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Sharks
French Polynesia

Portugal
Madeira

Bali
Liberty Wreck

Rebreathers
Why Switch?

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I N D O N E S I A

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COVER PHOTO: *Pair of Ornate Ghost Pipefish, Indonesia*
by Don Silcock

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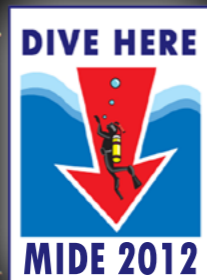
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Watching the recreational rebreather revolution unfold

Rebreathers for everybody?

'Recreational' rebreathers seem to be all the hype these days with every other manufacturer developing their own take on such a gadget. The technology seems to be finally coming of age, but is it really a game changer just yet?

I am all for technology that makes our lives easier. If we can now do away with the proverbial degree in engineering one needs to have in order to learn to dive these units safely out of the box, I'd say good riddance to the technical manuals. Diving is about adventure and experiences, not about nuts and bolts.

And just as we are able to take our car and go for a pleasant picnic in the countryside without having to be concerned about the engine's compression ratios or other technicalities, the ultimate rebreather should also just start and function steadily and securely within safe limits without the user having to constantly worry.

Modern cars now come with ABS, traction control, airbags and highly sophisticated electronics monitoring a long list of functions, and they are safer than ever before.

While undergoing a somewhat comparable technological evolution in terms of safety and user-friendliness, rebreathers are, however, not like cars. Big strides have indeed been taken towards higher levels of automation and 'fool-proofing' them, but some quite

important differences remain, which I am not convinced will ever be completely overcome or whether they even should be overcome.

First of all, if a car breaks down, you can pull over and fix it or call for assistance. Having a rebreather malfunction could kill you. Unless, that is, you are vigilant and instantly able to take appropriate corrective measures, which still requires intricate knowledge of how it functions. However, humans are inherently complacent creatures, and with the increasing levels of automation, I see a risk that many divers will drift into the trap of growing comfortable with diving their unit on 'autopilot' and forgetting to think.

How to handle various what-if scenarios are surely covered in user manuals and during the courses, as I am confident that it has all the attention of the training agencies. But let's think again—how many of us drivers ever went back to driving school and did the closed training circuit where one is first taught about aquaplaning with a car and how to recover from a skid? That beckons the question of whether or not frequent retraining for rebreathers will be recommended or required?

Secondly, closed circuit rebreathers (CCRs) are, by definition, coupled directly to our physiology, which is a complex biological sys-

tem that can be modelled only with so much accuracy and certainty. We also differ as individuals and from day to day.

Speaking of which, probably the most prominent key technology still missing in rebreathers is suitable CO₂ sensors—CO₂ remains one of the biggest hazards with CCRs, but the present technology does not actually measure CO₂. Instead, a temperature gauge traces how the scrubber gets progressively spent. For most purposes, this may be quite a good safeguard, but you are still left in the dark in regards to the actual CO₂ levels.

However, the biggest hurdle facing the recreational rebreather revolution is probably not of a technical nature but a matter of plain household economy. For the average diver, the price tag is still quite a mouthful. While the price has come down over the years, CCRs are still twice as expensive as a kit of open circuit gear, or equivalent to buying a small car in some countries.

All that being said, the latest developments are definitely pointing in the right direction. Learning about the latest developments and exactly how far we have come at Rebreather Forum 3 in Florida later this month is going to be quite exciting.

Stay tuned for more info...

—The X-RAY MAG Team



X-ray mag

News edited
by Peter Symes

from the deep
NEWS

Shark-dive tourism in Fiji worth US\$42.2 million a year

Will tourism save the sharks?



"This study clearly shows the role sharks and tourism play in the economy of Fiji."

—Matt Rand, director of global shark conservation at the Pew Environment Group

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This global over-exploitation of sharks highlights the need for convincing economic arguments that can halt or reduce declines and assist the implementation of more effective conservation strategies.

In 2010, shark-related diving contributed US\$42.2 million (\$73 million Fijian) to the economy of Fiji according to a report by the Australian Institute of Marine Science and the University of Western Australia. That year, shark-diving operations generated \$4 million for Fijian communities through salaries and local levies.

The study, *The socio-economic value of the shark-diving industry in Fiji*, found that overall tourism activities in 2010 generated US\$558 million, approximately 18 percent of the country's gross domestic product (GDP), and that one in ten tourists engaged in diving activities. It is estimated that 49,000 divers were engaged in shark-diving activities in Fiji accounting

for 78 percent of the 63,000 divers visiting the country. Dedicated and casual shark-divers accounted for 24 percent and 54 percent of all divers interviewed respectively.

The dive operations at Pacific Harbour in Beqa Lagoon were a major contributor to the revenues from shark-diving to Fiji. Beqa Lagoon has gained increasing attention of the international diving community as a world-class destination for shark-diving, due to the size, diversity and abundance of sharks and the reliability with which they can be observed. Its easily accessible location on the southern coast of the main island of Viti Levu close to international airports makes Pacific Harbour a



CHRISTOPHE JURDAN

popular destination for divers that travel to Fiji specifically to see sharks. In 2010, a total of 8,600 visitors were involved in shark-diving at this locality providing approximately US\$5.3 million in revenue. This economic contribution is likely to increase in the future given the rapid increase in tourism to this locality and the growing international reputation of the experience among divers.

Growing popularity

Diving with sharks in particular has become more popular over the past several years, and shark-diving is a growing business worldwide, with established operations found in at least 83 locations in 29 countries. Although places

such as South Africa, the United States and Australia have typically dominated this industry, shark-diving is becoming an economic driver across the Indo-Pacific. In Palau, a recent study found that US\$18 million a year (or eight percent of its GDP) is generated by this activity. In French Polynesia, diving with lemon sharks off Moorea Island brings in about US\$5.4 million annually.

Worldwide concern over the ecological and economic impacts of the loss of sharks

as apex predators in marine ecosystems has led a number of small island nations to grant greater protection to shark populations. Since the Republic of Palau created a nationwide shark sanctuary in 2009, other Pacific island states such as the Republic of the Marshall Islands and the territories of Tokelau, Guam and the Northern Marianas have followed suit by banning commercial shark fishing and the trade of shark parts, including fins, within their waters.

These bans are not restricted to the Pacific

Ocean. The Republic of the Maldives recently implemented the first nationwide shark sanctuary in the Indian Ocean, and the Honduras and the Bahamas have also created sanctuaries extending bans on commercial shark fishing to Atlantic waters. Protection measures have also been adopted by the American states of Hawaii, Oregon, Washington and the more recently California, which effectively banned commercial shark fishing and the shark fin trade off the west coast of the United States. ■



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Duke research team wins NASA award

Preventing decompression sickness in astronauts

Text by Rosemary E Lunn
Photos courtesy of Duke University Hyperbaric Center

A research team at the Duke University Hyperbaric Centre, (North Carolina, USA) has won a Johnson Space Center (JSC) Group Achievement Award from NASA. The Durham-based team comprising Dr Neal W Pollock, Dr Richard Vann, Mike Natoli and Dr Richard Moon developed an in-suit light exercise pre-breathe regiment to prevent decompression sickness developing in astronauts.

Although it might not seem immediately obvious, there is a strong link between astronauts, rebreathers, diving physiology and physics. A space suit is effectively an oxygen rebreather with the contents of the suit recirculated through a CO₂ scrubber. However, the helmet doesn't suffer the same CO₂ retention problems that some diving helmets can, mainly because the gas is far less dense, therefore it circulates easily around the system.

"When an astronaut transitions from Space Station pressure (1 bar) and dons a space suit (0.29 bar), the pressure on them drops by 0.71 bar," stated Pollock. "It's the same effect as instantly going from ground level to a 1,000 feet above Everest.

"Consequently, one of the dangers of



Dr Neal W Pollock (left) and Dr Richard D Vann

A space suit is effectively an oxygen rebreather

space walking is that decompression sickness will result if there is no intervention or treatment. Although the astronaut hasn't been diving, he does have nitrogen in his tissues—in equilibrium with the content at ground level pressure. With an immediate drop in pressure the gas comes out of solution forming bubbles, and the astronaut can possibly experience symptoms of decompression sickness, just like a

diver. We needed to wash out nitrogen from the astronauts' tissues by having them breathe pure oxygen—an old trick used since World War II by bomber and fighter crews.

"The standard protocol was to breathe O₂ for four hours prior to decompression (pre-breathe) to reduce nitrogen to a much lower level. This protocol was problematic, however, in that it made the length of space walking days longer than allowed by NASA, and consumed limited high pressure oxygen stores. Hence, our goal was to develop new protocols to speed nitrogen elimination during pre-breathe by combining oxygen breathing with controlled

exercise. (Adding exercise into the equation increases

the blood flow, which results in a faster nitrogen washout, but too much or too aggressive exercise can promote bubble formation and increase risk—this is the dualism of exercise).

"The same principle regarding blood flow actually applies to divers as well, but again

careful thought must be applied. If a diver exercises whilst descending or at depth, the inert gas absorption will be accelerated, effectively increasing the decompression obligation. A diver who does light exercise during decompression will accelerate inert gas elimination from his or her tissues, just like an astronaut who breathes oxygen. Too much exercise during decompression, however, can increase bubble formation and the risk of decompression insult, so caution must be employed. This

is definitely not a case of 'if a little is good, more is better'—'more' can get you into trouble, and there is no simple way to opti-

Although the astronaut hasn't been diving, he does have nitrogen in his tissues.



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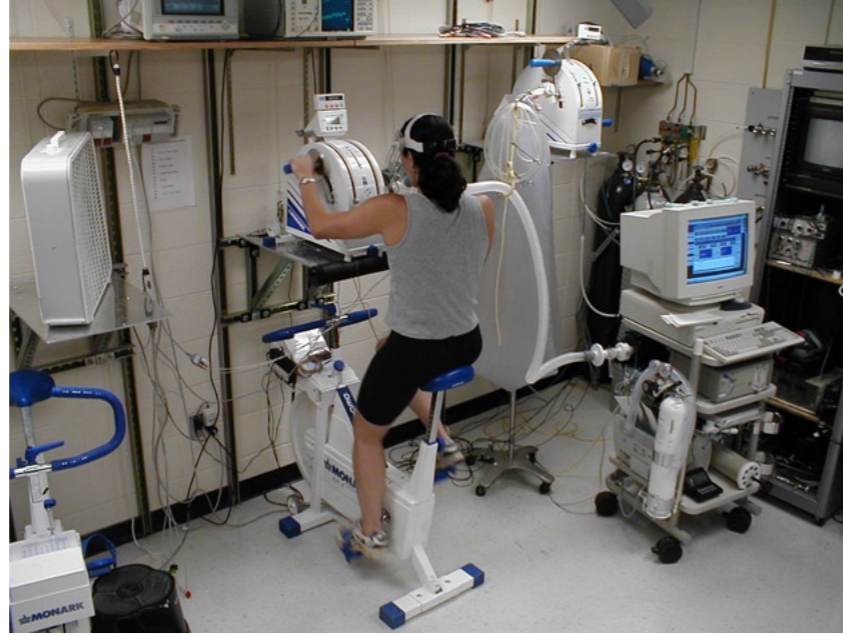
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One of the dangers of space walking is that decompression sickness will result if there is no intervention or treatment.

mize strategies."

A multi-center team developed and tested four protocols initially, resulting in the first protocol approved for flight (and a previous NASA award). The team included research groups from NASA Johnson Space Center, Duke University, University of Texas at Houston and the Defence and Civil Institute of Environmental Medicine [DCIEM] in Canada, and consultants from the U.S. Air Force. Duke subsequently took the lead in testing five



more protocols, with one of these also approved for flight.

"We were all delighted that the new prebreathe protocol, known as 'ISLE' (in-suit light exercise) worked successfully when it was tested in orbit during the STS-134 / ULF6 mission." It was this success that resulted in the current award. "This has very much been a team effort, and it's been a long project," stated Vann. "The genesis of this concept came about in the 1980s.

"I agree that exercising in space sounds quite straight forward to most people, but it does come with its own set of special challenges. The first operational trials by NASA took place during the shuttle missions when astronauts used exercise equipment whilst breathing oxygen. The equipment was complicated since it had to be built to avoid transmitting vibrations into the spacecraft during use. Ultimately, a simple cycle ergometer became a very complicated 'CEVIS' (cycle ergometer vibration isolation system). The complexity proved to be logistically cumbersome, failing several times on orbit. Therefore, our next task was to develop a protocol that didn't involve extra equipment. The logical step was for the astronauts to exercise whilst breathing oxygen in the space suit.

"The effect of gravity on Earth is our normal reference standard for exercise. After we lift a leg up, it falls back naturally. In space in zero gravity, when we lift a leg it keeps on moving. So, exercise in microgravity is different. The astronaut must be anchored to the wall, and then work to initiate limb movement, to stop it at the end of the movement range, and to initiate movement in a new direction."

Pollock and Vann also work at DAN Headquarters in Durham, respectively as Research Director and Consultant. They are two members of the team behind Rebreather Forum 3. ■



Bones of early Americans disappear from underwater cave. File photo by Kurt Amsler

Bones of early Americans stolen from underwater cave

The missing bones belong to a skeleton dubbed Young Hol Chan II, discovered in 2010. The cenote in which it was found had previously yielded another 10,000-year-old skeleton—the Young Man of Chan Hol, discovered in 2006.

Both skeletons were laid to rest at a time when sea level was much lower than it is today, and the cenote, now about eight metres below the water, was dry. Archaeologists have also found the remains of elephants, giant sloths and other animals in the caves, giving an indi-

cation of what the ancient humans ate. Researchers from the National Institute of Anthropology and History (INAH) in Mexico City have been aware of creeping theft of specimens from cenotes, but they lack the resources to guard the hundreds of sites that dot the peninsula. ■

THIS PAGE: Scenes from the Johnson Space Center Research Chamber and laboratory

Ambient Pressure Diving built the life support system for James Cameron's record dive

Ambient Pressure Diving, the manufacturer of the Inspiration and Evolution range of closed circuit rebreathers, designed and manufactured the life-support system for the submarine in which James Cameron conducted his record to 10,898m (36,070ft)—the ocean's deepest point—Challenger Deep in the Mariana Trench in March 2012. The APD system, responsible for keeping the pilot alive for up to 60 hours, was developed and the first units delivered within four months from the award of contract, APD informed.

This was achieved by utilizing many standard APD rebreather components within the new design, including their patented dual controller—automatic oxygen control system. The system APD developed is essentially a twin rebreather, a pri-



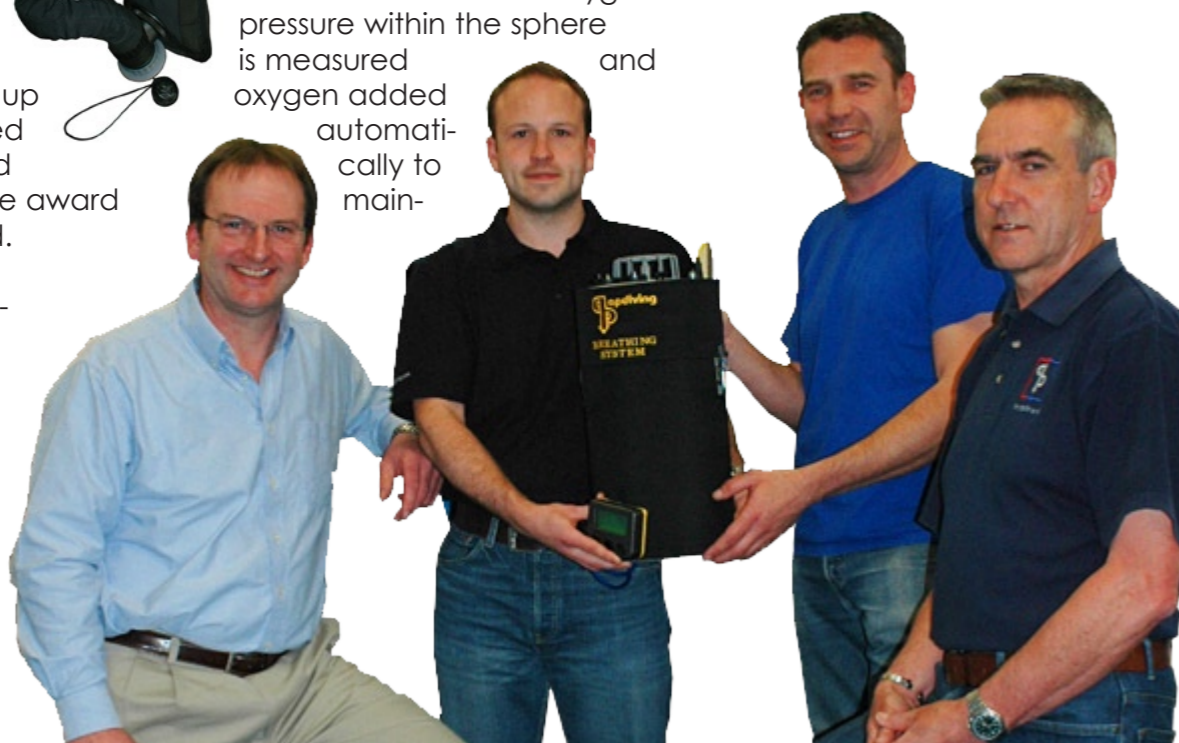
mary and a back-up unit, each capable of 30 hours life support.

The primary is open circuit (to the sub) in which CO₂ is removed by blowing air through the scrubber by electric fan, powered by the sub's own triple redundant power supply.

The independent dual oxygen controllers (primary and backup) each have their own power supply independent of each other and of the sub. Oxygen pressure within the sphere is measured and oxygen added automatically to main-

tain predetermined levels—just as it is in their production CCRs.

The emergency secondary system is closed circuit with breathing hoses to a full-face mask. In this system, the sub pilot uses his breath power to push the air through the scrubber filter. The closed circuit system will keep the pilot alive even if all submarine power is lost and gives the pilot a safe haven should the pilot have to deal with a fire, when smoke, carbon monoxide and fire extinguisher gases would make the cabin air unbreathable. ■



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From the left: Martin Parker (Managing Director), Alex Wall (R&D Manager), Darren Culme (Toolroom Manager), Terry Fisher (Chief Engineer)



Shipwrecks 2012

Reported by Robert Osborne

April 10, 2012 — It may not be the sort of place you associate with a major symposium on shipwrecks. Welland is a small town in the heart of southern Ontario that's seen better days. But there's still one marquis event that takes place here every year: the Symposium on Shipwrecks put on by the Niagara Divers Association. It was started 18 years ago as a way for a few locals to gather and discuss shipwrecks on the Great Lakes and raise money for establishing mooring blocks on wrecks. Today, the event has grown into something much bigger. It draws people from around the northeastern United States and eastern Canada. This year the attendance topped out at nearly 550 people.

The symposium, which took place on March 31, offered an impressive slate of speakers throughout the day. Jack Papes from the Maritime Archeological Survey Team presented a compelling look at a series of dives made to wrecks dating between the mid-1800s and the mid-1900s along Lake Michigan's western shore. Robert Osborne, CTV Producer and underwater film maker gave a multimedia presentation on the World War Two story about the Battle of Bell Island in Conception Bay Newfoundland (see X-RAY MAG issue #47.)

But the star attraction of the symposium

was Jill Heinerth, world renowned cave diver and cinematographer. She gave two presentations during the day—the first a talk on tips on underwater photography. Among the highlights of her first talk, a demonstration on the photography technique known as "painting". Find a pitch black location, take a camera on a tripod and lock it off. Then open up the aperture and run around the area with strobe flashing it on the elements in the scene you want to paint. The result is surreal almost impressionistic photo.

Heinerth's second talk of the day was about a pair of documentaries she's currently working on: Ben's Vortex, a story about a missing cave diver, Ben McDaniel, that plays out with more twists and turns than a John Le Carre novel. The story is full of hints of murder and mobsters and backwoods characters that could have been drawn from the movie, *Deliverance*. Jill and her husband, Robert McClellan, are both involved in getting that piece ready during the next few months. Heinerth also spoke about her upcoming documentary project, *We Are Water*—a film that looks at the close affiliation between



world renowned diver and TV star, Mike Fletcher. He talked about his history as a commercial diver as well as both of his TV series, *Dive Detectives* and *Sea Hunters*.

The afternoon was capped off by another pair of speakers who both described their searches for previously undiscovered wrecks. David VanZandt, chief archeologist for the Cleveland

humans and their water supply and the devastating results that occur because of our lack of concern about this resource.

The other marquis presenter of the day was

Underwater Explorers talked about his group's successful hunt for the shipwreck of the *Sultan*—a two-masted brigantine that went down in 1864. Georgann and Mike Wachter gave a compelling talk on their discovery of a wreck that they believe dates back to the War of 1812. They're still working on a positive identification.

For shipwreck junkies, the week-end was pure pleasure. In between talks, participants could also wander around the many booths that had been set up in the hall. They offered a range of activities from a chance to talk with members of Paul Watson's environmental group, The Sea Shepherd Society, to an opportunity to get close and personal with an number of old brass diving helmets.

All in all a successful day. It may not be DEMA or Beneath the Sea, but this



symposium is rapidly becoming a must attend for serious wreck explorers in Canada and the United States. The Niagara Divers Association is already planning next year's conference. ■





After 70 years on the seabed the Luftwaffe aircraft in Hafrsfjord will be returning to base, which in the meantime has become a museum.

WWII German seaplane to be salvaged in Norway

The unique aircraft was found right outside the Museum of Aviation History in Sola.

On 26 December 1942 when Norway was occupied by German forces, a Heinkel 115B seaplane from the Küstenfliegergruppe 906 based at Sola, set down on Hafrsfjord when one of the floats tore off, capsizing the plane. The crew was rescued and so was one of the engines, but the plane sank to the seabed where it lay forgotten for almost seven decades, until it was accidentally rediscovered, as the Norwegian Charting Authorities were testing new sonar equipment.

Ironically, the plane—which is very rare, as no other specimens have survived—has been laying there for so many years less than three kilometers from the Museum of Aviation History.

Little corrosion

Hafrsfjord is a threshold fjord. The inner part of the fjord, where the wreck is located, has low oxygen values. From an environmental standpoint, this is not desirable, but it was beneficial to the conservation of the 70-year-old aircraft. This means that corrosion is less than one might otherwise expect. Moreover, there

is little movement in the bottom water, so that the wreck has remained stationary. The plane is upside down on the bottom and seems to have suffered very little damage.

However, it is still salty water, so when the plane is raised, it must be immediately removed and rinsed, said Helge Nyhus who sits on the museum board.

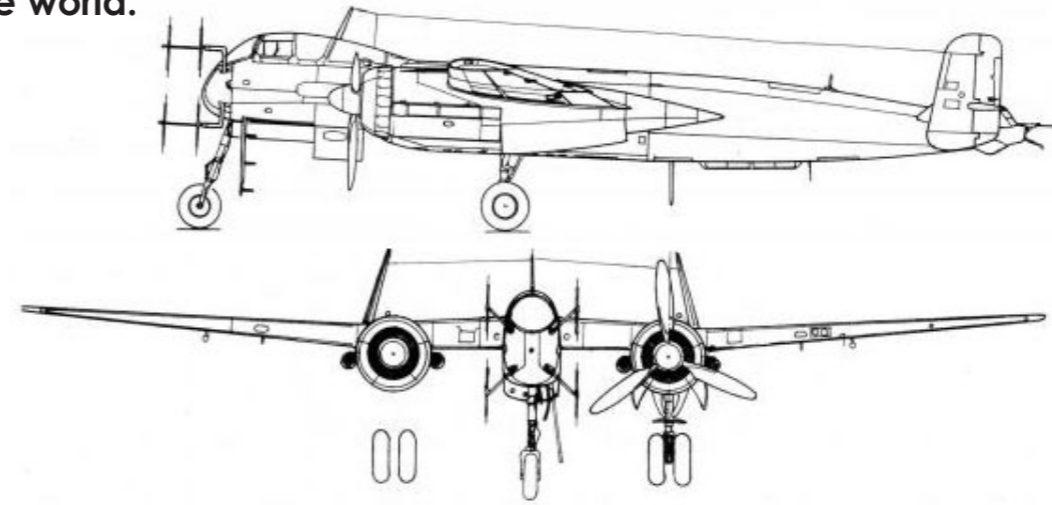
Salvage on June 2

According to plans, the old warbird will be raised on June 2. The goal is to have the aircraft safely placed in a tank of fresh water and hopefully displayed at the Sola Airshow, which takes place the same weekend. ■



Rare WWII German nightfighter found in the North Sea

The remains of a very rare German night fighter from WWII has been salvaged in the North Sea off the Danish fishing port Hirtshals. Only one other specimen exists in the world.



Not only is the German night fighter, which was retrieved from the seabed off Hirtshals, a sensational discovery, but it was also a very surprising one. So much in fact that some regard it a 'ghost plane', as there is no record as to why it crash-landed at sea and sank to the bottom some time during WWII.

As chairman of the Danish Air Historical Society, Ib Lødsen, examined parts of the landing gear from the German fighter, he quickly realized that he was looking at something out of the ordinary.

Surprise discovery

"I had to go around the table a few times," he told Danish daily Jyllands-Posten. "Because I could see that I stood with the remains of a German night fighter of which there only exists one other preserved copy, and it is in the

U.S." This was a Heinkel HE-219th.

Highly advanced

At that time, highly advanced aircraft were designed specifically for night combat patrols. For example, the exhaust was hidden in a long tube, so the flames from the exhaust could not be spotted by the enemy. Furthermore, the aircraft were equipped with ejection seats.

The remains of the aircraft were picked up from the sea last Monday by the salvage firm JD-Contractor. The wreckage

has been taken to the Defence and Garrison Museum in Aalborg where it will be cleaned and restored and eventually displayed.

Depth: 2.5 meters

The wreck was laying in only 2.5 meters of water about 100 meters off the coast of Hirtshals in Northern Jutland since the Second World War. The plane was already spotted by local scuba divers many years ago, but at that point, nobody realised what a rarity it was. ■

Michigan Shipwreck Research Association finds historic wreck

MSRA directors, Jack and Valerie van Heest and Craig Rich, discovered the wreck of a schooner while working with side scan operator David Trotter last summer. It rests in utter blackness 350 feet beneath the surface of Lake Michigan about 20 miles off the coast of Grand Haven. It is a remnant of the Age of Sail on the Great Lakes when schooners

provided the primary means of transportation.

This shipwreck ranks as the deepest schooner yet found in Lake Michigan. MSRA divers waited until a calm day in October to make the dangerous dive because the water is warmest that time of year. They could only spend 15 minutes on the bottom but had to spend two hours

decompressing.

The diver's video revealed an intact two-masted schooner about ninety feet long. A substance below deck may represent the cargo, possibly grain. The vessel has a unique scroll bow seen only on schooners built in the early to mid-19th century, making this a very old schooner.

MichiganShipwrecks.org ■



New airport scanners could end European liquid ban

Although the 100ml carry-on liquid restriction may cease, there are concerns that false alarms may worsen delays.

Having passed the U.K. Department of Transport's trials, the new devices, which can detect explosive properties in liquids, will be installed in all British airports and across Europe by 29 April 2013. While passengers will still have to remove liquids for inspection, they will no longer have to comply with the 100ml restriction. At London's Stansted airport, up to 20 household bins of confiscated items are thrown away daily, with seized items ranging from bottled water to champagne and expensive perfumes.

"I am pleased to see that the Department of Transport has approved a new generation of airport scanners that will allow passengers to carry containers of fluid larger than 100ml," said Sam Shead, reporter at U.K. technology magazine *The Engineer*. "It's frustrating when you have to buy expensive drinks in the departure lounge or throw away toiletries that you had forgotten to remove."

The new scanners have already been tested at a number of airports, including London Heathrow. The results have exceeded expectations of European Civil Aviation Conference's (ECAC) with an almost perfect detection capability.

Although the makers are confident the new scanners will enhance airport

security and improve passenger's experiences, Shead remains sceptical. "I do not think it will alleviate queues in airports, as passengers will still have to go through the process of removing liquid containers from their bags."

The ban on carrying liquids measuring more than 100ml was first introduced in 2006 and has been seen as a huge inconvenience to passengers. ■



File photo of airport scanner. It is not known to us what this type of scanner actually detects

iPads on planes



Pilots can now use iPads at all stages of flights, but not the passengers?

The U.S. Federal Aviation Administration (FAA) have stated that pilots on American Airlines flights would be allowed to use iPads instead of paper flight manuals in the cockpit even during take-off and landing. The elimination of paper charts and reports from airplanes could save upwards of \$1.2 million in fuel per year, although it isn't specific as to whether that's industry-wide or just per airline. Both the iPad I and the iPad II have been approved for use. Other airlines such as United, Alaska and UPS are also reviewing this potential, but none have been approved to conduct flight operations in all phases of flight except American.

In 2006, the FAA request the Radio Technical Commission for Aeronautics to test the effects of cell phones, Wi-fi and other devices on planes. They found no evidence to support the idea that such devices can interfere with the function of airplanes, and they found no evidence that they can affect flight safety. So, why can't passengers use Kindles and iPads during take off or landing? When put in airplane mode, they do not emit any signals. ■



Malaysia Airlines creates a no-child zone

First, it banned babies in first class. Now, Malaysia Airlines has declared a child-free zone on its upcoming Airbus A380s. The child ban applies to the upper deck economy section of its jets, restricting children to the lower deck, Australian Business Traveller reports. The move was revealed in an advisory issued to travel agents, which stated that children under 12 would be banned from the section on its new super jumbo, which is set to make its debut on July 1. ■

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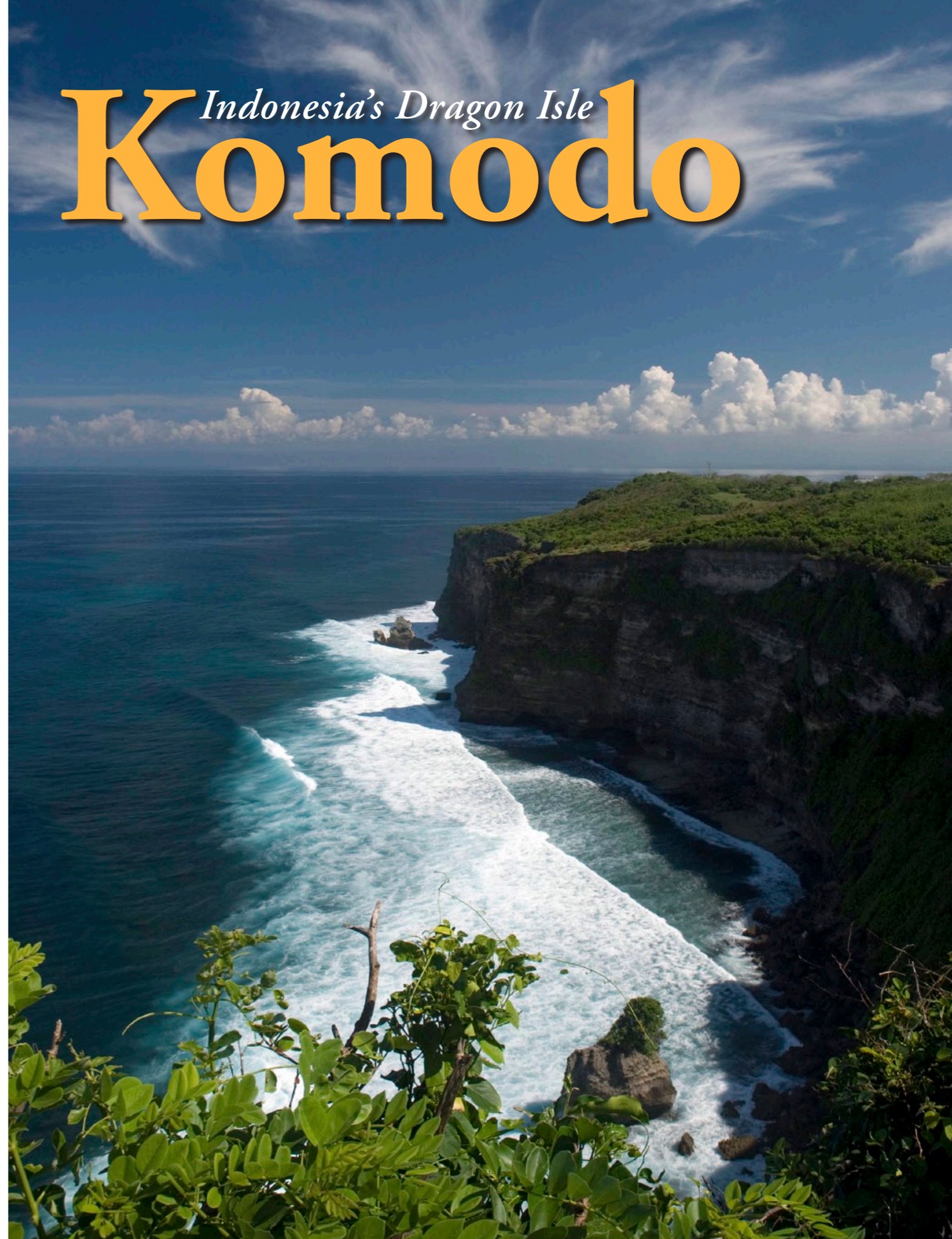



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Indonesia's Dragon Isle

Komodo

CLOCKWISE: The brilliant colors of a fire urchin; An impressive view of the surf break below Uluwatu; Komodo dragon



Komodo Island kept bobbing in and out of my field of vision as we continued to circle in water that was churning. I could almost see the Pacific colliding with the Indian Ocean.

Ali, one of the many talented dive guides from the luxury liveaboard *Arenui*, popped up from the depths and shouted, "The current is going off!"

The negative back roll entry couldn't come soon enough, and promptly, we were plummeting downward in cool blue water swirling with life. Ali was right, the current was pumping, and we worked hard to get down to depth—all the while, jacks and fusiliers were cutting lazily through the water as if there were no resistance at all.

We were here because when two oceans meet, there is magic to behold. The cool, nutrient rich

waters of the Pacific combine with the warm shallow waters of the Indian Ocean are the perfect recipe for thriving life and diversity. Add into the mix a living volcano and deadly oversized lizards and you have yourself Komodo National Park.

The area of Komodo is comprised of three large islands, Komodo, Rinca and Padar as well as 26 more, and was originally protected in 1980 for the dragons themselves. However, later exploratory diving,

Text and photos by
Abigail Smigel Mullens





Komodo



CLOCKWISE FROM LEFT: A snorkeler enjoys crystal clear waters and white sand beaches; One of the visitor's for which Manta Alley was named, located in Tora Langkoi Bay along the south coast of Komodo; Pink Beach magic—a green sea turtle, schooling fish and sun rays. INSETS: Colorful flora of Indonesia

we swam into a flatter patch of the dive site known as Crystal Rock and had a reprieve from the impressive current. Here, brightly colored soft corals bloomed around us, and the fusiliers and trevally continued their tango of cat and mouse above our heads.

When the sun suddenly became blocked, all our heads snapped skyward to witness the fusiliers compacting tightly into a seemingly endless school, as the trevally made their move. It was impressive, and I sensed that we were not the only ones on the reef observing the action.

Continuing on, we again fought the current and connected our

reef hooks to the cusp of the reef. Below us, we beheld the show of white-tip sharks and the occasional



largely by Larry Smith, revealed the wonders below the land of the lizards. Hence, the park, in its entirety, was designated a UNESCO World Heritage Site in 1991.

Diving

Skirting the edge of the seamount,





grey reef shark while our regulators ceaselessly vibrated against our mouths.

Both Crystal Rock and Castle Rock are dive sites where one could feel the power of Komodo's unpredictable and infamous currents. But to really experience the bounty these nutrients' yield, we had to travel south, and add another layer.

The waters in Horseshoe Bay, at the southern end of Rinca Island, harbor constant and unpredictable upwellings of cold ocean water from the Savu Sea. These currents carry nourishment and spark phytoplankton blooms that on one hand drop the

visibility, but on the other produce the most resplendent reefs I have ever laid eyes on.

Tucked in Horseshoe Bay is Cannibal Rock, named for a voracious Komodo dragon observed eating another. To say the reefs are flourishing is an understatement.

Here, life thrived and critters jostled for precious real estate. As we slowly sank down the wall that comprised this dive site, I heard our talented cruise director, Debbie Benton, giggling through her regulator and pointing. On the wall, tucked into some sponges, was the tiniest juvenile warty frogfish I had ever seen. How she spot-

ted it, I will never know.

The icing on the cake was located at the base of the wall in all his pink glory—a paddle flap rhinopia. He shifted to show me his best angle, and I snapped a few photos. The dive just got better as we continued—nudibranchs, sea apples, anemonefish, eels, crabs and more frogfish. I was dazzled by the shades of purple and green, as we made our way up the wall.

In this area, night dives became even more appealing than an early cocktail on the upper deck of our splendid boat. Although they were shallow, 45 feet at most, the black,

CLOCKWISE FROM TOP LEFT: A tight school of fusiliers swim past a soft coral covered rock off Crystal Rock; A pink Paddle Flap Rhinopia mugs for the camera; One example of the unique and gorgeous nudibranchs found in Komodo (*Eubranchus mandapamensis*); Juvenile anemonefish in purple anemone



Komodo

lunar landscape was host to some of the most bizarre critters most of us hoped to find.

