leisurely Sunday dive, doing some macro-photography somewhere up the coast. And did I mention it is not a bad looking piece of kit either? □

Scuba Confidential

Don't Let Folk Get Carried Away!

Text and photo by Simon Pridmore

A few weeks ago, a dive centre chartered a boat to take five divers and two instructors out to some islands off the south coast of Bali. It was rainy season and, behind the rainclouds, there would be a full moon that night in an area where currents are notoriously strong and unpredictable. However, water conditions seemed manageable, there were other dive boats out on the water and having done one dive without encountering any difficulties, the divers entered the water again for a second dive that was to be a drift dive.

After about ten minutes underwater, they found that the current was so strong that it was difficult to keep the group together. So they ascended early to find that a storm had swept in, surface conditions were now very rough, and the rain had reduced visibility to a few metres only.

Unaware that the divers had surfaced and expecting that the dive would last an hour or so, the boat crew did not pull up their anchor until about 40 minutes after the divers had entered the water. They moved off to look for them in the area they expected them to be. They did not find them. Then night fell and the divers were gone.

A little over 72 hours later, searchers found four of the divers perched on rocks some 20 kilometres away from their original entry point and one of the instructors in the water nearby. The bodies of the remaining diver and the other instructor washed up on shore in the following days.

This is not a bizarre one-in-a-million accident. Indeed, it is just the latest in a depressingly similar series of such incidents that have taken place in the same area in recent years. Neither is Bali unusual. Similar stories abound everywhere people dive and there are strong currents. Wherever you dive, however, this sort of accident is completely avoidable by adopting some basic procedures and using some very affordable technology.

Doing it properly

Running a safe, successful drift dive, indeed any dive, comes down to preparation and communication.

First, no matter if the boat belongs to the dive operation, or if it is a charter boat, an experienced and professional member of the dive centre's staff should be on board the boat throughout the dive. This person is the surface supervisor for the dive. Before the dive he or she discusses with the in-water guide what route they plan to take and what they will do in an emergency. They have considered all the possible things that might happen and have a plan for each eventuality. Indeed, the dive operation they are working for should have set procedures for all staff to follow so the dive guide and surface supervisor need only review

opinion

these and plan for any last minute issues that might have arisen, such as, during rainy season, the likelihood of a sudden rainstorm.

The sole function of surface supervisors is to monitor the dive. Their role is as crucial as that of the guide. They watch the bubbles initially to see if the guide is following the plan, and once the divers are en route, they instruct the boat crew to move and accompany the divers from a distance.

If difficult water or weather conditions arise, they ask the captain to bring the boat closer. They remain alert and ready to assist if there is a problem, for example if anyone makes an early ascent, and stay on watch until the whole dive team is safely back in the boat.

A little bit of kit

In scuba diving, we carry safety sausages and noisemakers to help a dive boat find us if we are lost at sea. These are essential pieces of equipment and everyone should have them on every dive. However, it is sadly futile to deploy a safety sausage or blow a whistle if nobody is there. In the incident described above, the divers might have had safety sausages raised, but for at least the first 30 minutes that they drifted, nobody even knew that they had surfaced. Then when the boat did start looking, it is likely that the surface conditions had swept the divers away, and the boat was searching in the wrong place. Then it got dark and the divers were gone.

Dive operators must look at the way they handle dives, especially in locations that are known diving black spots. Divers can play a role in improving standards too by asking the right questions and making sure that they dive with operators that are properly prepared and equipped.

In remote backcountry skiing, where avalanches are a risk, everyone is equipped with an avalanche beacon, a device that constantly emits a signal. In the event the skier is buried, the signal helps a rescue team find them. Now, wonderful as it may be to imagine a world in which every diver is required to carry an emergency signalling beacon in the event that they become lost at sea, this is unlikely to happen any time soon.

However, there are simpler and more practical alternatives available right now. Last year, a Singapore technical diving instructor found himself drifting alone in the South China Sea after a series of unusual events. He looked around, saw where he was in relation to the land, pulled out his hand-held GPS radio that he carries on every dive in a dedicated pressure resistant box and called the boat to come and pick him up — no drama!

The cost of a radio like this is under US$300. So a US$600 investment pays for a unit for a dive guide and another for the surface supervisor. As long as the guide maintains contact with his team and the radios are well maintained, the risk of loss at sea becomes tiny.

Improving standards

With a little forethought regarding procedures, better staff assignment and a little cheap technology, the seven divers would not have been lost that day. It would not have taken three days to find them. They would not have needed the miracle chance that the sea carried them towards some rocks to survive and two would not have lost their lives.

Dive operators must look at the way they handle dives, especially in locations that are known diving black spots. Divers can play a role in improving standards, too, by asking the right questions and making sure that they dive with operators that are properly prepared and equipped. □

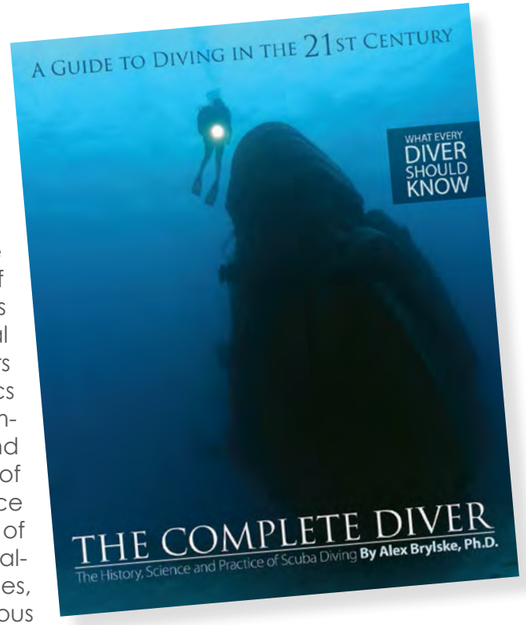
Simon Pridmore has been around the scuba diving industry in Asia, Europe and the USA (well, Guam) for the past 20 years. His latest book, also called Scuba Confidential, *was published in September and is available on Amazon.*

media

Divemaster game

This fun game from independent developer, Gyula Somogyi, has both iOS and Android versions for the iPad found on iTunes and Amazon. *Divemaster* is a casual simulator game of real diving from a divemaster's point of view. An avid underwater filmmaker himself, Somogyi saw there was a lack of realistic diving games for mobile devices, so he created a diver-friendly game with simple game mechanics coupled with real diving physics. Players are in control of an 8-person dive group and work the simulated job of a divemaster on a dive boat visiting tropical underwater reefs. Players can live out their dream job in this simulation in which they guide divers underwater to show them coral reefs and creatures and connect divers to animals they want to photograph. The more photos taken, the greater the rewards and tips to the player. There's no violence in the game, no animals are shot, and responsible behavior of divers is promoted. But divemasters beware: You must take care of your divers. If the divers run out of air, they perish and it's gameover.

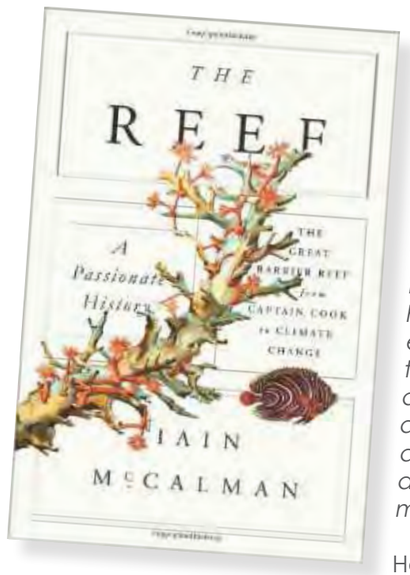
Guide to Diving



The Complete Diver: The History, Science and Practice of Scuba Diving, by Alex Bryske. The author, 20-year senior editor for Dive Training magazine, Alex Bryske brings his formidable expertise and experience in teaching diving and develping many of today's most popular dive training programs to this comprehensive book on recreational diving. In the book's 42 chapters, he covers the most important and most common topics and aspects of diving, as well as less common topics such as undersea exploration and innovation. In the content and approach of the book, the author has found a balance between the overly dumbed-down tone of many diving textbooks and the overly challenging content of highly technical sources, presenting a knowledge base every serious diver will want to acquire.

Paperback: 346 pages
Publisher: Dive Training LLC
Date: 29 October 2012
ISBN-10: 0615721338
ISBN-13: 978-0615721330

Great Barrier Reef



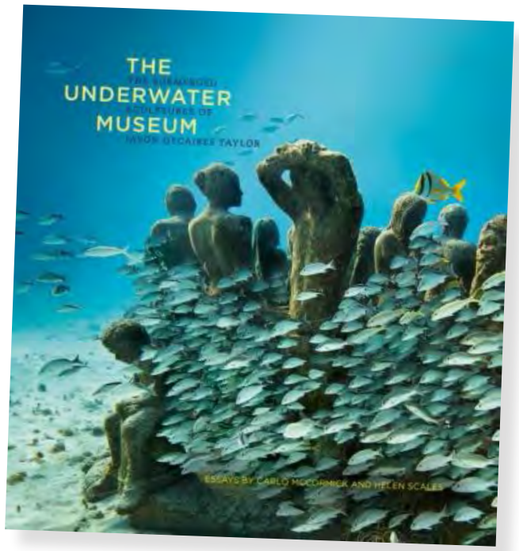
Visible from space, the Great Barrier Reef stretches for 1,400 miles along the coast of Australia and is home to thousands of marine species on 3,000 individual reefs and over 900 islands. Explorer and historian, Iain McCalman reveals in his new book, The Reef: A Passionate History: The Great Barrier Reef from Captain Cook to Climate Change, how human impact over two centuries has affected this extraordinary ocean ecosystem. The book discusses the relationship that people have had with the reef as well as the changing perceptions of the reef as a dangerous maze to a resource of economic gain to a frontier for scientific discovery, ultimately to raise awareness of this fragile World Heritage site and humanity's desire to save it for future generations.

Hardcover: 352 pages
Publisher: Scientific American
Date: 20 May 2014
ISBN-10: 0374248192
ISBN-13: 978-0374248192

Underwater Museum

In his new book, *The Underwater Museum: The Submerged Sculptures of Jason deCaires Taylor*, the U.K. artist and sculptor, with contributors Carlo McCormick and Helen Scales, takes us on a dive to visit the underwater sculpture parks where marine life grows over time on the unique and compelling life-size statues he has created, installations of special cement anchored on the sea floor to become living reefs. The science behind the art is explained, as coral, fish and algae are attracted to these statues transforming the installations, as well as the efforts these underwater sculpture parks aim to facilitate.

Hardcover: 128 pages
Publisher: Chronicle Books
Date: 11 March 2014
ISBN-10: 1452118876
ISBN-13: 978-1452118871



Why you should never go diving with an idiot

—and how to avoid that happening to you

Text and photos by Steve Lewis

Being swept along on this technical diving thing, has been a long, somewhat twisted, but definitely entertaining journey. If you and I had met when the whole affair started, we could not possibly have envisioned how directly and pervasively, what were then radical activities, like cave diving, trimix diving and rebreather diving, would influence the mainstream dive community. Watching the evolution of technical diving, and being able to observe the changes it's wrought on all aspects of recreational scuba, has been a true privilege—and great fun.

But perhaps, evolution is too soft a word to describe what's happened. So many things have changed. Gear, training, the places we visit to dive, how we exchange information, even what form dive magazines and textbooks take: case in point with *X-RAY MAG* for example. I'm not particularly nerdy or wired but "traditionally printed" magazines and books no longer figure very prominently in my professional or personal life. I still do carry a notebook and pen in my backpack, but there's an iPad, iPad mini, and two smart phones in there, too. I really have more than the proverbial "1000 songs in my pocket". And I am typical rather than an exception.

However, some things have not changed. Especially good advice.

A while back when the tech diving revolution was first building up a head of steam, one piece of advice that created some controversy came from the politically incorrect keyboard and mouth of a character called George Irvine III. He told anyone who would listen, not to dive with "strokes." The shortest possible explanation or definition of Stoke is someone who is unsafe and unaware. "Don't dive with strokes" was Irvine's corruption of much earlier advice from cave dive training manuals to not dive with folks whose skills and mindset were unknown. And that little gem—as light its impact was compared to Irvine's version—had its Genesis in the caution from open-water training to be mindful when diving with an "insta-buddy".

Personally, I opt for the middle ground: You should never go diving with an idiot.

Let's explore that statement.

What is a stoke?

One of the most controversial things about Irvine's don't dive with strokes advice, was the definition of a stroke itself. The actual guidelines describing where strokery began and ended varied depending on who was supplying the definition—the most radical being a form of tribalism that I found reminiscent of the gang mentality I saw as a kid on the terraces of football grounds in London's East End—a sort of modified, "We're Millwall. Nobody Likes Us and We Don't Care!"

My definition of the sort of idiot who should be avoided when diving is easier to draw a box around… and I believe

Self-assessment [can] help an experienced diver avoid the Siren-call of complacency

less tribal… but perhaps no easier for some of us to accept.

Complacency, for me at least and in the context of defining a diving idiot, is a solid starting point. If I wanted to build a monument to diving idiocy, complacency would be my cornerstone.

Complacency is sneaky, and the more skilled we become, the sneakier it gets. Regardless of how detailed and comprehensive our dive plan, it will be completely negated by complacency. Moreover, rather like a virus, once complacency gets a foothold in one's pre-dive process, it can spread and infect others. I believe it is a strong contender for top-spot in the list of things to avoid if we don't want to dive with an idiot.

Complacency kills experienced divers.

So, a simple technique that can help us side-step complacency is what I'd like to make a case for.

Again, back when the tech diving revolution was tearing down limits imposed by the PADIs and NAUIs of the dive industry, a pretty smart guy with more than a few dives in his logbook and a political incorrectness all his own, told me that complacency kills experienced divers.

