



GLOBAL EDITION
November 2016
Number 76



South Africa
Rocktail Beach

Wrecks
Battle of Jutland

Hotspots
Turkey

80 Years
Suunto

Feature
Critters of the Muck

Ecology
Hindbrains

UNITED STATES

Florida Keys

COVER PHOTO BY BETH WATSON

DIRECTORY

X-RAY MAG is published by AquaScope Media ApS
Copenhagen, Denmark

www.xray-mag.com

PUBLISHER & EDITOR-IN-CHIEF
Peter Symes
Editor@xray-mag.com

PUBLISHER, MANAGING EDITOR & CREATIVE DIRECTOR
Gunild Symes
Gunild@xray-mag.com

ASSOCIATE EDITORS
Scott Bennett, Toronto
Scott@xray-mag.com
Catherine GS Lim, Singapore
Cat@xray-mag.com
Michael Menduno, Berkeley
Michael@xray-mag.com

Russia - Moscow
Andrey Bizyukin, PhD
Andrey@xray-mag.com
Svetlana Murashkina, PhD
Svetlana@xray-mag.com

ASSISTANT EDITORS
Rosemary E Lunn, London
Roz@xray-mag.com
Barb Roy, Vancouver
Barb@xray-mag.com
Don Silcock, Sydney
Don@xray-mag.com

USA
Larry Cohen, New York City
Larry@xray-mag.com
Kelly LaClaire, Portland
Kelly@xray-mag.com

ADVERTISING UNITED KINGDOM
Rosemary E Lunn, London
Roz@xray-mag.com

USA & INTERNATIONAL
Matthew Meier, San Diego
Matt@xray-mag.com

Contacts page: Xray-Mag.com

SENIOR EDITOR
Michael Symes, Ph.D. - *Science*

SECTION EDITORS
Scott Bennett - *Travel, Sharks*
Andrey Bizyukin, Ph.D. - *Features*
Larry Cohen - *Photo & Video*
Kelly LaClaire - *Marine Mammals*
Catherine GS Lim - *News, Books*
Roz Lunn - *Equipment News*
Michael Menduno - *Tech*
Ila France Porcher - *Sharks*
Don Silcock - *Photo & Video*

COLUMNISTS
Pascal Bernabé - *Tech Talk*
Rico Besserdich - *UW Photo*
Steve Lewis - *Opinions*
Gareth Lock - *Training*
Andy Murch - *Shark Tales*
Mark Powell - *Tech Talk*
Simon Pridmore - *Opinions*
Lawson Wood - *UW Photo*

CONTRIBUTORS THIS ISSUE
Christopher Bartlett
Scott Bennett
Rico Besserdich
Kasia Cylwik
Kieran Hatton
Sabine Kerkau
Patricia Knight
Gregory Lecoeur
Catherine GS Lim
Rosemary E Lunn
Brandi Mueller
Ila France Porcher
Simon Pridmore
Don Silcock
Klaus M Stiefel
Gunild Symes
Peter Symes
Vic Verlinden
Beth Watson

SUBSCRIPTION

X-RAY MAG International Edition in English is FREE
To subscribe, go to: www.xray-mag.com
COVER PHOTO: Rudman's *Phyllosdesmium nudibranch*,
Puerto Galera, Philippines, by Beth Watson
(bethwatsonimages.com)

contents

Anemonefish in anemone. Photo by Brandi Mueller



8
FLORIDA KEYS
USA
BY LAWSON WOOD

51
TURKEY: MEDITERRANEAN
& AEGEAN HOTSPOTS
BY RICO BESSERDICH

columns...

65
SCUBA CONFIDENTIAL:
IT'S NOT BEASTING
BY SIMON PRIDMORE

19
CRITTERS
OF THE MUCK
BY BRANDI MUELLER

61
ECOLOGY: FISH
BUTTS & HINDBRAINS
BY KLAUS M STIEFEL

77
SHARK TALES:
POSTURING SHARKS
BY ILA FRANCE PORCHER

29
BATTLE OF JUTLAND
NORTH SEA WWI WRECKS
BY VIC VERLINDEN

71
SUUNTO
TURNS 80
BY PETER SYMES

87
UWPHOTO & VIDEO:
HOW I GOT THE SHOT
EDITED BY GUNILD SYMES

35
BATTLE OF JUTLAND
CENTENARY EXPEDITION
BY STEVE SLATER

82
DIVING THE URANIUM
MINE OF KOWARY
BY SABINE KERKAU

92
PORTFOLIO:
PATRICIA KNIGHT
EDITED BY GUNILD SYMES

41
ROCKTAIL BEACH
SOUTH AFRICA
BY CHRISTOPHER BARTLETT

plus...
EDITORIAL 3
NEWS 4
WRECK RAP 8
NAUI NEWS 9
TRAVEL NEWS 10
EQUIPMENT NEWS 50
BOOKS & MEDIA 69
MARINE MAMMALS 76
SHARK TALES 81

Not yet subscribed to
X-RAY MAG? Sign up now!
It's FREE! QUICK! EASY!
Click here...



DEMA SHOW 2016

Las Vegas Convention Center

Las Vegas, Nevada

NOVEMBER 16-19

EXPAND YOUR WORLD

JOIN US AT THE WORLD'S ONLY INTERNATIONAL TRADE-ONLY EVENT FOR DIVING, ACTION WATERSPORTS AND TRAVEL PROFESSIONALS

DEMA Show has new, innovative ways to increase your customer base and ultimately fulfill your business goals. Come find fresh technologies and products, grow your areas of expertise and build a powerful professional network around the globe.

REGISTER NOW at DEMAShow.com



EXPAND YOUR BUSINESS, YOUR CAREER, YOUR WORLD.



RYMD

A properly designed product is one with a really good interface you can use straight out of the box. But just because you can, does this mean you should forget all about reading the manual?

When it comes to dive equipment, I think not. Your dive computer may switch on automatically on water contact and it may by default display all the essential information. It may function according to some nifty algorithm, which scores of researchers have refined over the decades in order to keep you out of harm's way. In the vast majority of cases, they do a pretty good job even when you just don and dive, without too much forethought.

But it is not a brain. It is but a tool, which is only as good as the premises and assumptions coded into it.

Dive gear, we should always remind ourselves, is life preservation equipment, which we entrust with our limbs and lives. Not only do we owe it to our loved ones to keep it in good nick, but in order to both stay safe and to get

the most of our dive, we also need to understand the limitations of our equipment—and, by the same token and on a perhaps more appealing note, also its capabilities and what it can enable us to do.

That means—yes, you guessed it—reading the manual and preferably not only once.

In my diving and my photography, I both need and want to know exactly what my equipment can and cannot do. Only then can I make the most of it.

In order to dive smoothly and with a minimum of effort—which is not only more relaxing and enjoyable, I can assure you, it is also safer when physical and mental task loads are kept to a minimum—I rehash the operation of all instruments, such as dive computers and rebreather handsets, if I have been out of the water for a while.

In photography, my camera needs to feel like an extension of myself. The handling of my kit underwater should be second nature and a matter of

routine and muscle memory. Figuring out menus, settings, knobs and dials is better done beforehand, in your living room and not once on the seabed.

Yes, it may come across a bit nerdy, as I lie there on the sofa reading my manuals many times over. With camera or dive computer in one hand, like a kid playing with a new toy, I explore and investigate all the options to fully appreciate what I have in my hand—to really know it. In the process—as some sort of added bonus—I frequently come across new functions and learn something new once I start toying around and trying to figure it out; whether I make use of it later is another question.

The bottom line is not having to figure out how things work—or trying to figure out why they don't—once you're in the water, with perhaps other challenges on your hands.

— RYMD: Read Your Manual, Dummy

— Peter Symes
Editor-in-Chief



News edited
by Peter Symes

NEWS

from the deep



Moorish idol, a fish species currently found in tropical waters and doesn't appear to tolerate colder temperatures, would most likely thrive in the warmer Eastern Australian coastal habitat, research conducted at University of Technology, Sydney finds.

Move or keep cool

Coral reef fish, which struggle to adapt to the warmer ocean temperatures brought about by global climate change, may instead opt to relocate to cooler parts of the ocean where they will compete with the local fish species to establish viable populations.

There is already evidence that many coral reef fish and pelagic fish, such as tuna, are moving in response to warmer ocean waters, and that this is beginning to affect global fisheries. Previously, few of these tropical vagrant species have been able to survive the winter, but with climate change driving increases in ocean temperatures at this warming hotspot, survival rates are increasing. Which species will be winners and losers under a warmer future is something scientists are trying to understand in order to make predictions about how the planet's biodiversity may be impacted and how the functioning of ecosystems may be altered.

Other species may opt for stay-

ing put and adapt to warmer ocean temperatures, particularly those coral reef fish that are dependent on reefs for habitat. As corals cannot migrate as fast as the temperature increases are predicted to happen, corals and coral-dependent fish will have to adapt or move to deeper waters where living conditions are less than ideal.

But how can fish adapt?

"When fish have to deal with increased temperature, there are physical consequences. They need more energy to cope, and they may not be able to handle stress or reproduce or even grow," said marine scientist Jacob Johansen of the University of Texas at Austin. According to a study conducted at University of Copenhagen, fish that were accli-

mated to the highest temperatures lost 30 percent of their body weight and some of them died. Commercially important fish species such as coral trout become lethargic with rising temperatures, spending more time resting on the bottom and less time swimming in search for food or reproductive opportunities.

Adaptations have taken place in the past but these were gradual processes occurring over evolutionary times scales, which is much slower than the changes incurred by climate change. Moving, where possible, may simply be the only possible option for many species. ■

SOURCES: BIOLOGY LETTERS, ARC CENTRE OF EXCELLENCE FOR CORAL REEF STUDIES, GLOBAL CHANGE BIOLOGY.

Maldives
Maldives Blue Force One & Maldives Blue Force Two

Blueforce
MALDIVES BLUE FORCE ONE & TWO

Weekly Diving Liveaboards from Saturday to Saturday.
Guaranteed departure.

5 Atolls Classical Route & South Hemisphere Route.
Check our Offers in www.maldivesblueforce.com

AUGUST 2016 OFFER!!!!
10 Days Special Route with Manta Trust

Follow us : Maldives Blue Force

BROCKEN INAGLORY / CC BY-SA 3.0



PETER SYMES

A peppered moray, *Gymnothorax pictus*, appears almost timid in this file photo, as it carefully takes a peek at what may be lurking behind the reef.

CO₂ is messing with fish

Research into the impact of rising CO₂ has shown it can disrupt the senses of fish, including their smell, hearing and vision, and even make them swim towards predators instead of away from them.

Influx of CO₂ is disrupting fishes' sense of smell, sight and hearing, marine biologists at the University of Exeter finds.

According to a paper just published in the journal *Global Change Biology* by Dr Robert Ellis and Dr Rod Wilson, abnormal behaviors have been linked to the effect of CO₂ on how the brain processes signals from sensory organs.

How exactly is not clear. What is clear is that the problem is sure to get worse as the oceans' CO₂ lev-

els are expect to rise by a factor of 2.5 by the end of the century.

Lab on hand

The scientists believe that further study of farmed fish—which already provides as much seafood for human consumption as that caught in the wild—may be crucial for understanding how aquatic species will evolve to climate change. Farmed fish often live in CO₂ conditions 10 times higher than their wild cousins.

Why hasn't anyone noticed

odd behaviors before? As animals reared in many aquaculture settings are living in a relatively benign environment, being provided with abundant food, relatively constant environmental conditions, protection against disease and absence of a predation threat, it is perhaps not surprising that the ecologically relevant physiological and behavioral disruptions caused by end-of-century CO₂ levels have not emerged from aquaculture studies. ■



An experience without equal

At Wakatobi, we take great pride in providing the ultimate in exclusive and personalized service. Our dive staff and private guides ensure your in-water experiences are perfectly matched to your abilities and interests. While at the resort, or on board our luxury dive yacht Pelagian, you need only ask and we will gladly provide any service or facility within our power. For all these reasons and more, Wakatobi takes top honors among discerning divers and snorkelers.



www.wakatobi.com



Survey finds more than 40 shipwrecks in the Black Sea

An international expedition surveying the seabed off the Bulgarian coast of the Black Sea—where thousands of years ago, large areas of land were inundated as the water level rose following the last Ice Age—has been making some astounding discoveries.

"We're endeavoring to answer some hotly-debated questions about when the water level rose, how rapidly it did so and what effects it had on human populations living along this stretch of the Bulgarian coast of the Black Sea," said Professor Jon Adams, founding director of the University

of Southampton's Center for Maritime Archaeology and Principle Investigator on the Black Sea Maritime Archaeology Project (Black Sea MAP).

"As such, the primary focus of this project—and the scope of our funding from the EEF—is to carry out geophysical

surveys to detect former land surfaces buried below the current sea bed, take core samples and characterize and date them, and create a palaeoenvironmental reconstruction of Black Sea prehistory," Adams added.

Fancy ROVs

Based on board the *Stril Explorer*—an off-shore vessel equipped with some of the most advanced underwater survey systems in the world—the international team of researchers is surveying the seabed using two Remotely Operated Vehicles (ROVs).

During the surveys, members of Black Sea MAP have also discovered and inspected a rare and remarkable "collection" of more than 40 shipwrecks, many of which provide the first views of ship types known from historical sources, but never seen before. The wrecks, which include those from the Ottoman and Byzantine Empires, provide new data on the maritime interconnectivity of Black Sea coastal communities and manifest ways of life and seafaring that stretch back into prehistory. ■ SOURCE: UNIVERSITY OF SOUTHAMPTON

Beer brewed with yeast from 220-year-old Sydney Cove shipwreck

What is believed to be the world's oldest beer survived in a bottle salvaged from the protected historic shipwreck *Sydney Cove* (1797).

The Queen Victoria Museum and Art Gallery in Launceston, Tasmania, has achieved scientific results of interest to beer brewers and drinkers worldwide. Initial analysis of the alcohol was undertaken 25 years ago and revealed grapes, port wine and beer. It was preserved thanks to secure corkage and by being kept cool at the bottom of the ocean.

Light and fresh

However, Queen Victoria Museum and Art Gallery Conservator David Thurrowgood suspected that some of the yeast may have survived the centuries, and decided to take a crack at bringing the beer back to life

by assembling a team of expert scientists from Australia, France, Germany and Belgium. The research team has isolated live yeast from the bottle contents and used it to brew beer using period recipes. The beer has a distinctly light and fresh flavor, giving a taste of beer that has not been sipped for 220 years. ■ SOURCE: QUEEN VICTORIA MUSEUM AND ART GALLERY



Photogrammetric model of a shipwreck from the Ottoman period



Recovery of beer bottle from the *Sydney Cove* shipwreck site. Cork and wax seal was intact. Excavations were conducted during 1991-1994.



Edited by
Peter Symes

Bringing camera batteries on planes

What are the rules?

Samsung Galaxy Note 7 smartphones has now been banned onboard airlines worldwide, following a series of widely publicised incidents where the phone's batteries combusted causing fires.

Could this possibly happen with camera batteries too? Cell phone manufacturers compete to make their phones last longer on a charge while weighing less and

thus pack a lot of charge in a very tight space. If a shortcut arises for any reason, the build-up of heat can lead to a fire. Camera batteries tend not to pose such a high risk as they do not contain as much energy as phone batteries do, but they can still be the cause of a fire if they are not treated correctly. Airlines allow lithium-ion batteries to be carried in carry-on luggage as a fire can be dealt with more easily in the cabin than in the hold.

There are, however, restrictions to observe. The US Federal Aviation Authority (FAA) stipulates that:

Spare (uninstalled) lithium ion and lithium metal batteries must

be carried in carry-on baggage only. When a carry-on bag is checked at the gate or at planeside, all spare lithium batteries must be removed from the bag and kept with the passenger in the aircraft cabin. The battery terminals must be protected from short circuit.

Some airlines recommend that the contacts are covered with tape. Better still is to place each battery in its own protective case, plastic bag or package, such as the original retail packaging. Other methods include using a battery case, using a battery sleeve in a camera bag, or putting them snugly in a plastic bag or protective pouch.

Take steps to prevent crushing, puncturing or putting a high degree of pressure on the battery, as this can cause an internal short circuit, resulting in overheating. Lithium ion (rechargeable) batteries are limited to a rating of 100 watt hours (Wh) per battery. ■

US government seeks to make airfares more transparent

The US Department of Transportation unveiled a new plan to increase the rights and protections of airline passengers and is considering requiring airlines to provide customers with "all-in-one pricing information".

Transportation Secretary Anthony Foxx announced the department would conduct a rule-making to "explore" a requirement for all-in-one pricing that includes fees for baggage, seat assignment, change and cancellation of tickets, *US Today* reports. The goal would be to reduce piecemeal pricing for ancillary fees, which the industry calls unbundling, because it frustrates travelers by making it tougher to compare fares.

The new regulations follow an

executive order President Barack Obama issued in April to boost competition and increase transparency for consumers. The order said, "maintaining, encouraging, and supporting a fair, efficient, and competitive marketplace is a cornerstone of the American economy."

In addition, a new rule will require online travel agents to disclose if they have any bias favoring one airline over another when travelers shop for tickets. ■



PETER SYMES

Arenui
THE BOUTIQUE LIVEBOARD

- PRISTINE CORAL REEFS ✓
- PELAGICS FROM MANTAS TO MOLA ✓
- MACRO FROM PYGMIES TO BLUE-RINGS ✓
- RAJA AMPAT ✓
- AMBON, MALUKU ✓
- KOMODO & ALOR ✓
- LUXURY CABINS ✓
- MASSAGE & SPA ✓
- 5 STAR SERVICE ✓

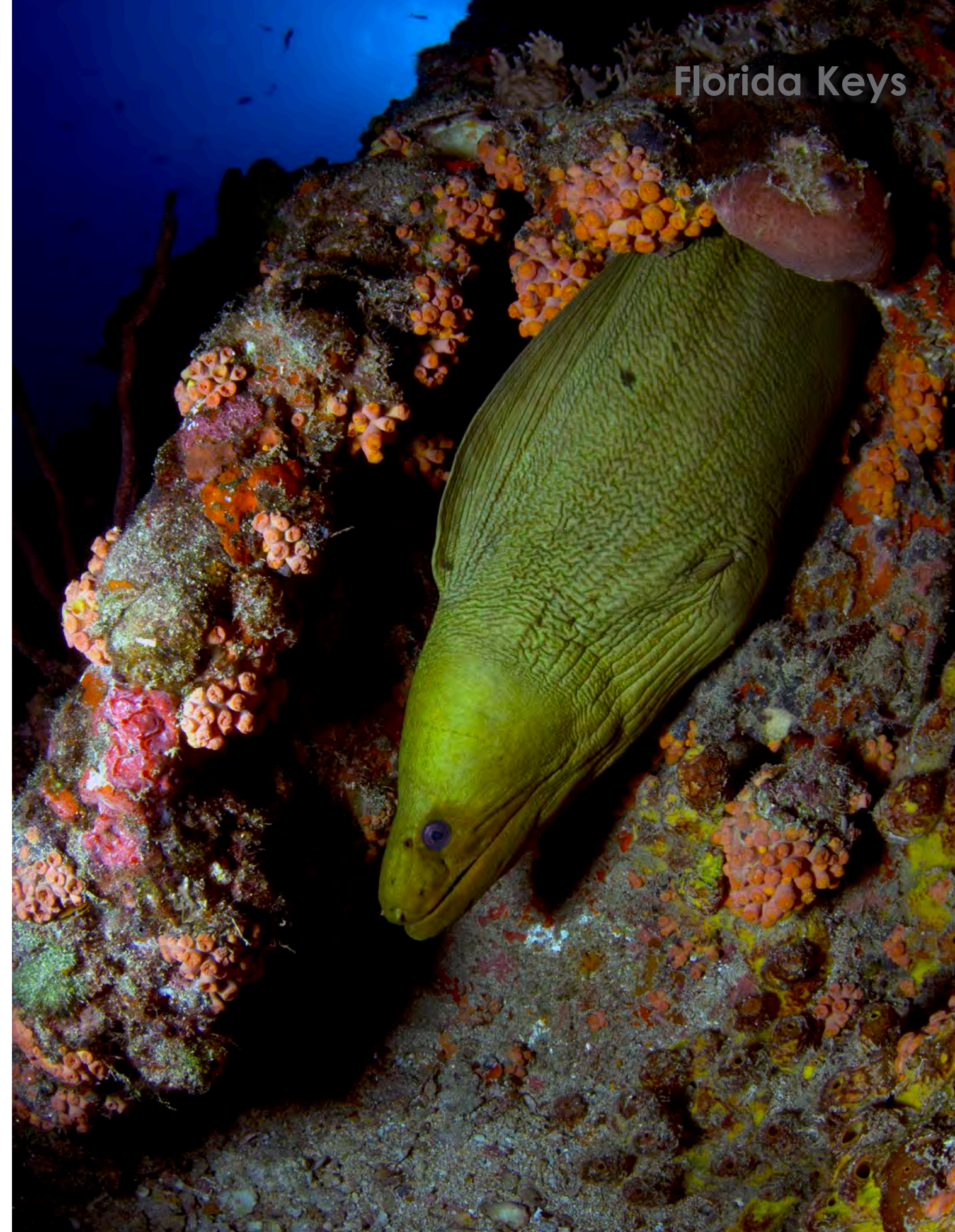
WWW.THEARENUI.COM



America's **Florida Keys**

Text and photos by Lawson Wood

— *A Haven for Wrecks*



Statistics show that more Americans dive in the US state of Florida than any other place on the planet, but when you consider what is on offer, it is hardly surprising. The state's government has been instrumental in sinking some of the world's largest (so-called) artificial reefs, but there are also freshwater pools, caves and caverns with a constant warm water temperature all year-round, which certainly appeals to winter divers.

There are great encounters with large critters like manatees. And of course, the further you travel south towards the Florida Keys, the more the country is influenced by the might of the Gulf Stream. There is great ease of access down to the Sunshine State. More than anything else, Americans are able to experience almost the full range of Caribbean-style diving without leaving the country or need of a passport.

There are very good quality coral reefs, albeit a 20 to 30-minute ride offshore, a huge wealth of marine life, and I can honestly testify to the fact that I can see more different varieties of Caribbean reef fish here than most other locations in the Caribbean. All well and good for the Americans, but why should foreign

divers opt for this particular diving destination?

Artificial reefs. Some of the largest artificial reefs in the world have been sunk off the east and west coasts of Florida, and particularly along the eastern and southeastern flanks of the Florida Keys. The state tourism agency, Visit Florida, which is responsible for the promotion of the Keys, is so switched on that it has an annual advertising budget which surpasses most large multi-national companies. Such is their power, that it is no wonder tourists make their annual pilgrimage to a long string of sand bars connected by bridges, which are really only appreciated in Hollywood blockbuster movies.

This tourist board will do (almost) anything to get divers down, and

Moray eel (above) on *Duane* wreck (above and top left), Key Largo, Florida Keys, USA
 PREVIOUS PAGE: Diver under bright yellow cup coral decorating the *Eagle* wreck, Islamorada, Florida Keys





Join our school.

Even if you hated biology class you'll love learning to dive in The Florida Keys. In just three days you can be certified by the world's best instructors. Before long, you'll go down with the ships and come face-to-face with thousands of different species on America's only living coral reef.

fla-keys.com/diving



Vandenberg wreck (right);
Caribbean reef fish on *City of Washington* wreck (below);
Octopus on *Duane* wreck,
Key Largo (bottom right)

that includes sinking a large number of derelict ships out in the 36m (120ft) range at the confluence of the eddies, which are produced by that constant flow of the Gulf Stream. This nutrient- and plankton-rich current is so full of microscopic marine life, that in hardly a blink of an eye, the ships sunk as diver attractions are soon covered in a patina of marine organisms and the ubiquitous reef fish that love those environments, including horse-eye jacks, trevally, barracuda, chromis, creole wrasse, hamlets, snapper, grunt and parrotfish.

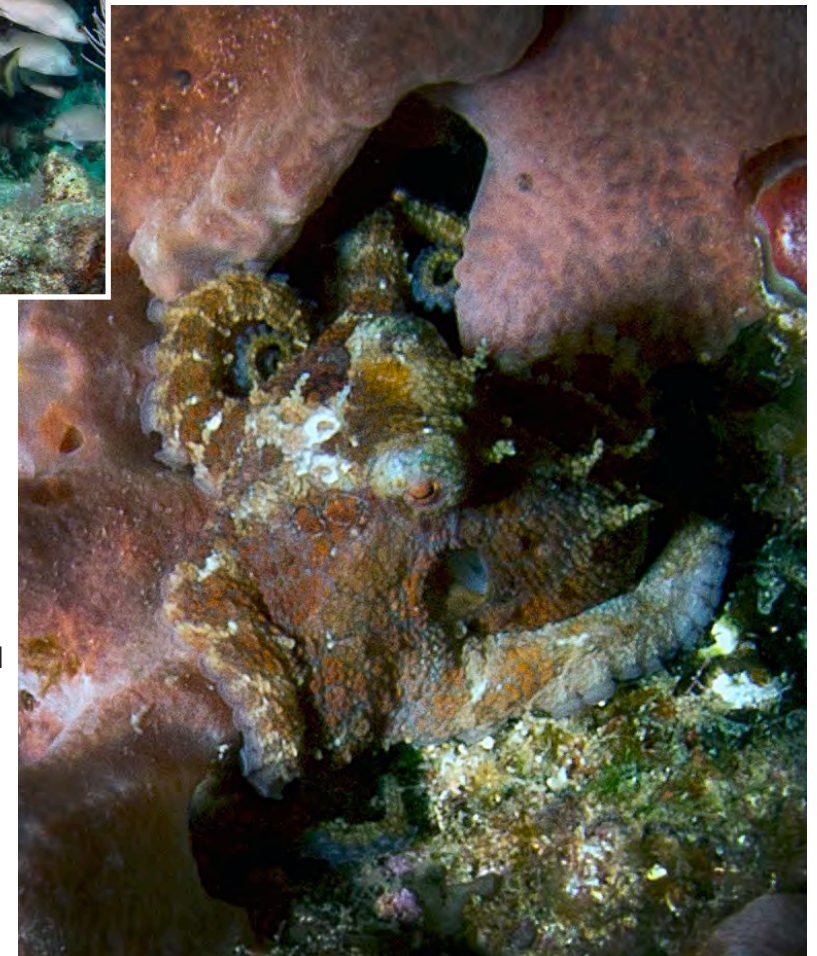


Civil War. And, as always, ships that get wrecked in shallow waters are not only salvaged extensively, they are always pounded incessantly by the storms, which rumble up this coast from June to November each year. However, it is those ships sunk as diver attractions that are a "must-see" for most divers, and I can honestly say that I agree with them!

Shipwrecks. Not only are there artificial reefs—old ship hulks sunk as tourist attractions—there are also the remnants of the Spanish treasure fleet, which foundered on the shallow shoals and sandbars around the Keys. These ships carried so much wealth back to Spain that only 10 percent of their cargoes ever reached the "Old World," and that 10 percent bankrolled the country for over 300 years. If you have time in Key West, go and check out Mel Fisher's share of what was brought up—whilst he was still alive—and what is still being brought up today from the *Nuestra Señora de Atocha*.

That of course leaves the other 90 percent of the Spanish treasure ships still to be found, many of which are recorded as coming to grief upon the shallow reefs of the Florida Keys.

There are also ships dating back to the American





Satellite map of the Florida Keys (above); Diver on shotline of Vandenberg wreck, Key West (below)

Dry Tortugas

South of Key West, at the very end of Highway 1, you can take a small seaplane or boat trip out to the Dry Tortugas, the very tip of the sandbars that created the Florida Keys. The snorkeling here around Fort Jefferson—a former Civil War prison—is excellent and seems so far away from the rather hectic road that connects the rest of the Keys.

The Florida Keys are roughly fishhook-shaped and are really an eons-old result of the massive outflow of water from the

Mississippi River coupled with the permanent current of the Gulf Stream, combined with the might of the trade winds and the periodic, yet fairly predictable hurricanes and tropical storms that



out the three or four miles to where the reefs and wrecks are, if the weather is in any way inclement.

There are those companies who will get you out there, and they will tailor the diving to the experience of the diving group. This may exclude some divers for the safety of the whole group; and in all cases, the diving is set to the lowest common denominator, with safety first and foremost at the top of the list. Decompression diving is discouraged on any of the deeper wrecks, and indeed frowned upon; and dive guides will cajole you along to many of the best bits of reef or wreck to see, before you have to

ascend to the obligatory safety stops on the mooring lines. That is not to say that they are wrong, but sometimes I would just like to stay a little bit longer.

pile even more sand and coral debris onto the shores of the Florida Keys. Needless to say, virtually all of the diving undertaken is well offshore, and most of the smaller diving operators up and down the Keys will just not venture

Some of the diving done in the Keys has the potential, really, to challenge technical divers; but with the great care taken in the sinking of the artificial reefs, the diving experience is the same as it can be for everyone concerned.



Dive boat, Pennekamp State Park, Key Largo



SEACAM
silver

cinema of dreams



www.seacam.com



© J. Haschek



THIS PAGE: Scenes from the *General Hoyt S. Vandenberg* wreck off Key West

with divers and snorkelers, but all of this diving involves fairly lengthy boat rides.

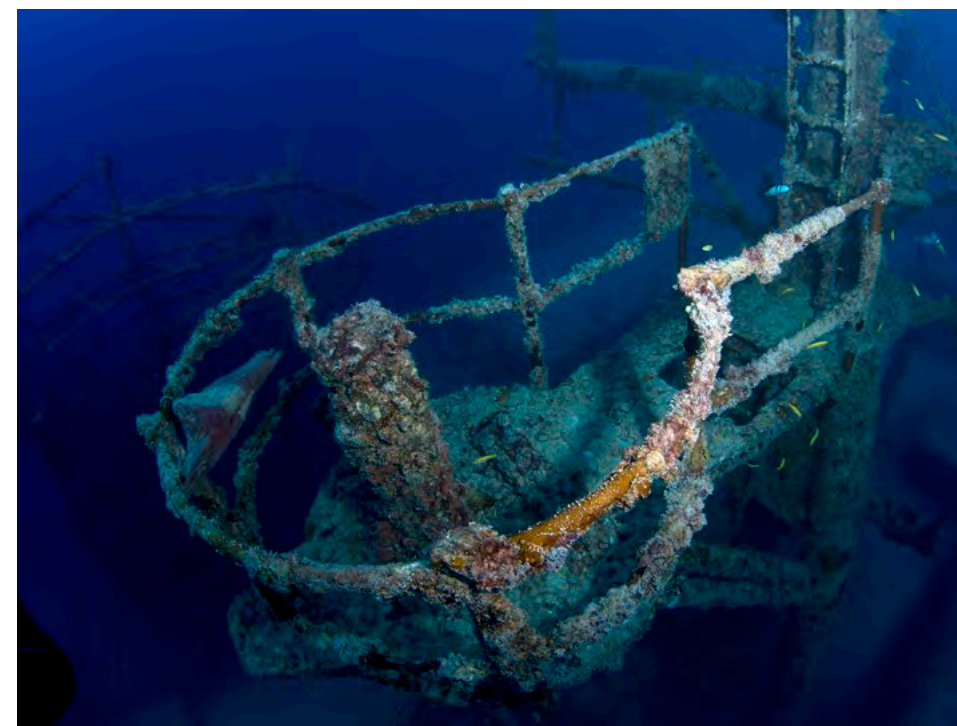
General Hoyt S. Vandenberg wreck. From Key West, the wreck of the *General Hoyt S Vandenberg*, once used as a film prop for a Hollywood epic, sunk in 2010 is undoubtedly the star

attraction. This former troopship and missile tracker has two huge radar dishes on either side of her deck.

At 156m (520ft) long, it can take a number of dives to get your bearing and really appreciate the scale of the ship. You should expect some current, but the ship has several mooring buoys,

and the super-safety conscious dive leaders will make sure they get you back safely and in plenty of time.

Large pelagic schools of fish are the norm here, and there was even an unconfirmed but very confident sighting of a great white shark the week before I arrived! With its huge American flag constantly flying from its superstructure, the ship is becoming colonized at a rapid pace. Turtle, barracuda, scores of tuna and jacks surround the ship, and most divers will do a twin tank dive just to get a flavour of the amount of superstructure that is underwater.



Even in rainy, windswept conditions and in relatively rough seas, I was kind of reminded of venturing out into Scapa Flow, but the ship lying underneath me was in waters very much clearer than in Scotland, so much warmer, and being able to see huge vistas is staggeringly superb with plenty of photo opportunities. Bob Holston and his wife Ceecie at Dive Key West are very much the driving force behind the sinking of this ship and its promotion, as it takes a lot of time and effort to get to Key West to do this particular shipwreck.

EXPLORE THE
UNDERWATER
WORLD



BS KINETICS | **EXTREME**
PHOTO & VIDEO | CARBON FIBER
UW HOUSINGS

www.bskinetics.com





Coral-encrusted structure on *Eagle* wreck, Islamorada, Florida Keys, USA

Marathon

Moving up the Keys in that wide sweep of mangrove swamps and sand cays, incredible bridges connect everything, and amidst the scene of many a Hollywood blockbuster, are the delightful reefs around Marathon. There are more fish species recorded on these reefs than anywhere else in Florida; but again, these reefs are also offshore and do involve some lengthy boat rides. However, once you get out to the Looe Key National Marine Management Area, it is all worthwhile.

Looe Key National Marine Management Area.

This triangular-shaped, shallow reef has a maximum depth of only 12m (40ft) and you can swim around the classic spur and groove reef structure hunting for little critters, as well as enjoying larger fish such as tarpon and rainbow parrotfish. In the channels under the bridges, bull sharks are regularly seen; and whilst fishermen have known of them for a long time, it is only recently that a number of local divers are becoming more interested, where the currents push vast quantities of water through the connecting channels and are having amazing creature encounters.

Islamorada

Up in Islamorada, a few dive centres will run you out by Alligator Key where the wreck of the *Eagle* is located nearby. Located at the Postcard Inn, the Islamorada Dive Center's boss, legendary spearfisherman Eric Billups, has been taking divers out to the *Eagle* since it was first sunk as an artificial reef in 1985.

Eagle wreck. Laying on the starboard side with its bows pointing north in 33m (110ft), the *Eagle* is 86m (287ft) long and is fairly intact, apart from a large open section in front of the main wheelhouse area where the

Where modern technology enhances old fashion diving

W4 5mm



STYLISH SILVER DESIGN LOADED WITH FEATURES.

W4 is the latest back-zip wetsuit from Waterproof. After nearly 30 years of experience of making wetsuits we have put all our knowledge into this high-quality suit with an eye-catching retro-futuristic design.

The 3D anatomical design, with pre-bent arms and legs with stretch panels and gender specific construction ensures a comfortable fit and a relaxing body position in the water. 3D-moulded real rubber kneepads are perfect for the diving instructor who spends a lot of time on his/her knees in the water while teaching.

Double smooth-skin seals at arms and legs, adjustable neck and a 10mm spinepad, with an extra seal at the backzipper work together to keep the cold water out. Seals are designed to fit WP boots and gloves.

All zippers in top class Vislon from YKK. The Bronze slider in the back zipper ensures trouble-free function for many years. ToughTex panels at elbows and knees, Bonded HiQ Nylon Thread and 100% CR Neoprene in all panels - quality in every detail.

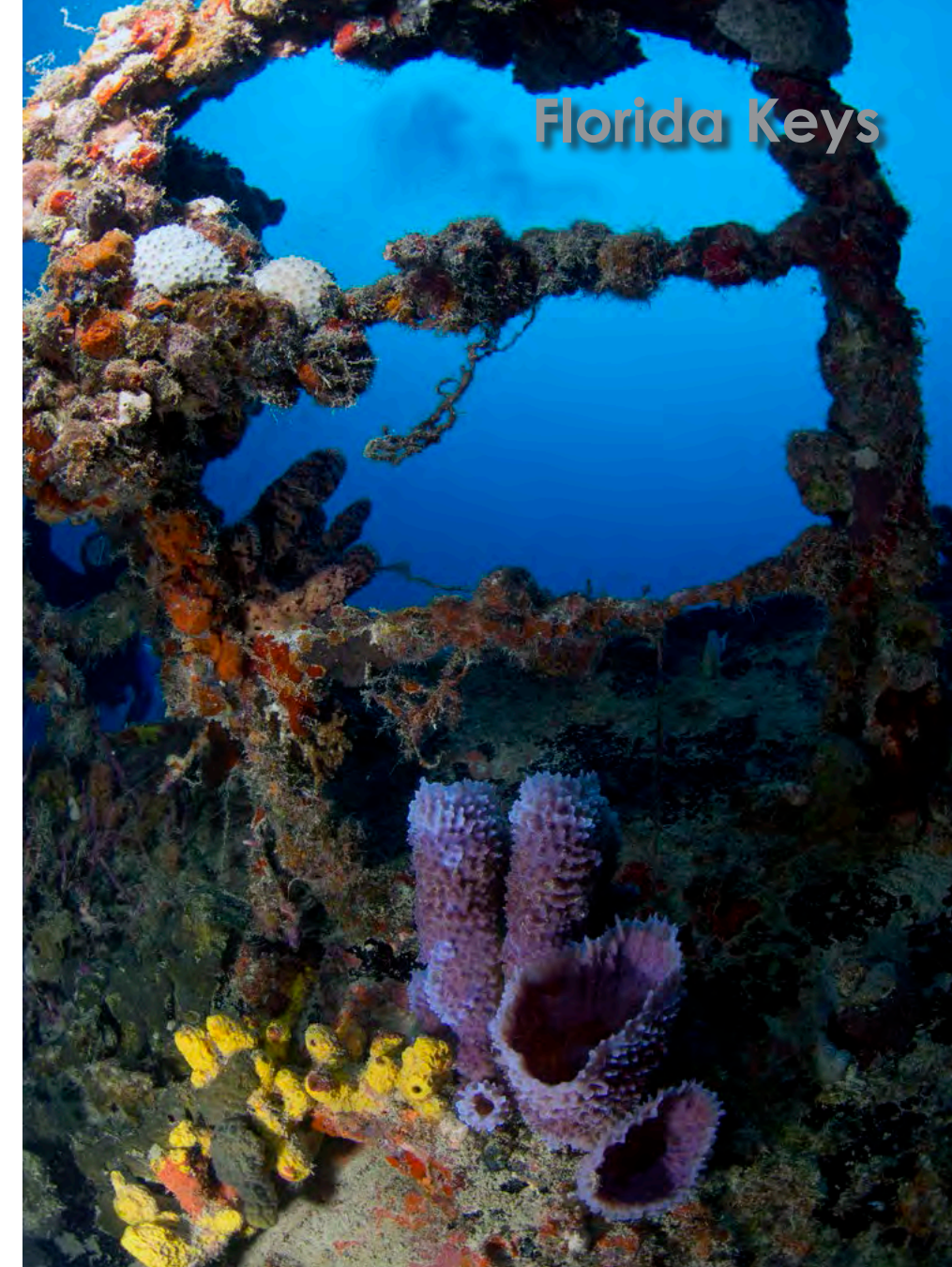
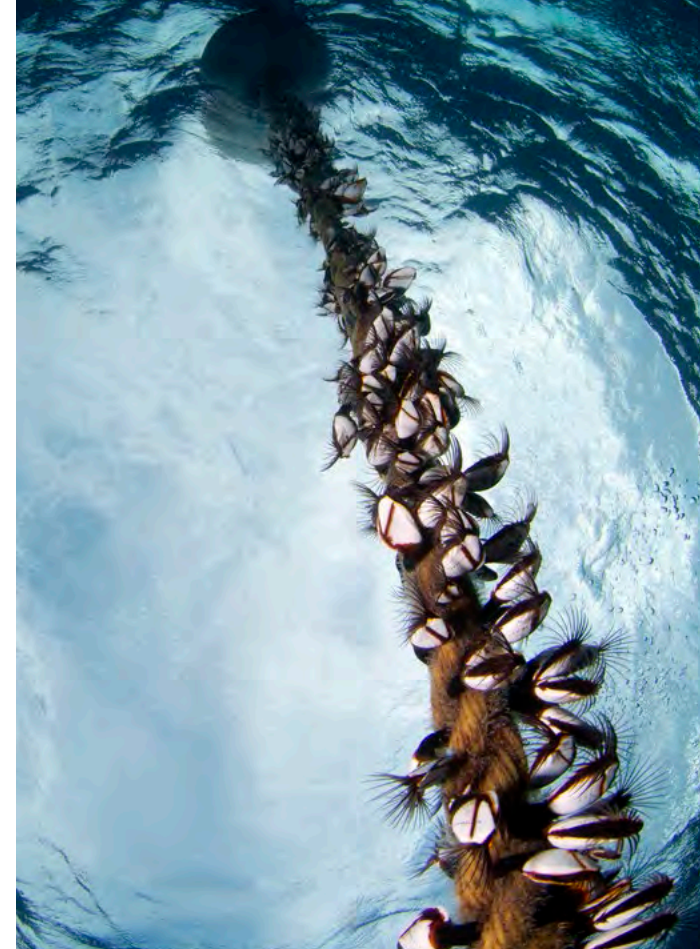
The W4 also features double computer strap anchors with anti slip, comfort front neck zipper, inner plush lining, seat and shoulder antislip reinforcement.