I was seeking the bobbit worm. Named after the infamous Lorena Bobbit, this creature is the stuff of nightmares. It has an opalescent, segmented body, topped with incisors that look like they were put there for a reason. Even more disconcerting is that for the three to six inches exposed there is liable to be nine feet more below the sand.

On our second dive at Torpedo Alley, I responded to much tank clinking and swam to a group of at least six divers surrounding one such critter. Apparently no one else had brought their camera, and they ushered me into the stew pot to shoot. As I lined up for my first frame, I looked up and noticed I was suddenly alone with a bobbit worm. One flash of my strobes and the thing emerged two more inches. What was I dealing with here? I wracked my brain but couldn't think of any diver tales of bobbit worm attacks. I shot a few more frames and swam off, looking over my shoulder as I went.

At the opposite end of the spectrum are Komodo's manta rays. One of the best locations

to consistently see these gentle giants is at Manta Alley, located at the southern tip of Komodo Island—although the day boats will tell you, Takat Makassar.

Here, the currents smashed up against the rocks concentrating phytoplankton for feasting. Small mantas skimmed the surface above us while the occasional

large manta swam low across the bottom, over the tops of the divers as if patrolling the deep. These mesmerizing creatures would hover motionless for several seconds and then, with one beat of their expansive wings, disappear into the blue.

Of course, we walked with the

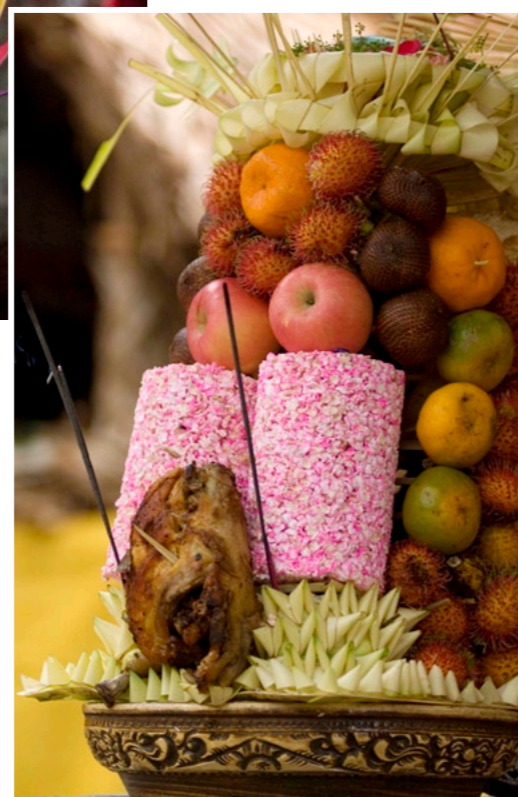


CLOCKWISE FROM ABOVE: Glassy sweepers swirl under a coral outcropping; A lizardfish secures dinner; A cuttlefish profile; Juvenile clown frogfish in the reef



A temple attendee in Bali (left); A small Balinese temple goer (below); One of many Balinese temples (right)

Komodo



A temple offering in Bali (left); A resident of the island of Bali, which flights to Labuan Bajo fly through (right); Something not to miss are Bali's colorful temples (far right)

Komodo dragons as well, the draw for almost 45,000 visitors a year. Unique to this area, they are found nowhere else in the world.

Dive sites

Komodo National Park is comprised of several islands, the largest being Komodo and Rinca. This dive trip is a two-wetsuit trip with warmer waters along the north and waters cooled by upwellings along the south. Although cool water sounds less than appealing on a tropical vacation, with it comes nutrients that creates an explosion of life below the surface.

Hot Rocks. The dive guides will assure you that Gunung Api, the volcano on Sangeang Island, is "alive" rather than active. Black sand contrasts with the fluorescent colors of soft corals and crinoids creating a feast for the eyes. The volcano won't allow you to ignore its presence however, bubbles of gases escape through the black sand in streams that you can swim through.

Castle Rock. An exhilarating dive with strong currents, you will want to bring your reef hook for this one. Hook in and watch the show while whitetip reef sharks pace back and forth along the reef and trevally hunt fusiliers. Don't forget to take your eyes off the show to view lush soft corals all around you.

Crystal Rock. Just the tip of Crystal Rock juts out from the swirling waters, leaving no indication of the riches that

surround its submerged self below. Schools of anthias and fusiliers pulse over the rich underwater landscape of soft and hard corals. If you look into the deep blue you may catch a shark sighting.

Cannibal rock. This dive site got its name from the large Komodo dragon feeding on another of its kind when this area was being explored. Below, the richness of this reef will leave you



awestruck. Frogfish, nudibranchs, anemonefish and even rhinopias, if you're lucky. You won't even mind the cooler temps and green water.

Torpedo Alley. Torpedo Alley is named for the small electric stingrays that can be found here. This shallow dive makes for a productive night dive with usual suspects of frogfish, bobtail squid, skeleton shrimp and even the bobbit worm. Hop from interesting critter to even more bizarre critter for your entire dive at 30 feet.

Manta Alley. This is the spot for in Komodo for diving with mantas. It is located along the south coast of Komodo and harbors strong currents in relatively shallow water that the mantas love. Feeding lazily at the surface or hovering

with what seems like no effort at all, these animals are a sight to behold.

The diversity of life that we witnessed, large and small, land and sea, will keep me coming back to this very special place. A dive location anywhere else in the world will be hard pressed to top it. ■

Abigail Smigel Mullens is an underwater photographer based in San Francisco, California. She specializes in both underwater children's portraits and travel/lifestyle underwater photography. See: www.seastarportraits.com and www.abigailsmigel.com



Komodo



CLOCKWISE FROM TOP LEFT: Underwater photographer, Abigail Smigel Mullens; Residents of Bali's Uluwatu temple; Not a bad view from an Indonesian villa's pool; A Komodo dragon walks along Rinca Island; The *Arenui* with a late afternoon glow

fact file



Komodo, Indonesia



SOURCES: US CIA WORLD FACT BOOK, SCUBADOC.COM, E-MED.CO.UK

History Komodo National Park was established in 1980 and was declared a World Heritage Site and a Man and Biosphere Reserve by UNESCO in 1986. Initially created to conserve the Komodo dragon, the park now encompasses marine species as well as terrestrial.

Geography The Komodo National Park is a national park in Indonesia located within the Lesser Sunda Islands. The park itself includes the three larger islands of Komodo, Padar and Rincah, as well as 26 smaller ones, with a total area of 1,077 square miles.

Climate The climate is one of the driest of Indonesia with annual rainfall between 31.5 and 40 inches. The dry season runs from May to October and the average temperature runs about 100 degrees fahrenheit.

Population Approximately 4,000 people live within the park. These inhabitants are members of villages that existed prior to the park's inception in 1980. Just outside the park's borders the population increases dramatically with

a number just under 17,000.

Currency

Local currency is the Indonesian Rupiah. American dollars are also widely accepted here. There are a handful of ATMs in Labuan Bajo, but your best bet is to bring cash to avoid the high exchange rate.

Language Indonesian is the official language here, with a smattering of local languages spoken as well. Additionally, many people speak English.

Health Malaria and diarrhea are problems in the villages within the park due to the scarcity of fresh water, especially during the dry season. All of Mesa island's water is brought in from Labuan Bajo.

RIGHT: Location of Komodo on global map
BELOW: Location of Komodo on map of Indonesia



Park is on a liveaboard as there are no resorts within the park itself. However, if you choose not to book a liveaboard, Labuan Bajo is a great destination for day trips to the park for scuba diving as well as experiencing the majestic dragons.

Getting There

The jumping off point for Komodo is Labuan Bajo. Flights are almost daily from Denpasar, Bali via the four airlines Merpati, Lion Air, Trans Nusa and Indonesia Air Transport. Your liveaboard will more than likely assist in booking this leg of travel.

Web sites

Indonesia Tourism
indonesia.travel ■

Decompression Chamber

Unfortunately there is no decompression chamber in and around Komodo. The closest chamber is located in Bali, Indonesia.

BALI, INDONESIA
Sanglah General Hospital
USUP Sanglah Denpasar Jl.
Diponegoro, Denpasar 80114
62-361-227911 extension 232

Planning Your Trip

Currently the only way to sleep in Komodo National





ANDREY BIZYUKIN

Issues with cyanide fishing

The coral reefs of Komodo are amongst the richest in the vast Indonesian archipelago and yet, despite being designated U.N. World Heritage Site and a National Marine Park, they continue to be plagued by the twin scourges of cyanide and dynamite fishing.

The remoteness of the 202,340-hectare reserve means that it is extremely difficult to police the marine park, and rogue fishermen take advantage of this to ply their incredibly destructive practices.

There are conflicting reports as to the severity of these practices, with dive operators and conservationists saying the government is not doing enough to protect the area while Sustyo Iriyono, the head of the marine park authority, said problems are being exaggerated and denied claims of lax enforcement.

Iriyono said park rangers have arrested more than 60 fishermen over the past two years, including a group of young men captured recently after they were seen bombing fish in waters in the western part of the park.

One of the suspects was shot and killed after the fishermen tried to escape by throwing fish bombs at the rangers, Iriyono said. Three others, including a 13-year-old, were slightly injured.

"You see?" said Iriyono. "No one can say I'm not acting firmly against those who are destroying the dive spots!"

Dive operators beg to differ and say enforcement has dropped dramatically since 2010, when the government reclaimed sole control of operations.

For two decades before that The Nature Conservancy, a U.S.-based nonprofit organization, had helped the government confront destructive fishing prac-

tices in the marine park by creating "no-take zones", protecting spawning areas, putting coastal areas off limits and using park rangers, navy personnel and local police to enforce the restrictions.

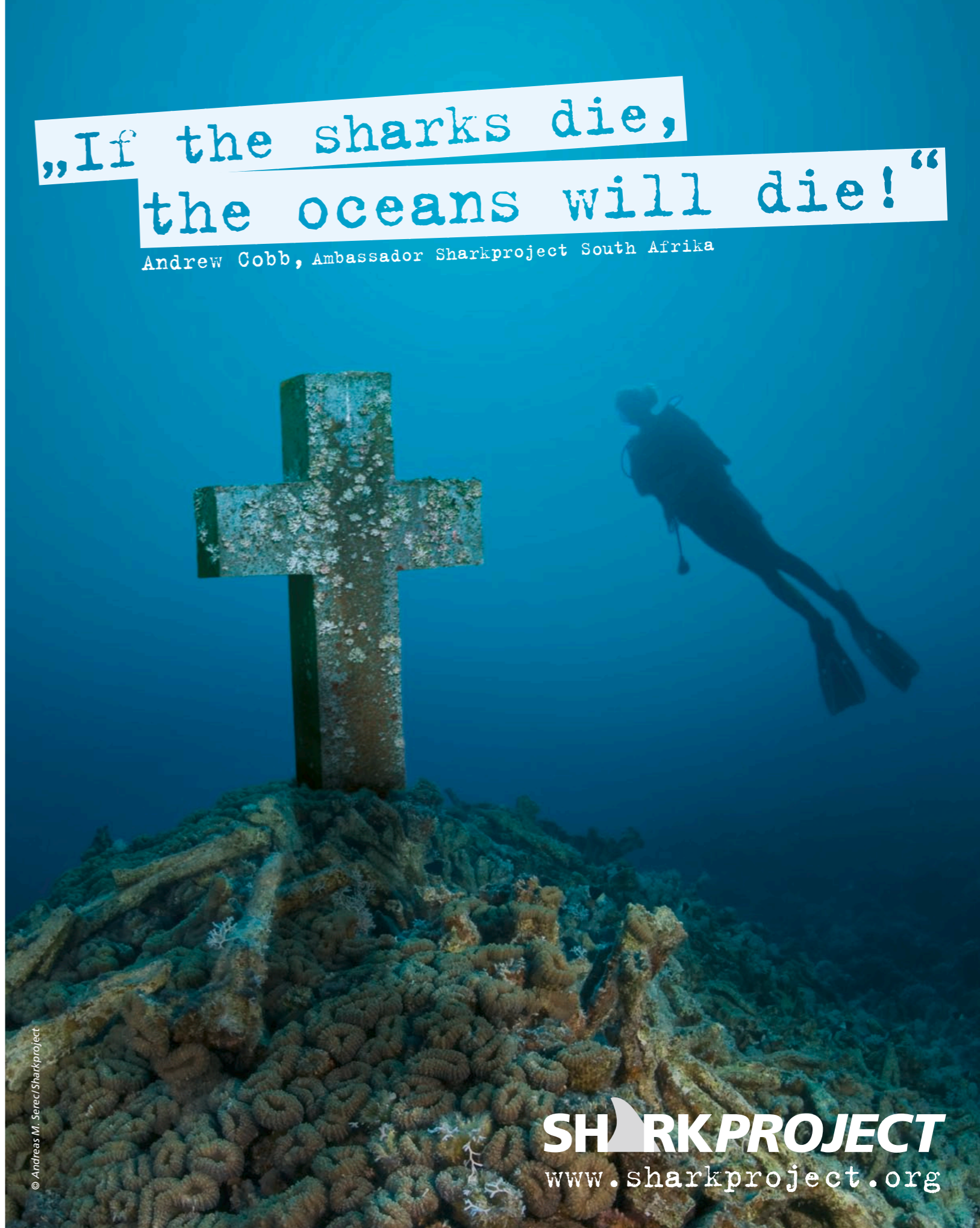
Then in 2005, the government gave a 30-year permit to Putri Naga Komodo, a nonprofit joint venture company partially funded by The Nature Conservancy and the World Bank to operate tourist facilities in hopes of eventually making the park financially self-sustaining.

Entrance and conservation fees, previously just a few dollars at the time—went up significantly giving the park, with around 30,000 local and international visitors annually, a budget of well over US\$1 million. But outraged government officials demanded that the funds go directly into the state budget and the deal collapsed in 2010, when Putri Naga Komodo's permit was terminated.

■

„If the sharks die,
the oceans will die!“

Andrew Cobb, Ambassador Sharkproject South Afrika



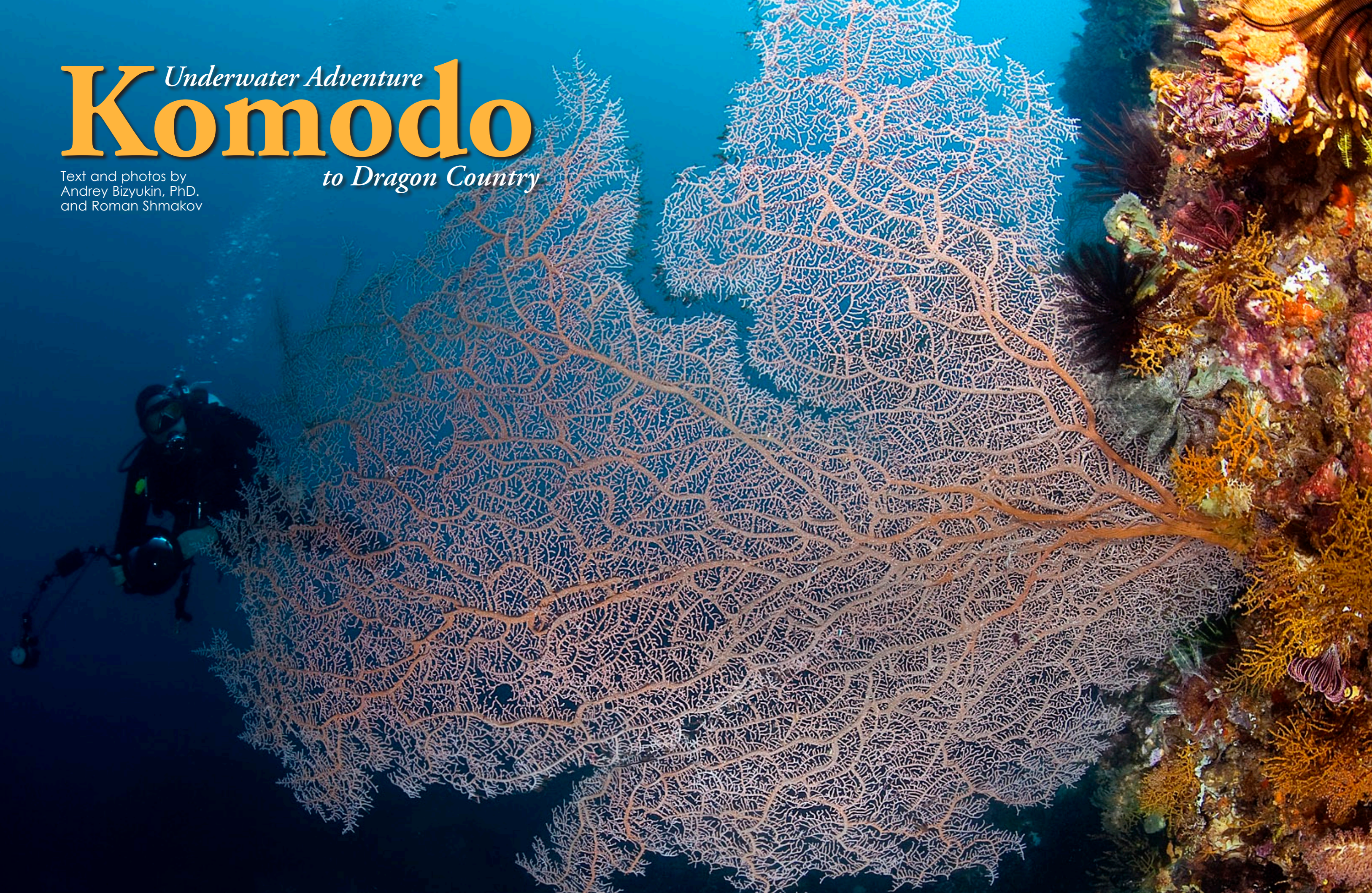
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SHARKPROJECT
www.sharkproject.org

Underwater Adventure **Komodo**

Text and photos by
Andrey Bizyukin, PhD.
and Roman Shmakov

to Dragon Country





Komodo



Komodo is a wildlife paradise both on the surface and underwater, with many quiet bays hidden from prying eyes—an ideal haven for pirates. Frogfish (right)

The new year was coming—the Year of the Dragon on the Chinese calendar—when an old friend of mine called from Singapore and told me about the amazing diving on Komodo Island, where the last living dragons on our planet still existed. In anticipation of the Year of the Dragon and the possibility of diving off the island of the descendants of dinosaurs made my heart beat faster, pushing me to pursue this adventure.



Komodo dragons. PREVIOUS PAGE: Diver and giant gorgonian at Komodo

Our plane landed at Denpasar International Airport. We took a short trip to the Benoa marina and stepped onto a large, two-masted, four-decked schooner with a magical name, *Damai-II*. The luxury boat with a length of 40m and a width of nine meters was designed for only ten guests, primarily underwater photographers. The vessel had a sculpture of a graceful mermaid under the bowsprit and the largest diving deck we had ever seen.

The photography room was equipped with specialized

areas for ten cameras, as well as tables and shelves for complete comfort when working with the equipment. Individual seats were equipped for each diver including a bench with a personal locked cylinder and an individual snow-white tub with fresh water for rinsing of underwater photographic equipment. All these features were of course immediately fascinating to us. There was a joyful smile on each team member's face. The large cabins had all the amenities. Fresh plush towels and bathrobes reminded



CLOCKWISE FROM ABOVE: Tropical storms with thunder and lightning followed our liveboard and dazzled us almost every night; Feather star; Brilliant soft corals; Clownfish in anemone; Giant sponges (right)

me that we were in the heady realm of luxury.

The journey

Our ship moved slowly between magical mountainous islands under the unfamiliar constellations of the southern hemisphere. A

bright moon lit our way. Light sea breezes soothed me. There were distant flashes of lightning in the night sky and faraway sounds of thunder. In anticipation of the approaching tropical storm,

I sank into sleep with thoughts of what it would be like diving Komodo, a place that made it onto the list of the Seven Wonders of the World in 2012.



people have had the opportunity to sunbathe on a beach of black sand. I wondered what was underwater.

Sangaung Island. On the way to Komodo, we did a couple of dives close to Sangaung Island. An underwater eruption created the broken valleys and hills of the island with the peak of its highest mountain reaching 1,200m, covered with black volcanic sand. Few

We dived at the cape, which protected us from tidal currents, and the water visibility immediately amazed us—about 30m. We started the dive in 29°C water. At depth, we passed through a thermocline and met 26°C water temperature. Right away, my 3mm wetsuit seemed too cold.

The underwater landscape of the island was a vast meadow of black volcanic ash—sand

partially covered with fresh colonies of corals and sponges. An unusually bright variety of colors immediately caught my eye. The corals seemed to be the same as everywhere else, but they looked much brighter and more saturated in color—astounding. We were immersed in an underwater canyon six to eight meters wide with completely vertical walls. It was dotted with huge gorgonians in purple, brown and green



Huge corals full of pygmy seahorses enchant divers for a long time



Nudibranches, big and small sea-horses, multi-colored mimic octopuses and giant-sized frogfish are typical at many of Komodo's dive sites

Hot Stones. Our second dive here was at the Hot Stones dive site. Volcanic bubbles of hot gas came out of the black sand, boiling gently as they rose to the surface. We explored a lava cave and saw an underwater forest of huge soft corals in the black sand, a unique sight with the combination of brightness and color. All of this diversity and variety created in our minds the feeling of being in another world, where one could still see the

creation of a natural masterpiece of color, poured against a background of black sand.

Bima Inlet. Despite our passionate desire to see the Komodo dragons as soon as possible, our guides strongly advised us to spend one more day diving on Bima Inlet (a site with a very fuzzy bottom). The first impression of the dive was just awful—full of muddy water. The visibility was about three meters. All it took was one awkward movement of the fins and muddy clouds lifted up from the bottom, covering everything with a thick layer of silt. But after a few moments of letting the silt settle, we started to look more closely through the murky

haze. We froze in surprise. We began to pick out the outline of a huge frogfish, unprecedented soft corals and large sea-horses. Just a few yards further were two eye-catching striped shrimp and a few frisky octopi merging with the environment. Sand wafted outward from the writhing edges of these strange creatures with legs sticking out in all directions (like a new species of sea urchin). We then realized that we were in a macro-lover's paradise.

We paid closest attention to three frogfishes of various colors (yellow, black and red spotted). The yellow one was swimming around us, posing for photographers at different turns. The black one followed the red one relentlessly, so that the camera always framed two



shades, gray bushes of black corals, huge sponges, as well as stunning caves filled with curious fish.

We combed the bottom of the canyon in search of leopard sharks, which had been seen here at a depth of 40m just ten days ago by divers who came before us. My pressure gauge showed my air dwindling, but still, no

sharks.

The underwater landscape around was truly unique. To avoid the strong current, we had to quickly retreat back to the surface through a nearby canyon. We followed the computer's advice, made a micro bubble stop and returned back to the warm, sunny world of humans.



Komodo



THIS PAGE: Komodo diving is an unforgettable paradise for macro photography

frogfish and a diver.

At one point, the yellow frogfish climbed onto a diver's back and inspected him from top to toe, not forgetting to look into the lens of his camera at the same time. Finally alone after the underwater photographers had enough of shooting and turned away from the frogfishes, the yellow one looked longingly after the retreating humans, already upset by the divers' neglect, and crept back into his cozy nest under a huge rock. After 85 minutes of immersion, rejuvenated by so many impressions, I came back on board the ship with only 40 bars in the tank.

Diving Komodo

At last, we anchored off the long-awaited country of the Dragon. We had been anxiously waiting to dive Crystal Rock and Castle Rock,

the two sites known as the best dive sites of Komodo. From the protected bay, we went out in a small speed boat in the direction of the three rocks standing in open sea about a kilometer from the shore.

Our guide told us that it was very important to know the direction and strength of the currents in order to be able to get the whole group of divers quickly underwater. Once in, we fell like stones onto the reef. Indeed, the force of the current was so strong that it literally pushed us to the wall. We constantly had to deal with strong current. Air consumption increased several times beyond average, especially if you were carrying your camera underwater.

Our team members had various levels of diving

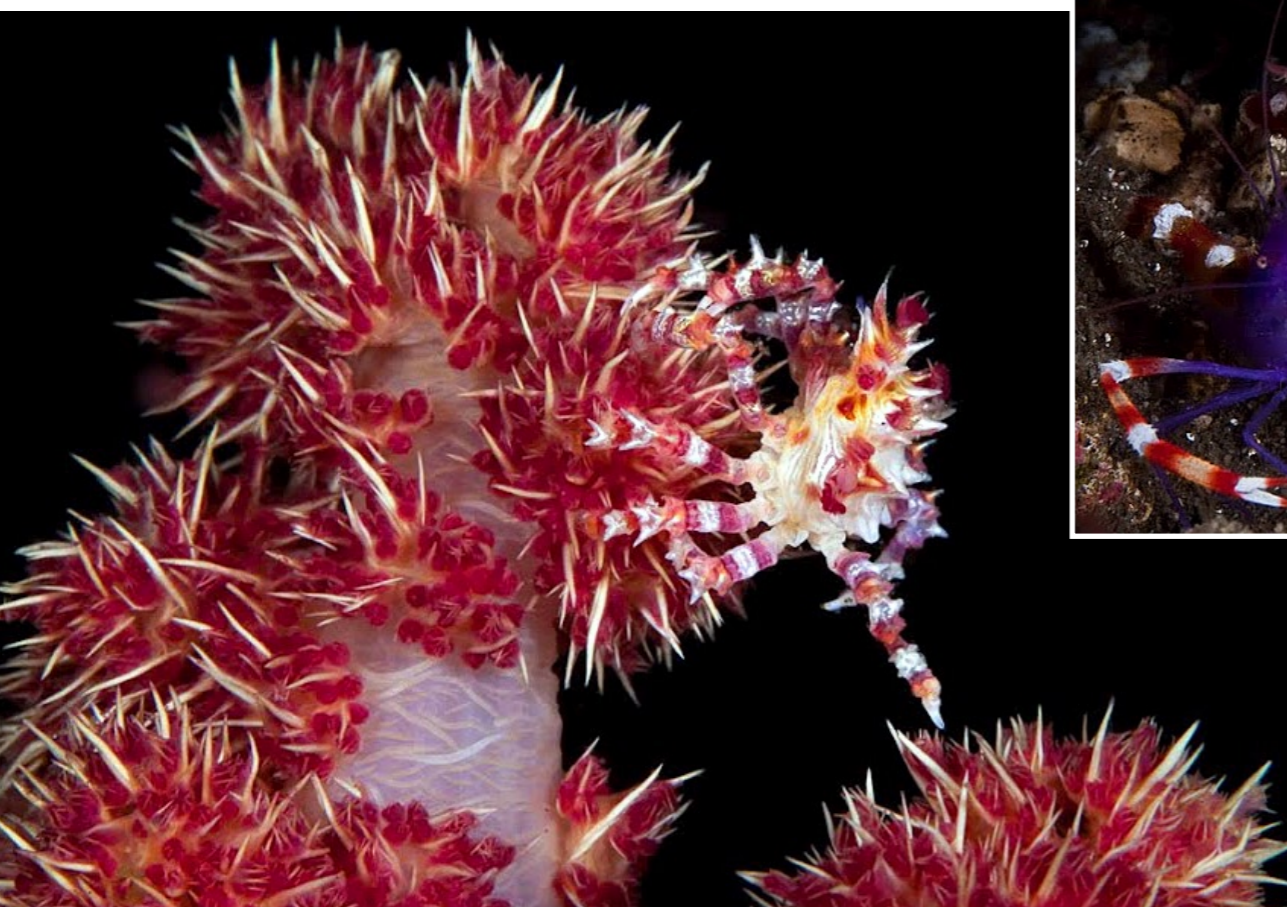


experience, so we flew over long distances at different depths. I lost my friends quickly and caught a stone, hung on for a minute to catch my breath and looked around. Somewhere at



Komodo

THIS PAGE: Komodo is an exciting place for marine biologists looking for new species, discoveries and scientific descriptions



the bottom of this 'Big Blue' there just had to be a shark. With this in mind, I rushed towards the depths. At 30m, a gentle sandy slope appeared. A pretty blacktip shark emerged out of the blue haze, heading straight towards me. It examined me curiously, all around, making a circle and dissolved into the endless sea. At the bottom, I could see a few sharks in the depths, but they were too far away from me to take any good shots.

Then came the time to go back. I walked along the wall of the reef, as close to the slope as possible, fighting the current, trying not to break the camera, carefully controlling the air flow and regulating my breathing. At

three meters below the surface, the current was so strong that it literally tore at my flesh. And when, after a safety stop, I put myself into the hands of the underwater monster, I flew away like the last autumn leaf ripped off by hurricane winds. The boat, waiting dutifully on the ocean surface, quickly came to pick me up and delivered me back to the world of people where there was once again comfort and the calmly pacifying talk of food and the traditions of the world that surrounded it.

Castle Rock. Before the second dive, I was hoping that it would be more productive in terms of underwater



CLOCKWISE FROM TOP LEFT: Decorator crab; Frogfish; Painted porcelain crab; Moray eel; Boxer crab; Banded coral shrimp; Candy crab



The great underwater biodiversity of these sites attracts many curious and keen visitors, but few can fly to the opposite side of the planet to dive here often. CLOCKWISE FROM LEFT: Green sea turtle; Reef octopus; Harlequin sweetlips; Cuttlefish; Blue-spotted stingray; Porcelain crab



Komodo



photography than the last one. But the dive on the next site, Castle Rock, was exactly the same. Forty minutes of endless fin-kicking and only four black tips sharks, plus some Napoleonfish, an octopus and corals, corals, corals. It was very difficult to take pictures in such strong currents. A photographer feels like a member of an audience riding in a compartment of an underwater highspeed train, outside of which slip by countless wonderful pictures.

A diver named Jeff tried to swim forward as fast as he could against the current in order to take a picture of our whole group dangling off our reef hooks. But when he was still raking a few meters ahead, he suddenly turned around to take pictures, quickly and deftly catching the reef with a hook and lifted up his feet. He immediately found himself in an upright position, head down, and flying over us, making acrobatic flips. In the next moment, he disappeared behind a small rock, where he managed to hide from

the flow.

We all climbed up via a buoy rope and were almost horizontal in position because of the strong current. Those who lost their grip just drifted away into open ocean. After such an extreme dive, a new nickname was coined for us—Flag-team divers—meaning a bunch of divers, caught on corals by hooks, who flutter in the strong current like flags.

Shotgun. Our next dive was at the Shotgun dive site. This was a narrow strait where there were two



currents meeting each other. Hence, the water turned into raging foam at the surface of the strait. We started the dive 500 meters from the entrance to the strait. It was easy for us, as the weak current accelerated gently and

slowly. Its gathering speed carried us forward. A wide channel filled with corals growing on the white sand opened up before our eyes.

We paused near some huge black corals. A large flock of glassfish lived in the corals' branches. We took photos and kept to a smooth pace in our underwater flight along the slope





Underwater photographers can spend hours underwater with great enjoyment and an incalculable number of small, beautiful creatures. CLOCKWISE FROM LEFT: Crinoid shrimp; Blue seastar; Whip coral shrimp; Hairy squat lobster; Yellow sea cucumber; Various nudibranchs; Zebra crab



Komodo



slingshot, I flew up to a depth of four meters, just above the edge of the underwater ridge. Zipping along the current, I dodged huge bumps along the coral reef, all the while shielding my camera with my hands and body. This place had very strong currents, and divers were really flying around like bullets fired from a gun.

Komodo dragons

Our boat maneuvered between mountainous islands. We checked bay after bay for a good anchor site. These quiet bays were well-hidden from prying eyes—ideal havens for pirates.

Most of the large and small islands had symmetrical slopes, which was



of the broad, spacious ravine. We followed a turtle, which didn't like pesky photographers and used the current to easily escape his pursuers.

There was a visible sloping wall of an underwater ridge ahead, which blocked the channel. Here, the water slowed down near the bottom, forming a huge seafood pot. All around us was a soothing quiet. It looked like a great place to take pictures of tropical fish. But a strong current caught me again, and like a stone slung from a





indicative of their volcanic origins. This area of Indonesia was one of the most seismically active zones on the planet. For an experienced volcanologist, it would be immediately clear that the whole surface of the land was relatively recent (in geological terms) and rose out of the water. However, despite the relative youth of this land, it was inhabited by the descendants of one of the most ancient inhabitants on Earth—the Komodo dragon—a creature that evolved many eons ago.

We anchored in a quiet, enclosed bay called Horseshoe Bay. It was surrounded by Cannibal and Head Pelican rocks. Our ship had already been spotted from the shore by two Komodo dragons, which emerged from the jungle onto the open sandy beach. They sniffed and got accustomed to our ship. They headed into the water to get even closer to us, trying to choose a new victim perhaps or maybe looking for some human remains.

There are more than a thousand dragons living on Komodo. Their main sources of food are buffaloes, pigs, deer and monkeys (macaques). But Komodo dragons do not disdain humans. At the first opportunity, they courageously attacked people, thus demonstrating that only they were the true hosts of Komodo Island and did not want anyone else to share their land.

The normal life expectancy of dragons

THIS PAGE: Komodo dragons are the real bosses of the island. They patrol their land, keeping all unsolicited guests at a distance, even if they are humans

is only 50 to 60 years. They mate once a year in the hottest season. The male digs a few shallow pits in the ground. The female lays a few dozen eggs in one of these pits. Then both parents leave the eggs in this underground incubator.

Hatched dragons emerge from the ground after nine months. They are always hungry and ready to hunt prey as soon as they come out of the nest. But they have to escape to the trees, hunting birds and other small inhabitants of the rainforest, in order to avoid becoming victims of their own parents, who are apparently not averse to cannibalism.

The preferred hunting method of an adult Komodo dragon is to lie in wait for a victim and then make a surprise attack, with a quick bite to its prey, at least once. Even if the potential victim



flees after one bite, it has still been inflicted with an extremely toxic range of microbes, which are very comfortable breeding in the mouth of the Komodo dragon. Even one bite of a dragon is enough to kill a huge buffalo, which will die within a week of a bite. Some potent bites of the dragon are enough to kill a large animal after only an hour and a half. The cause of this quick death is sepsis. After an attack, a Komodo



dragon will then haunt its prey constantly, until it dies, and finally, eat it.

The favorite hunting time of Komodo dragons is in the morning when the sun has risen and temperatures warm up. Komodo dragons have attacked one ranger of the national park. He was rescued and survived only by sheer luck. I asked the local rangers: "Do dragons dive?" It turns out that none of them had ever seen a dragon diving, but we all knew that they came up to their necks in sea water and spent a long

time seeking out something in the coastal waters.

Dragons also do not leave out divers as a potential meals on Komodo. There was a case when Komodo dragons attacked divers who came ashore out of the water instead of off a boat. So, here on Komodo, it is necessary to always respect the territorial claims and gourmet tastes of the local residents, day and night.

Cannibals Rock. After making close acquaintance with the dragons, we continued our introduction with underwater world of Komodo and ready for next dive on Cannibals Rock, with a range of 27°C to 32°C water temperature depending on depth. The sea was overflowing with life. Underwater, there were

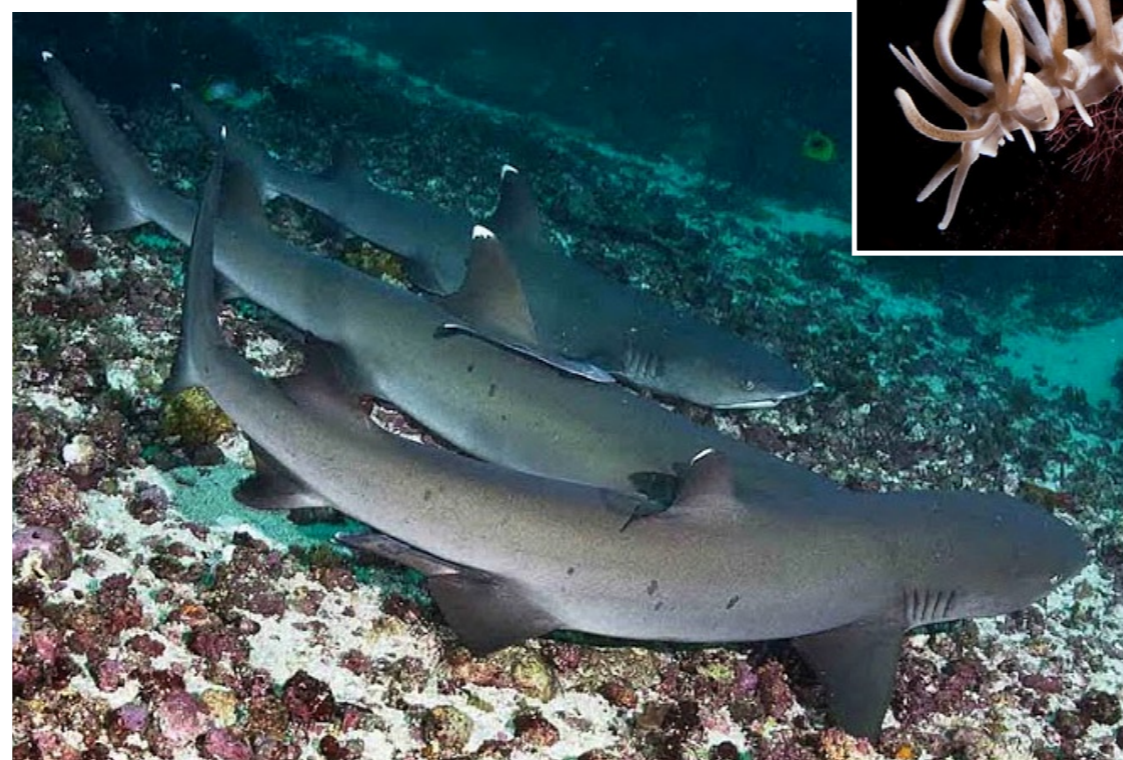
The team placed a buoy, and we leaped into a strong current dive descending to ten meters very quickly. We got on top of the rock, trying to hide from the current and descended to a depth 30m. There should be hammerheads and white tips sharks here. We were promised barracudas and stingrays, too. We went even deeper and crossed a second thermocline. The water temperature dropped to 28°C, and immediately much more life was visible in the cool water—big fishes, jacks, rays and sharks—but too far away from us to take good pictures. It was nice to see these deep sea inhabitants in their natural conditions. They were all such beautiful creatures.

white octopus, sleeping nurse sharks, lots of lemon-colored nudibranchs and huge black coral bushes—in general, a paradise for the underwater photographer, or a person addicted to the contemplation of beauty.