His was not a quick and cursory sidebar conversation, but a week-long rationalisation that was part my first technical instructor program. It was Bret Gilliam, founder of TDI (Technical Diving International) who formalised for me the essential process of self-assessment, and reinforced for me the value of self-assessment as part of the prelim for each and every technical dive. It was, he insisted, self-assessment that could help an experienced diver avoid the Siren-call of complacency. Therefore, self-assessment was held up as a good habit to cultivate, and not a bad barrier to raise between you and a huge mistake.

The self-assessment process

Self-assessment begins with the quiet and reflexive process of providing oneself with honest answers to a series of simple questions.

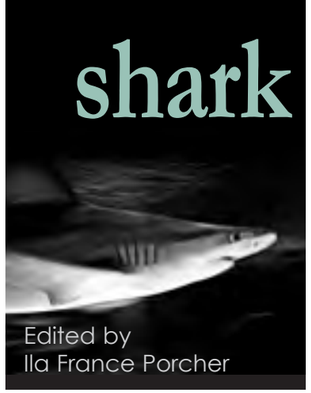
- Does my training and experience match the needs of the team on this dive?
- Do I understand what's meant by the phrase "most skills are perishable" and have I recently practiced the skills needed to perform this dive?
- Do I have fluency in the distinct and particular skills needed to get me and my mates back to the surface in one piece should the crap hit the fan during this dive?
- Are the other team members ready for this dive, and in the event of a catastrophe, can they save themselves and me without submitted themselves to an unacceptable risk of injury or death?
- Is the gear my team and I are using appropriate and does it meet or exceed the requirements of this dive, and is it fit for purpose?
- Is there more than enough gas for everyone, and is it the right flavour or flavours?
- Do I feel confident, comfortable and capable to complete this dive safely, today?
- Does our dive plan cover our arses and our assets?
- Are the environmental conditions here at the dive site less challenging, as challenging or more challenging than we planned for and how does that affect the answer to the next question?
- Is there is ANYTHING at all about the plan and intended execution of this dive that is outside the security of best practice? If so, has every one of us and our loved ones signed on it?

A lot has been said and written about the promotion and use of checklists in diving—especially rebreather diving—of late, but I believe that the self-assessment checklist needs to be adopted as part of the pre-dive protocols for ALL divers.

Actually, I feel strongly enough about the point to tell you that if you and your buddy do not engage in any form of structured self-assessment as part of your pre-dive routine, you are diving with not one, but two idiots… and so is your buddy.

And just to be clear, diving with an idiot can get you killed.

Steve Lewis is a diver, instructor, dive-industry consultant and author. He teaches and lectures at home and abroad. His main focus is to increase safety and point out ways to make us all better divers than we are now. His latest book, Staying Alive: Risk Management Techniques for Advanced Scuba Diving, *is a best-seller, available at Amazon. For more information visit:* ***Techdivertraining.org****. This article is based on a presentation first made by Lewis at Beneath the Sea in 2013 and 2014.*



Cognition in Sharks

Text by Ila France Porcher. Images by Ila France Porcher, Wolfgang Leander

A difficulty in obtaining information about wild animal behaviour is that detailed observations of different individuals is necessary over long periods of time, and this is especially hard to achieve with sharks. But in the shallow lagoons of French Polynesia, such observation was possible without the encumbrance of scuba gear, and without the problem of the shark disappearing into the depths. Over a period of 15 years, I searched out and observed reef sharks in the different locations where I lived there, and for seven years, studied them intensively.

As I learned where and how to look for the local sharks, I focused on blackfin reef sharks (*Carcharhinus melanopterus*), because they were so easy to find patrolling the shores. But other species, including whitetip reef sharks (*Triaenodon obesus*), grey reef sharks (*Carcharhinus amblyrhynchos*), sharptooth lemon sharks (*Negaprion acutidens*) and nurse sharks (*Ginglymostoma cirratum*) were present and often observable for long periods, too.

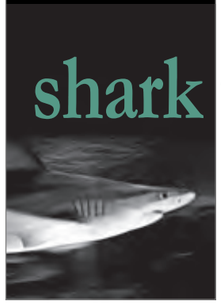
As time passed, I learned to put them at ease with me, they became accustomed to my presence, and accepted me into their community. By recording the actions of the various individuals, I was able to access a dimension of their lives that had not previously been documented.

Individual differences

Individual differences marked each shark's behaviour. Each one had a unique pattern of roaming, under the dual influences of the lunar phase and the reproductive cycle. Some were nearly always present in their home ranges, while others travelled for months at a time. Individual sharks demonstrated different rates of learning, and they varied greatly in their responses to different situations. They had complex social lives, and their behaviour showed a flexible intelligence.

In time I concluded that they were using cognition rather than reacting automatically to stimuli. This was the reason that I spent so much time observing them, and following the precepts of cognitive ethology, tried to learn what they were like as animals and individuals.

ILA FRANCE PORCHER



shark tales

Cognition is the term used for thinking in non-human animals—the process of knowing through thinking. An animal shows that it is using cognition, rather than trial and error, when it must have referred to a mental representation in order to act as it did. Many life forms, including invertebrates, are increasingly found to be using cognition in their daily lives, and cognition in fish has been well studied.

ILA FRANCE PORCHER

Knowing others as individuals

The sharks recognized each other as individuals, which is the prerequisite for the complex social lives in which cognition is most evident. They tended to travel with preferred companions, and these sets of friends joined with wider groups of sharks at times. Due to the circular paths in which they move, they repeatedly crossed each others' scent trails, and thus remained in loose contact as they roamed, together, yet not usually within visual range.

Companions were individuals of the same gender, and usually the same age as well. Some sharks usually travelled alone, some always with the same companion, and others changed companions relatively frequently. Often, travellers were temporarily joined by sharks residing in the regions through which they moved. There was always excitement when travellers and residents met. They would follow each other around and swim side by side for long periods, before the companions moved on together.

As far as I was able to determine, such friends came from the same region. The reef sharks were acquainted with the other individuals whose home ranges overlapped theirs; travelling companions were usually neighbours at home.

Bonnethead sharks, too, have been shown to recognize each other as individuals, and it has been documented that at least some species of sharks and rays choose their mates, providing further evidence that individuals know each other.

Memory and learning

Learning plays an important role in the lives of sharks, as has been well documented. Learning is closely involved with memory, and the sharks I had under observation frequently showed their ability to remember events far back in time. Familiar sharks recognized me in the lagoon as much as two years after their last meeting with me, and their behaviour, of greeting and swimming with me, was unchanged.

Like people, different sharks had different rates of learning. For example, among those who accompanied me most often, one of them never learned to take a treat I threw for her, while only a few caught on immediately without practice.

Vigilance

Wild animals are always vigilant, always on the look-out for danger, and sharks are no different. Whenever anything was different about my visit, whether it was in a different place or at a different time, the sharks' behaviour became more cautious.

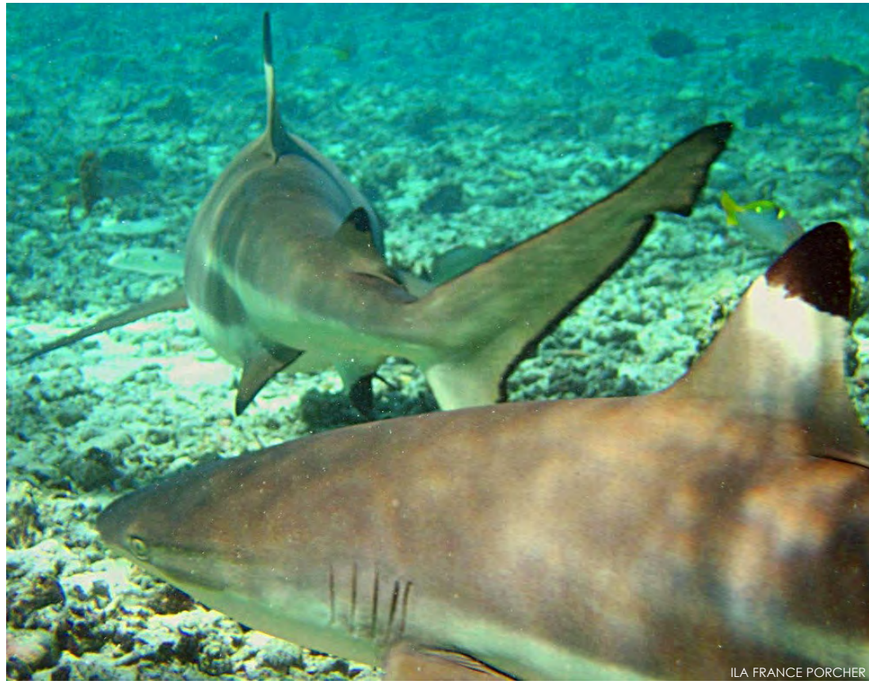
When I brought a second person with me, which happened very rarely, they initially vanished beyond visual range after a swift approach when I first appeared underwater. Many minutes passed before they reappeared, usually approaching the stranger first, in long lines led by the boldest among them. This initial disappearance never happened when I was alone, and demonstrated their alertness to changes, and their ability to make quick decisions based on unexpected findings.

Those who complain that shark feeding dives cause sharks to harass spear fishermen, have failed to understand this crucial point—sharks easily discern the difference between a shark feeding event and a spear fisherman. It is the fishermen themselves who attract sharks, by holding dying fish underwater and trailing scent.

Approaches

All of the species of reef sharks I observed habitually used the veiling light to conceal themselves. Once out of sight, they often continued to pay attention to events from beyond visual range, by listening and through their lateral line sense. Sometimes they passed into view for a brief look just at the visual limit, then vanished again beyond their curtain of blue.

The diagram (above) shows the general pattern of approach of a



ILA FRANCE PORCHER

THIS PAGE: Blacktip reef sharks

shark tales

Medication of shark

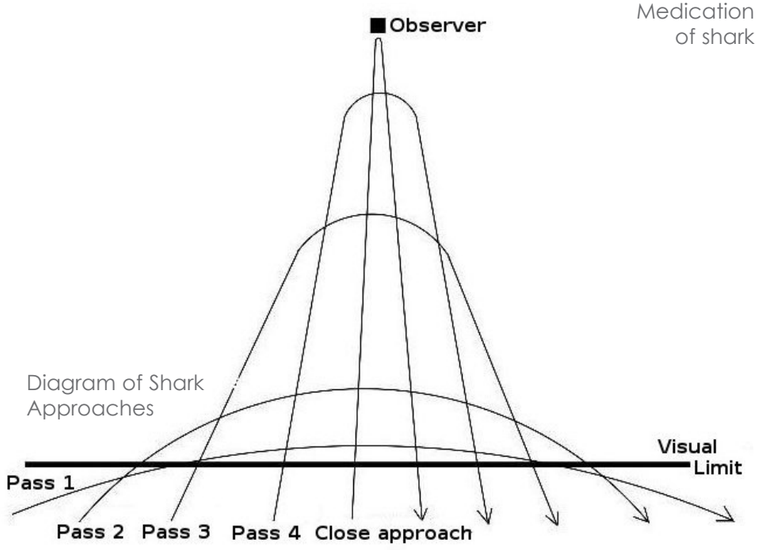


Diagram of Shark Approaches

blackfin reef shark.

Initially, the shark curves briefly into visual range, then out. A few minutes later, it appears again for a closer look. With each repetition, the arc becomes more acute until, if the shark is very interested, it approaches nearly head on.

Any variation on this pattern could occur. Shy older females often lingered out of visual range before making one or two passes into view, but never came close, while males coming into the lagoon in exited bands to mate after sunset, often omitted the 'cautious passes' phase, and zoomed straight up to me.

Other species showed a similar general pattern of approaching, but their closest approach came more from the side than head-on.

Hiding

Often a shy shark who appeared briefly in visual range would suddenly pass close behind me, but dart away if I turned and saw her—she had come to look without being seen. Sharks had no trouble recognizing frontal views, and they understood the direction in which a person was looking. In other ways, too, they showed that they were aware of whether or not they could be seen. When I was with another person, for example, they always swiftly approached if we raised our heads above the surface to talk.

Once I was swimming with my step-son, and he climbed on a dead coral structure to look around above the surface. The shark who was accompanying us swam over to sniff his legs, and with his head above the surface, the boy never saw her. Sharks even surprised me by swimming between my face and hands when I was drawing, which never happened when I was paying attention to them. One unusual shark passed me nearly every time I went to the lagoon, drifting by from left to right, always and only when I was looking the other way. She did this for eight months before relaxing her vigilance and moving around me more freely.

Always on the alert, the sharks used their awareness of whether or not a person could see them to their advantage. Therefore, it is not surprising that it is said that you never see the shark who bites you. As with other predators, it is best to face them, and pay attention to them when you are with them. But, that said, shark bites are very rare, and sharks were the only wild animal with which I was in intimate contact for many years—which never did bite me, either through accident or irritation. My conclusion in the end was that an inhibition against biting companions was at play.

Close approach by a shark

Attention, curiosity and observation

The sharks were very curious, and investigated anything new. If a coconut floated across the surface, one would notice and rise to sniff it, followed by the others. They would often follow me for long distances, sometimes for hours, while remaining hidden beyond visual range. From time to time, I checked to see who was with me by suddenly stopping, whereon they came into view. It was surprising that they would remain concentrated on one thing for so long.

Sometimes unexpected events revealed patterns I might not otherwise have seen. When one of the sharks became ill, each evening I tried a different tactic to give him a piece of food in which I had inserted antibiotics. The other sharks seemed to anticipate each of my attempts, and their actions made it very difficult for me to medicate him.