The WPAD™, or the Waterproof Personal Accessory Dock, is a soft artfully constructed docking station located on the right thigh used for attaching our expandable pocket.



www.waterproof.eu



ship has been broken apart. Every piece of the surface of this wreck is covered in marine life many layers deep, with the most brilliant yellow cup corals vying for space with purple soft corals, brilliant red sponges, gorgeous queen angelfish, hamlets, chromis, many species wrasse and parrotfish.

As the shallowest part of the ship is in 20m (66ft), this is the perfect wreck to do two dives back to back to explore the entire length of the superstructure. I loved this wreck and cannot wait to get back! Eric has promised me a night dive on the wreck, which I suspect will have to be seen to be believed.

Alexander Barge wreck. Just to pique



THIS PAGE: Scenes from the *Eagle* wreck, Islamorada, Florida Keys

your interest is the nearby wreckage of the *Alexander* barge sunk in 1984 in 31m (103ft) of water. The sinking of this boat was really the start of the artificial reef programme;

and as you can imagine, this is also well encrusted in marine organisms, but is overall a much deeper dive and most divers would rather opt for the easier option on the *Eagle* as it is so close.

D&B Barge wreck. Also nearby is the *D&B* barge wreck which is a natural shipwreck and absolutely covered in marine life and is a great spot for fishermen, so watch out for loose fishing lines.

Concentrating on the wrecks, there

are a number of historic ships and anchors littering the shallow barrier reef; but for most divers, it is the wrecks sunk as dive attractions that get the eel's share. Some of those anchors have become the focus for a dive, and names such as *Pirate's Anchor* are really only to pique your interest.

Key Largo

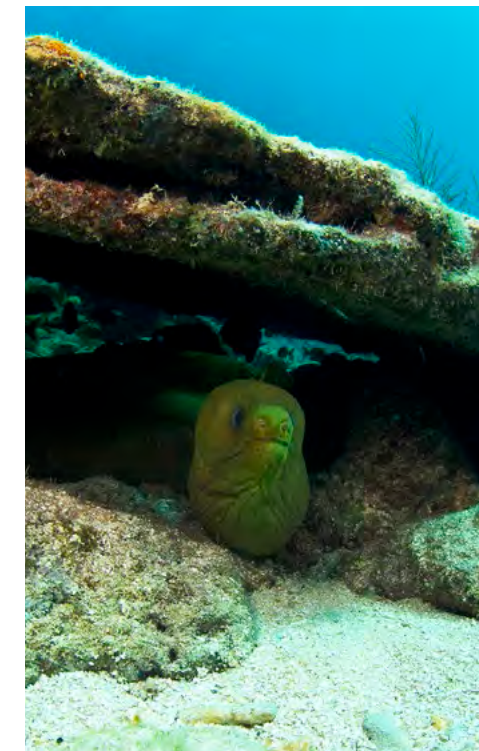
Key Largo in the north is considered the epicenter for the majority of divers. In fact, this long, stringy island gets customers both travelling south and north, giving divers a second chance to get where they want to go, with most people diving on both the wrecks and reefs. Subsequently, there are more dive centres located here than any other island in the Keys. However, there are also a lot of "tourist boats", which take

literally hundreds of families of snorkelers out to the reef; and whilst they may be a nuisance to get your boat anchored up at a favoured dive site, they do not create any impact on the marine ecosystem at all.

John Pennekamp Coral Reef State Park.

You cannot dive Key Largo and the great variety of wrecks there, without first visiting the John Pennekamp Coral Reef State Park. Founded in 1960, the marine park is located in an area known to have the most extensive coral reefs in the United States and covers over 75 square miles of ocean.

With over 500 species of fish recorded amongst the shallow reefs



THIS PAGE: Scenes from the *City of Washington* wreck, Key Largo



and protected mangrove forests, the shallow reef plateau has an average depth of only 8m (27ft), making it accessible for everyone. The first marine preserve in the United States is celebrated by a wonderful statue known as the "Christ of the Deep" or "Christ of the Abyss." Located 10km (6miles) east-northeast of the South Cut on Key Largo, the statue is a replica of that created originally by Italian sculptor Guido Galletti for Edidi Cressi, who presented it to the Underwater Society of America. It has been underwater since 1961 and has been visited by literally thousands of divers and snorkelers.

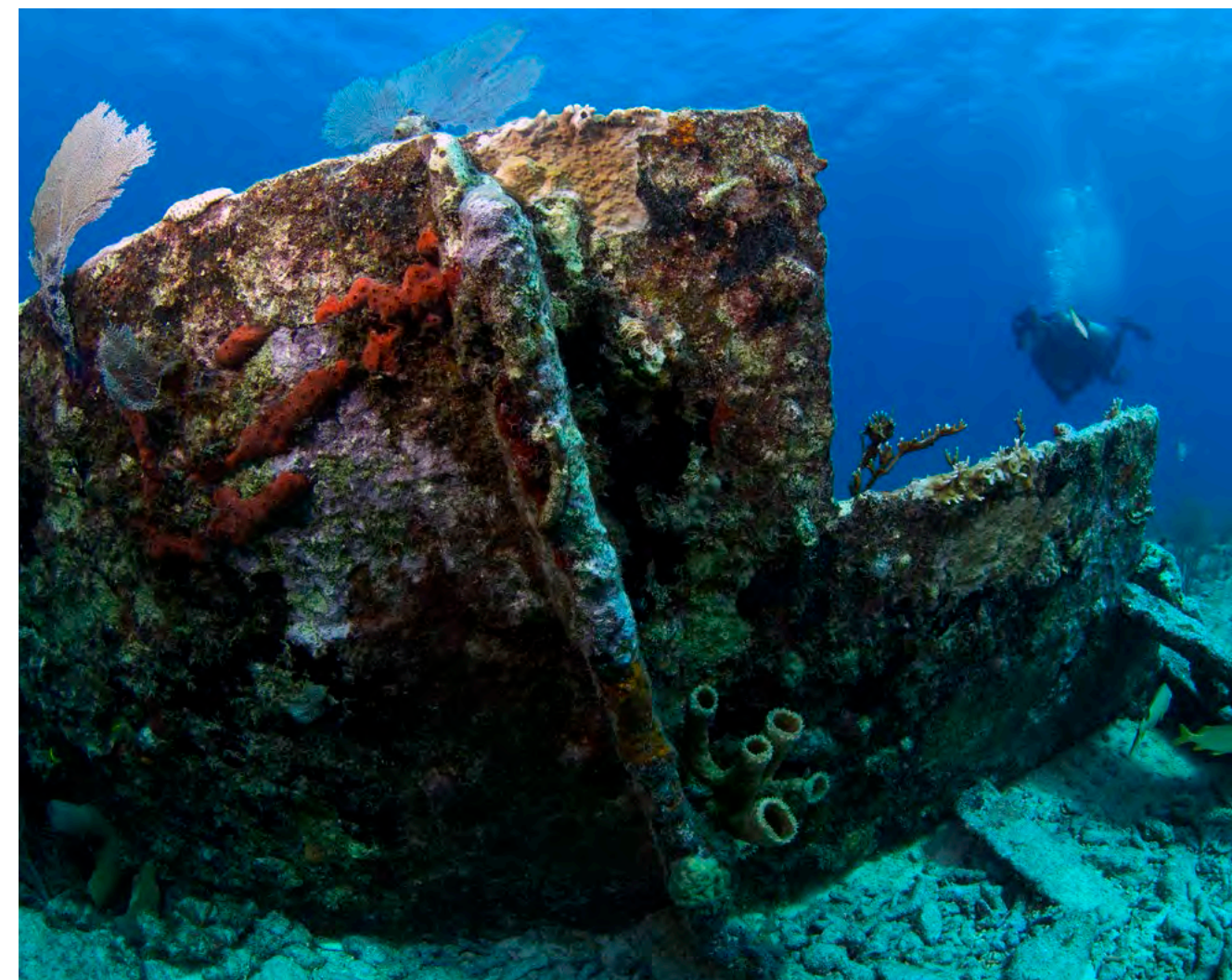
This region of a large, horseshoe-shaped reef often has poor visibility, but nothing detracts from the statue or the condition of the reefs themselves.

Mollases Reef. Nearby Mollases Reef to the north is, however, well known for its excellent visibility underwater, and being so shallow, gets lots of sunlight

to brighten up even the dullest day. Mollases Reef has been undergoing something of a transformation lately, with newly seeded coral species being "planted" on the shallow reef platforms. Of those I viewed, most appear really healthy and vibrant.

City of Washington wreck. Further to the north on a reef known as Wreckage Reef, or The Elbow, are the remains of the *City of Washington* in only 6m (20ft) of water. This steel freighter ran aground in 1891 and was pounded mercilessly by the annual storms until it was well broken up and encrusted in low hard corals, sea fans and literally thousands of Christmas tree worms.

Better known for its role in rescuing the survivors of the *Maine*, when the vessel blew up in mysterious circumstances in Havana Harbour, the *Washington* is a great shallow dive, in an area synonymous with clear water and good quality corals. There is a



Replica of "Christ of the Deep" by Guido Galletti, Pennekamp Coral Reef State Park, Key Largo

When it comes to diving leadership,
one name stands apart from the rest --
NAUI Worldwide.

Train your divers to become

NAUI

FIT



NAUI's Pathway to Leadership is Proven.

The Familiarization-Instruction-Testing (FIT) Program sets a new standard for dive education and leadership training. With its heightened level of performance evaluations, critiques and counseling, candidates will soar in their state of FITness for NAUI Leadership.



Learn more about NAUI's Familiarization-Instruction-Testing Program at www.naui.org/certifications/leadership/FIT



Photo by Kadu Pinheiro

Florida Keys



Aerial view of Upper Matecumbe Key (above); Divers on *City of Washington* wreck, Key Largo (below)

resident friendly moray eel, as well as hawksbill sea turtle.

Towanda wreck. Close by are the wooden remains and anchor chain from a ship thought to be the *Towanda*, which sunk during the American Civil War. A 17th or 18th century, coral-encrusted anchor is also found in the same vicinity.

Artificial reefs

Located also in the marine protected area are several other ships also sunk as part of the artificial reef programme: the *Duane*, *Bibb* and *Spiegel Grove*. Notwithstanding a large number of ships that have sunk naturally (or accidentally), these ships sunk specifically as dive attractions are a natural magnet for everything.

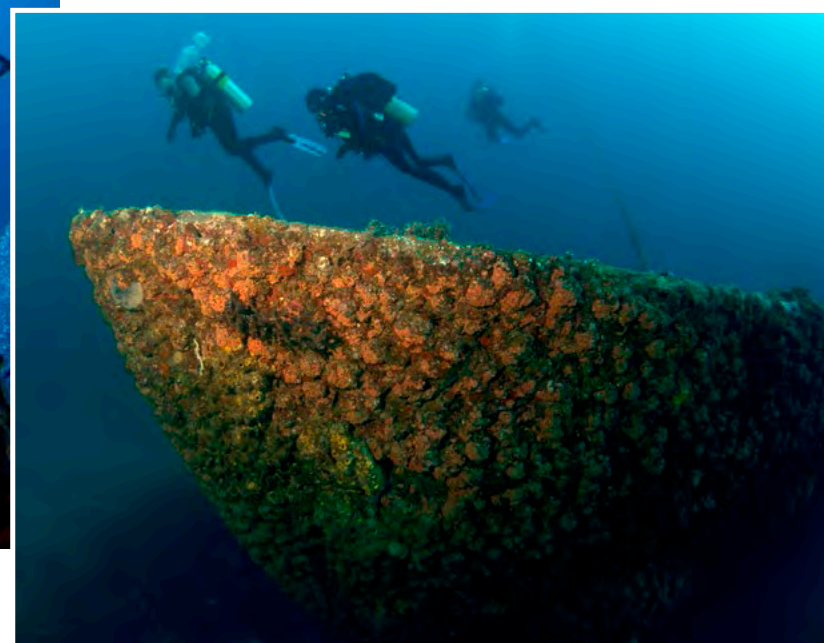
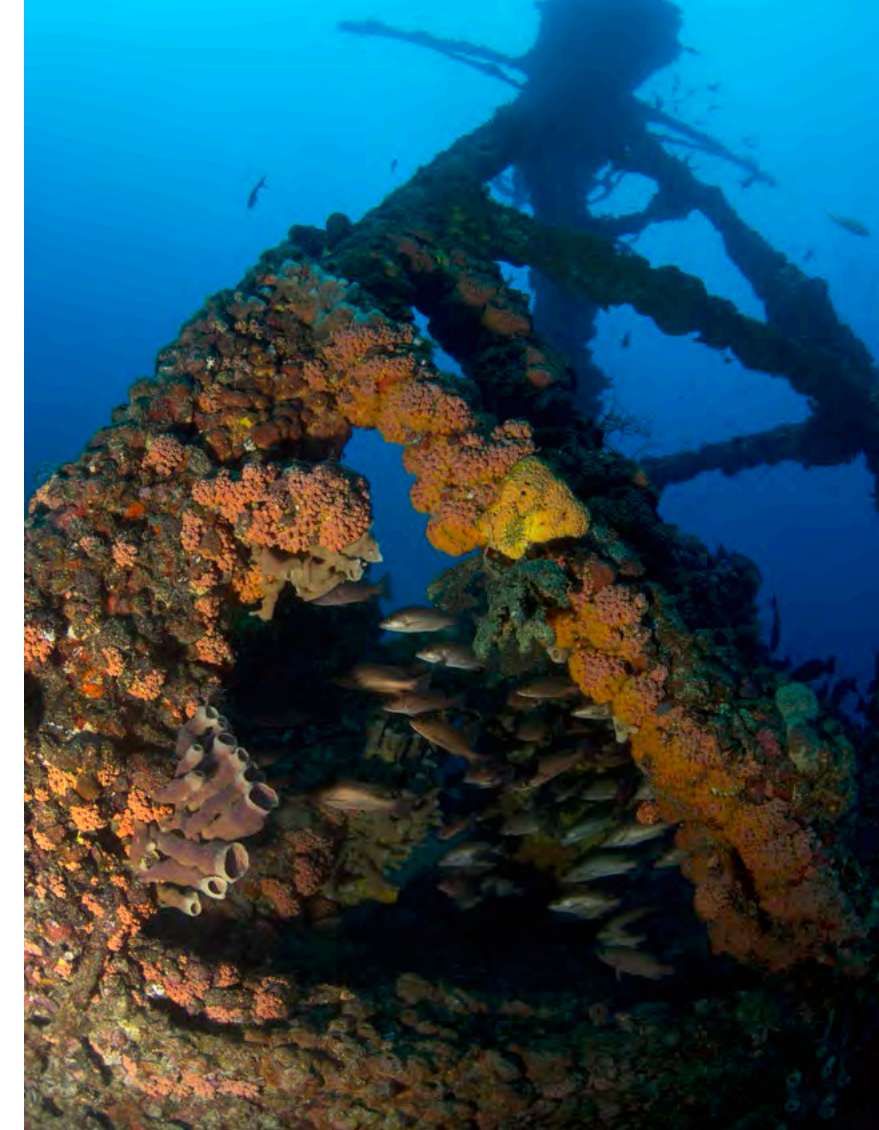
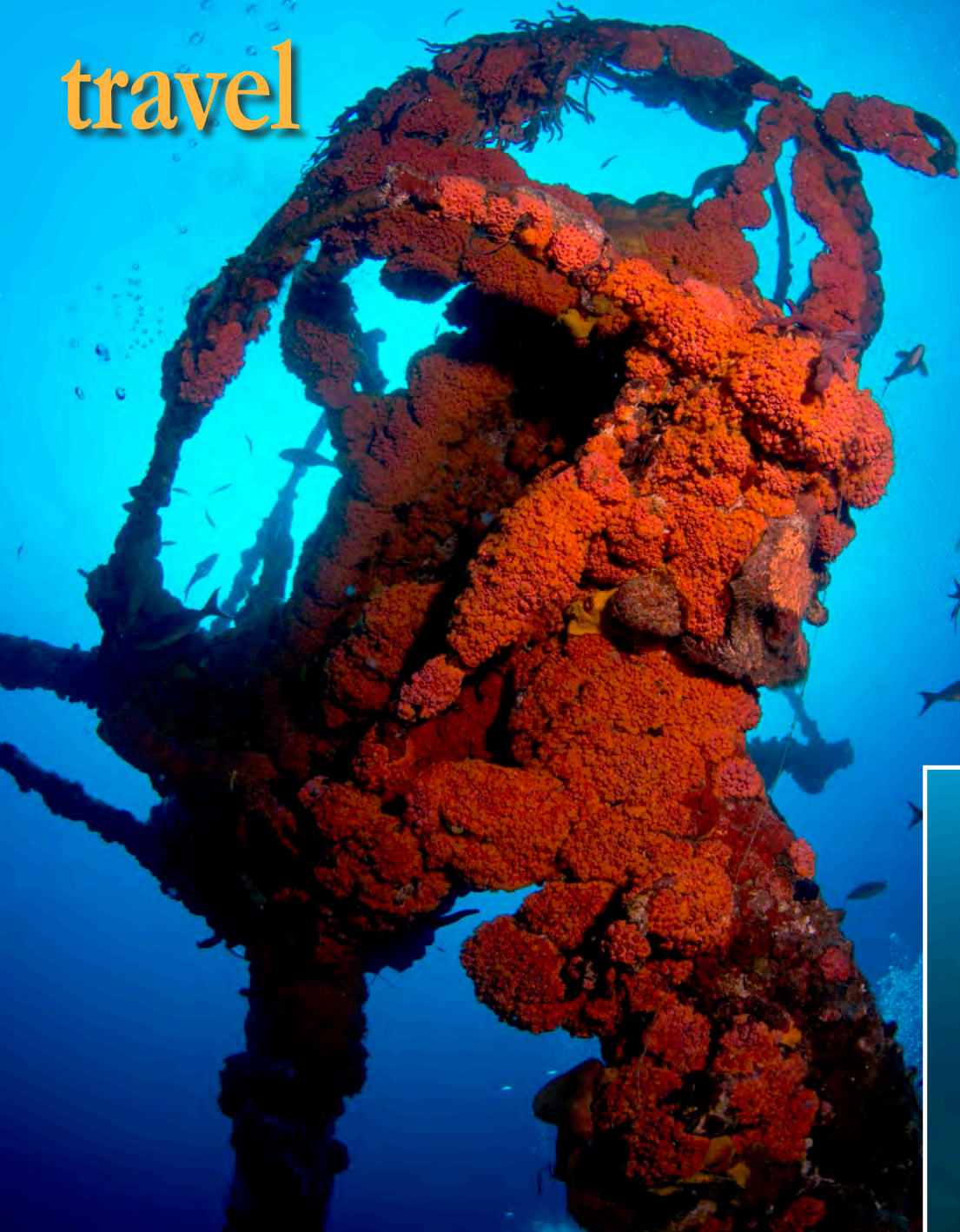
Benwood. Another shipwreck in the immediate vicinity is the *Benwood*. It was a casualty of a German submarine attack during WWII and was subsequently rammed accidentally by a "friendly" ship. Later, several bombs exploded

in the vessel, amidships, and sent it to the bottom. Part of the superstructure was still above the surface, and it was latterly used for bombing practice before the bows were blown apart, as the ship was becoming a navigational hazard. Lying from 7.6 to 16.7m

(25-55ft) of water, *Benwood* is, as one can imagine, well broken up and very much a part of the extensive shallow coral reef platform.

Duane and Bibb. Nearby the Mollasses light tower, the *Duane*





THIS PAGE: Scenes from the *Duane* wreck, Key Largo

and the *Bibb* were sunk deliberately on 27 November 1987 as dive attractions. Former US Coastguard cutters, they are both 98m (327ft) long and were sunk in relatively deep water, over 30m (100ft), to be certain that they would be navigation problem-free. Subsequently, these dives are regarded as deep wreck dives; and with time underwater always a problem on these dives, that just means that you have to return several more times to get the full appreciation of the wrecks.

Having only limited time to visit these wrecks due to the onset of

bad weather conditions, I was advised to dive the *Duane* out of all three new wrecks. Not only does it have the best coral growth and fish life, *Duane's* superstructure is more interesting and the crew's nest comes to within 1.5m (50ft) of the surface, to allow you to start your safety stops, yet still be able to do some photography. Amazingly, *Duane's* entire uppermost steelwork is literally covered in golden cup corals (*Tubastrea coccinea*) giving the outline of the ship a golden, fuzzy appearance.

The Gulf Stream undoubtedly has a huge influence on these wrecks; and occasionally, the unpredictable currents and eddies just rip along the shore here, making diving on them virtually impossible. Dive lights are always recommended on these dives, to allow you to penetrate further into the ships, but I am always quite happy to bumble about on the outside, enjoying the coral growth and the fish life surrounding them.

remarkable.

Current, as always, can be a problem when one is so far out in the Gulf Stream, but the rewards are utterly amazing, and I have to say that these wrecks to the east of the islands in the Stream have to be on everyone's diving list. I only visited them briefly, but I am

Spiegel Grove. Amazingly, when the *Spiegel Grove* was first sunk further north from the *Benwood* and *Dixie Shoal*, it ended up on its port side, making it a difficult, if not interesting dive. However, a few years and a few hurricanes later, *Spiegel Grove* was put back up on an even keel, making the ship even more

MOMENTUM
PROFESSIONAL DIVE WATCHES

AFFORDABLE, RELIABLE, TOUGH
LUMINOUS DIAL // 20 ATM // SCREW CROWN

TORPEDO BLAST // IM-DV74R1B

TORPEDO BLAST // IM-DV74Y7B

www.momentumwatch.com/xray



Diver at *Eagle* wreck, Islamorada, Florida Keys, USA (left and below); Diver (right) and sea turtle (lower left) on *Duane* wreck, Key Largo

the reefs and wrecks are all so far offshore, the sea conditions have to be near perfect before any dive boats will venture out into the Stream. Offshore storms along the east coast of Florida are always a problem, but for the most part, all of the reefs and wrecks are manageable.

Conditions and visibility

The inshore reefs along the Keys average around 15m (50ft), with greater visibility variable



determined to return and also dive them at night, as the colours, often hidden during the daylight hours, will all be revealed in their glory after dusk.

Best time to go

Diving is available all year-round. However, there are periodic storms from the southeast, which can strike the Florida Keys any time from June through to November, but the summer months also yield the best visibility. Strong currents and eddies from the Gulf Stream can cause problems on the deeper wrecks; and due to the fact that



the further one travels offshore. The underwater topography undoubtedly has an influence on the visibility, as on two back-to-back dives at the "Christ of the Deep" statue and then the nearby *City of Washington* wreck, which was in shallower water, the difference was at least 15m (50ft) better on the

shallow reef where the wreck is found. The sea temperature rarely drops below 22.2°C (72°F) in the winter months, and increases by 10° on average, depending on the strength of the Gulf Stream. ■

The author was supported by the Florida Keys Tourism Association and the Postcard Inn in Islamorada and dived with Dive Key West, Islamorada Dive Center, Rainbow

Reef Dive Center and Pennekamp State Marine Park. Special thanks to Cecilia McCafferty, Eric Billups, Bob and Ceecie Holston, Jo Thomas, Carol Shaughnessy, Jodie Remick, Stacy Sheldon, Allison Ballester and DJ Wood.

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



Critters of the Muck

Text and photos by Brandi Muller

You just have to do it to understand it. Until you have experienced it, the name itself does not stir the emotions as much as other types of diving. But once you have experienced the treasure hunt for yourself, you will be hooked. Marketing specialists would agree that it is probably misnamed and they have even tried to rename it, but nothing has stuck the same way as the coined term “muck diving.”



Painted frogfish, *Antennarius pictus*

So, what is muck diving? The term can be used to describe several types of diving but usually involves diving in areas you wouldn't initially think about diving in. Under piers and bridges, right off shore in the shallows, such as seagrass beds; sometimes below shipyards, where you

might only expect to find garbage and often poor visibility... but always with amazing critters. These spots that may not look like the best diving locations have turned out to be some of the best places to find and photograph the weird and the wonderful of the ocean.

Where to muck dive

Some of the world's most popular muck diving locations are in the Coral Triangle, the region between the Philippines, Papua New Guinea and the Solomon Islands. This region has the highest biodiversity in the ocean, and favorite muck diving

places include Indonesia's Lembeh Strait, many parts of the Philippines, and the shallow waters right off Papua New Guinea.

Muck diving occurs in other places as well, with one of the most popular muck diving sites in the United States being under the Blue Heron Bridge in



Mantis shrimp, *Odontadactylus scyllarus*, (right and above) with eggs; Seahorse (top right)

Florida. Divers spend hours in shallow waters finding seahorses, nudibranchs, octopus, batfish, crabs, shrimp, eels and more. Other places around the world include places in the Caribbean, Canada and Australia.

What will you see?

The list is far too long to be completely covered in one article (in fact, several large books won't even cover them all) but here is a list of some of the favorites and why the critters of the muck are so darn cool.

Mantis shrimp. Often found peering up at you from a burrow in the sand or from a crevasse in

coral, mantis shrimps are some of the coolest critters in the sea. You won't want to mess with them though, as some species have the ability to "smash" or "spear" with a second pair of thoracic appendages, with enough force that the punch generates tiny bubbles, which cause a shock wave that can stun or kill prey on its own. They have even been known to crack camera ports, so don't get too close.

Beyond being phenomenal fighters, mantis shrimp have eyes with 12 to 16 types of color-receptive cones (humans only have three). They have compound eyes that allow them to see from three parts of each eye, giving

them depth perception that likely helps them out in their ability to attack prey with such speed and accuracy. Mantis shrimp eyes are perched on stalks that allow them to move independently of each other.

Some can be beautifully colored too, such as the peacock mantis shrimp, which is probably one of the most colorful critters of the muck. With purple and blue eyes, and bodies of green, red and blue, they are

always exciting to see and photograph. Mantis shrimp are thought to mate monogamously for their entire lives, and the duty of taking care of the eggs (which are pink

in the peacock mantis shrimp) by holding them in their arms, can fall on both males and females sharing the task in some species.



GANGGA ISLAND
RESORT & SPA



E-Mail: info@ganggaisland.com

www.ganggaisland.com





Seahorses. Seahorses are another favorite ocean animal no matter where you are diving, and they are commonly found in the muck, coming in many shapes, colors and sizes. Beautiful with their unique half-horse and half-fish profile, we can't help but love them.

Some of the smallest seahorses are the pygmy seahorses, which are about 2cm tall or slightly smaller than your pinky fingernail. The largest is the Pacific seahorse species, which can be up to 30cm tall.



Another reason we love seahorses: Pairs often mate for life and their reproduction habits are quite interesting. When two seahorses are about to mate, there is an elaborate courtship dance between the



Muck

CLOCKWISE FROM TOP LEFT: Pregnant male seahorse; Robust ghost pipefish; Pregnant male pygmy seahorse; Pipefish

of seahorses, the males give birth to many tiny seahorses.

Pipefish. Cousins to the seahorse are the pipefish. Looking like a stretched-out seahorse, both share several similarities. For one, some pipefish species also have the males brood the offspring. Pipefish also come in many colors and sizes, with one of the smallest being the pygmy pipe dragon, which even up close looks like nothing more than a stray strand of algae. They are usually 2-3cm long and thread-like skinny.

Some pipefish are colorful, like the banded pipefish, which has pretty red stripes, and others are uniquely shaped, such as the ghost pipefish. Many blend in with their surroundings perfectly, such as the ornate pipefish, which swim among crinoids



looking just like them—or the robust ghost pipefish, which can alter their colors to blend into a seagrass or seaweed habitat.

WWDAS

WORLDWIDE DIVE & SAIL
presents

Siren Fleet

Dive Komodo with the Indo Siren
Deluxe en-suite cabins, outdoor dining
& plush lounges, spacious dive deck,
camera station.

**FREE Nitrox and
Rental Equipment**

Contact us for
further information



Scorpionfish (left) is a master of disguise, its camouflage blending into the reef; Blue-ringed octopus (right); A coconut octopus (*Amphioctopus marginatus*) holds onto its brood of eggs in the Philippines (lower right)

Scorpionfish. Masters of disguise, scorpionfish have the ability to blend in with their surroundings, but sometimes their hiding spots are given away in the muck; although, at other times, they hide even better in the black sand or silt common to muck dives. Almost all are venomous. Many species of scorpionfish exist with some of our muck favorites, including the lionfish, leaf scorpionfish, rhinopias, waspfish, stargazers and more. With a face only a mother could love, the scorpionfish may get a bad rap because it will leave a severe sting if you do not see it and accidentally rub up against it. But photographers love them, and it is always amazing to see only rocks and coral, and a second later, you realize it is actually a scorpionfish.



Muck

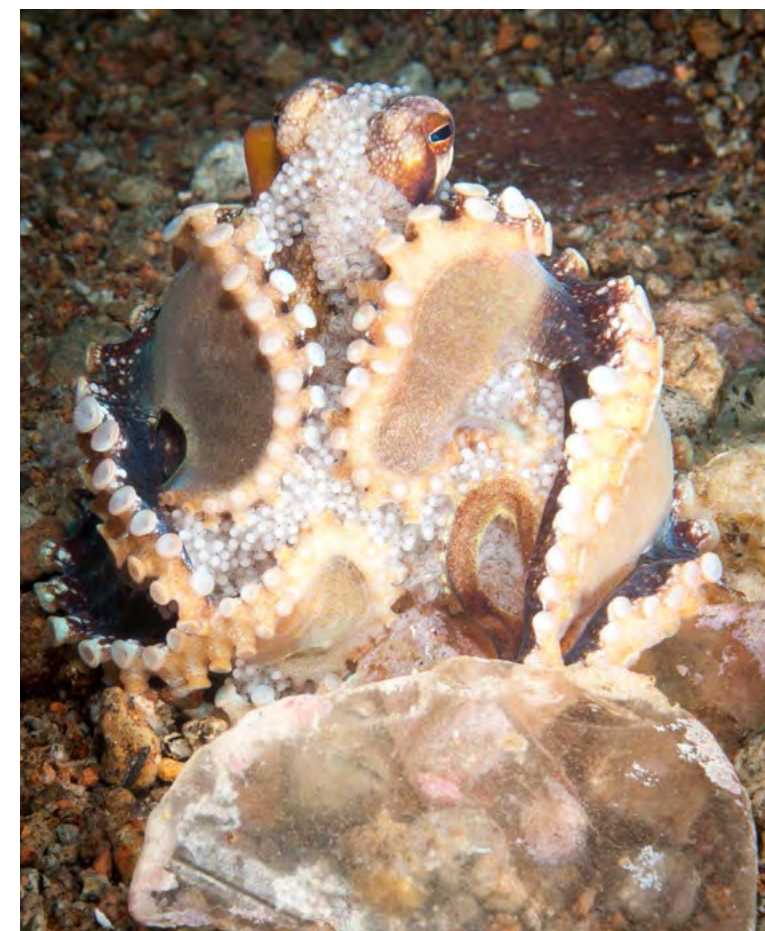


Wonderpus (*Wunderpus photogenicus*)

Octopus. Another favorite for critter finders and photographers alike are the many shapes, sizes and colors of octopus in the muck. One of the most popular (and the most deadly) is the blue-ringed octopus. It is also one of the smallest, being only 12 to 20cm. Brilliant blue rings identify this octopus, although it can make them fade away, showing only a white or cream-colored body to blend in with its surroundings. Usually, when it is agitated, it shows the vibrant blue.

Mimic octopus and wonderpus are two other amazing octopuses. Both have long and skinny tentacles with brown and white stripes. Mimics are thought to mimic other animals and will mold their bodies into different shapes to look like a flounder, lionfish, eel or another reef species.

The smallest species are the



tiny pygmy and algae octopuses, which can be as small as 4.5cm. Larger species include the coconut octopus, named thus because it likes to make its home in objects such as sunken coconut shells, discarded bottles and other trash. All octopus species

Mike Ball Dive EXPEDITIONS
COD HOLE • CORAL SEA • GREAT BARRIER REEF • AUSTRALIA

Expeditions On the Wild Side

The Best Diving on the Coral Sea & Great Barrier Reef!

Dive with giant potato cod, explore deep walls, witness shark action at Osprey Reef.



Minke Whale Season! June-July

Unique Opportunity on the Great Barrier Reef.
www.mikeball.com/minke

New Special Expeditions!

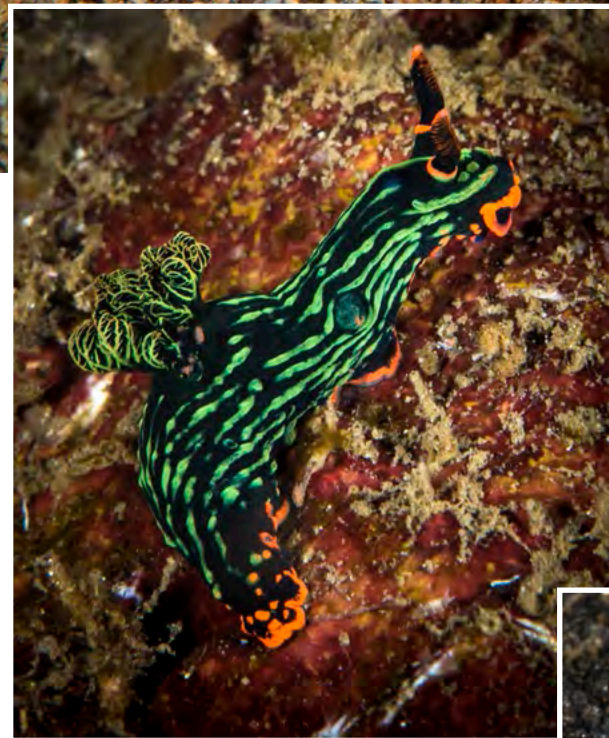
Check out our website for details.



Phone: +61 7 4053 0500

www.mikeball.com

Email: resv@mikeball.com Fax: +61 7 4031 5470
Visit: 3 Abbott Street, Cairns, Queensland 4870 Australia



have three hearts; and their blood is green instead of red because it contains a copper-containing protein called haemocyanin, instead of haemoglobin.

Cuttlefish. Cuttlefish belong to the class Cephalopoda, like the octopus, and they have eight arms and two tentacles. The smallest of the cuttlefish is the pygmy cuttlefish, which can be 15cm long, while the largest can be up to 50cm and weigh over 10kg. Often

seeming to interact with divers, they are always a great find during dives.

Cuttlefish communicate by changing their body coloration, and they do this through the use of chromatophores, which contain pigment granules. They also have iridophores, which produce iridescent colors that may look



metallic. They are able to change colors and patterns rapidly, either to camouflage themselves or make themselves bright and well-seen—which may be a way of showing aggression, courtship, or

other communication with their bright and fast moving colors.

One of the smaller and favorite cuttlefish species is the flamboyant cuttlefish, which can show brilliant red, purple and yellow hues. The flamboyants have 42 to 75 different skin coloration elements (other cuttlefish vary up to 34 elements). It often looks as if it is walking along the sand. When hunting, the flamboyant and other cuttle-



fish species have two feeding tentacles with suckers at the end that are used to grab prey and retract to the beak where they are “paralyzed by venom.”

Nudibranchs. When talking about muck diving, one cannot discuss nudibranchs. Even though they are found worldwide, many species can also be seen in muck diving locations. Nudibranchs are colorful sea slugs belonging to the mollusk family,



Muck

CLOCKWISE FROM FAR LEFT: Flamboyant cuttlefish hunting—cuttlefish have specialized feeding tentacles that have a patch of suckers at the end to grab prey; Cuttlefish in seagrass; *Flabellina pedata* nudibranch; *Chromodoris kuniei* nudibranch; *Costasiella kuroshimae* nudibranch with eggs (center); *Hypselodoris infucata* nudibranch; *Nembrotha kubaryana* nudibranch



although they are a shell-less version. Over 2,000 species are known, with more and more species being discovered. Looking like long, skinny, painted Easter eggs, nudibranchs have two rhinophores that project from their heads like rabbit ears, which are used for smelling. They have a tail-like plume of feathers, which is an open gill system through which they breathe.

With so many different species, many nudibranchs have some very exciting habits. Some are cannibalistic and will eat other nudibranchs of different species as well as their own kind. Some species are solar-powered, because they



Muck



Snake eel (top left) being cleaned by a cleaner shrimp; A sharptail eel under the Blue Heron Bridge in Florida (far lower left); It is thought that the blue ribbon eels (top center) turn blue (left) when they have possibly become adult males or transformed into females. As ribbon eels continue through their life they will finally turn completely yellow, this one (top right) is nearing that. Yellow may signify when they have transformed into females or when the females have past sexual maturity.

the key to finding the best nudibranchs in a specific area.

Eels. Eels can be a common find on most dives, but eels in the muck tend to be cooler than most. In some areas, there are blue ribbon eels—although the name is misleading because they are not always blue. This eel actually changes gender and color throughout its life. As juvenile males, they are black, with a tiny yellow stripe on their dorsal. Eventually, they will turn into females and turn blue, with a yellow stripe on the dorsal. Then, as they complete sexual maturity as a female, they turn completely yellow for the last phase of their life.

eat algae and hold onto the chlorophyll cells in extensions of their body, which then absorb sunlight and make energy for the nudibranch. Bright colors also serve as warnings for predators, because many species are toxic from feeding on hydroids and keeping their nematocyst cells within.

Despite being so colorful, finding nudibranchs can be a challenge. They are small and blend in with their surroundings, often being in similar colors to the sponges they eat. So, local dive guides are

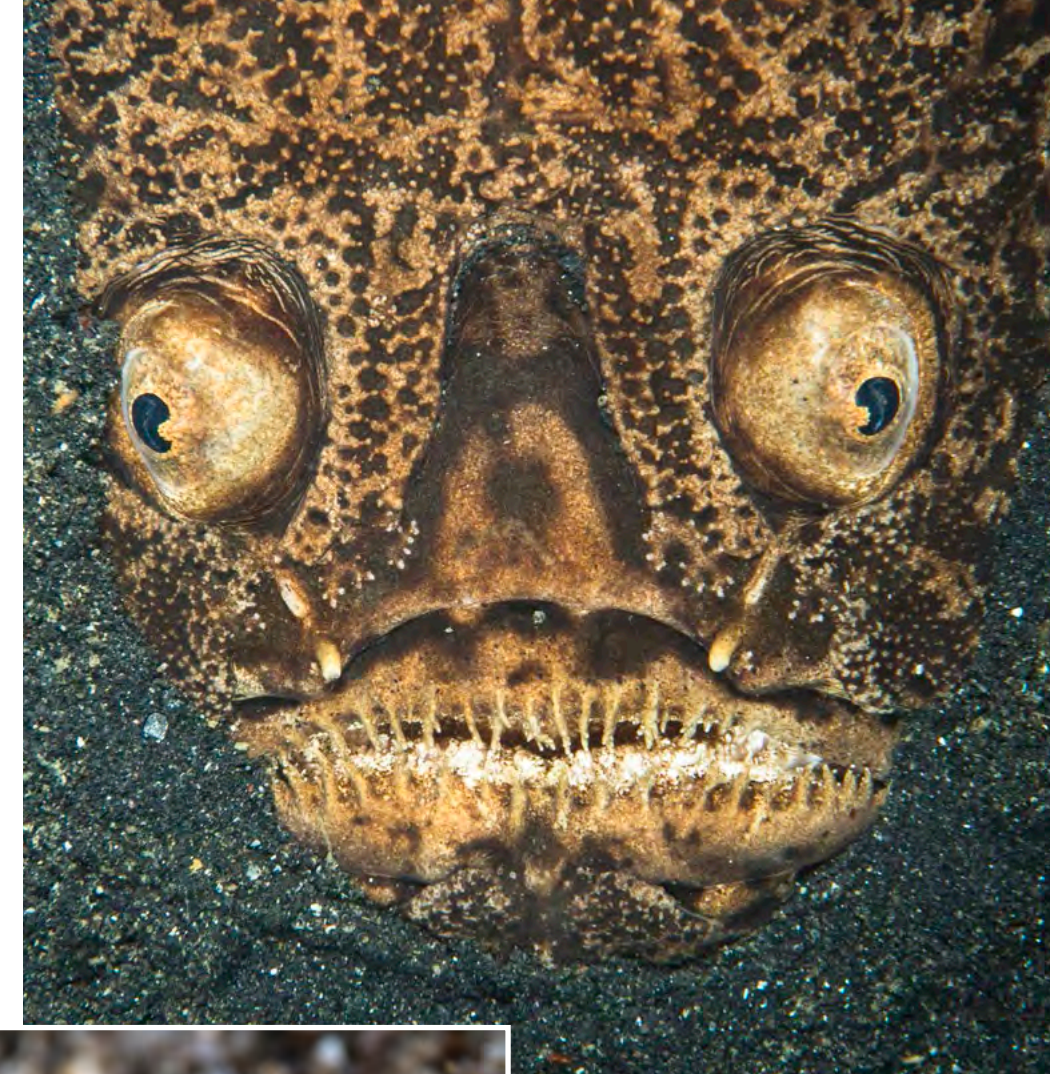
Snake eels are another unique eel that generally strike me as quite creepy. Often seen on night

Turquoise Bay
Dive & Beach Resort

Sunsets and smiles included dive vacations!