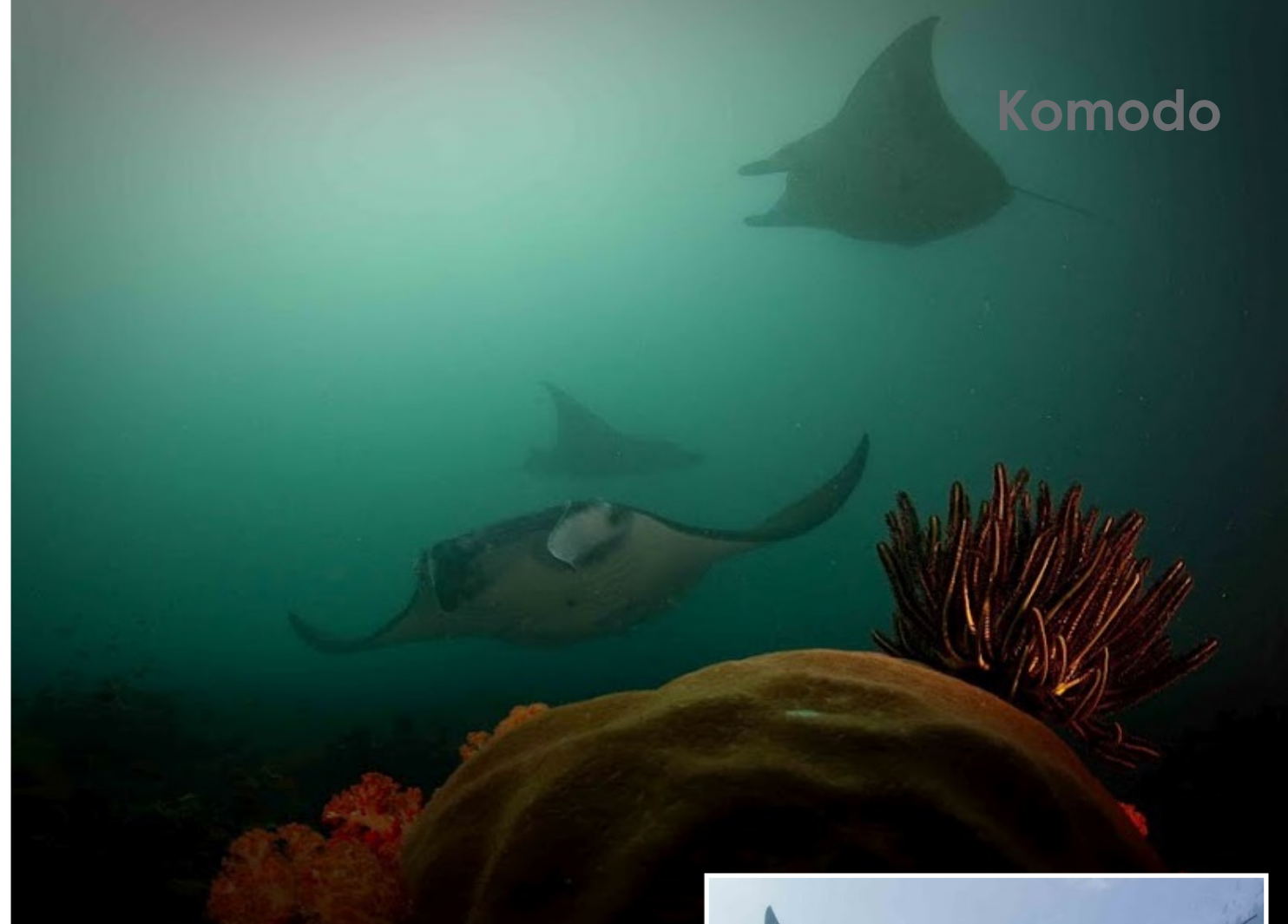
Along the perimeter of the bay, there were always hungry and constantly vigilant Komodo dragons watching from behind us.

Rodeo Rock. We tested our strength at Rodeo Rock, a dive site on the reef at the entrance of the bay.

CLOCKWISE FROM TOP LEFT: School of glassfish; White octopus; Bamboo shark; Scorpionfish; Nudibranch (inset)



Komodo is the country of sharks. They prefer deep, cooler water, which is not so easy for divers to get to. But we were happy to take pictures of at least a few of them: sleeping nurse sharks (above), a friendly group of whitetip reef sharks (right) and the very rare bamboo shark (top right)



Komodo



which brought us a lot of trouble. Someone lost a lid at depth, another was taken almost a kilometer out to open sea, and someone else picked out the buoy. It is not an easy job for the underwater photographer here, if he or she is going to capture pictures of this underwater Rodeo on camera.

Manta Alley. On our last day on Komodo Island, we went to the Manta Alley dive site. This was a narrow and short channel between the Pacific and Indian oceans. And here was the strongest current, as always. But this place had been for many years chosen by large oceanic mantas.

They gathered here in groups of several dozen individuals, and their mouths were wide open. They were relaxed, swinging huge wings as they soared to meet the current, passing through a ton of water and plankton. We were in the mad

flow, clinging to the bottom and hiding behind rocks, trying to crawl up close to them with but one wish—to make another stunning shot.

We had three dives with the mantas at Manta Alley. Time flew by quickly, as if in one breath, with our enthusiasm for the mantas. The beauty and perfection of these fascinating marine giants did not leave us indifferent. The great shots captured will long remind us of the amazing strait of mantas off the dragons' island.

Afterthoughts

With the help of our experienced dive operator, we were pleasantly impressed with the high level of professionalism and diving organization on Komodo. The crew team helped us not only to dive successfully and safely but also to actively engage in photography



during all ten days of diving in such difficult underwater conditions. It was a rare and unique opportunity to dive with professionals who gave us a chance not to be distracted by the little things but be focused only on the most important thing—the process of underwater photography.

Associate editor and cave diver Andrey Bizyukin and rescue diver Roman Shmakov are underwater photographers based in Moscow, Russia. ■

THIS PAGE: Scenes from Manta Alley; Black manta (right inset)



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POINT & CLICK ON BOLD LINKS



Equipment *in the news*

Edited by Peter Symes & Rosemary 'Roz' Lunn



Mares Matrix

The new sleek metal housed wrist computer from Mares features a full-dot matrix high resolution display, tilt-compensated digital compass with bearing function, graphic profile during the dive and multi-gas algorithm. The watch offers the choice of digital or analog time of day display, second time zone and a precision stopwatch. The 35-hour logbook features dive profile graphs at 5s sampling rate. The battery is rechargeable, which means years of maintenance-free use. The charging cradle doubles up as PC (or Mac) interface for downloading dives and for firmware upgrades. Mares.com

TUSA M-211_HR

TUSA has gone back to the drawing board to redesign the humble mask and are quite excited by the result. The TUSA designer and engineering teams spent time analysing mask fit, facial bone structure and mouth movement, hence the Freedom mask has three specific design features—a dimpled skirt, varied silicone thickness and stability ridges. TUSA said that this will reduce leakage in key areas (temple, forehead and around the cheek bone), enhance comfort and fit, and minimise compression whilst maintaining ideal skin surface contact. Other features include a Quick-Adjust Buckle System, 3-D Anatomic Strap and Crystalview lenses with an anti-reflective coating. Naturally the skirts are available in clear and solid black silicone. Tusa.com



Poseidon Ballistic bag

Poseidon's Ballistic dry bags are waterproof, made in ballistic nylon and designed to withstand the toughest environments and challenges. The bags, which come in 20-, 52- and 110-liter sizes are fitted with an additional outside pocket, inside lining with pockets and padded shoulder strap. Only available in black.

Poseidon.com

Light & Motion Sola 2000

Light & Motion's Sola™ 2000 Video lights can be used with multiple camera systems from L&M's housings through to DSLR rigs or action cameras like the GoPro™. It benefits from a regulated output, accurate lumen ratings and a visual dashboard that clearly indicates the power output, battery status and charge status. Light & Motion state this Sola™ light needs zero maintenance, has a flood-free design, an intuitive user friendly ergonomic switch, and is very bright compared to its size—283 grams with mount, up to 2,000 Lumens, 240 burn time at 500 Lumens.

uwimaging.com



Oceanic USA line

A number of manufacturers have adopted a philanthropic ethos of 'paying it forward'. (Breast Cancer research recently received a financial boost with a rash of pink equipment). Now it's the turn of Oceanic with a more patriotic flavour. This product line is slated to hit the shelves this summer, and we believe it will sell like hot cakes. Appropriately coloured red, white and blue, seven percent of Oceanic's sales from this line will be annually committed to their programme to support injured qualified military personnel. It's hoped that this program will provide US\$250 to each of 300-350 qualified veterans to help them purchase diving equipment. Oceanicworldwide.com





Mares Instinct

The hydrodynamic design of this second stage has several advantages. The side exhaust deflects the exhaled bubbles away from the diver's view, and the angled diaphragm combined with the VAD system ensures high performance in any orientation. Openings have been put in the back to minimize the likelihood of freeflows in strong current. The 12S first stage, which is a balanced diaphragm type, features DFC system for consistent flow and comes with two HP and four LP ports.

Mares.com



Aeris Atmos

Due for release shortly, the Atmos from Aeris has seen a revamp resulting in a more competitively priced, lighter weight, good all-around BCD. Aeris said that the combination of the wrap-around air lobes, which snuggle the diver's torso with the rear inflated hybrid air cell, gives the diver a better upright position at the surface. As you would expect to come from the Aeris stable, the Atmos comes with all the usual goodies: depth compensating cummerbund, padded backplate, seven stainless steel D-rings and an integrated weight system. Divers also have an option of a pocket knife mount, large zipped pockets and grommets for retractor mounting.

diveaeris.com

Halcyon Defender



The new Halcyon Defender Pro series of guideline devices expands upon the time-tested utility of Halcyon Defender spools by providing enhanced flexibility and unique operational advantages. The solid center that reduces spool size makes it small and light, enhancing portability, ease of operation and eliminates any risk of catching a finger. The Easy Grip adaptor provides a good grip even with gloves. Available in 30m, 45m, 60m (100ft, 150ft, 200ft) sizes with #24 line.

www.halcyon.net

Scubapro Meridian

The Meridian is a stylish multi-function wrist watch with Scuba, Apnea and Gauge mode. Displays are visually clear and easy to navigate. An intuitive +/- push of a button leads you to more advanced information and data. In Scuba mode, The Predictive Multi-Gas algorithm lets you enjoy the full benefits of carrying high oxygen concentration mixes (21%-100% O₂ compatibility) in addition to your main breathing gas. Meridian's ZH-L8 ADT MB algorithm calculates the decompression schedule for all possible gas combinations and in case you don't switch to the new mix, it adapts the calculation accordingly. The unique integrated Heart Rate Monitor senses your effort, incorporates it into the workload calculation and then adapts the decompression algorithm. The result is safer diving, because each diver is unique, because each dive location and situation is different. Scubapro.com



Lavacore

Thermal protection has vastly improved from the white polyester cotton Long Johns of yesteryear. Today, its amazing looks equally match superlative performance,, and Australia-originated Lavacore is a perfect example of this. The Lavacore range was developed, designed and trialed by a large team of water-sports enthusiasts, and it shows. For instance, a full gusset has been incorporated into the under-arm to offer exceptional arm movement and stretch, whilst an anti-bacterial inner fleece minimizes odour and eliminates bacteria growth. Thought has also gone into the problem of 'riding up', and the rear of the shirt benefits from an extended panel. Both male- and female-specific cuts are available in this adaptable range, offering the diver thermal protection either as a stand-alone garment or as part of a layering system. The four-way stretch high performance material is wind-proof, fast drying and has SPF 30+ protection. Small wonder that thermal protection has hotted up. www.lavacoreinternational.com



Nuytten rolls out the new Exosuit

The EXOSUIT, the next huge leap forward in the world of the undersea exploration, was unveiled at North America's largest diving show, Beneath the Sea, by Dr Phil Nuytten, designer and manufacturer of the revolutionary submersible.

Developed and built in North Vancouver by Nuytco Research Ltd, this hard metal dive suit allows divers to operate safely down to a depth of 1,000 feet and yet still have exceptional dexterity and flexibility to perform delicate work. The amazing technology of the EXOSUIT atmospheric diving system (ADS) maintains a cabin pressure of the surface and still allows the suit to bend due to a unique rotary joint invented by Nuytten.

The EXOSUIT, looking more like a spacesuit than a diving suit, incorporates an advanced design with operational capabilities far exceeding existing present day undersea technologies. The suit is a fully-certified submarine in the shape of a human being. It has its own life

support, which is capable of sustaining an operator for up to 50 hours. There is a fibre-optic tether supplying full network capability between the EXOSUIT operator and the surface. This allows suit telemetry (the monitoring of life-support systems, sonar management and communications), and high definition video to be sent to the surface. The EXOSUIT "flight pack" has thrusters that are more powerful and yet more sensitive to the operator's inputs than previous one atmosphere hard suits, allowing the pilot of the submersible to fly effortlessly through our oceans.

The EXOSUIT is a natural successor to Nuytco Research's original Newtsuit. Like its predecessor, the EXOSUIT will become an invaluable tool for research scientists around the globe, as well as commercial dive companies, military organizations and explorers.

Nuytten, 2012 recipient of the William Beebe Award (given to an individual who has made exceptional contributions to

underwater exploration) from the Explorers' Club, has been involved in undersea construction, technology and exploration for over 40 years. He invented and is the patentee for the "Remora" submarine rescue system (which set the standard for the U.S. Navy mobile submarine rescue system) and a series of deep diving submersibles, the DeepWorker and the Dual DeepWorker. He has also contributed to many Hollywood movies, including James Cameron's *The Abyss* and *Titanic* and formed part of an advisory committee, set up by Cameron, to tackle the Deepwater Horizon oil spill.

In a time when ocean exploration is very much a hot topic, Nuytco's latest creation, the EXOSUIT, is the next generation of undersea technology and will aid humankind in exploring the ocean depths, proving Canada helps lead the way in exploration technology. ■

"Take me to your leader"

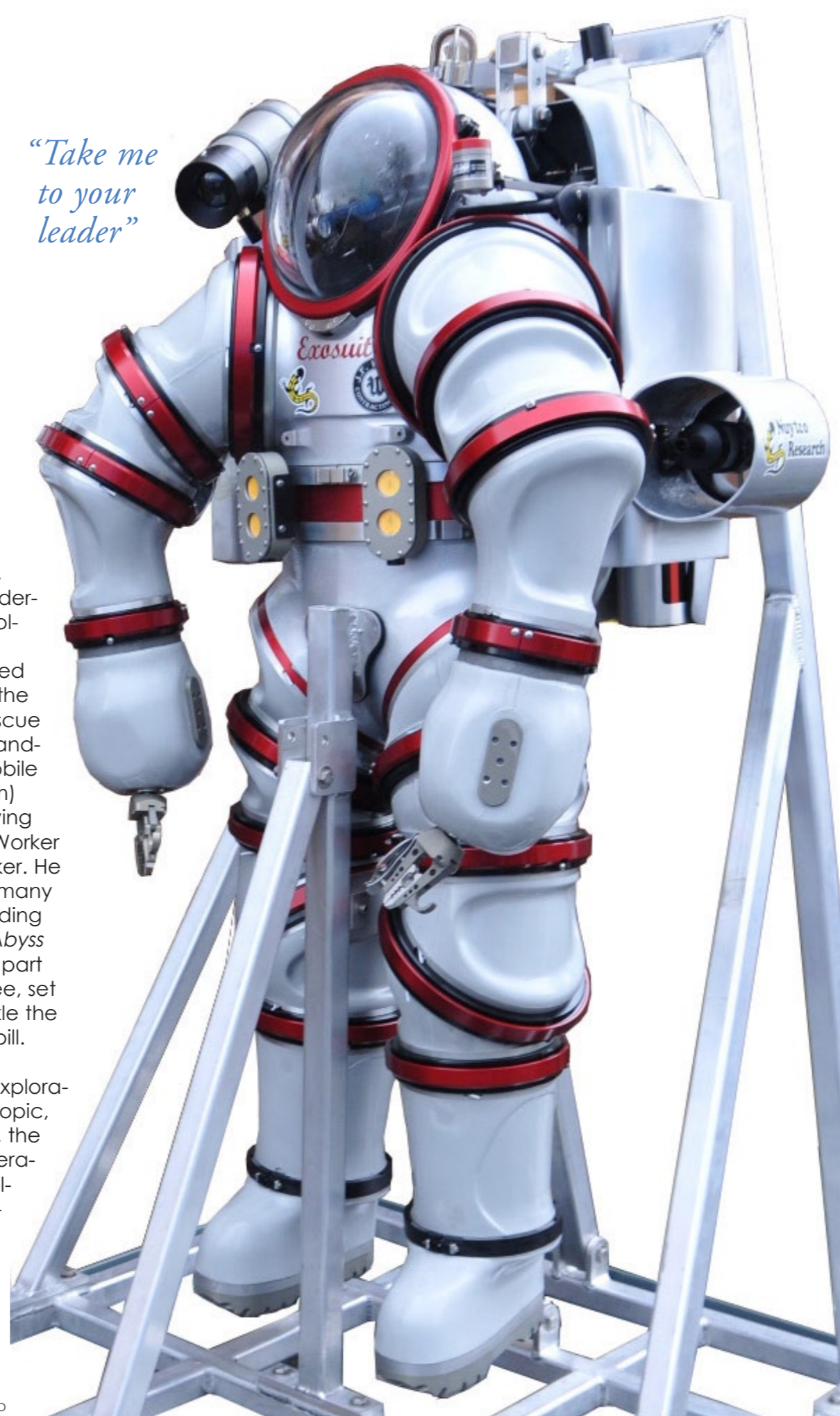


PHOTO COURTESY NUYTCO

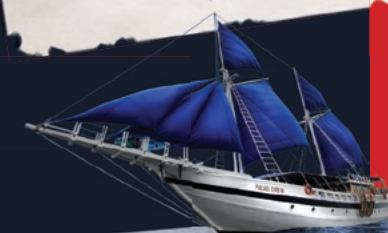


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The Oceanic Archipelago of

Madeira

Text and photos by Nuno Sá





Large anemone and diver at Baixa do Lobo

The oceanic archipelago of Madeira lies approximately 1,000km southwest of Lisbon, right in the middle of the Atlantic Ocean. Located between latitude 30° and 33°N, quite close to the Strait of Gibraltar almost the same as Casablanca (Morocco). Seven islands form the archipelago but only the biggest two, Madeira and Porto Santo, are inhabited and have a harbor and airport. The remaining islands and islets are divided in two small groups, the Desertas and the Selvagens, and are natural reserve parks due to their immense biological wealth.

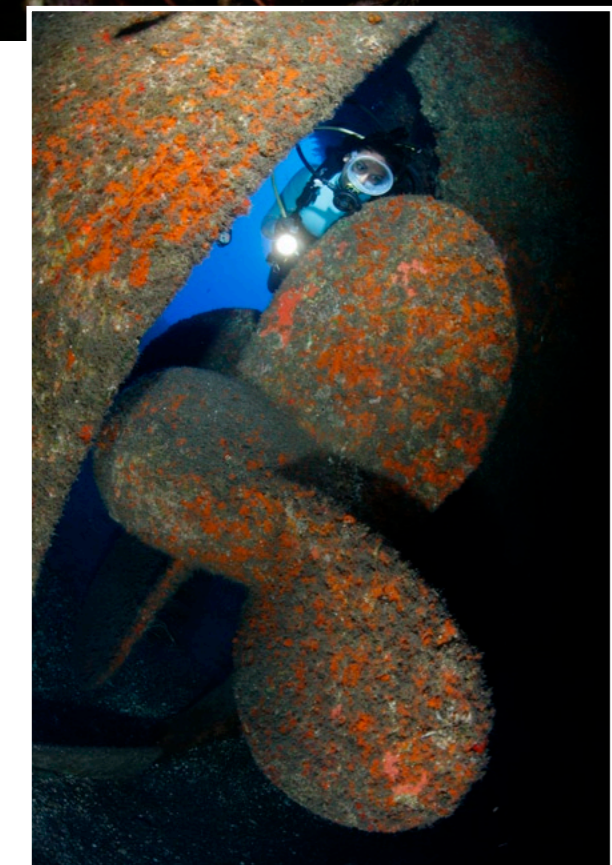
Geographically, located in a subtropical region and conditioned by the southern branches of the Gulf Stream, the archipelago has moderate climate all year round, with no great yearly thermal amplitudes. Average air temperatures range from a maximum of 23°C to a minimum of 15°C, and water temperature hovers around 22°C in summer, gradually lowering to 18°C at the end of the winter.

As in most oceanic archipelagos, the sea topography lacks a continental shelf, reaching high depths at relatively short distances from the shores. These characteristics allow the sighting of ocean specimens such as large pelagic fish, manta ray, turtles and marine mammals in diving spots close to the shore.

The archipelago of Madeira has deep blue waters, with excellent visibility (20 to 35m on a typical summer dive) and



Hikers enjoy the rugged Madeira landscape (above); Diver explores the wreck of *Bowbelle* (left)
PREVIOUS PAGE: Huge school of blue-striped snapper with diver at Garajau Natural Reserve





is home to some 360 marine vegetable species, together with 550 marine fish, 21 marine mammals and an enormous amount of invertebrates. The biodiversity of species that co-inhabit the waters of Madeira is unique worldwide. Being an oceanic archipelago, Madeira has not only Atlantic varieties of species, such as large pelagic fish, but also a wide-range of species from the North Sea to the Mediterranean, as well as some tropical species that have Madeira Island as their northernmost distribution limit.

Diving
Madeira Island offers a wide range

of diving sites, including several wrecks, cave dives and coastal dives. However the top dives on this island are concentrated in a small area called Garajau Natural Reserve. This protected area was the first exclusively marine reserve created in Portugal 23 years ago. Since then, the area has become populated by a wealth of flora and fauna.

This 376-ha (929-acre) natural reserve is located on the south coast of Madeira, not too far from Madeira's capital, Funchal, and has several diving sites marked by yellow marker buoys. Some of these dives can be made directly from the coast, with some diving



CLOCKWISE FROM TOP LEFT: Diver explores cave at Roca Mar; Seahorse at Reis Magos; Dusty grouper and diver at Garajau; Diver and sabre squirrelfish at Garajau



The beautiful Madeira coastline; Diver and school of blue-striped snapper at Garajau (right)

centers offering direct access to the dive sites from the bathing areas of hotels.

Dives in the reserve include several cave dives, including a 35m-long cave (gruta da ponta da Oliveira) with a large air pocket inside where divers can reach the surface. It is often visited by the world's most endangered sea mammal—the monk seal (*Monachus monachus*).

However, the Garajau dive site is by far the most visited of them all, and definitely the top dive site on the island. Depth starts at about 15m but quickly descends to about 30m. During the summer time, the reserve comes alive with shoals of pelagic fish, which pass through the archipelago with the Gulf Stream, such as white trevally or guelly jack, yellowmouth barracuda, almaco

jack and greater amberjack and bastard grunt. Also towards the end of the summer, the graceful and elegant mobula rays can sometimes be seen slowly gliding over the divers.

Here you can also encounter large specimens of barred hogfish and comb grouper apart from all other species that are abundantly present at any dive such as several species of moray eels and colorful anemones. However, a particular species captures the special attention of most divers—the dusky grouper, considered the symbol of the Garajau Reserve.

Dusky groupers at Garajau are very large—they can weigh up to 60kg—but extremely playful and curios, usually following the divers along the whole dive. Due to their longevity—they live up to 50 years—and hospitality, regular visi-

Beach at Porto Santo





tors can recognize particular individuals year after year, such as Malhado (Spotty)—Garajau's oldest, largest and most famous grouper. Three or four dusky groupers can be seen on a typical dive at this site, many times competing for the divers' attentions and usually swimming beside the dive masters that have know them for several years.

Also fun to observe are the large colonies of brown garden eels that in some places cover the sand bottom looking at the divers and quickly vanishing in the sand as they approach.



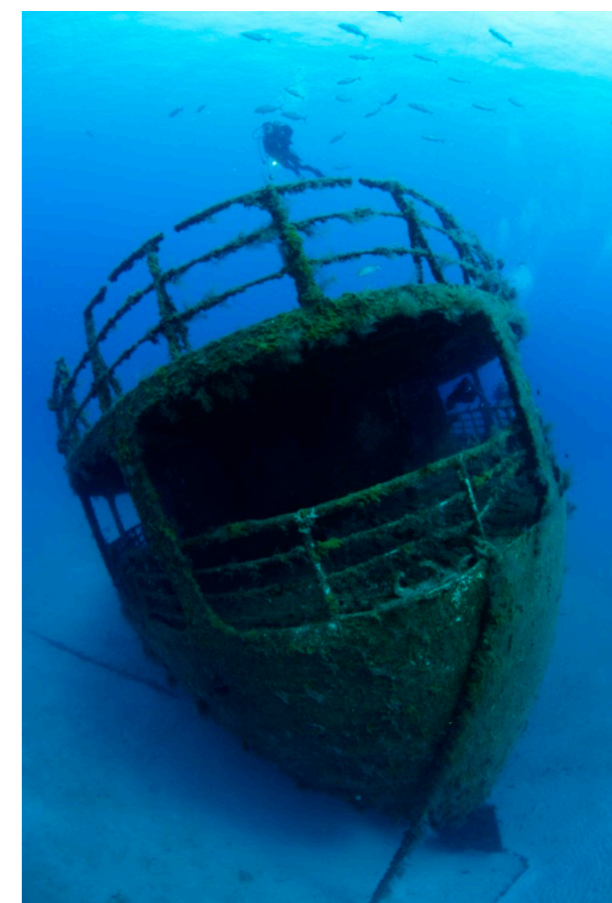
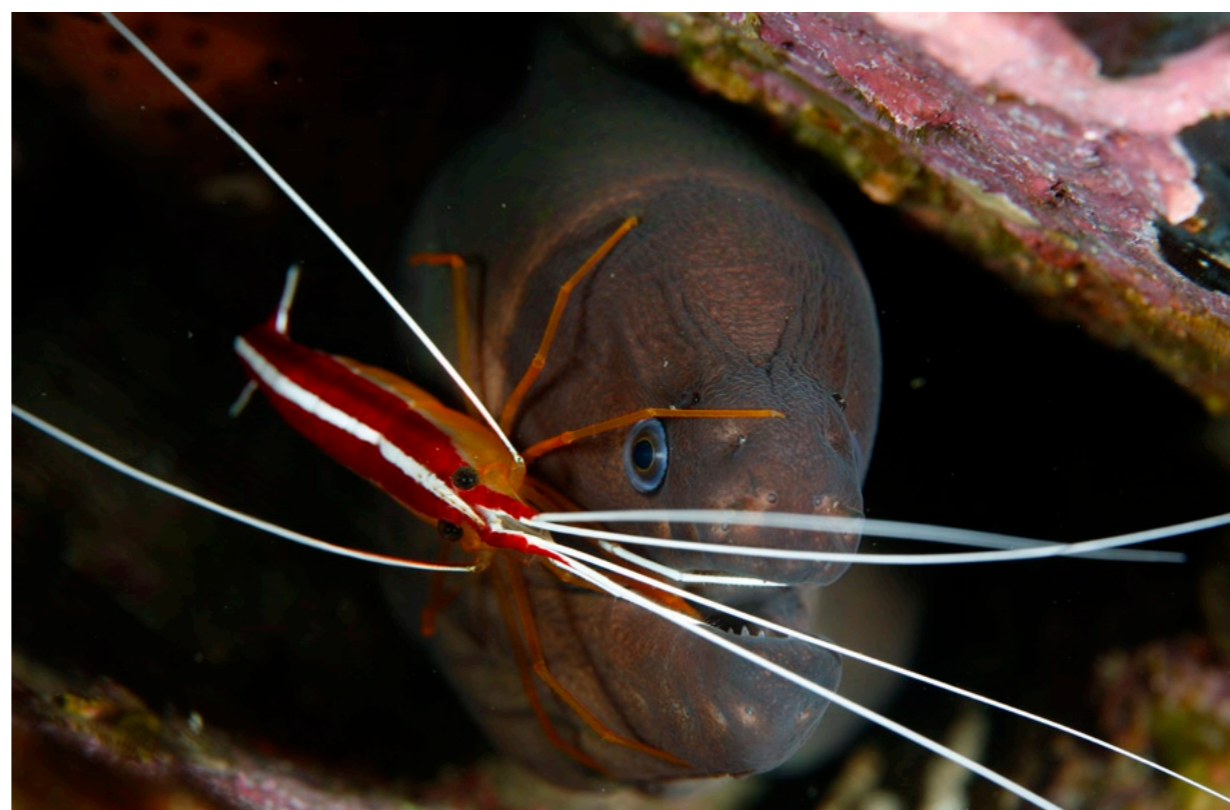
Porto Santo

Just 27 miles off the high rocky cliffs of Madeira, lies the small island of Porto Santo. Although close together these island's landscapes could not be more different, as Porto Santo is a small island with a large coastal plane bathed by five miles of golden sandy beaches.

Less touristic than Madeira Island, it has a calm and easygoing trend to it and is also home to some of the archipelago's

best dives and most pristine waters. With daily three- to four-hour-long boat rides and flight connections, visiting both islands for a one-week dive trip is certainly possible and recommended. Porto Santo also has a large marine protected area, with several dive sites in its borders. Distances to dive sites are, however, larger, and a short boat trip to the main dive sites is necessary.

Porto Santo is home to a huge biodiversity of marine species, which ranges from



CLOCKWISE FROM TOP LEFT: : Diver at *Pronto* wreck; Diver at Desertas Pedregal; The *Madeirense* wreck at Porto Santo; Cleaner shrimp services moray eel at Roco Mar; Fangtooth moray eel at Roco Mar



Madeira

CLOCKWISE: Rugged coastline of Madeira; Map of Madeira archipelago; Diver and big red seastar; Diver on *Bowbelle* wreck

dusky grouper, comb grouper, moray eels to large-sized common and round stingray, shoals of yellowmouth barracuda swimming in circles, white trevally, almaco jack and skipjack tuna.

The best and most well-known dive site in Porto Santo is without a doubt the *Madeirense* shipwreck. This dive alone makes a trip to this island worthwhile. The ship *Madeirense*—a ship that was used for decades to connect Madeira to Porto Santo—was sunk on purpose for diving in the year 2000.

Nowadays, it is filled with a panoply of diverse species from resident dusky groupers to large shoals of other fish. As in Garajau

Reserve, these groupers are very playful and enjoy the company of divers. As soon as divers start the decent to the wreck that lays verti-

cally on the 34m-deep sandy bottom, large schools of fish can be sighted and Big Lips—the wreck's most curious grouper—usually leaves the wreck to meet the divers as they descend.

When approaching the top of the ship, we can usually sight large shoals of almaco jack, white trevally and yellowmouth barracuda all concentrating on the capture of small bogue (*Boops boops*) that wander in their thousands around the wreck. Exploring the inner areas of the ship's bow, we may find other less curious dusky groupers and comb groupers always keeping an eye on the sandy bottom, where resting common stingray and spiny butterfly ray are usually sighted.



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CLOCKWISE FROM LEFT: Squat or sexy anemone shrimp, *Thor amboinensis*, at Roca Mar; Diver spies large triggerfish at Mamas; Nudibranch at Roca Mar

Desertas and Selvagens Islands

Desertas Islands are a group of three major islets located 22 nautical miles away from Funchal and have been a natural reserve since 1995. Visiting these islands is possible with some dive centers and is a three-hour trip from Madeira Island.

The protection of the Desertas Islands and the launching of the natural reserve was mainly caused by the need to create conservation measures for the monk seal, whose population was in danger of extinction in Madeira. This species, classified as threatened (in critical danger) by IUCN, is the rarest seal in the world but can still be sighted on these islands. Its population in the archipelago of Madeira seems to be recovering now. It is currently estimated at around 25–35 specimens. Increase in population tends to increase the distribution area, which now includes some

spots in Madeira island.

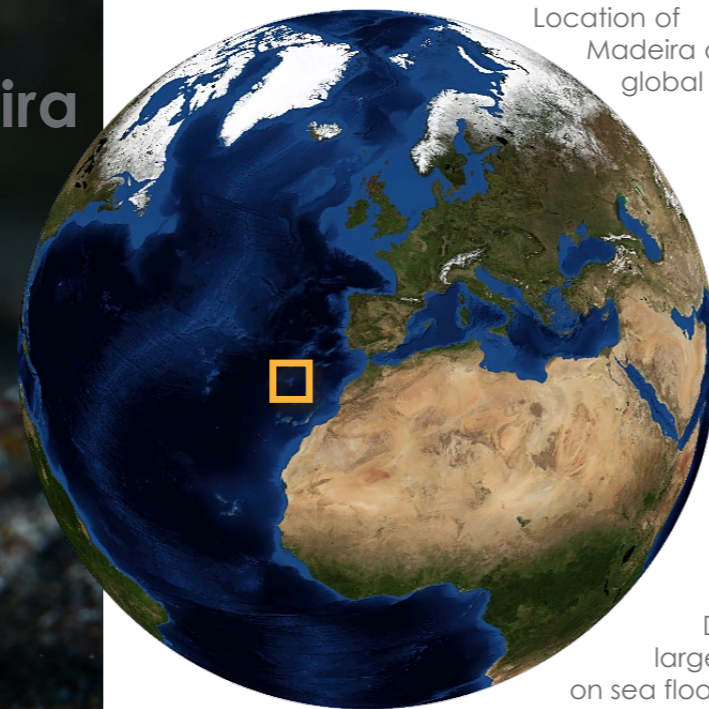
Only half of the reserve can be visited by divers, as the area most visited by monk seals is completely forbidden to navigation, bathing or diving.

The coastal area of Desertas is mostly characterized by steep cliffs only accessible through some rolled gravel beaches in some coastal spots. Its landscape is sculptured by constant sea and wind erosion, extending below the sea level where the rocky formations are true works of art from Mother Nature.

Diving in Desertas can mean a chance to witness large shoals of yellowmouth barracuda, white trevally, almaco jack and great lumberjack, and manta ray. In addition, it is also possible to encounter a sea wolf!

The Selvagens Islands, on the other hand, are located 163 miles south of Madeira and also have three major

Madeira



Location of Madeira on global map

Lizardfish (left)
Diver with large stingray on sea floor (below)

islands. However, diving activities are subject to permission issued by the Madeira Natural Park, and its distance from the other islands in the archipelago is enormous, which vastly limits the ecotourism activities in these islands.

All together, this group of islands has a bit to offer to every diver, from beautiful wrecks, cave dives, pristine waters, a healthy sea life, very reasonable weather year round and just a two- to three-hour flight from many European capitals.

Together with beautiful landscapes, hundreds of kilometers of walking trails, excellent bathing areas and the opportunity to see several species of whales and dolphins on a whale watching trip, Madeira is definitely a destination for keeping in touch with nature.

Nuno Sá is an underwater photographer and author based on the Azores. Visit: www.photonunosa.com

HYPERBARIC CHAMBER: There is one hyperbaric chamber available for the whole archipelago located on the island of Madeira.

DESERTAS: 22 nautical miles from Funchal.

PORTO SANTO: 42 nautical miles from Funchal.

GETTING THERE: SATA and TAP are the Portuguese airlines with daily connections to Madeira. Lufthansa, Spanair, Transavia, Continental, Easy Jet and several European airlines have regular direct flights to Madeira and Porto Santo.

GETTING AROUND: Connections from Madeira to Porto Santo: By boat – Porto Santo Line www.portosantoline.pt By plane – SATA www.sata

Madeira Tourism
www.visitmadeira.pt



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DONG ENERGY A/S

A primer on

Island Biogeography

— *And the common features of decommissioned oil rigs, windfarms, wrecks and artificial reefs*



As most anglers and many divers know by first hand experience, man-made structures on the seabed, whether put there deliberately, such as an artificial reef, or by accident (e.g. a shipwreck) can become a home to numerous species of fish and other wildlife. So, why are these structures sometimes a help to wildlife?