One of the tactics they used after several nights of missing out on the food, was to wait beyond visual range. When the time came, and I went to the kayak and threw the food into the water, seven sharks whom I thought had left an hour earlier, soared in, and the fastest one snatched the treat in mid-water.

Since they had been out of sight, they had based their decision to act on a signal they had heard. They had understood the sounds of me getting the treat and throwing it, and their actions were effective, because one of them did get the food! This example shows their ability to predict something that might occur in the future, and to concentrate on it. Cognition is indicated because they must have held a mental representation of food coming under such circumstances, the signal that would trigger its imminent arrival, and what they planned to do when it came.

It often seemed that the sharks tried to be one step ahead of me. In long-evolved predators who catch swift and evasive fish for a living, the strategy of watching and waiting, and trying to predict from past experience what the prey would do next, could well have been selected for.

Self-awareness

Cognitive ethologist Donald R. Griffin pointed out that when

ILA FRANCE PORCHER

Sharks passing into view

an animal hid itself from view, it was demonstrating self-awareness. He described how Lance A. Olsen had reported that grizzly bears sought places from which they could watch hunters while remaining hidden. Other observers had reported too, that bears tried to avoid leaving tracks. The researchers concluded that these bears were aware of being present and observable, as well as creating effects□their tracks□through their movements, which could be seen by others.

The sharks' habitual way of remaining concealed behind the veiling light until an opportunistic moment, or approaching from behind to avoid being seen, is in the same category of behaviour, and indicates that they are aware of being present and observable. This is the reason why the so called 'shark counts' divers are asked to participate in, have no scientific validity. Since sharks are either attracted to divers, or avoid them, the numbers of sharks seen by divers are not representative of the true numbers on the reef.

Where sharks are habituated to divers and come to see them, such counts may give the impression that there are many sharks, when actually, their numbers are few. Shark finners are attracted when the information is publicized, and the dive site is fished out.

Decision making

Occasionally, reef sharks would flip on their backs to wriggle in the sand, presumably to scratch or to free themselves of parasites. On other occasions, a shark would turn to whip the side of its body against a sand bank. The floor of the lagoon was made up of sand interspersed with reef flats and coral, and the sharks invariably chose only sandy places for such manoeuvres.

Sometimes a shark carefully positioned himself to use a smooth, flat surface of dead coral on which to rub himself. Apparently, he had intentionally surveyed the environment and chosen a suitable structure to use. He must have held a mental image in mind of what he wanted, and referred to it while looking for a formation of the right shape.

Though this may not seem to be very impressive in terms of thinking in sharks, the availability of surfaces to use in this way doesn't mean that the animal will realize how they can be of benefit.

For example, mynah birds (*Acridotheres tristis*), and junglefowl (*Gallus gallus*), the wild ancestor of domestic chickens, both spend much of their time foraging for insects on the ground, and both have strong feet for walking. However, mynah birds haven't discovered that they can use their feet to help them uncover these insects, while junglefowl do so instinctively.

I was lucky to witness a clear decision made by two sharks, between two possible choices. One day near my study area, the fins of several blackfins were slicing through the surface, and underwater, fish were spawning, and sharks were gliding among them, occasionally snapping

shark tales


ILA FRANCE PORCHER

one up.

Two came over when they saw me, and returned from time to time to circle me over a 15-minute period. When I left and travelled another half a kilometre into the lagoon, these two sharks followed from the spawning site.

They decided to follow me even though they had not seen me for several months, and they made the choice that was based on a mental reference, a thought or memory, that sometimes I brought food. Yet, they were in a situation in which they could see, hear and smell food, moving in a stimulating way, and I had not fed them in that location before.

Such memories of events that can be called upon for decision-making, are called declarative memories. It is now thought that they cannot be used in the absence of consciousness.

Communication

I could not see evidence of communication between sharks except through body language. If you have ever met an aggressive shark, you will know how well body language communicates at a physical level. The response arises deep within us without any interference from the frontal lobes of the mammalian brain!

Occasionally, companions acted in concert, leaving the other sharks, and swimming in formation to perform a specific act together. How they communicated the decision to do this was not clear, but likely body language played a role.

In his book, *The Secret Life of Sharks*, Professor Peter Klimley described how great white sharks ritualize their conflict when a seal, which one of them has killed, comes under dispute. Each slaps the water at an angle with its tail, and the shark who raises the most water and blasts it farthest wins the prey. For this ritual to be effective, each shark must view its opponent's gesture as a communication, and understand it, since the winner gets the seal without a fight, which could badly hurt both sharks.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Scheduling

Sharks often passed the same place at the same time on consecutive occasions. One young visiting male passed by my observation post about five meters to the right, between ten and 15 minutes after sunset each night for several weeks. Each time, he saw me and came for a closer look, then turned and went on his way. Another rare visitor's first four visits, though months apart, occurred precisely at the moment that the sun touched the horizon, four days before the dark of the moon.

Intrigued, when one of the residents who had habitually met me on my arrival in the lagoon, began coming instead at the end of the feeding session, and missing out on the food, I kept careful track of the time of her return. For reasons known only to her, she had suddenly begun to spend her days in the ocean. Over a period of many months, she returned about ten minutes before sunset, night after night. Sometimes, she still met me when I arrived, yet other times, I saw her return from the sea when it was nearly dark, passing in the distance, and not coming to the feeding session.

Besides illustrating a remarkable ability to follow a daily schedule, and yet be flexible about it, her actions indicated that she had not become dependant on my weekly feeding sessions, though she had known about them since she had been a juvenile.

The sharks seemed to have no trouble catching a fish when they wished to, and often came to the feeding sessions only to socialize. Resident sharks routinely left for months at a time, and visitors did not remain in the area because of the food. Though many came to my feeding site at the proper time, their long-term schedules were unaffected by the few scraps I provided weekly to facilitate my observations.

Social learning

The resident sharks learned, in time, that the fish-scraps I brought to the feeding sessions were in the back of my kayak. Though this species has not been documented breaching the surface to eat or to look around, these sharks found that the food could be accessed by leaping from the water and leaning towards the boat, while snapping at whatever they could locate. The sound of their jaws snapping shut made loud clapping sounds, and some of the kayak's straps were cut, punctured and sliced by their sharp little teeth.

This behaviour pattern, which was a new foraging technique, was initiated by one or two sharks and instantaneously copied by the others present. Later it was repeated by the sharks in that group. This discovery occurred twice, in different locations, under different circumstances, with different groups of sharks, and is an example of social learning, which is basic to the development of culture.

Under normal circumstances, the space above the surface is not something that these sharks

shark tales

would have reason to consider. But they were presented with an artificial situation in which I came from above the surface and returned there, and so did the food in which they were interested.

They would doubtless have stored memories about the surface from the occasions, particularly when they were small, when they swam through it or up against it while chasing a fish, though it is unlikely they could have formed more than a vague impression that there was a space above, from such brief events. Yet, their behaviour suggested that they were aware of a volume above the surface in which things could exist, and from which I came and went.

A question in cognition is whether an animal knows that something continues to exist when he or she can no longer see it. An object apparently ceases to exist for dogs, for example, when it goes out of sight. So few people would agree that sharks could understand that I was in the boat, even when I had just left their company and climbed into it. Yet they were aware.

Could they see me through the surface? It often appeared that they could, and when they raised their heads from the water, they raised them straight towards my face as if they could see it from beneath. Once their faces were in the air, they could certainly see me there in the mysterious volume above the surface—great white sharks are known to deliberately look around above the surface.

The electro-sense works at close range, and possibly continued to inform them that my living body was just beyond the plastic hull when I vanished. Further, they could hear the sounds of my movements in the hollow craft with their lateral line sense and sense of hearing, a way of perceiving the environment that appears to be dominant in sharks.

If the sight of me underwater was replaced by the sound of my movements in the hollow plastic kayak as I got in, these perceptions could well continue to inform them that I was still present, even though their view of me was blocked, just as it was blocked whenever they listened to me underwater, from beyond visual range.

Indeed, the many ways that sharks took advantage of the opportunity to hide behind the veiling light, and to approach when they were not visible, such as when a person's face was above the surface, strongly suggests that they are quite comfortable with the idea that something continues to exist, in spite of being out of sight.

Sharks have exquisitely coordinated senses, and their behaviour indicated that they used this sensory input alertly to make moment-to-moment decisions, and respond flexibly and appropriately to changing circumstances. They remembered the events in their lives, and referred to these memories to make decisions.

They were curious, but cautious, and learned quickly. Their versatile behaviour, individual differences, and different ways of handling various circumstances, were not indicative of a set of stimulus or response reactions. Yet, distanced so far from us in evolutionary time, the motives and true states of subjectivity experienced by sharks must remain mysterious.

I have observed other species, including bull sharks and tiger sharks, for shorter periods, and found that their behaviour was remarkably similar to the behaviour of the requiem sharks, far off, but not too distantly related, whom I had known in Polynesia. This is to be expected since sharks have been evolving for approximately 420 million years, and many species travel widely and are found around the globe.

The essential qualities that sharks evolved to be so successful would already have developed in the ancestral forms, before they evolved into modern species occupying the ecological niches we know today. There is no reason to assume that the Polynesian sharks were different. It is more probable that they were ordinary sharks, quite representative of their kind.

Though fish may seem primitive when looking down on them from the altitude of Homo sapiens, in fact they are highly complex and evolved life forms. And no brain is simple, as anyone who has observed the activities of a spider will appreciate. □

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

Lemon shark

WOLFGANG LEANDER

WOLFGANG LEANDER

Lemon and tiger sharks

Edited by
Michael Menduno

Bail out with
Inspiration
rebreather,
Tahiti

The Art of Bailing Out

Text by Pascal Bernabe
Photos by François Brun

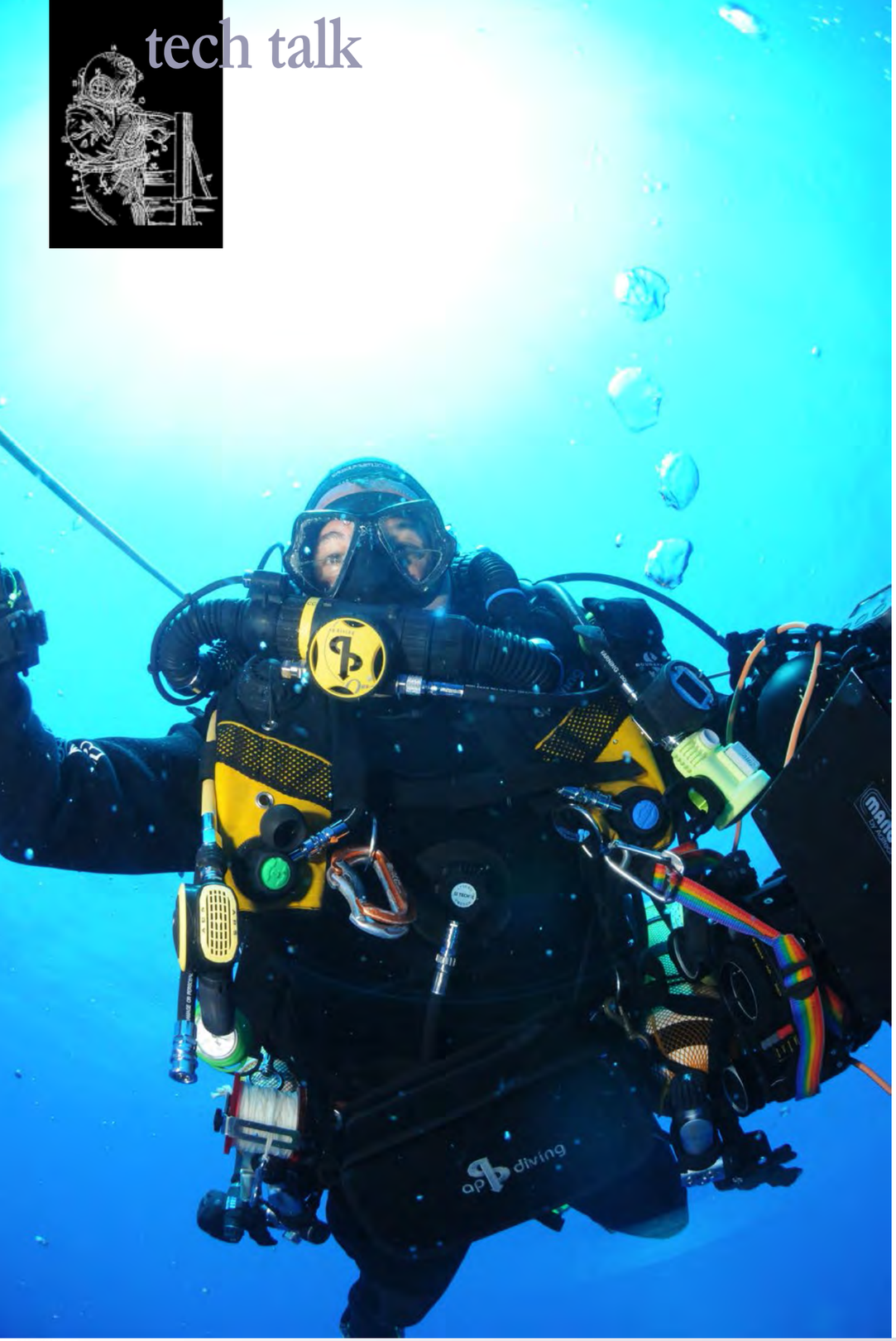
Rebreather diving is currently one of the fastest growing activities in the diving universe. Divers' motivations for getting a rebreather vary. Some derive enjoyment from "piloting" a sophisticated machine like a cosmonaut journeying through (inner) space. Others find pleasure in possessing a powerful tool for exploring caves, wrecks, canyons and reef walls, and being able to silently approach and photograph marine life without any bubbles.