Roatan, Bay Islands, Honduras
Phone: +504 9885-0840, +617 391-8338
email: info@turquoisebayresort.com
www.turquoisebayresort.com





CLOCKWISE FROM LEFT: Reptilian snake eel; Frogfish on sponge; Stargazer buried in sand; Bobbit worm (*Eunice aphroditois*); Juvenile painted frogfish

unsuspecting fish crosses right over their mouth. Then, like a bolt of lightning, they shoot out and grab the fish, sometimes pulling it back down into the sand or using their long tails to capture the prey. Snake eels can be red or cream-colored, black, or spotted like the Napoleon snake eel. Another popular night time snake eel is the stargazer.

And so much more...

The above animals are just a few of the many unique and wonderful critters of the muck. There are hundreds of species of crabs and shrimps, colorful gobies and wrasse as well. Juvenile fish of many species also hang out in muck areas for protection until they get larger. Frogfish of all colors and sizes can be found too.

In addition, there are the Bobbit worms,



a terrifying monster of a worm, which hides completely in the sand except for two antennae that feel for a fish to swim over. When an unsuspecting fish is just above the Bobbit worm, it emerges and uses scissor-like appendages to cut the prey in half, or grab it and drag it completely back into the sand.

Even after years of muck diving, there are still critters on my wishlist to see, and new things to discover, with dive guides often



SAM'S TOURS
PALAU
www.samstours.com

Palau's premier scuba diving and eco-adventure company.

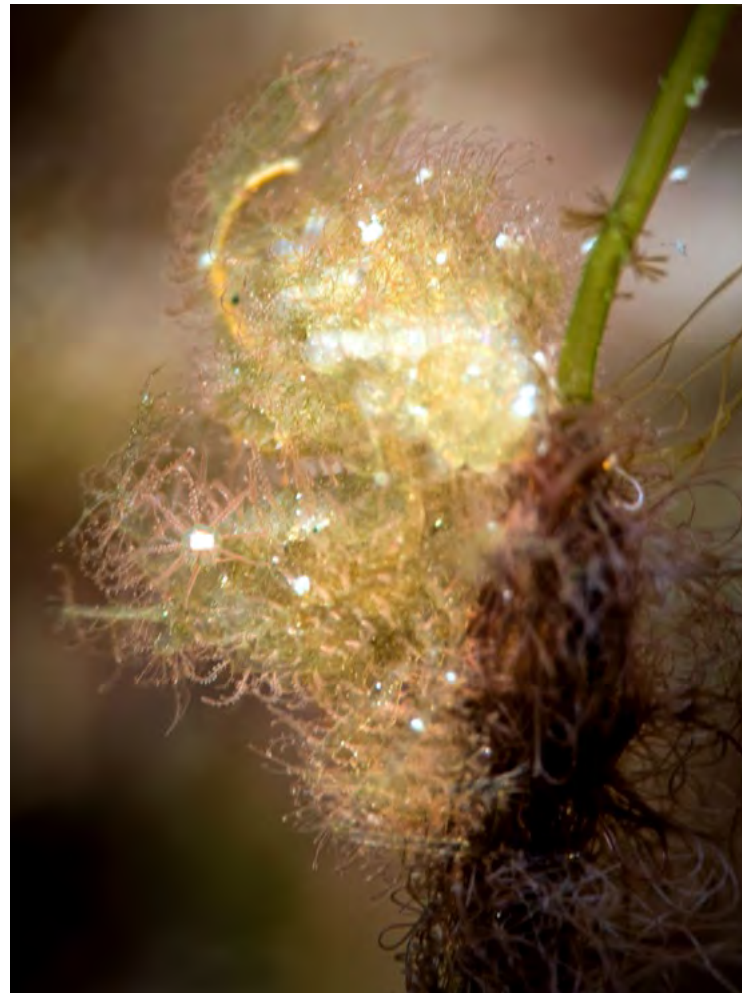
Scuba Diving • PADI Dive Courses • Liveaboard
Kayaking • Snorkeling Tours • Land Tours



reservations@samstours.com
Tel: +(680) 488-1062 Fax: +(680) 488-5003



Muck



showing me things of which I have never heard. The treasure hunt is indeed endless.

Tips for muck diving

Get a good dive guide. If you are new to muck diving, the first thing to do is find a good dive guide to help point out the critters. It is amazing how, on your first few muck dives, you may swim right over all the good stuff, and your dive guide will point to a tiny thing that looks

like a piece of dust, and it will become a tiny baby frogfish right before your eyes. Local dive guides also know where certain animals hang out, so your chances of finding them will be better.

Practice good buoyancy. Good buoyancy is a must on all dives, and this is especially true on muck dives as they are often in shallow, sandy and/or silty

areas. One misplaced kick can create a sandstorm that will reduce visibility and can cause backscatter in your own and your buddy's photos. I also highly recom-

CLOCKWISE FROM TOP RIGHT:
A crab on an anemone; Goby;
A hairy frogfish, or striated frogfish (*Antennarius striatus*); *Chromodoris willani* nudibranch; Hairy shrimp (*Phycocaris simulans*); Orangutan crab (*Achaeus japonicas*)



Waspfish (above)—a skinny, elongated type of scorpionfish (*Paracentropogon rubripinnis*); False clownfish in anemone (right); Painted frogfish, *Antennarius pictus* (left)

Go slow. Going slow is key to finding stuff, as so much of it is tiny. A small patch of sand might look like just sand until you get close and slowly look over the whole area. There may be baby frogfish, nudibranchs or even tiny octopus,

blending in with the sand. out on the night dive. Like all night dives, muck dives at night are completely different than those during the day. A whole new set of critters come out, and you won't want to miss them. Behaviors also change at night. Things like hunting can be seen, and some critters, which stay hidden during the day, come out in full force at night.

So, the next time you hear the term "muck diving", don't cringe at the thought. Instead, think of all the wild and wonderful tiny stuff in the ocean you will find, turning your dive into a little bit of a treasure hunt. ■

Brandi Mueller is a PADI IDC Staff Instructor and boat captain the

*Marshall Islands. When she's not teaching scuba or driving boats, she's most happy traveling and being underwater with a camera. For more information, visit: **Brandiunderwater.com.***

REFERENCES:
[HTTP://WWW.WIKIPEDIA.ORG/WIKI/MANTIS_SHRIMP](http://www.wikipedia.org/wiki/Mantis_Shrimp)
[HTTP://WWW.WIKIPEDIA.ORG/WIKI/NUDIBRANCH](http://www.wikipedia.org/wiki/Nudibranch)
[HTTP://EN.WIKIPEDIA.ORG/WIKI/OPHICHTHIDAE](http://en.wikipedia.org/wiki/Ophichthidae)
[HTTP://WWW.THESEAHORSETRUST.ORG/SEA-HORSE-FACTS.ASPX](http://www.theseahorsetrust.org/sea-horse-facts.aspx)
[HTTP://WWW.WIKIPEDIA.ORG/WIKI/RIBBON_EEL](http://www.wikipedia.org/wiki/Ribbon_eel)
[HTTP://WWW.MOLLUSCS.AT/CEPHALOPODA/INDEX.HTML?/CEPHALOPODA/SEPIA](http://www.molluscs.at/cephalopoda/index.html?/cephalopoda/sepia)

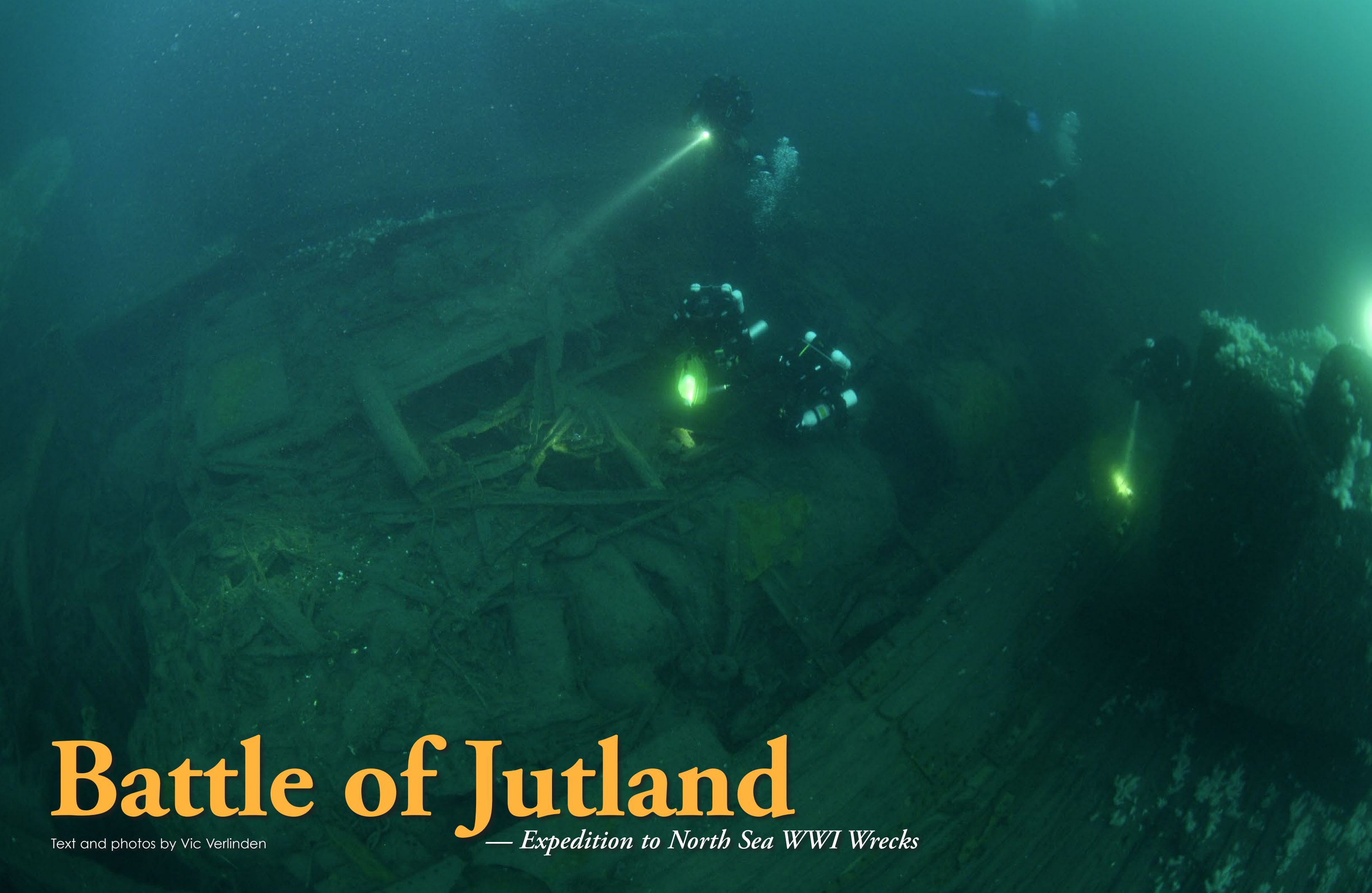


Juvenile filefish

mend a pointer stick, not to poke at or harass the marine life with, but to use to stabilize yourself in the sand or on rocks without life, while searching or photographing the muck critters.

Don't skip the night dives. I know, I know. I am as guilty as anyone of having a lovely glass of wine at dinner after that warm shower and skipping

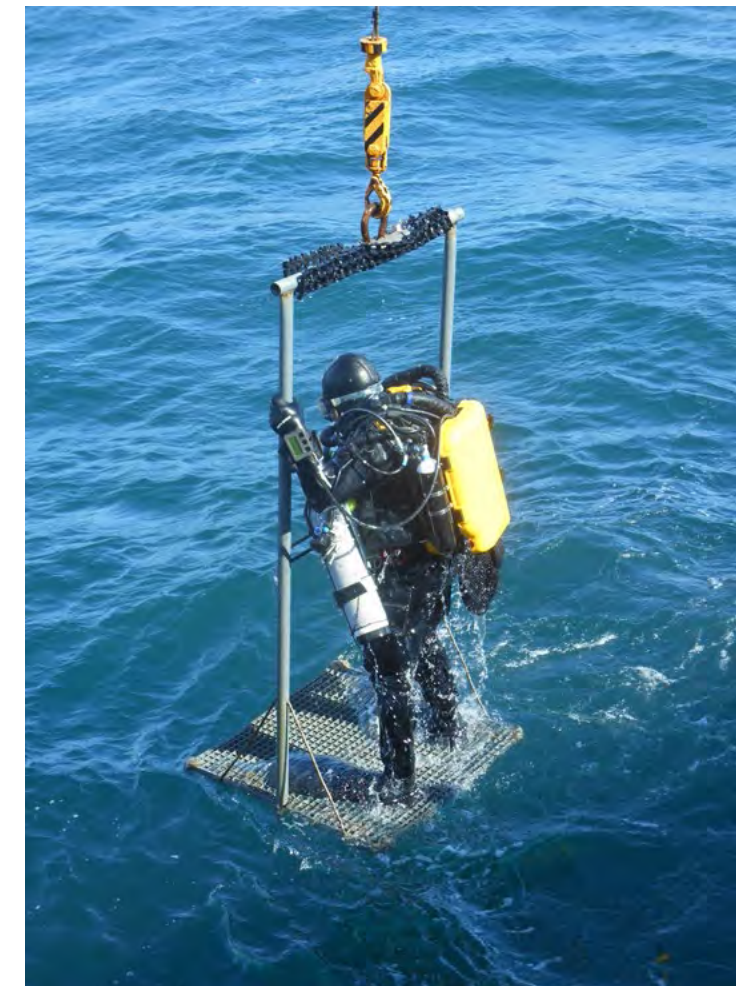




Battle of Jutland

— *Expedition to North Sea WWI Wrecks*

Text and photos by Vic Verlinden



CLOCKWISE FROM LEFT: Diver readies to enter the water; Dive team member makes preparations for a dive; The expedition ship, Cdt Fourcault in port; Bridge on Fourcault. PREVIOUS PAGE: Divers on wreck of HMS Defense

The Battle of Jutland in 1916 was the biggest naval battle in the First World War. Over two days of combat, 25 warships were sunk. Undertaking a diving expedition to this isolated place was a real adventure.

Two years before this expedition, I had booked a trip with a team from England to dive the wrecks

of Jutland (in the North Sea, near the western coast of Denmark's Jutland peninsula), but this trip was cancelled at the last moment because the expedition ship's permit was not in order. It seemed that the papers to go so far out to sea with passengers did not follow regulations.

In 2014, we got a second chance. A dive team from Ghent, Belgium was fully prepared for a trip and looking for more divers to cover the cost of hiring an expe-

dition ship. The intention of the project was to arrange a trip for a group of 30 divers. The 60m long Cdt Fourcault was chosen as the expedition ship. The owner and captain was Dutchman Pim de Rhoades, and the ship's home port was Antwerp.

I had already done a dive trip to Scapa Flow on this ship in 2006 and knew that she met all the requirements. The expedition ship was also equipped with a decompression tank and a helicopter that

Diver on the ship's lift used to exit the water



Divers on HMS *Defence* (above and right); Historical photo of HMS *Black Prince* (left), a Duke of Edinburgh-class armoured cruiser of the Royal Navy; Porcelain sink on the seafloor (lower left)

this same hurricane also influenced the weather in the North Sea off the western coast of Denmark. With alternating high winds and storms, we worried whether or not we would get better weather for our departure.

Our port of departure was a fishing port of Thyborøn, about 1,000km away from Antwerp.

On Thursday, August 21, it was time to go, and we headed off to Denmark, with a stopover in Germany. Cdt *Fourcault* was already in port, so we could embark immediately. Alas, there were still high winds, so we were forced to stay two more days in the harbour.

On Sunday evening, the weather service predicted a little let-up in weather conditions, so Captain Pim took this opportunity to sail to the distant wrecks.

could be used in case of an emergency. A seaworthy ship with a good crew is an absolute necessity for a trip such as this one, to open sea, about 90 miles away from the nearest port. The dates for the expedition were set for August 22-29.

Stormy weather expected

About 14 days before departure, a hurricane travelled up the eastern coast of the United States. Across the ocean,

We decided to dive the southern, shallower wrecks first, because the weather forecast was a little better there. On the following days, we visited the deeper, northern wrecks.

The southern wrecks

After a restless night, we looked forward to our first dive and made preparations. The first wreck we visited was the British cruiser, *Black Prince*.

HMS Black Prince. During the Battle of Jutland, the ship was under heavy bombardment. When its ammunition depot exploded, it caught fire, causing the ship to sink immediately. Today, *Black Prince* rests at a depth of 47m.

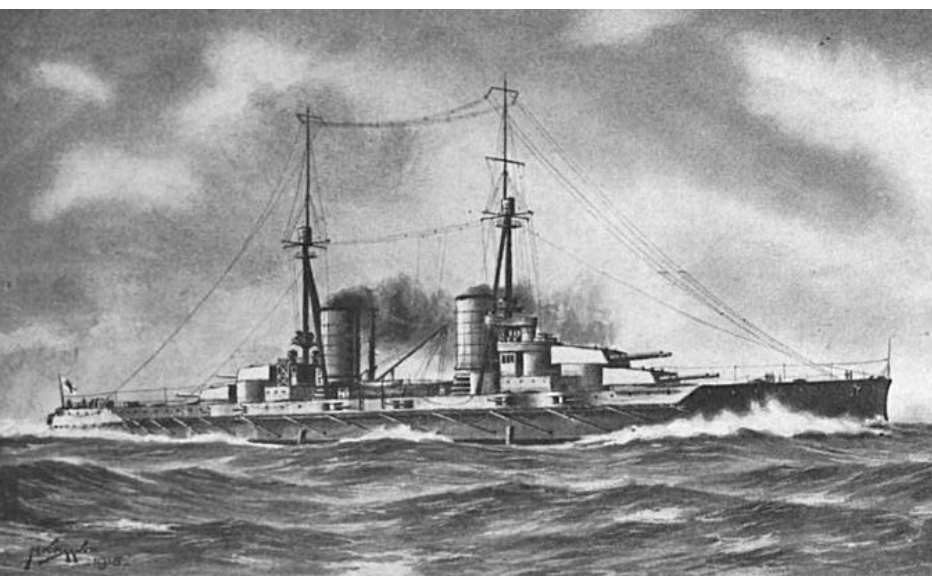
On our dive, visibility on the wreck was about 5m. The weeks of bad weather and storms had, of course, affected visibility underwater. However, it was still a beautiful dive, without any problems.

After our decompression stop, we sped back to *Fourcault* on a speedy auxiliary motorboat. We were then lifted on board by an elevator.

SMS Elbing. Our second wreck of the day was the German light cruiser, *Elbing*. On good authority from the salvage company, I knew that this wreck was almost as intact as the other wrecks of Jutland. *Elbing* was quite a large vessel, with a length of 140m and a weight of 4,320 tons.



During the descent, we could already see that the visibility was a little better. It was immediately clear that the wreck was in better condition than we had thought. From the widespread scatter of



WIKIMEDIA COMMONS / PUBLIC DOMAIN Siebe Gorman diver helmet (above) found on wreck of the SMS *Frauenlob*; Diver at turbine in the engine room of the *Lutzow*; Historical illustration of SMS *Lutzow* (left)

objects on the seabed, it was evident that the wreck had not had a lot of visitors.

We could see portholes all over the wreck. There were also china and glassware resting in different places. During the dive, I saw a big cod swimming past us. These fish have become very rare at the wrecks in my home waters off the Belgian coast. After about 45 minutes, I started my long

decompression stop. on the dives for the next day. Meanwhile, the weather got a lot better, and the forecast for the rest of the week was good too. The goal for the next day was another German light cruiser named *Frauenlob*.

SMS *Frauenlob*. The cruiser was built in 1902, with a length of 110m and a weight of 2,700 tons. During the Battle of Jutland, the ship came under fire

Unique discovery

After an excellent dinner, we were briefed

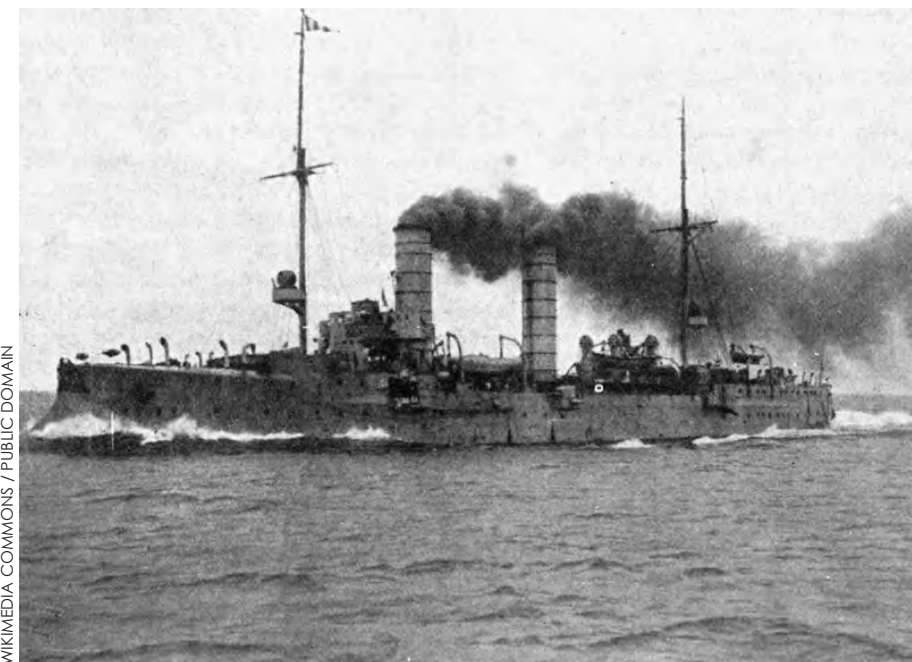
from the English flagship, *Southampton*, which was under the command of Commodore William Goodenough.

Almost immediately, *Frauenlob* was hit by a torpedo from *Southampton*. The engine room was seriously damaged and the ship submerged completely. It all happened so quickly that none of the 320 crew members survived the disaster.

At the mooring buoy, we followed the descent line to the wreck. When I reached the bottom, my computer indicated a depth of 48m. The visibility was about 5m and the water still had a milky colour. Because I was taking photographs with my camera during the dive, I lost sight of my buddy very quickly.

As on the other wrecks, there were a lot of portholes on this wreck, and I could also distinguish different parts of the steam engine. I also saw a thick iron sheet on the wreck, which had obviously been hit by three shells. At the places where it was hit, the steel was totally bent inwardly.

When I got onto a more even keel, fellow diver Erik Billiau swam along with me. A few moments later, he was violently agitating his lamp. When I swam closer, he signalled toward an object situated in a hole between the sheets of the hull. As I happen to have some antique dive helmets in my possession at home, I immediately recognised the object as a copper Siebe Gorman diver



WIKIMEDIA COMMONS / PUBLIC DOMAIN

Historical photo of SMS *Frauenlob*



Diver on *Queen Mary* (above) and at cannon (top right) on HMS *Defence*; Evidence of the impact of grenades (left); Historical photo of the British battle cruiser HMS *Queen Mary* (right)

helmet.

The temptation to bring this special object to the surface was strong, but these wrecks are war graves, and as such, are protected and must be treated with respect. So we left the helmet on the wreck. It was, however, curious that the helmet, which was of English workmanship, was found on a German wreck. Of course, it could also be that this wreck was not the *Frauenlob*, but an English cruiser. I have no idea why the name *Frauenlob* was linked to this wreck in the past.

The big armoured cruisers

SMS *Lutzow*. That same day, we also dived to *Lutzow*. With a weight of 26,000 tons and more than

200m in length, this was the biggest wreck on our list. Of this dive, I will always remember the big cannon laying among the wreckage. It was difficult to estimate, but I think it was about 15m long, with a width of 1m at the thickest part.

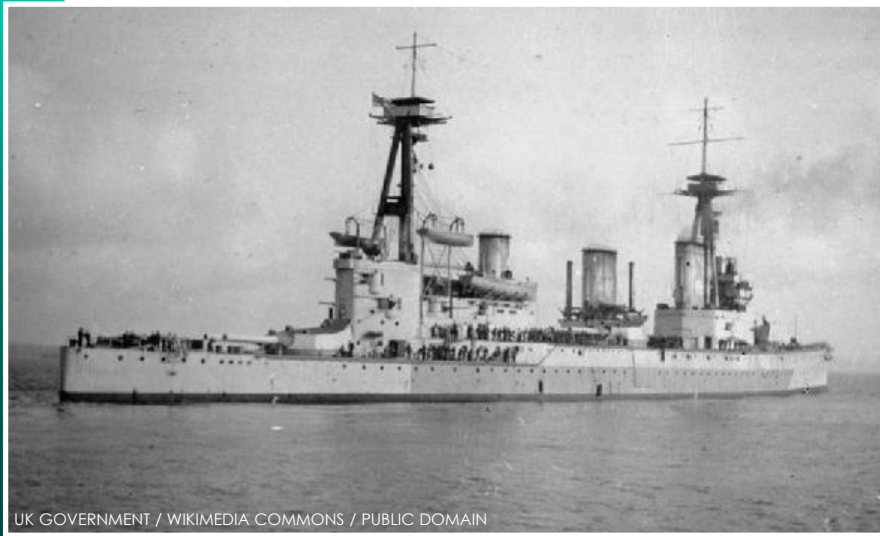
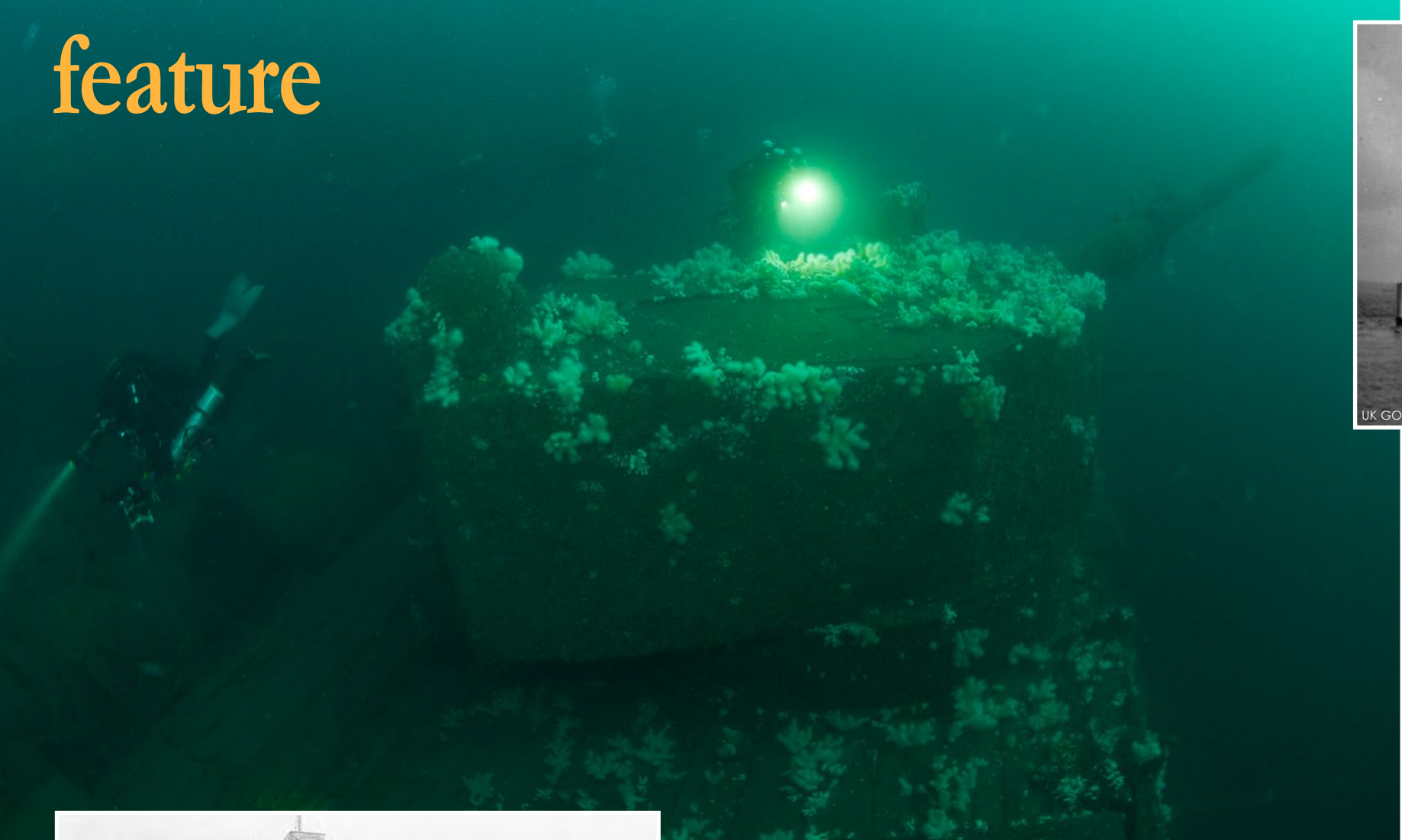
HMS *Queen Mary*. The day after, we made a dive on another giant. *Queen Mary* is almost as big as *Lutzow* and rests, as so many of the big battleships do, upside down on the bottom of the sea. This



occurs because of the weight of their big cannons. It was also obvious that salvage work had been done on these wrecks.

The northern wrecks

With a calm sea and a radiant sun, we could now



Historical photo of British battlecruiser HMS Indefatigable

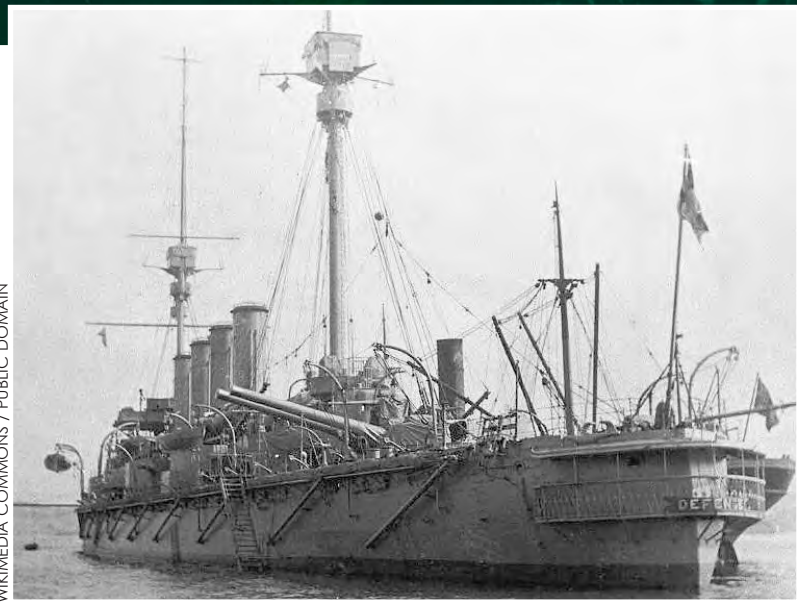
Jutland

of 170m, it was a rather large wreck and time flew by. The second dive of the day was also made on this beautiful wreck. HMS *Defence* was, for me, the apex of a week of fantastic diving. I cannot wait to go back! □

Beneath me, I saw two powerful motors, still standing up. Farther on, I saw some Yarrow boilers which were still recognisable. The cannons, too, were still standing up. It was an unforgettable sight.

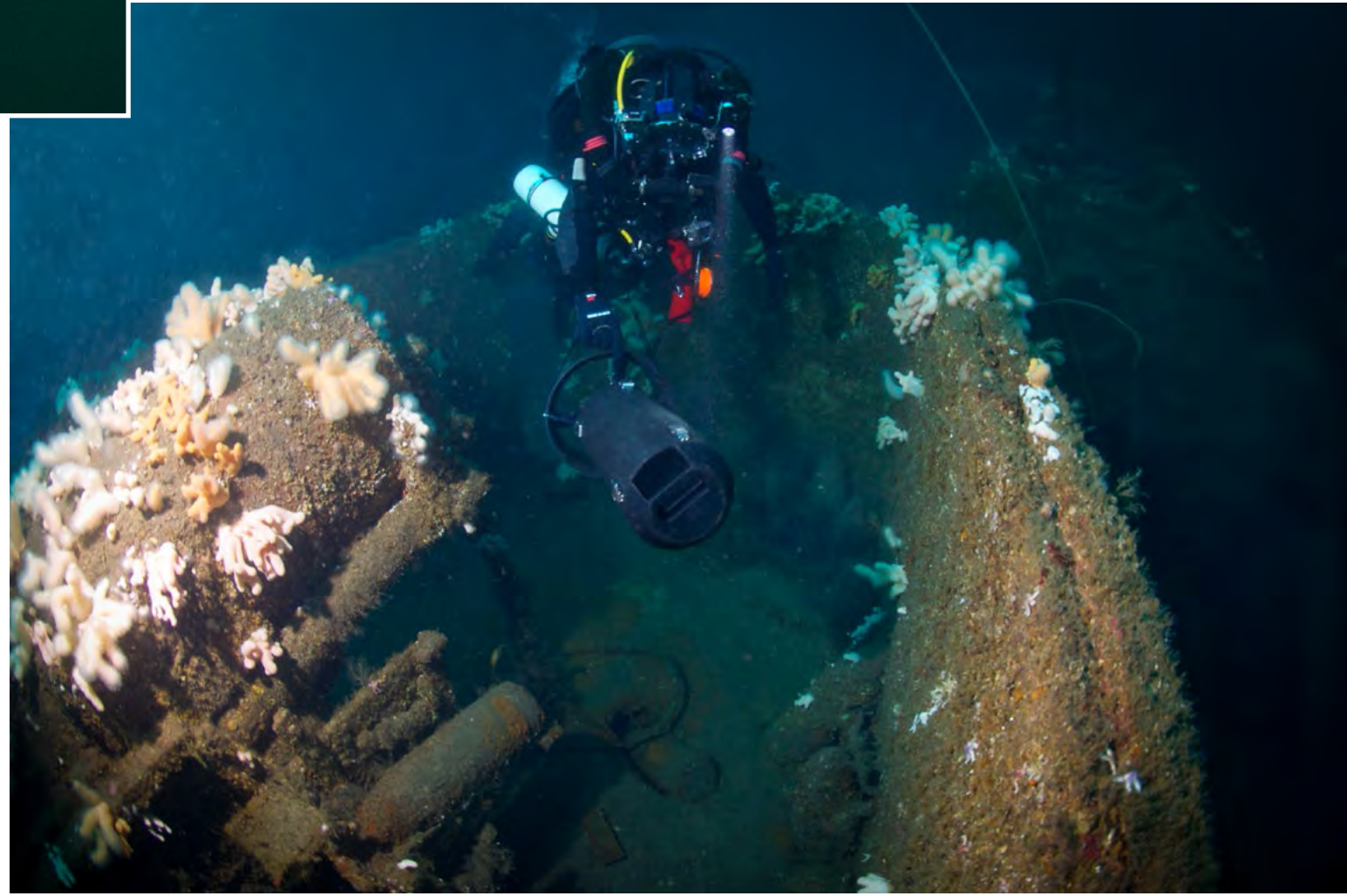
Farther on, we also found the bow, with the anchor windlass and chain. We saw portholes all over the place, and in the bottom of the bore of one of the cannons, there were shells still in place, ready to fire. With a length

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



Divers at cannon (above) on HMS *Defence* (left)

The best for last
HMS Defence. On the last day of the trip, we planned to dive HMS *Defence*, and everybody was impatient to know what this dive would bring. During my descent, I could already see the wreck 20m under me. Of course, we had ideal circumstances, with calm seas and a lot of sun, so light was able to penetrate at depth.



Diver at cannon loading system on HMS *Defence*; Group photo of the divers on the Cdt *Fourcault* expedition (left)

move to the northern wrecks. The first wreck we looked for was the *Indefatigable*.

HMS Indefatigable. This British battle cruiser of about 19,000 tons was, unfortunately, totally in ruins. The salvagers did not achieve their goals here. It was amazing, however, that we had more than 10m visibility on this dive. Due to the breaking up of the wreck, the wreck field became enormous and difficult to survey.

WIKIMEDIA COMMONS / PUBLIC DOMAIN



Battle of Jutland

Centenary Expedition

Text by Steve Slater
Photos by Kieran Hatton



Cannon shot marks the opening ceremony of the Jutland Memorial Park in Thyborøn, Denmark

Searching for the Battle of Jutland wrecks (above) in the North Sea, off the west coast of Jutland, Denmark. Wreath laying ceremony at the site of the HMS *Invincible* wreck (left). PREVIOUS PAGE: HMS *Defence*, starboard side 7.5-inch turret

It is hard to put into words what I was feeling at this stage. I was descending the shot line in approximately 15m visibility and an image started to appear. Not the random wreckage you often see, or even the straight lines of a cargo ship, instead these were two long barrels. This was no ordinary wreck—I was looking at the 'X' Turret of HMS *Invincible*.

Twice before had our UK deep wreck diving team, Darkstar, attempted to get to the site, but a combination of bad

weather and mechanical problems had so far thwarted our plans. In mid-September 2015, however, a discussion with Mark Dixon, who leads the dive team and owns the project's 12m long catamaran (also named *Darkstar*), started a plan that would take nine months to execute. Not only would we once again try for Jutland, but we would do it on the 100th anniversary, and lay a wreath in memory of the sailors who perished over the two days of the battle on 31 May and 1 June 1916.

Getting there

Taking the catamaran to the site was the first leg, and a challenge in itself. Mark and I took the boat over from the Royal Quays in North Shields to Thyborøn on

the Jutland peninsula in Denmark, via West Terschelling in Holland—a journey that took over 24 hours. Sailing through the darkness of the North Sea at night is not for the faint-hearted. We may as well have been in a room with black shutters, only occasionally alleviated by a light in the distance. However, we were blessed with calm seas and the passage proved uneventful.