What matters is the physical presence of substantial objects on an otherwise featureless seabed. Granted, many man-made structures that end up on the seabed may also pollute—such as ships going under carrying large quantities of fuel or constructed with materials that may be toxic to marine life—hence, the need to thoroughly clean and strip down decommissioned vessels destined to become artificial reefs. But that side of the matter we'll leave for another discussion.

A structure on the seabed such as a shipwreck does not only provide shelter for fish and other marine life but in many cases also constitutes a physical substrate upon which sessile organisms, such as corals and seaweeds, can attach themselves. In this manner, the structure may become a habitat in its own right, and as such perhaps even an important one.

Consider the scenario where we have two comparable shipwrecks, one of which is positioned in a diverse area with plenty of

Text by Peter Symes





corals or other natural structures, while the other is placed on a barren sandy or muddy seabed. In the latter case, this artificial structure may become a habitat for a range of creatures, which would not survive on the plain bottom. Such a wreck constitutes a virtual island in the middle of a barren expanse. And this is where the concept of *Island Biogeography* comes in.

The focal point of this scientific discipline is the species richness of isolated natural communities. Originally, this field of research was developed to study the biodiversity on actual islands, but the theoretical framework was soon extended to the concept of islands in a more generalised sense—such as an oasis in the middle of a desert, patches of bogs in the middle of farmland or expanses of grassland surrounded by highways or urbanisation. In other words, in terms of biogeography an “island” is any area of suitable habitat surrounded by an expanse of unsuitable habitat—a

definition that also clearly fits a shipwreck laying in sandy area. Henceforth and within the scope of this article, the term, *island*, will refer to this wider theoretical concept rather than only actual islands.

Connectivity and pathways

In addition to their significance as habitats for residing species, islands may also play an important role in facilitating migration by providing the proverbial pit-stop or stepping stones for creatures on the move. These could either be dedicated migratory species where the individuals move due to their own locomotion—e.g. trekking birds—or sessile species that propagate through dispersion of egg, larvae, pollen, seed, etc. Where islands are placed close enough together they may constitute what is termed a habitat corridor, which is a pathway

Where islands are placed close enough together they may constitute what is termed a habitat corridor, which is a pathway or network along which species can migrate across expanses that would be otherwise impossible or prohibitively difficult to cross.

or network along which species can migrate across expanses that would be otherwise impossible or prohibitively difficult to cross. Such immigration is obvi-

In terms of island biogeography, shipwrecks may constitute an island. Notice how the propeller and the rudder of this shipwreck in the Danish straits have become a substrate for soft corals such as dead man's fingers (*Alcyonium digitatum*) as plumose anemone (*Metridium senile*). *M. senile* adheres to rocks, boulders, man-made structures, pebbles and shells. It favours places where the current is strong, where it can catch small organisms floating past. Smaller forms inhabit the lower shore where they are found under stones, beneath overhangs and in shaded places

ously largely dependent on the distance of an island from the source of colonising creatures. Islands that are more isolated are less likely to receive immigrants than islands that are less isolated, and thus also likely to harbour less species. This is known as the *distance effect*.

Number of species

How many species can live on an island? This depends on a number of factors related to both isolation and island size. Among other things, it hinges on the relative balance between immigration and extinction. All other factors being equal larger islands tend to maintain a higher number of species and individuals. Species may actively target larger islands for their greater number of resources and available niches and larger islands may accumulate more species by chance merely by virtue of being larger. Larger habitat size also reduces the probability of extinction due to chance events.

Smaller islands, on the other hand, are more susceptible to fluctuations and disturbances in their environment. For example, epidemic diseases may easier wipe out an entire population on a small island. Populations on less isolated islands are less likely to go extinct because individuals from the source population





DONGENERGY.DL

At Horns Rev, the Danish Energy company Elsam (now DONG Energy) built the first offshore wind farm in the North Sea. A total of 80 Vestas V80-2.0 MW units, capable of producing 160 MW, were installed

and other islands can immigrate and replenish the island population before it becomes locally extinct. This is known as the *rescue effect*.

The literature in species-area relationship is not unanimous but most plots of this relationship clearly demonstrates an equilibrational mechanism that regulates the number of species present on islands.

Recolonisation and species composition

In stable communities, population numbers of component species are generally in rough balance, maintained by density-dependent feedback effects as illustrated by the curves (right), but what happens if this equilibrium is perturbed? Does the system just bounce back to where it was? In a now classic study, the insect fauna on a small mangrove island in the Florida Keys was

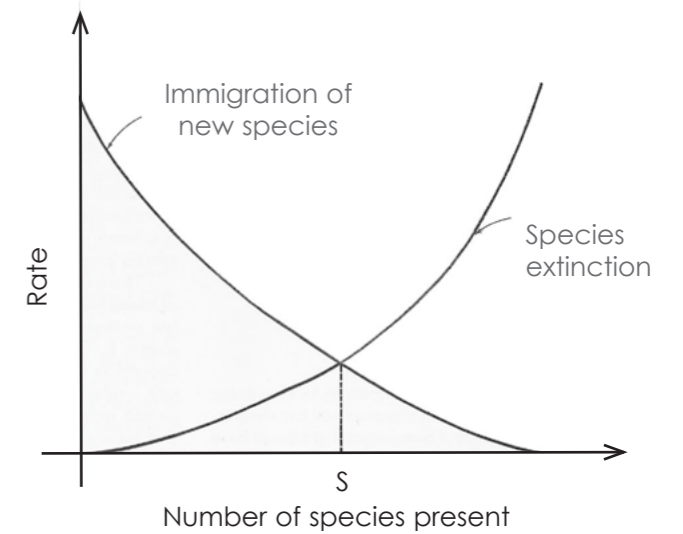
censused. All animal life was removed by putting a cover over the islet and pumping in some toxic substance which killed off all the animal life while leaving plants unharmed. Thereafter, the islands were observed to see how fast they were re-colonised. Once a steady state was achieved, the island had roughly the same number of species present as before they were poisoned. Interestingly, the composition of species was different. Evidently, conditions on the island did not specify which particular species shall live there but determined roughly the number of species that could live there.

Continued censuring also demonstrated that while the number of species living on the island remained the same, the composition changed continually as new species arrived and old ones became locally extinct. As

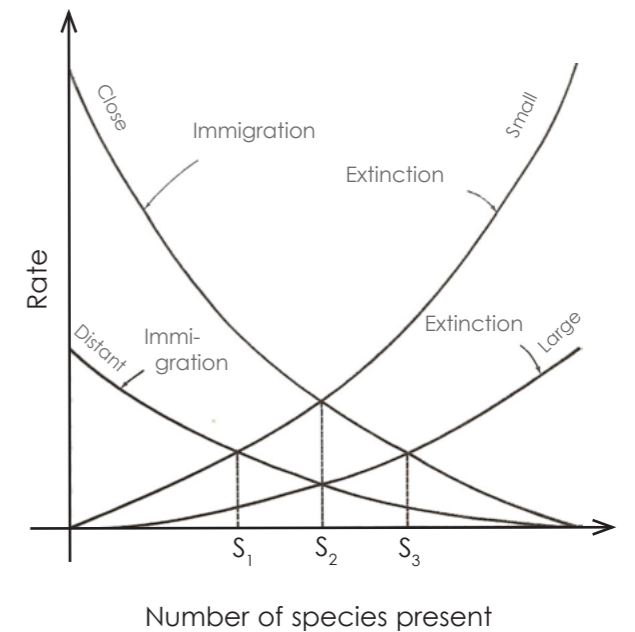
“Horns Rev is situated in an extremely tough environment with strong wave action, which means, for example, that seaweed forests, together with the small fish that live in them, cannot establish themselves. We would therefore expect the positive reef effects to be even greater still in a park located for example in the more sheltered Kattegat.”

—Claus Stenberg, Biologist

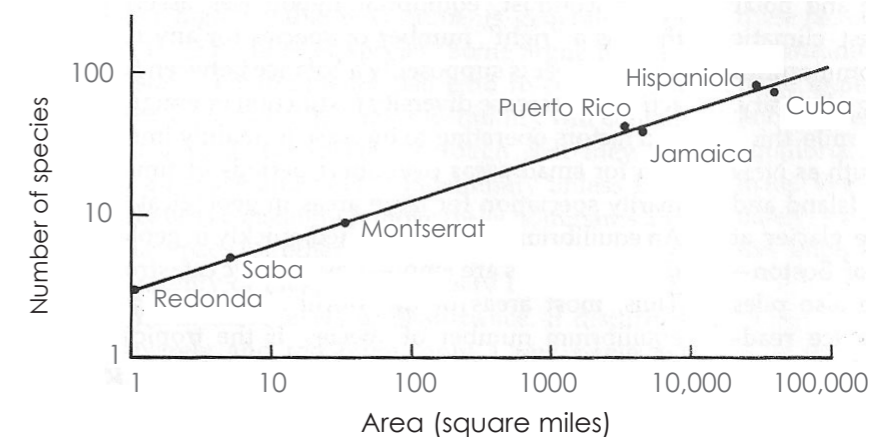
The equilibrium theory of diversity on islands. The immigration rate declines as more species reach the island from a mainland source because fewer migrants will belong to new species. But extinction rate rises as immigration rate declines because as the island becomes more crowded with species, intensity of competition increases and less ecological space remains for new species. The *equilibrium number* (S) lies at the crossing of the curves.



Predictable change of equilibrium number of species with changing size of island and distance to continental source of immigrants. Immigration rates will be higher on close islands, thus raising the immigration curve and pushing equilibrium number to the right (S_3). Equilibrium number will also rise on large islands, but for different reason: the extinction curve is lowered because the island can hold more species. Immigration rates are low to distant islands. The immigration curve is thus depressed and the equilibrium shift to the left (S_1). Equilibrium value also falls for small islands because space is more limited and extinction rates are higher.



Number of species of reptiles and amphibians plotted against island area on logarithmic scales for West Indian islands. The close fit to the straight line with a slope of about 0.25 means that numbers of species increases about one-fourth as fast as island area. Equilibrium theories of diversity predict that number of species should increase in regular way with island area, other things being equal.



REPRODUCES FROM "A VIEW OF LIFE", BY LURIA, GOULD AND SINGER, 1981

REPRODUCES FROM "A VIEW OF LIFE", BY LURIA, GOULD AND SINGER, 1981



the equilibrium was approached, new species had increasing difficulty to gain foothold as successful colonists usurped space and resources, preventing others from settling in. At equilibrium, no new species could be added unless old ones disappeared.

Artificial reefs are not a replacement for natural ones

Recent studies of various shipwrecks in the United Kingdom and the Red Sea have shown that these artificial reefs often create new and different types of habitat than natural reefs. In 2004 the

former Royal Navy frigate *HMS Scylla* was scuttled off the coast of Cornwall, UK, to become an artificial reef. From the beginning, the wreck was closely monitored by scientists observing how the marine life interacted with it.

According to Dr Keith Hiscock, an associate fellow at the Marine Biological Association in Plymouth, who carried out the majority of the colonisation research, the researchers were in for a few surprises. The first two years saw a massive colonisation of sea urchins—a species which are normally found under boulders close to shore. Then wrasse arrived and



Scylla Reef was created when the former Royal Navy frigate *HMS Scylla* was placed on the seabed in Whitsand Bay, southeast Cornwall, after a series of controlled explosions, on 27 March 2004. Since placement, the reef has established itself as a centre for scientific research, a habitat increasingly rich in marine life and a unique destination for recreational divers

ate the sea urchins. A coral on a nearby natural reef only 30 meters from the wreck took three years, but once established on the wreck, they spread prodigiously and unexpectedly quickly.

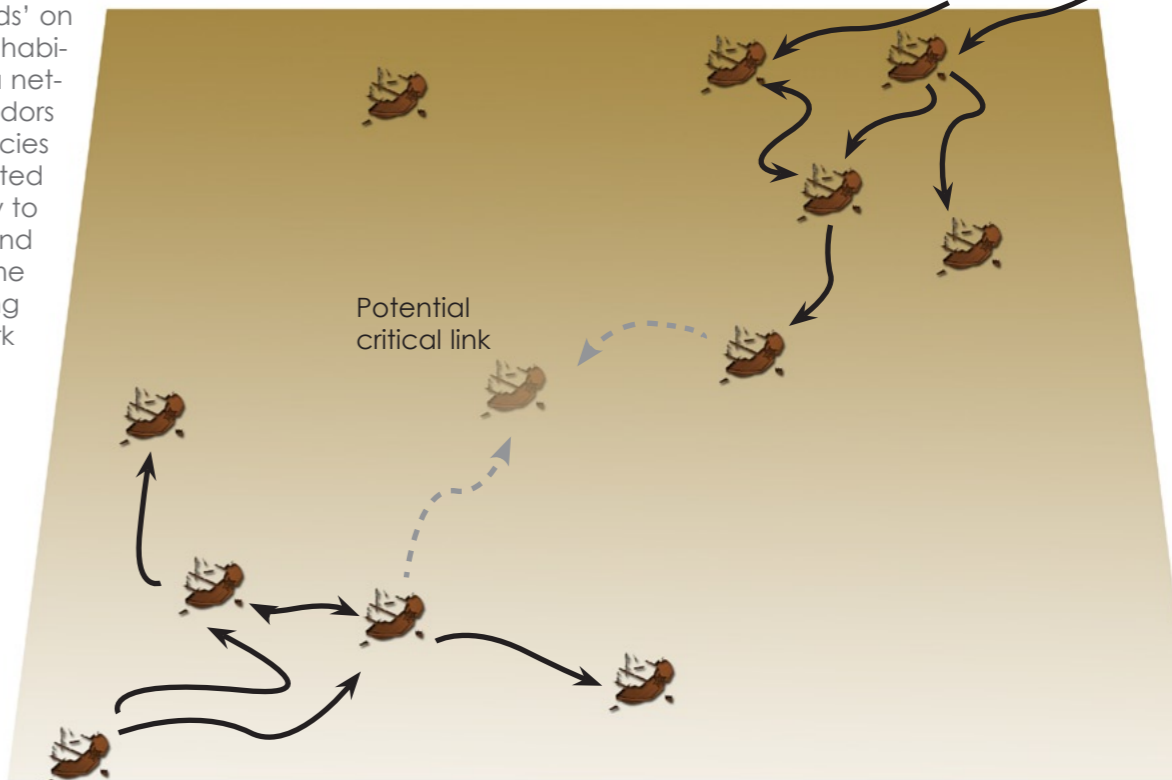
Pink seafans on the wreck were also growing surprisingly fast, Hiscock told BBC News. They were thought to grow about one centimetre a year, but some had grown 40cm in just a few years, he explained.

Windmill parks

About ten years ago, the first large scale off-shore wind farm in the world with 80 turbines was erected on Horns Rev (also known as Horns Reef), which is a shallow area in the eastern North Sea, about 15km (10 miles) off the western-most point of Denmark.

In this area, which is mostly less than 20 meters deep, the number of fish species has increased since the erection of the windmill park, according to a study published in 2012 by DTU Aqua, the Danish National Institute of Aquatic Resources. The turbines at Horns Rev rest on foundations that are driven deep

Shipwrecks as 'islands' on the seabed, providing habitat and constituting a network of habitat corridors through which species can propagate. Isolated islands are less likely to receive immigrants and few islands may become critical links in tying together a network



into the seabed and are protected by a rim of surrounding boulders, which prevent currents from eroding the base. The study suggests that these stone structures also act as artificial reefs, providing enhanced conditions for fish, with an abundant supply of food and shelter from the current, and

attract fish like a rocky sea bottom.

As such, the turbines have created habitats for a number of new species in the area. "Species such as the goldsinny-wrasse, eelpout and lumpfish, which like reef environments, have established themselves on the new reefs in the area—the closer we came to each

turbine foundation, the more species we found," biologist Claus Stenberg stated in a DTU newsletter.

Oil rigs

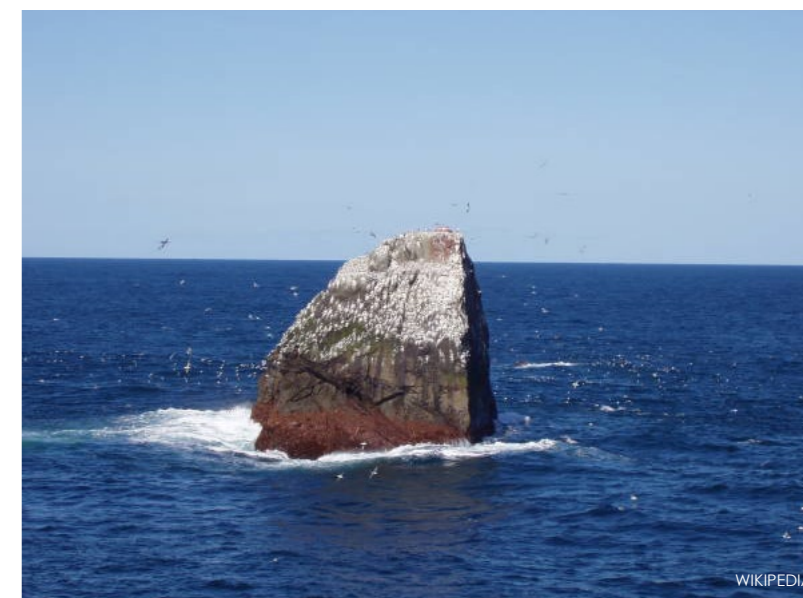
When gas or oil rigs outlive their original purpose, they have to be removed. This process is called

platform decommissioning and can be accomplished in four different ways: total removal, partial removal, toppling and leaving-in-place. Removing the rigs could be devastating to resident and nearby marine life and create a number of pollution problems in the process, so leaving part or all of abandoned platform structures in place has become an increasingly popular alternative.

By shearing off the top of the rig and leaving the tall steel jacket and support struts, it maintains what in many cases has already become a thriving habitat for marine life and at the same time

saves oil companies money on their decommissioning obligations.

This process has become known under the popular name "Rigs-to-Reefs". It should also be noted that as oil platforms contain toxic materials and are often surrounded by contaminated debris, their complete removal is warranted in some cases. Research suggests that fish populations around the platforms are healthy, stable and



Size matters. On Rockall, a small and isolated island in the North Atlantic, small populations of sea birds seem to barely be clinging on for their dear life. Yet, it constitutes a habitat. Also beneath the surface

"Scylla does not emulate rock reefs. You can't say, 'Oh heck, we've put so many scallop dredges through the rock reefs that we've wrecked them; let's put down another frigate as a replacement.' No, it's a different sort of habitat."

—Dr Keith Hiscock, Marine Biological Association in Plymouth

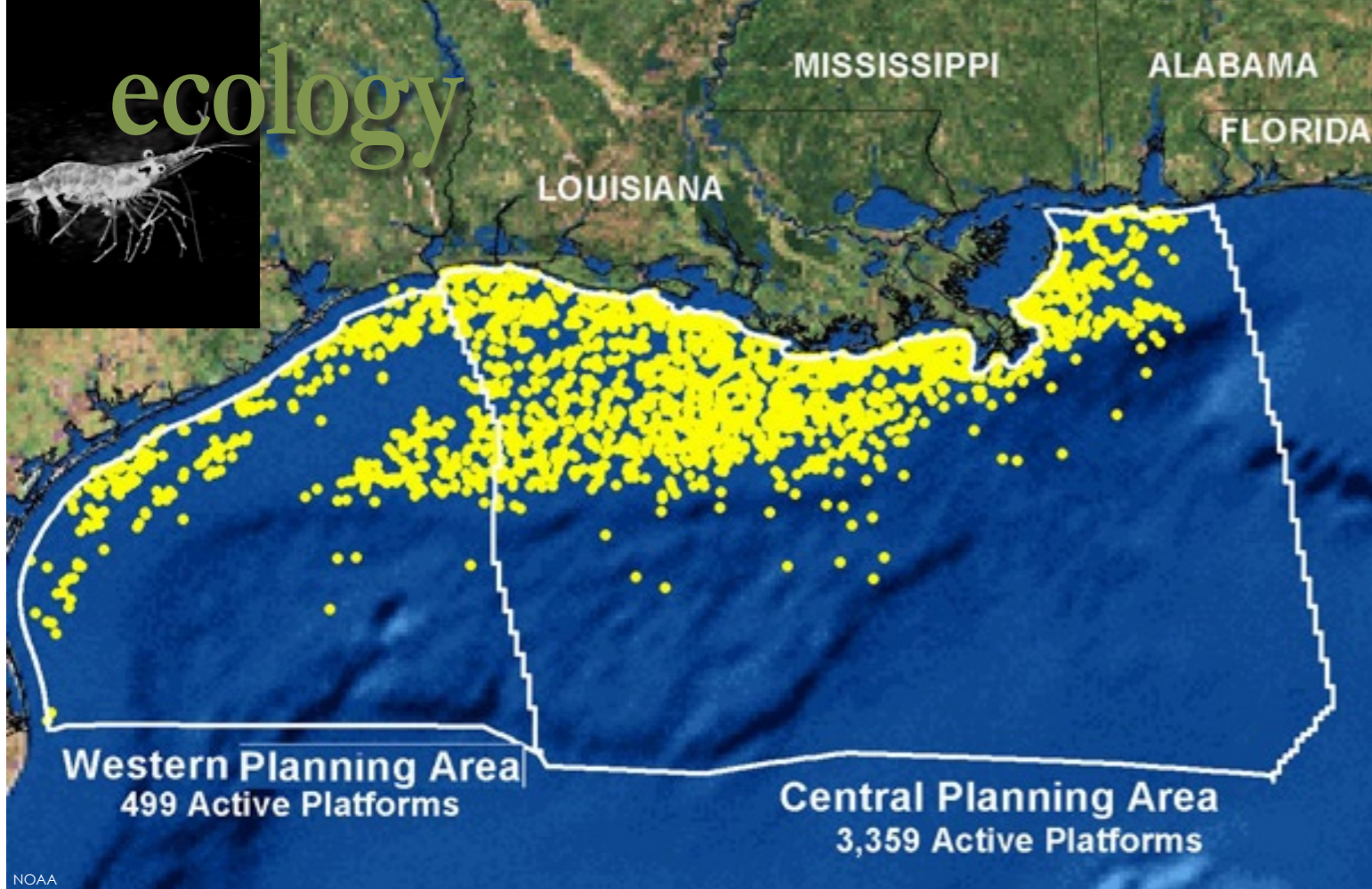


Chart of U.S. Gulf Coast platforms (above); Constructing artificial reef using concrete blocks (below)

reproducing well.

In their 2011 report, *Rigs-to-reefs: Will the deep sea benefit from artificial habitat?* authors Peter I Macreadie et al pointed out that "... decommissioned rigs could enhance biological productivity, improve ecological connectivity, and facilitate conservation/restoration of deep-sea benthos (e.g. cold-water corals) by restricting access to fishing trawlers".

Preliminary evidence indicates that decommissioned rigs in shallower waters can also help rebuild declining fish stocks. Conversely, potential negative impacts include physical damage to existing benthic habitats within the "drop zone", undesired changes in marine food webs, facilitation of the spread of invasive species, and release of contaminants as rigs corrode.

The combined ecological and economic benefits of maintain-

ing parts of the decommission rigs in situ has spurred many states, in particular in the United States, to legislate the matter. In Texas, the Artificial Reef Act of 1989 directed the Texas Parks and Wildlife Department to promote



and enhance the artificial reef potential off Texas. To fulfill this purpose, the Department developed the Texas Artificial Reef Plan, which was adopted by the Parks and Wildlife Commission in 1990. In California, a similar law was signed into effect by the then-governor, Arnold Schwarzenegger.

Natural islands

These theories and models also have wide applications in management of wildlife resources, including Marine Protected Areas and national parks. For these reserves to become successful, the same principles apply. Protected areas need to be both big enough to sustain diverse populations and a sufficient number of species, and to be placed where they can serve as a reservoir for migration. ■



A structure on the seabed such as a shipwreck does not only provide shelter for fish and other marine life, but in many cases also constitutes a physical substrate upon which sessile organisms, such as corals and seaweeds, can attach themselves

Patagonia's Killer Whales Orcas of Valdes

Valdes orca stalks seals at water's edge by using a unique hunting strategy

Text and photos by Frank Wirth
Translated from German
by Dr Ingrid Visser

The Valdes Peninsula is located in the north east of the Argentinian province of Chubut on the Atlantic coast. Approximately 3625 km² in size, it is an important nature reserve and was classified a World Heritage Site by UNESCO in 1999. The Peninsula consists mainly of barren landscapes with small salt lakes scattered throughout. It is of particular importance because of the marine mammals (sea lions, elephant seals and fur seals) that inhabit the coastline. Southern right whales can be found in Golfo Nuevo and Golfo San José, protected bodies of water located between the peninsula and the Patagonian mainland. Peninsula Valdes however, has become renowned for the Orcas and the spectacular hunting technique they use to catch sea lion and seal pups off the beach, something so called an 'intentional stranding' by researchers.

The Orcas of Valdes

Orcas have been observed hunting around the Cape of Punta Norte since 1976. Two male orcas, named Bernardo and Mel, taught the whole population how to successfully catch sea lion pups off the beach, a technique that is now transferred from generation to generation. Nowadays, up to 13 resident orcas

showcase their sophisticated hunting skills as they pursue young sea lion pups playing on the beaches. If you have ever seen footage of such an attack, it was without doubt filmed at Punta Norte, on a 50 meter wide so-called 'attack channel'. This area is not accessible for tourists. Only photographers or filmmakers with a special government permit are allowed

to enter this area.

There is a second hunting area on private property ground of Estancia La Ernestina, where the Punta Norte Orca Research Project (PNOR), founded in 2004, is based. These beaches are also prohibited for the public, yet a small group of guests of the Estancia is permitted to enter the beach area, guided by

Juan Capello, the owner of the Estancia and one of the principal scientists of the Orca Project. Photographs taken by participants of our expeditions are evaluated and given to the PNOR for identification purposes.

The Hunt

The beaches of Peninsula Valdes are sur-

rounded by shallow reefs that emerge at low tide. Between these reef formations channels are formed, which still allow water flow at low tide. These channels are used by the orcas while they hunt, hence the name, 'attack channels'.

The orcas are only able to hunt for the sea lion pups on the beaches when tide, wind and weather conditions allow the





THIS PAGE: Orcas teach their young how to intentionally strand to catch seals

picture of their surroundings. The animals also possess the ability to determine whether the prey is an adult animal or a juvenile. Instead of wasting energy on chasing experienced, fast seals, the orcas rather concentrate on the less challenging and less heavy, young pups. The chances of capturing an adult sea lion are less than 20 percent,

whereas catching younger animals offer a chance of more than 50 percent. In addition, it is possible that the soft, tender meat of the young pups tastes better to the orcas.

The orcas are also known to display inventive tactics that trick the sea lions. A part of the group of orcas will swim fast and noisily towards their prey, which in turn



flees in the opposite direction where another orca is waiting to catch the pup. The attack is fast. When the timing is right, the orca rides a wave right up onto the beach, snatches up a sea lion pup, and then rolls back out into the water with the next wave.

Apart from the sea lion pups, the orcas also hunt for young ele-

phant seals. In March 2011, at the attack channel of Punta Norte, we were able to witness, and get footage of an extraordinary attack by a female orca named, Marga, catching a young elephant seal weighing around 500 kg!

animals to get close to the shore. Typically, the orca can start hunting from three hours before high tide to three hours after high tide.

When the tide is rising, the orcas have the opportunity to manoeuvre closer to the beach where the sea lions frolic, the main prey of the orcas of Valdes.

Southern sea lions (*Otaria flavescens*) at Peninsula Valdes give birth in January. Each year between February and April, the small 'nurseries' of sea lions pups start exploring their surround-

ings and play in the shallow surf close to the beach. With their first attempts at learning how to swim and unaware of danger, the pups are most vulnerable in these first few weeks and become an easier target for the orcas to prey upon. Even their mothers are slow to warn and protect them, as the orcas begin the approach.

Very often we can watch the orcas patrolling the beach. With their echolocation skills, the orcas continuously scan the shallow water and receive a detailed





Orcas



Training the young

Often the orcas spend time training their young in the attack channel. Learning these sophisticated hunting skills, something referred to by researchers as an "intentional stranding", can be a dangerous undertaking. Therefore, in order to prepare their young for the real hunt, the orcas will simulate attacks to allow their young to learn how to get close to the beach without stranding themselves perma-

nently. Observation of the orcas shows clearly that the young animals are being taught to apply specific timing to their attacks. While the successful capture of a sea lion pup has many elements, the most crucial skill required is calculating how to utilize the waves to reach their desired prey and more importantly catching the next wave back to the safety of the ocean.

The orcas also engage in a "cat and mouse" training technique in open water. After a sea lion pup has been snatched off the beach by one of the experienced hunters it is not killed and eaten straight away, but offered to a young orca and used as a tool to teach how to attack and kill a sea lion in open water. The orcas will 'play' with it. They slap it around with their tails like a game of tennis before sharing it as a meal. What appears to the casual onlooker as brutal is for the orcas nothing more than learning a hunting technique vital to the survival of the next generation of orcas of the

Peninsula Valdes.

The hunting season of 2011 turned out to be excellent at the attack channel in Punta Norte. Researchers were able to clearly determine that two young orcas named, Llen and Pao, from the so-called Maga group, used the hunting technique successfully for the first time. The four- and eight-year-old siblings performed a spectacle beyond compare and didn't even seem to get enough of it.

What do orcas eat?

Orcas are the greatest predator of the seas. They feed on several fish species, sharks, rays, an extensive list of marine mammals and occasionally seabirds and turtles. Their diet is variable and often geographic, or population specific, and they have developed various different hunting techniques in order to sustain themselves. Within certain areas, orcas have developed

preferences for certain prey species. However, they are also known to travel vast distances to get their favorite food. There are reports of orcas that migrate from the high Arctic to the mid-Atlantic to feed on tuna.

The orcas of Valdes have only a limited amount of weeks to hunt the sea lion pups, correlating directly with the pupping season. March and April are the two main months to hunt for Southern sea lions, whereas in September and October, they have a chance to hunt for elephant seals. The rest of the year, the orcas must sustain themselves by feeding on other prey. The rich biodiversity of the Patagonian coast allows for their diet to vary most likely between rays, various fish species



COUNTER-CLOCKWISE FROM RIGHT: This series of images captures the frame by frame action of a killer whale tossing a seal pup with its tail fin. Nicknamed, pup tennis, it looks to be a cruel treatment of prey to the outsider, but like cats play with mice before eating them, the orcas let their juveniles play with their food to learn valuable hunting skills important for survival





and whales and dolphins.

Importance of research

Observation and data collection is important, since the orcas of Patagonia are one of two groups of orcas in the world that use the dangerous and unique hunting strategy of intentional stranding.

The Punta Norte orca popula-

tion currently consists of only 23 animals of which 13 demonstrably hunt on the beaches. Photo identification is the most important tool to identify the individuals and keep track of the size of the pod. The ID database must be updated annually. Various orcas have been split into groups for identification and research purposes, such

as the Maga Group, the Jazmin Group, the JC Group and the Mel group.

Mel is one of the two male orcas who taught the whole population how to successfully catch sea lion pups off the beach. He was last seen on 16 March 2011 when he only briefly showed up in the attack channel. Mel

is approximately 50 years old, which is beyond the average life span of 30 years for a male orca. However, Mel has surprised us before by disappearing for a longer period of time, after which he returned to the attack channel in 2009 and 2010 where he hunted successfully for weeks on end.

Since April 2012, Mel's female

THIS PAGE: Orcas display their ingenious hunting strategy of intentional stranding in order to capture seals at the water's edge





partner has been observed regularly with a young male. This animal is an unknown individual and has yet to be identified as offspring from the Punta Norte orca pod. On 14 April 2012, the young animal was observed hunting in the attack channel for the first time.

There are only a few people in the world that can positively identify the orcas of Punta Norte, including orca scientist Dr Ingrid Visser and Juan Capello from the Punta Norte Orca Project, wildlife warden Roberto Bubas and Hector Casin.

Casin is a conservationist and is responsible for photographers and film crew that have a special government permit to enter the area of the attack channel. Every year, he is stationed right at the attack channel for six to eight weeks. He collects data and communicates with the research team of PNOR. All the data collected enable

them to get a better picture of the lives of these killer whales. The photos and film footage from participants of the expedition groups is a helpful tool in gathering more information, since it's often small details that make an ID possible.

Orca expeditions

Every year, orca expeditions are organized in a two-week Orca Camp in Patagonia for nature and wildlife enthusiasts, students and amateur photographers. In close collaboration with scientists at the Punta Norte Orca Research (PNOR) station and under guidance of New Zealand orca scientist, Dr Ingrid Visser, and experienced marine biologists, participants visit the orcas of Punta Norte for eight days. In addition to viewing the orcas as they demonstrate their predatory techniques, participants will help with

the collection of research data, which includes conducting photo and video ID for the Punta Norte Orca researchers. Snorkeling with sea lions, kayaking and cycling around the peninsula is also part of the program.

The second portion of the trip involves the exploration of Patagonia's remote coastal and steppe-like areas and its magnificent wildlife further south. Participants have the chance to encounter numerous penguin colonies with Magellanic and rockhopper penguins, Commerson's and Peale's dolphins, various seabirds and the animals from the Pampas, such as the Darwin ostrich, guanacos, maras and foxes.

In addition to the Orca Camp, professional photographers and film crews can also elect to go on customized expeditions. The attack channel—the zone that the orcas use most to patrol and hunt—is a narrow band of beach

Orcas wave their tail fins at the moon over Patagonia; Location of Patagonia on global map (right)

only 50 meters wide between two underwater reefs. It is not open to the public, but is limited exclusively to photographers and film makers with a special permit issued by the Argentinian government. At times, the orca may only be 20 meters away from the photographers.



Location of Patagonia on map of Argentina

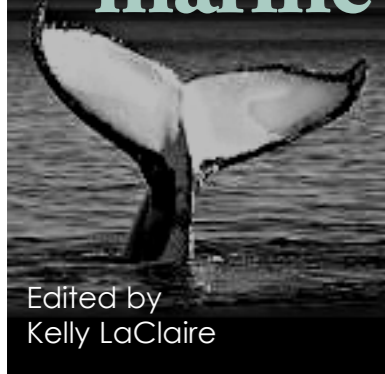


The relatively high cost of the permit and the difficulty obtaining the permit limits the size of the group. Per time period and on set dates, there are only six spaces for photographers available. ■

For more information on the various orca expeditions or professional film and TV productions, please visit www.patagoniaproject.com or email Frank Wirth at whales@gmx.net.

Frank Wirth has worked in the marine mammal tourism industry worldwide for more than 20 years. Having travelled to the Valdes Peninsula since 1993, he guides the orca expeditions and coordinates film productions. Considered to be one of the more experienced guides in the area—knowing everything there is to know about the orcas and their behavior—Wirth organizes the daily schedules for photographer teams and nature enthusiasts.

Dr Ingrid Visser is New Zealand's only scientist specializing in orcas and one of the lead scientists and co-founders of PNOR. She works in cooperation with Wirth during the orca expeditions. Additional professionals of Punta Norte include Juan Capello and Hector Casin.



Edited by
Kelly LaClaire



NOAA

Dolphin Gangs?

Maybe I just haven't been paying attention, maybe it's common knowledge, but when I learned that a disoriented and stressed dolphin was stranded in a wetlands in Southern California, USA, because a gang of hostile males had chased him—in fact, intimidated him—into those shallow waters, I was more

than just a little surprised.

Did dolphins really form gangs? I wondered.

Well, it turns out they do, and it's not all that uncommon.

In March of this year, scientists from the University of Massachusetts, Dartmouth, released the results of a five-year study of more than 120 adult dolphins in Shark Bay, Western Australia. Their findings specifically stated that male bottlenose dolphins formed gangs to protect their females and drive off other males who may be potential suitors.

Richard Connor, a co-author of the study and a biology professor who has studied dolphins for more than 20 years, said that male dolphins' social lives can be very passionate and severe. "They do get in fights," he said. "They are in these incredible gangs—we call them 'alliances.' There are big fights between groups over their females. Just like people, they have squabbles. Relationships are complicated."

This is the exact scenario playing out in the Bolsa

Chica Wetlands just south of Los Angeles. For a little more than a week now, "Freddy", a seven-foot, black-and-white common dolphin has been hiding out and swimming in circles only a few feet from the shoreline, apparently afraid to leave.

Trying to get Freddy back into the sea, Peter Wallerstein, director of El Segundo-based Marine Animal Rescue and five wildlife officials each climbed onto paddle boards in an attempt to slowly push the dolphin back into the harbor and thus, get him on his way back out to open waters.

But as he was moving into the harbor, four male dolphins appeared and proceeded to hound and attack the lone Freddy, harassing him back into the relative safety of the wetlands.

"He was scared. He was intimidated," Wallerstein stated. "Dolphins can be very aggressive toward each other. They do have a dark side."