However, despite their increased capabilities, rebreathers can be subject to serious failures. Accordingly, one of the primary objectives of good rebreather training is to learn how to react correctly and quickly to a problem and perform the emergency procedure appropriate to the situation or the failure.

There are a number of rebreather failure modes that require the diver to get off the breathing loop immediately and switch to a reliable back-up system, typically open circuit scuba, which is currently the most reliable and inexpensive form of back-up. Rebreather divers refer to this as switching to "bailout"—in other words, an alternate gas source appropriate for the dive in the event of problems with the rebreather. The general rule taught in rebreather classes is, "If you are in doubt, switch to bailout."

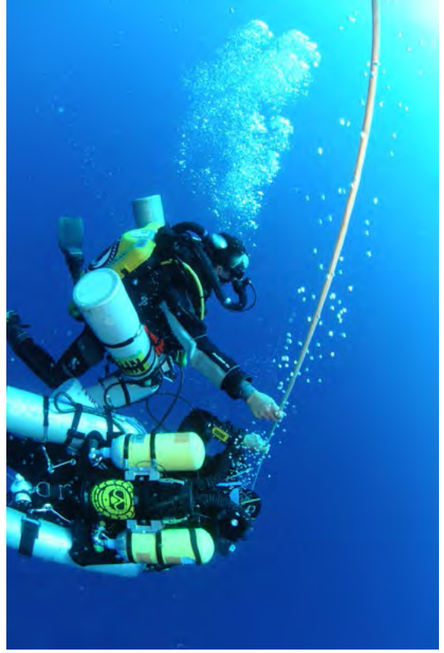
There are a number of situations that would prompt a diver to bailout. These include:

- A completely flooded loop that has become un-breathable, for example, due to a rupture in the breathing hose or counterlung.
- An excessively high partial pressure of oxygen (PO_2) in the breathing loop creating an immediate risk of hyperoxia particularly at deep depths and where the PO_2 exceeds 1.6 bar. (Note: the solenoid is an electric value that injects oxygen into the breathing loop in order to maintain a constant oxygen partial pressure, usually between 0.7 and 1.3 bar.)
- A low PO_2 below 0.16 bar in the breathing loop, resulting in the immediate risk of hypoxia.
- Shortness of breath and/or a carbon dioxide (CO_2) hit caused by strenuous effort for example swimming against a strong current, panic or the failure of the CO_2 scrubber system to remove carbon dioxide from the breathing loop. This can occur if the diver exceeds the scrubber duration, there's an error in assembling the unit, particularly the absorbent canister, or there's a failure in the mushroom valve.



Bail out and BOV with Inspiration rebreather

Bail out with rebreather, Tunesia



- A complete failure of the electronics (PO_2 display and heads up display) making it impossible for the diver to know the PO_2 in the loop.
- Running out of onboard oxygen and/or diluent.
- The failure of two or more oxygen sensors. In this case, the diver can no longer be sure of his or her PO_2 (when three cell voting logic is used).

The general rule for bailout is that there should be enough of the appropriate gas to ascend to the surface while allowing for a safety margin. For example, the rule used in cave rebreather diving, that is also applicable for decompression diving, is to calculate one's consumption rate based on 30 l/minute (1.1 ft^3/min) multiplied by 1.5 for a safety margin or 45 l/min. (1.6 ft^3/min. Experience shows that in the case of getting short of breath or CO_2 intoxication, the gas consumption may rise to as much as 70 l/min (2.5 ft^3/min) during the first minute and to lower to some 25 l/min (0.9 ft^3/min.) during the following minutes.

Bailout options and configurations

A. Open circuit bailout (tanks)
The first question divers have to ask is whether to have an integrated bailout valve (BOV) on their rig or not. A BOV is a regulator integrated into the rebreather's mouthpiece that allows the diver to immediately switch from the closed circuit to the open circuit by moving or turning (depending on the design) a special lever.

Ideally the BOV should be connected via a quick-release and waterproof Swage Lock type fitting to a tank with gas breathable at the maximum dive depth, and provide means of reconnecting it to other tanks according to the depth during the ascent, for example, to manage the

Bail out and BOV with Inspiration rebreather, Tahiti

Bailing Out

A SHORT GLOSSARY FOR REBREATHER NOVICES

PO_2: Oxygen partial pressure, which should ideally lie between 0.7 and 1.3 bar according to the dive phase: 0.7 during the descent and at shallow depths and 1.2-1.3 bar at the bottom. PO_2s are sometimes boosted to 1.4 during decompression.

Diluent: An air, nitrox, or trimix/heliox, which is contained in the left tank of the rebreather and is blended with oxygen to give the diver the best mix for a given depth.

Solenoid: An electric valve that adds oxygen at the right time to maintain a constant PO_2.

Onboard Gas: Gas inside the rebreather system.

Off Board Gas: A gas source outside the rebreather system (stage/bailout tanks).

HUD: A heads-up display that shows the PO_2 and is positioned on the loop next to the mouthpiece and is very easy to see.

mCCR: A closed-circuit rebreather with manual controls (if the diver needs more oxygen he or she injects oxygen, if the diver wants to lower oxygen he or she adds diluent, simple, no electronics).

eCCR: closed-circuit rebreather with electronic controls. Constant PO_2 is maintained with the help of solenoid.

Bail out with two rebreathers

Bail out with lateral rebreather (below)

Bailing Out

decompression.

It is not recommended that divers connect the BOV to the small onboard diluent tank that often has only 3-liter (15-21 ft³) capacity tank, which offers too little gas in the case of emergency.

The arguments for a BOV? It is the quickest means of switching from the closed to the open circuit, which is essential in case of emergency.

The arguments against a BOV? It is a fragile and also a costly piece that requires regular maintenance and may free flow on occasion. Moreover, it may represent a risk for a diver if a hypoxic mix is connected to the BOV at the time of switching to the open circuit, for example near the surface.

Bail out with Megaladon rebreather, Tahiti

Some other things to note:

1. Bailout tanks can be carried as stages, or may be attached at the back of a rebreather at both sides with or without manifold, as in some DIR configurations. Such configurations are typically used by divers equipped with semi-closed passive rebreathers such as the RB80, but are becoming more common with closed-circuit rebreathers with manual (mCCR) or electronic (eCCR) controls. Typically the cylinder on the right has a regulator with a long hose of 2m (7ft) in order to share gas with a buddy in the event of an emergency. The cylinder on the left side has a regulator with a short hose that goes under the neck attached by a neck ring in addition to a pressure gauge or manometer. This configuration is an adapted deviation of the Hogarthian configuration, so dear to the heart of DIR divers. It allows them to carry huge amounts of bailout gas.

2. Usually bailout tanks are carried as stages, and are attached with the spring hooks at the sides of a diver. Sometimes they can be carried in sidemount configuration where the neck of the stage cylinder is attached under the arms with the help of a rubber band to get them close to the body, and the bottom is attached at the sides or to the butt-plate fixed beneath the rebreather at the buttocks level. This is much more hydrodynamic!

3. In any case, the golden rule is to not connect the Automatic Diluent Valve (ADV), a regulator system that adds diluent to the loop on demand to compensate for ambient pressure to the same tank as the BOV, wings, dry suit, and or hose for the manual diluent supply to the same tank!

Connecting the rebreather and buoyancy devices to the same small onboard 3-liter tank is a receipt for disaster. If the tank is empty there will be no gas for the rebreather or for maintaining buoyancy!

Instead these connections are typically evenly allocated among different tanks. For example:

- Connect the ADV and the wing to the rebreather's onboard diluent tank if the dive is not deep. Connect the wing to one of the stages if the dive is deep or it is a

Bailout with semi-closed rebreather, Lot, France

cave dive with a saw-tooth profile.

Connect the back-up manually injected diluent to one of the off board bailout tanks and the dry suit to another tank, if there is one, containing air or nitrox (helium mixes create thermal problems) or to a small suit inflation bottle mounted on the side of the rig.

B. Rebreather bailout

A bailout rebreather can be carried on the back creating a double back-mounted rebreather. Two rebreathers are heavy and their buoyancy is hard to manage. The drysuit, wing and two full loops make at least four gas spaces to manage and vent during the ascent. No easy task! A back-up rebreather can also be mounted at the side (like a stage cylinder) or in front of the body—for example, an M3S Triton a White Arrow Sweet Deco.

In general, using a secondary rebreather for bailout is much more expensive and difficult to manage in comparison with an open circuit back-up.

Moreover, a bailout rebreather does not allow the diver to recover as quickly in the case of a CO_2 hit i.e. shortness of breath. Finally, the diver does not necessarily know whether the bailout rebreather, which was not breathed during the descent, is full of water or has an appropriate PO_2 when the diver is in urgent need of it (This problem has already happened!) In that case, you completely lose your operational capacity!

The real benefit to a bailout rebreather system is the huge run time (3 to 5 hours) it affords in the event of an emergency. Hence, it's the option of choice for the divers engaged in exploration who want to achieve the best balance between the run time and bulk important in Alpine technique.

Pascal Bernabé of France holds the world record depth on a deep dive using self-contained breathing apparatus. He dived to 330m on trimix in 2005 off Propriano, Corsica. See; ***Pascalbenabe.com***

Pascal Bernabé with semi-closed rebreather

photo & video

Edited by Don Silcock

Flamboyant cuttlefish photographed with a snoot

Precision control of light

Sensational Snoots

Text and photos by Mike Bartick

Ask any photographer the one thing they would like to improve in their underwater images and most will likely say, "The lighting." Lighting in photography is everything and shooting underwater often requires the photographer to read the ambient light and to create durable images on the fly. Unlike terrestrial photographers, underwater photographers don't have the luxury of time and a studio full of equipment to help design their images, so many photographers have explored other, more portable methods to assist.

Snoots are an effective tool for underwater photography that gives the user precision control of light quality and direction that can be used for creating interesting compositions in macro photography.

But be sure to bring your sense of humor and be prepared for a challenge as learning to use them is anything but easy. That said, once your images begin to take shape, the additions to your portfolio and your understanding of light will reach new heights and be well worth the effort.

I've carefully crafted my first crude snoots with precise amounts of duct tape, tin foil, funnels and zip ties. These were so effective that I think I left a trail of them across the ocean floor from Southern California to Indonesia and across to the Philippines. Recently, I have decided to re-visit my love for snoot photography, and after seeing some of the new products emerging on the market, I decided to go with a manufactured snoot over a DIY project—and I am happy that I did.

photo & video

Needlefinger shrimp

So what exactly is a snoot?

Well, it's a device that fits over a strobe head that controls the direction and size of the strobe flash beam. The area of the beam is controlled by a variety of means depending on the brand of snoot and can range from a broad beam of light to a narrow more laser-like surgical tool.

Using a snoot will help you to create more dramatic compositions through lighting, cut down on backscatter and help you, the photographer, to totally control the direction of light and how the light source plays out in an image.

Often snoots are used off-camera, either handheld, pointed by an assistant or mounted on a tripod. While all of these options work, I personally like to mount the device on-camera and use a long articulating arm for greater reach and control from behind my camera, which enables me to limit the task load and allows for quick and accurate changes.

There are many different brands of snoots to choose from these days. My snoot of choice is the Reefnet Optical Snoot, which is basically an articulating arm with fiber-optic lines on the inside. The base plate fits tightly and is secured over the strobe head in a screw-down method, and doesn't fall off when adjusted. The snoot base includes one arm but has dual bulkheads for two arms. Each of the arms includes two interchangeable tip sizes, which can be easily changed underwater.

The Reefnet device doesn't have an aiming light to help find the subject, which makes it tough to learn, but as a benefit, your subject won't turn its head away either.

I strongly recommend starting with the single arm and larger tip. Then, as your patience and skill levels develop, add the additional arm and try the smaller tips, because while the smaller snoot tip provides a tighter radius of light, it also increases the difficulty of using the device.

The flash beam is best controlled by the height of the tip in relation to the subject. The closer the optic tip is to the subject, the narrower and more intense is the beam, while elevating the tip from the subject broadens and softens the beam.

Pandalid shrimp

Technique

Shutter speeds, f-stops, lens choices and distance to the subject all come into play as the decisions on how to light your subjects will change the dynamics of each image. Pay close attention to the details as overexposing the highlights can happen easily when the tip and light source is close to your subject.

Techniques on how you use your snoot will develop with experience as each subject requires a different method for lighting. Your techniques will also develop around the lens selection and style of photos you're creating.

Super-macro images tend to miss the point of snoot lighting but can benefit from the directional effect of an articulating snoot. When using a 100/105mm lens with a diopter, I like to use a more directional lighting affect by articulating the arm into a front lighting position, rather than standard top lighting. The front lighting plays well with a narrow depth of field created by using magnifiers and diopters, with the light precisely positioned to accentuate features and decrease shadows, rather than the standard overhead strobe flash.

The needlefinger shrimp (above) was shot by top lighting the subject, and while it works, I feel it doesn't quite have the dramatic effect as a front lit image. Keep in mind that while using a snoot, sometimes it is more of what isn't in the frame than what is. Lens selection is key in this aspect.

I prefer the 40-60mm macro range best as it allows a tight working distance and a better tonal quality of light since there is less water to shoot through, and it maintains the negative space that I'm after. The negative space is a key feature of using a snoot and should not be overlooked.

Special effects

"The Glow" is an effect that I strive for when shooting images of nudibranchs, and the more translucent the subject is, the better the glow will be. Using a snoot really increases that effect.

The softer directional lighting of an

Phylodesmium nudibranch (right); The author's camera rig setup with snoot (below center)

articulating snoot works well for nudibranchs. As they tend to move and wrap themselves around objects, the snooted light will illuminate them in different ways.

Standard strobe light creates a similar effect, but the snoot seems to fill the subject with light in a unique manner that compliments a nudibranch's natural beauty and quickly creates more of an artistic image, elevating the image from ordinary to something a bit more elegant.