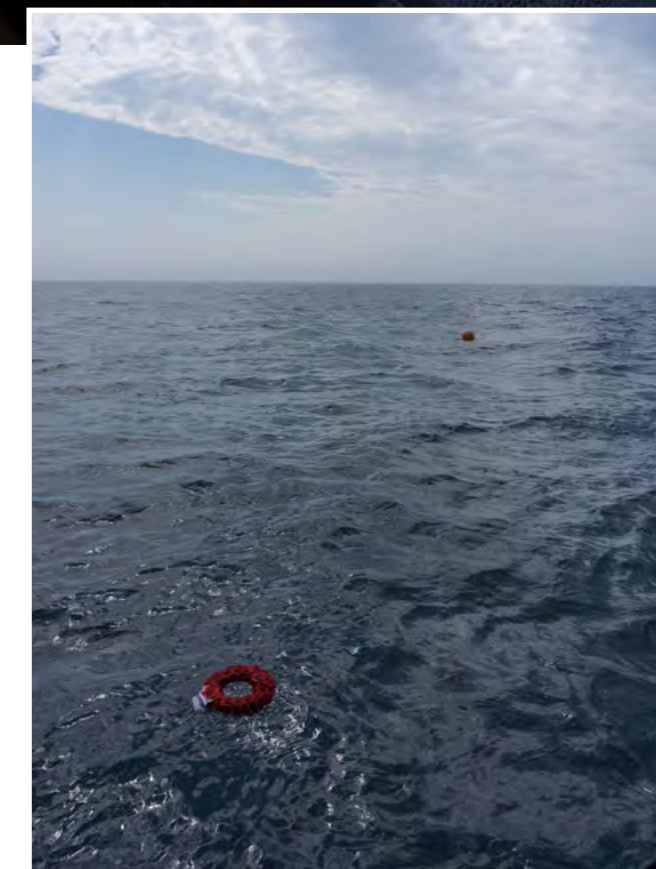
On arrival, the rest of the team had already reached the destination, having driven to Thyborøn via the Channel Tunnel. All good so far—except for the wind—and boy, did she blow! I have heard of Jutland expeditions sitting in harbour for four weeks and managing only three days of diving—but surely, not

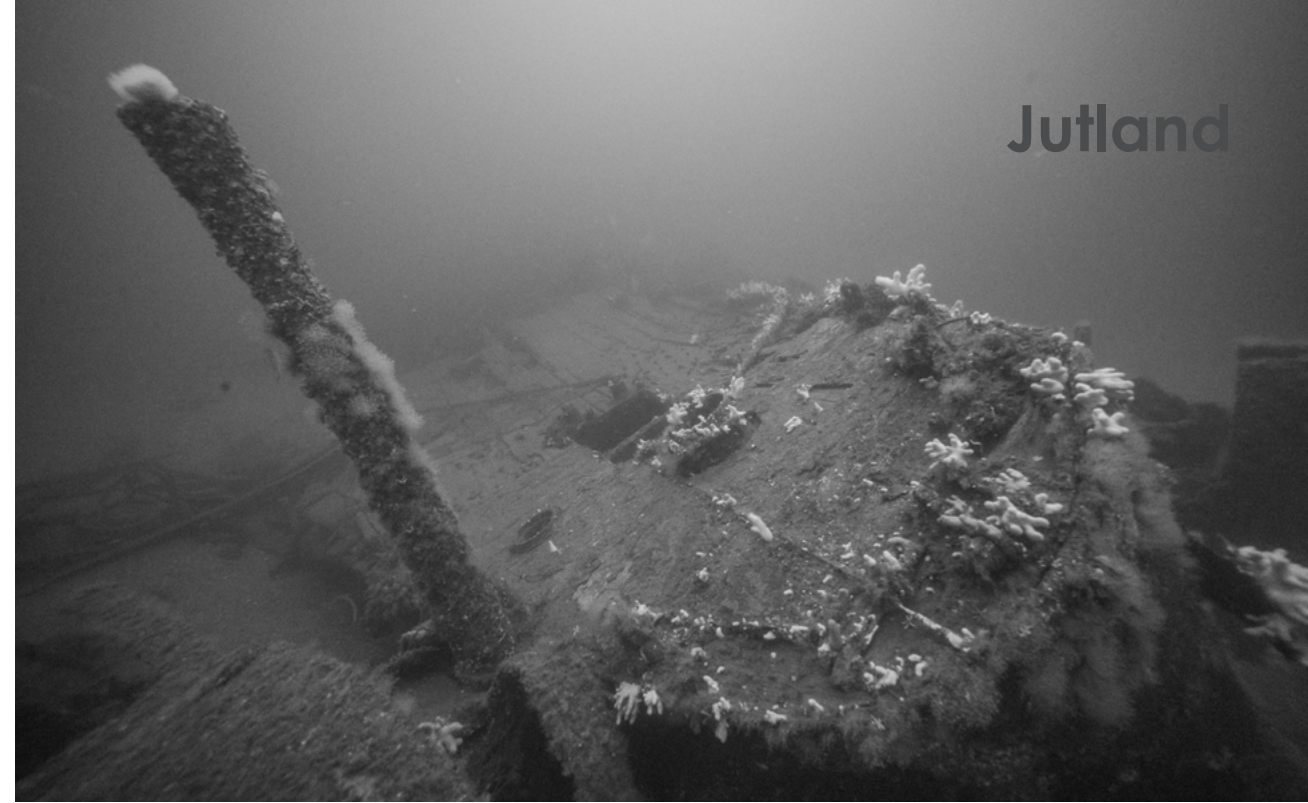
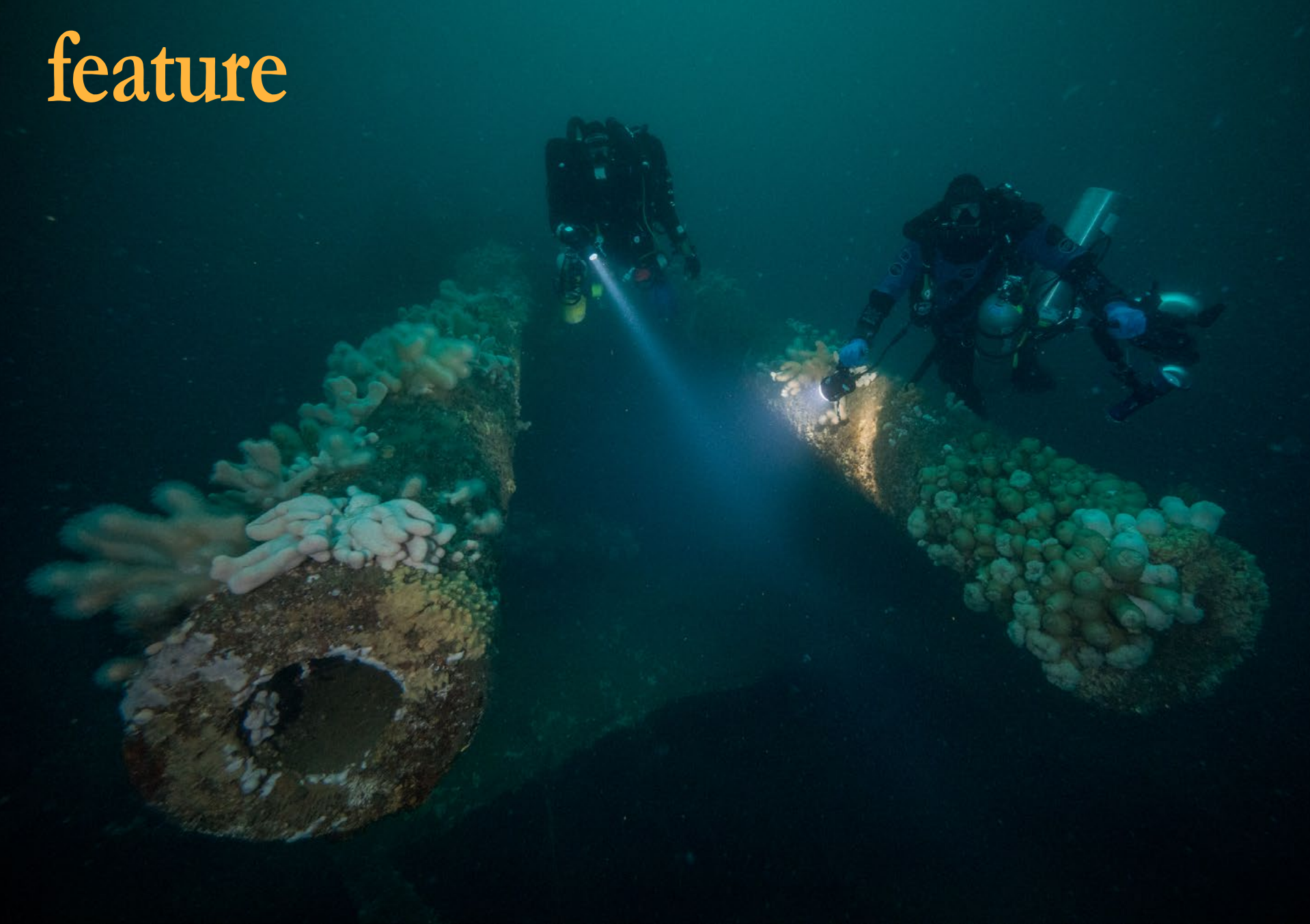
this time?

The waiting around did allow us time to visit the new Sea War Museum Jutland in Thyborøn (opened in September 2015) and become involved in the opening ceremony of the Jutland Memorial Park. May 31 was a no-go; the wind did not abate and we were left kicking our heels. Then, 100 years to the day of the second day of the Battle of Jutland, the weather calmed and we headed out at last. Our destination was to be the closest wreck to the port, a mere 75 miles to the final resting place of HMS *Invincible*.

HMS *Invincible*

Invincible was the first battle cruiser built anywhere in the world. Built at Armstrong





HMS *Invincible*'s X turret—an 11-inch main armament (above); stern deck—note the teak decking still present (top right); and Q turret bar-bette (far right)—it was here that *Invincible* suffered her fatal blow; Map of Battle of Jutland (right)

Whitworth on the Tyne and launched in 1907, it weighed 17,250 tons and was 173m in length. By the time of the Battle of Jutland, the ship had already taken part in the Battles of Heligoland Bight and the Falkland Islands, having played its part in the sinking of the German cruisers *Scharnhorst* and *Gneisenau*.

Under the command of Admiral Hood, *Invincible* was the flagship of the Third Battlecruiser Squadron at Jutland. At approximately 6:30 p.m. on May 31, the ship came under intense fire from the *Derfflinger* and *Lutzow*. A shell penetrated 'Q' turret, which in turn led to a detonation

in the magazine, and possibly igniting 'A' and 'X' turrets. The ship broke in half, its stern and bow sticking out of the water. With 1,026 lives lost, there were only six survivors.

Like most divers, I had dived wrecks with loss of life before. That these wrecks were grave sites was a constant thought in the back of my mind as we swam around "enjoying" the hobby that modern techniques and equipment give us. This experience, however, was on a whole different scale. Each turret had approximately 70 crew members working on them, and I was looking at their last

resting place before I even reached the wreck.

On arriving at the turret, in approximately 50m of water, it was immediately clear that an explosion must have also taken place here, as the roof was missing, presumably blown out as the fire ripped through the magazines. Swimming to the back of the guns, I found the breeches closed and locked—a clear indication that artillery was loaded and ready to fire when the fateful salvos came from the ship's German counterparts. Were the guns still loaded, I wondered, or would the shells have erupted as part of the

cataclysmic explosion that tore this once mighty warship in two?

Dropping down from the turret to the wreck itself, a vast array of twisted metal soon revealed itself. Moving forward, a number of smaller, 4-inch guns lay strewn about the ship, as were there small ammunition lying concentrated in one area, while some of the larger shells still lay near 'X' turret.

The distinctive Yarrow boilers soon

came into sight as we swam towards the upturned bow—a long swim! As impressive as all these features were, however, the most poignant finds were the human elements: small ceramic pots, plates,

GRANDIOSE / WIKIMEDIA COMMONS / CC BY-SA 3.0



HMS *Invincible* x turret and barbette (left); Wolffish on HMS *Invincible* (center)

its part in churning up the muddy seabed.

At this stage, I would love to tell you of all the interesting sections on the *Frauenlob*, but the visibility was just too bad. Moving along the edge of the wreck, it was obvious that, unlike the *Invincible*, *Frauenlob* was reasonably intact. Gauges and pipes seemed to indicate that we were in the vicinity of the engine room and heading aft, but that was as much information as I could glean from the dive.

Upon surfacing, conditions had slightly improved. But time was getting on, so we soon headed

back to port. With a good forecast from here on in, we looked forward to diving more of these iconic wrecks. Alas, it was not to be!

HMS *Queen Mary*

The next day, as we headed out to the site of HMS *Queen Mary*, we were treated to bright sunshine and flat, calm seas. Less than half a mile out of harbour, it was clear that something was not right. Mechanical gremlins had struck the boat down, and we headed back to port—our diving was over for the week.

Fast forward a month. The boat,

still in Thyborøn, was now repaired and needed bringing back. So why not go out for the week and try and finish off what we started? It seemed too good an opportunity to miss. Starting from where we had left off, we now headed out to HMS *Queen Mary* again.

Queen Mary was the pride of the British Fleet. The last battle cruiser built before the outbreak of World War I, *Queen Mary* was the sole member of its class. At 214m long and 26,700 tons, the ship's four shafts could produce 28 knots.

During the battle, the vessel came under fire from SMS *Seydlitz*.

knives and forks and, perhaps—the most moving of all—the sole of a leather shoe.

All too soon, it was time to head up. Once back aboard *Darkstar*, we placed a wreath in the water in memory of those lost and as a tribute to their sacrifice. We headed back to shore in a mood that was both sombre and elated.

SMS *Frauenlob*

The next morning, our nemesis, the wind, returned. Forecasts, however, told us that by midday it would start to back off. So, as morning turned to afternoon, we gingerly pointed our bows out to sea in what could best be termed “questionable” conditions. Our target this time was the German light cruiser SMS *Frauenlob*.

Sometime after 10:00 p.m. on 31 May 1916, the *Frauenlob* got involved in a firefight with the British Second Light Cruiser Squadron of

HMS *Southampton*, Dublin, Birmingham and Nottingham. At approximately 10:35 p.m., the *Southampton* fired a torpedo and *Frauenlob* sank soon after taking 320 officers and crew members with it—there were only nine survivors.

For over four hours, we battled against 2m swells, as we headed out to the *Frauenlob*'s final resting place. Arriving on site, a discussion took place as to whether the conditions were, indeed, diveable, and a consensus was reached: It was time to go.

Heading down the shot line, the visibility soon deteriorated. As



I reached the wreck itself, it was soon evident that this was not going to be a dive similar to the one the previous day. Visibility was at best at 1 to 2m, and that was being charitable! On top of that, the swell was still evident at the bottom, which, no doubt, played



Clarkson cases on HMS *Queen Mary*. The propellant for the guns was kept in these cases. Poor handling and storage of them was one of the major contributing factors to the way the British battlecruisers blew up.





HMS *Queen Mary*'s massive 13.5-inch warheads



HMS *Defence*, port side 7.5-inch turret (above); Diver on deco after diving HMS *Queen Mary* (left inset)



But it would be shells from SMS *Derfflinger* that would cause the detonation that sealed the *Queen Mary*'s fate. The ship disappeared below the waves at 4:26 p.m., with the loss of 1,266 officers and crew members.

Queen Mary is quite a different dive from the *Invincible*. Split into two sections, we were diving on the stern, which lies upside down—the thick, armour-plated sides descending to the seabed. However, it is not the upturned keel, as

section we arrived at, there was clear evidence of this. The keel and metal plating had been ripped open, as if by a mechanical grab, exposing the innards of the ship, revealing massive piles of enormous shells and cordite.

Moving forward, we came to the remains of the engine room. Parts of the boilers were missing, and condensers and other parts of machinery lay exposed. More wreckage lay strewn amongst the seabed, though it was un-

you would normally expect, that first catches the eye.

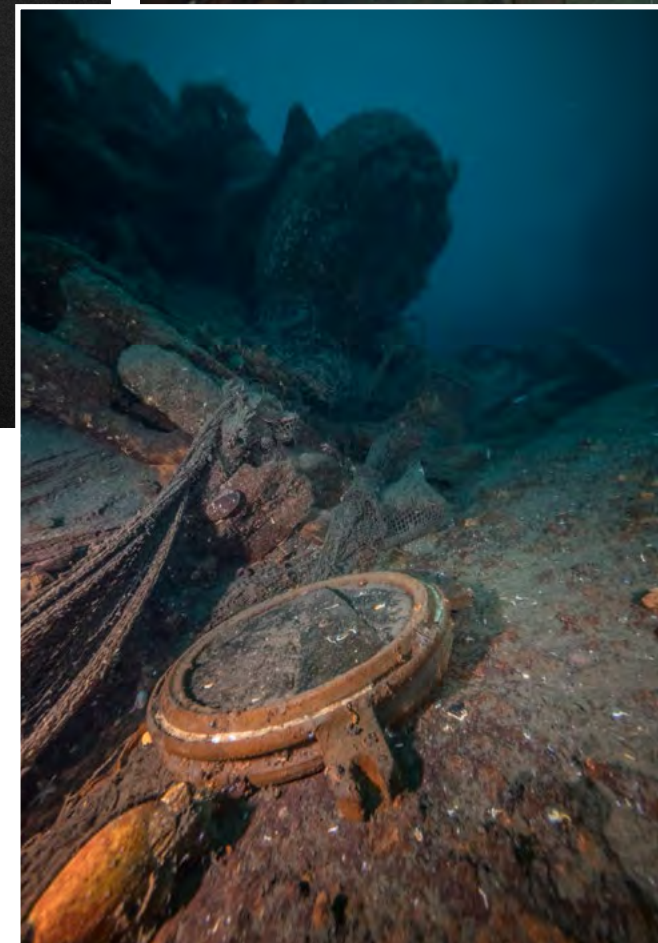
There have been rumours for years that some of the Jutland wrecks have been illegally salvaged and, at the

clear whether this was due to the explosion or the subsequent salvage.

HMS *Defence*

The wind blew for another couple of days. However, this was soon to be forgotten. The forecast for Friday was the best of the week, so we were determined not to waste it. A 3:30 a.m. start saw us heading for what must be one of the most memorable dives in the world—HMS *Defence*.

Launched in 1907, *Defence* was the last armoured cruiser built for the Royal Navy. At 14,600 tons, the ship was a little over 158m along. Under the command of Rear Admiral Sir Robert Arbuthnot, *Defence* led the First Cruiser Squadron.



On HMS *Defence*, there were 7.5-inch warheads inside the turret, ready for loading (above); Bow anchor capstans and fallen porthole on *Defence* (center inset); Foredeck of *Defence*, view from the bow looking aft (top left); The dive team (lower left)



When the wounded SMS *Wiesbaden* was spotted, *Defence* opened fire. However, at 6:05 p.m., *Defence* was spotted

level, the immediate impression was gun turrets and more turrets—barrels still at an angle trained on a foe that had left the

by *Derfflinger* and four battleships at only 8,000 yards. At 6:20 p.m., it was reported that *Defence* disappeared in a massive explosion, with the loss of all hands, reported to be between 893 and 903 souls.

The shot was on the seabed, on the starboard side of the ship. Contrary to the reports of the time, *Defence* was relatively intact. Swimming up to the deck

scene 100 years ago.

Swimming up to the deck, I saw that the original wooden decking was still in place but it had caved in towards the centre. Inside the turrets, shells were stacked, still waiting to be loaded into the breeches. Passing the engine room, I saw that the engines were exposed, with gauges all still in place.

Bow and stern were both blasted off the main wreckage, but also still in place. Moving back onto the main body of the wreckage, the human element was once again evident, with plates and bottles lying amongst the wreckage. By far, this was the most intact of the Jutland wrecks we had visited and a must-see for anyone who manages to

get out to the site.

The day, however, was not done, as we undertook a second dive, with a return to HMS *Invincible*. Once again, I was faced

with the massive turret that had started this adventure, a month earlier. It was a fitting way to end our expedition.

Besides myself and Mark, divers Duncan Keates, Ric Waring, Rich Stevenson, Kieran Hatton, Barry McGill and Steve Burke were assisted by Paul Mee on deck. It was a trip that would live long in the memory.

For myself and Mark, however, the trip was not quite over. As the other guys headed off on a 15-hour drive home, Mark and I pointed the bows to North Shields, England. Some rough seas and heavy rain, mixed with calm seas and sunshine greeted us over the next 33 hours, but we finally docked home, safe and sound.

And, we are already planning our return!



Rocktail Beach

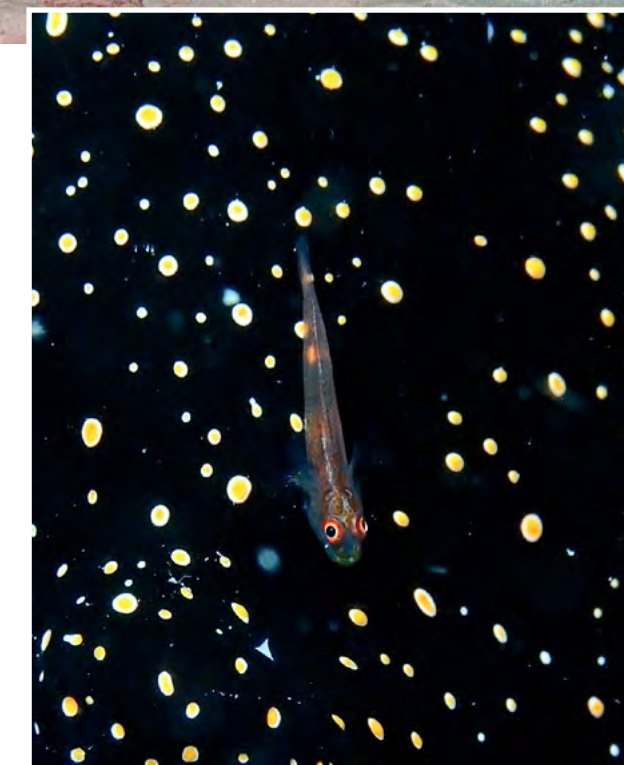
— *South Africa's Best Reef Diving*

Text and photos by Christopher Bartlett





LEFT TO RIGHT: Diver with round ribbontail ray and school of goatfish; Hawksbill sea turtle; Close-up of tiny whip coral shrimp. PREVIOUS PAGE: Scorpionfish



Gobie on cowry

South Africa's dive scene is well known for its shark diving. Yet, there is a great deal more to see underwater off the coast of the old continent, towards the border with Mozambique, at Rocktail Bay.

In South Africa, there are year-round opportunities to see oceanic blacktip sharks, bull sharks, scalloped and great hammerheads, black and whitetip reef sharks, and ragged-tooth sharks (a.k.a. sand-tiger sharks in the US or grey nurse sharks in Australia). There are seasonal baited dives with tiger sharks, and whale sharks are present in the Indian Ocean. Off the Western Cape, one can find broadnose seven-gill sharks, blue sharks,

mako sharks, shysharks and, of course, great white sharks. But the Indian Ocean hides some gems beyond this plethora of sharks, with some of the country's best reefs to be found off Rocktail Beach.

Part of iSimangaliso Wetland Park, a UNESCO World Heritage Site since 1999 and a Ramsar site since 1986, Rocktail Bay sits amongst the towering coastal dunes and lush coastal forests of the Maputaland Marine Reserve. Meaning "a miracle" or "something wondrous" in Zulu, the word iSimangaliso comes from when some of King Shaka's subjects were sent to the land of the Tsonga, and returned to describe the beauty that he saw as a miracle. The biodiverse reserve combines untouched coastline with coral reefs, freshwater lake ecosystems—including South Africa's largest freshwater lake, Lake

Sibaya—coastal forests, wetlands, grasslands and woodlands.

Getting there

Getting to the place is an adventure in itself. After driving four hours north from Durban, you pull into a car park at a small cashew factory and shop to be met by one of the guides from Rocktail Beach Camp and transfer to a four-wheel-drive open game viewer for a 30-minute drive along sandy tracks though the forest up to the coastal dunes, which are amongst the tallest vegetated dunes in the world and home to an array of wildlife and birds.

On arrival, my kit bag was taken to the dive centre and I went to check out my room. Rocktail Beach Camp has long been considered the premium dive lodge in the country, and it was easy to see





LEFT TO RIGHT: View from a room's veranda at Rocktail Beach Camp; Diver and snapper; Whip coral goby

why. The open plan bar-lounge area, dining room next to the pool, wrap around veranda and raised viewing deck are simple but classy. Set off a trail in the forest, the rooms, of which there are 17, are tented suites with sliding glass doors. When the canvas is rolled up, the view from the inside of the honeymoon suite over the canopy to the ocean is superb.

Dive centre

I went for a walk down to the beach, 10 minutes away, and met Michelle and Clive Smith, the couple running the only dive centre in the area. Clive was

pulling one of their 7.2-metre RIBs out of the sea with a tractor, as you do in these parts. Apart from three people in wetsuits, the beach was deserted, and stretched endlessly in both directions without a soul on it, golden and pristine. It is a stunning location, and offers diving year-round as most of the resident fish remain on the reefs throughout summer and winter seasons.

The main seasonal differences are water temperature and visibility and the special migratory humpback whale sightings. During the summer months, there is a noticeable increase in shark sightings, including grey

reef sharks, zebra sharks, blacktip sharks, hammerhead sharks (scalloped and great), tiger sharks, white tip sharks; as well as sightings of guitar fish, round ribbontail rays, honeycomb rays, sharpnose stingrays, blue spotted rays and occasional butterfly rays.

We talked about the following day. I was to be their only diver and Michelle wanted take me to Gogo's and Yellowfin, her two favourite spots. As it was August, they had not seen any sharks for a while, but there were rays around and some big resident grouper. I had had a good fill of sharks down at Aliwal Shoal on

my last dive trip, so I was keen to check out the reef life.

Diving

Despite the choppy surface conditions, the launch was easy, a shallow reef forming a natural RIB-sized harbour close to the beach, and we were at the site in a matter of minutes. I wasn't expecting much in terms of visibility. The sites are mostly shallow, generally not deeper than 18m, and the wind was up. But as I rolled in, I could see the large reef top about 10m below me.



White-banded cleaner shrimp



Gogo's. The topography of Gogo's makes it an ideal haven for fish life, with collapsed features, gullies, overhangs, crevices and swim-throughs. Gogo's is considered the "show piece" of diving at Rocktail Bay. From the reef formations to the abundant fish life, there is something for everyone on Gogo's. A school of silvery slingers danced over the hard and soft corals as trumpet fish hunted, and anthias swam into the gentle current.

I had been promised a potato bass, and within a few minutes a female cruised by. Michelle waggled her finger at me and shook her head "no", then spread her arms and puffed out her

cheeks, hoiked a thumb to the left and turned that way. I followed her lead.

Hovering over a bommie, unphased and regal, was the biggest male potato grouper I have seen for some time, nearly 2m long and going nowhere. His stern face was in stark contrast to my beaming smile. I had been underwater for less than 10 minutes and I could see the riches of Rocktail were abundant. The grouper was so not going anywhere, and I snapped away for a while as Michelle looked for shrimps. Each to their own.

Old Grumpster ignored me, I was insignificant, not worthy of his recognition, but I stayed and watched a cleaner



Potato bass; Tomato grouper, sweepers and glassfish (top left)

Slinger seabream; Honeycomb moray eel and antheas (top right)



Rocktail



CLOCKWISE FROM LEFT: Potato bass being cleaned by blue-streak cleaner wrasse; Green sea turtle; Whip coral goby; Round ribbontail ray with a school of snapper in the background; Gold spotted sweetlips and bannerfish

wrasse nibble around his eye from less than an arm's length away, until a hawksbill sea turtle swam past slowly. It swam slow enough for me to overtake it and get some front-on shots as it cruised the reef, no doubt looking for a tasty snack.

Michelle had found an impressive honeycomb moray eel, which was swaying around, more out of its crevice than in, as if it was being charmed by a tune that

music, but whale song. And, my word, it seemed close. And then there was a reply. Michelle and I both looked around. The whale song was so loud, it seemed like these giant marine mammals must be close enough to see. But apart from a few thousand fish, the only mammal I could see was Michelle.

Then the duet started. One high pitched, one deep back and forth, the sound reverberating through the water

was inaudible to us, putting on a show to the slingers and anthias in the vicinity. I was trying to work out what tune it might be dancing to, when I heard one.

Not eel-charming

and through me. I have been in the water with humpbacks to photograph them before, and of course they sang, but not like this, and not this loud, and it was getting louder. Were they going to swim by us?

Trying to find them would prove fruitless. It is very difficult to work out which direction a sound is coming from underwater, so we just drifted gently, peering into the distance in opposite directions as the concert went on for 10 minutes, until the end of our dive. It was such an incredible experience, we raved about it to Clive during the surface interval.

Yellowfin Reef. Next up was Yellowfin Reef, another pretty dive site with good topography of sink holes and collapsed features, and plenty of corals as well as an abundance of fish life. More shoals of slinger, blue banded snappers, surgeonfish and fusiliers hung in mid-water as there are numerous pinnacles on this site that attract the schooling fish in sig-



nificant numbers. During the season, one can spot grey reef sharks passing by, just off the reef.

A juvenile green sea turtle made an appearance, and resting placidly on

the sand was a 2m wide round ribbontail ray, half-covered in sand, sheltered by the reef on one side. Getting close to the sand, facing the ray, I inched forward, extending the pauses between my





CLOCKWISE FROM LEFT: Diver with male potato bass over table coral; Orangutan crab in tentacles of an anemone; Durban dancing shrimp under reef ledge (center); Anthias and grouper on rocky reef; Hawksbill sea turtle

inhaling and exhaling as far as I could, turning my head away on the exhale to avoid spooking the ray. The ray filled my camera frame, with its sand-covered body and blotchy head, as it eyed me up.

Topside excursions

The dive centre has hot showers, shampoo, and shower gel, so there is no need to go back to your room after the dive if you are hungry, other than to just soak up the view and or give yourself another dose of wow. Most of the time, dives finish

early enough for divers to either go on an afternoon guided or unguided excursion into the forest to look for duiker and reed-buck (antelope) and some of the 300-odd bird species found here.

The guided excursions are on foot or in the four-wheel-drive game viewer and are free, as are sundowner trips to Lake Sibaya, and full day trips there. Lake Sibaya has one of the highest concentrations of hippos. You can also plan a morning off and visit Tembe Elephant Park, a Big Five reserve, 50 minutes

away. In turtle nesting season, there are also trips to look for either turtles laying their eggs, or the eggs hatching.

As we had made two long dives, I missed the game drive departure, so took a leisurely late lunch, sorted through my photos and had a chat with the bar staff. Before I knew it, it was time for a sundowner on the deck with some new arrivals. The pre-dinner nibbles came out, as did another sundowner (just to make sure the sun went down properly) and then it was time for a top notch three-course dinner. After all that, my giant bed was calling.

More diving

Pineapple Reef. The next day we headed to Pineapple Reef, named after the pineapplefish that are often seen there. Pineapplefish are a very rare find in this part of the world, but are sometimes found with a close look under certain ledges, so I took a macro lens with me. Seems like the fish didn't know I was coming (or maybe they did) and had gone off on a day trip.

Still, there were plenty of other subjects for me to photograph, including Durban dancing shrimp, white-banded cleaner shrimp, an orangutan crab and a bright orange frogfish. And there were, of course, three





CLOCKWISE FROM LEFT:
Durban dancing shrimp under ledge; Pair of whip coral gobies; Frogfish; Pair of Whip coral shrimp



more potato bass, which are not quite macro subjects unless they are getting a clean. These three were not, so they were happily gliding around the reef in blue water, whilst my fisheye lens was on the boat.

Never one to tire of potato bass, on the boat I switched lenses and asked if we could do it again. Michelle explained that they sometimes saw four there, and that in the warmer months, manta rays, whale sharks and loggerhead turtles are sometimes seen. But it was mid-winter and the shark and manta action was quiet, much like further down the coast where even on baited dives, tiger sharks would only appear from December to early May.

The bass were still there, doing their bassy thing, this time in front of the right lens. Another honeycomb moray was half out of its hole, so I stopped to take some shots of it as Michelle stayed out of my field of view, with her buoy line.

She was off to one side, checking for pineapplefish again.

Next thing I knew, there was a frantic tugging on my fin. I thought some choice expletives in my head. Couldn't she see I was busy? Then I thought, "Hmm. She's been doing this for 15 years. She clearly can see I am busy. It must be important." So, I turned around and a very animated Michelle communicates to me that there had been a 4m tiger shark behind me (no doubt curious about my camera settings), but that it had swum off as she made eye contact with it.

It was a most curious event, and a subject of much discussion, as it was widely thought that the tiger sharks migrated away from the KwaZulu-Natal coast in the winter (between May and November) for unknown reasons, as they were never seen. Except on our dive, which took place in mid-winter. Two weeks later a dead humpback

whale appeared close to Aliwal Shoal, and it was estimated that up to a dozen different tiger sharks were seen feeding on it over the weekend. So, they are most definitely around, just invisible—unless you happen to have a dead whale on you, or take photos of honeycomb moray eels.

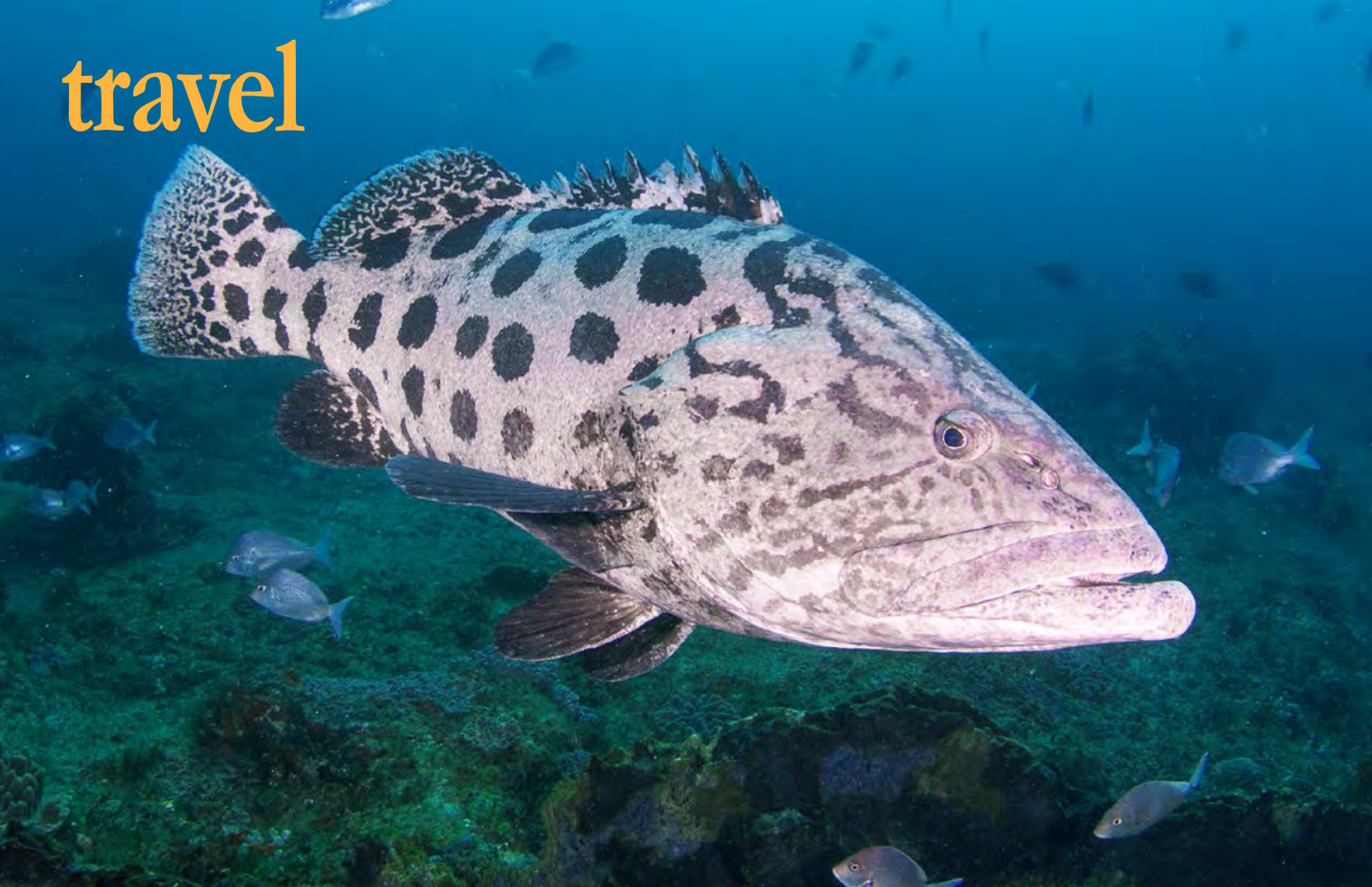
Other dive sites

In addition to the three sites I dived,

there are another dozen dive sites in the area, which are primarily shallow dives. There are also a couple of deeper sites, including Blood Snapper, which descends to 50m.

In the worst month of the year, I had had a great time. Rocktail Beach's diving was excellent, with healthy, vibrant reefs and plentiful fish. The Camp lived up to its reputation as the premier dive lodge in the country. The service





Honeycomb moray eel and anthias (left); Potato bass (above)

was impeccable, top drawer, and supremely friendly. I can't wait to go back to dive in the summer.

Activities for non-divers

One great thing about Rocktail Beach are the options available for the non-diving members of the family. As well as the morning and afternoon nature activities and day trips to the lakes and Tembe Elephant Park (which is a wilderness area requiring four-wheel-drive expertise, not an African Disney World), the dive centre also runs Ocean Experience trips, either for snorkeling or just observing from the boat. One of the dive sites frequented by ragged-tooth sharks is so shallow, you can snorkel with them. Dolphin sightings are also common, both bottlenose and the shyer spinner dolphins.

Seasons and conditions

In the spring and summer from late September to May, water temperatures rise from the colder winter temperatures to between 21-23°C in spring and up to

25-28°C in summer. Visibility averages around 18-25m and can be as good as 35+m.

During the summer months of December to March, pregnant ragged-tooth shark sightings are very common, as the sharks move northwards from the Eastern Cape area up to southern KwaZulu-Natal, where they mate. The females then continue northwards to these warmer waters and rest for approximately three months during their gestation period, before heading back to the colder Eastern Cape waters to give birth to their pups. The other magical summer sighting is of female loggerhead and leatherback sea turtles coming ashore at night to lay their eggs during nesting season from October to March.

In the autumn and winter months from June to early September, water temperatures drop to an average of 20-23°C in winter, with 19°C being the



coldest recorded winter temperature. Visibility drops to an average of 12-18m but can occasionally get up to 20-25m. August and September are traditionally the windiest months of the year. Diving is still good, but the wind may cause surface conditions to become very choppy. Diving continues unless the swell becomes too big.

The highlight during winter is the arrival of the humpback whales on their annual migration to Madagascar between June to late August, and then returning southwards to the Antarctic between September to November. The whales tend to travel further out to sea on their migration up to Madagascar, as these are mainly adults and adolescents on their homeward journey. We get to see the whales much closer to shore as they travel with their babies. ■

School of snapper

Rocktail

HOW TO GET THERE

Fly to Durban via Johannesburg, Cape Town, Dubai or Istanbul and either drive up or have a transfer arranged. It is a four-hour drive to Coastal Cashews. Or fly to Richards Bay, and then transfer or drive up. It is a three-hour drive to Coastal Cashews.

DIVING FEES AND EQUIPMENT

Dives cost 530 ZAR per dive. Cylinder and weights cost 150 ZAR per day (not per dive).

ACCOMMODATION

For 2017, accommodation costs 2,900 ZAR during the low season (February, March, May, June, September, October, November) and 3,290 ZAR during the high season (January, April, July, August, December).

DISTANCE TO OTHER LOCATIONS

Diving in Sodwana Bay is one hour south, Aliwal Shoal is 4.5 hours south, and Protea Banks is 5.5 hours south.

TOPSIDE SAFARIS

Safari combinations are plentiful. There are a handful of excellent Big 5 game reserves and safari lodges in KwaZulu-Natal, less than two hours away. Or you could fly to Johannesburg, Nelspruit, or Skukuza to visit the legendary Kruger National Park.

TOUR OPERATOR

This trip was arranged by Indigo Safaris, www.indigosafaris.com. Email Ines on ines@indigosafaris.com and she will put together a dream trip for you.