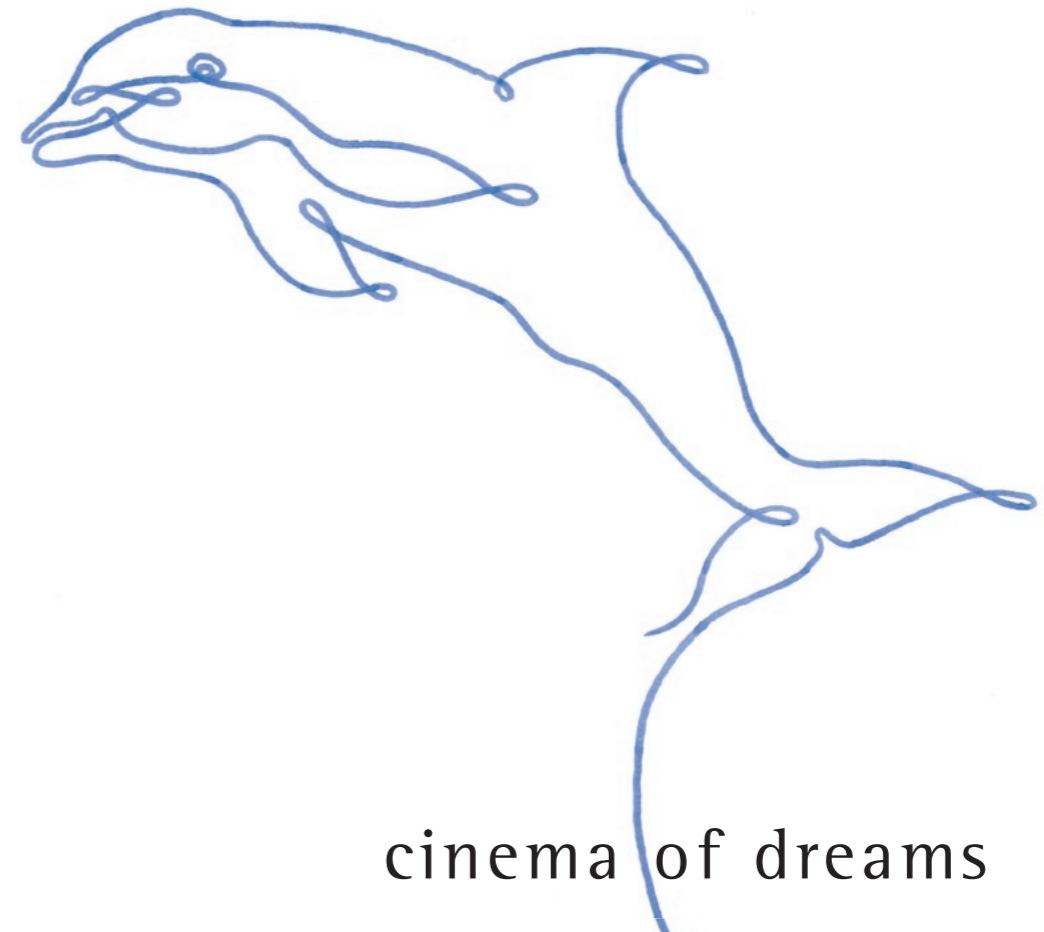
For now, wildlife officials have decided to leave Freddy alone and hope he returns to the open ocean when he is ready and the "gangs" aren't watching. We'll keep you posted.

You can see video of Freddy and the rescue attempt at abcnews.com. ■ SOURCE: ABC NEWS



NOAA

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Edited by
Kelly LaClaire

North Sea Bottlenose holding fast

The east coast of Scotland boasts the majestic and expansive Firth of Forth as well as a resident population of bottlenose dolphins who call those waters home. For more than two decades, the University of Aberdeen has been carrying out consistent monitoring of the pod in an effort to discern the health and stability of the only known resident pod in the entire North Sea. As of May, the researchers commissioned by Scottish Natural Heritage (SNH) that the group of nearly 200 dolphins is healthy, stable and may even be increasing in size.

This is very good news for the man-

agers of the Moray Firth SAC (Special Area of Conservation), a group that monitors the conservation efforts of the waters spanning 500 miles of coastline of the Northeastern Scotland coast. The dolphins use this entire stretch year round as their food supply migrates, and the entire area is protected under EU laws.

"We can say with some confidence that the population of bottlenose dolphins on the east coast of Scotland is stable or increasing. And the number of dolphins using the Moray Firth SAC between 1990 and 2010 appears to be stable," said Morven Carruthers, SNH

policy and advice officer.

"However, this population is considered vulnerable due to being small and isolated from other populations. The east coast bottlenose dolphins are a special part of Scotland's nature and wildlife and a major tourist attraction, and it is encouraging to see that the population is currently stable. Monitoring will continue to observe the dolphins and help ensure that they do well."

Since 1989, this specific population of dolphins has been the focus of research programs led by the University of Aberdeen in coordination with the University of St. Andrews and supports the work carried out under the Dolphin Space Program (DSP), whose goal is to promote sustainable and educational dolphin-watching opportunities in the Moray Firth.

The resident pod remains one of the most recognizable wildlife species in all of Scotland and along with the beauty and scenery of the Firth of Forth, draws many, many tourists (and needed revenue) to the eastern coast. ■

SOURCE: WILDLIFE EXTRA, SCOTTISH NATURAL HERITAGE



Bottlenose dolphin

Norwegian controversial whale hunt underway



Minke whale breaching

The first three whales of this year's Norwegian hunt have been harpooned off the Arctic Lofoten archipelago, a month after the official whale season began in that country.

Currently, Norway, Iceland and Japan are the only countries in the world who still openly defy the 1986 international moratorium on commercial whaling despite nearly planet-wide opposition and resentment.

Japan uses a loophole in the law that allows killing cetaceans for "lethal research" while Norway justifies its yearly

harvest with claims that Minke whale stocks are large enough to sustain controlled hunts.

Norway has set their 2012 season quota at 1,286 minke whales. This is the same number they aimed for in 2011 even though they only killed 533 whales and public demand for commercial minke meat has diminished drastically.

"There is really no problem pulling up the quota," said a Norwegian whaling representative. "We hope that the sales will go better this year and that Norwegians will consume more whale meat."

Norway's whale harvest season began on April 1 and will run until August 31, but weather conditions have been poor and boats have been unable to hunt. According to weather services, however, these conditions will steadily improve, making the controversial killings easier. ■



Minke whale



Edited by
Kelly LaClaire

THIS PAGE: Iceberg, the white orca, with his pod caught on film by Russian scientists studying whales and dolphins in the seas around the Commander Islands

Researchers find what may be the world's only adult white orca

Scientists from Russia studying acoustic and social interactions among whales and dolphins off the Commander Islands believe they have discovered the first ever adult white orca.

The researcher, a group from the Far East Russia Orca Project (FEROP) led by Erich Hoyt, a senior fellow with the Whale and Dolphin Conservation Society, first spotted the whale when a pod of orcas swam near their vessel and out of the waves emerged an all-white, seven-meter (22-foot) killer whale.

"It has the full two-meter-high dorsal fin of a mature male, which means it's at least 16 years old," said Hoyt. "In fact, the fin is somewhat ragged, so it might be a bit older."

Orcas normally mature at around the age of 15 (males can live up to 50 or 60) and "Iceberg"—as he has been

named—seems to be perfectly happy and healthy and well on his way to living a long, full life.

Other species of white whales have occasionally been seen around the world but the only known white orcas have been young and have not survived into adulthood.

"We've seen another two white orcas in Russia, but they've been young, whereas this is the first time we've seen a mature adult," Hoyt stated. "Iceberg seems to be fully socialized. We know that these fish-eating orcas stay with their mothers for life, and as far as we can see, he's right behind his mother with presumably his brothers next to him."

It is possible that Iceberg is not a true albino whale, since he has color on his saddle (the area behind his dorsal fin) and the cause of his unusual pigmentation is not known. One way

to find out for sure would be to see if Iceberg's eyes are pink—positive proof of albinism, but this will take a very close encounter indeed, which isn't always easy.

Although this is the first news we are hearing of Iceberg, he may actually be the same whale that was spotted by different researchers in Alaska in 2000 and again in 2008. Iceberg and the previously seen whales look very similar, and it wouldn't be odd for Iceberg to have made the Russia-to-Alaska crossing with his pod; fish-eating North Pacific killer whales are known to migrate more than a 1,000 miles following food sources.

Whatever the case, Hoyt and the folks at FEROP were elated, "We can see that he is a healthy-looking male, a handsome, robust member of his fish-eating pod, so we can presume that his coloration doesn't affect

him in a negative way. Finding a beautiful animal like Iceberg shows us that there are still great surprises to be found in the least visited parts of the ocean."

"I would hope," Hoyt added, "That Iceberg would help motivate people not only to save whales but to save their habitat, their homes in the sea." ■

SOURCE: BBC NEWS
NATIONAL GEOGRAPHIC



E LAZAREVA/ FEROP



E LAZAREVA/ FEROP



E LAZAREVA/ FEROP



An underwater photograph of a coral reef. A diver is visible in the center, illuminated by a light. The reef is covered in various types of coral, including large, branching orange corals. Numerous small fish are swimming around the reef. The background is a deep blue water.

Bali's Treasure Liberty Wreck

Microcosm of Life

Text and photos by
Don Silcock



THIS & PREVIOUS PAGE: Scenes from the wreck of the *Liberty*; Pinnate batfish (right)

The *Liberty* wreck has long been a dive that most divers aspire to have in their logbooks, but in recent years the wreck has graduated onto the backpacker “must do” list of experiences that have to be completed before reaching 25.

The first ones arrive just after eight and on a busy day, within the next hour the car park will be filled with a selection of cars, mini-buses plus the odd large coach and a quick walk around will expose you to a veritable United Nations of international accents. They used to come mainly from the east,

up the coast road and over the nearby mountains into the town’s main street—in fact, the only street—but now they are also being bussed in from the west and the new resorts that have been built in nearby villages where the real estate is cheaper.

This is Tulamben, the small town on the northeast coast of Bali, and “they” are the scuba diving tourists who come to experience the island’s most famous wreck, and arguably one of the best known wrecks in the world, the *USAT Liberty*.

I vividly remember my first dive on the wreck back in 1999 and how impressed



I was by the rich marine life and beautiful soft corals it supported, but I also recall being taken aback by the number of divers on the wreck.

That was some 13 years ago when there was no car park, only a hand-



full of dive resorts in operation, and it felt really crowded sharing the overall experience with 20-30 other divers.

These days, it is not uncommon to have more than 100 divers on the wreck during the busiest hours of the day, and in the peak seasons, those numbers can easily exceed 150!

So, is the *Liberty* wreck still worth diving, or is it being killed by its popularity and become a mere shadow of its former pristine glory?

Liberty Insider's Guide

If you had asked me last year, "Have you dived the *Liberty*?" I would have waxed lyrically about the various experiences I have had on the wreck and how I have learned to dive it early in the morning before everybody arrives. Plus, I would have told you about the various hot-spots you should visit on the wreck to see a particular type of fish or coral.

But then I realized that although I

had indeed dived it dozens of times over the years, I could still manage to get lost on it and did not possess the intimate knowledge of its topography that I needed to write a definitive article on this famous wreck.

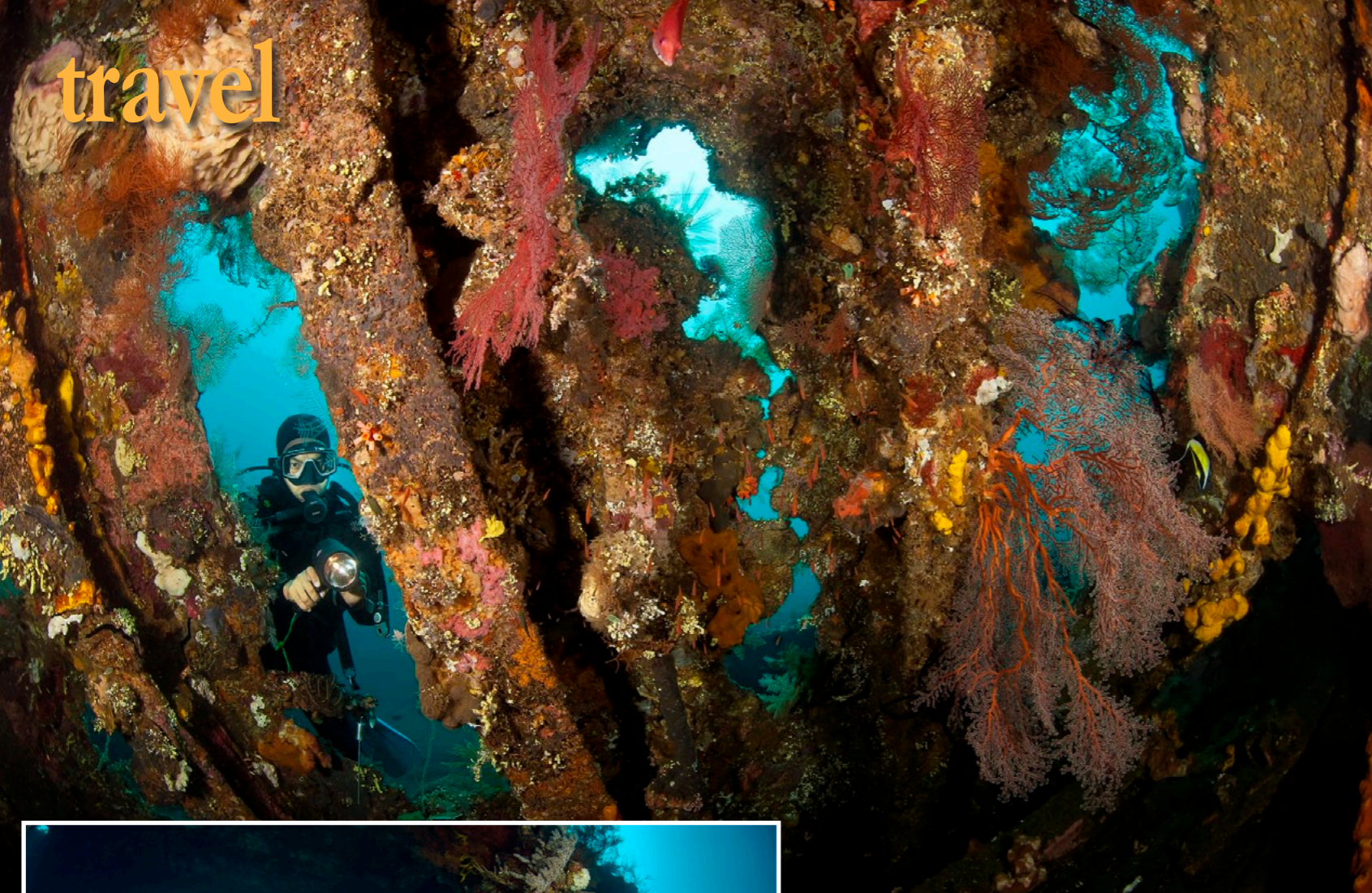
So, I approached Tony Medlow of Tulamben Wreck Divers to see if he would help me write an "insider's guide to the *Liberty* wreck", and to my delight, my email was answered within minutes. The next week, I was

on my way back up to Tulamben.

Tony and his wife, Dot, are very well-known in the Australian dive industry as the people who developed the Exmouth Dive Center and scuba diving on Ningaloo Reef, in Western Australia, and also helped set-up the whale shark Code of Conduct that has been a key part of the successful interaction with whale sharks there.

Tony and Dot have been diving the *Liberty* wreck since the early

Longnose hawkfish (above); Diver in huge school of jacks (top); Bumphead parrotfish and diver on reef (right)



Liberty

THIS PAGE: Diver explores the architecture of the *Liberty* wreck, heavily laden with thriving corals and marine life



very early and then dive different sections during the day with specific objectives in mind.

His view is that the *Liberty* is basically a

that run down the northeast coast of the island into the mighty Lombok Strait. Those waters flush through Tulamben Bay and are the key to the sheer resilience of the wreck and its ability to regenerate.

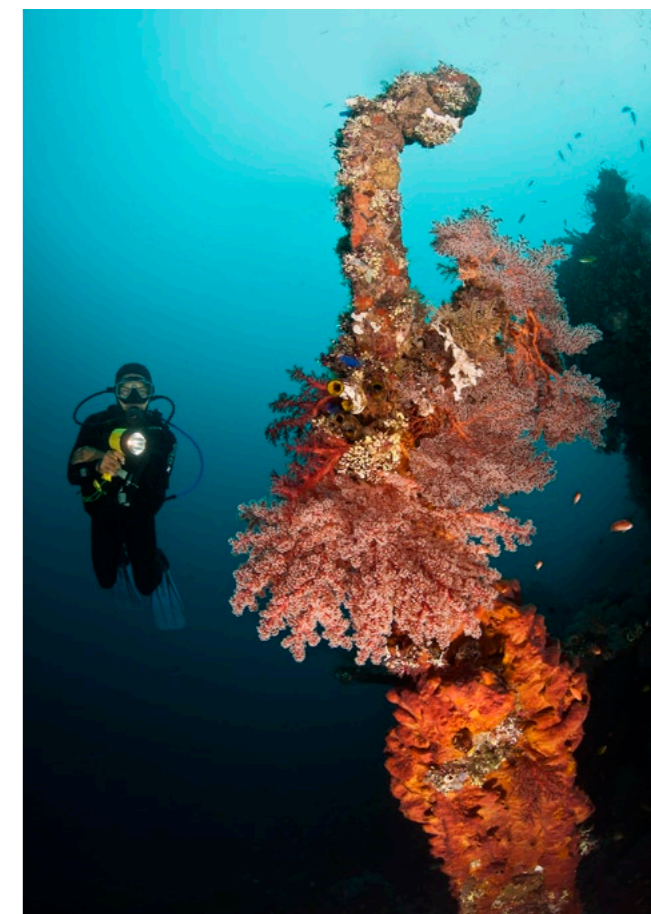
The rich marine population of the *Liberty* has also learned to adjust to the daily influx of visitors. So, if you arrive during peak hours with a fish-eye lens to capture the bigger residents, you are likely to be disappointed. But if you adjust your timing and expectations around the rush hour(s), it's possible to have some incredibly

memorable dives.

Early morning on the *Liberty*

I used to be utterly convinced that entering the water around 07.30 was the best time of day on the *Liberty*, but the truth is that you really should be leaving the wreck at that time to enjoy a hot breakfast and reflect on what you have just seen. Zero-6.00 is the witching hour if you want to start the day with a "bumphead moment", because around the stern—the usual entry point for the wreck—in about 15m of water, you will encounter a large school of bumphead parrotfish performing their morning ablutions before heading out for the day.

Early risers, the bumpheads spend the night down around the bow in about 25m of water where they can rest in the shelter of the hull. They congregate around the stern as the sun's rays start



1980s, and when they decided to sell their business in Exmouth, a move to Tulamben became the logical next step. They set up Tulamben Wreck Divers in 2001 in partnership with former dive guide turned local entrepreneur, Wayan Ambek.

Tony's very clear advice to me was that if I really wanted to experience the best the wreck has to offer I should start

microcosm of the best diving Bali has to offer, but it is more than just a dive site—the wreck is a living thing, nourished and sustained by the rich waters





THIS PAGE: More scenes of the coral-encrusted wreckage; Candy crab (right)



to penetrate and light up the wreck.

If you are lucky, you will get 15 to 20 minutes with them. With a bit of careful maneuvering—whilst keeping a wary eye on those formidable teeth—it is possible to edge up really close to the bumpheads, which makes for some memorable photography.

Early morning is also the best time for a random encounter with “George”, the giant barracuda that has made the *Liberty* his home. George appears to have lost much of his natural apprehension to scuba divers, and being a curious fish, will often come and eyeball you—offering a special Kodak moment if you are prepared, or one of immediate and imminent danger if you have never heard or seen him before.

At nearly six feet long, and equipped with some fierce-looking dental capability, George is a serious fish who graces you with his presence and moves on when his curiosity is satisfied.

If George is nowhere to be seen, you can go for quantity, rather than individual quality, and spend some time with the huge school of jacks that hangs out around the stern. Used to divers and snorkelers, the jacks will allow you to enter their midst if you do so slowly and carefully. A good model will allow you to create some stunning images in the early morning light.

There are usually very few other divers around. So, early in the morning, if you are lucky enough to be diving on a rising tide bringing

in clear water from the deep, once you have had your fill of the jacks, it is a great time to photograph both the stern and the bow of the *Liberty*. Both are large steel structures, which at first sight are difficult to recognize as part of a large ship, but if you take your time to understand the orientation of the wreck, it is possible to define them



THIS PAGE: Huge soft corals; Resident school of bumpheads (above)

against the negative space of the clear blue water. A good model, carefully positioned, will add a nice touch of scale. At that time of the morning, because of the wreck's position parallel to the northeast shore of Bali, the sun will be behind you and will help to illuminate the structures despite the low level of the overall light.

The sheer prolificacy of the currents that run through Tulamben Bay means that the prominent large structures of the bow and stern are richly coated in marine growth, and the two guns that were mounted on those structures are hardly recognizable as deadly armaments anymore.

Prophetically, the gun on the bow now has a large flower like growth of gorgonian fan on its breech, which will make you

want to put that "If you're going to San Francisco" tape you have been saving into the cassette player of the VW Combi hippy wagon...

Mid-morning, early afternoon

From 08.30 in the morning, the car park will be filling up, and the volcanic stone beach will have a lot of divers getting ready to enter the water. This is the time to forget about the larger residents of the *Liberty* and its structures and concentrate on the smaller stuff that lives in the nooks and cracks of the wreck.

It is also when your dive guide

transforms from super-model to critter finder and becomes worth their weight in gold. Depending on how deep you meander on the wreck, the maximum bottom time you can probably expect is about one hour, and with the right guide, this can be a very productive period. On the other hand, if you





Diver hovers over the *Liberty* wreck (left and right); The volcano, Mount Agung, on Bali (lower left)

unlike places like the Lembeh Strait where critter locations are networked, in Tulamben, the location of a photogenic critter is kept as tight a secret as the U.S. nuclear codes.

That's why you need a good guide like Made Sadia from Tulamben Wreck Divers, who was the perfect combination of super-model and critter-spotter.

The *Liberty* wreck is not critter-



central like Lembeh Strait or the Twilight Zone, but it has a lot to see—if you can find it in amongst all the wreckage. The mid-section of the wreck is the most prolific area, but there is stuff all over the place, and a good guide like Made will know where to find it.

You can easily do two very productive and enjoyable dives mid-morning and early afternoon by looking down in amongst the wreckage and simply ignoring the promenade of scuba-diving tourists doing their obligatory circuit of the wreck above you.

Late afternoon

By about 15.30 the tourists are packing up and getting back in their cars and busses, and just like the house vendor after one of those necessary but very painful open houses, the residents of the wreck start to reclaim their home after everybody has left.

Usually, the visibility is not too good at this point because all the visitors have stirred things up a bit, plus the light fades rapidly, as the sun dips behind the 3,000m-high Mount Agung volcano that dominates Tulamben. But it is still a good time of the day to put a wide-angle lens back on your camera and photograph the beautiful and incredibly prolific soft corals around the deeper sections of the wreck's mid-section. It never ceases to amaze me just how rich these corals are, and very interestingly, how much they evolve over time.

I have been diving and taking

THE WRECKING OF THE *USAT LIBERTY*

The *Liberty*, contrary to urban myth and what its name suggests, is not a Liberty class ship. It was actually built in 1918, at the end of WWI as a freighter in Kearny, New Jersey, by the Federal Shipbuilding Company, with a length of 120m and a beam of 17m. Its draft was 24m and had a gross tonnage of 6211 tons.

At the start of WWII, it was requisitioned, fitted out with guns on the bow and the stern, and then operated by the U.S. Army as a transport ship.

At 04.15 on the morning of 11 January 1942, it was torpedoed by the Japanese submarine *I-166* in the Lombok Straits, as it was passing through in a convoy of ships taking supplies from Australia to the Allied campaign in the Philippines.

Badly damaged, two of the destroyers protecting the convoy took the *Liberty* in tow to the ship repair facilities at Singaraja on the north coast of Bali, but the damaged ship was taking on so much water that it had to be beached in Tulamben Bay to prevent it from sinking.

There were no casualties in the actual torpedoing and all the crew was safely evacuated after the *Liberty* was run aground, but the imminent arrival of the Japanese forces in Bali prevented any of its cargo being salvaged.

The *Liberty* remained beached for another 21 years, providing a source of assorted hardware to the local villagers and a fishing platform into the deeper waters of Tulamben Bay until 17 March 1963.

On that fateful day, the nearby volcano, Mount Agung, which had been rumbling for several days, exploded with such violent seismic force that the rusting carcass of the *Liberty* was physically lifted and rolled down the slope, breaking its back in the process and leaving the wreck on its side some 40m offshore, parallel to the shore. ■

go alone you will probably finish the dive wondering what all the fuss is about.

The bottom line in Tulamben is that scuba diving is the only industry in town, and its relative prosperity revolves around visitors coming to experience the *Liberty*. So jobs in the town all relate, in one way or the other, to the wreck and the dive guides are the local alpha-males.

They all know each other, but

group has grown in numbers, as there always seems to be much more than 20 porters on duty whenever I have been in Tulamben.

The system works really well, whether you are day diving or staying at one of the resorts, as the porters just seem to appear when they are needed, nonchalantly hoisting at least two sets of gear on the heads before heading off down the beach. The group operates as a collective and pools their earnings and tips and the portage fees. So, make sure you give them a reasonable tip, because they are definitely worth it! ■

TULAMBEN'S DIVING HELPER CLUB

One of the things that always intrigues visitors to Tulamben is the sight of local women carrying multiple sets of diving gear on their heads. No mean feat in itself, doing it with what appears to be at least twice their body weight while walking along a volcanic pebble rock beach is something else!

Run by the villagers themselves, the Diving Helper Club was an initial group of 30 women who arranged to have 20 of their numbers always available on any given day to carry the heavy equipment of the diving tourists to where they want it. Started in 1978 by Pak Kari Yasa, the



Woman of Diving Helper Club carrying air tanks



Liberty

Just look at the life! The *Liberty* wreck is a thriving ecosystem of marine organisms (left); Circling school of bumphead parrotfish with diver; Diver at forward gun (below)

photographs of the *Liberty* for over 13 years, and strikingly photogenic hard and soft corals in this area seem to come and go from year to year. Without a doubt, the heavy traffic of inexperienced and often deliberately over-weighted “resort divers” take its toll. But incredibly, the wreck seems able to regenerate itself. The only rational explanation of this regeneration phenomenon has to be the sheer fecundity of the currents that wash over the wreck, as they head for the Lombok Strait and the Indian Ocean to the south.

After dark

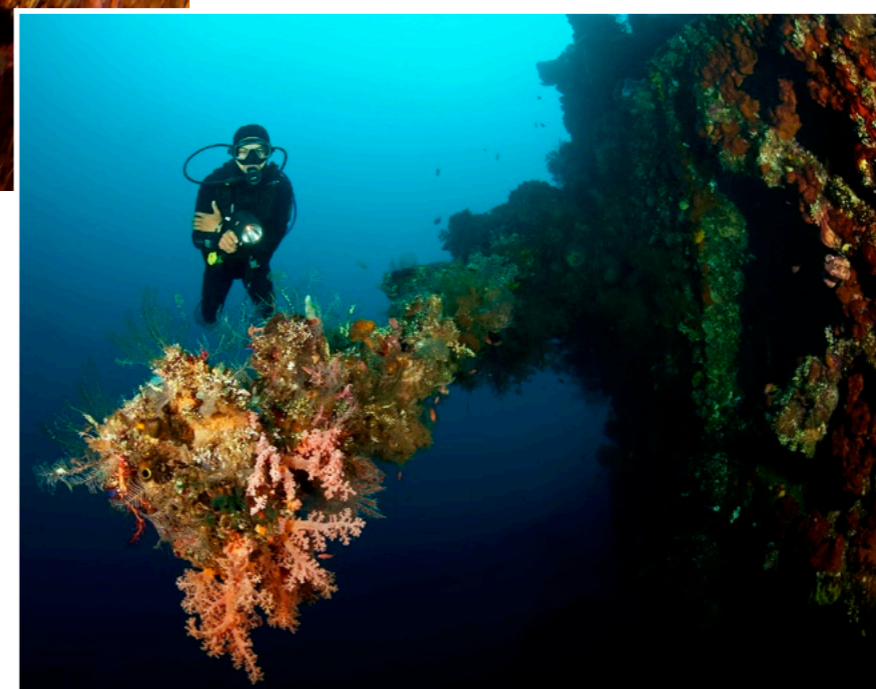
A night dive on the *Liberty* is a special

thing, but one that needs to be considered carefully because it's easy to get lost and a little bit disorientated even during the day, so after dark, you can almost guarantee you will. The Tulamben dive guides know the wreck better than the backs of their hands—so would you if you were diving it every day of the week. They also know the best place to find stuff once darkness has fallen on the *Liberty*. So, do yourself a favor and use a guide to dive the wreck at night and experience it at its eerie best!

Random encounters

As the old saying goes, “you should have been here last week”—you will be

sure to hear that regularly in Tulamben, because the wreck acts as a beacon to the true pelagics of the Indo-Pacific. Mola mola's are spotted regularly around the *Liberty* in the deep waters around the mid-section, particularly around August and September when they become quite common. Whale shark's also put in periodic appearances. On my last dive of this trip, while I was down at the bow in the early morning light trying to get that front cover shot, a four-meter-long whale shark



was entertaining a group of Japanese divers at the stern. We emerged around the same time,

and while my Japanese was limited to “thank you” and “one more beer please”, I could tell they were very excited about something and eager to share their images.

That's the thing about the *Liberty* wreck, you just never know what is around the corner, and it seems to possess an almost infinite capability to surprise and enthrall its visitors. ■

Correspondent Don Silcock is based in Sydney, Australia. He travels widely in Asia and his website (Indopacificimages.com) has extensive information and imagery of the USAT Liberty wreck and other great dive sites across the Indo-Pacific region.

fact file



Bali, Indonesia



SOURCES: US CIA WORLD FACT BOOK, SCUBADOC.COM, E-MED.CO.UK

History In the early 17th century, the Dutch began to colonize Indonesia. During WWII, the islands were occupied by Japan. After Japan's surrender, Indonesia declared its independence, but four more years passed with intermittent negotiations, recurring hostilities, and UN mediation before the Netherlands let go of its colony. Home to the world's largest Muslim population, Indonesia is the world's largest archipelagic state. Its government faces several challenges including alleviating poverty, preventing terrorism, consolidating democracy after 40 years of authoritarianism, reforming the financial sector, irradicating corruption, halting human rights violations by the military and police, and controlling avian influenza. Indonesia reached a historic peace agreement with armed separatists in Aceh in 2005, which led to democratic elections in December 2006. In Papua, a low intensity separatist movement continues to confront Indonesia. Government: republic. Capital of Indonesia: Jakarta. Main city of Bali: Denpasar.

Geography Indonesia is located in Southeastern Asia. It is an archipelago of islands between the Indian Ocean and the Pacific Ocean with a total coastline of 54,716 km. The island of Bali is

one of Indonesia's 17,508 islands, an archipelago located south of the equator where the Indian Ocean meets the Pacific. The tropical Indo Pacific region in which Bali is located is considered to be on of the world's richest ecologically biodiverse systems. Bali is in essence a volcanic island with the volcano, Mount Agung, revered as a great spirit by the local people, as its highest peak rising 3,142 meters above sea level. Another peak, Mount Seraya, which lies east of Agung, rises 1174 meters above sea level. Volcanic island with high crater peaks, deep valleys, cultivated lowlands, lush terraced rice fields and thick tropical forests in the highlands.

Time Zone GMT plus 8

Climate Tropical, hot and humid. Temperatures range from a high of 31°C (88°F) to 25°C (78°F) low. Highlands are cooler and drier. Lowlands along the coast are pleasantly drier than



the main tourist areas in the south. Monsoons. The dry season takes place April through November, and the wet season, December through March. Natural hazards include occasional floods, severe droughts, tsunamis, earthquakes, volcanoes and forest fires.

Environmental Issues Deforestation, sewage, industrial water pollution, urban air pollution, forest fire smoke and haze

Health In Bali, there is no major risk. Unlike islands further east in the archipelago, there is no Malaria/Dengue fever in the



RIGHT: Location of Bali on global map
BELOW: Location of Tulamben on map of Indonesia
FAR RIGHT: Diver hovers over wreck of the *USAT Liberty*



When traveling in the rest of the country, be aware of the high degree of risk of 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. Please note that highly pathogenic H5N1 avian influenza has been identified in Indonesia, but it poses a negligible risk with extremely rare cases possible among visitors who have close contact with birds (2008)

Population 3,000,000 (2011 est.); Religion: 87% Hindu, 3% Christian, 8% Muslim

Visa Travelers from most Western countries do not need a visa and are automatically given a 30-day stay permit upon arrival. Passports must be valid for at least six months upon arrival in Indonesia. Indonesian immigration is very strict. No work is permitted while visiting on a tourist visa.

Indonesian Law Very hard on drug offenders; the death penalty is regularly applied on narcotics couriers.

Driver's License A valid international driving license is required. Rental car insurance is highly recommended. Drive care-

fully. Traffic rules are not followed as well as in the West. Accidents are frequent.

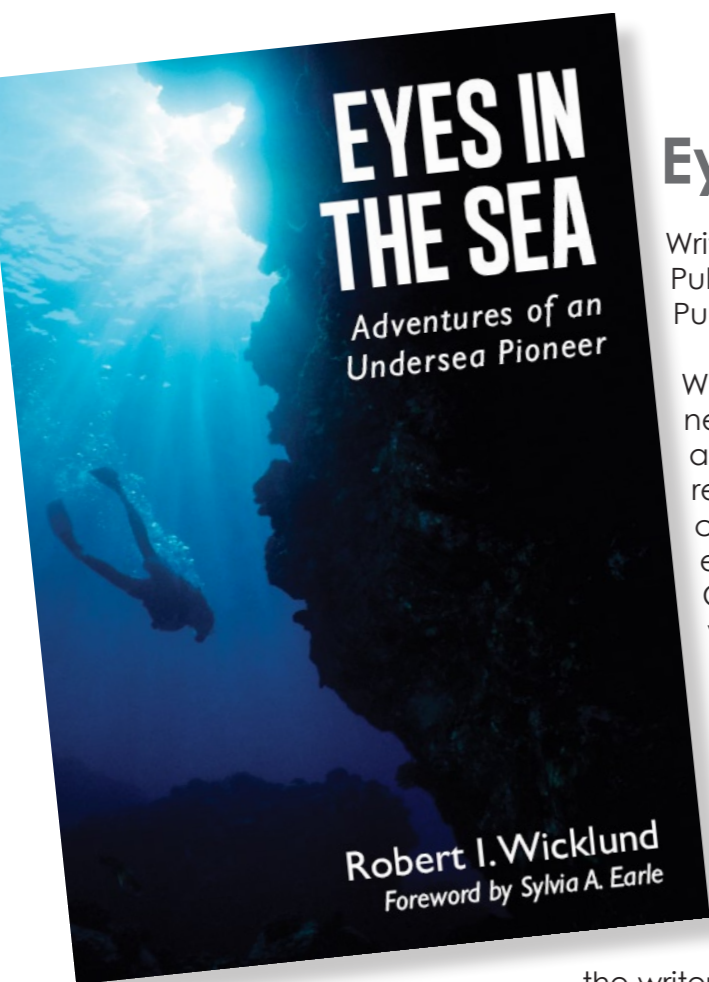
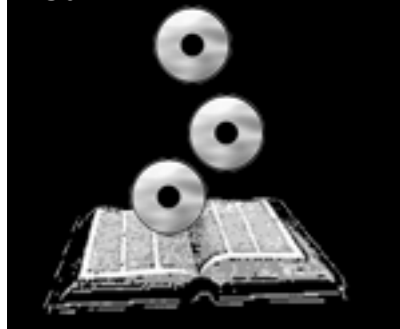
Currency Indonesian Rupiah (IDR). Exchange rate: 1 EUR=10,002 IDR; 1 USD=9132IDR; 1 GBP=14537IDR; 1 AUD=9,500IDR; 1 SGD=7,316IDR. Credit cards are accepted by most higher end resorts and businesses. Payment in US\$ cash and traveller's checks is widely accepted.

Dive Season All year round; Underwater visibility varies 15 to 35 meters during dry season, 10 to 20 meters during wet season.