When I found the orange and white gymnadoris (below), I quickly changed the tip to the narrow beam and concentrated on lighting just the front portion of that nudibranch. The natural teardrop shape of the notum stubby Rhinophores and flat colors were isolated by the narrow strobe beam creating a special composition that again helped to create something different.

Orange and white gymnadoris nudibranch

A phylodesmium nudibranch (top right), or solar-powered nudibranch, is a perfect subject in illustrating the glowing effect. I used the wider tip to help capture the mane-like cerata and purple creamy pigments of the solar-powered nudibranch while leaving everything else out.

Anticipating your subject's movement and positioning your light source, then waiting, is another useful technique for creating something special.

Hypseledoris apolegma nudibranch

Yawning Ambon scorpionfish (left); Hairy frogfish (right, below); Harlequin shrimp (lower left)

Snooting scorpions

A surprising benefit of using my snoot was discovered while shooting a smaller Ambon scorpionfish (*Pteroidichthy amboinensis*). In the past, I have struggled with creatively lighting Ambon scorpionfish and other filamentous critters. Cryptic subjects blend in well with sand and algae and are difficult to separate from that element in an image.

Using a top/front lighting angle on the snoot, I was able to keep the light above the substrate and on the subject, creating a deep rich image that didn't lose quality in the highlights.

I enjoy shooting other benthic creatures such as octopus and flamboyant cuttlefish, but my favorite has to be the hairy frogfish (*A. striatus*). Using the snoot on the hairy's has created incredible results, as the snooted light really brings out the natural beauty of these special creatures.

The *A. striatus* tends to inhabit the shallows here in Anilao, Philippines. Subsequently, the silt and surge can be problematic at times, but the snoot helps to decrease the backscatter to the point that there is little or nothing to do to edit one's image.

I have noticed that the skin tags and filaments surrounding an *A.striatus's* face form a natural frame that I have tried to bring out using standard methods. I've even resorted to cropping my images to bring that out, but with standard lighting, I have consistently missed or overlit my subject.

The directional beam of light cast by the wider tip enabled me to hit it just right, with hardly any post process editing.

Shooting in shallow daylight conditions using higher shutter speeds will decrease the ambient light almost completely, allowing for rich strobe saturation and the use of higher f-stops to retain the natural beauty and details of your subject.

Tips

In summary, here are a few tips that might help when you are attempting to use a snoot with or without a focus light for aiming:

- Get to know your lens and working distance.
- Compose your shot, then articulate the snooted strobe head for lighting.
- Make small corrections and movements.
- Try using the snoot at home before taking it underwater.
- Use the larger tip first.
- Sedentary objects and critters make the best models.
- Change from landscape to portrait.
- Higher shutter speeds help to decrease the ambient light.
- Distance of your light source from the subject will soften and widen the beam.

I rarely dive without a snoot these days, especially when using my 60mm macro lens, and when I set up my system, I put the snoot onto my left strobe or use the cold shoe mount on the top of my housing.

It's really important that I dedicate my left hand to making adjustments and my right hand on the camera controls, as I don't like the tripod or off-camera method because it takes far too long to set up the shot before your subject is spooked and decides to move away.

Having your snoot mounted on the strobe will help you capture more images, as you will quickly pick up a feel for the position and lighting of your device.

Lighting is everything with underwater photography, and having the power to control the light is an effective tool that should be in every underwater photographer's gear box. The changes it will make in simple or complex subjects will add to your portfolio, and as your skill level and confidence grows, so will your subjects and shot selections.

Now get out there and have an adventure! □

Mike Bartick is a Photo Pro at Crystal Blue Resort, Anilao, Philippines.

photo & video

Edited by
Don Silcock

PRODUCT SHOTS
COURTESY OF THE
MANUFACTURERS

Canon XF200 and XF205 Camcorders

Canon has announced the imminent release of two new compact professional quality camcorders—the XF205 and the XF 200. Both camcorders offer HD video in MXF and MP4 formats plus manual control of focus, zoom and iris. The XF205 will retail in the United States for $4,400 and the XF200 for $3,900. Both will be available in mid-July.

Sealux 4K CC1DC Housing

Sealux has released a new housing for the Canon EOS 1D-C. The 4K CC1DC is specifically designed to maximise the underwater potential of the 1D-C's excellent video capability of True 4K (4096 x 2160 pixels) and innovative functions such as Canon Log Gamma. Sealux has designed the 4K CC1DC housing with dial controls on the left for zoom and on the right for manual focus. It also has three viewing windows and accepts their port system.

Aditech Mangrove Housing for Sony AX100

Aditech has announced the release of its new Mangrove housing for the Sony FDR-AX100 and HDR-CX900 4K cameras. The design of MVHS-AX100 housing incorporates 12 electromagnetic push buttons to control the camera via LANC. The housing also includes a rear mounted 3.5-inch High–Resolution TFT LCD monitor or an optional 3.5-inch AUO 16:9 ultra-high resolution monitor.

Nauticam NA-A5000 Housing

Nauticam has announced details and release dates for its new housing for the Sony A5000 mirrorless camera. The NA-A5000 housing features access to the A5000's power zoom lever, which allows the lens to be zoomed without the usual lens rings. The new housing also includes the port lock lever system first seen on the recent Nauticam E-M1 housing, plus a built-in vacuum leak detection system. The NA-A5000 will ship from May 1 at a U.S. retail price of $1,350.

Nikon V3 Mirrorless Camera

Nikon has released the latest iteration in its "1" line of mirrorless cameras—the V3. The camera has a 18.4-megapixel CX-format image sensor, a new EXPEED 4A image processor, 1080/60p Full HD video capabilities and can shoot at 20fps. Its ISO is 160-12,800 with high ISO noise reduction and Nikon will bundle an electronic viewfinder with the camera. The Nikon 1 V3 is available now at a bundled price of US$1200 for the camera body, 10-30mm VR zoom lens, DF-N1000 electronic viewfinder and GR-N1010 grip.

Ikelite EOS 100D/SL1 Housing

Ikelite has announced its new housing for the diminuitive Canon EOS 100D/Rebel SL1 camera. The housing is small and compact to reflect the essential design concept of the EOS100D/SL1 and features Ikelite's signature TTL flash triggering. Ikelite is releasing the new housing with an optical grade acrylic dome port and zoom ring as standard, which allows both the Canon EF-S 18-55mm STM kit lens and the popular Tokina 10-17mm lens to be used—although there is some slight vignetting in the 10-12mm range with the Tokina.

DeepPro GoPro housing

DeepPro has announced that it will be releasing a new housing for GoPro HERO 3 and 3+ cameras. The GPH3 housing is manufactured from aluminum and features a dome port that is claimed to increase the GoPro's field of view underwater to the same as it is on the surface. DeepPro also claims that the dome port means that there is no vignetting even when the GoPro is used in Superwide mode, plus the dome also reduces the minimum focus distance to six inches. The GPH3 housing is fitted with a bulkhead that will allow the use of an external monitor or recorder. No dates are currently available for when the DeepPro GPH3 housing will be available, but pre-orders are being accepted at an eventual retail price of US$1,295.

SEACAM Underwater Photo Academy

Online Seminars for Underwater Photographers

Kurt Amsler in online seminar for SEACAM Underwater Photo Academy

SEACAM founder and CEO, Harald Hordosch, in SEACAM Underwater Photo Academy video

Text by Kurt Amsler, edited by Gunild Symes. Photos courtesy of SEACAM

SEACAM has just unveiled a series of online seminars in their new Underwater Photo Academy. Now you can learn about underwater photography from a professional underwater photographer via video on the Internet. Renown Swiss photographer, Kurt Amsler, conducts the online seminars sharing his tips, tricks and secrets.

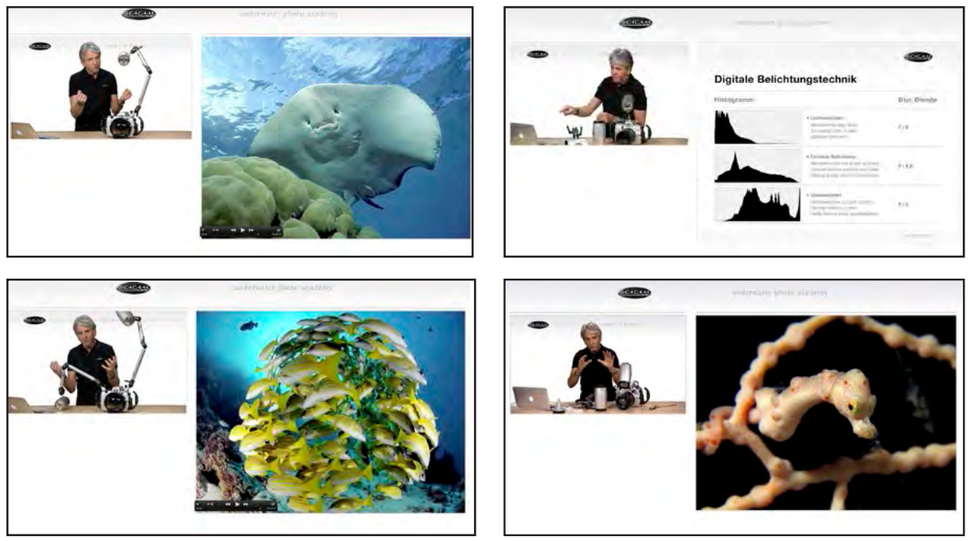
These so-called "cyber lessons" have been available for years in other sectors such as the sports or music industries, for example. In the diving and photography scene, however, this kind of dissemination of knowledge is absolutely new. There is nothing available at the moment comparable to the SEACAM Underwater Photo Academy.

There are currently nine complete courses available, which were produced in a professional studio, in both German and English. The courses offered are designed for all underwater photographers who have basic knowledge and experience. The explained and demonstrated techniques are not meant for exclusive use with SEACAM equipment, but can be practiced with all major brands of photo equipment.

Professional instructor

Thanks to more than 25 years of teaching photography, Kurt Amsler knows exactly what techniques photographers have the most problems with. His lessons are specifically aimed at addressing these techniques, including flash and mixed lighting techniques, wide-angle and fisheye photography, super-macro, wreck and model shots, just to mention a few. The lessons take over an hour and include a lecture, demonstrations, photographs and graphics.

These "webinars" can easily replace the "classic" photography course. The explained and demonstrated techniques are so simple and logical that they can immediately be practiced by the photographer independently underwater. With sample images included in all the lessons, customers can also compare their work with that of a professional.



Various views from online seminars offered by SEACAM Underwater Photo Academy

The lessons are provided in streaming video, easily downloaded, to make viewing as convenient as possible. An added bonus is that it is also possible to download these workshops onto smartphones and tablets, so you can take them along wherever you go.

Payment for the online courses can be made with credit card or PayPal. The online SEACAM store has everything fully automated for this purpose.

The webinars include lessons of different lengths on various topics, and the prices range between €80-140 (US$111-193) per webinar. Customers can purchase individual courses, but if you buy the whole series at once, the price is cheaper. For each course purchased, the customer will receive, as a bonus, the 50-minute course, *The Right Equipment,* for free.

The following link takes you to the FREE download of the lesson, The Right Equipment, *and a look at all the trailers at:* ***www.seacam-store.com/en/academy***. □

An Overview of Photo Editing Software

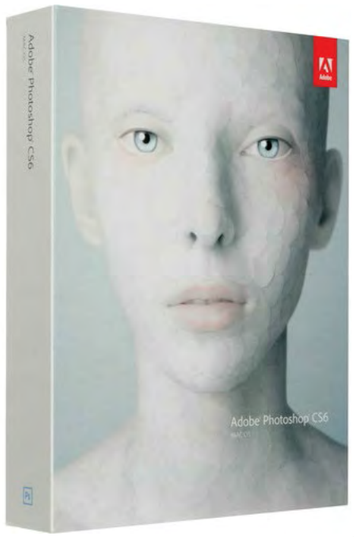
Text by Matthew Meier. Product images courtesy of the manufacturers

Creating photos in this digital age requires postproduction computer work to get the most out of your images. In days of old, post processing meant time in the darkroom developing film and then perhaps hours spent massaging the final print under an enlarger. The techniques may have changed but the concept is the same. The real question is where do you start?

There are many options on the market that vary from easy to complicated, expensive to free of charge, and your choice will depend on your level of expertise and/or expectation. This article is by no means meant to be a definitive glossary of photo editing software but more of an overview of several of the top players at various levels on the spectrum.

Adobe Photoshop

For a large majority of professionals in the photo world, Adobe Photoshop is the image software of choice. It works with both PCs and Macs and is currently available as a stand-alone or cloud-based application. Though it appears as though the future will be limited to a subscription based in the cloud.



Currently, Photoshop is available at US$9.99 per month for subscribers and a one-time cost of $649 for the previous CS6 stand-alone version.

As the most expensive option on the market, it stands to reason, that this is also the most feature rich and powerful image editing tool out there. The software allows for global and localized adjustments, innumerable effects, layering, and the ability to process RAW files, plus the organization of photos through Bridge.

Photoshop is also complex, requiring ample time and effort to master. There are incredible resources at your disposal for that knowledge gathering, including online tutorials, forums, books and classes. However, this learning curve and/or price tag may not be suitable for everyone. **www.adobe.com/products/photoshop.html**

Photoshop Elements

At a more reasonable price of $99.99, Adobe Photoshop Elements is a simpler version of the flagship model. The software contains similar features, though less in number and also works on Macs and PCs. It offers global and localized adjustments, the ability to process RAW files, sharing to social media sites and is easier to use.