Christopher Bartlett is a widely-published British underwater photographer, certified FGASA African field guide and dive writer based in London. He leads photographic trips to Papua New Guinea, Southern and Eastern Africa, Mexico and the Maldives providing free workshops and tuition. For more information, visit: Bartlettimages.com.

fact file



South Africa



SOURCES: US CIA WORLD FACTBOOK, US DEPT OF STATE, DIVEPHILIPPINES.COM

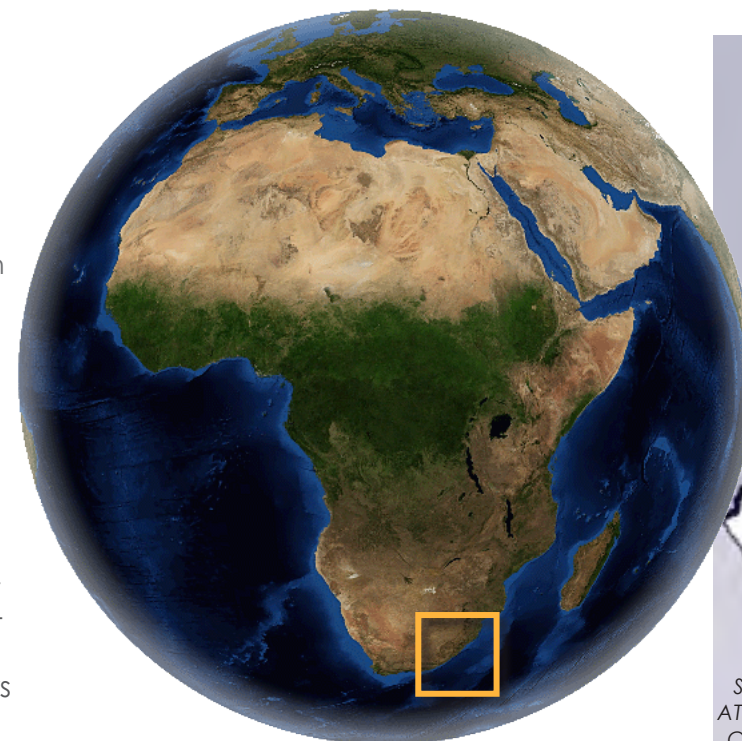
History In 1652, Dutch traders landed at the southern tip of modern day South Africa and founding the city of Cape Town, establishing a resupply station on the spice route between the Netherlands and the East. In 1806, many Dutch settlers (the Boers) travelled north to establish their own republics after the British seized the area of the Cape of Good Hope. In 1867 and 1886, the discovery of diamonds and gold encouraged wealth and immigration. This intensified the subjugation of the indigenous population. The years 1899-1902 saw the British defeat the Boers resistance during the Boer War; but, the British and the Afrikaners, as the Boers became known, governed together under the Union of South Africa. The National Party was voted into

power in 1948 and instituted a policy of apartheid—the separate development of the races. In 1994, the first multi-racial elections saw the end of apartheid and brought in black majority rule. Government: republic. Capital: Pretoria.

Geography Southern Africa, is located at the southern tip of the continent of Africa. The country of Lesotho is completely surrounded by South Africa, which also almost completely surrounds Swaziland. Coastline: 2,798km. Terrain comprises a vast interior plateau surrounded by rugged hills and a thin coastal plain. Lowest point: Atlantic Ocean 0 m. Highest point: Njesuthi 3,408 m. Natural hazards include extended droughts.

Environmental issues Extensive water conservation and control measures are required due to the lack of important arterial rivers or lakes; water usage increases outpace supply; agricultural runoff and urban discharge cause pollution of rivers; acid rain due to air pollution; soil erosion; desertification.

Economy A middle-income, emerging market with a large supply of natural resources, It is the world's largest producer of gold, platinum and chromium. South Africa has well-developed financial, legal, communications, energy, and transport sectors. Its stock exchange is the 17th largest in the world. Its modern infrastructure supports an efficient distribution of goods to major cities throughout the region. Since 2004, growth has been strong, as South Africa reaps the benefits of macroeconomic stability and a boom in global commodities. However, there is still high unemployment and an outdated infrastructure limits growth. The country began to experience an electricity crisis at the end of 2007, due to supply problems of the state power supplier Eskom plagued with aged plants. It necessitated "load-shedding" cuts to businesses and residents in the major urban areas. Remnants of the apartheid period include daunting economic



RIGHT: Global map with location of South Africa
FAR RIGHT: Location of Rocktail Beach on map of South Africa
LOWER LEFT: Hawksbill sea turtle at Rocktail Beach



problems, especially poverty, no economic empowerment among disadvantaged groups, and public transportation shortages. The economic policy of the country is fiscally conservative but pragmatic. It focuses on controlling inflation, sustaining a budget surplus, and—as a means in increasing job growth and household income—employing state-owned enterprises to provide basic services to low-income areas.

Climate South Africa is mostly semiarid with with sunny days and cool nights. There are subtropical areas along the east coast.

Population 54,300,704 (July 2016 est.) This figure factors in the effects and mortality rate of AIDS which is ravaging the country's population. Ethnic groups: black African 80.2%, white 8.4%, colored 8.8%, Indian/Asian 2.5% (2014 est). Religions Zion Christian 11.1%, Pentecostal/Charismatic 8.2%, Catholic 7.1%, Methodist 6.8%, Dutch Reformed 6.7%, Anglican 3.8%, Muslim 1.5%, other Christian 36% (2001 census), Internet users: 27.868 million or 51.9% (2015 est.)

Currency rand (ZAR). Exchange rates: 1USD=13.98ZAR, 1EUR=15.22ZAR, 1GBP=17.10ZAR, 1AUD=10.63ZAR, SGD=10.03ZAR

Language IsiZulu 23.8%, IsiXhosa 17.6%, Afrikaans 13.3%, Sepedi 9.4%, English 8.2%, Setswana 8.2%, Sesotho 7.9%, Xitsonga 4.4%, other languages: 7.2% (2001 census).

Health There is an intermediate degree of risk for food or waterborne diseases such as bacterial diarrhea, hepatitis A, and typhoid fever. Vectorborne diseases include Crimean Congo hemorrhagic fever and malaria. Water contact diseases include schistosomiasis (2008). Please refer to your health department for required and recommended vaccinations and precautions.

Security Most visitors enjoy their trips to South Africa without incidents. However, there is a high level of crime, particularly in urban areas at night. Please refer to

your state department for security alerts and updates. The country's emergency line is 10111.

Visa Two completely blank visa pages are required in your passports. Otherwise, entry will be denied and you will be forced to return home. Passports must be valid for at least 30 days. Tourist visas are issued at point of entry. Visitors with US and UK passports do not require a visa in advance for tourist travel up to 90 days. Please refer to your state department or local South African embassy for visa requirements and updates.

Decompression Chambers
DURBAN: St. Augustine's Hyperbaric Medicine Centre
Hyperbaric and Woundcare Unit
St. Augustine's Hospital
24-Hour Hotline: Tel. 031-268-5000

Web sites
South Africa Tourism
Southafrica.net □



POINT & CLICK
ON BOLD LINKS



THE FACTS AND VIEWPOINTS IN THIS SECTION ARE NOT NECESSARILY THE VIEWS OF X-RAY MAG. EQUIPMENT PRESENTED IN THIS SECTION HAVE NOT BEEN TESTED BY X-RAY MAG STAFF, NOR ARE THE ITEMS WARRANTED. INFORMATION PROVIDED IS CONDENSED FROM MANUFACTURERS' DESCRIPTIONS. TEXTS ARE USUALLY EDITED FOR LENGTH, CLARITY AND STYLE. LINKS ARE ACTIVE AT THE TIME OF PUBLICATION.

Equipment

Edited by
Rosemary E. Lunn



KUBI Dry gloves

The KUBI dry glove system is the brain child of an ardent cave diver. Like a number of successful equipment manufacturers, Peter Kubicka drew on his personal experience, using his own diving as a test bed to ensure everything he created and manufactured worked. Kubicka regularly dives in 4°C (39°F), and he had found that the kit he was using did not perform as it should in cold water. Until now, there were only three sizes of aluminium rings: 80mm, 90mm and 100mm diameters. KUBI has just augmented its award-winning dry glove system with the launch of a smaller sized ring of 70mm. Kubi.sk

of an ardent cave diver. Like a number of successful equipment manufacturers, Peter Kubicka drew on his personal experience, using his own diving as a test bed to ensure everything he created and manufactured worked. Kubicka regularly dives in 4°C (39°F), and he had found that the kit he was using did not perform as it should in cold water. Until now, there were only three sizes of aluminium rings: 80mm, 90mm and 100mm diameters. KUBI has just augmented its award-winning dry glove system with the launch of a smaller sized ring of 70mm. Kubi.sk



Hammerhead vision

Who wants to see forever? Heads turned at EUROTEK.2016 when Darkwater Vision unveiled their Hammerhead zero visibility underwater vision system. This ground-breaking vision technology allows divers to see clearly up to 2.5m (8ft) in dark, turbid and zero visibility conditions in real time. A special torch illuminates the area with near-infrared light. This light is picked up and amplified by the headset. The resulting black and white image can be clearly seen on the HDMI stereo LCD display affixed to the front of the divers mask. The Hammerhead is a self-contained unit, with the canister providing between six to 12 hours of burn time, depending on the brightness of the light. It is depth-rated to 30m (100ft). Testing is currently underway to increase this depth rating. Darkwatervision.com

Tank H2O Water Bottle



According to Associate Professor Neal Pollock "proper hydration helps promote effective circulation, thermoregulation and decompression health". It is worth noting, however, that you shouldn't over hydrate. Excessive hydration brings its own problems, i.e. potentially increasing susceptibility to immersion pulmonary edema. So how can you reduce your use of "one-time plastic" and stay hydrated in a fun way? Tank H2O has developed a stainless 18/8 stainless steel water bottle with BPA-free plastic cap for divers and lovers of ocean adventurers. The durable bottle holds 750ml (26oz) of fluid and is good for cold drinks only, i.e. it is uninsulated. Tank H2O recommends that you hand wash the bottle. Tankh20.com

Zulu strap

Suunto has launched an extremely durable army-style textile Zulu strap based on the popular NATO strap. The NATO strap was developed for the British Army in the 1970s. The single-piece construction design was popular with the military because it provided a secure fit. You simply weave the strap underneath the spring bars in seconds. Should one of the spring bars become loose or snap, the watch case will remain firmly attached. The strap is easy to adjust for wearing over a wetsuit and looks stylish for daily wear. Suunto states that this strap can be retro-fitted to the D6 range. Colors include black, stealth (drab olive) and blue. The blue option is available for dive instructors only. Suunto.com



AP Switch

There are occasions when you really need to reconfigure a handed regulator. But unless you are a service technician, you are a bit stuck. Until now. AP Diving launched the world's first diver configurable regulator—the AP Switch—at EUROTEK.2016. According to AP, this regulator has a unique patented clip and switch mechanism, which allows the diver to change the second stage from a left- to a right-handed orientation in seconds—may be at the dive site or on the boat—without the need for specialist tools or an authorized service engineer. This high performance regulator comes in two versions—cold water (sub 10°C / 50°F) and warm water (anything above 10°C / 50°F)—with a choice of a DIN or A-clamp first stage. The second stage can be dived with up to EANx40, straight out of the box, with the nitrox second stage suitable for diving 100% oxygen. Available Spring 2018. APDiving.com

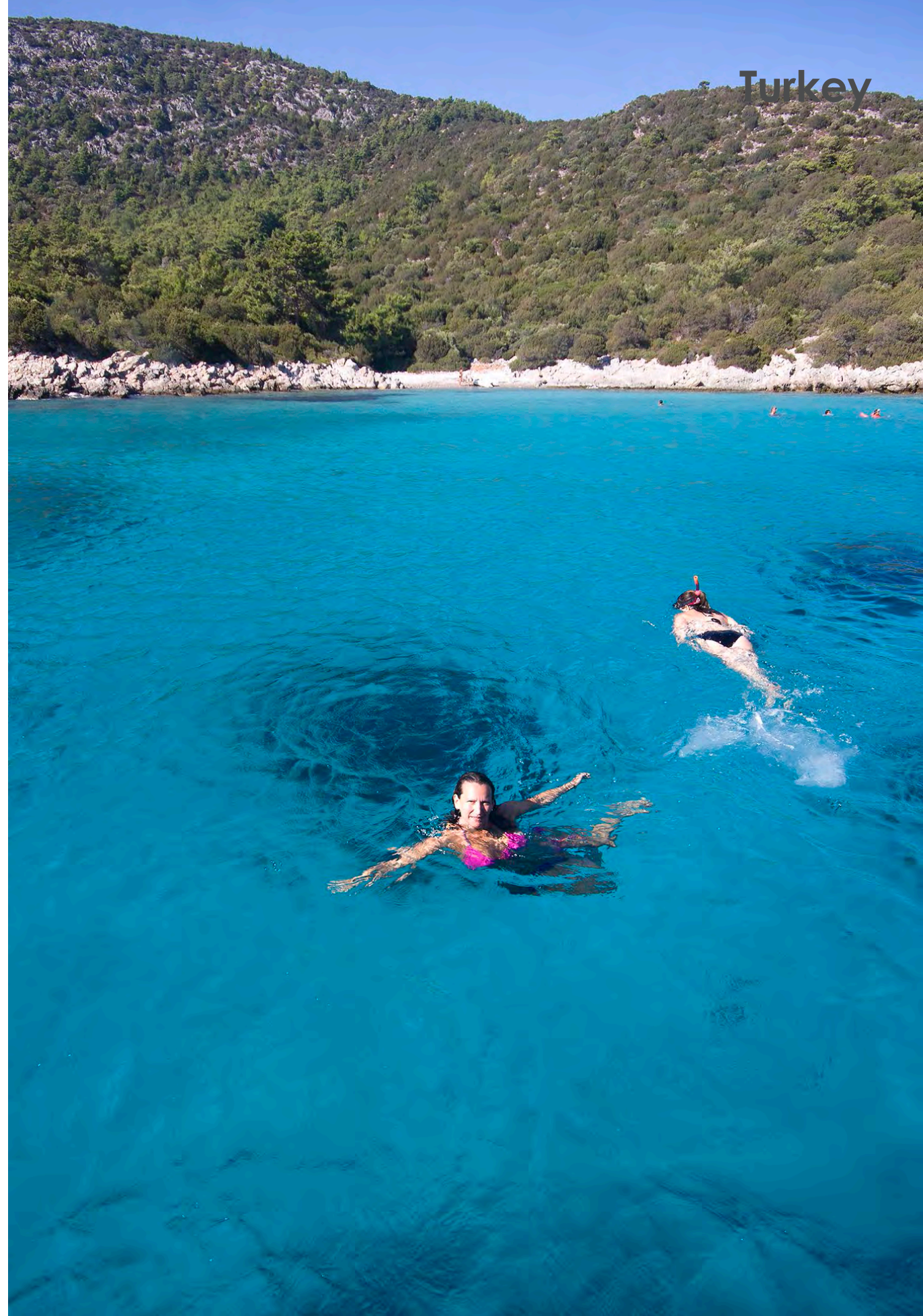


Turkey

Mediterranean & Aegean Hotspots

Text and photos by Rico Besserlich





Like diving in warm, turquoise waters with great visibility? Enjoy a laid-back atmosphere, without the stress of mass tourism, but still proper structures and professional services for scuba diving on site? Want guaranteed sunshine and excellent food from one of the world's greatest cuisines? Or perhaps you have a passion for history and culture as well, but not if it requires endless flights and travel? Then, Turkey is for you.

The most outstanding feature of the seas around Turkey is the remains of past civilizations. Turkey is where the East meets the West. The ancient Romans named this region "Asia Minor". But long before they came, the country saw the influx of the Hittites, the

Assyrians, the Phrygians, the Byzantine Empire, Alexander the Great, the Persian Empire and the Ottoman Empire.

This "breath of history" can be seen and felt everywhere in Turkey, even underwater. There is almost no dive where you won't spot ancient amphorae, some of them dating back to 500 BC. Lots of shipwrecks, ancient and modern, are awaiting discovery—which is often a relaxed endeavor, as water visibility is usually 40m or more. The water itself comes with colour tones that cannot be found elsewhere.

Marine life

The Mediterranean Sea is not famous for its rich marine life and often it simply needs luck to spot something special. However, groupers, barracudas, sting-rays and jack fishes are around—squids and sea turtles, too. As far as invertebrates and small fishes like wrasses, gobies and sea breams are concerned, they can be seen on every dive.



There are no fancy corals around here, but there are quite impressive underwater landscapes, with stunning rock formations, underwater canyons, caverns and hints of history, everywhere. While swimming in these waters and experiencing the great visibility, you might re-discover that wondrous

Snorkelers enjoy the clear, turquoise waters of Bodrum on the Aegean coast of Turkey; Motorized traditional Turkish wooden schooners, or *gület*, in Bodrum (top left); Curious shrimp on night dive (left)





The Canyon is one of Kas' top dive sites; View of marina from Bodrum Museum of Underwater Archaeology (top right); With a sharp eye and patience, you can find seahorses (right)



feeling, the gleeful “freedom of diving”, once again.

Dive sites in Turkey are found in the Aegean Sea, on the west coast, and in the Mediterranean Sea on the south coast of the country—also known as the

“Turkish Riviera.” It is on this south coast where you will find Turkey’s most popular dive sites.

About Turkey

Turkey is a country which belongs to Europe and Asia at the same time. Whilst the today’s Republic of Turkey is still a young one (founded in 1923), the Anatolian Peninsula is one of the oldest permanently settled areas in the world. There is evidence that even 40,000 years ago, people inhabited the area.

The world’s oldest known shipwreck—the “Uluburun,” dated 3,300 BC—was found in Turkish waters (see my article on Uluburun in issue 55 of X-RAY MAG at: <http://www.xray-mag.com/content/uluburun-oldest-wreck-world>)

The oldest man-made religious temple—Göbekli Tepe, dated to 10,000 BC—is located in Turkey and so are the ruins of Troy, dating from 3,000 BC to 500 AD. Some might recall from history class that the ancient city of Byzantine, later named, Constantinople, was one of the most significant cities in world history.

Well, the city is still here, but today its name is Istanbul.

The Temple of Artemis, one of the seven wonders of the ancient world—yes, that one—is in Turkey, too. It is in Turkey you will find the House of the Virgin Mary on Mt. Koressos; the Hagia Sophia—Constantinople’s Orthodox cathedral, turned imperial mosque, in Istanbul; the Library of Celsus in the ancient Roman capital of Ephesus; the Siren Rocks at Foca, fabled to be the site where Odysseus shipwrecked, in Homer’s Odyssey; and plenty more really old stuff.

It is actually nearly impossible to take a step without sniffing the smell of archeology. And still there are new finds almost every day, which makes modern construction a tricky thing sometimes; by law, if ancient artifacts are found during construction, it has to stop until archeologists can process the site.

Turkish cuisine

While in Turkey, we sniff and smell the thousands-of-years-old culture, our noses might sniff something else, too: the



Ancient amphorae are very common in Turkish waters; Flatworm and friend (left); Loggerhead sea turtle (right)



zen pizza and stuff it in the microwave. Never, ever.

The cuisine varies depending on the area. In the Aegean and Mediterranean regions, olive oil, vegetables, herbs and fish dominate the kitchens, whilst plenty of different kebaps (meat dishes) are typical for the Anatolian region.

food—oh, the food! Turkish cuisine is considered by many to be the third greatest cuisine in the world, not far behind French and Chinese. If you are a real foodie, one lifetime is not long enough to taste everything Turkish cuisine has to offer.

Turks love food—quality food, with the finest ingredients, and of course, everything must be fresh and homemade. No food-loving Turk would ever buy a deep-fro-

The right kebab is a science in itself. And nope, I am not talking about that unidentifiable meat served in a pita wrap, which you find on many a street corner of a cosmopolitan city. That ain't a proper kebab, and you will not find such things offered here in Turkey itself.

In Turkey, besides the traditional restaurants, which always offer "some of everything," there are plenty of small, local kitchens in the streets. If you see a place

with just three small tables in front of it, be brave and check it out. These local kitchens often specialize in only one special dish. Maybe you will find yourself sit on simple wooden or plastic chairs, and maybe everything around you looks incredibly simple, but at these small kitchens, you can eat like a gourmet, albeit at reasonable prices made for common folk—just US\$2.00 to \$5.00 for a rich, delicious meal.

But beware of those small green pepperonis that often come as a free side dish: They are hot as hell. Do not trust those old Turkish gentlemen sitting next to you who are eating these fiery things like French fries!

Raki

Turks are very social people and they like to socialize in the evenings over dinner. A Turkish "raki sofrasi" (or Raki dinner) is a cul-

tural experience and a must to try. Plenty of different starters (or mezze) are served, and the main dish might be fish or beef, just as you like it. At a raki sofrasi, the table is full of food—lots of different foods, each extremely tasty and freshly made, of course.

The namesake of this type of meal is Raki—or "Lions Milk" as it is called by some. It is an anise-flavored drink, and is the proper thing to drink at a raki sofrasi. But no worries—there are several very drinkable Turkish wines, and Turkey's Efes beer is good too.

If you are going to try raki, have a "tek" (a single) or a "duble" (a double), add some water and ice and enjoy. The founder of modern Turkey, Kemal Mustafa Atatürk, was a big fan of the raki sofrasi—he actually invented it.

Music

Another advantage of raki is that,

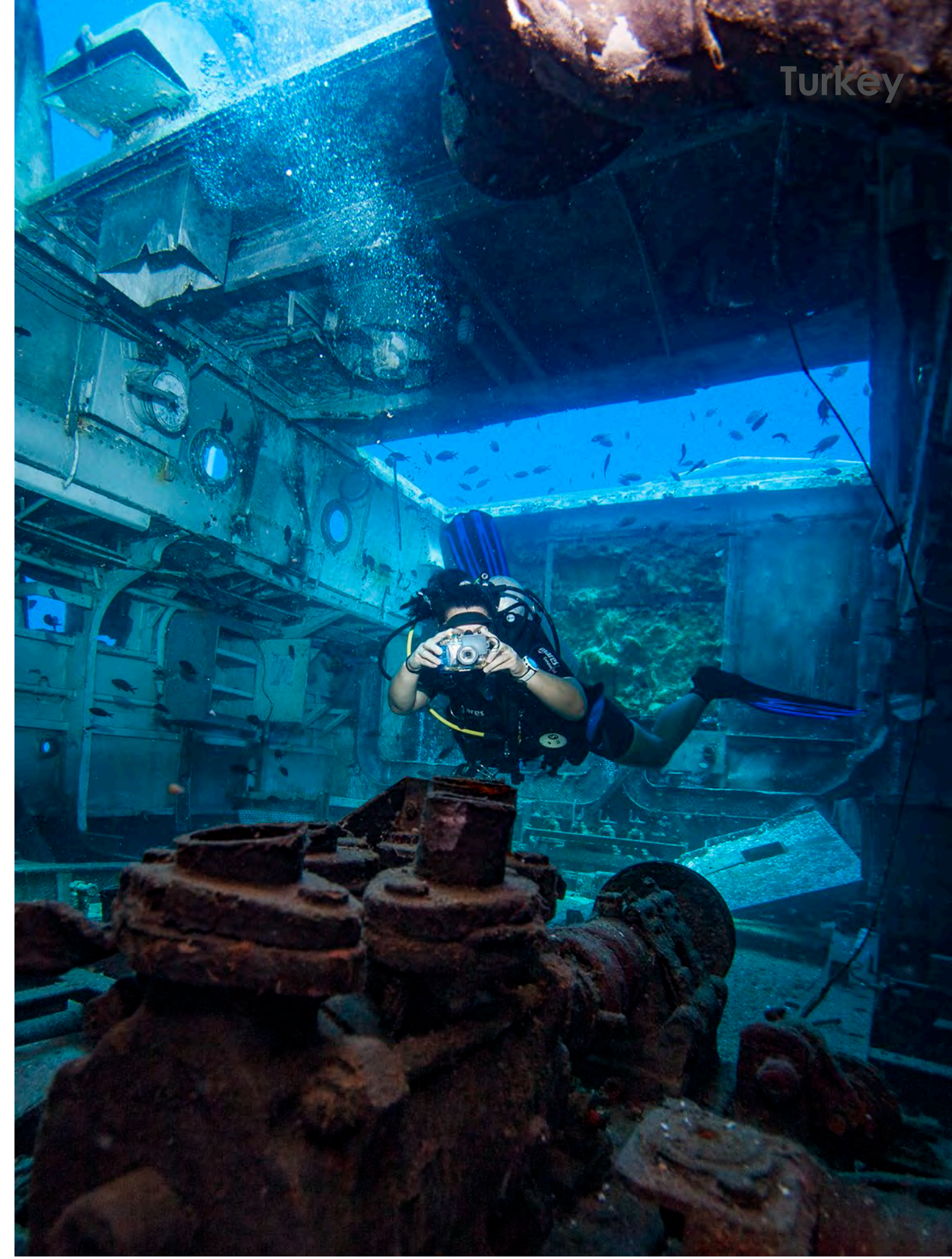


after the second one, you start to enjoy the music. It's all a matter of taste, of course.

Music is an important part of Turkish culture. Whilst the melodramatic "arabesque" style might be tricky for non-Turkish ears to appreciate, the Turkish gypsies come up with some pretty cool grooves. Sometimes in a public

square, you might see a six-year-old, young gypsy boy playing the "darbuka" (a type of drum) as a teenage gypsy girl dances to it, accompanied by her great-grandmother, who might be around 90 years old! Have a third raki, and you will be ready to join them!

The Dolapdere Big Gang is



a Turkish musical group that plays covers of international hits, albeit “gypsy style.” Check out their version of “Don’t let me be misunderstood” (<https://www.youtube.com/watch?v=McDoisLBXel>) and feel the “Turkish groove.”

Turkish brunch

The day after a raki sofrasi, you might want to have a good breakfast. Oh, the Turkish breakfast! It isn’t a proper Turkish breakfast if it hasn’t got more than ten different dishes on the table, let me tell you! You don’t want to miss trying some “simit” (sesame bread). Then there are the homemade jams, a selection of fine cheeses, fresh tomatoes, cucumbers, the world’s finest olives, not to mention the “sucuk”—a Turkish sausage, sliced and baked together with eggs in a traditional copper pan.

A Turkish Sunday brunch can easily last three to four hours. You might like to round up the meal with a traditional Turkish mocca, and if you have a “wise woman” sitting at your table, she will tell you your future from the coffee grounds remaining in your cup. Surprisingly and certainly not proven by science, these wise

women are often right, and they might make you think about powers beyond human imagination, rational thought and science. Welcome to the mysterious Orient!

Street vendors

In Turkey, the “micro business” is a very common thing to see. Whilst laying in your hotel room, you might hear people shouting on the road. The “eskici” collects old stuff no one can or wants to use anymore; the “simitci” sells the super-tasty simits; others might praise their tomatoes to be the best in the world or just offer to clean your carpet.

The unique Turkish humor reaches every corner, even micro businesses. You might hear a vendor yell: “Don’t make the children cry—buy a simit!” The twilight zone of Turkish micro business is hard to explain in words alone. Check out the short video “Ben Geldim, Gidiyorum” (or “I’ve come and I’m gone”) here: <https://www.youtube.com/watch?v=8qzMHfis2vQ>. And you’ll understand what I am talking about.

Tea time

Drinking tea is something impor-



tant, too. Turkish people invite each other for a tea, almost continuously. Turks are the no. 1 tea drinkers in the world. No matter if it is a classy restaurant or a small local kitchen: if no tea is served, no Turk will ever sit there.

The Turkish “Cay” tea is served in very small glasses, and in Turkey the rule is: Whatever trouble you have, or whatever hassle you are in, there is always time for a glass of tea. As

Diver inside the SG-114 shipwreck; View of Kas, the top dive location in Turkey (top left); Squid (left)





Remains of an Italian bomber plane (left) at 58-71m at Flying Fish dive site in Kas; Juvenile baracudas cruising around in the shallows (right); Wreck of a Douglas "Dakota" C-47 aircraft in Kas (below)



("tesekür ederim"), but the French word "merci" works, too. And if you can't recall anything, just smile. That works as well.

Turkish people are all natural born "McGyvers", meaning that they always find a way. And even though there might be a slight language problem, just give them a minute and they will find a neighbor, friend, cousin or someone who knows some English and will happily give a hand. Give them two minutes and they will find a cousin who has a cousin that lives just one block away from your home in your home country! Yes, they can do such things.

Open every day

In Turkey, only Sunday is considered a day off, sort of, as it is

said, they take their tea very seriously. Sitting in one of the small cafes, having a cay and just watching what is happening on the streets, is almost a sort of core element of the Turkish culture itself.

You might then want to talk to people and then find that the Turkish language is beyond your capabilities of pronunciation. Doubt it? Try to pronounce "Üzgünüm" correctly. If you can do that, then you know how to say, "I am sorry", in Turkish. No worries, in tourist areas (which includes dive locations as well) most people know some English.

But with just a few Turkish

words, suddenly you are not a tourist anymore. They will make you family. The basic dialogue is always the same and works in 99.5 percent of all cases. We are of course talking about small-talk here. For example:

"Merhaba" means "Hello."
 "Nasilsiniz" means "How are you?"
 "İyi'm. Siz nasilsiniz?" means "I am fine. How are you?"
 And "Bende iyi'm" means "I am fine, too."

Learn this mini dialogue and see the real Turkey open its heart to you. The Turkish phrase for saying "thank you" might sound difficult



mainly only true for banks and offices. Shops of all kinds are open every day, usually from 9:00 a.m. to 10:00 p.m. The same is true for hairdressers.

Oh, the hairdressers. They never sleep. A proper haircut or shave (or both) in Turkey is a lifetime experience. A good one, of course. And it's not done with a quick snip. No, no, you are the king of the scene. Tea will be served (I

told ya!) and every single hair of your head will be treated like a piece of gold.

You will get a relaxing neck massage and don't be surprised if the hairdresser will even trim your eyebrows. That's all part of the service, usually somewhere between US\$5 and \$10—perhaps three bucks more for a proper shave, and no, it's not a shave you could do at home.

As the coastal areas of Turkey provide 300 sunny days per year, most of life happens outside. Street life. Drinking tea (yes, again) or whatever you like, exploring history, recovering from the raki sofrasi and making new friends. That's easy in Turkey.

Religion and tolerance

Turkey's major religion is Islam. But when on holiday in Turkey, you will not find any "limitations". Turks are very warm-hearted people, and

Turkish hospitality is legendary. Going out on the town at night, you will be surprised how youthfully Turkish women are dressed. Things might look different in the deep east Anatolia, but on the Turkish coastal areas, everything is easy-going. To go "topless" sunbathing might be, here and there, a bit too provocative, but no woman has to cover her hair, except when visiting a mosque. Female divers can travel alone, without being bothered.

Turkish people still feel honored if anyone from abroad visits their country. It is the warmth, not only in the climate, but in the heart of the people, that makes a visit to Turkey a special event. And let's not forget: Turkey has some pretty cool spots to dive, too.

Kas

Kas is the number one dive desti-



Airplane wreck (above) and typical underwater scene (right) at Bodrum; Diver at wreck of Greek cotton freighter (far right)

nation in Turkey. It is a nice, small town 140km from Dalaman and 200km from Antalya. With around 20 worthwhile dive sites, it is a lovely place to stay for divers and non-divers alike. Recommended dive centers include SunDiving, Kas Archipel Diving Center, SubAqua Dive Center. Here are some of the top dive sites.

C-47/Dakota. Here, an intact C-47 aircraft rests in 18-26m of depth. You cannot find a complete wreck like this anywhere else in the world.

Flying Fish Reef. For years, this has been Turkey's No 1 spot and placed on the international list of "100 best dive sites worldwide." It is a huge underwater island where there are good chances to spot jack fishes and huge groupers. Some rare nudibranchs can be found here too. There is also an Italian bomber aircraft from

WWII at 58-70m.

Canyon.Tunnel. One of Turkey's largest caverns.

Topside excursions. Explore the old town, sit in a bar, have a drink and just "let God be a good man." There are lots of nice shops that sell Turkish handcrafts and other artworks. You can also visit Kekova, a sunken city, half underwater and half above it. Daily boat trips are available. Or take a boat trip to the lovely Greek island of Castellorizo, just 3 sea miles from Kas. Other outdoor activities in Kas include sea kayaking, mountain biking, hiking, paragliding, exploring half-forgot-



ten mountain villages, jeep safaris to Sakklikent Canyon and Butterfly Valley, and trips to Kaputas or Patara Beach (where sea turtles breed at Patara). Various local agencies offer lots of trips to explore all the "surface beauty"

of the region. No advance reservation in necessary.

Kalkan

This small romantic village, just 20km away from Kas (just take a bus or rent a car to reach it)



is quite popular with the British. There are around 10 worthwhile dive sites, including Dutchess of York, a huge freighter shipwreck; Heybeli Reef, a Mediterranean macro stuff paradise; and Ince Burun, with its beautiful underwater landscape. I recommended the dive center Dolphin Scuba Team. Other activities and things to see or to do include walking around, enjoying the local flavor

and don't miss having a dinner at the Aubergine Restaurant!

Kiris/Kemer

Very close to Antalya, this place provides good quality hotel resorts, designed for divers with families who like to relax and do a dive from time to time. The top dive spots include Paris Wreck, a French freighter from WWI that sank in the bay of Kemer.



CLOCKWISE FROM ABOVE: Blenny; There are many “good days” with visibility of +40m—not every day, but nearly; Cuttlefish on night dive; Flatfish

Ranging from 16 to 31m, it is one of Turkey's best wrecks. Other top spots include, Three Islands Cave and Three Islands Aquarium. I recommend using the dive center Kemer Diving. Things to enjoy while topside include exploring the old harbour of Antalya, relaxing and enjoying your drink at the hotel pool bar.

sites include TC SG 115, with a wreck of a military patrol boat; Pirate's Bay, where one can find hundreds of nudibranchs and sometimes thousands of wrasses; C47, the second dive site with a

Bodrum

A city with a long history, Bodrum has a very beautiful marina and an old part of town, in the city centre. Located on Turkey's Aegean coast, water temperatures here are three degrees lower than at the other mentioned places. But in return, you will find the best water quality experienced in Turkey—very much a “turquoise dream.” The top ten worthwhile dive



Dakota airplane wreck. This C47 is broken, but still beautiful. It has the best underwater visibility in all of Turkey—close to 50m! And

archaeology, which is located in the old crusader's stronghold near the marina. It hosts the treasures of the “Uluburun” (the

finally, there is Big Reef, which is very rich with marine life and lots of fish. I recommend the dive center Happy Bubbles Dive Center.

What to do when topside includes visiting the world's only museum of underwater

oldest shipwreck ever found in the world, dating to 1,400 BC) and many, many more awesome things... One needs a full day to discover all. You can also explore the marina and enjoy Turkey's “jet set” holiday destination. If you still have energy at night, Bodrum is notorious for its nightlife.

Dive logistics

Turkish dive centers are used to foreign guests and do everything they can to make their divers happy. Diving is usually done in two separate dives by boat per day. Nitrox is not very common



adapters are provided.

Seasons and conditions

The diving season in Turkey goes from end of April until the end of October. The peak season is July through August. The water is 18-19°C in May, 21-23°C in June, 24-28°C in July, August and September and 24°C in October. July, August and September are

summers. There are 300 sunny days per year are the average. The hottest months are July and August, with temperatures rising up to 34-39°C.

Rates

Compared to other dive destinations in the Mediterranean Sea, Turkey still offers recreational diving opportunities for reasonable rates. An average quote for a 10-dive package (including tanks, weights, boat trips and dive guide) is between 190-220 EUR, depending on the area and on the dive center. The more dives you do, the lower the price gets. If booking a 15- to 20-dive package and bringing your own scuba gear, you will get the single dive for 14-16 EUR. Dive centers that are located in big hotel resorts (4 to 5 stars) do charge 30-35 EUR for a single dive, regardless

of how many you do. A beginner diving course, such as the PADI OWD, is 290-340 EUR, and includes all materials (books) and certification fees. ■

Rico Besserlich is a widely published German photographer, journalist and artist based in Turkey. For more information, visit: Mavipho.com.



Swimmer enjoys the clear waters of Bodrum; Diver at the SG-114 shipwreck (left); Rocky reefs and superb visibility are common in the Turkish Mediterranean Sea (top)

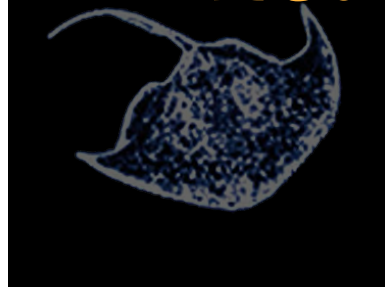
in Turkey, but some of the larger dive centers do offer nitrox for an extra fee. Other gas mixes such as heliox are nearly impossible to find, the same is true for rebreather scrubber. Only a handful of

dive centers in the entire country are qualified and certified to provide technical diving services. Dive tanks are usually 12-liter steel tanks with a single DIN valve. For divers with INT valve regulators,

the best months for underwater visibility, which is (depending on the dive site) between 35m and 45m. The coasts of Turkey have the classic Mediterranean weather, with mild winters and hot, dry



fact file



Turkey



SOURCES: US CIA WORLD FACTBOOK, US STATE DEPT, US CDC, XE.COM, LONDONDIVECHAMBER

History After the Ottoman Empire was defeated, modern Turkey was founded in 1923 by national hero, Mustafa Kemal, later dubbed, "Father of the Turks." Radical political, social and legal reforms ensued, eventually leading to multi-party politics, and then in 1950, victory and a peaceful transfer of power to the Democrat Party. In 1945, Turkey joined the United Nations, and NATO in 1952. The country became an associate member of the European Community in 1963.

There have been periods of instability and military coups in Turkey, occurring in 1960, 1971, 1980 and 1997. After each coup, formal political power was returned to civilians. In 1984, the Kurdistan Workers' Party (PKK) started a separatist insurgency that has killed more than 40,000 people. The PKK agreed to a cease-fire with the Turkish Government in 2013, but fighting broke out again in 2015.

There have been several incidents of terrorism in Ankara and Istanbul in 2015 and 2016. Another military coup was attempted in July 2016, resulting in around 300 people killed and 2,000 injured, spurring mass demonstrations in the streets by Turkish citizens, against coup forces. Mass arrests of military personnel by the Turkish Government ensued. The country has seen a quickly growing

economy in the past ten years due to economic reforms. Government: parliamentary republic. Capital: Ankara.

Geography

Turkey is located in Southeastern Europe and Southwestern Asia—the area of west of the Bosphorus is considered part of Europe geographically). Turkey borders the Black Sea, between Georgia and Bulgaria, as well as the Aegean Sea and the Mediterranean Sea, between Syria and Greece. Coastline: 7,200km. Terrain consists of high central plateau in Anatolia) and narrow coastal plain, with a few mountain ranges. Lowest point: Mediterranean Sea 0m. Highest point: Mount Ararat 5,166m.

Climate Turkey's climate is temperate, with mild, wet winters and hot, dry summers. Natural hazards include: severe earthquakes, especially in Turkey's northern areas; and rare volcanic activity from its three active volcanoes Tendurek, Ararat, Nemrut Dagi, which have not erupted since the 1800s.



Location of Turkey on global map (right); Location of Kas on map of Turkey (below)



Language Turkish is the official language, but Kurdish and other minority languages are spoken.

Health There is a risk of hepatitis A and typhoid through contaminated food or water, especially in rural areas. Rabies is found in bats, dogs and other mammals. There is a small risk of malaria. Check with your health department for recommended vaccinations.

Decompression chamber

There is a hyperbaric chamber in Istanbul.

Travel/Visa Citizens of the European Union get their visa automatically at passport control when entering the country, without any extra fee. The tourist visa is valid for 90 days. Citizens of many other countries outside the EU will need to apply for a visa prior to their flight. Such a visa can be acquired online (www.evisa.gov.tr/en/) and the fee is EUR20. Passports must be valid for at least 60 days beyond the expiry date of the traveller's visa or the end of the traveller's visa exemption period.

Security US and European authorities have issued travel warnings of terrorism in areas of Turkey, with extremists targeting foreign and American tourists. It is recommended that visitors avoid the southeast region, and take caution in large urban centers. Please consult your state department before traveling to Turkey.

Web sites

Tourism Turkey
Tourismturkey.org

to debt investment grade in 2012 and 2013. But growth slowed significantly in 2014 due to lagging domestic and European consumer demand, and high interest rates, which were increased by the government to reduce inflation and boost the country's currency. Interest rates were cut in 2015 to energize economic growth. Current challenges include a relatively high account deficit, unsure commitment to structural reform, and destabilizing shifts in the economy due to instability in neighboring countries.

Currency Turkish liras (TRY). It is recommended to have some local money in your pocket. Exchange rates: 1USD = 2.99 TRY 1EUR = 3.36 TRY 1GBP = 3.89 TRY 1AUD = 2.29 TRY 1SGD = 2.19 TRY

Population 80,274,604 (July 2016 est.) Ethnic groups: Turkish 70-75%, Kurdish 18%, other minorities 7-12% (2008 est.) Religions: Muslim 99.8% (primarily Sunni), other religions 0.2% (mainly Jews and Christians) Internet users: 42.7 million, or 53.7% of the population (July 2015 est.)

Environmental issues

Challenges include urban air pollution; pollution of water with chemicals and detergents; deforestation; oil spills are a concern with increasing ship traffic in the Bosphorus.