Decompression Chambers Hyperbaric Medical Department Sanglah General Hospital USUP Sanglah Denpasar
Jl. Diponegoro Denpasar80114 Bali, Indonesia
info@sanglahbalihospital.com
www.sanglahbalihospital.com

Rumah Sakit Angkatan Laut (Navy Hospital)
Jl. Bendungan Hilir No.17 JAKARTA 12950, JAVA, INDONESIA
Tel: +62-(0)21-2524974

Web Sites
Bali Tourism Authority
www.balitourismauthority.net
Bali Guide
www.baliguide.com ■

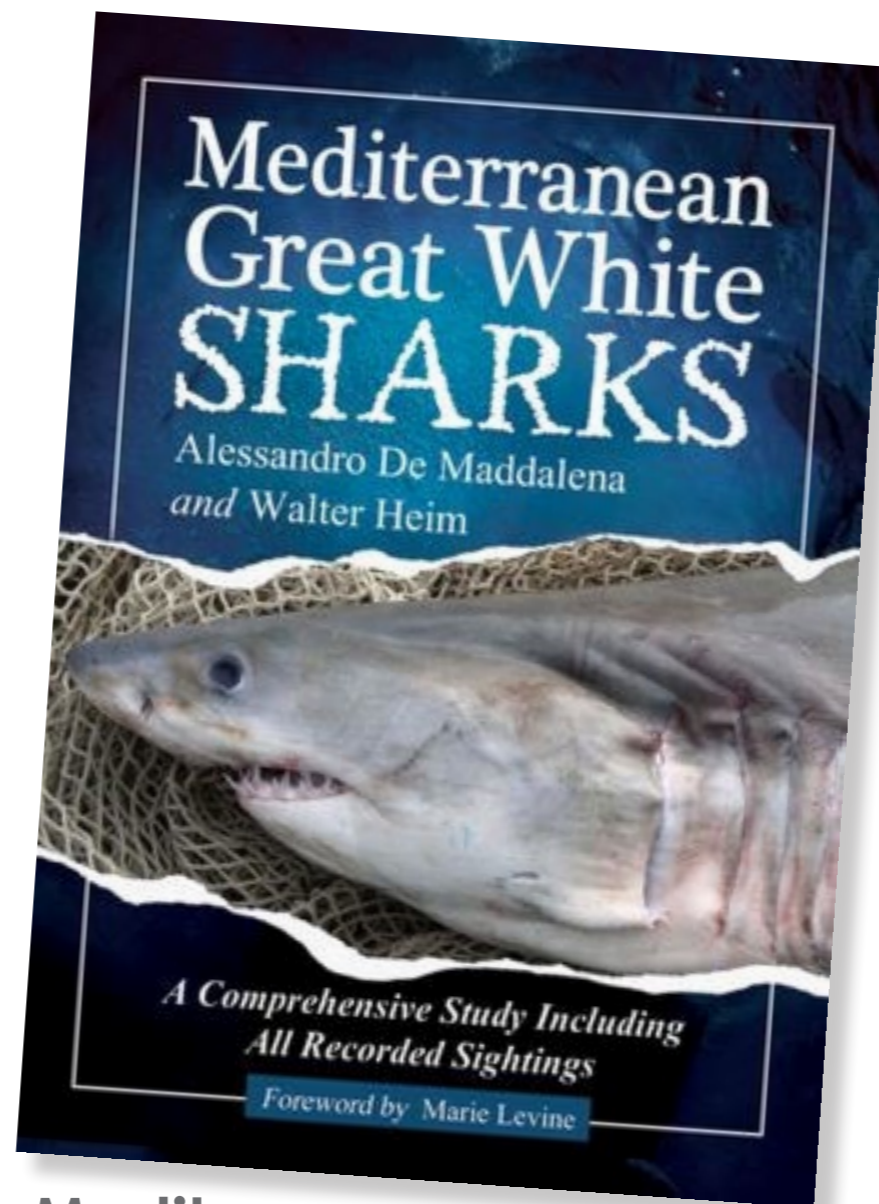


Eyes in the Sea

Written by Robert Wicklund
Published by Mariner Media
Published in March 2012

Written by underwater pioneer Robert Wicklund, this action-packed book takes readers on a literary roller-coaster from underwater encounters with Fidel Castro to spending time with Prince Charles in the hydrolab, to expeditions in icy Arctic waters and standoffs with drug smugglers. Yet you won't find this book under the Fiction section of your bookstore—the stories within depict

the writer's real-life experiences, which had propelled him to become one of the world's leading underwater scientific observers. In writing the book, Wicklund "wanted to chronicle the events and adventures that we had". He sought to share with others the natural history and marine life within our oceans, depicted through his experiences over the last 50 years. As Sylvia A Earle wrote in the Foreword, "Bob Wicklund shares an insider's view of historic events [...] some terrifying, some wise, some breakout-laughing hilarious, others painful sagas of loss, both of treasured friends and of treasured places in the sea." So, if you're in the mood for a thriller—albeit one that's based on actual events—Robert Wicklund's *Eye in the Sea* is a pretty good bet.



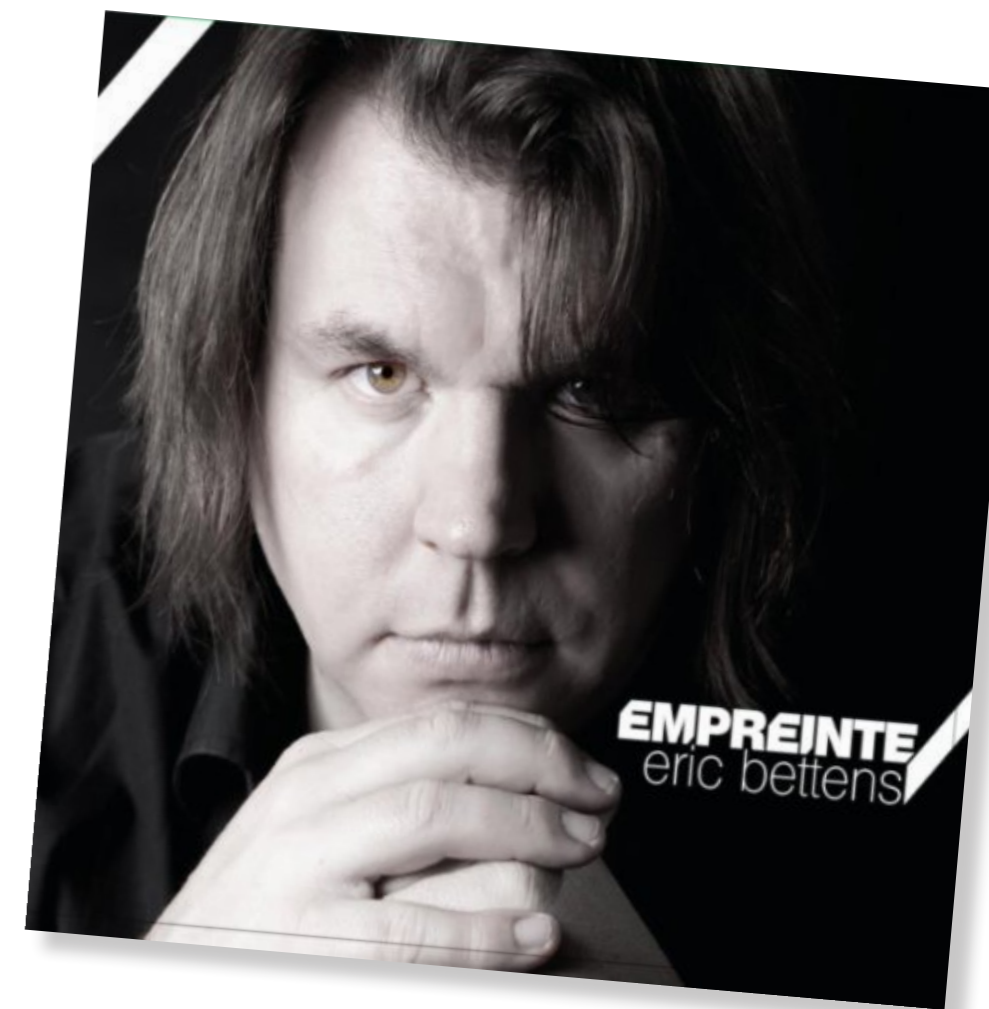
Mediterranean Great White Sharks

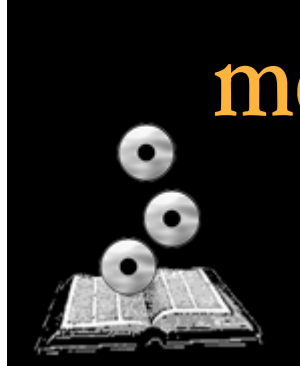
Written by Alessandro De Maddalena and Walter Heim
Published by McFarland

It started out as a university thesis about great white sharks in the Mediterranean, but it became a platform for something far greater. After Maddalena submitted his thesis, he continued working on it, unleashing its full potential as a database of the entire great white shark population in the Mediterranean. Today, the Italian Great White Shark Data Base is possibly the world's most extensive study of the great white sharks in the region. Information about the species' size, habitat, behaviour, diet, reproduction and other related factors can be found in this book. All recorded sightings of the mammal since the Middle Ages can also be found in this book. Author Maddalena is a founding member of the Mediterranean Shark Research Group and has written 17 other books about sharks.

Empreinte

It is quite rare that we give music a mention on this section but Belgian Eric Bettens composes music for the underwater world and has performed at several dive festivals as well as created music scores for several films. I first met Eric at the World Festival of Underwater Pictures in Antibes, France, where the jury awarded him the François de Roubaix Prize for his work—for a good reason, as Eric Bettens' compositions work very well with underwater footage. An often symphonic blend of acoustic and electronic music with elements of both classical music, jazz, folk and ambience, his music defies easy classification but it's got its own complex yet pleasant character that seems to work equally well on the Hi-Fi, the iPod and in the car. Soundbits of his music can be freely sampled and later purchased on various sites such as iTunes and MySpace. Check it out. Eric-Bettens.com



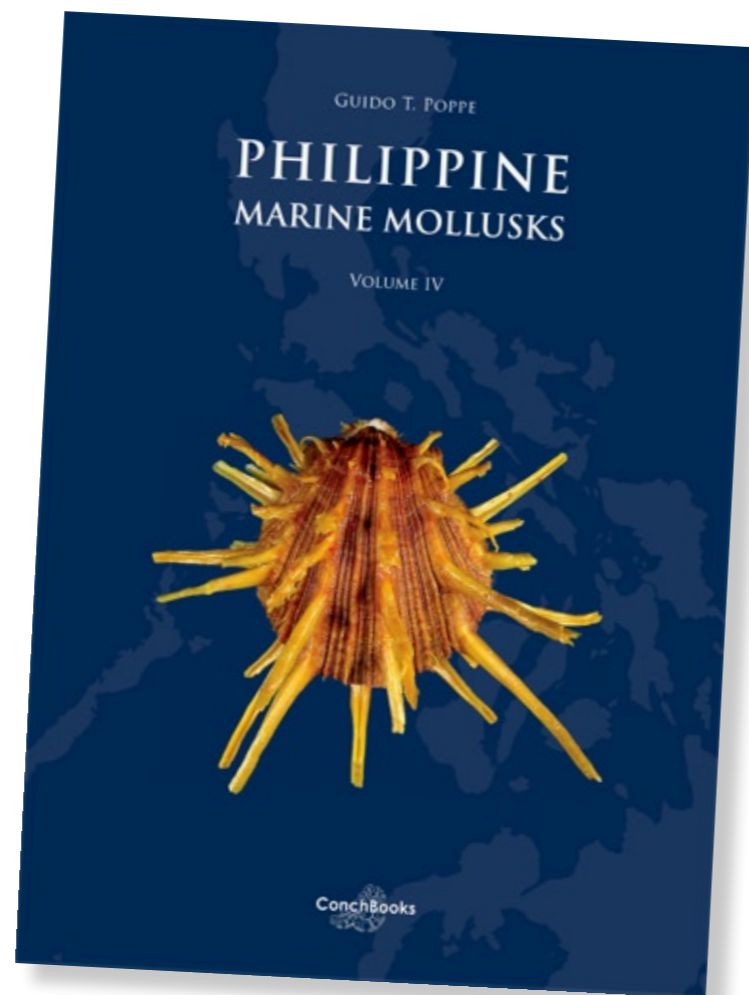
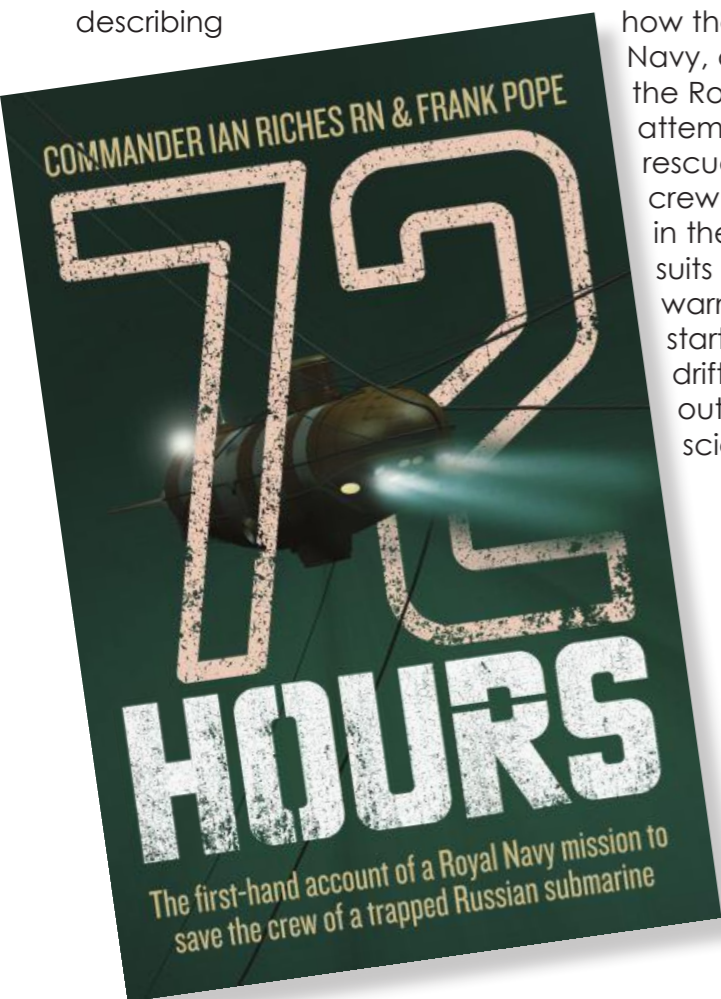


72 Hours

Written by Frank Pope
Published by Hachette Australia
March 2012

We go through life hardly thinking about the air we breathe. Yet when air becomes scarce, this very basic function becomes an all-consuming compulsion. This was possibly what a seven-man Russian crew on a secret mission experienced when their submarine got snared by cables deep in the ocean, sinking to the sea floor and leaving them with 72 hours' worth of air. This book is based on actual

events in 2005, how the Russian Navy, and then the Royal Navy attempted to rescue the crew who, in thermal suits to keep warm, had started to drift in and out of consciousness.



Ships and Boats: Prehistory to 1840

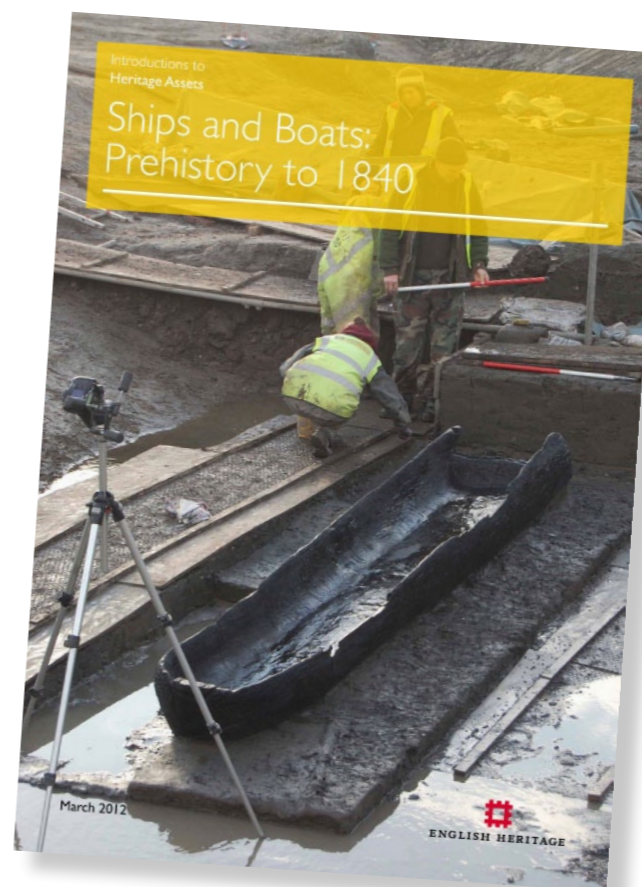
Published by English Heritage
Published in April 2012

This compact volume packs a wealth of information in just 16 pages. It covers the history of shipbuilding in Europe, starting from the basic hollowed-out logs of prehistory to the racing yachts of the 1800s. The evolution of shipbuilding is explored, describing vessels that have sailed in inland, coastal and open waters. Even ships that have been long abandoned or buried are featured. Without beating about the bush, the author dives into the whirlpool of different seafaring vessels through the centuries: from simple dugout canoes and skin boats to Viking ships, steamships and military craft. Personally, more diagrams would have been more useful to help illustrate the technical details. Nevertheless, this book is jam-packed with more data than most readers would be able to absorb at one reading. Definitely a worthy addition on the bookshelf of anyone interested in seafaring history.

Philippine Marine Mollusks Volume 4

Written by G. T. Poppe
Published in March 2012

This 680-page book – the fourth volume – concludes this comprehensive series on the marine mollusks in the Philippines. Published early this year, this book has become an invaluable resource for conchologists studying the mollusk species in the region. From the Bivalvia and Lucinidae, all the way to the Chamidae, Tellinidae, Psammobiidae and Mactridae; readers get to sieve through as many as 1,005 different species, via thousands of pictures. Many of the photos depict live specimens. As the knowledge about the region is constantly increasing, this volume includes more than 280 species not described in the previous Volumes because they were not yet discovered (either in the region or at all) at the time of writing. And, as if the information contained in the series is insufficient, there is also a seven-page round-up of the complete literature concerning this particular region.



Apps

Marine Fish ID: Great Barrier Reef

app by Neville Coleman is a must-have iPhone app for snorkelers, divers and others interested in marine species. For over 45 years, Neville Coleman OAM, world renowned underwater naturalist, photographer and marine life author, has explored the world's oceans, found new species and observed marine life behaviour. The *Marine Fish ID: Great Barrier Reef* app contains a comprehensive selection of 890 fish species found in the seas of the Great Barrier Reef and Queensland, Australia—an area of great diversity in marine fauna.



WhaleALERT

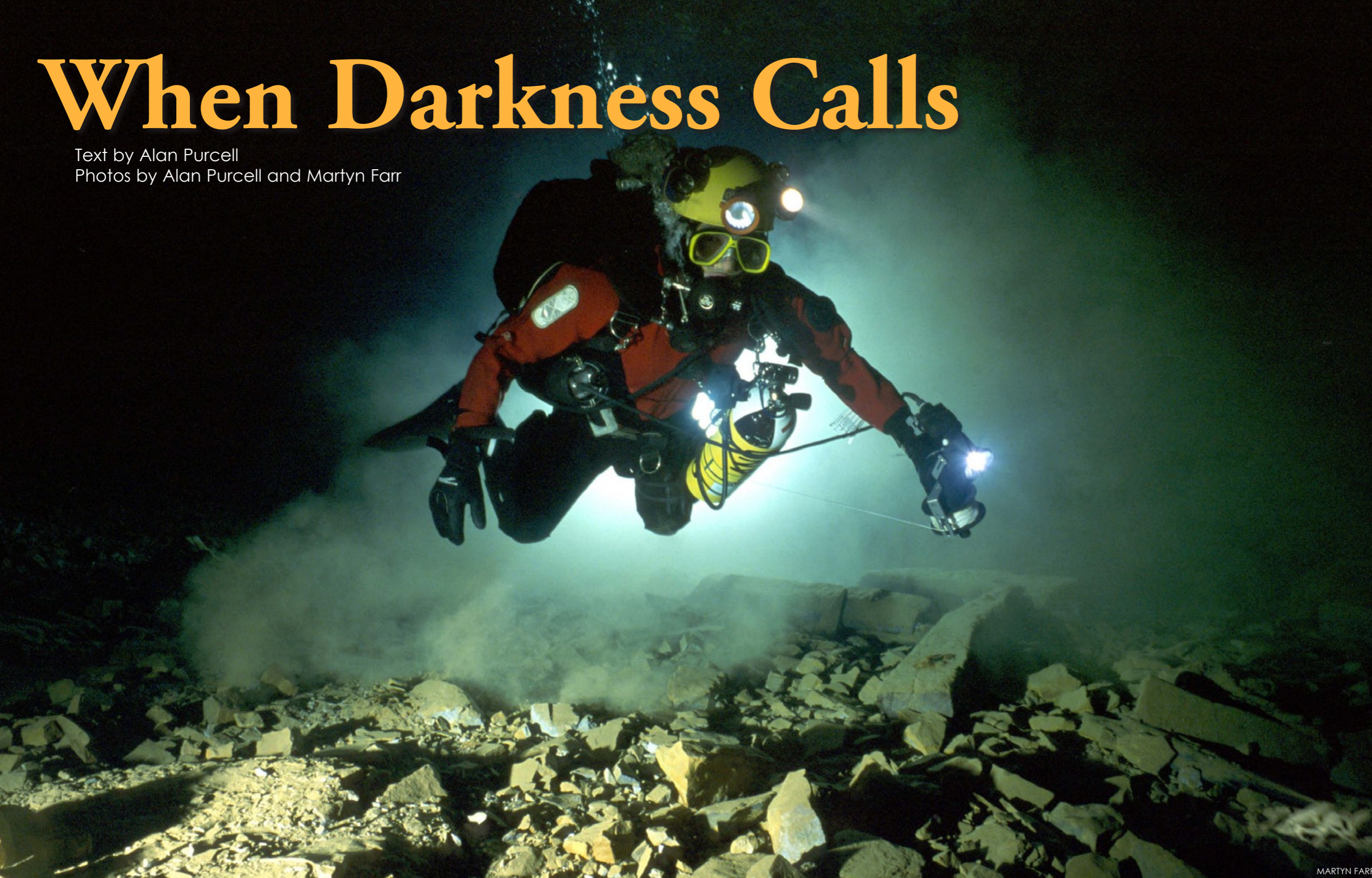


Mariners along the U.S. east coast can now download a new iPad and iPhone application that warns them when they enter areas of high risk of collision with critically endangered North Atlantic right whales. The free Whale Alert app provides one source for information about right whale management measures and the latest data about right whale detections, all overlaid on NOAA digital charts.

When Darkness Calls

Text by Alan Purcell

Photos by Alan Purcell and Martyn Farr



Diver in
Silica Mine

Alan Purcell talks about the moon, jelly doughnuts, and what happened when he went to South Wales, UK, to meet renowned author and cave diving expert, Martyn Farr, to try out the first part of his Cavern and Overhead Environment course.

I'm in a mine in South Wales (this doesn't happen every day), I'm underwater, and my computer registers a depth of seven metres. The only light comes from our helmet-mounted torches shining out into the 30m+ visibility, and where only two metres above my head, my expelled air gathers like pools of liquid mercury on the ten metres of solid rock that make up the cavern roof! I gaze down at the boulder

strewn floor, a carefully positioned line marks our way out. My instructor swims into view and indicates to my buddy and I that it's time to run through our zero visibility drill—following a line in the darkness using touch alone. I grab hold of the line and hesitantly switch out my light... Madness! That's what you're probably thinking at this moment, but let me tell you what made me go on this course,

and why I think everyone could learn something from it.

First of all, a bit about me. I'm essentially a novice diver with just over 100 U.K. dives and 30 odd dives in various places from the Mediterranean to the Maldives. My favourite place to dive is definitely Scotland, so far. I don't have a particular favourite type of diving. I like the big wall dives and overhangs at the Garvellachs

(Garbh Eileach), the drift dives on Skye and Falls of Lora and the odd wreck (*HMS Port Napier* and the *Thesis* being my favourites) but mostly I just like getting under the water. I'm not brave, or looking for that next "thing" to add to my list. Diving is the most adventurous thing I do (when my children allow it).

After seeing a documentary with David Attenborough about caves and some amazing underground locations, which showed divers floating through crystal clear water, I thought that maybe one day that would be something I would like to do. I then came across an advert for Farworld in a magazine, which looked pretty interesting, only, when I got home, I did a web search for "Farrside" instead, by mistake. I eventually came across Farworld and Martyn Farr—this looked like the thing!

There were numerous courses on offer, and at this point, I didn't actually think it would be something that I would do. (adventurous things were what other people did.) It was just really interesting. I bought some of Martyn's books—*The Darkness Beckons* and *Diving in Darkness*. Even if cavern or cave training doesn't appeal to you, these are still fantastic books.

The techniques, kit configuration and numerous stories were all fascinating, and I started to seriously think about doing the initial course, more so to get a better appreciation of what people like Martyn Farr, Jochen Hasenmeyer and other cave diving legends, had accomplished.

I'll confess that the kit configuration part became a bit of an obsession. Why did they wear their gauges on their arms? Why weren't their knives on their legs? Why did they have three lights, etc, etc? Gradually, it all started to make sense. After reading other people's trip reports on numerous forums, I decided this was something I needed to do. I contacted Martyn and got the course booked for February. Christmas came

MARTYN FARR





ALAN PURCELL

The Abyss: This is the bottom of the hole and the exit point of the dive from the White Lady Cave entrance

and he didn't waste a moment.

The practical lessons were in a pool. The pool was covered, which gave us a great feel for being "underground", and we took it in turn to practice laying line before conducting a lights out or silted environment drill, which entailed being placed at one end of the line and feeling your way round the course without getting tangled up or wrecking the line.

Martyn placed a black cloth in my mask and then led me into the water. I got a little disoriented and didn't have a clue

where I was facing, so I made sure I was a little negatively buoyant and then focused on not letting go of the line.

It's quite strange how your body compensates for having one of its senses cut off. Hearing was of little use, so I focused totally on the information my fingers were getting through my 5mm gloves. This quite literally was my lifeline—at least, that's how I treated it—and slowly but surely I worked my way to the end and came back to the surface to words of encouragement from my buddy and Martyn (this was a great confidence

boost).

With the pool session over, we went over what would be expected of us on day two, with Martyn explaining everything on a plan view of the Silica Mine. We then met up for drinks (after I'd had lamb chops at the Vine Tree for the second night in a row) and Martyn went through more theory and a general recap.

Day 2. We met up at Martyn's, packed up our gear, and then headed off to the Silica Mine. Martyn was kind enough to answer some of my ques-



ALAN PURCELL

and went, and then the number of "sleeps" left countdown began.

The trip down

I drove down from Scotland, and the journey wasn't too bad. I eventually got to Langattock, and after a few wrong turns, I found my guesthouse, Park Place, which was actually just outside Langattock. It was very nice, offered massive breakfasts and was only two minute's drive from Martyn's house.

Day One. I arrived at Martyn's, slightly nervous—just what was this guy going to be like? I needn't have worried. He came rushing out of his house with a smile,

signalled for me to pull into the drive, and I instantly knew this guy was going to be a lot of fun.

My buddy for the weekend turned up a few moments later. He had driven down from Lochaline (there's me thinking, I'd had a long journey!) We got invited into Martyn's straight away, and Helen was instantly welcoming us, making us tea and getting us to sign the usual training documentation.

Martyn gave us a slide presentation, taking us through different types of cave diving, line laying techniques and what constitutes a cavern dive, etc, before taking us out to his equipment room, which looked like Aladdin's cave with maps of the Silica mine

at Dinas Rock, amazing photographs and loads and loads of equipment. We then went through the required equipment for the course, safety reel, helmet and Martyn's own equipment.

This was great for me—getting an insider's guide from the guy who had quite literally written the book on cave diving. The key was simplicity, with everything to hand within a moment's notice. Martyn then took us through our own kit and made the necessary changes in preparation for the practical lessons in the afternoon.

I should point out here that over the course of the two days, Martyn was always providing bits of useful information. The two days were quite literally packed,

This is the entrance to White Lady Cave where we got ready





MARTYN FARR



ALAN PURCELL

Caverns

This is about 20 metres inside the White Lady Cave and shows the entrance

FAR LEFT: Cavern diver in training

tions about his own explorations and his experiences with Jochen Hasenmeyer. We then split up our gear so as to make two trips over the "hill". Other people have relayed that this part was "a bit of a trek", and they weren't joking.

I'm basically a jelly doughnut in human form so was beginning to pant when only half way up. Martyn and my buddy were way ahead of me, but I eventually caught up and got into the mine for a cool down. We kitted up, fitted our helmets, switched on our torches and made our way down to the water. I did feel a little nervous and mentioned this to Martyn. He explained that this was just because I was doing something new and that I would be fine.

The water didn't look deep enough, but when I stepped in, it reached waist height. We went through our buddy checks, our air (calculating out loud our turn points and rules of thirds) before running through the dive plan and last minute queries.

Exercise 1. Exercise one was to be led by my buddy. We would then turn around and switch our lights off at a designated point and make our way back to the entry point via the pre-laid line.

The dive itself was fantastic. It was very exciting to be diving through the tunnels (we were at no point any further than about five meters from a main air filled chamber, but you certainly got the full overhead experience). I did not feel tense or worried in the slightest, and this surprised me. It was very relaxing, and the 30m+ visibility (yes, really) made for a fantastic "floating through air" experience. This was what I had come for—absolutely superb.

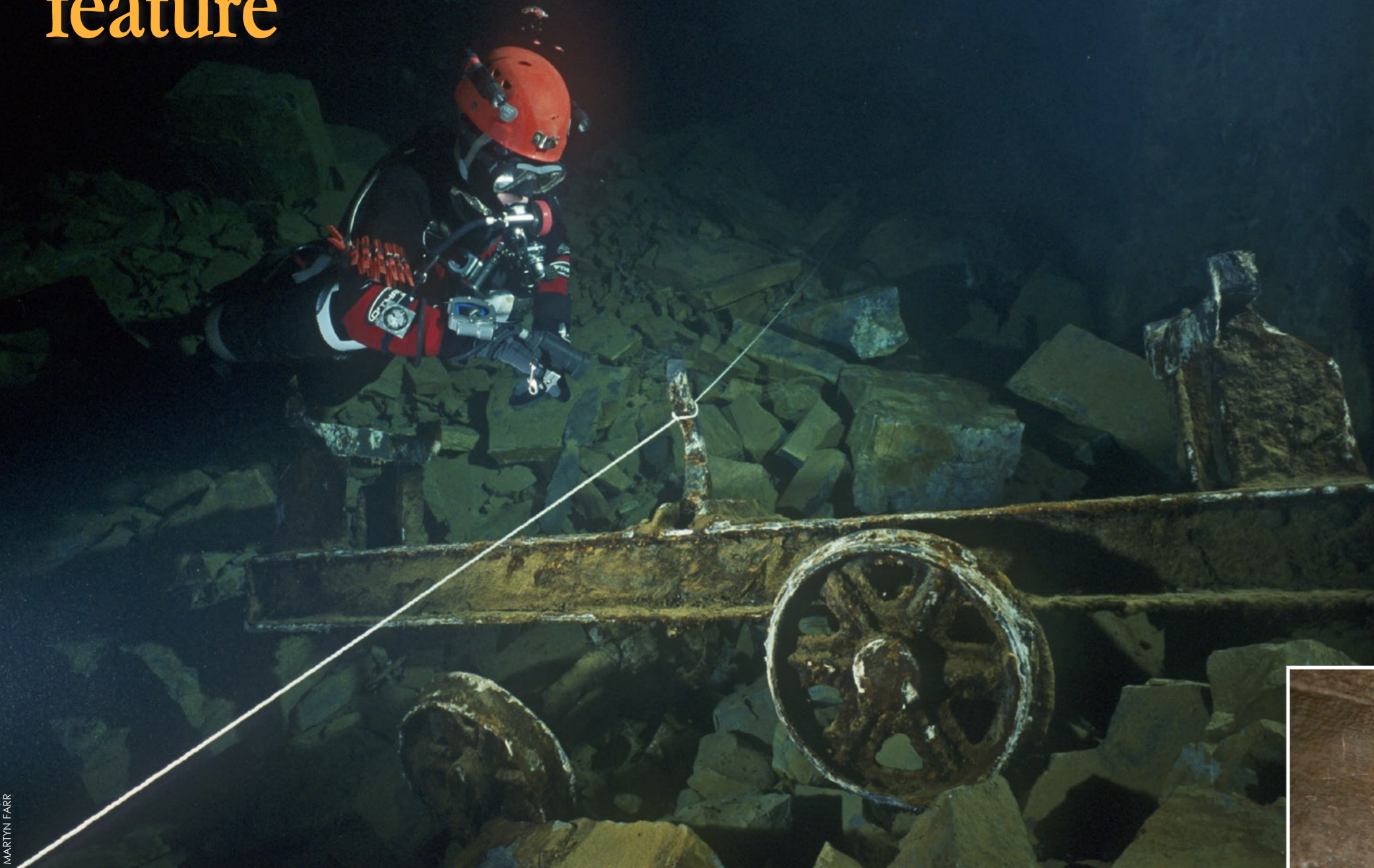
We carefully followed a thick green line that varied on its course from 3m depth to about 7m depth. After about 13 minutes, we turned around, and I led signalling "OK" to my buddy every now and then either by rotating my head mounted torch to shine a circle on the mine wall or just lighting up my hand, as

I would do in a normal night dive. Martyn was with us the whole time but kept back and let us take our own pace.

After going round a few more corners, Martyn came into site and signalled for us to turn our torches off. It was now time for the lights out drill and for us to execute our "bump and go" strategy of me following the line for a few metres and my buddy then following, squeezing my ankle three times to indicate he was okay before I set off again.

The actual experience of doing this in the dark was a huge mixture of emotions. Bear in mind that I was about 7m underwater, in complete darkness whilst overhead there was about 10m of solid rock. I did not feel panic, not a drop of fear—just incredibly calm. I could feel the line, I could breathe. All I needed to do was replicate what I had done in the pool the day before.

Touch became everything. I'd made some mental notes whilst following the line on our entry. This is



Diver inspects the tram in Silica Mine

Caverns

was a BIG metal reel) laying line, all took a fair amount of practice. So, I made myself a little more negatively buoyant than usual, tying off the first belay around a nice big rock. Every ten metres or so, I made another belay, sometimes tying onto a rock, sometimes taking a “snoopy loop” (all hail the mighty snoopy loop) out of the “garter” on my leg, looping this onto the line and then wrapping it around a rock (making sure that the line was always available from the top—we might be relying on this before too long).

A small bit of confusion followed. We were supposed to surface into a side passage and swap over duties, but my buddy obviously had his sights focused on laying some

line, and so I went with it and followed on just tweaking the line every now and then to make sure it wasn't too tight or, more dangerously, too slack.

We headed up to a small opening, and my buddy was a little confused trying to make his way through. I had remembered this “window” from the dive briefing the day before and knew that our corner lay a few metres further on, so indicated that to my buddy, and we headed off.

We then got to our designated “turn” point and indicated that it was time to “turn” the dive (this hand signal is similar to that of being marked). I was approaching the end of my third of air and so passed that onto my buddy, and off we went. I went ahead taking the loops off the rocks and keeping the line fairly taught to enable an easy reel in.

We swapped over half way through just as we were going down a small incline, and I went down the hill (holding the reel) a little faster than I would

worth doing as there were a few places where later on, Martyn explained, there were some deliberate pitfalls, a place where the line goes under a mine rail for a metre or so, and a place where a much thicker climbing rope is attached. These mental notes were invaluable, and the need for making good belays with line that you could actually feel continuously were all hammered home. If your visibility was to be restricted—this was your lifeline.

Every few metres I stopped to wait for my buddy. After about four or five “bumps”, I felt him approach behind

me, but no three squeezes—what was wrong? I felt around for where I imagined his wrist to be and squeezed it three times. Once would have been “I'm panicking” or “something is wrong, help”. He had simply forgot. He instantly squeezed three times back, and we carried on.

Eventually, I could make out a slightly lighter portion come into my vision. This was the torch that Martyn had placed near our entry/exit point and a mixture of “yes, we've made it” and “over so soon” came into mind.

We surfaced to congratulations from Martyn. He asked how we thought it had

gone. I had loved it, and thought it had gone okay. Martyn said it was one of the best practicals he'd seen (now, whether he says this to everyone or not I don't care—right then and there, I was on top of the moon!).

Exercise 2. After a few handshakes, it was back to business. I was to lead the next dive, this time laying our own line, my buddy to follow checking the line, etc, as we went along. We set off. Now, other than putting up a DSMB about 40 times, I've never had to carry anything, and the act of carrying a reel (and this



ALAN PURCELL

This is about 50 metres inside the White Lady Cave looking towards dive base



ALAN PURCELL

An elevated view of the White Lady Cave with dive base just around the corner

Silica Mine entrance (top and bottom right)

We packed up our kit, trekked back over the hills and made our way back to Martyn's—talking through all aspects of the dive, areas where we could improve, things we did well, etc. Martyn gave a more formal debrief once we were back at his house and said that, overall, we had done well. He issued an exam paper to be completed in our own time and went through some of the things we could expect to do should we decide we move onto doing the "Intro Cave" course. Wow, bar the exam paper, looks like I actually did okay.

I was a bit sad to be saying goodbye, but I know that I will be back (probably next year) to follow on. Who knows if I'll ever go diving in a Mexican Cenote or Floridian cave (I hope I will) but some more training with Martyn is a definite. ■



MARTYN FARR



ALAN PURCELL



MARTYN FARR

have liked. Line was going everywhere—not good. I sort of crouched/wedged myself to the side of "The Mine Cart" (everyone whose done the course will know where this is) and slowly got myself back on track. My buddy came to the rescue by gathering up the slack, and after a spot of team-work, we were off again.

Before we knew it, we were back at the surface for a debriefing from Martyn. I hadn't done quite as well this time around, but Martyn said that our communication was good and that at no point did he feel like he needed to step in and sort things out.