Numerous video tutorials and online forums help with the learning curve, but there is still effort involved in mastering this application. To help they have added several one-step enhancement shortcuts, which are aimed at helping the less-experienced user obtain desired results more quickly. **www.adobe.com/products/photoshop-elements.html**

Corel Paint Shop Pro

In a similar vane, Corel's Paintshop Pro will run you around $79.99 but only works on Windows-based PC's. It offers RAW, HDR and plug-in support with 64-bit performance. The software has a wide array of editing tools including layers, brushes, quick selection and vector tools. Like Elements, Paintshop Pro has a shortcut feature they call Smart Photo Fixes, which are suggested corrections that may be accepted and/or fine-tuned. Video learning is also available for assistance along the way. **www.paintshoppro.com**

Vivid-Pix Picture-Fix

One of the newest options on the market is designed specifically for amateur underwater photographers. Vivid-Pix's Picture-Fix software works on both Mac's and PC's and costs $49.99 for the online download. While Picture-Fix will work on topside photographs, its strength lies in improving the exposure, contrast and color of underwater images. The software is incredibly easy to use and upon import, offers a nine-window preview of possible corrections to the original photo. Once selected, the improved photo may be further fine-tuned by adjusting a handful of sliders, in a side by side display with the original image. At this time, there are no localized adjustments, layering, metadata or text overlay available, and the software only supports the processing of JPG files. All edits are non-destructive, and the final adjusted photo is saved as a new file, leaving the original untouched. New features, just released, allow control of sharpness and crop, and the website contains a video and FAQ section with the full overview of the software. While a bit limited in scope by comparison to the other options listed here, Vivid-Pix is a great tool for the budding underwater photographer looking to improve the look of their pictures. **www.vivid-pix.com**

photo & video

Google Picasa

There are several free image editing software on the market, and one of the easier to use is Google Picasa. It works on Windows, Mac and Linux systems but currently offers no iCloud support. Picasa does support RAW images and has an array of photo effects, plus features like geo and name tagging along with facial recognition. The software is intuitive, has good organization tools and offers side by side editing to compare changes made from the original file. Picasa contains an extensive online help system and is designed for easy sharing of photos on Google+ and social networks. **picasa.google.com**

Gimp

Another free option with near Photoshop-like image editing capabilities is called Gimp. It also works on Windows, Mac and Linux systems but is considerably more complicated to use than Picasa. Gimp supports RAW images, plus layering and plug ins. It offers a vast array of photo effects but in a less intuitive and cramped interface. There are tutorials on the Gimp website and online forums to reference for questions. For capabilities resembling Photoshop, at none of the cost, this software may be worth the learning curve and inherent quirks. **www.gimp.org**

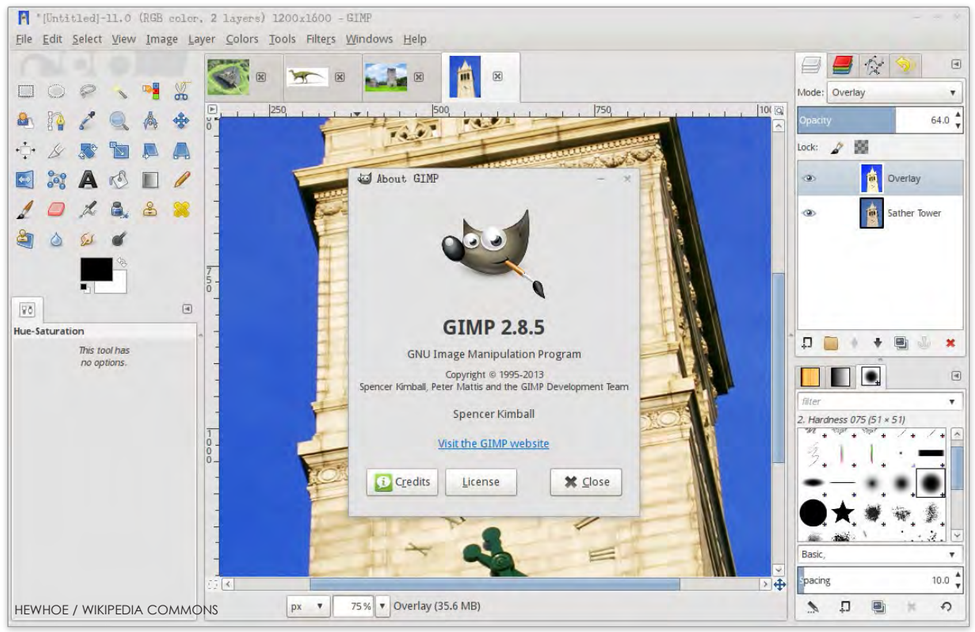
Photo Mechanic

Another major player at the professional level is software called Photo Mechanic. It works on Macs and PCs but does not process RAW files or even edit photographs. Photo Mechanic is a fast import, preview, selection, organization and metadata tool. It offers direct upload to standard services and exports to other applications for editing. The software uses unconventional terminology, so there is a bit of a learning curve to using it, however, many pros consider Photo Mechanic invaluable for the speed at which it helps them sort through mountains of images after returning from a job. The current price online is $150. **www.camerabits.com/products**

Apple Aperture

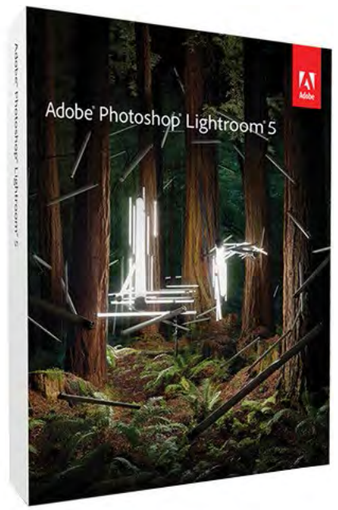
Last but not least on the list are two programs that not only aid in image editing, but also do a masterful job of keeping track of your photo library. The first is Apple Aperture, which is a Mac only software that is listed at $79.99. It offers local and global adjustments, support of RAW files, numerous effects and multimedia sharing, while being fully integrated with Apple's iPhoto. Aperture automatically shares photos on the web through Photo Stream and furthermore allows for the creation of photo books. Like Photo Mechanic, some of the terminology used is a bit different, but there are many online tutorials and forums to aid in the educational process.

As in most of these programs, images must first be imported into Aperture before use, and they are then stored according to folders. Unfortunately, that filing structure itself is hidden from the user, and in my opinion, is one of the pitfalls of this system when trying to retrieve images. It is not possible to look on the hard drive for a folder of images, so the only way to access them is through Aperture. That being said, this program offers a great many more features than most others in this price range and should not be dismissed. **www.apple.com/aperture**



Gimp running on Linux system

Photoshop Lightroom



The final software offering is Adobe Photoshop Lightroom. It is currently obtainable as a stand-alone application for $149 and in conjunction with Photoshop as a subscription from the cloud. Lightroom runs on both Macs and PCs and will process RAW files. In fact, it uses the same RAW processing engine as Photoshop and is fully integrated for advanced editing techniques as well. All adjustments are non-destructive and include both global and local changes.

The vast majority of Photoshop tools necessary for image enhancements are available in Lightroom, save layers and some specific localized adjustments. In fact, many photographers use Lightroom for most of their image corrections and edit in Photoshop only when necessary.

Additionally, Lightroom keeps track of all of your images, regardless of whether or not they are on your computer or external hard drive. It has an excellent printing interface, creates slideshows, exports to the web and also allows for book creation through Blurb.

This is an incredibly versatile tool, but its immense array of features certainly requires time and energy to understand. Lightroom has an extensive built-in help system, plus a plethora of online tutorials, forums, books and classes to assist in that process. **www.adobe.com/products/photoshop-lightroom.html**

Editor Matthew Meier is a professional underwater, nature and travel photographer living in San Diego, California, USA. For more information, visit: ***www.matthewmeierphoto.com***

Brazil's

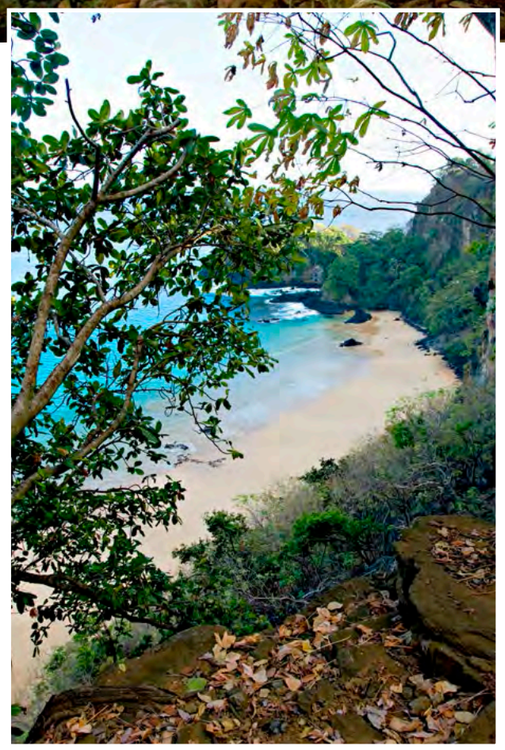
Fernando de Noronha

Jewel of Nature

Text and photos by Michel Braunstien

Noronha

Employees counting dolphins (left side of photo) at Baia dos Golfinhos



The fabulous Baia do Sancho

If I were to tell you about a special place where no one locks their doors at night, where crime is virtually nonexistent, where the number of tourists is intentionally restricted to preserve the ecological balance, and where each visitor must pay a daily fee of 15 Euros (approximately US$20) to protect the environment, would you think about Brazil? Probably not!

Yet, Brazil's tiny archipelago of Fernando de Noronha still resists the changes and other influences from the continent. The archipelago entails 21 volcanic islands and is located at 360km (224mi) from the closest coast of Brazil (Natal). Spreading over a total area of 26 squ km, it is located in the Atlantic Ocean near the Equator (3° 51□S, 32° 25□W). The main island, the only one which is inhabited, is about 10km long (6m) and up to 3km wide (1.8mi). The archipelago gained international media attention after the terrible accident on 1 June 2009 of Air France Flight 447 flying from Rio to Paris, as searches were conducted by the Brazilian Air Force from the archipelago.[1]

History

Discovered in 1503 by the Portuguese, the archipelago was named after Fernao de Loronha who received it as a gift in 1504 from his friend, King Manoel I of Portugal. However, Loronha quickly forgot this gift and

View of Morro do Pico from dive boat. PREVIOUS PAGE: Splendid arch underwater at Pedras Secas

LEFT TO RIGHT: Fernando de Noronha's church; Atlantis dive club fleet; Location where prisoners were punished in colonial times; Buggies are the ultimate vehicles on Noronha

never saw it at all.

Ruled by England, then France, and then by the Netherlands, the archipelago came again under the yoke of Portugal in 1737.

Mainly a prison colony, it was used by the U.S. forces as a military base during World War II and again in the late 50□s and early 60□s during the cold war against Soviet Union. Since 1988, the islands have been open to tourism, 85 percent of which being of Brazilian origin. Over two thirds of the archipelago's total land surface is a marine national park, classified since 2002 as part of the UNESCO world heritage.

Hotels and transportation

There are no hotels on this preserved site but there are living units, or *pousadas,* in private homes. Infrastructure is very basic. A single seven-kilometer paved road crosses the inhabited island. Buggies are commonly used as a means of transportation and allow driving outside the main axis.

Nature and conservation

The site's nature conservation is exceptional; it has a rich and varied flora and fauna. Non-governmental protection agencies for the study of various species are quite active on the island and entail projects such as the Projeto Golfinho Rotador for the dolphins, the Tamar Project for the turtles, and other projects pertaining to the study of sharks, birds and crustaceans.

Some environmental mistakes made long ago by the Portuguese can still be noticed today. For example, two different lizard species were introduced to eat rats but preferred eggs, chicks and turtles that have just hatched; unfortunately, it is now too late to reverse the process.

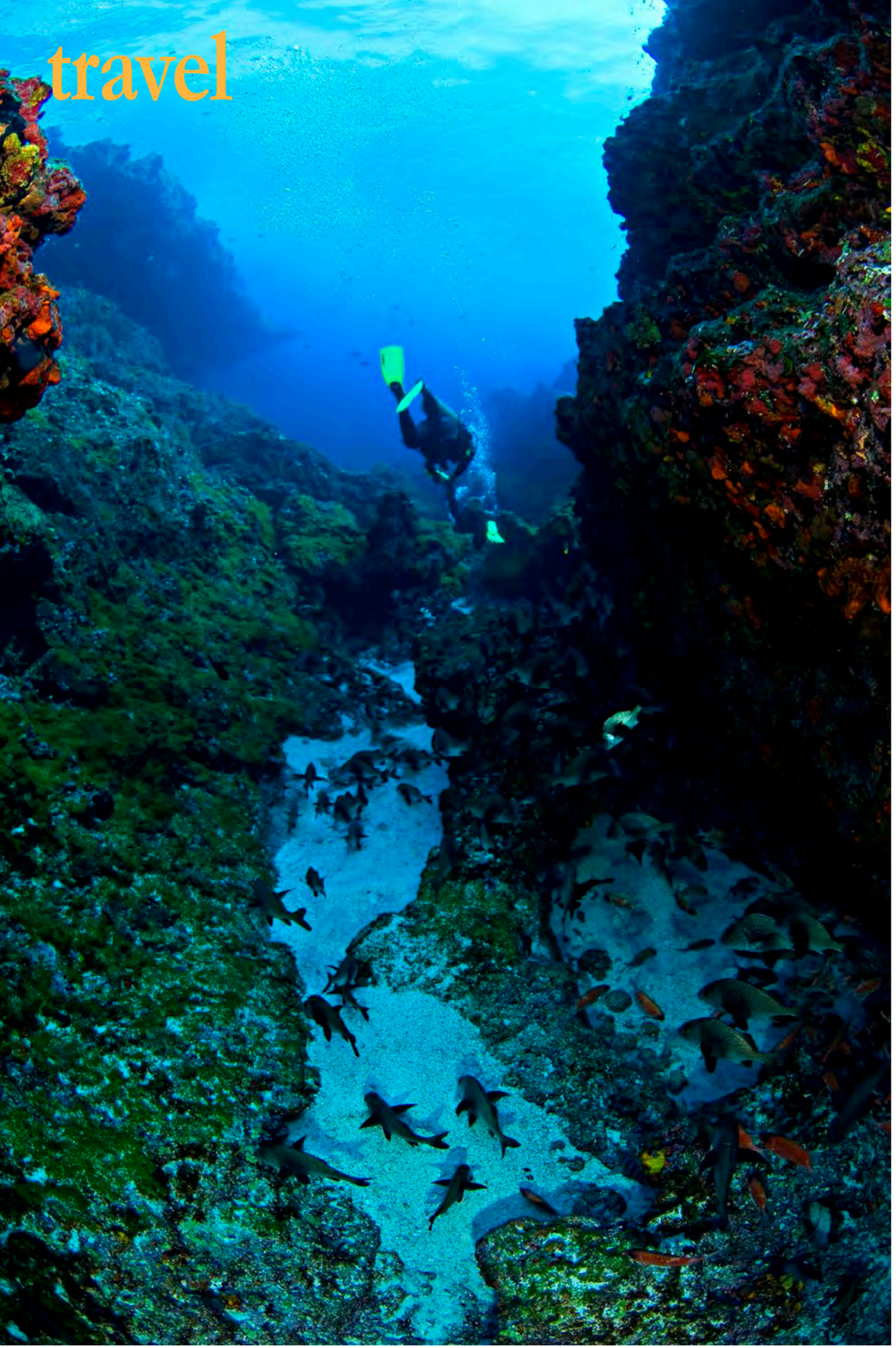
Beaches

At sunset, whilst visiting Baia dos porcos, you can admire, the Dois Irmaos, the two renowned tiny sister islands. Morro do Pico, an impressive peak rock, is another one of the local spots.