Economy With a largely free-market economy, Turkey's industry and service sectors are surpassing the traditional agriculture sector, which still provides a quarter of jobs. Privatization has reduced state management in banking, basic industry, communication and transport. Spurring the economy are more and more middle-class entrepreneurs who are expanding production beyond traditional textiles and clothing sectors, which have also been surpassed as exports by the

electronics, automotive and petrochemical industries. Since 2006, up to one million barrels per day have been brought by pipeline to market from the Caspian region. Measures are in motion to bring natural gas from the same region through Turkey to Europe, thus addressing the country's dependence on imported gas, which supplies 98 percent of its energy requirements. Financial and fiscal reforms strengthened the economy after a severe financial crisis in 2001, fostering strong annual growth until 2008, when the global economic downturn caused a contraction in the country's GDP in 2009. However, the well-regulated banking system and financial markets aided the country's economic rebound in 2010-11, leading to the upgrading of Turkey's



Edited by
Peter Symes

Text by Klaus M. Stiefel
Photos by Brandi Mueller
and Klaus M. Stiefel

It is a situation many underwater photographers have experienced, even though they don't talk about it. And the resulting photos certainly don't make it onto Flickr or Facebook. A camera-toting diver sees an interesting and beautiful fish, maybe a large grouper or a gaudily-colored tropical sweetlip. The diver then swims closer to the animal, in an effort to capture it in a frame-filling image. The fish tolerates the approach at first, but then gets nervous and panics. It turns around in an instant, to initiate a rapid escape. The bedazzled photographer presses the shutter too late, and the photograph ends up showing the fish's posterior. In nature photography, we are taught to focus on the eyes of an animal, not its backside. Pictures of escaping fish from behind certainly belong in the "fail" category.

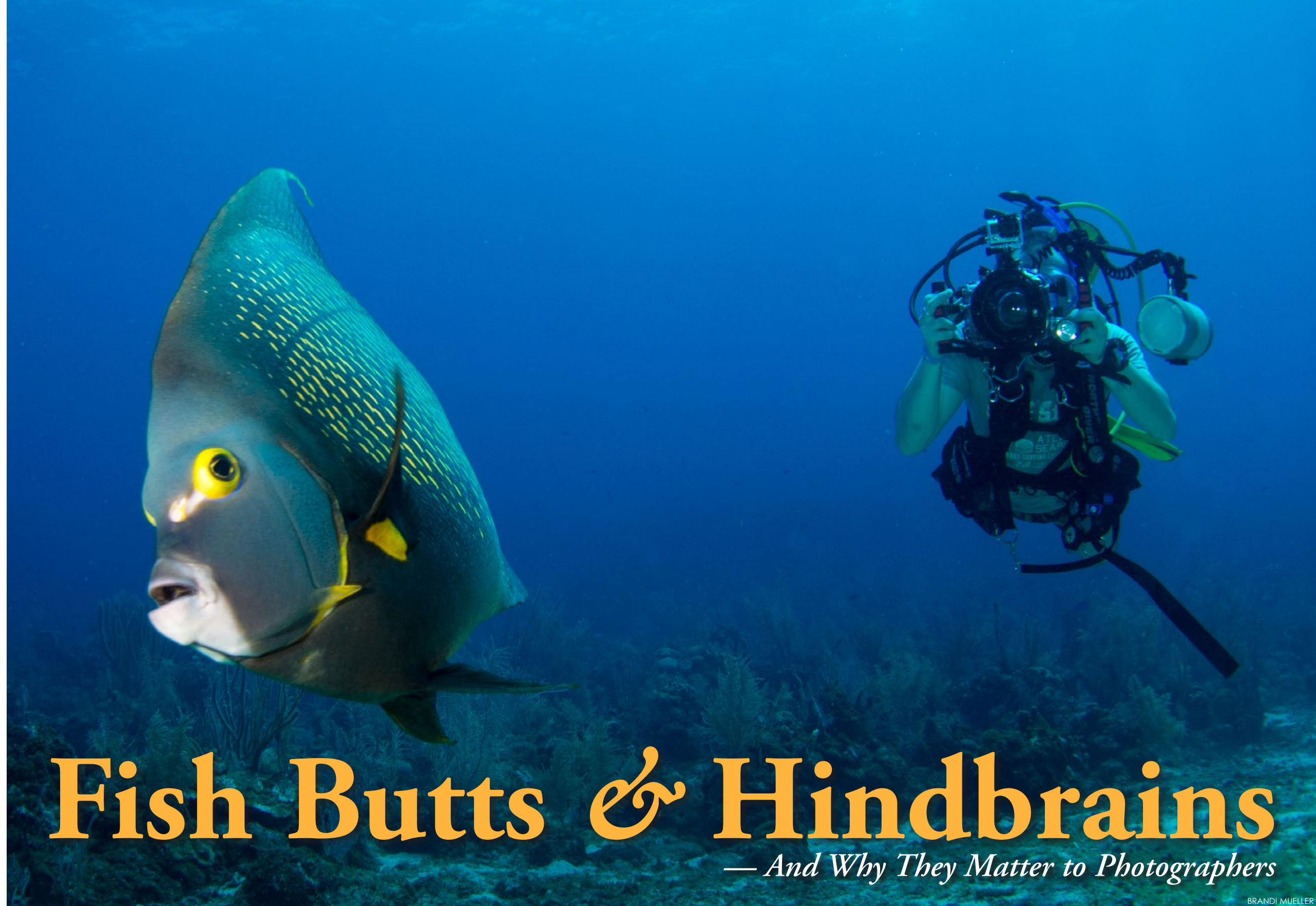
There is, like for so many things in life, a pretty good scientific explanation for such fish escape behavior. As so many underwater photographers have observed too many times, fish show a very distinct escape response. When they

see or hear something they consider to be a threat, most fishes curve their bodies to one side, then dart away rapidly. This behavior is highly stereotypical (it is executed in the same way, every time) and it happens very fast.

The Mauthner cell

— *Commander of fish escapes*
The fish escape response is implemented in the fish brain by a pair of large neurons (nerve cells) called Mauthner cells. There is one Mauthner cell on the left and one

on the right side of the brain. They are located in the hindbrain, the tail-most part of the fish brain, right where the brain ends and the spinal cord starts. The Mauthner cells are command neurons. They are central integrators of infor-



Fish Butts & Hindbrains

— *And Why They Matter to Photographers*

BRANDI MUELLER





BRANDI MUELLER

mation relevant to escaping, and they send out commands to the spinal cord to initiate the escape.

The input to the Mauthner cells come from all sensory modalities, most prominently from the fish's eyes and auditory system. Electrical impulses from the eyes reach the Mauthner cells indirectly (via a brain area called "optic tectum"), and from the

sound-sensitive hair cells directly.

The output of the Mauthner cells go to the neurons of the spinal cord, which then activates the muscles in the tail. The fast twitching of these muscles causes the fish to rapidly escape.

Interneurons

There are also a bunch of smaller neurons connected to the Mauthner cells, called inhibiting neurons or interneurons. These neurons inhibit the nerve cells to which they are connected.

One set of interneurons makes sure that only one of the Mauthner cells (left or right) is active during an escape reflex. Another set of interneurons cuts off the sensory inputs reaching the Mauthner cells after a short time.

In this way, they make sure that only rapidly changing sounds or sights activate the Mauthner cells and subsequently the escape reflex. Any persistent, non-changing sound or sight will not activate the Mauthner network.

So, basically, the Mauthner cell is the commander of the fish

escape reflex. Just like a military commander, it receives all kinds of information (about sights and sounds from the sense organs of the fish), and then decides whether to initiate action (the escape reflex) or not.

Research

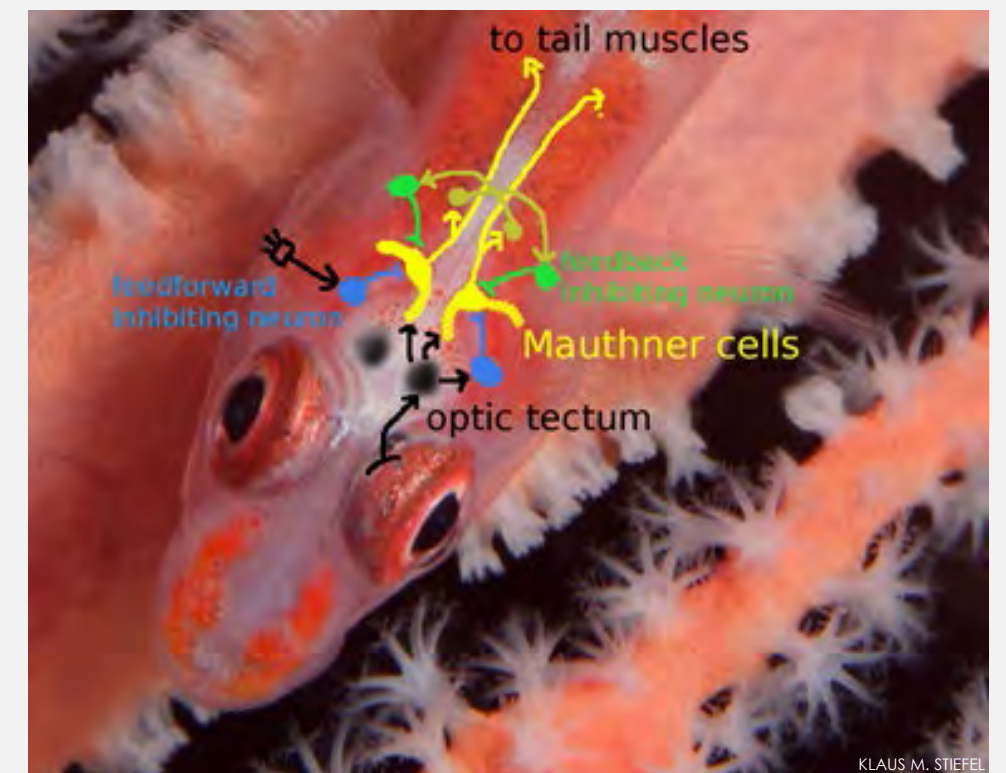
The fish escape reflex and the Mauthner cell have been studied since the 1960s, with a variety of gnarly scientific methods like: filming fish escapes at high speeds; sticking tiny electrodes into Mauthner cells; and measuring the calcium levels in these cells with the help of genetically engineered dyes and lasers.

A search in the scientific literature shows a total of 591 scientific papers featuring the term "Mauthner." If we estimate that each paper took a year to



KLAUS M. STIEFEL

This rare shot of a shrimp goby, *Ambyeleotris guttata*, shows the onset of the escape response. When photographing it, I inadvertently scared the fish an instant before pressing the shutter, and in the image, it just starts to bend to its right, initiating an escape directly to its burrow. Shot in Dauin, Negros Oriental, Philippines.



KLAUS M. STIEFEL

The Mauthner cell network in the fish hindbrain. Not drawn to scale relative to the fish brain, but you get the idea! The Mauthner cells (yellow) receive input from the eyes via a brain structure called "optic tectum" and from the auditory hair cells of the fish (black). In this way, they get activated by sudden loud noises and large visible objects. The output of the Mauthner cells reaches the fish tail muscles via neurons of the spinal cord. A number of smaller interneurons (blue, green), make sure only one Mauthner cell is active during an escape response (feedback inhibiting neuron), and only for a short time (feedforward inhibiting neuron). The arrows ∇ denote activating and T inhibiting connections between neurons. For a more detailed explanation and a complete diagram of the network, see Medan and Preuss, *Journal of Physiology*, Paris, 2014.

complete, then that's about 12 full working lifetimes' worth of Mauthner cell study. Now, that's a lot of science.

Lessons for photographers

So, what lessons can we as underwater photographers learn from the scientific study of the Mauthner cells?

No warning. Firstly, the Mauthner is a thresholding device. It constantly receives information from the fish's senses, but does not react until the inputs together reach a certain threshold. Then, all of a sudden, it sends an output to the spinal cord and starts the escape. There might be no warning in the behavior of the fish you

are approaching that an escape is imminent up to the point when it is too late. Sounds and sights just below the threshold might not make the fish seem even a bit nervous. Sensory inputs just a bit above the threshold will make the fish execute its full-blown escape behavior.

Be small and quiet. Secondly, in the decision whether or not to initiate an escape response, the Mauthner cells of the fish evaluate visual and auditory cues. That means that if the fish sees something threatening or hears something threatening, both factors enter into the decision whether or not to flee. So, as underwater photographers, we need to avoid



BRANDI MUELLER

being noisy and looking big and scary. But we especially need to avoid doing these things at the same time.

No bubbles. If you are swimming at the fish (and your image in the eyes of the fish changes), don't exhale noisy bubbles; if you exhale, stop your approach for a few seconds.

No noise, please

Naturally, it's best to avoid noise and visual disturbances altogether. Unfortunately, the aforementioned exhalation bubbles are quite loud. What can you do against these noisy bubbles when trying to photograph a shy fish? As a PADI instructor, I can't recommend holding your breath while scuba diving!

But there are ways to avoid noisy bubbles underwater.

Exhale slowly. One way is to exhale very slowly, through your nose and mask. That breaks up the bubbles into smaller, less noisy ones.

Use a rebreather. Or, you could use a rebreather. Advantage: no bubbles. Plus, a lot of extra dive time, and the breathing feels pretty much like on the surface,

with nice moist air. In addition, everyone sees that you are one of the cool kids, with one of these fancy units strapped to your back. Disadvantage: looking at your bank account after acquiring your rebreather.

Freedive. Another possibility is to shoot photo and video while breath-hold diving. I shot this mini-documentary about veery skittish gobies purely on apnoe. Holding your breath is free, but you can stay underwater for only so long before brain damage and death ensues.



BRANDI MUELLER

Any seasoned underwater photographer intuitively knows that one should approach fish subjects slowly in order to keep the fish calm. The goal is to ensure that your image on the retina of the fish changes slowly, because an escape response is most likely triggered when an image in front of the fish rapidly grows, or a sound gets louder.

Fish Butts

Approach slowly. A slow approach helps to keep the fish calm—your image on the retina of the fish should change slowly. Any seasoned underwater photographer intuitively knows this.

The Mauthner cells like changes. The fish's Mauthner cells react best to temporarily changing stimuli, both visual and auditory. An escape response is most likely triggered when a sound gets louder or when an image in front of the fish rapidly grows—which probably means something is approaching the fish.

I like to think of myself as the anti-Michael Phelps: I am a champion in swimming slowly. Nobody can do the last half-meter between camera and goby



BRANDI MUELLER

KLAUS M. STIEFEL



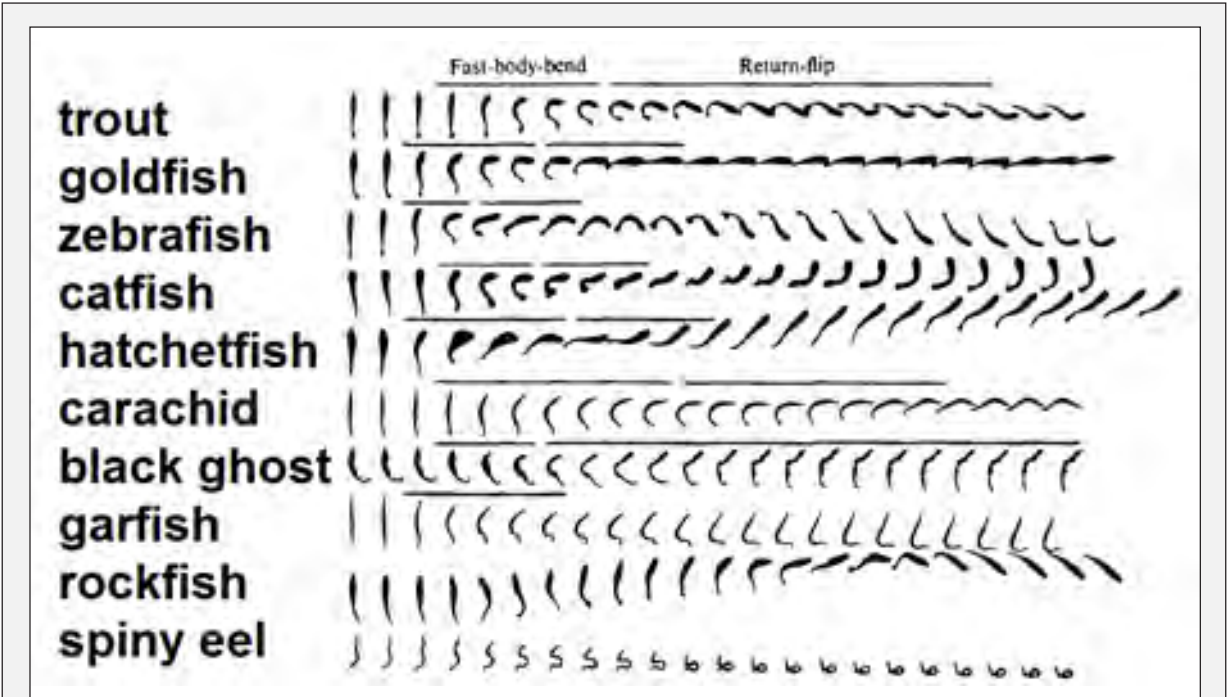
initiate and execute an escape—now you know why.

Diverse fishes with diverse escape behaviors

Lastly, the study of the fishes' Mauthner cells taught us how different the escape reflex works in different fish species. There are about 20,000 species of fishes known to science, and a survey of the Bird's Head Peninsula in West Papua has found 1,300 coral reef fish species.

Even on your average tropical diving vacation, you could see a few hundred different fish species. Each of these species will have a Mauthner neuron-commanded escape system, which fits the environment it lives in and the predators it faces.

It is actually rather surprising how similar the escape reflexes are



The escape reflexes of a number of different fish species. You can see the outlines of the fish, each spaced 1/200 second apart during successive phases of an escape reflex. Most fish species bend sideways (fast body bend), and then dart away (return flip). The spiny rockfish has less to fear from predators and hence only bends a little bit, and then swims forward. The eel prefers to withdraw its head when threatened. Adapted from Eaton, Bombardieri and Meyer, *Journal of Experimental Biology*, 1977.

Another shrimp goby, *Cryptocentrus sp.* These extremely pretty fishes are also very skittish, and it takes a very calm approach to photograph them. Shot taken in Dauin, Negros Oriental, Philippines.

slower than me. My dive buddies claim that some of the faster tectonic plates have overtaken me on some occasions. All of that slowness keeps the Mauthner cells of the fish in front of my camera lens from activating.

Slow escapes in cold waters

The fish escape reflex also shows a pronounced temperature dependence. Most biological processes run about twice as fast when it gets 10°C warmer. This is true for both the Mauthner cells as well as the tail muscles they activate.

The temperature difference between a tropical coral reef (~28°C) and an alpine lake (~8°C) is about 20°C, and we can expect fish brains and muscles to work four times slower in the Alps. If you are not one of those vacation-only, warm-water divers, you will notice that fish in temperate or cold oceans take longer to



Moray eels, like these two friends in Sydney, Australia, are good photo subjects because they have a weak and atypical escape reflex: rather than swimming off quickly, they retract into their home burrow when threatened.

between species so distantly related as trouts and goldfishes (a carp relative), as you can see in the figure below. Still, other species show very different escape reflexes.

One study found that an eel retracts its head instead of bending and escaping. The rockfish, well-protected by its spines, shows a much weaker and slower escape reflex, and moves forward rather than escape sideways. These differences in fish behavior are reflected in differences between the connections of the species' Mauthner cells.

The diagram above shows the "typical" zebrafish (a member of the carp family) Mauthner cell and its connections. I drew it on top of a skull of a goby, and I assume that given the similar escape behavior in gobies, the Mauthner neuron network will look very similar. But in eels, rockfish and garfish, the diagram would look slightly different.

One species at a time

Underwater photography legend Marty Snyderman is known to recommend concentrating on photographing "One species at a time!". By this, he means that an underwater photographer needs to study the escape behavior of each fish species separately.

To learn what scares one species of fish away, and what does not; and to study how to approach that particular species with your camera, one needs to get into the fish's head. So what Marty really means is that underwater photographers must crack the functioning of the Mauthner cell of just one species at a time. ■

Dr Klaus M. Stiefel is a biologist, underwater photographer and PADI Tec Deep instructor based in the Philippines. His blog is found at: Pacificklaus.com.



Scuba Confidential:

It's Not Beasting

SCOTT BENNETT

Text by Simon Pridmore
Photos by Scott Bennett
and Peter Symes

In the 1950s, in the early days of recreational scuba diver training, many of the instructors were retired ex-military and they would use words like “beasting” to describe the harsh regime they meted out to their students to ensure they met their exacting standards for diver certification. Much was made of dropout and failure rates, as if the quality of an instructor resided not in how many students passed the course but how many failed.

This kind of mind-set was unlikely to build a successful commercial industry and, in the early 1960s, scuba diver training attitudes changed.

Over time, scuba diver training became much less of a commando exercise. The drills and skills changed so that they were no longer a test of courage, self-discipline, determination and the ability to conquer fear. The skills that were retained were those that taught new divers how to deal with the aquatic environment, manage their equipment and rescue themselves or their buddy from any emergencies that might arise. The emphasis was on “no-decompression-stop” diving, excursions where a direct ascent to the surface was always a viable avenue of escape if something went wrong, and the training was built around that

premise.

The result of these changes was a boom in the diving industry. From once being a sport that only the young, brave and super-fit could enjoy, now virtually everyone could learn to dive. So far, so very good.

However, having started swinging, the pendulum of change kept moving, as pendulums are designed to do. Over time, not only did diver training become less physically and mentally challenging, the trend towards cheaper, shorter courses meant people were being certified as divers with less well-developed capabilities. Beginner diver courses now gave students little

experience of dealing with stress and less importance was accorded to skills, such as mask clearing, that required mental discipline and took time to teach properly. It became very rare for a diver to fail a course. “Beasting” was a thing of the past.

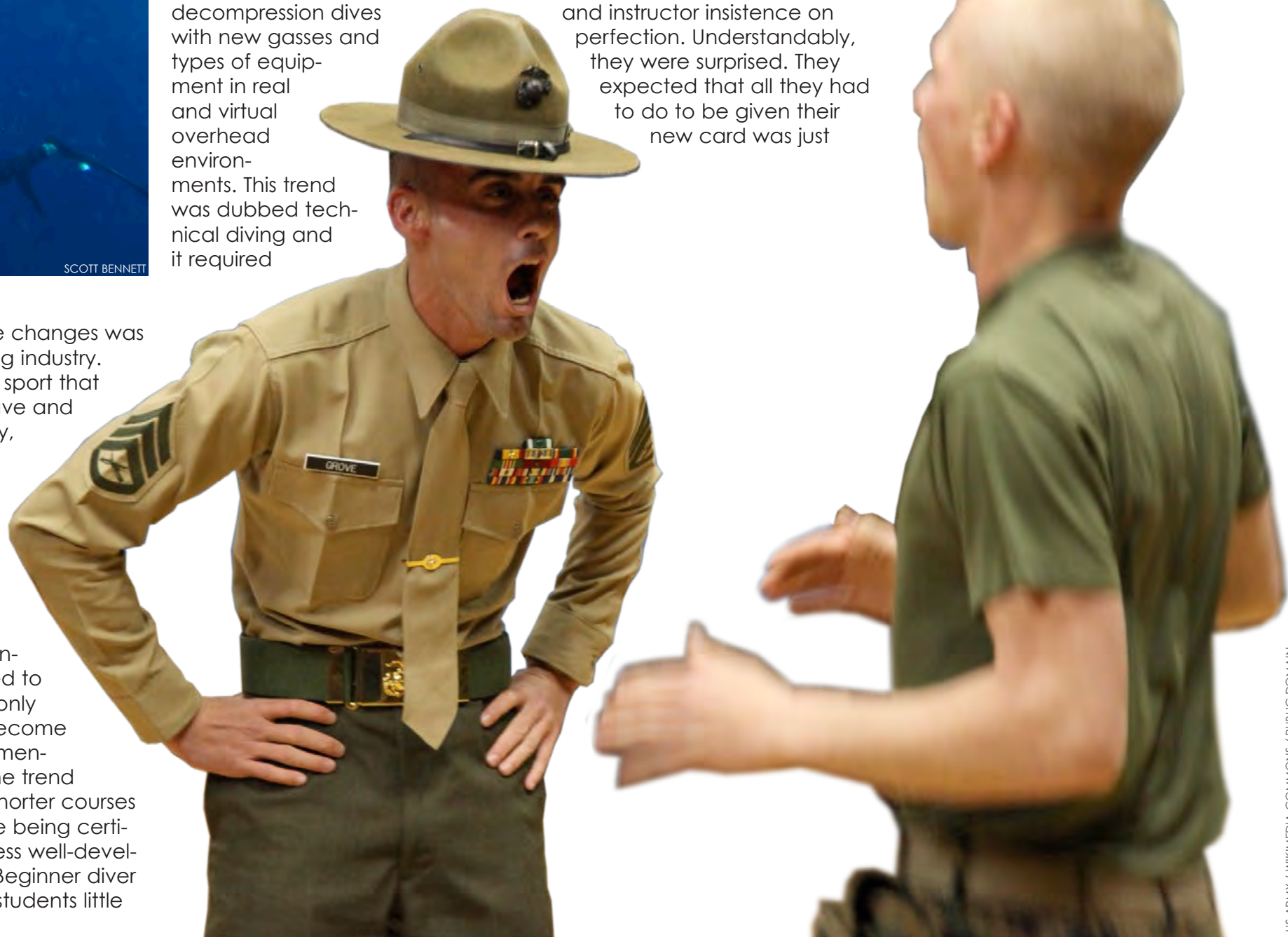
The technical revolution

In the early 1990s, opportunities arrived for sport divers to begin engaging in extended decompression dives with new gasses and types of equipment in real and virtual overhead environments. This trend was dubbed technical diving and it required

levels of skill and training far beyond the sport diving norm.

Dealing with more complex equipment and surviving in more challenging environments and situations demanded very high levels of performance. Most candidates for technical diver training, even very experienced divers, found it very tough. They had never before encountered concepts such as conditioning exercises, repeated practice and instructor insistence on perfection. Understandably, they were surprised. They expected that all they had to do to be given their new card was just

turn up, go through the motions, get things kind of right and that would be that. After all, every diving course they had done before had followed this sort of format. Oh, what a shock they got! And this, of course, led to technical diver training being referred to as “beasting”—the same word associated with the courses run back in the 1950s.



US ARMY / WIKIMEDIA COMMONS / PUBLIC DOMAIN





PETER SYMES

It's not beasting

There is a huge difference, however, between attitudes in those days and the way modern day technical diver courses are run. In technical training today, divers with poor skills are not cast aside as failures. They are encouraged to work harder and improve.

Technical diving courses are tough because the risks involved in technical diving are greater than in mainstream sport diving. Technical diving demands dedication of time and effort. Courses are academically testing. There is a vast quantity of information to digest and a huge amount of maths. The courses are also physically challenging with many hours of skills sessions and several long dives, during which students are confronted with a number of staged life-threatening incidents to deal with.

Complacency is a major threat to the safety of a technical diver. People who sign up for the courses often have a great deal of diving behind them and think that they already know everything. The initial confined water skills session is designed to be a sharp reality check, a reminder to the students that, despite their experience, they do not have the necessary skills. They discover that there are levels of diving ability that they have not even perceived before.

Embrace the opportunity

If you are not yet a technical diver and you are contemplating going down this road, don't be deterred by this. Prepare yourself for the feeling of being a novice again and embrace



PETER SYMES

it! Don't let your ego get in the way. Understand that the concept of pushing students to a point where they may break helps identify weaknesses in skills, mind-set, attitude or teamwork that must be strengthened if you are to become a safe technical diver.

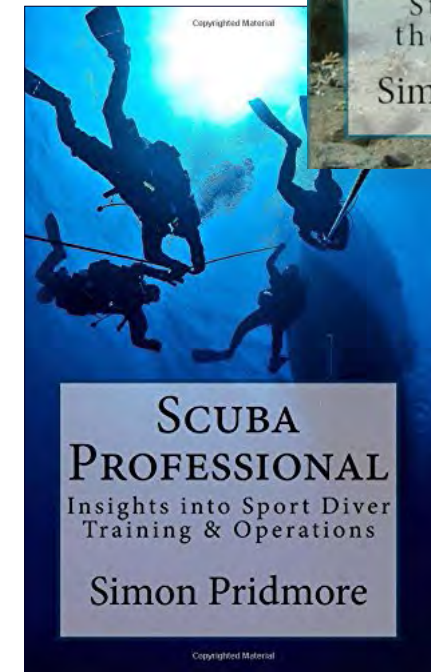
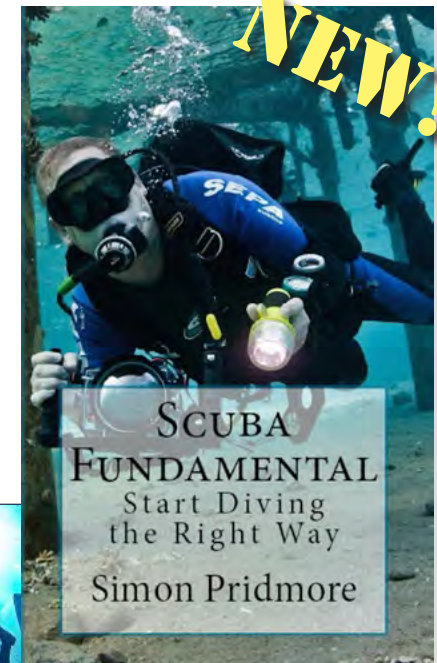
This training concept requires the instructor to devise artificial situations mimicking real life emergencies that will induce stress in the students. The students are faced with problems to solve, and their failure provides the instructor with opportunities to make teaching points in circumstances where the student is in the perfect state of mind to receive them. When divers make mistakes, particularly mistakes that they know could threaten their survival if the mistakes were made in a real life situation, then the memory of

the incident and the course of action they should have taken will become seared permanently into their minds. Such experiences also dispel complacency and encourage the diver to continue to practice and maintain their newly acquired crucial skills and instincts beyond the course so that they do not get forgotten.

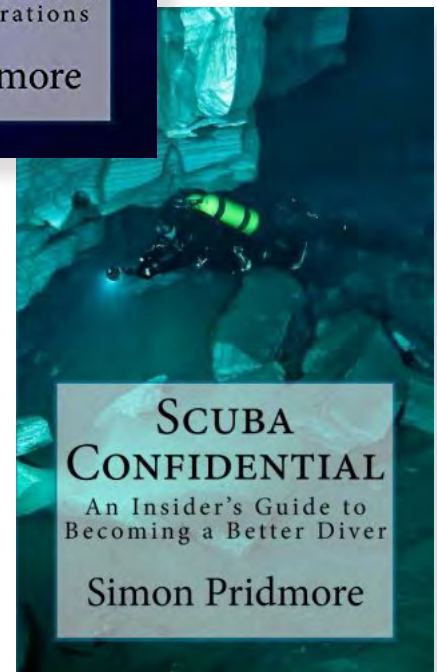
Divers learn the skills and techniques required to survive emergencies and repeat these until their performance becomes automatic. This creates a physical memory of a series of procedures that the divers will deploy instinctively, should similar emergencies occur for real in the future. Also, the knowledge that they have encountered the problem in training and dealt with it successfully gives them confidence. This is another crucial weapon in their survival armoury.

Get the trilogy!

Three books by Simon Pridmore no diver should be without



Available as paperback, ebook and audiobook at Amazon, Audible and iTunes



Click on the book cover to go to the order page, or go to the link below

www.simonpridmore.com



SCOTT BENNETT

Not Beasting

Luis's story

One of the reasons that technical diver training needs to be tough is in order to break divers of habits that they have fallen into and that are a threat to their survival. Let me end with an example.

Luis signed up for a technical diving course and was determined to show the instructor his stuff. He excelled in the confined water sessions and was made team leader for the first training dive.

It all started off fine. Arriving at depth, he gave an OK signal, indicated the direction of travel and then started swimming along the wall. For someone wearing doubles and a stage cylinder for the first time, his buoyancy and trim were excellent. He had a powerful fin stroke and looked good in the water. The only problem was that his team were not faring so well and they quickly fell behind.

Seeing the situation and spotting a great teaching opportunity, the instructor created a number of simulated team emergencies, all of which the team had to handle without their leader. They began to fall still further behind and, by now, Luis was too far ahead to notice. Half way through the planned bottom time, he reached the turn point of the dive. He waited patiently for

the others to catch up, flashed a quick OK sign, indicated that they were all to turn around and headed back to the ascent point. He arrived right on time. The others, who had fallen behind again, were late. This meant extended decompression time, which took them all, Luis included, to the limit of their gas reserves and created a lot of stress.

With everyone back on the boat, equipment stowed and drinks in hand, they all went to the bow for the dive debriefing. Luis was smiling confidently. But, instead of conducting the debriefing himself, the instructor handed it over to the dive team and asked them to assess their leader's performance. They completely savaged him. All the resentment, frustration and anger that had built up during the 90-minute dive spilled out. The lessons Luis learned from his teammates were transmitted with such passion that he probably still remembers them today.

Luis ran the dive as if it was a competition rather than a team exercise where, unless everyone succeeds, they all fail. Scuba diving is a team exercise, not an individual pursuit. Unfortunately, in mainstream sport diving, although the concept of diving together is mentioned frequently in the

Easier Communications
Faster Learning
Safer Diving...



Human Factors Skills in Diving

Do you want to learn how to apply the hard-worn lessons from aviation, oil & gas and healthcare to your diving to make it more fun, having greater awareness and more memories, and ultimately become a safer diver?

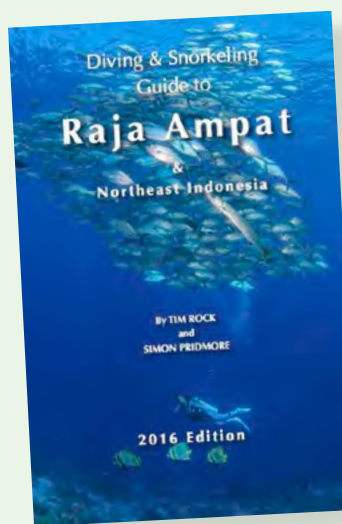
Globally unique training and coaching focussing on creating high performance dive teams and individual divers.

Visit

www.humanfactors.academy
to learn more



Unlocking high performance in teams and individuals



New Dive Guide to Raja Ampat

As part of their series of 2016 Diving and Snorkeling Guides, authors Tim Rock and Simon Pridmore have produced a brand new guide to Raja Ampat and Northeast Indonesia.

Diving or snorkeling in this remote region at the edge of the Pacific Ocean is a life-affirming, bucket-list-topping experience! Abundantly rich in

marine life, these seas are proving to be a gift for divers that keeps on giving. Raja Ampat is the superstar destination, but other areas such as Cenderawasih Bay, Triton Bay and Southwest Halmahera are shining brightly too and acquiring similarly mythical status.

This richly illustrated, detailed and informative guide is the first to cover all of these incredible places! It tells and shows you—the adventurous travelling diver—what to expect from this remote, fascinating and often downright astonishing part of the world. It will help you plan your trip, enhance your experience when you get there and provide you with the best possible souvenir of your visit. Available on **Amazon.com**



opinion



PETER SYMES

context of the much-maligned buddy system, it is greatly misunderstood, poorly applied and largely ignored. So experienced divers usually end up functioning alone and only look for another diver to help them when an emergency strikes, hoping there will be someone around.

In technical diving, the concept is that the team is always stronger than the sum of its parts. It is crucial that a dive team swim together, stay in visual contact and not drift too far apart. This is so that they can always use their

combined force, skills and gas supply to help a team member who gets into difficulty. This is one of the principal things that most divers have to learn when they begin technical diving and it is not easy to break old habits. That is why the training is uncompromising. The reason why students often fail tests in the early phases of the training is that they try to solve the problems alone. Once they start working as a team, the solutions are much easier to find.

There is a method. There is a purpose. It is not just beasting! ■

Simon Pridmore is the author of the international bestsellers, Scuba Confidential – An Insider's Guide to Becoming a Better Diver, Scuba Professional – Insights into Sport Diver Training & Operations and Scuba Fundamental – Start Diving the Right Way. He is also the co-author of diving and snorkeling guides to Bali and Raja Ampat and Northeast Indonesia. This article is adapted from a chapter in Scuba Professional.

DIVE SHOW RU 2017

ESSENTIAL SCENE FOR UNDERWATER PEOPLE

FEBRUARY 2-5 SOKOLNIKI, MOSCOW

DIVING

SPEAR-FISHING

FREEDIVING

U/W PHOTO & VIDEO

NEW FEATURES FOR 2017

WATER PEOPLE

WATER KIDS

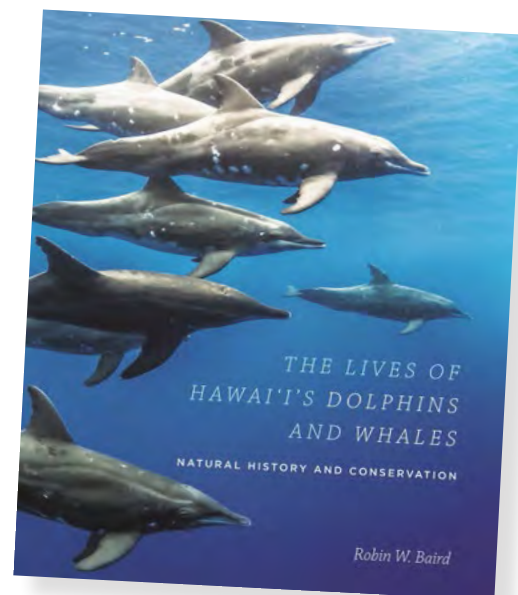
BEACH

PLAYGROUND

BOOK YOUR BOOTH!

sale@diveshow.ru

Edited by
Catherine
GS Lim

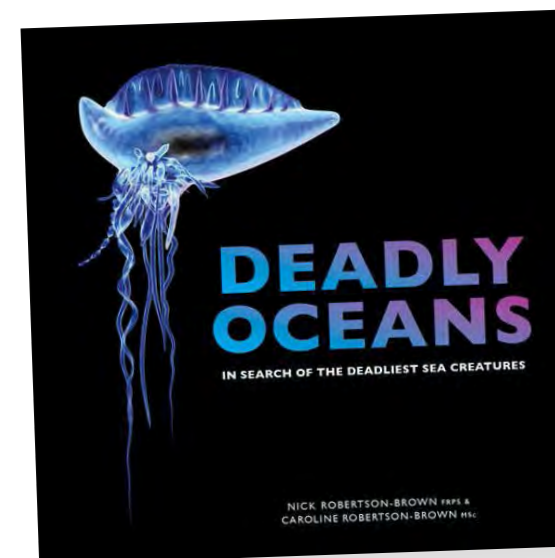


Dolphins

The Lives of Hawai'i's Dolphins and Whales: Natural History and Conservation, by Robin W. Baird.

This book features Hawaii's dolphins and whales, with stories and observations from the author's work over the last 17 years. It includes full-color photographs of each species, life history descriptions, conservation threats and maps showing sighting locations and movements of tagged individuals. For each species, author Robin W. Baird presents data obtained from long-term photo-identification studies, with distinctive individuals tracked through time and space. He also provides information on predators and prey, social organisation, diving and night-time behavior. The book then focusses on conservation issues, engaging readers to consider ways to protect these creatures.

Paperback: 352 pages
Publisher: University of Hawaii Press
Date: 30 November 2016
ISBN-10: 0824859987
ISBN-13: 978-0824859985

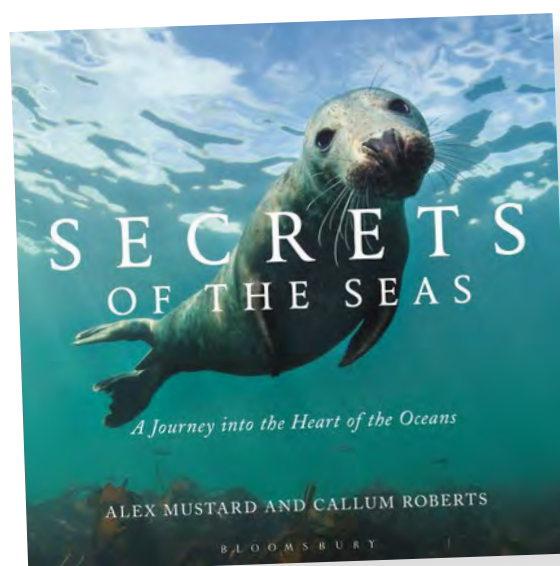


Sea Creatures

Deadly Oceans: In Search of the Deadliest Sea Creatures, by Nick and Caroline Robertson-Brown.