This (I think) is the mark of a good instructor. We were at no point in any danger, but when things got a little difficult, he let us work it out for ourselves. Focusing on our communication and methodical approach, we learned a great deal purely by doing, rather than being nannied.

All too soon the dive was over, and I had loved every minute of it.

LEFT: The underwater tunnel is located to the right of this pool and exits at the Abyss



It's raining sharks in
French Polynesia

Text and photos by Andy Murch



French Polynesia



Napoleon wrasse (left); Diver and silvertip shark (above)

Imagine if you had the opportunity to explore a tropical island nation split into five diverse archipelagos, collectively containing 118 exotic islands and atolls. Each one has its own unique underwater flavor and a traditional culture as complex and fascinating as any indigenous people's of the world. So far so good, but now imagine that out of those 118 fantastic destinations, you can only visit one.

For many divers, French Polynesia (FP) presents an impossible dilemma. Names like Tahiti, Rangiroa, Moorea and Bora Bora immediately spring to mind as must-dive destinations, but

for the discerning big game hunter, it all comes down to the mega fauna. If you stick your head underwater virtually anywhere in FP, you're likely to see sharks swimming around, but there is an atoll in the Tuamotu Archipelago where the sharks are so thick that they practically block out the sun—Fakarava. In our shark-free brave new world, that is a very rare sight indeed.

Fakarava is a mere one-hour puddle-jump from the capital city of Papeete on the big island of Tahiti. In turn, Papeete is a mere eight-hour flight with Air Tahiti Nui from Los Angeles, making it one of the easiest South Pacific destinations for North Americans to get to.

Exceeded in size only by Rangiroa, Fakarava is the second largest atoll in French Polynesia. Roughly rectangular

in shape, it is a pancake flat, coral encrusted donut that is as underdeveloped and picturesque as one could possibly hope for in a tropical paradise.

Fakarava's entire infrastructure consists of a few small villages, a handful of guest houses and restaurants, one beautifully rustic luxury hotel (the White Sand Beach Resort) and a pearl farm or two jutting into the inner lagoon.

Although well known among savvy European divers, there are so few tourists for much of the year that the island feels as though it has been deserted.

In stark contrast to Fakarava's peaceful terrestrial ambience, below the surface is a bustling metropolis of hard coral structures that form a continuous ring of healthy reef around the island.

In Fakarava, its all about the sharks.



The Coral Garden; Grey reef sharks and school of sabre squirrelfish; Day octopus (inset)

Paris to dive this protected atoll, and its not why I am here either. In Fakarava, its all about the sharks.

Diving with the sharks

There are two channels that allow tidal water to flow in and out of

Fakarava's 1,000sqkm inner lagoon: Passe Garue in the north and Passe Tamakohua in the south. I was told that the 800m-wide Passe Garue would make an ideal introduction to the marine wonders of French Polynesia, so I signed up with Top Dive Fakarava (FP's premier dive company with locations on many diver friendly islands). My only stipulation was that I wanted them to find me lots of sharks.

Barely ten minutes from the White Sand Resort Jetty, we stalled on a stretch of unbroken blue so wide and deep that it didn't really look like we were in the entrance of a pass at all.

Dropping into clear blue bottomless water, we kicked lazily and waited for the current to pull us into the channel. As the sea floor crept into focus, I could see dozens of shadows obscuring the coral heads below us. When



Grey reef sharks



All that pristine real estate supports a food chain as complex and abundant as the reef itself. From tiny threadfin butterflyfish to cow-sized Napoleon wrasse, Fakarava's fish species are diverse and extremely prolific. Schools of bright orange sabre squirrelfish hover under every available coral overhang and day octopuses ooze from one coral head to the next

in search of anything slower than they are.

The reefs are in such good shape that in 2006 the entire island was listed as a UNESCO Marine Biosphere Reserve. That in itself is reason enough to visit Fakarava, but it is not why plane loads of French plongeurs fly all the way from



Diver watches a large gathering of grey reef sharks; Purple crown jelly (top right); More grey reef sharks patrolling the reef (right)

the gap closed, the shadows transformed into scores of grey reef sharks holding position with imperceptible effort against the rushing water that was quickly dragging us into the shallow lagoon.

Once the sea floor was within reach of our nitrox mix (nitrox is free and encouraged on all dives with Top Dive), we descended into the next available dip in the coral and held on. Countless grey reef sharks drifted past as though the current was a figment of our imagination. For the most part, the 1-2m long sharks kept their distance, but occasionally one would swim right up to our hiding spot and eyeball us closely before peeling off down stream again.

With a memory card full of grey reef shark portraits, we rose up into the full force of the flow and let it sweep us into the shallows where the current finally abated, and I was able to start exploring the reef itself. Above 15m, whitetip reef sharks lorded over a food chain mostly composed of bannerfish, various squirrelfish species and some enormous schools of bright yellow goatfishes. That was more than enough to keep me entertained until my safety stop where I bumped into some bright purple crown jellies (*Netrostoma setouchina*) lit up by the midday sun.

Coral Garden. In the afternoon we visited the Coral Garden—an immaculate

stretch of reef on the outer wall just beyond the north entrance. There were sharks there, too, but not in the impressive numbers that inhabit the pass itself. Visibility outside the lagoon was exceptional, so I panned as wide as my lens was capable and tried to capture the sheer magnitude of the reef.

For an hour we slipped over seamless fields of coral. There were no snagged hooks or discarded nets, no broken coral heads from boat anchors or clumsy divers and no sign of coral bleaching even in the shallowest spots. It was like being transported back in time to that golden age before we lost our way.

That evening I snorkeled around the house reef at White Sand and watched



CLOCKWISE FROM LEFT: White Sand Beach Resort; Blacktip reef shark; Threadfin butterflyfish; Whitetip reef shark; Bicolor parrotfish

After an hour of dodging rain squalls, we descended onto a reef so clogged with sharks that I could not have counted them if I had tried.

Thirty meters below the surface, hun-

dreds of sharks held their ground against the gentle current. The majority were grey reef sharks, but I could also see at least 20 silvertip sharks and a handful of large ocean going blacktip sharks (*Carcharhinus limbatus*) keeping to themselves on the far side of the pass.

We settled onto a small sand patch (disturbing a few whitetip reef sharks in the process) and then watched the slow progress of the parade. The sharks worked their way through the narrow channel until there was no more pass for them to navigate through, then they allowed the current to drag them to the back of the group and began the oxygen replenishing journey all over again.

We stopped and marvelled wherever the sky was so thick with bodies that it appeared to be raining sharks. I tried to estimate the size of the school by splitting it into sections, but by the time we had drifted out of the pass, I had reached a number that I found unbelievable even though I had

just witnessed it with my own eyes. For the record, I am going to run with a very conservative 500 sharks, but I am sure there were more in the shadows and further out in deeper water.

The reefs of Fakarava are very well stocked, but how that many sharks can survive in such a small area without decimating the resident fish populations is beyond me. The sharks do not look undernourished. In fact, they appear to be relaxed and content, but I wouldn't want to be a wounded fish in Passe

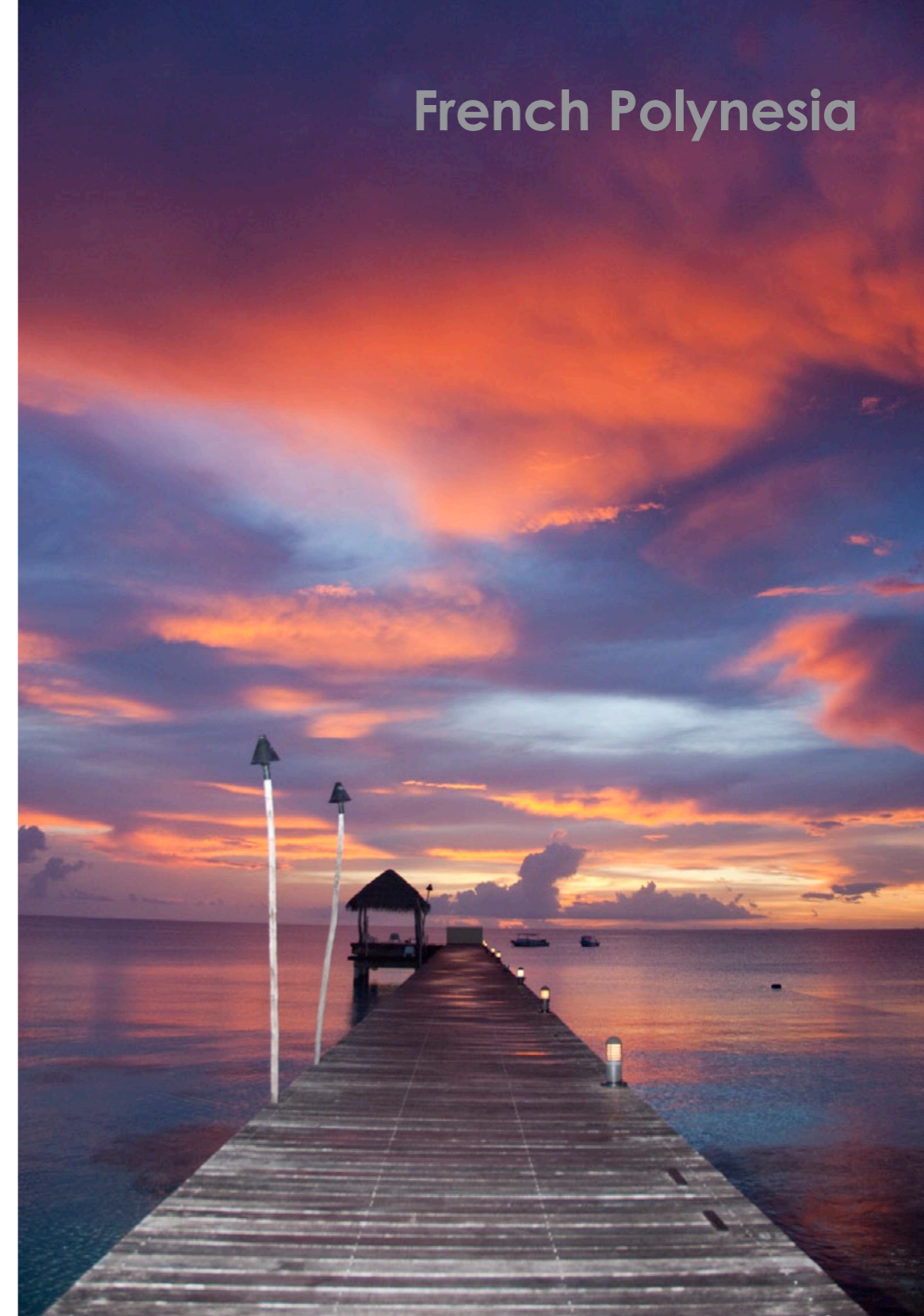
Tamakohua.

At the end of the dive, we surfaced in an area known as the swimming pool; a protected sandy spot where IndoPacific blacktip reef sharks (*Carcharhinus melanopterus*) and some even more enormous than usual Napoleon wrasse congregate in the hopes of scoring scraps from moored fishing boats. While the crew laid out a lunch of tropical fruits, pastries and delicious savory dishes (ah, the French!) I snorkeled with tiny blacktips; one eye firmly fixed on the intimidating mega-

the sky catch fire as the sun plunged into the lagoon. Not a bad introduction to French Polynesia, but the next day promised to be even better and possibly trump every day of shark diving I have ever had.

Passe Tamakohua. Top Dive provisioned one of their larger vessels, and we headed towards the much more remote Passe Tamakohua at the south end of the atoll.





wrasse.

Later, we visited a gorgeous pink sand islet where no footprints or other signs of humanity could be found. It should have been a dreamy way to wile away the afternoon, but the shark parade in Passe Tamakohua was so entrenched in my mind that I had trouble appreciating anything less intense.

The next day, we repeated the experience, but after three days of diving in the most shark-infested water I've ever had the pleasure of submerging into, I was forced to move on—curse inflexible itineraries! Fortunately, Fakarava is not the only French Polynesian destination with world-class mega fauna; 1500km away in mysterious Nuku Hiva, it's all about the whales! ■

Andy Murch is an underwater photographer and shark expert based in Victoria, British Columbia, Canada. Visit: www.elasmodiver.com



CLOCKWISE FROM ABOVE: Diver at the Coral Garden; A pristine pink sand island at Fakarava; The Swimming Pool near Tumakohua Pass; Sunset at White Sand Beach Resort; School of crescent-tail bigeyes

fact file



French Polynesia



SOURCES: US CIA WORLD FACT BOOK, SCUBADOC.COM, E-MED.CO.UK

History During the 19th century, France annexed various Polynesian island groups. The French resumed nuclear testing on the Mururoa atoll in September 1995 after a three-year moratorium. Widespread protests followed. In January

1996, the tests were suspended. French Polynesia's autonomy has been significantly expanded in recent years. Government: autonomous overseas collectivity of France since 2003, employing French law. Capital of Indonesia: Papeete, Tahiti

Geography

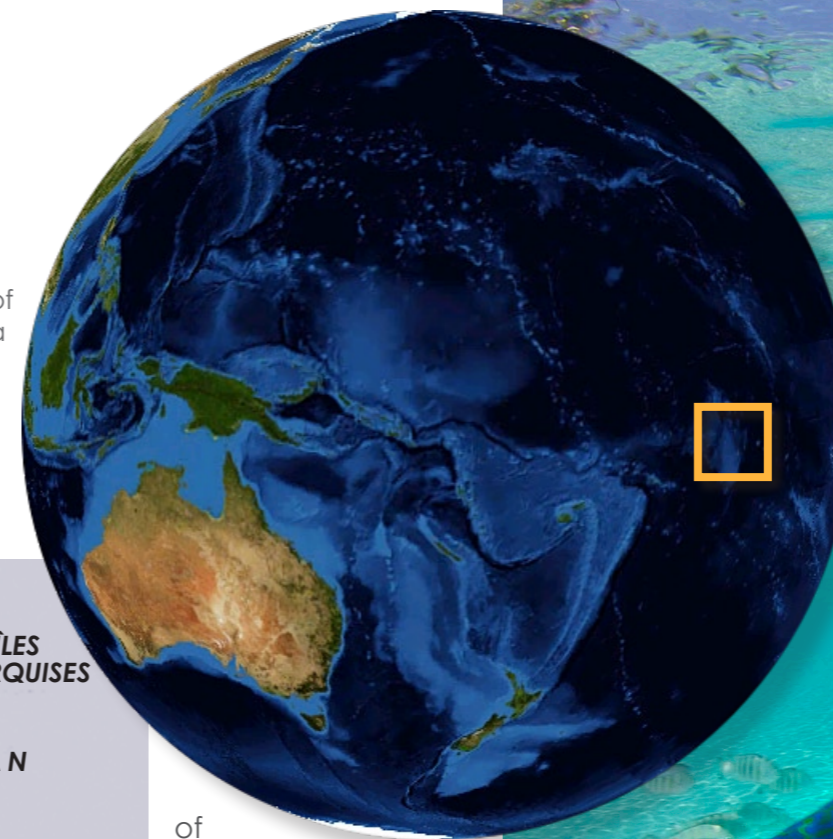
French Polynesia consists of five archipelagoes (four volcanic, one coral) of Oceania, a region in the tropical Pacific Ocean. These archipelagoes include Archipel Des Tuamotu, Iles Gambier, Iles Marquises, Iles Tubuai and Society Islands. They are located about mid-way between Australia and South America, in the South Pacific Ocean. The terrain of the area is a combination of low lands with reefs and rugged high islands. Coastline: 2,525km. Lowest point: Pacific Ocean 0m. Highest point: Mont Orohena 2,241m.



Climate Tropical, yet moderate. Natural hazards: a few cyclonic storms in January

Economy Since France stationed military personnel in the region in 1962, French Polynesia has shifted from a subsistence farming to an economy in which a large part of the work force either works for the military or in the tourism industry. But the military contribution to the economy fell sharply with the halt of nuclear testing by the French in 1996. Tourism leads the economy with about one-fourth

NASA



RIGHT: Location of French Polynesia on global map

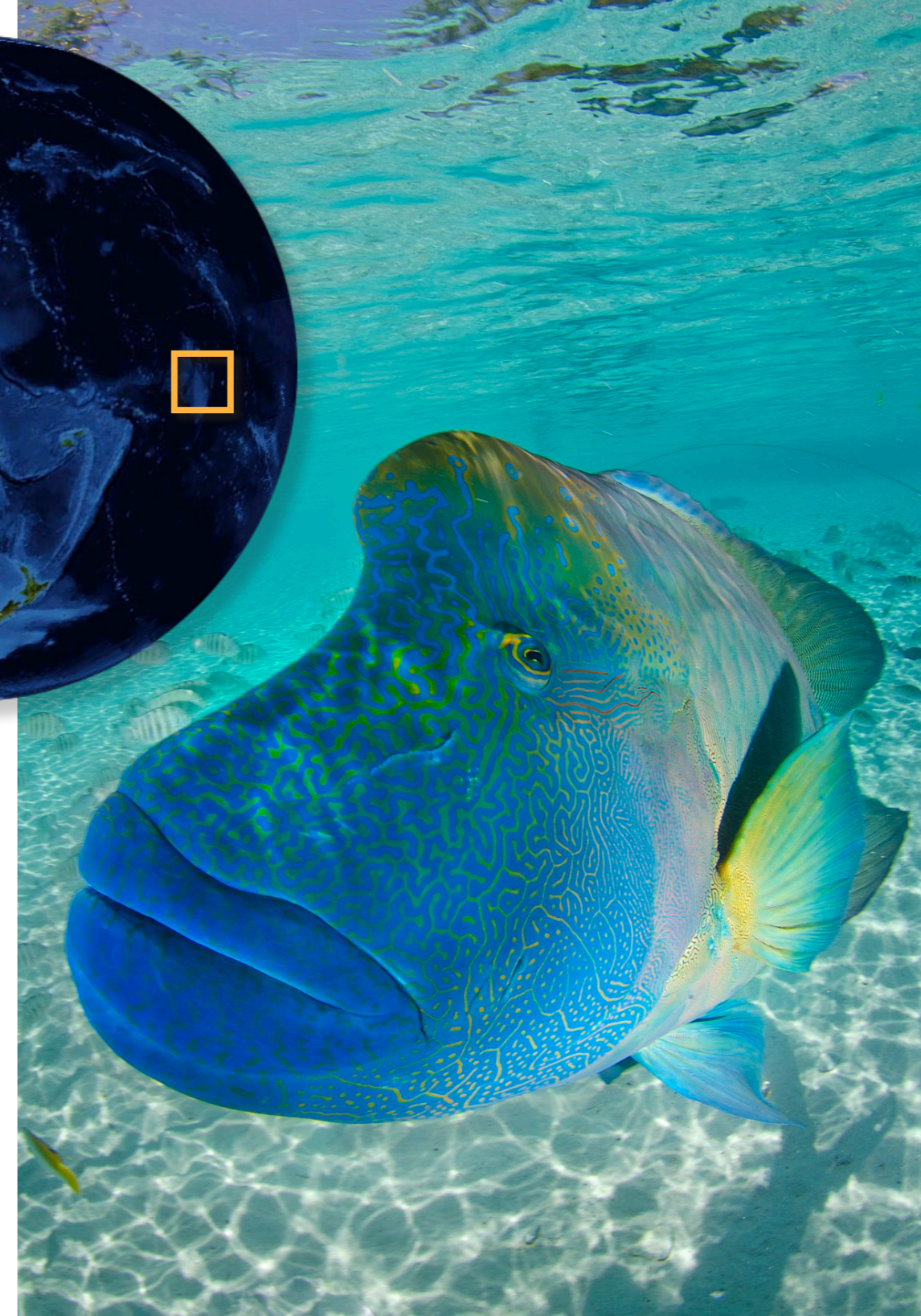
BELOW: Location of Papeete, Tahiti, on msp of French Polynesia

FAR RIGHT: Napoleon wrasse

of GDP and is a major source of hard currency income. Deep-sea commercial fishing and pearl farming are other sources of income. Agricultural products are processed primarily by a small manufacturing sector.

Development agreements with France focused primarily on creating new businesses and strengthening social services have benefited the territory. Natural resources include timber, hydropower, fish and cobalt. Agricultural production includes coffee, coconuts, vanilla, fruits and vegetables; fish, beef, poultry and dairy products.

Population 274,512 (July 2012 est.) Ethnic groups: Polynesian 78%, Chinese 12%, local French 6%, metropolitan French 4%. Religions: Protestant 54%, Roman



Catholic 30%, other religions 10%

Languages French (official) 61.1%, Polynesian (official) 31.4%, Asian languages 1.2%, other languages 0.3% (2002 census) Internet users: 120,000 (2009)

Currency Comptoirs Francais

du Pacifique francs (XPF). Exchange rates: 1EUR=119.33XPF; 1USD=90.05XPF; 1QBP= 146.36XPF; 1AUD=94.18XPF; 1SGD=72.77XPF

Web Sites

Tahiti Tourism www.tahiti-tourisme.com



Tropical rain shower at White Sand Beach Resort

shark tales



Filmed at Belize's Glover's Reef Marine Reserve, which is a coral atoll, this footage shows a juvenile nurse shark (*Ginglymostoma cirratum*) (left) and Caribbean reef shark (*Carcharhinus perezii*) (right) competing for access to the bait cage of one of the baited remote underwater video (BRUV) cameras used in the stud



INSTITUTE FOR OCEAN CONSERVATION SCIENCE

More Sharks In Protected Areas

Caribbean reef sharks are more abundant in marine reserves than in areas where fishing is allowed.

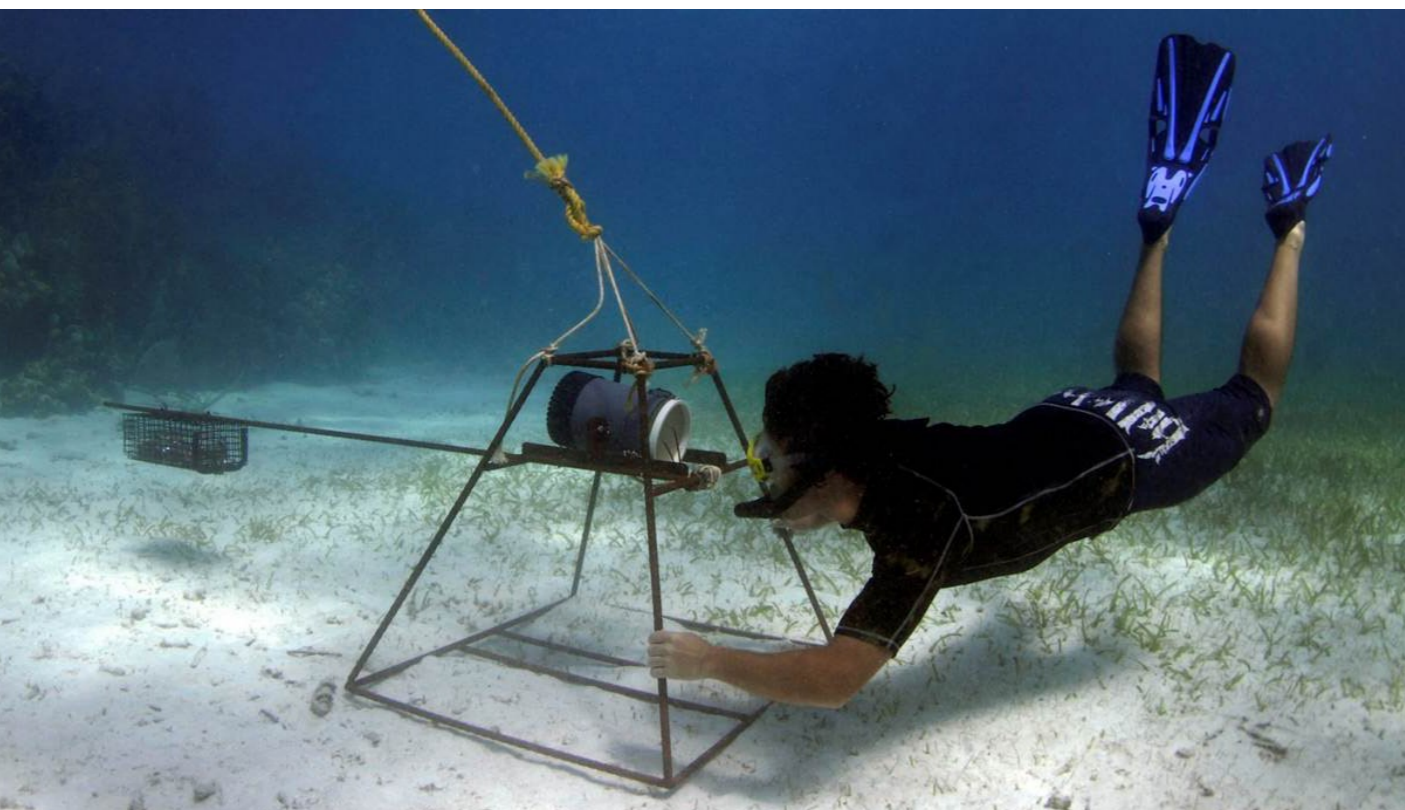
Researchers from the Stony Brook University Institute for Ocean Conservation Science compared the relative abundance of reef

sharks in two marine reserves with those in two areas where fishing is allowed and demonstrated that the sharks were more abun-

dant in the reserves. Data was collected from over 200 baited remote underwater video (BRUV) cameras, which were placed both inside and outside aquatic reserve areas on the Mesoamerican Barrier Reef in the Caribbean.

The video cameras were enclosed in protective housing and placed on the sea floor with small bait-filled cages positioned in front of them. Sharks, attracted by the smell of the bait, swam to the cameras, which allowed the research team to record, count and compare shark populations in the marine reserves to those in the areas where fishing is permitted, at no stress to the sharks. In addition to the BRUV surveys, the scientists fitted 34 reef sharks with acoustic transmitters and tracked their movements, using moored underwater listening stations. They found that the sharks, both juveniles and adults, live year-round within the reserves. ■

THE RESEARCH FINDINGS APPEAR IN THE PAPER, REEF SHARKS EXHIBIT SITE-FIDELITY AND HIGHER RELATIVE ABUNDANCE IN MARINE RESERVES ON THE MESOAMERICAN BARRIER REEF, PUBLISHED ONLINE IN THE JOURNAL PLOS ONE.



Lead author of the study, Mark Bond of the Institute for Ocean Conservation Science, positions one of the baited remote underwater video (BRUV) cameras, nicknamed "chum cams", down current at Glover's Reef Marine Reserve



HAMMERHEADS - TIGER BEACH - SPERM WHALES
HUMBOLDT SQUIDS - SAILFISH BAITBALLS - MANTAS
WHALE SHARKS - HUMPBACK WHALES - SANDTIGERS
DOLPHINS - SOUTH AFRICA - CROCODILE ENCOUNTERS

Scientists who study tigers or jaguars in the wild use camera traps to count them. It is just as difficult to count sharks in the ocean, so we took a page from the big cat researchers' playbook and deployed baited video cameras to count the sharks. It's only fitting since these large apex predators are the 'big cats' of the sea, and like their feline counterparts, their continued existence on Earth is threatened.

—Dr Demian Chapman, assistant professor in the School of Marine and Atmospheric Science at Stony Brook and leader of the research team





Switching to Rebreathers

Why Switch?

Text by Mark Powell
Photos by Chris Sterritt

Technical diving instructor Mark Powell looks at switching from traditional open circuit SCUBA to closed circuit rebreathers.

In the United Kingdom, the use of rebreathers has become very common amongst technical divers, much more so than in many other countries. In this article, we will look at the advantages of a rebreather and some of the reasons why people may want to switch to diving one. We will also look at the type of person who is suited, and in comparison, those who are not suited, to rebreather diving.

Gas costs

One of the biggest factors that comes into the decision to switch to a rebreather is costs. This has two aspects—the costs of the rebreather, including buying and maintaining it, set against the cost of open circuit diving. One of the biggest disadvantages of open circuit trimix diving is the cost of the gas. A twinset of trimix can cost anything from GB£30 (US\$49) for a relatively week mix for use in 40m to over

£100 (\$162) for a mix suitable for diving deeper than 100m. This makes each trimix dive an expensive proposition.

On the other hand, a rebreather uses much smaller cylinders, because the gas is reused rather than wasted. As a result, we use much less, and the gas costs are much lower. We might

only be spending £10-£20 (\$16-32) for the same mixtures discussed above.

As a result, there is a significant gas saving when compared to open circuit diving. This can look very attractive when you are spending considerable amounts on each open circuit fill. However, this must be set against the costs of the rebreather.

Depending on the model,

a rebreather is likely to cost between £4,000 and £8,000 (\$6,500-13,000). If you go for an older second hand model, then you might get one for less than this. In addition to the initial cost of the rebreather, you will need to factor in training on the rebreather, which is likely to add on another £1,000 (\$1,623). In addition there will undoubtedly be additional costs to add on extra equipment to the basic rebreather. As a result, it is not uncom-

mon for the initial start up costs on a rebreather to be between £6,000 and £10,000 (\$9,700-16,200). Obviously, you will need to do a lot of trimix diving in order to save enough to justify this initial outlay.

The vast amount of technical divers do not do enough diving to clearly justify buying a rebreather based on savings in gas costs. Unless you are doing 20 or more trimix dives a year, then it is not cost effective. If you also do a significant amount of recreational diving, then each dive may actually cost you more on a rebreather.

On open circuit you may only need to pay for an air fill, but on even the shallowest dive, you will still need to use pure O₂ in one of the cylinders and use carbon dioxide absorbent in the rebreather. The annual replacement

of the three O₂ sensors and handset batteries also needs to be taken into account. This means that a shallow recreational dive may only cost £5 (\$8) for an open circuit diver but £10-£15 (\$16-24) for a rebreather diver.

It is clear that unless you are doing significant numbers of deep trimix dives a year with little or no recreational

diving, then the gas savings from using a rebreather will not outweigh the initial start up costs. However, there are still

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Rebreathers

the critical factors become the amount of decompression we are incurring, the duration of our carbon dioxide absorbent and our risk of oxygen toxicity.

Of course, this assumes that the rebreather will always work as intended. Just in case there are any problems with the rebreather, we also need to carry open circuit gas to get us safely to the surface. In this case, we would need a bailout cylinder that we could start using at the maximum depth and would then need sufficient bailout to get to the surface completing all our decompression. Unlike the open circuit diver, the rebreather diver will not use their stages unless there is an emergency but will still need to carry them.

The fact that we are only using smaller cylinders makes the logistics of filling much easier. The volumes of gas needed are much

a number of other reasons why a rebreather is an attractive option.

Gas logistics

Every time we breathe in, we only use a small proportion of the gas we inhaled—the rest is breathed out. On open circuit, this is exhaled into the water and lost. However, on a rebreather, the exhaled gas is fed back through the rebreather, carbon dioxide is removed and the oxygen we used up is replaced. As such, it makes much more effective use of the gas we have, and we don't need to carry anywhere near as much gas. As we have already seen, this makes each fill much cheaper. It also has a number of other advantages.

The amount of oxygen the body uses in each breath is roughly the same independent of depth. This means that we use the same amount of oxygen at 100m

as we would at 10m, and so our oxygen cylinder will last the same amount of time at 100m as at 10m.

On open circuit, we breathe much more at depth due to the effect of pressure, and so as we go deeper and deeper, we have to take larger and larger cylinders. Despite taking these large cylinders, they will still be used up very quickly, and so the amount of available gas becomes the most critical part of our dive planning.

On a rebreather, our gas supply is used up at the same rate irrespective of depth, and so the amount of gas we are carrying is no longer the limiting factor. Instead,

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smaller when filling a 3L cylinder rather than twins 12s, and so it becomes feasible to take enough gas with you for even a week's diving.

This contrasts with the situation when using open circuit where significant volumes of helium and oxygen will be required, as the majority will be breathed out and wasted. This can make a big difference if you don't have a local dive shop that can fill trimix. If you have to drive 50 miles there and back to drop off a twinset for a trimix fill and then do the same thing the next day to pick it up, then the logistics of this can be significant. Similarly, if you are diving somewhere without easy access to a dive centre that can fill trimix, the ability to take your own gas simplifies the planning and logistics.

But I want one

Even if you won't save money and don't need a rebreather for logistic reasons, there are still other reasons to switch. Diving is



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Rebreathers

less require more care and maintenance than open circuit. For divers that throw their kit into the back of the car, or into the garage, and then don't look at it until the next dive, this can cause a problem. This type of person is not really suited to rebreather diving, unless they can discipline themselves to ensure they maintain the rebreather.

On the other hand, there are many divers who enjoy cleaning and maintaining their equipment almost as much as the dive itself. They get pleasure from adjusting the kit until it is just right, and it is viewed as part of the hobby rather than an added chore they must do. This type of person is ideally suited to rebreather diving.

In addition to cleaning and maintenance, rebreathers require discipline while diving them. There is a certain mindset that is required to ensure that the unit is assembled correctly each time, and that all of the pre-dive checks are rigorously followed.

Most rebreather accidents are caused by the divers not following the correct procedure. This includes not diving the unit if there is any problem with it. Many divers become complacent and will dive with known problems with their rebreather.

They are confident that they can overcome the problem, and in the majority of cases, they manage to deal with the known problem. However, if there is any problem during the dive, the impact of the initial problem can be significantly

a hobby and so doesn't always have to be justified on cost reasons. The cheapest option is not to dive, but most of us don't consider this a possibility. In the same way that some people spend their money on motor-bikes, horses, home cinemas, model helicopters or any other hobby, there is no reason why someone shouldn't spend their money on a rebreather just because they want one. Other people may switch to a rebreather to challenge themselves to learn something new.

Should you switch?

As we have seen, there are a number of reasons why many divers want to switch to a rebreather. However, the risks of rebreather diving mean that there are some people who are better suited to rebreather diving than others.

Rebreathers are significantly more complicated pieces of equipment than an open circuit scuba set. Whilst rebreathers do not require a huge amount of effort, they do nonethe-

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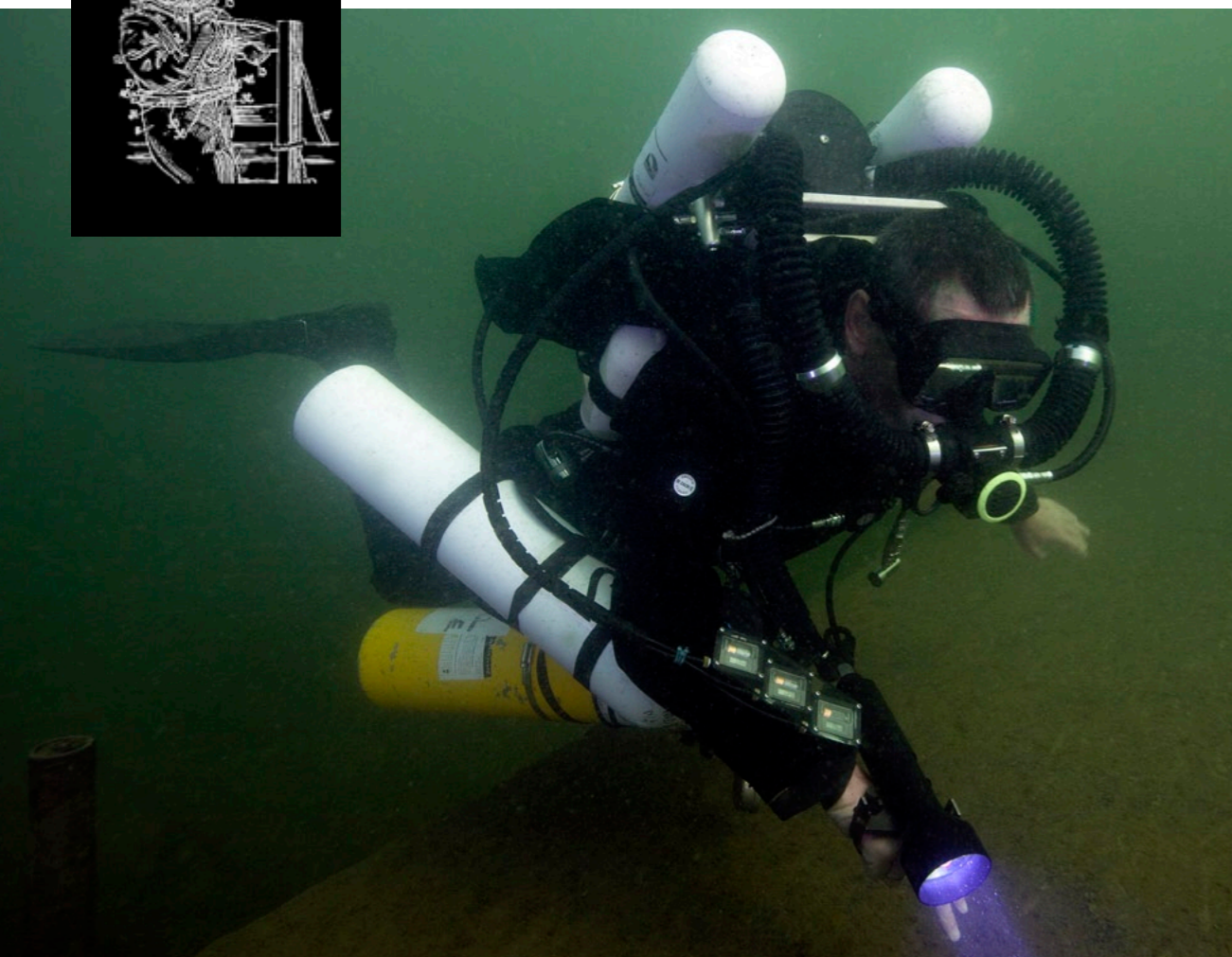










increased by subsequent problems.