The main island is surrounded by 16 heavenly beaches that are clean and almost deserted, making it almost impossible not to stop and have a look.

Baia do Sancho is without a doubt the most sumptuous beach and is rated first in the Brazilian beach ratings. The water is crystal clear and the shoreline is bordered by dense vegetation. This is an ideal place for snorkeling. You can often see stingrays, turtles, as well as other species.

Nevertheless, access to the beach is rather difficult, involving a hike down a steep cliff, 50 meters (164 feet) high, if you wish to swim. Two ladders allow crossing of a narrow opening between the rocks, followed by a large flight of stairs that leads to the beach. This is not easy, but it is well worth the effort for both the experience and the view.



Diver in narrow passageway; Turtle (right) asleep during night dive, Perdras Secas

Diver passes through a narrow passageway on the way to Caverna de Sapata

Dolphins' Bay

Baia dos Golfinhos—the Bay of Dolphins—is near Sancho Bay. A large number of spinner dolphins (*Stenella longirostris*) swim together here every morning at dawn. They come to the bay to seek shelter after a night of hunting before returning to their marine odyssey.

These spinner dolphins, commonly named *golfinho rotadores* in Portuguese, are known for their spectacular jumps. They can perform up to seven spins during the same jump. An impressive amount of them can be seen from the observatory at the top of the cliff, some 50 meters above the sea.

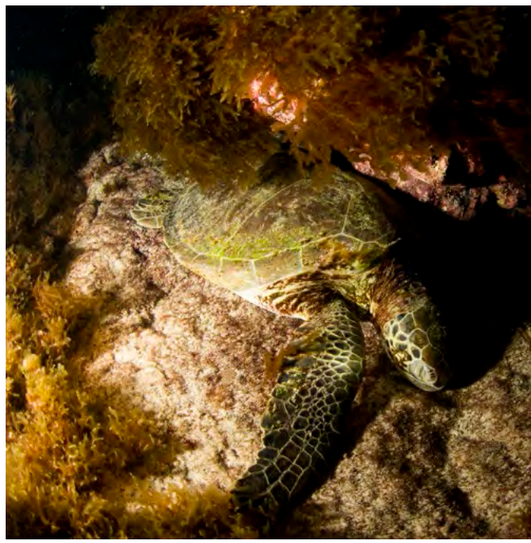
Every morning, the employees of the Projeto Golfinho Rotador organization count the dolphins to monitor their progress. Daily, on average, 315 dolphins reach the bay to breed, care for their young, or seek shelter from shark attacks. At times, one can even count up 2,000 dolphins. Noronha has the largest spinner dolphin count and population density in the world, in a single place.

Turtles beach

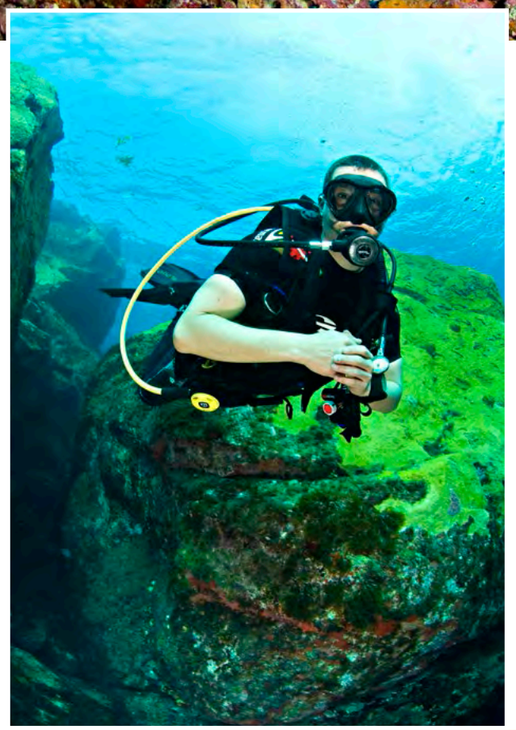
Baia do Sueste is at the other end of the island and sea turtles come there to lay their eggs between December and June. Nests are protected by the Tamar Project patrol (Projeto Tamar). You can see turtles here throughout the year if you swim beyond the bay's surf, equipped with a mask, snorkel and fins.

Diving

All year round in Noronha, you can have great quality dives, thought to be some of the most magnificent of the South American continent. The water has a pleasant average temperature of 26°C. The visibility is outstanding, ranging from 25 to 45 meters. During the months of September and October, the visibility



is at its best. Although you won't find coral or macro life here as it exists in the Indian Ocean, the underwater world of Noronha is mainly interesting for its volcanic rock formations, narrow



passageways, tunnels and caves, making it a very special place. Marine species are generally very large and quite numerous. It is not uncommon to encounter dolphins underwater, and if you miss them there, you can often see them swimming alongside boats.

Sapata Cave

The magnificent Sapata Cave has a very wide entrance with which a little imagination makes you think of a mouth. A large grouper lives within the entrance, and although it still appears to be quite young, it already weighs over a hundred kilograms (220 pounds).

Fauna

During each dive, large stingrays are visible. Barrel sponges are very common. Reef sharks and nurse sharks can be met mainly in the superb reef of Pedras Secas. Sometimes, during a night dive, you can even come across a turtle sleeping under a rock. There are many schools of fish, and on occasion, you can see manta rays and hammerhead sharks.

Wrecks

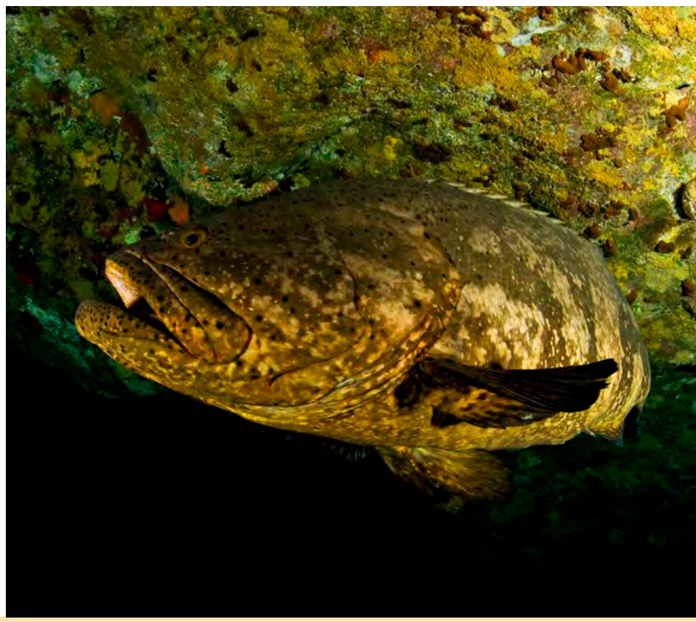
The Corvette Ipiranga V17 wreck is that of a Brazilian Navy warship that sank in 1982, after hitting a rock that did not appear on any map. She drifted and sank during an eight-hour stretch, reaching the seabed at 62 meters deep (203 feet) in perfectly straight position. She remains in excellent condition.

Diving into the wreck requires trimix, which can be relatively expensive, and requires very accurate preliminary training. On the wreck's deck, there is still a heavy machine gun.

In Noronha's port, there is another wreck which is accessible by snorkeling as it is only about six meters deep (20

Large barrel sponge (above); Stingray at 42m depth (top left); Diver between huge lava rocks (left)

Huge lava rocks underwater (above); Diver in splendid entrance to Sapata Cave (top left); Divers in swim-through (left); Giant grouper, Sapata Cave (right)



feet). These are the partial remains of a Greek ship named *Eleana Stathatos* that sank in 1929.

Fernando de Noronha is a model of environmental preservation. The tourist industry remains limited due to the small infrastructure and means of access; there are only two medium sized planes landing there every day. This place has a unique charm as a result of all these factors, making it a true jewel of nature and a true delight to the eyes.

Dive clubs and tourism info

There are only three dive clubs in the small archipelago. The nicest and most professional one, with the best ships, is Atlantis Divers owned by Patrick Muller. The two others are Noronha Divers and Aguas Claras. If you don't speak Portuguese, take a dictionary with you to Noronha, because locals do not speak English. You can also get in touch with Adriana Schmidt from Your Way travel agency in Noronha. She's a great guide and perfectly fluent in English. She can help you with any kind of reservation on the island. Email her at: adriana@yourway.com.br.

Michel Braunstein is a Belgian underwater photographer and dive writer based in Israel. For more information, visit: ***www.michelbraunstein.com***

SOURCES: [1] EN.WIKIPEDIA.ORG/WIKI/AIR_FRANCE_FLIGHT_447

fact file

Brazil

SOURCES: U.S. CIA WORLD FACTBOOK, RAF.MOD.UK, WIKIPEDIA, WWWNC.CDC.GOV

History After over 300 years of Portuguese rule, Brazil gained its independence in 1822. It maintained a monarchical system of government until 1888 when slavery was abolished and the military subsequently proclaimed the country a republic in 1889. Exporters of Brazilian coffee dominated politics in the country until 1930 when populist leader Getulio Vargas rose to power. Over five decades of populist and military government passed before power was finally peacefully ceded to civilian rulers in 1985. Brazil, being the largest and most populous country in South America, continues to pursue growth in the industrial and agricultural sectors while developing its interior, exploiting its vast natural resources and a large labor pool. Today, it is South America's leading economic power. As a regional leader, Brazil is one of the first in the area to begin economic recovery. However, there is still large inequality in income distribution in the country, and crime remains a pressing issue. Government: Federal republic. Capital: Brasilia.

Geography Brazil is located in Eastern South America and borders the Atlantic Ocean. As the largest country in South America, Brazil shares common boundaries with every South American country, with the exception of Ecaudor and Chile. Coastline: 7,491km. Terrain consists primarily of flat to undulating lowlands in the north, with a few plains, hills and mountains, as well as a belt of narrow coast. Lowest point: Atlantic Ocean 0m. Highest point: Pico da Neblina 2,994m.

Climate Primarily tropical, Brazil does have temperate climate in the south. Natural hazards include floods and sometimes frost in the south as well as periodical droughts in the northeast.

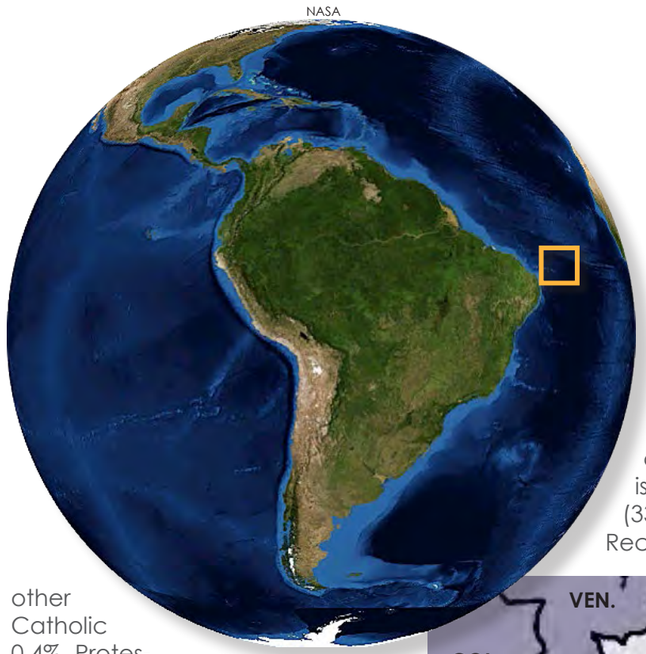
Environmental issues

Deforestation in the Amazon Basin is destroying habitat and endangering a myriad of indigenous animal and plant species. A lucrative illegal wildlife trade is also having an adverse effect on indigenous species. Rio de Janeiro, Sao Paulo, and other large cities are plagued with air and water pollution. Improper mining activities is causing land degradation and water pollution. Other challenges include wetland degradation as well as devastating oil spills.