This book showcases the 50 deadliest marine animals in the world. Among those making it to the list are the usual suspects, including the jellyfish, sea snakes, lionfish, pufferfish, stingrays, leopard seals, orcas, crocodiles, sharks, blue-ringed octopuses and cone shells. Photographs by Nick and Caroline Robertson-Brown accompany every entry, along with a concise description of the creature's capabilities and location. Despite its dire subject matter, this 160-page hardcover book is bound to be of interest to both divers and non-divers alike.

Hardcover: 160 pages
Publisher: New Holland Publishers
Date: 1 November 2016
ISBN-10: 1921517824
ISBN-13: 978-1921517822



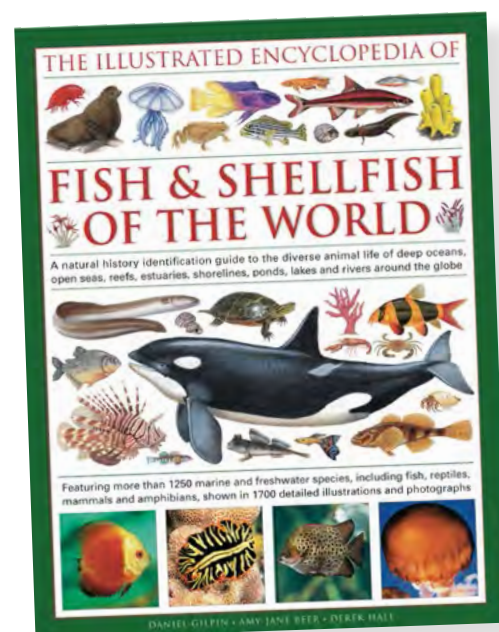
Marine Life

Secrets of the Seas: A journey into the heart of the oceans, by Callum Roberts, with photos by Alex Mustard.

This book deals with the issue

of change in our oceans, alongside stories of oceanography, marine life and human history in the seas. Through reading it, it is hoped that readers would be more acquainted with the oceans and understand how marine animals live underwater, as well as how the creatures adapt to change in the past, present and future. Each chapter contains a 1,500-word essay with captions by natural history writer Professor Callum Roberts. The stunning photographs in this book—more than 200 of them—are taken by award-winning underwater photographer Alex Mustard.

Hardcover: 240 pages
Publisher: Bloomsbury Natural History
Date: 11 October 2016
ISBN-10: 1472927613
ISBN-13: 978-1472927613

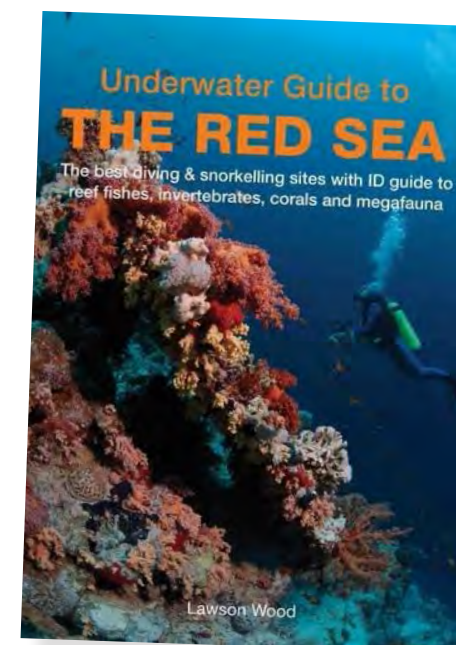


Fish Encyclopedia

The Illustrated Encyclopedia of Fish & Shellfish of the World, by Daniel Gilpin, Derek Hall and Amy Jane Beer.

This is an identification guide featuring the diverse range of fauna living in the deep oceans, open seas, reefs, estuaries, ponds, lakes and rivers around the world. More than 1,250 marine and freshwater species are covered in this hardcover book, which contains as many as 1,700 illustrations and photographs. The animals featured include fishes, crabs, corals, echinoderms, jellyfish, sharks, rays, whales, reptiles and amphibians.

Hardcover: 512 pages
Publisher: Lorenz Books
Date: 7 November 2016
ISBN-10: 0754820718
ISBN-13: 978-0754820710

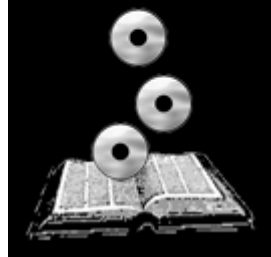


Red Sea

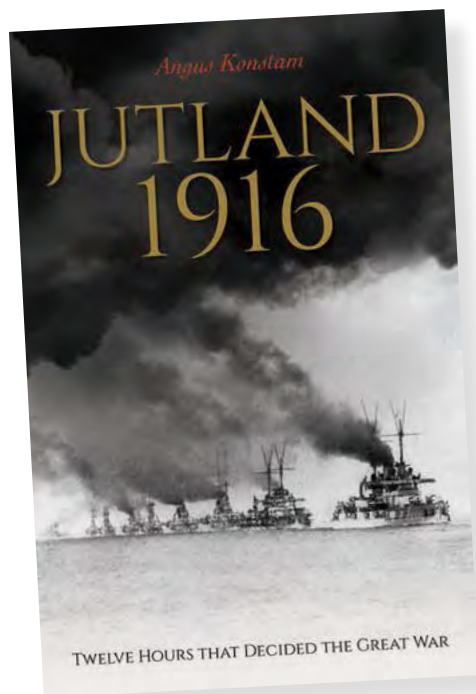
Underwater Guide to the Red Sea, by Lawson Wood.

With over 1,000 invertebrate species, over 200 species of soft and hard corals, as well as 1,100 fish species, the crystal clear waters of the Red Sea is without doubt a popular dive destination. There are shallow patch reefs, drift dives and walls, and interesting wrecks like the *Carnatic* and *Thistlegorm*. This 160-page pocket-sized guide provides a general introduction to diving and snorkelling in the Red Sea. Readers find out what to expect, where to base themselves, and which are the best dive sites. There is even a photographic identification of 280 common species of marine life.

Paperback: 160 pages
Publisher: John Beaufoy Publishing Ltd
Date: 28 October 2016
ISBN-10: 1909612847
ISBN-13: 978-1909612846



Battle of Jutland

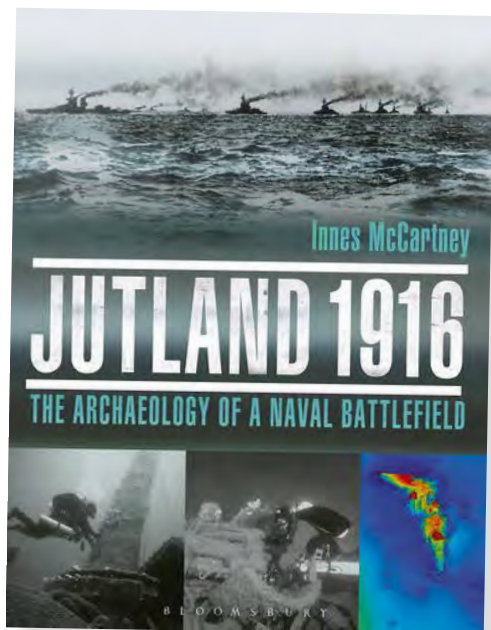


12 Hours

Jutland 1916: Twelve Hours to Win the War, by Angus Konstam.

This book tells the story of the Battle of Jutland, the greatest naval battle during World War I. Drawing on a number of first-hand accounts (some previously unknown) and original research, the author uses a fast-paced narrative approach to relate the events as they unfold. As the story is told from both the British and German sides, this book provides a fresh perspective on this battle.

Hardcover: 352 pages
 Publisher: Aurum Press Ltd
 Date: 9 August 2016
 ISBN-10: 1781312885
 ISBN-13: 978-1781312889



Marine Archaeology

Jutland 1916: The Archaeology of a Naval Battlefield, by Innes McCartney.

In this book, marine archaeologist and historian Dr Innes McCartney reveals for the first time what became of the warships that vanished on the night of 31 May 1916. He examines the circumstances behind each ship's demise and reconciles what was known in 1916 with what today's archaeological surveys have revealed. In doing so, the facts behind several Jutland enigmas, including the devastating explosions which claimed five British warships, the details of the wrecks of the 13 destroyers lost in the battle, and the German warships scuttled during the night phase are unravelled. This is the first book to identify the locations of many of the wrecks, making it an invaluable reference for anyone interested in naval history and marine archaeology.

Hardcover: 272 pages
 Publisher: Conway
 Date 31 January 2017
 ISBN-10: 1844864162
 ISBN-13: 978-1844864164



Revelations

Jutland: The Naval Staff Appreciation, by William Schliehauf and Stephen McLaughlin.

The Battle of Jutland had led to arguments and ill will within the Royal Navy, including those in the upper ranks who were directly involved in the battle. An attempt to produce a critique of its performance was delayed and heavily censored, and this was followed by the Naval Staff Appreciation volume, which attempted to record the developments of the battle for use in training future officers at the Naval Staff College. This was regarded as too damaging, so its publication was halted and all proof copies destroyed. Nevertheless, a few copies managed to survive. This book has been transcribed from one of the last remaining copies, and contains modern commentary and explanatory notes to place it in the proper context.

Hardcover: 256 pages
 Publisher: Naval Institute Press
 Date: 15 April 2016
 ISBN-10: 1848323174
 ISBN-13: 978-1848323179

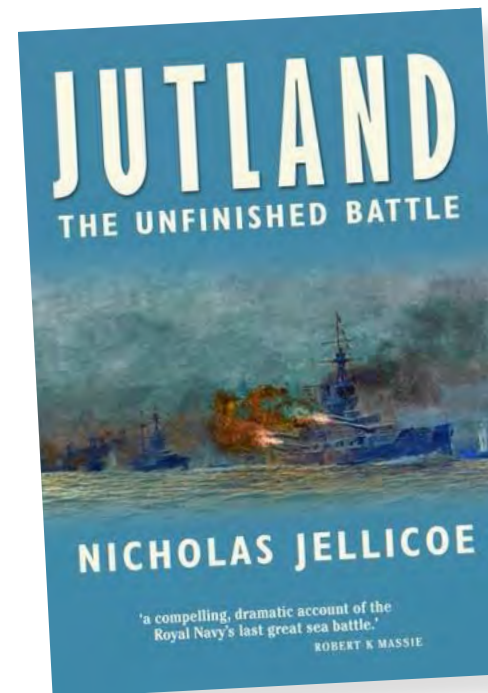


Perspective

Skagerrak: The Battle of Jutland Through German Eyes, by Gary Staff.

This book tells the story of the Battle of Jutland from the German perspective. By cross-referencing German and British official records and accounts, author Gary Staff has established the most coherent narrative of the battle, using eyewitness accounts from the crews of the German ships. The result is a gripping read that gives a real sense of the drama, tension and terror of being in battle. The well-researched and accessible text is supported by clear maps and many archival photos (many of which have never before published), showing the German vessels before, during and after the battle.

Hardcover: 288 pages
 Publisher: Pen and Sword
 Date: 8 July 2016
 ISBN-10: 1783831235
 ISBN-13: 978-1783831234



Controversy

Jutland: The Unfinished Battle: A Personal History of a Naval Controversy, by Nick Jellicoe.

A century after it took place, historians are still debating this controversial and misunderstood Battle of Jutland. What was in fact a strategic victory stands out starkly against the background of public disappointment in the Royal Navy, and decades of divisive acrimony and infighting between the camps supporting Admiral Sir John Jellicoe and Admiral Sir David Beatty. Based on the latest research, this book retells the story of the battle from both a British and German perspective, clarifying the context of this naval clash. It also traces the "Jutland Controversy", the dispute that ensued until Admiral Jellicoe's death in 1935.

Hardcover: 352 pages
 Publisher: Naval Institute Press
 Date: 15 May 2016
 ISBN-10: 1848323212
 ISBN-13: 978-1848323216



The Suunto DX, built on the award-winning Suunto D9tx, is the first of its kind to feature CCR compatibility.

Text by Peter Symes
Photos: Peter Symes. Historic images: Suunto

Suunto is like Kellogg's cornflakes to me—a brand that has been with me, like, forever. Well, perhaps not quite that long, but at least since my early diving days, now obscured in the fog of memory. Several decades down the line, I am now on my fourth instrument. Not that I have actually worn out any of them; they have all been good and reliable companions. But as newer and much more capable models invariably came along, upgrades were too hard to resist. I was thus excited to be given a chance to visit Suunto in Finland, and have a look behind the scenes.

The headquarters are located on the outskirts of Helsinki, which, by the way, is quite an exciting and appealing city, laden with history and interesting shopping. Oh, and did I mention design?

Suunto, as I would find out, is very much the embodiment of Finnish virtues: fiercely independent, innovative, quality-minded and design conscientious. I have conducted business on three continents, and most businesses with which I have dealt have always been somewhat grounded in or flavored by local customs, but rarely to the degree I saw in Suunto's conference room. Their famed lakes, vast forests and convoluted

shorelines were never far away, as I listened to their thoughts on legacy, nature, design, lifestyle and how it all came together. "Sophisticated Roughness," the tagline read on one of their opening Powerpoint slides, which had an image of high-tech society juxtaposed with an image of grand wilderness. That is indeed the apparent contrast Suunto appears to strive to unify.

But I am getting ahead of myself—some 80 years or so. "Humble beginnings" is an over-used cliché, but in Suunto's case, it is appropriate. It started off with a problem looking for a solution. As the company's annals state, in the early 1930s, Tuomas Vohlonen—an engineer and surveyor by trade—had grown frustrated by the inaccuracy and lack of steadiness in using

"Like so many other companies, it was started by one man, having one idea."

Suunto

Turns 80
— It Started with a Compass



Historical photo from of Suunto's factory in the 1940s

Suunto's vision statement:

The most desired brand of sports watches and solutions for adventurers

compass also worked underwater. Provided with his feedback, Suunto didn't take

long to introduce the SK-4, the world's first dedicated diving compass, and with it, the company's first foray into the still nascent dive industry. The present SK-8 model is a direct descendant thereof.

Among the many milestones, one that stands out as significant was reached in 1987 when Suunto introduced the first wrist-mounted dive com-

puter for the sport diving community—the SME-ML, which could be seen now as the grandfather of dive comput-

ers as we have come to know them. Compared to present-day computers, it was, obviously, quite basic. But at the time it hit the market, it was groundbreaking.

Basically, it was an electronic dive table (US Navy) paired with a depth gauge and timer. The computer also added multi-level capability—a defining feature, which we now take

for granted. It also looked very much like a dive computer, as we have come to know them, and not all that dated either, taking into consideration that it is now a nearly 30-year-old invention.

A long series of dive instruments followed, and new models continued to be introduced on a regular basis, leading up to the DX—the first rebreather-compatible wrist-sized dive computer, which was unveiled in 2013. It was followed the next year by the EON steel, which combines advanced technology with a bright color



a traditional dry compass and set out to find a better solution. He came up with the liquid-filled compass in which the magnetic needle and damping fluid were completely sealed.

After being granted a patent in 1935, he founded Suunto Oy ("suunto" is Finnish for "direction") with his wife and nephew, and the rest is history—albeit one peppered with milestones and significant inventions. Vohlonen died just four years later in 1939, after which, his widow took the helm and guided the com-

Historical photo from the 1950s of an employee calibrating a Suunto compass.

pany through the difficult times of war. After WWII, the company underwent rapid expansion, supplying compasses and other navigational instruments to both the civilian and military sectors.

Diving

Fast forward to the mid-1960s: Suunto got into diving when a British sport diver, in 1965, took note that his

Suunto wrist



Suunto SK-4, the world's first dedicated underwater compass



Suunto's old warehouse in the 1940s



THIS PAGE: Scenes from Helsinki, Finland

was developed by Dr Bruce Wienke. It lists three varieties of this model: Suunto RGBM, Suunto Technical RGBM and Suunto Fused RGBM, which are used in different models. The finer details about how they differ is a complex story for another day.

While all these innovations for divers were being launched at regular intervals from the late 1990s and onwards, Suunto branched out to making instruments for other outdoors activities. Highlights include the Vector from 1998—an outdoor training watch, which featured an altimeter, barometer and compass. It remained in production until 2015, even after the launch in 2012 of the Ambit, which had additional features such as a built-in GPS and body monitor.

Diving is thus but one business unit of Suunto, which now employs 500 people worldwide and reached an annual turnover of 140 million Euros (US\$152.8 million). Since 1999, Suunto has been a subsidiary of Amer Sport—another Finnish company, which also owns a range of brands of sporting and outdoor goods such as Salomon and Atomic Ski (snowsports), Arc'teryx (hiking, climbing, backpacking) and several more.

“Amer Sport is an exciting company to be part of,” said Suunto’s president, Mikko



Moilanen, “but first of all, we are the market leader in dive computers, and we are in that position because we were there first and have invested massively in developing technology and new innovations such as the PC-interface, RGBM, air integration and so on...”

Philosophy

“At the base of all our designs is rock-solid engineering,” explained Business Unit



screen and customizable features. Suunto’s own timeline is posted here: <http://bit.ly/2eRSzbc>.

Suunto has also worked extensively on dive algorithms for the calculation of decompression, building on the reduced gradient bubble model (RGBM), which





Upwards view from the reception area



Suunto is also a lifestyle accessory. Screenshot from presentation on Suunto's design philosophy and branding on the global market.



Suunto's HQ in Vaanta, a short commute from the center of Helsinki, is a rather nondescript complex on the outside but facilities on the inside seemed like a quite pleasant place to work, with lots of open space in between offices.

"We cover the highest mountains to the deepest oceans, and everything in between."



The Ambit3 series is a GPS watch with advanced outdoor and multisport function, which comes in three varieties: Peak, Vertical and Sport. While exercising, a Bluetooth-connected heart rate sensor measures and stores the heart rate data, which is then transferred wirelessly to the watch.



Kailash is a contemporary traveler's watch, which logs your travels and keeps you up to date wherever you are. See calls, messages and push notifications on the watch with smart mobile connection.

Director Mika Holappa. "First of all, the products are built for the outdoors. Yes, they are beautiful—design is obviously important to us—but they also need to function under extreme conditions. So, there are certain elements, such as authentic craftsmanship, which goes into it. And this kind of Scandinavian approach works extremely well ... There's no nonsense, no fuss, which is what differentiates us from the lot. Design is not an easy thing; the devil is always in the detail. We also put a lot of thought into our interfaces, and our computers are known to be easy to use, but that is also a challenge in itself. Less and less people actually bother to read the manual, so it should be straightforward to use straight out of the box."

Design

"How do we do things?" Design Director Antti Kujala asked rhetorically. "First, what I like about this brand," he began, "is that you get work in the context of sports. Secondly, everything is designed and manufactured here in Finland, and we don't separate things. It is the same people who work on several product ranges. We are also aware that, at any given moment, 24/7, some people somewhere are

doing wild things and relying on our products to keep them alive while enjoying themselves—and that is pretty humbling.

"Everything we do needs to be authentic, and we need to be aware that this is serious stuff. Putting that together with nice design is where things get difficult. As a Finnish brand, Suunto adheres to the Nordic and Scandinavian design philosophy in which everything is required to have a function or a purpose, and that is where you see the reductionism—where we are striving to simplify and reduce the



The Suunto Spartan solution for athletic and adventure multisport comprises Suunto Spartan GPS watches, renewed Suunto Movescount.com and mobile smart phone applications.



Essential is a rugged but stylish watch with built-in altimeter, barometer and compass. Made from ceramics, stainless steel and Sapphire crystal glass.



The EON Steel combines advanced technology with a bright color screen and is designed to be visually intuitive, with a simple, easy user interface of menus and buttons. It is fully customizable and has the following modes of operation: gauge, air, nitrox, trimix and CCR.

"Design is not an easy thing; the devil is always in the detail."



THIS PAGE: The Suunto factory floor as it is today. The product line is divided into "cells" in which products are assembled by hand. The environment of the factory is tidy, clean, functional and safe, and rather muted—not much sounds at all.



Suunto Cobra 3 hose air integrated dive computer



Where these three iconic dive computers (and others) are assembled by hand and tested.

resulting product. You see this in Apple products too, so it is a universal quality. There are a couple of reasons for this. First of all, you need to be able to trust the product. Secondly, when you have less visual clutter, the materials start to breathe. Thirdly, it has to be functional in use."

Production

The product line is divided into "cells" in which products are built by hand. At first glance, the factory floor, as seen from above, looks like—well, I was about to say it looks like a scene from an upcoming Terminator movie, but certainly, it was a bit surreal, like a gargantuan Meccano set. In this bewildering maze of pipes, cables, racks, equipment, test benches, screens, tools, apparatus and numerous contraptions and construc-



Suunto DX technical dive computer

tions least eye, a unknown function— perhaps for some pressure chambers—staffers worked intently, manually assembling and testing the many fine products in Suunto's assortment.

The environment and ambience of the factory, while being a far cry from cosy and bordering the sterile, appeared tidy, clean, functional and safe—as it should be—without any weird smells or loud noises. In fact, it was rather muted, with not much sound

of, at to my mostly function— except

Suunto Vyper Air dive computer



at all, just like some sort of laboratory.

I thought, "So, that's what a high-tech manufacturing plant making dive instruments looks like." Well, that was interesting. ■





App allows the public to follow whales

Unmanned deep diving gliders equipped with voice recognition software make it possible to follow large baleen whales as they swim off the coast of Atlantic Canada. An app just launched by the Canadian Wildlife Federation allows the public to follow the whales.

The Underwater gliders deployed by Dalhousie University can dive to a depth of 200m, detect whale calls up to 100km away and stay at sea for up to three months.

Equipped with hydrophones (underwater microphones), they listen for the whales. When whales are heard, the types of whales and their location are transmitted to the Whale, Fish and Particle Lab at Dalhousie University for validation.

Next, the gliders alert regional ship traffic and even the navy to the locations of these whales in

near-real time. The researchers hope this information will help ship traffic avoid collisions with whales.

In real time

Since the summer, the gliders have traveled thousands of kilometers off the coasts of Nova Scotia and the Gulf of St. Lawrence in northern New Brunswick, sending back real time locations of whales and ocean water conditions. Although the Dalhousie researchers get real time locations, the glider data will be uploaded to the app weekly.

The gliders do not say how many

whales are out there. They only ping each time there is an encounter. Tracking showed the endangered Atlantic right whale—whose population is down to about 500—congregating off the Gaspé Peninsula and not in traditional grounds in the Roseway Basin off southern Nova Scotia.

“They are showing up in places where we didn’t expect or not showing up where we do expect. Now we have a way to search for those animals in a cost effective manner,” said Kim Davies, a researcher at Dalhousie University. ■



North Atlantic right whale



Extinct Baiji possibly spotted in the Yangtze River

Chinese conservationists believe they may have caught a rare glimpse of a freshwater dolphin that was declared functionally extinct a decade ago, the *Guardian* reports.

Song Qi, the leader of the expedition told the *Guardian* the unconfirmed sighting occurred during a seven-day search mission down the Yangtze that began in the city of Anqing on 30 September. The amateur conservationist, whose day job is as a publisher in Beijing, admitted he was not a baiji specialist, but local fisherman who had also seen the creature were “100 percent certain” it was the baiji.

Song said he hoped his team’s unconfirmed baiji sighting would prompt renewed efforts to save the species. With the apparent confirmation of its demise, the narrow-beaked river dolphin has become a symbol of the devastating environmental price China has paid for decades of unchecked development.

Skepticism

“Extreme claims for the possible survival of probably extinct species require robust proof, and while I would deeply love there to be strong evidence that the baiji is not extinct, this isn’t it,” biologist Samuel Turvey, a senior research fellow at the Zoological Society of London who took part in the unsuccessful 2006 search mission wrote the *Guardian* in an email. ■

Our World Underwater
BEST DIVE & TRAVEL SHOWS
in the Central United States

LONE STAR STATE
DIVE & TRAVEL EXPO



January 28 - 29, 2017
Saturday 9AM - 6PM
Sunday 10AM - 4PM

Dallas/Frisco Embassy Suites Hotel, Convention Center
7600 John Q. Hammons Drive, Frisco, TX 75034

CHICAGO
DIVE & TRAVEL EXPO



Feb. 24 - 26, 2017
Friday 5PM - 9PM
Saturday 9AM - 6PM
Sunday 10AM - 4PM

Donald E. Stephens Convention Center
5555 N. River Rd., Rosemont, IL 60018

Equipment Sales - Large Exhibit Area - Travel Planning
Film Festivals - In-Depth Workshops - Seminars

For More Information:

Call: 630.209.2445

E-Mail: info@OurWorldUnderwater.Com





Sharks are usually peaceful together (as shown) but can display agonistic postures when threatened or irritated

Text by Ila France Porcher
Photos by Ila France Porcher
and Peter Symes

Meaningful posturing in sharks was first noticed in the gray reef shark. Richard Johnson of French Polynesia found that when sharks of this species were chased and cornered, they performed a complex display.

The animal would arch its back, raise its snout, depress its pectoral fins and swim toward the offending diver with exaggerated horizontal swimming movements, sometimes rolling or looping in a spiral. Then it would either flee, or, with a lightning gesture, deliver a warning slash. (One of the most startling things about sharks is the speed at which they can suddenly move.)

The intensity of the shark's display increased with the speed and directness of the diver's approach, and the degree to which its escape route was blocked. The gesture appeared to be a ritualized warning that the animal was being pushed too far, and was about to act

more decisively: to slash or flee.

Johnson termed this posturing an agonistic display—agonistic being the term used to describe social behaviors involving competition and conflict among animals. In contrast, acts of predation are done at high speed and very suddenly, with no signaling in advance by the shark.

Agonistic displays in other species

Aiden Marten's 2007 review of shark displays describes variations of the gray reef shark's dramatic posturing in 23 species of sharks from six families, including the great white shark, tiger shark, sand tiger shark, scalloped hammerhead shark, silky shark, blue shark, several reef sharks and basking shark.

Jerky, exaggerated movements or sudden turns, accompanied by the depression of the pectoral fins, are most common. Sometimes the shark also holds its mouth open, gapes repeatedly, or billows its gills. While diving with sharks, the best indicator to look for is sudden changes of direction, and lowered pectoral fins.

One reported incident took place on the Great Barrier Reef when silvertip sharks were crowded by photographers. They accelerated away initially, then some charged back. At about two body lengths from the divers, they turned broadside and moved slowly past the divers. Each displaying shark lowered its pectoral fins and tail, gaped its jaws

Posturing Sharks

PETER SYMES





rhythmically and vibrated its entire body, as if shivering, as it passed the offending divers. Then it accelerated away.

The sandbar shark will also turn broadside to divers while depressing its pectoral fins. In one instance, female sandbar sharks were reported to ram a diver with their snouts, while the males veered away while still over a body length away.

The great white has been documented displaying with arched back toward other sharks during feeding, and gaping repeatedly.

The ritualization of conflict

Animals that have evolved weapons that are dangerous to others, will also have behavioral strate-

gies that keep them from mortally injuring others of their own kind. A wolf which finds itself on the losing end of a battle, for example, will roll over to display its unprotected underside to the teeth of its adversary. And no wolf—or dog for that matter—would ever break the unwritten rule that once the submissive gesture is given, the fight is over. Certain fighting birds will offer the back of the head in defeat, in a similar gesture. The agonistic displays of sharks are likely strategies serving the same purpose.

Shark ethologist Peter Klimley described in his book, *The Secret Life of Sharks*, how great white sharks ritualize their conflict when a seal that one of them has killed

comes under dispute. Each slaps the water at an angle with its tail, and the shark who raises the most water and blasts it farthest, wins the prey. For this ritual to be effective, each shark must read the gesture as a communication, and the loser must acknowledge the winner to avoid a physical battle for the seal, which would badly hurt both sharks.

Other shark gestures

Marten's comprehensive review suggests that agonistic displays are likely widespread among sharks of many species, but also that the gray reef shark's posturing is exceptional in its form and presentation. In other species, such displays are less clearly defined, or predictable. Agonistic displays are rarely seen on dives, so most sightings are anecdotal, which results in a tendency to view them as rigid and unchangeable. Marten himself found that, unlike the gray reef sharks of French Polynesia, those in the waters off Australia would not display. When chased, they simply departed.

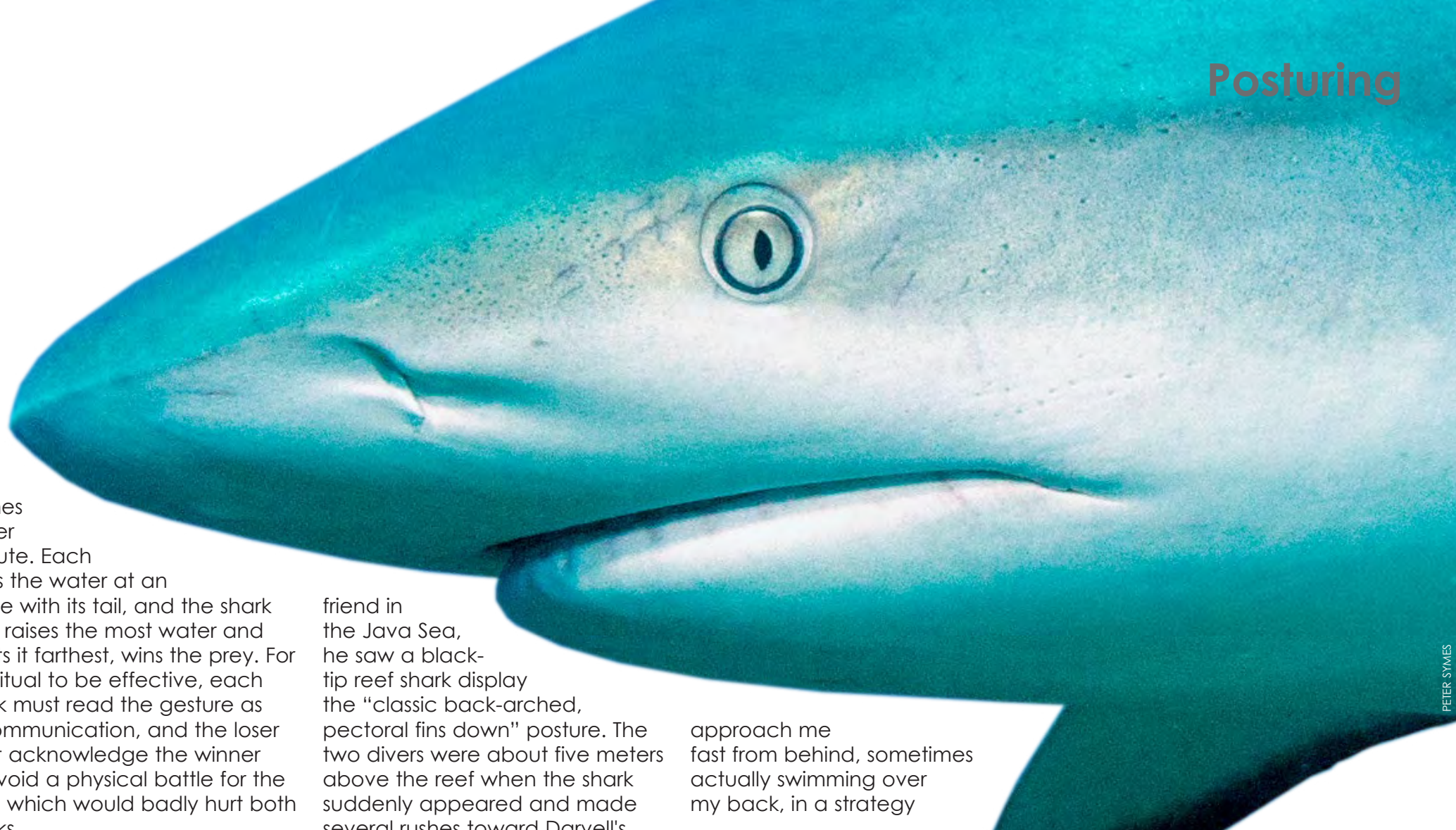
Shark diver Dr Brian W. Darvell reported that while diving with a

friend in the Java Sea, he saw a black-tip reef shark display the "classic back-arched, pectoral fins down" posture. The two divers were about five meters above the reef when the shark suddenly appeared and made several rushes toward Darvell's buddy. No food or scent was present, and the shark had been neither chased nor cornered.

The blacktip shark is known for its habit of dashing up to a person and turning away at the last minute, and spear fishermen will often complain about this harassing close approach. Except for the arched back and lowered fins, Darvell's unique account is reminiscent of such behavior. Had the shark learned from prior experience that divers may have fish to steal, its actions become more understandable.

In past field research with sharks, I was sometimes harassed by blacktips that had apparently learned that divers can trail dead or dying fish on lines behind them. These individuals would

approach me fast from behind, sometimes actually swimming over my back, in a strategy



Blacktip reef shark turning without displaying

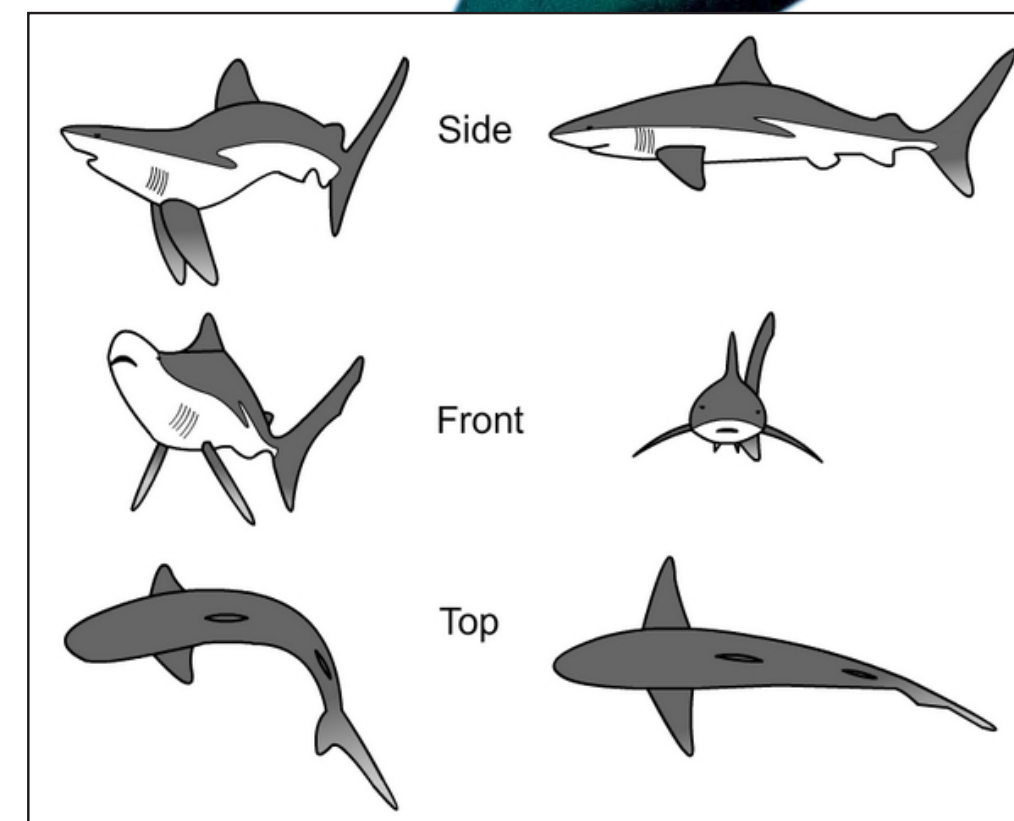


Diagram of the gray reef shark's agonistic display

PETER SYMES

CHRIS HUH / WIKIMEDIA COMMONS / PUBLIC DOMAIN

ILA FRANCE PORCHER

shark tales



learned from experience—learning is an important aspect of feeding in sharks. But once they learned that I did not trail fish behind me, their behavior changed accordingly, and they never swam over me from behind again.

Darvell's report is the only one of such a display in a blacktip reef shark.

One gesture may serve many purposes

Blacktips present a variety of other muscle-flexing and agonistic behaviors, which were not reported by Marten. Usually, for example, these sharks perform their close approach to divers slowly.



ILA FRANCE PORCHER

Once the wild blacktip sharks I studied in French Polynesia had become familiar with my visits to their ranges, certain ones would swim slowly up to my face as soon as I appeared underwater, suggesting that in this context, the purpose of the gesture was connected with affirming my

identity. In the wild, animal gestures often appear to be adaptable for use in various situations.

Occasionally, at a feeding session, a shark would make a close approach to an eel, when one of the large ones—the Javanese moray—was stealing pieces

of food. The shark would poise in front of the eel for a moment, before veering away. Its approach seemed to correlate with the eel's response in that the distance at which it paused, depended on the eel's reaction to its offensive gesture. So, in this case, the close approach seemed to be a test of the mettle of the other animal—would it flee or not? The shark's action suggested predator inspection, with the

inspector highly attuned to the reaction of the inspectee. The close approach of the blacktip shark, whether done quickly or not, never results in opening the mouth or biting, and presents as an agonistic display, though no muscle-flexing is involved.

Fear reactions

The only times I saw blacktips swim jerkily with the back arched, was after being startled, usually after a juvenile had nearly collided with a larger shark of another species. The small shark would accelerate away, arching its back vertically in a series of rapid jerks. The reaction seemed adapted to make the pup harder to grab by a predator, and the arching of the back guaranteed that the shark would rise upwards as it fled, free from the hindrances of the sea floor.

When startled, adult sharks, too, would sometimes accelerate away with a few sharp vertical undulations. Their behavior resembled the agonistic display of the gray reef shark without the exaggerated



PETER SYMES

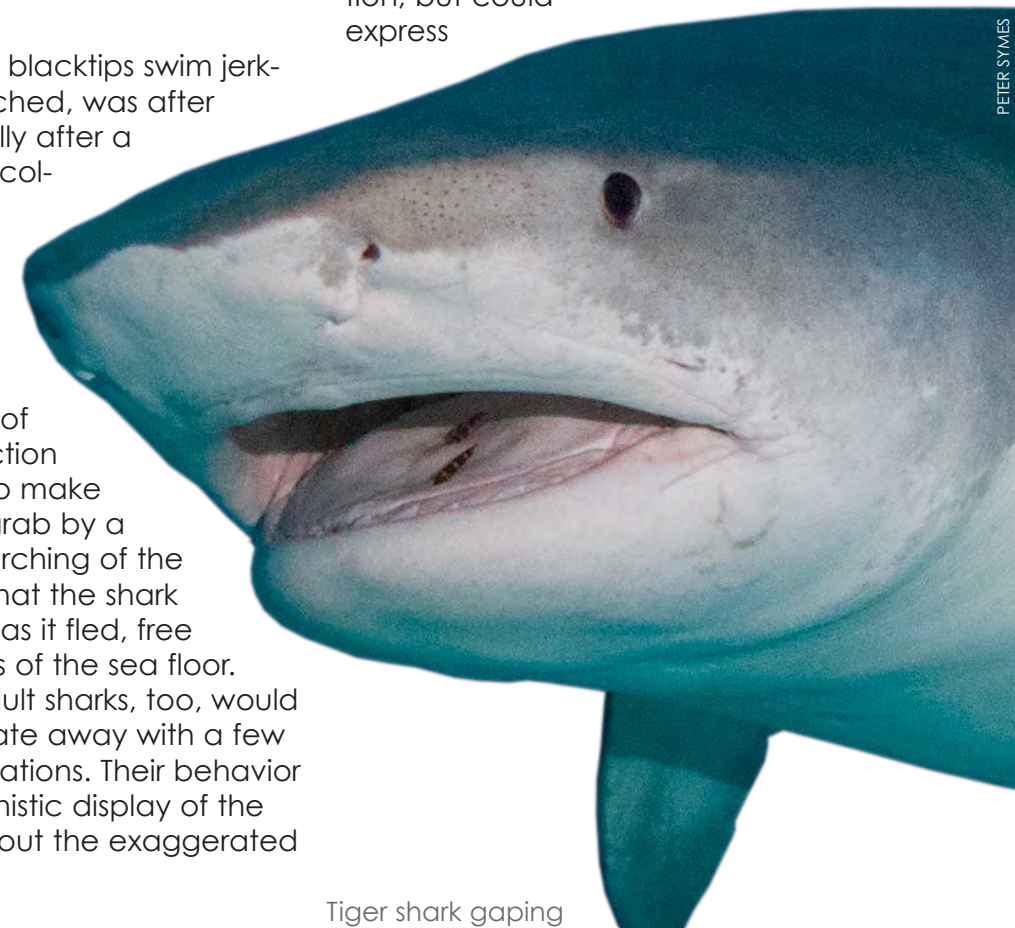
Tiger shark gaping at a lemon shark

Posturing

horizontal movements, yet it was neither agonistic nor a display. It appeared to be a reflex response that had evolved to protect the shark from injury.