It requires a significant level of discipline to call a dive for what might appear to be a minor problem, but becoming complacent about these failures is one of the most common causes of rebreather accidents.

During the dive the diver must constantly monitor the unit to ensure it is operating correctly. This is summed up by the golden rule of rebreather diving: "Always know your partial pressure". It doesn't matter if the diver is at 10m or 100m, the level of monitoring is the same, and so a 10m-dive must be approached with the same mindset as a 100m-dive.

As such, there is no such thing as a casual rebreather dive. Not all divers have the mindset to adjust to rebreather

diving, but without this mindset, they should not consider rebreather diving.

In order to be a safe rebreather diver, there are a number of skills that need to be mastered over and above the basic open circuit skills. Some of these are

related to the normal operation of the rebreather, and some are related to emergency situations.

Like any skill, it takes practice to master these skills and practice to maintain them. When moving from open circuit to a rebreather there are skills, like buoyancy control, which must be re-learned. This takes time and effort.

For an experienced diver, this means the frustrating process of going back to basics and building up their experience. Unless you are prepared to put in the time to master the basic skills, you will always be diving on a base of weak

First, you must decide whether there is a good reason to dive a rebreather and then whether you have the right mindset to be able to dive it safely.

Ambient Pressure meets PADI RecTec rebreather requirements

According to Ambient Pressure Diving's March newsletter, the new range of APD rebreathers, which will be available soon, will feature a number of developments.

The Rec2Tec range is an adaption of APD's existing range to meet PADI's CCR TecRec requirements.



These requirements set a standard for each level. At the Rec level, the software has to be depth limited to 18m, and the unit has to be supplied with ADV (Automatic Diluent Valve) and OCB (Open Circuit Bailout mouthpiece) as standard. Also, there has to be no manual inflators, so the customer will get

blanked ports, which can have inflators added later, and once the user

progresses to higher levels.

The second level is depth limited to 40m by the software. The Tec 3 level is the existing trimix unit with ADV and OCB as standard further to PADI requirements. It is a relatively easy factory-fit model to add extra inflator ports for off-board plug-ins.

"Essentially all three existing APD units can be easily adapted to whatever requirements PADI, or any other training agent, requires by software download or hardware plug-and-play fitting," APD wrote. "From the point of view of the PADI instructor/resort offering these courses, the same APD unit is good for all levels and can be simply switched over from Rec 'try-dives' to deep Tec, same unit, same day." ■

rebreather skills, even if you were previously a very experienced open circuit diver.

These skills also need to be practiced regularly in order to ensure that they are maintained. This means that it is essential to dive a rebreather regularly in order to maintain the appropriate skill levels.

It is clear that for some people a rebreather is a desirable, and in some cases, an essential way to progress their technical diving. For others the advantages do not necessarily outweigh the disadvantages. For this reason it is a very personal decision and not one to be taken lightly.

First, you must decide whether

there is a good reason to dive a rebreather and then whether you have the right mindset to be able to dive it safely. Like many things, the correct decision will vary from one person to another. ■

Next time, Mark Powell looks at some of the mental aspects of technical diving. For more information on any aspect of technical diving, contact Mark at: www.dive-tech.co.uk mark@dive-tech.co.uk

fourth element
EQUIPMENT FOR ADVENTURE

FOURTH ELEMENT TEAM DIVER, Pete Mesley
in Truk Lagoon, June 2010
Pete wears PROTEUS wetsuit.

PROTEUS



photo &
video

Manta Ray (*Manta birostris*), Little Cayman Island, Cayman Islands. 15mm lens, Fuji Provia (scanned) ISO 100, YS300 Sea & Sea flash, 1/100th second at F.11

Text and photos by Lawson Wood

Night diving also takes on another dimension of concentration in your photography, as your field of view is limited, as well as your choice of subject matter. Fish that were once plentiful on the reefs have virtually disappeared and, in fact, there may be very little to see at first (even although you are using a flashlight or its equivalent for ambient illumination). Shortly after dusk, there is a brief hiatus in critter viewing, as this time period revolves around all the day fish and critters going into hiding for the night, and the night time fish and critters not having fully ventured into the open. Your eyesight is concentrated around the small pool of light created by your torch and inevitably you start to focus on the stronger colours—the reds, oranges, yellows, etc.

As you get into the dive, several things happen. Firstly, you start to see more colour, or are more aware of more colour, than you did during the day. As

you are focusing closer and closer to the reef, you gradually start to see more small creatures. By this time, you are starting to relax more, so your breath-

ing has slowed down, your buoyancy has improved, and after 20 minutes or so, it looks like all of your dreams have come true, as a myriad of exciting new

and wonderful fish and critters seem to apparently manifest themselves before your eyes.

Whilst the obvious temptation is

always there to swim close to the edge of the reef or seabed, we should not ignore the water column above us, as many creatures live in a planktonic

Night Photography





photo & video

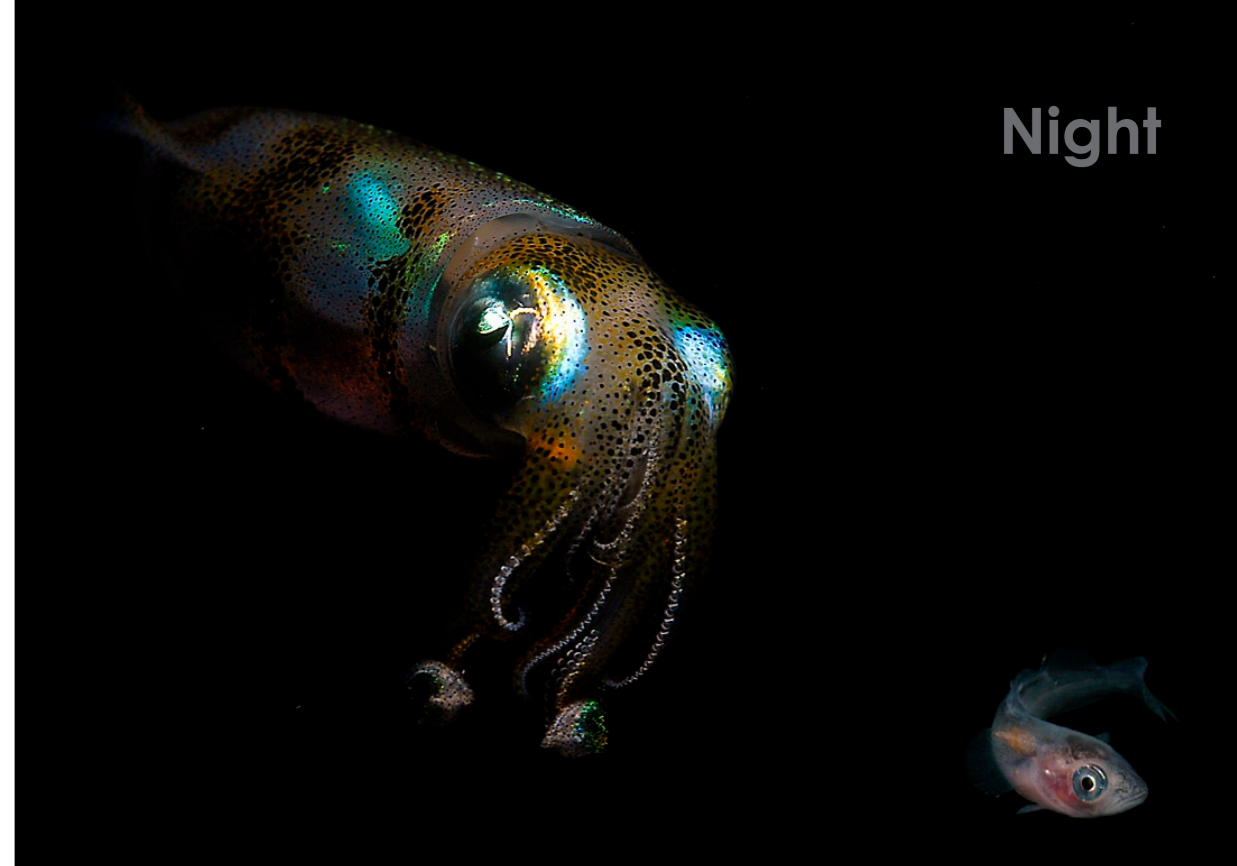
Red Banded Lobster (*Justitia longimannus*), Dominica. Canon S95 set on macro/automatic with full zoom and internal camera's flash



state, drifting by in the currents and feeding on other similar creatures. Other animals such as squid actually live in this water column, hunting small fish and crustaceans. On one particular night dive at Candi Dasa in Bali, diving with Gangga Divers, I had a superb guide who was searching the lower reefs for interesting critters, but my wife Lesley is also a great spotter for me, and she found this tiny juvenile squid acting out that age old game just above my head, and I hadn't even noticed, such was my concentration elsewhere.

Undoubtedly, we are attracted by colour, and it is this colour saturation that will always set your photographs apart from all others. Yes, this is just another form of macro photography, but now

we are even more concentrated in our aspect and viewing power. I do take wide angle photographs at night, particularly on wrecks where the vista is the same at any time of the day or night, but quite often you may be in a location where manta rays feed at night or even whalesharks. Macro and close-up photography are obviously used most of all, but do not ignore the chance of wide

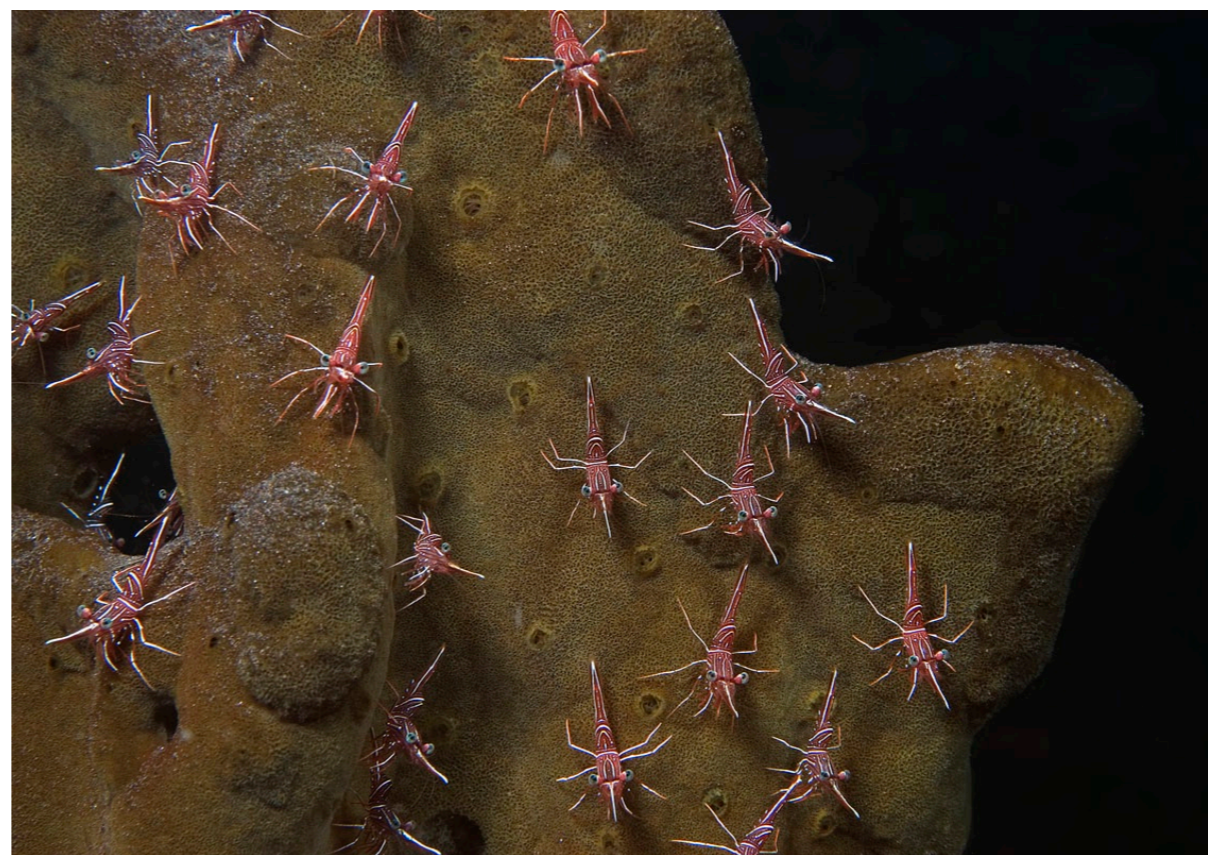
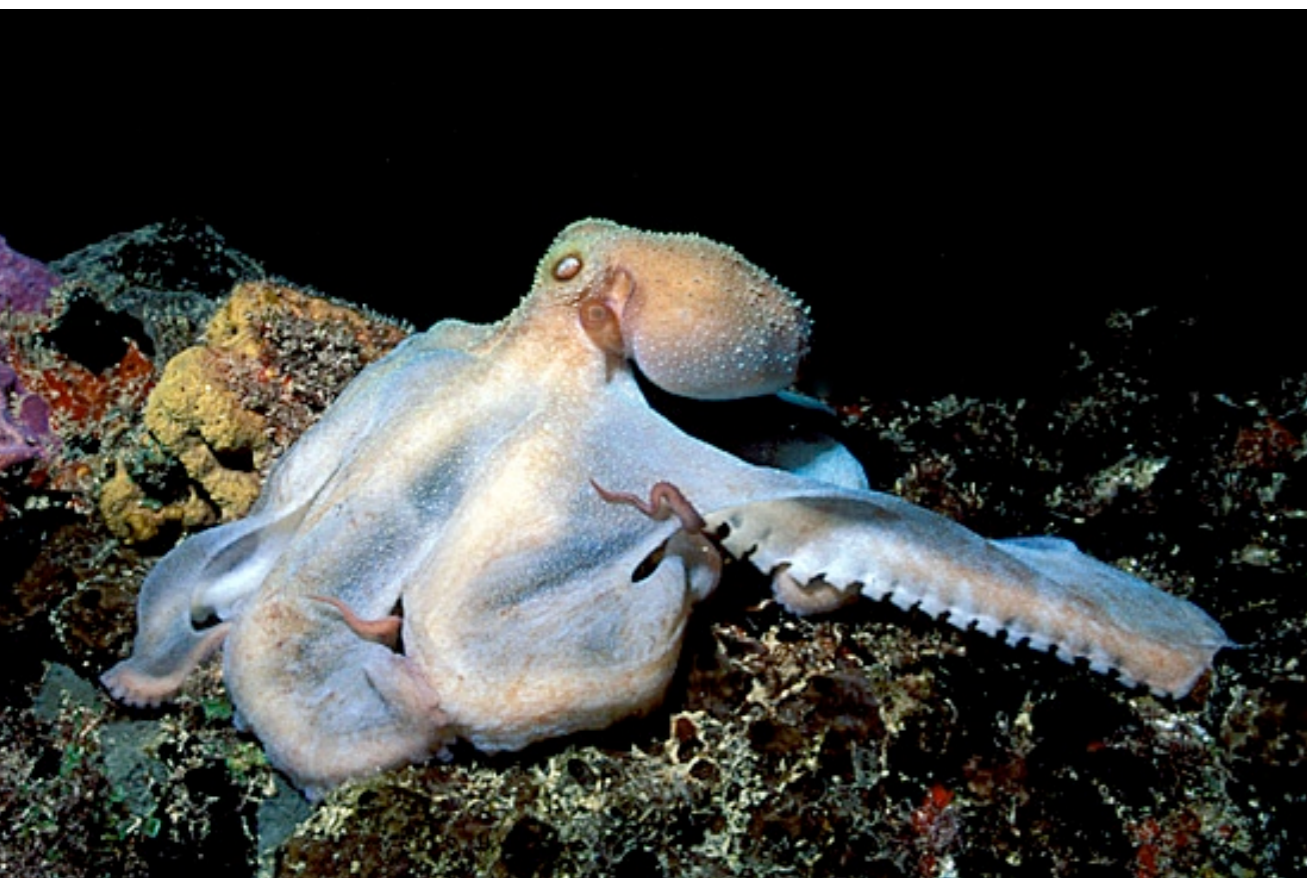


Night

Reef Squid (*Sepioteuthis lessoniana*), Bali, Indonesia. 105mm lens, ISO 100, twin YS110 Sea & Sea flash, 1/80th second at F.1

Hinge-back Shrimp (*Rhynchocinetes durbanensis*), Bali. 105mm lens, ISO 100, twin YS110 Sea & Sea flash, 1/80th second at F.16

Caribbean Reef Octopus (*Octopus briareus*), Salt Pier, Bonaire. 15mm lens, ISO 50, Sea & Sea YS 350 flash, 1/80th second at F.16



angle photography wherever it is appropriate.

As we get into the night dive, free swimming fish, such as parrotfish, wrasse and anthias godfish tuck themselves into the reef amidst stony corals and sponges. Parrotfish actually secrete a

membrane cocoon around themselves for protection. It is very important not to disturb any sleeping fish, as they can wake up with a start and blunder off at full speed, crashing into the corals and damaging both the corals and themselves. Others may actually attack if they

are disturbed.

Shy creatures such as octopus actively hunt at night, and they are always a delight to find. Rare animals such as the orange-ball corallimorph only appear at night, as they are very light sensitive. You may actually only get one chance to take a photograph, before they retreat underneath the sand once more. Spotted lobsters are more approachable, as are a variety of fish, which are very shy during the day, yet appear to pose for us at night.

Some brilliantly coloured coral polyps also only come out at night, and for those who frequent tropical waters, look out for the Spanish Dancer nudibranch, which can move freely through the water by undulating the mantle of its



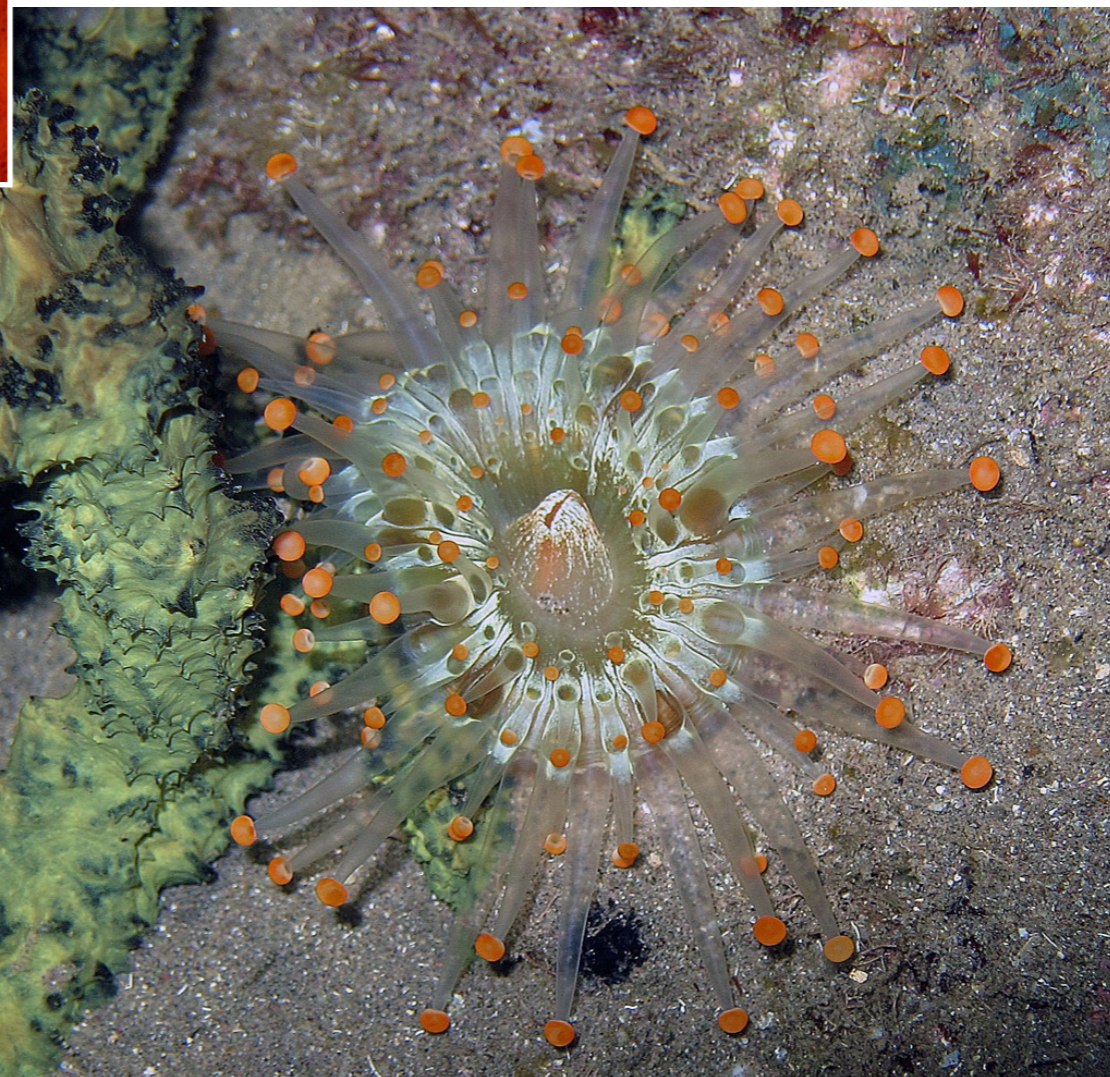


photo & video

Orange-ball Corallimorph (*Pseudocorynactis caribbeorum*), Dominica. Canon S95 set on macro/automatic with full zoom and internal camera's flash

Sharpnose Pufferfish (*Canthigaster rostrata*) asleep on sponge, Honduras. 60mm lens, Fuji Provia ISO 100 (scanned), YS120 Sea & Sea flash, 1/60th second at F.16

Blue Parrotfish (*Scarus coeruleus*), Theo's Wreck, Grand Bahama Island. 15mm lens, Fuji Velvia ISO 50 (scanned), Sea & Sea YS300 flash, 1/60th second at F.16



body. Please do not encourage them to 'swim' to get the photographs you want. Whilst these colourful large nudibranchs are always a delight to find on the reef, look closely around the gills as there are usually a pair of commensal cleaning shrimps living on the back of this beautiful creature.

Night diving etiquette

Night diving has been classed as an adventure within an adventure. With that in mind, on entering the water for the first time at night, it is sometimes better to dive with someone experienced with the dark and also someone who has knowledge of the particular marine environment that you are in. Once you have chosen your night dive location, if possible, you should familiarize yourself with the site by diving the same area during the day. Perhaps

Golden Cup Coral (*Tubastrea aurea*) Red Sea. 60mm lens, ISO 100, twin YS110 Sea & Sea flash, 1/80th second at F.16

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Spanish Dancer (*Hexabranchnus sanguineus*) L'Ilot, Seychelles.
15mm lens, Fuji Velvia ISO 50 (scanned), Sea & Sea YS300 flash, 1/60th second at F.16

Juvenile Spiny Lobster (*Panulirus versicolor*) Sulawesi.
105mm lens, ISO 100, twin YS110 Sea & Sea flash, 1/80th second at F.16



Night

Berried Anemone (*Alicia mirabilis*) Sulawesi.
60mm lens, ISO 100, YS120 Sea & Sea flash, 1/100th second at F.11



some low level photography, be absolutely certain that you are not going to land on something, as you jockey for position. This includes the circle of area which extends to your tips of your fins. Also be careful when you rise up from the seabed, as your fin kicks can utterly ruin the scene for someone else coming along, as well as dislodging whatever it was that you were photographing.

the easiest way of introducing yourself to the night would be by diving at dusk and slowly acclimatizing yourself to the change between ambient light and the artificial light of your dive lights, photographing the transitional stages of natural light on the reef and the creatures associated with it.

- Get your buoyancy correct as soon as you enter the water, as you have to be even more careful about approaching the reefs at night. In general, there are more fragile organisms out in the open, plus of course the danger of blundering into an unnoticed sea urchin, scorpion fish or electric ray.
- Stay well clear of fellow photographers, particularly if you are

working along a vertical wall, as your exhaust air bubbles may pass in front of a diver above you and inadvertently dislodge or frighten whatever critter they were photographing, plus of

course ruining the shot and annoying a colleague.

- When approaching the seabed, perhaps to kneel down or lie down to do

- Many creatures are very skittish at night, so try and be particularly sensitive and do not 'over shoot' the subject as they are out at night because they do not like strong lights.

- Try and avoid photographing large sleeping fish, as the sudden flash may scare them awake and they flee from you, crashing into corals and injuring them and the corals. ■



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Canon's new DSLR's

Following right behind Nikon's recent announcement of its new high end DSLR's the D4 and the D800, Canon has announced the EOS 5D Mark III and the EOS-1D C. The EOS 5D Mark III is the latest in its enthusiast full-frame 5D series and successor to the popular EOS 5D Mark II. The new based around a 22MP full-can shoot six frames per second 61-point AF system much like the capture 1080p movies at 24, 25 or 30 fps and offers high quality intraframe (All-I) video compression amongst a host of movie-related improvements. The Canon EOS 5D Mark III became available from the end of March with an MSRP of US\$3499 / €3299 / GB£2999.99



camera is frame sensor, and features a EOS-1D X. It can also capture 1080p movies at 24, 25 or 30 fps and offers high quality intraframe (All-I) video compression amongst a host of movie-related improvements.

Nauticam Housing

The NA-D800 housing incorporates many of the features from the highly regarded Nauticam housing for the Nikon D7000 such as the redesigned sub command dial control and right thumb-operated control, which uses a double paddle lever assembly to engage the record function. A double paddle arrangement has been utilized so that the left thumb can be used to activate playback and ISO control. The



multi-control features a pad arrangement rather than buttons, and the housing has a port that is capable of taking the company's HDMI bulkhead. The NA-D800 housing has two fiber optic ports as standard, although Nikonos, S6 and Ikelite bulkheads are available. The new housing will start shipping on 11 May, 2012 and will retail at US\$3600. www.nauticam.com

Canon EOS 1D C

The EOS-1D C is Canon's new high specification video enabled DSLR and is capable of capturing 4K (4096 x 2160 pixel) video at up to 24p, without downscaling, from an APS-H crop of its 18MP full-frame sensor. The camera, which shares the majority of its specifications with the still-awaited EOS 1D X, can also capture 1080p60 or 50p or output it uncompressed over its HDMI connector. Full HD can be captured from a 16:9 crop from the whole sensor, or a smaller, APS-C-like Super 35mm sub-frame, that allows the use of Canon's EF Cinema Zoom lenses. The camera will cost around €10,000 and will be available from October.



Canon G1 X Housing

The new full-featured Ikelite housing for the Canon Powershot G1 X camera is an affordable option for the "most discerning of underwater photographers", the company writes. As standard, the housing comes with an optical port that allows full use of the camera's zoom without vignetting. Additionally, special circuitry built into the housing allows TTL with any of Ikelite's DS strobes. Changes include a right-angle bulkhead, which "relieves strain on the sync cord during handling and assembly". ikelite.com



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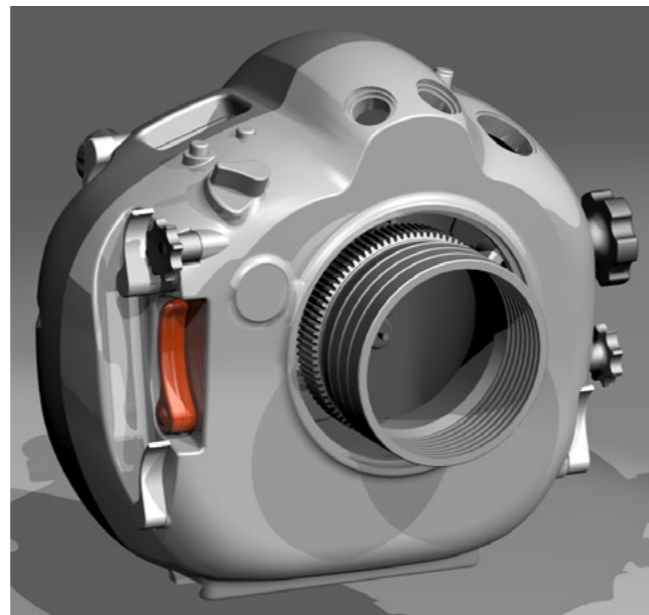
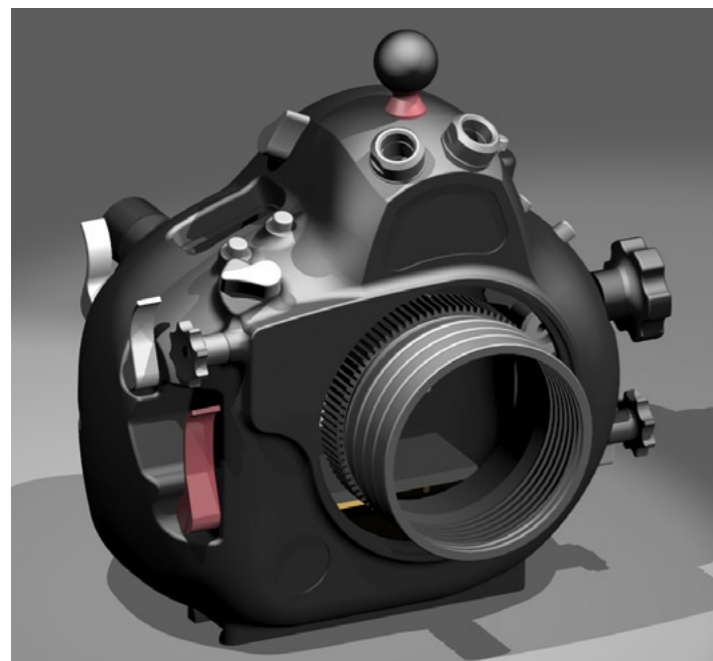
www.bskinetics.com



photo & video

Hugyfot

The Belgian manufacturer seems to be well down the path with its housings for both the Nikon duo and the Canon's and provided conceptual designs for its D800 and D4 housings.



Subal

Subal is also developing and testing housings for the Nikon D4 and D800, plus the Canon 5D Mark III and the EOS-1D C and provided a conceptual design of its D800 housing.



Gates Deep Epic Video Housing

Gates has announced that they are now delivering their first shipments of their Deep Epic video housing for the Red Epic and Red Scarlet Cinema cameras. The new housing features support for a wide range of lenses, external monitor, adjustable fingertip focus/iris/zoom controls and is manufactured from machined aluminum, depth rated to 450 feet and comes with a two-year warranty. The Deep Epic housing is an impressive 25 percent smaller than the previous DEEP RED housing.

BS Kinetics Namib

The Namib is BS Kinetics' lightest and smallest video housing, weighing only 1.8 kg and measuring 190 x 145 x 205mm. The controls fit a range of cameras from Panasonic, Sony, Canon or JVC. Since up to 12 controls can be fitted, all supported cameras can be fully controlled. The housing is built from a composite of carbon fibre and epoxy resin, which is very tough, durable and resistant against saltwater and UV rays. The integrated port comes with an M67 thread, which enables the attachment of wet lenses for both macro and wide-angle recordings. bskinetics.com



Blackmagic Design

Blackmagic Design, a company best known for its external film recording boxes, has announced a compact-style cinema-quality video camera called the Cinema Camera. The Cinema Camera captures 2.5K, 12-bit RAW footage on a sensor very similar to the micro-four-thirds ones used in mirrorless cameras, so that just as those cameras brought SLR quality to smaller bodies, the Blackmagic Cinema Camera brings cinema-quality video to a compact size. Blackmagic Design claim an impressive 13 stops of dynamic range for the Cinema Camera, which features a Canon EF lens mount, a touch screen and thunderbolt connection for speedy transfers. The Cinema Camera comes with a price tag of US\$3000.

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Ski & Dive Andorra

Text by Svetlana Murashkina, PhD.
Photos courtesy of Igor Murashkin,
Diving Andorra, Vallnord Andorra

The first ascent. From the top of Les Portela (Les Portelles 2,552m) we could see the surrounding peaks Arcalis and Kota, trails and wild nature. I seemed to have it all for myself! Large snow flakes settled gently on the trail from their journey out of the sky, creating a perfect ski slope and melting on my lips. I put on my gloves, then my hood and mask. Then felt like I was missing something. Oh yes, I'd better put the regulator in my mouth, too.

But wait a minute, I am on a *ski* vacation. Even an editor of a dive magazine needs to have a holiday once a year and go skiing in white sparkling snow with the wind whistling in the ears, among rocky peaks, with crowds of tanned skiers. This time, I went to Andorra, the tiny principality wedged high in the Pyrenees straddling the border between France and Spain.

We made several fast downhill runs on the slopes, before doing the foolhardy thing of venturing off the trails into deep snow. Later, as I headed home to the lodge, I found a red trail, La Kanaleta, which went down a long way but was not very steep so a variety of turns could be made. On the slope, I passed a sign saying, Diving Andorra, but at first, I did not realise the meaning of it. The next downhill run took me close by, and I decided to inves-

tigate. The path took me over a small lake, and at the far end, I could see something that looked like a wooden house and a boat ramp. Vacation or not, this was interesting!

High-altitude diving

At the entrance, there were a couple of skis and boards. Inside the house, the inhabitants were donning drysuits right over their ski pants and putting on dive gear. And down they went into the depths of La Kanaleta Lake. The depth was six meters, and there were routes under the ice of the lake. It started at the maina (hole) and went along the lake perimeter. There was another maina in the middle of the route, just in case. Divers entered in pairs, and there were two instructors in the water. Both certified divers and beginners, for whom it was the first dive,

THIS PAGE: Scenes from under the ice of mountain lakes in Andorra





CLOCKWISE FROM LEFT: Diving in the mountains, divers prepare a dive hole in the ice; Preparing for a cold dive under the ice; Svetlana Murashkina points out the sign on the ski trail to Diving Andorra (below inset)

level. The beautiful lake is of glacial origin and some access points are only accessible by helicopter. In the fresh water there is trout, medium-sized vertebrates, amphibians and local micro-organisms, some of which have not yet been described by science.

The lake is also being studied by researchers from the University of Zaragoza who conduct diving under the ice during winter, bringing up equipment by donkey during summer and volunteer divers who are taking part in the study of flora and fauna of the lakes. Enkenty Hector, one of the founders of the project and director of the dive center told us an amazing story. Funds for the center have been provided by an Andorran government body as a grant for innovative projects which aim to attract more tourists to the country.



Andorra



DIVING ANDORRA

could have their ice diving "baptism" here. Going under the ice in a drysuit for the first time was something out of the ordinary for me, too, so why not? For tourists, it would be a lifetime memory. But many, especially from neighbouring countries France and Spain, could return for regular diving courses later.

The dive center

Diving Andorra, which happens to also be the name of the dive center, is only a few years old. The purpose of the center is to provide high-altitude diving. In Andorra all the conditions are met: mountain lakes with unique ecosystems, depths from six to 90 meters at an altitude ranging from 2,000m to 2,700m above sea



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The dive shop office, which has a compressor, equipment and documentation, is located near the Andorran Olympic swimming pool, and at the ski station Vallnord (La Kanalete), they have a "field base".

Hector—who is a

hydrogeologist, a graduate of the University of Barcelona and one of the founders of the underwater Andorra Red Cross—is the master mind of this project along with Raul Baro, an experienced dive instructor specialized in ice diving, drysuit diving, and high-diving. He has worked in many parts of the world including the Caribbean, Polynesia and Micronesia, Malaysia, Indonesia and

Divers outfitted with dive gear head to the dive site on skies

feature

Andorra





Preparing the maina, or dive hole; Preparing for the dive at the maina (right). PREVIOUS PAGE: Vallnord backcountry area

the Red Sea. Hector and Raul continue to work together, but have acquired a group of staff and volunteers.

What I find most remarkable is that this place is used as a base for the Canadian training agency ACUC. Andorra has also established its own teaching and research organization—the Center for Training and Development Maintenance and IDI (research, innovation). And Diving Andorra issue their own certificates. “A person who has been trained by us, will always remember that there is on Earth a tiny mountainous country, Andorra, which is not only good for skiing and walking in the mountains, but also for diving!” Hector proudly proclaimed.

Mountain lakes

The most beautiful lake that is relatively accessible is Tristayna, which is located in Ordino-Arcalis (Vallnord). In this formation there are three lakes of glacial origin. The altitude is 2,305m, and the maximum depth is 25m. You can walk there from La Coma Restaurant or descent on skies via a free-ride zone, like we did.

In the Ordino-Arcalis area, there are not only 25 kilometers of normal ski routes, three official free-ride zones and a large number of off-trail opportunities but also four mountain lakes! And Andorra had other surprises in store for us. Sakura is a city



park, which has been donated by the Japanese government. There are free buses that take you from the capital to the ski area Vallnord, and there is a dive site right in the ski area. I should probably come back on a business trip. ■

Associate editor Svetlana Murashkina, PhD., is an expert in geographical science and serves as editor of the premier Russian dive magazine, InVertum.



Diving in as onlookers take pictures; Vallnord ski resort (top)