Economy With vast and well-developed agricultural, manufacturing, mining and service sectors, Brazil has the largest economy of all the South American countries. Expanding its presence in world markets, Brazil has, since 2003, improved its macroeconomic stability. Economic measures have seen the country's foreign reserves rise and its debt profile fall. Strong growth prior to the 2008 global financial crisis was followed by two quarters of recession but then the country was one of the first emerging markets to begin a recovery. Growth increased leading to rising inflation in 2010, so the government took measures to slow the economy in the following years. Unemployment is at an all time low while the gap in income inequality has steadily decreased. High interest rates attract foreign investors, but the large inflow of capital in recent years has hurt manufacturing, so government intervention in foreign exchange and taxation was necessary. The current administration is committed to fiscal restraint, combatting inflation and maintaining a floating exchange rate.

Currency Reals (BRL) Exchange rates: 1EUR=3.05BRL; 1USD= 2.21BRL; 1GBP=3.70BRL; 1AUD= 2.08BRL; 1SGD= 1.78BRL

Population 202,656,788 (July 2014 est.) Ethnic groups: white 47.7%, mulatto (white and black mix) 43.1%, black 7.6%, Asian 1.1%, indigenous 0.4% (2010 est.) Religions: Roman Catholic 64.6%, other Catholic 0.4%, Protestant 22.2%, other Christian 0.7%, Spiritist 2.2%, other religions 1.4% (2010 est.) Internet users: 75.982 million (2009)



NASA

RIGHT: Global map with location of Noronha. LOWER RIGHT: Location of Noronha on map of Brazil

Language Portuguese is the official language and most widely spoken. Other, less common languages include Spanish, German, Italian, Japanese, English, and several Amerindian languages

Health

There is a risk of hepatitis A and typhoid through food and water contamination; dengue, leishmaniasis and Chagas disease from bug bites; as well as malaria, rabies and yellow fever in some remote areas. Check with your doctor 4-6 weeks *before* your trip for details and updates on vaccination requirements and health risks. For helpful tips for travelers to Brazil, visit http://wwwnc.cdc.gov/travel/destinations/traveler/none/brazil

Decompression chamber

Fernando de Noronha is remote. There are several chambers in private and military hospital facilities in Brazil's larger cities of Sao Paulo and Rio de Janeiro as well as naval facilities along the coast, but the closest facility is around 545m (338mi) away in Recife, so please check with your dive operator for more details.

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Erika Pochybova-Johnson

P O R T F O L I O

Red Reef, by Erika Pochybova-Johnson. Acrylic on canvas, 34 x 24 inches

Edited by Gunild Symes
Photos courtesy of Erika Pochybova-Johnson

Pochybova-Johnson

A Shrimp, 8.5 x 11 inches (above) and *Aftermath*, 44 x 68 inches (previous page) acrylic on canvas by Erika Pochybova-Johnson

Originally from Slavakia, self-taught artist Erika Pochybova-Johnson creates brilliant, spell-binding, intricate paintings inspired by nature, the sea and its creatures. Now based in Lubbock, Texas, the artist shared with *X-RAY MAG* her artistic vision and connection to the underwater world.

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

EPJ: I grew up in Bojnice, which is an old city [in Slovakia] known for its tourist attractions, such as one of the most visited castles in Europe (first mentioned in 1113), the oldest zoo in Slovakia and one of the oldest spa resorts in Slovakia. The house in which I grew up is located right by the Bojnice Castle (a five-minute walk from our house) and touring the castle and its exhibits (including numerous traveling art shows of European art) was one of the most pleasant and interesting activities I did throughout my youth. In addition, both of my parents are big appreciators of European art (in any form) and we took many trips throughout the country to visit many historical areas that contain amazing collections of art.

Pochybova-Johnson

In addition, the town lies in the Nitra River valley and is surrounded by beautiful mountains. Often, we would take hiking trips, mushroom-hunting trips, or just simply trips into woods and explore the wonders of the surrounding nature. I believe these experiences have not only established my strong appreciation for art, beauty and nature but also have influenced my work and my vision of the world considerably.

X-RAY MAG: What is your artistic mission or vision?

EPJ: The arts, in general, are a means of sharing the human experience. The visual arts, in particular, imbue an object, such as a painting or sculpture, with a wordless language of thought, emotion and visual experience. The object is static, but it can bridge the gaps of space and time. The artist's vision can trigger a feeling of recognition in the viewer or present a new way of looking at a familiar thing. It is like a conversation without words between two people who have never met. This simple yet magical quality is what has drawn me to making art. For me, making art is about adding some beauty to the world. Whether it is beauty in truth, beauty in nature or beauty in and of itself, art objects have contributed to the quality of human life for centuries.

X-RAY MAG: What about the sea and its creatures inspires you?

EPJ: As a visual artist, the colors, shapes and lines of sea animals and plants are especially interesting because they are so different from what we normally see as surface creatures. I love the variety in their colors, the refracted light of the underwater world, and how their forms move with expressive gestures in seemingly zero gravity. To me, it all combines to create a magical new dimension of life on Earth that is not appreciated often enough. The sea and its creatures inspire me with awe.

Gliding, by Erika Pochybova-Johnson. Acrylic on canvas, 24 x 34 inches

Undulating, by Erika Pochybova-Johnson. Acrylic on canvas, 24 x 34 inches

Black Sea, by Erika Pochybova-Johnson. Acrylic on canvas, 23 x 16 inches (left)

X-RAY MAG: Tell us about your experience in the underwater world, scuba diving or snorkeling. How and why did you start diving?

EPJ: I have always loved water. I almost drowned when I was a toddler, and after that, I spent countless hours in the water, learning to swim and swimming. When I was 15, I signed up for a scuba diving course. This brought a completely new dimension to my already developed love for water and swimming.

X-RAY MAG: What are your favorite dive sites, underwater subjects, locations?

Octopus' Garden, by Erika Pochybova-Johnson. Acrylic on canvas, 16 x 21 inches

EJP: I don't really get to dive much anymore since I live in a very dry part of the world. But my favorite place that I have been recently was on the northwest coast of Costa Rica. In the water, I just love to see anything with color.

X-RAY MAG: Tell us about your paintings... How are they made?

EPJ: I think that the fact that I am a self-taught artist contributes considerably to my unique vision and the consequent uniqueness of my work. Because I am not academically trained in painting, I do not think of predefined rules, and I do not find any need to follow them—I do not even want to know what those rules are. I invented my unique painting style intuitively. My images are created with thousands of dots that I carefully place, one by one by, on the sur-

Jellyfish, by Erika Pochybova-Johnson. Acrylic on canvas, 24 x 14 inches

Red Lobster, by Erika Pochybova-Johnson. Acrylic on canvas, 16 x 20 inches

face of my paintings. I like to improvise when I work; I choose colors in my work intuitively, and often, I do not know what the final image is going to look like. I love moments of surprise in my work. I do not look at my pieces from a distance to evaluate them until they are more than 80 percent done, and that, for me, makes the entire process even more fun and interesting. I like to express what I see in a way that seems very natural to me, and perhaps this contributes to the uniqueness of my style and imagery.

X-RAY MAG: Do you use underwater photography—your own or other sources?

EPJ: I do not paint from photographs, per se. I look at many images and create my own composition from various source materials and my imagination. I do not want to copy an image that I have already taken or seen, but rather create something that has never been seen. My paintings represent an imaginary world that is influenced by real life experiences, encounters, and are recollections of my memories or visions. And painting is a wonderful medium for enticing people into looking at something in a new way.

X-RAY MAG: How does your art relate to conservation or environmental issues facing our oceans and reefs?

EPJ: One powerful element, to which people respond, is beauty. There is nothing quite like beauty, and people pay attention when they see something beautiful. My goal is to bring awareness about

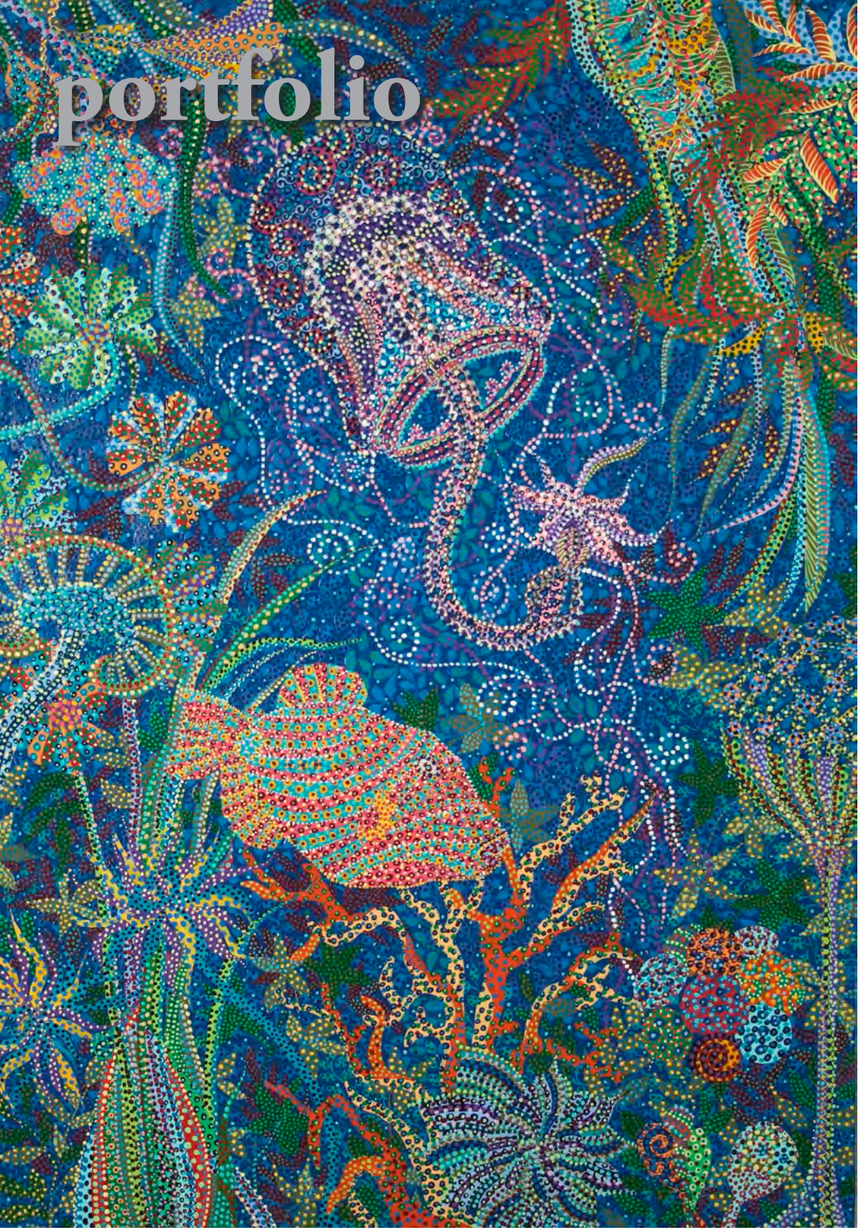
Pochybova-Johnson

Small Jellyfish, by Erika Pochybova-Johnson. Acrylic on canvas, 11 x 8.5 inches

Strolling, by Erika Pochybova-Johnson. Acrylic on canvas, 16 x 23 inches (below)

the beauty that is present in nature and the plants and animals of the underwater world—and how fragile it is.

One example: It has been almost 37 months since the Tohoku earthquake triggered a tsunami that devastated eastern Japan and severely damaged the nuclear reactors in Fukushima. This tragic event, that resulted in a continuous leak of harmful radioactivity, was the inspiration for my painting, *Aftermath.* At first glance, one feels the positive energy, a glorious underwater world, teeming with seemingly playful life. But upon further observation, one may wonder about a strangely out of place Japanese motorcycle. The sea creatures appear disturbed



Jellyfish #2, by Erika Pochybova-Johnson. Acrylic on canvas, 27 x 19 inches

and anxious about this unnatural intrusion. Barely visible, like radioactivity, in the chaos are arrangements of particles that form floating radioactive symbols and the logo of Tepco. (Tepco is the electric power company that was responsible for maintaining the nuclear reactors.) When one takes the time to really see and contemplate the painting, it reveals a more complex world where all is not well. *Aftermath* is, at once, a tribute to some of the miraculous life our planet has produced and a warning about the fragility of that life—an apology to Nature.

Aftermath #2, by Erika Pochybova-Johnson Acrylic on canvas, 24 x 36 inches

X-RAY MAG: Why art? Why is art important? What are the challenges and benefits of being an artist today?

EPJ: I enjoy making art because it makes me feel like I am contributing something positive to the world. Looking at other people's art, past and present, has enriched my life, and I want to contribute a little something to the giant fabric of human culture. There are some challenges with being an artist but the rewards, both personal and professional, far outweigh them. And to me, true artistic success is having the peace, time and resources that allow one to make art for most of the time one spends on Earth.

Aquatic Apparition, by Erika Pochybova-Johnson. Acrylic on canvas, 32 x 24 inches

X-RAY MAG: What's next? New? Upcoming?

EPJ: My goal is to continue striving to bring more beauty to the world with my paintings… and perhaps raise the awareness about the fragility of nature. I want to pay tribute to nature's purity and hope that our civilization will learn to live in harmony with that. I also would like to learn to see the world through the eyes of animals, whose spirits are pure, and discover some universal truths that would help us humans get along in the world. I continue to have some hope. □

For more information and to purchase art work or prints, visit: ***www.ebova.com*** *or* ***www.erika-pochybovajohnson.artistwebsites.com/index.html****.*

Curious, by Erika Pochybova-Johnson Acrylic on canvas, 10 x 8 inches