After startling and rocketing away, the shark was likely to reappear some minutes later, in shiver mode. It would suddenly twist, and unpredictably, change direction. Often, the shark appeared to have shivers running through it as if it were made of water, and from time to time, someone disturbed it. This restless flicking and twisting at times continued for long periods.

One adult male shot into view one night in shiver mode, and remained in that state for more than 20 minutes, shuddering, jerking and making unpredictable flights, until it was too dark to see. It gave a performance of utterly erratic motion, yet was accompanied by two other males whose behavior was normal. This sighting suggested that the state was not always a brief reaction, but could express



PETER SYMES

Tiger shark gaping



shark tales



ILA FRANCE PORCHER

No inter-animal distance

A charging shark might return a few minutes later to charge again, and as others followed, increasing numbers of sharks became involved. At such times, the repeated charges often resulted in menacing circling, which could continue for long periods. Sharks in this behavior mode tend-

me en masse, when I was in my kayak. Something would trigger their outburst, and the entire company of three dozen sharks would attack!

On many occasions, the heavy weight of the loaded boat was bashed with shocking force first one way, and then the other, as the sharks slammed it from multiple directions. For many minutes the slamming was continuous, and after the heavy blows from the first sharks, more slammed right behind, and more behind them.

The sea surface was replaced by sharks emerging at high speed, then twisting and shooting away together as more replaced them. The heavy blows came mostly from beneath, since they would arch their backs during this behavior while accelerating upwards from some distance directly below.

But there were other occasions in which sharks who knew me

a longer-term condition of stress or fear.

Though shivering was seen in an agonistic display in the silvertip shark, in blacktips, it is associated with a fear reaction. Traces of it appeared occasionally too, in sharks who arrived at the sessions in a state of agitation. Swimming swiftly, and twitching at times, the animal would make sudden rushes, then whip back around in a tight circle.

Blacktips with nurse sharks

As night fell on my shark sessions, nurse sharks would carpet the site, some of them as large as draft horses. At times, they would lay on the fish scraps, and though the blacktips would circle around them, they would make no effort to encourage them to move off their long-awaited food.

Only once did a large blacktip female dart up to the nurse shark in an intimidating close approach, with many more gliding in behind her, but the nurse shark did not move, and it did not bite. Sometimes, the blacktips became excited as the nurse

sharks tore the fish heads apart, and circled, about three meters away, intermittently charging in to try to get one. At times a tornado of blacktips surrounded the nurse sharks, all in high excitement, yet there was never any aggression among them.

While the blacktips would not threaten the nurse sharks, however, nurse sharks would occasionally threaten them. One would suddenly turn sharply toward the offending blacktip as it passed and then circle, watching it, while the blacktip would turn away and depart.

Other agonistic behaviors

The most direct form of agonistic behavior in the blacktips came in a different form than those reported so far. They were prone to charging, coming straight forward at medium to high speed, and passing just to one side. Other sharks would join in, and follow the leader in single file, which could result in a long line of sharks approaching. Sometimes they adopted a triangular formation, like a small fleet of fighter planes.

ed to become aroused, and the behavior resulted in a state of palpable tension, as all the sharks present participated. At the center of their circles, you realized that any movement at all could trigger them, which in their case meant slamming you.

Slamming

Slamming was the natural consequence of menacing circling, and fortunately for me, the sharks only performed that against

THE BEST BIG ANIMAL DIVING ON EARTH!

SOLMAR V
Socorro • Guadalupe

Liveboard Adventures

Socorro Islands **Guadalupe Island**

© Erick Higuera © Marty Wolf

Now a Unesco World Heritage Site

"WE LOVE WHAT WE DO"

310-455-3600 • www.solmarv.com • ask@solmarv.com

Clear, Blue Water Lots of Sharks

f i y

became enraged enough to slam me personally. It was possible to recognize the imminent attack in the speed of their approach, straight into my solar-plexus, and just before they made contact, I would push them in another direction, or strike them on the

head with my hand, whereon, each time, they changed direction.

Thus, it seems possible that the blacktip's close approach can escalate from predator inspection, to intimidation, to charging, to slamming, under the right cir-



PETER SYMES



cumstances. Possibly the shark begins to arch its back as it passes a threshold of arousal when approaching at high speed to intimidate, as the video suggests.

However, these incidents were as rare as they were incomprehensible. Indeed, the few accounts we have of agonistic displays and behavior in sharks provide a tantalizing glimpse of how much is still mysterious about them. Among all predators, sharks may be the least conflictual.

They are not territorial. Hence, conflict among them is almost unknown. □

Illa France Porcher, author of The Shark Sessions, is an ethologist who focused on the study of reef sharks after she moved to Tahiti in 1995. Her observations, which are the first of their kind, have yielded valuable details about their lives, including their reproductive cycle, social biology,

population structure, daily behavior patterns, roaming tendencies and cognitive abilities. Her next book, On the Ethology of Reef Sharks, will soon be released.



Sand Tiger Shark. Evidence of complex social behaviors in sharks and other elasmobranchs is sparse, however we are beginning to understand the importance of studying shark aggregations



The friendly side of sand tiger sharks

Sand tiger sharks, *Carcharias taurus*, exhibit group behavior that has historically been associated with higher order mammals.

While many sharks are solitary predators, some are known to live in groups and are suspected of engaging in complex social behaviors. Meanwhile others simply aggregate due to similar habitat, food or mating requirements. Using a novel tagging procedure, scientists in the United States have discovered that some shark species like to spend their time mixing and chilling out together.

University of Delaware researchers collected tens of thousands of interactions between the 300 or so sand tiger sharks, fitted with electronic tags, over the past four years. In some cases, the sharks were found to spend up to 95 consecutive hours together.

Brainy

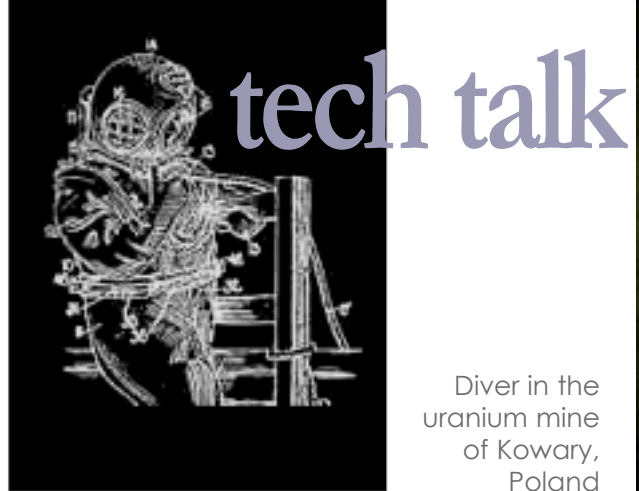
Sand tigers have high brain to body mass ratios when compared to other

Chondrichthyes (cartilaginous fishes), and therefore may have the ability to maintain complex social structures and social behaviors such as coordinated group feeding behaviors similar to those observed in marine mammals.

The University of Delaware project was launched in 2012 with only a modest 20 sand tiger sharks involved at first. Each had an implanted acoustic transceiver fitted to study their movements throughout the year. Initially focusing on two male sharks, the devices also recorded details of other animals carrying transmitters that came near the two sharks. These included Atlantic sturgeons, white and sandbar sharks, spiny dogfish and also lemon and bull sharks.

They all met up

The two sand tiger sharks did not always travel together, it was found, but they did reconnect at various times of the year and encountered more than 50 percent of all the other tagged sand tiger sharks on the east coast of the United States. ■ SOURCE: NATURE JOURNAL SCIENTIFIC REPORTS

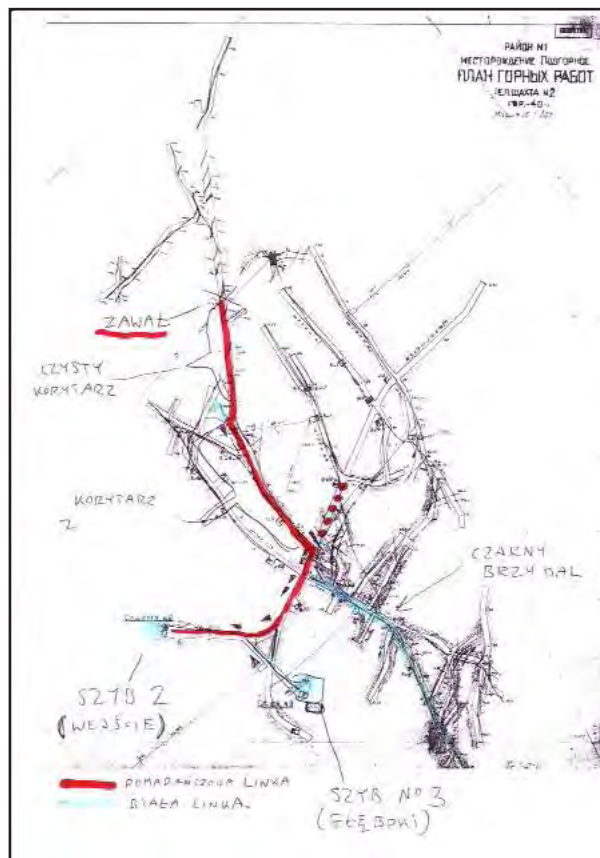


tech talk

Diver in the uranium mine of Kowary, Poland

Text by Sabine Kerkau
Photos by Kasia Cylwik

Diving in old mines and tunnels is becoming more and more popular. More and more cave divers are discovering a love for the exploration of these unique time capsules.



Map of uranium mine in Kowary, Poland



Diving the Uranium Mine of Kowary, Poland

In recent years, I have had the chance to dive a series of mines. Mainly these were iron mines and slate mines, which have been opened for years to trained cave divers. However, as is the case

everywhere, the law of supply and demand also applies to mining. The bigger the interest is, the more possibilities there are.

The uranium mine in Kowary, Poland,

is a good example. It was September 2015, when I first saw pictures of divers in the uranium mine. I thought initially that it was a Halloween joke or a printing error. Diving in a uranium mine? Wasn't it too

dangerous? What about the radiation? But the pictures were so impressive that I had to look for more information. This led to an invitation I received from a couple of Polish dive buddies, who said it would





Gear stands ready at the point of entry for the dive in the Kowary uranium mine. Note the macabre decoration in the background—the outer shell of an atomic bomb; Bats hang in the tunnel to the dive site (right)

be best if I came in person and took a look at the mine, and that it would be even better if I brought a few friends.

At the end of March 2016, I took my team to Poland. There we met Michal Czerminski and Michal Rachwalski, who had kindly agreed to accompany us during our dives in the uranium mine. They knew the mine very well and belonged to a team of Polish cave divers, who handled the exploration of the mine.

Getting there

The mine is located in the middle of a forest, so it was a challenge

for even off-road vehicles to get there. Once there, one must register in a small wooden hut, which is apparently occupied day and night.

After all the formalities were completed, we began to bring our equipment into the mine. The distance from the parking lot to the entrance of the mine is about one kilometer. Fortunately, we did not have to carry our extensive and heavy equipment. A quad with a trailer was available for transport.

While Czerminski transported the



equipment, we divers started on foot. Then, to get from the mine entrance to the point of entry for diving, we had to go through a long dark tunnel. There was no light here. One had to have a

THE SUCCESS CONTINUES...

WITH REINFORCED PANELS, SOFT BOOTS AND DOUBLE POCKETS

D9X
BREATHABLE
(only 3.2kg)



D9X BREATHABLE

- 4-Layer Breathable Ultra light shell
- Flexible TIZIP Master Seal Front zipper
- Soft lightweight boots
- Reinforcement knees, elbows and seat
- Double lightweight pockets
- Prepared for Dry Glove system
- Quick-Dry
- Latex seals
- Warm cuffs
- SI TECH valves
- Telescope Torso
- Seam free crotch
- Integrated suspenders
- Pre-bent knees
- Zipper cover
- Mesh bag

www.waterproof.eu





Discover the WWII shipwrecks and flooded iron ore mines of Newfoundland and Labrador, Canada with Ocean Quest Adventures.



headlamp or something comparable to navigate. On closer inspection of the ceiling of the tunnel, I could see colonies of bats.

After about 700m, we left the main tunnel and entered an area that consisted of three consecutive chambers. In the first chamber, we could store our equipment and move around a bit. However, in this chamber, there also was no lighting, which made preparation of our equipment a challenge. In the adjoining, much smaller chamber, there was some lighting, and on the walls, there were maps showing the different levels of the mine. The passage to the next chamber was made difficult by some macabre decoration—the outer shell of a large atomic bomb—



which was the last obstacle that separated us divers from the dive entry point.

Diving the mine
The first dives in the uranium mine were guided dives, and those who did not have at least 10 dives in



THIS PAGE: Scenes from the dive to level 3 in the uranium mine of Kowary; Divers lower gear into the water (left and above) in preparation to enter the shaft leading to level 3 (top right)

BOOK NOW:
keith@oceanquestNL.com
or call 1-866-623-2664
oceanquestadventures.com





Divers shed light on support beams strewn on the floor of the mine corridor



Divers lug their gear down to the entry point

the mine could only look at the first level. Access to the deeper areas was not permitted. My dive partner was Czerminski, who knew the mine very well.

Divers had to enter a narrow shaft, which led down to the fourth level at a depth of 150m. From this shaft, one could also enter the overlying levels of the mine. One had to be extra careful not miss the entrance to the level one wanted to dive, as some entrances only opened to a wall of the mine.

Every dive in the mine was a decompression dive. Since the decompression stops had to be carried out in the shaft, each dive group could not exceed three divers. So, groups of divers, three at a time, began their dives in a timed manner. The distance between the groups had to be great enough so that there

would be no difficulties in the last group's decompression stops.

Czerminski and I began our dive after the group ahead of us completed their dive. At the point of entry, I had to get used to a narrow passage. Two other divers helped me establish the stages. While diving, I hardly dared to move, as it seemed like everywhere I was bumping into walls or beams.

At about 24m depth was the entrance to the 30m level, our destination. Criss-crossed bars made access difficult. The visibility in the entrance area was not good, but that changed quickly. The path we followed was supported by beams. Other beams were strewn on the ground. We hovered through half-open doors. The walls were roughly hewn and the passages were narrow. On the ground as

EXPLORE DEEPER



Does the thought of diving through underwater mines intrigue you? Unearth the underwater world and get qualified to plan & execute limited-penetration, navigation, & no-decompression dives in a unique setting. Define your experience as a **NAUI Mine Diver** and take your confidence to new limits!





Diver in main tunnel of Kowary mine (right)

well as on the surface of the water were carpets of bacteria, which whirled up with every careless movement and danced through the water.

This trip into the underwater labyrinth was exciting and spooky at the same time. All too soon, it was time to turn around. Back in the shaft, which would bring us back up to the water's surface, we started our ascent. After 90 minutes, we finished our dive.

We left our equipment in the mine for the next day, when we would be accompanied by our Polish friends yet again. Even though we were not allowed to leave the 30m level, the second day of diving was as interesting as the first. When we were done, the quad with the trailer was used again to easily transport our equipment back out of the cave area.

The visit to the uranium mine of Kowary was indeed special. It was exciting and creepy and intriguing, all at the same time. We will surely come back and hopefully also take a look at



the next three levels at 70m, 110m and 160m.

If you are interested in diving the uranium mine of Kowary, please contact Michal Czerminski at: michal-czerminski@wp.pl, or Michal Rachwalski at: michal@emnet.com.pl. ■

Sabine Kerkau is a German technical diver, dive writer and underwater photographer based in Switzerland. For more information, please visit: Sabine-Kerkau.com.



THIS PAGE: Scenes from the dive on level 3 of the Kowary uranium mine



photo & video

Safe House, by Beth Watson, took the overall theme prize at the UN World Oceans Day 2016 photo contest. Canon 5DMKIII camera, Canon 8-15mm lens, Nauticam housing, Ikelite DS 125 strobes, 1/125, f/10, ISO 160

Edited by Gunild Symes
Photos by Greg Lecoeur,
Brandi Mueller, Beth Watson

In June at this year's United Nations World Oceans Day photo contest, three of our regular contributors won awards. American photographer Beth Watson claimed the competition's grand prize, the overall theme award "Healthy oceans, healthy planet"; French photographer Greg Lecoeur won first place in the Underwater Life category, second place in the Above Water Seascapes category and third place in the Underwater Seascapes category; and American photographer Brandi Mueller won third place in the Underwater Life category. Here are the stories behind their winning shots.



How I Got the Shot

Beth Watson

My husband and I were diving the epic Birds Head Seascape region known as Raja Ampat, Indonesia. It was a blissful day and our next dive site was Citrus Ridge. This is a

highly anticipated dive site known for its beauty and diversity.

From my previous experience, I knew mangroves grew on the shoreline and wanted to capture their beauty again. We dropped

in on a gradual sloping wall, our dive group descended to explore the deeper area, but I headed towards the shallows where the mangroves trees adorned the shoreline. The visibility was good,

the sun was shining and a few clouds were in the sky.

Experimenting with different camera settings, I dialed in the appropriate settings to balance the ambient light with a bit of

strobe flash. Reflections are something that I enjoy capturing. I proceeded to work the shoreline in the hope of finding something interesting and eye-catching.

About 20 minutes into the dive,

BETH WATSON





photo & video

Green Turtle, Tenerife, Spain, by Greg Lecoeur, took first place in the Underwater Life category of the UN World Oceans Day 2016 photo contest. Equipment and specifications: Nikon D7200 camera, Tokina 10-17mm f/3.5-4.5 lens, Nauticam housing, Ikelite DS160 strobes, 1/250, f/11, ISO 100



GREG LECOEUR

Humpback Breach, Port Saint John's, South Africa, by Greg Lecoeur, took second place in the Above Water Seascapes category of the UN World Oceans Day 2016 photo contest. Equipment and specifications: Nikon D7200 camera, Tokina 10-17mm f/3.5-4.5 lens, 1/1000, f/8, ISO 400

I crossed an inlet that led into the bay. On the corner was a beautiful grouping of mangroves. The arrangement was especially appealing because the sloping wall, soft corals and growth protruding from the sandy bottom would provide a foreground element, giving the image depth and dimension. I noticed three juvenile batfish hanging out underneath the mangrove canopy and knew there was potential to capture something special.

It was important to stay focused. I kept my left eye open, looking out for the occasional crocodile, and kept my right eye glued to the

viewfinder, waiting and hoping for that magical moment when the batfish were in alignment. Several anxious minutes passed... then it happened. All three batfish turned magically, positioning themselves in the center of my viewfinder. The image was recorded, and after deliberation, the image was titled "Safe House."

Greg Lecoeur Green Turtle, Tenerife, Spain.

Photographing marine life is not so easy and requires a lot of patience. But sometimes we are lucky and all the ingredients come together to achieve the expected



GREG LECOEUR

image, as during this dive in Tenerife when the conditions were perfect. This green sea turtle decided

to play like a model through the sunlight. So all that remained for me to do was to set the exposure

and frame the shot!



GREG LECOEUR

Sharks and Rays, Moorea, French Polynesia, by Greg Lecoeur, took third place in the Underwater Seascapes category of the UN World Oceans Day 2106 photo contest. Equipment and specifications: Nikon D7200 camera, Tokina 10-17mm f/3.5-4.5 lens, Nauticam housing, Ikelite DS160 strobes, 1/250, f/13, ISO 100

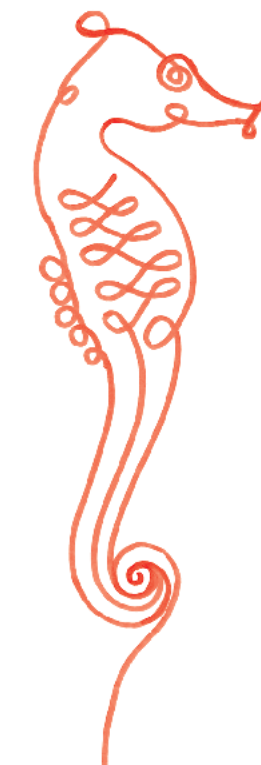
Humpback Breach, Port Saint John's, South Africa.

During the Sardine Run event along the wild coast of South Africa, it is also the time for the migration of the humpback whales. I was looking for bait ball action when I spotted a big splash on the horizon. It was a humpback whale breaching. The whale was probably communicating with others mammals and didn't stop breaching. It was spectacular to see how 40 tons came out of the water, while the light on the horizon provided something magical to the scenery.

Shark and Rays, Moorea, French Polynesia.

rench Polynesia is an amazing place for nature lovers. In the lagoon of Moorea, I was snorkeling with a lot of marine life, especially blacktip sharks and rays.

SEACAM
silver



cinema of dreams



www.seacam.com





photo & video



BRANDI MUELLER

Initially I stopped at the anemone because I was drawn to the pretty purple color and the contrast of the orange clownfish (left). After getting a few shots of the clownfish I noticed several cleaner shrimp in the anemone too (left and below).



BRANDI MUELLER

Brandi Mueller

Muck diving in the Philippines is always a treasure hunt and it is one of my favorite types of diving because you just never know what you might see. I was diving off Dumaguete, and at the very beginning of the dive, I was drawn to a vibrant purple anemone with two

false clownfish swimming around it. I stopped to take a few shots and I noticed there were at least five or six tiny purple cleaner shrimp hopping around in the anemone as well.

With my eye looking through the viewfinder, I was waiting for one of the clownfish to look at me so I could snap a photo when I noticed one of the cleaner shrimp was moving closer to the clownfish. Finger on the shutter, I waited, and the shrimp hopped right onto the clownfish and started cleaning the fish. I snapped a shot, and the second my strobe lights went off, both the fish and shrimp darted off in opposite directions.

I wasn't sure if I got the shot but I was hoping I might get another chance. So I waited, following the clownfish through my camera, to see if it would happen again. After about five minutes, they still hadn't gone near each other. Evidently,

the shy clownfish did not want any more photos during its bath time. I was really excited to get back to my room and download the photos to see if it turned out. In the end, I was pleased with this one and only shot that I got with the shrimp on the clownfish.

Behavior and conservation

Observing cleaning behavior is one of my favorite things to see underwater. It always amazes me when an eel opens its mouth wide for a shrimp or wrasse to clean its teeth, but the eel resists making an easy meal of this food already in its mouth.


These acts of symbiosis show how delicate the balance of the ocean is. Every creature in the ocean is there for some purpose, so many of which we don't have any idea. This is one of the reasons why ocean conservation is so important. We need to reduce threats to every part of the ocean because we don't fully understand how it is all connected, and how even small changes may have huge negative impacts. That way we can all continue to observe these special connections in the underwater world. ■



BRANDI MUELLER

Spa Day, Dumaguete, Philippines, by Brandi Mueller, took third place in the Underwater Life category of the UN World Oceans Day 2016 photo contest. She said, "This was the only shot I got with the cleaner shrimp cleaning the clownfish." Equipment and specifications: Nikon D750, Nikon 105mm lens, Ikelite housing, Ikelite DS161 strobes, 1/160, f/16, ISO 200.


ULTRALIGHT
CONTROL SYSTEMS



TRAYS, PIVOTS, AND ARMS FOR CAMERAS, HOUSINGS, STROBES, AND LIGHTS

The original arm with o-rings in the balls for ease of use. Accept no imitations. Your quest for the best arm system is over, once you have an Ultralight arm you will never need to upgrade.

Visit our website: www.ulcs.com for product info & to locate a dealer near you. Unable to find a dealer?



E-mail: info@ulcs.com



photo & video

CLOCKWISE FROM RIGHT: Best Night – Mike Stallings; Best of Show – Mike Stallings; Best edited with Vivid-Pix – Mike Stallings; Best Wreck – Mike Stallings; Best Shark – Mike Stallings; Best dSLR – David Herrick; Best Compact Camera – Ray Darwin

Roatán Underwater Photo Fest 2016 Report

Text by Brandi Mueller

The second annual Roatán Underwater Photo Fest was held at Turquoise Bay Dive and Beach Resort in Honduras from 24 September to 1 October 2016. Photographers of all skill levels met for an epic week of diving to practice and improve their underwater photography led by hosts Brandi Mueller, Andrew Raak, Paddy Ryan, Markus Daase and special guest speakers Mickey Charteris and Brenda Stumpf.

Roatán diving provides the perfect elements to develop underwater photography skills, with plenty of marine life and a variety of dive sites. Photographers practiced their wide-angle skills at dive sites such as the *El Aguila* wreck, a cavern system called Dolphin's Den, a shark dive and lots of beautiful mini-wall dive sites, which provided opportunities to photograph turtles, eagle rays, green moray eels and more. The dives also had plenty of macro life, including juvenile spotted drums, octopus, flamingo tongues and decorator crabs, just to name a few.

At the end of the week, a photo contest was held to show off everyone's photos from the week and honor those who got the best shots. Congratulations to the winners.

The week

Participants arrived on Saturday and got settled in, unpacking gear and setting up cameras. After dinner, participants met festival presenters for introductions and a brief presentation on how to keep your camera dry, protecting the environment (from underwater photographers), and what to expect throughout the week. The plan was to keep everyone busy and immersed in underwater photography, with 16 dives planned and two or three presentations per day.

Sunday started off with two reef dives in the morning to check gear and make sure everything was working followed by a third dive after lunch. Before dinner, participants were split into two groups with dSLR cameras and compact cameras. Andrew and I gave talks on tips on how to get the best photos

possible, including camera settings, focusing, composition and lighting.

After dinner, special guest Mickey Charteris—author and photographer of *Caribbean Reef Life of the Bay Islands, Honduras*—gave a fantastic presentation on the marine life of Roatán as well as tips on what and where to look for some of the rare and most photogenic critters of the area. After his talk, everyone was super excited to go macro critter-hunting on the next dives.

On Monday and Tuesday, there were three dives each day focusing on macro photography on the first day and wide-angle, including a wreck





photo & video

CLOCKWISE FROM RIGHT:
2nd Place Night – Michelle Scamahorn; 2nd Place edited with Vivid-Pix – Mike Stallings; 2nd Place dSLR – David Herrick; 2nd Place Shark – David Herrick; 2nd Place Wreck – Michelle Scamahorn; 2nd Place Compact Camera – Tom Hawkes



MICHELLE SCAMAHORN



MIKE STALLINGS

diving situations, including wrecks, shark dives, night dives, wall dives and caverns. The fantastic dive guides provide safe, helpful environments, going slowly while pointing out critters.

Sponsors

The event was honored to

be graciously sponsored by some of the top brands in scuba diving, underwater photography, dive travel and media. Sponsors included DAN, DIP Shipping, Fantasea Line, Ikelite Underwater Systems, Light and Motion, Mares, NightSea, PADI, Sealife Underwater Cameras, SUSV FSSS, Trident Diving Equipment and Vivid-Pix. Media sponsors included Blue Magazine, Dive News Network, Dive News Wire, Divemag.org, Sport Diver, Unterwasser and X-Ray Mag. Travel sponsors included Caradonna Adventures, CM Airlines, Dream Weaver Travel, Erlebe-Mesoamerica, Maduro Dive, Roatán Charter, Subway Watersports and Turquoise Bay Dive and Beach Resort.

photographer, Brenda Stumpf, gave an after-dinner presentation about photographing models underwater, both in pools and in the ocean. I think everyone was thoroughly impressed with how much planning, preparation and safety is involved in getting her amazing artistic photos.

The last two dives were done on Friday morning. After lunch, several participants took part in a photography land tour of the island. After dinner, everyone gathered together to share photos from the week and see the winners of the photo contest.

Roatán is a perfect place for all levels of photographers to learn or improve their skills. The diving is easy, in warm waters, with little or no current, and plenty of marine life is to be expected. There is also a variety of diving allowing divers to practice both wide-angle and macro photography in many interesting

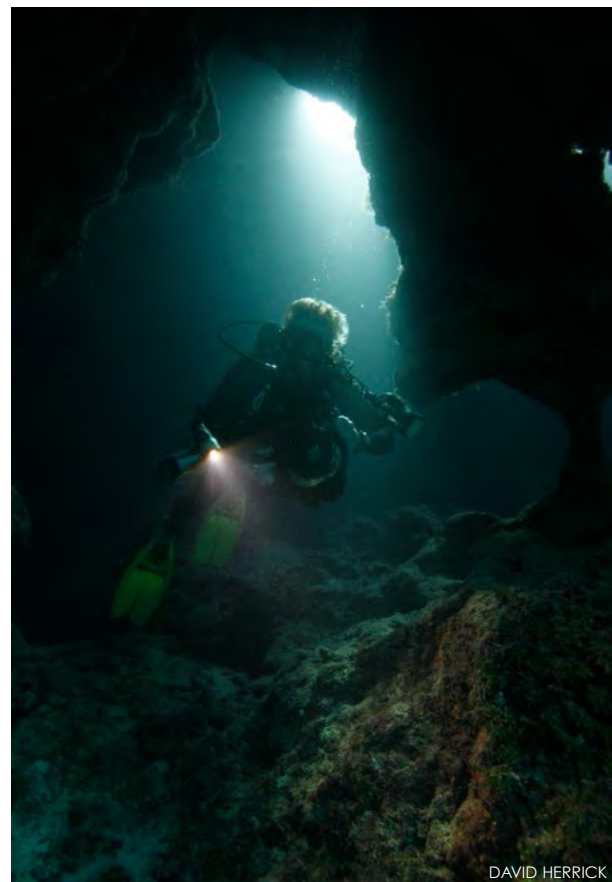
On Thursday, the weather was ideal to head to Pigeon Cay, off the northeast tip of Roatán. The two-hour boat ride revealed the stunning coast of Roatán

Wednesday was shark day. Vans were loaded with all the dive gear and everyone headed to Coxen Hole for Roatán's famous shark dive. This dive has been going on for over ten years and pretty much guarantees plenty of female Caribbean reef sharks. As expected, at least 21 sharks showed up, giving all the photographers plenty of shark models.

After the shark dive, everyone returned to Turquoise Bay Resort for lunch and talks on fluorescence night photography and more photo editing. Then participants headed out for a twilight and night dive on the reef. The night dive was particularly exciting, with several Caribbean octopuses out hunting on the reef, cryptic teardrop crabs, shrimp and even a few sea slugs posing for photographers.



TOM HAWKES



DAVID HERRICK

Returning to the resort, Paddy gave a talk on slowing down while diving and remembering to consider the amazing textures

and patterns that can be found underwater. His talk was an important reminder that amazing photos can come from even what one may initially think of as common subjects, if we look at them a little differently.

Special guest and underwater portrait

and the ride was worth it for two beautiful wall dives with gorgeous, giant barrel sponges, lots of coral and fish life. Participants had lunch on the white sand beach of Pigeon Cay and took in some topside beauty (and photographs) as well.



MICHELLE SCAMAHORN



DAVID HERRICK



Patricia Knight



P O R T F O L I O

PREVIOUS PAGE: *Clownfish "Hey"*, by Patricia Knight. Linoleum and ink jigsaw print, 6 x 6 inches

Mermaid Grotto, by Patricia Knight. Digital illustration (vector drawing of 3D paper-cut), 20 x 30 inches

Ice Diver, by Patricia Knight. Digital illustration (vector drawing of 3D papercut), 20 x 30 inches

Text edited by Gunild Symes
All art work and photos
by Patricia Knight

American artist and scuba diver Patricia Knight creates dynamic papercut graphics and sublime linoleum prints of marine life and divers in underwater scenes, combining age-old printmaking techniques with modern digital graphics. Inspired by the underwater realm, she strives to raise awareness of the ocean's fragile ecosystem through her art.

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

PK: Growing up in a really small farming town in western New York, we didn't even have any art classes in school. My parents really indulged me by ordering an art instruction course through the mail, and that's when I discovered that my fledgling ability to copy figures from the latest magazines could actually be trained into something much more artistic. That was a revelation to me—that art was a skill like anything else—and the more you practiced and studied, the better you would be.

X-RAY MAG: Why marine life and underwater themes? How did you come to these themes and how did you develop your style of printmaking?

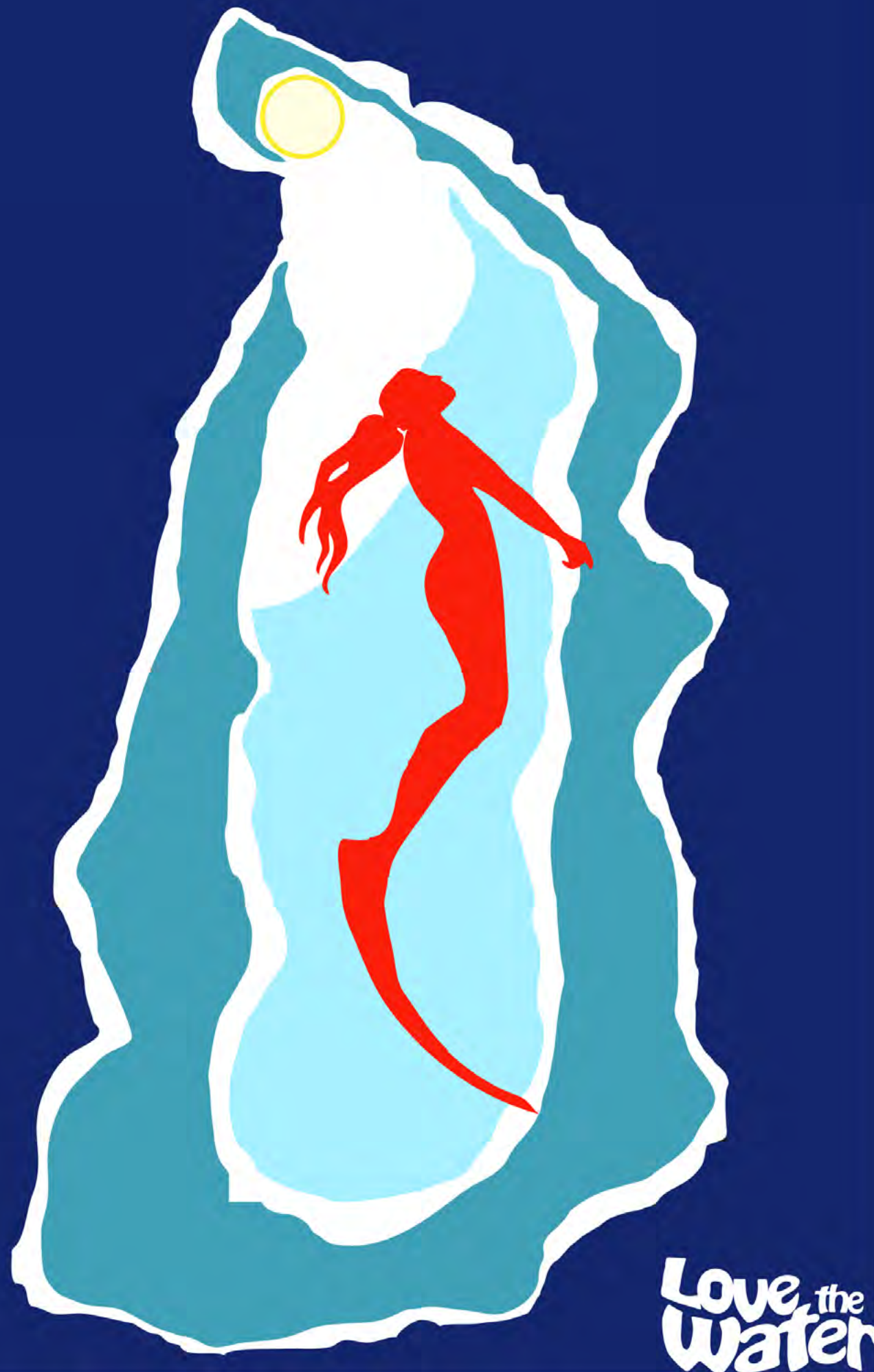
PK: In college, I tried out a wide variety of mediums and techniques, but the process of printmaking really captured my attention. Looking back, I think it was that lack of early formal instruction that kept me open to combining such diverse mediums such as carving, paper cutting and vector illustration under the heading of "printmaking." I use the same initial planning and thinking process for all my prints, whether they end up as a traditionally or digitally printed output. I know that sounds odd, and I have been told that those two mediums cannot possibly be lumped together, but it works for me.

Although I do illustrate other themes, I find myself always coming back to the water. The shapes of water are so fluid

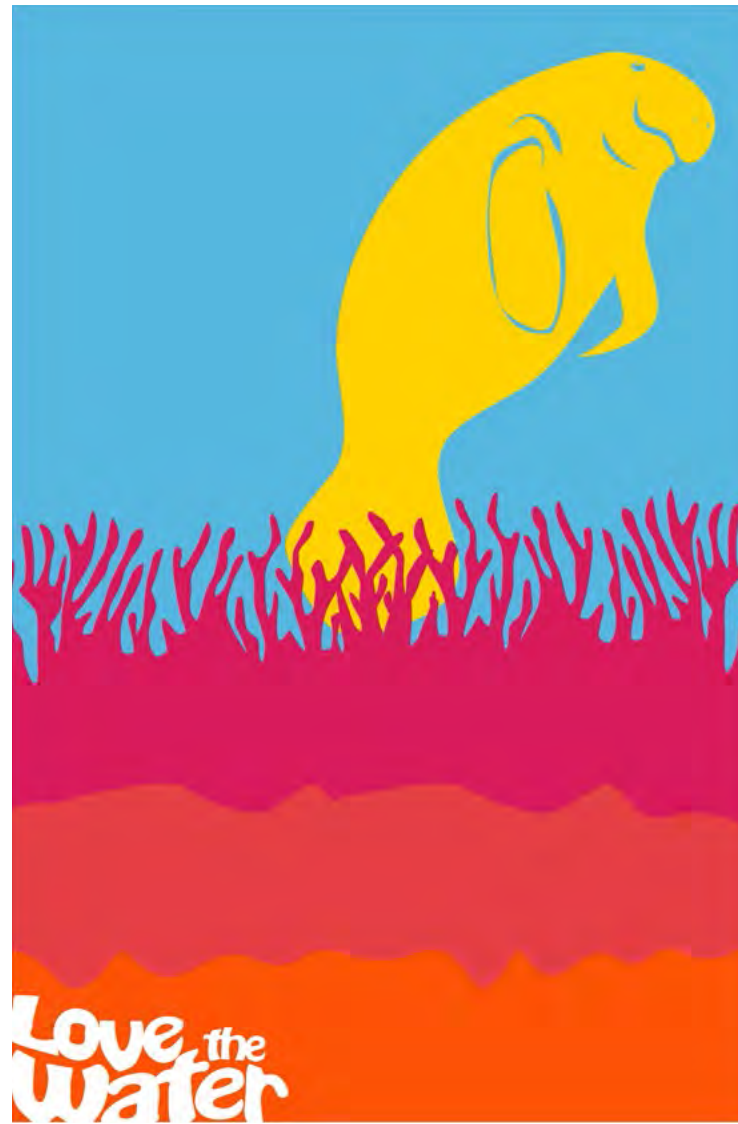
and the creatures can be so alien—those flowing lines and unusual shapes are exciting to render in brilliant colors.

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

PK: I usually start with a photo that I have taken (or that a dive buddy has shared) for my initial inspiration when developing ideas. At this point, the idea may turn into a free-hand drawing for



Love the water



LEFT TO RIGHT: *Stingray Arches*, *Manatee Smile*, *Shipwreck Atlantica* and *Seahorse Love*, from the *Love the Water* series, by Patricia Knight. Digital illustrations (vector drawings of 3D papercuts), 20 x 30 inches

my monoprints. But my color prints get an extra step.

When I was first developing ideas for my “Love the Water” line (series), I knew I wanted to make the shift to digital art, but I still wanted to work with organic shapes that had some texture and spontaneity, for which vector graphics are not necessarily known. So I make small prototypes from colored paper—ripping and cutting and folding layers and shapes—until I find a perfect combination of color and design.

Once I have a good idea of what the final product should look like, I make the decision to proceed with the print as either a linoleum cut or as a vector design. If it will be a digital print, I scan in my prototype and start redrawing it in Adobe Illustrator. But if it will be a block print, I break out the carving tools.

For multiple color block prints, I usually use a technique called reduction printing in which each color printed is carved away, thereby “reducing” the amount of linoleum left on the plate and

ultimately destroying the plate by the end of the print. Sometimes I might use a “jigsaw” technique for color printing in which multiple pieces of linoleum are cut and then inked separately, to be reassembled like a jigsaw puzzle for the final print.

My digital art goes to a local specialty art printer, and I work closely with them to make sure each “Love the Water” print is true to my original colors and flawless.

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

PK: For most of my life, I was much more familiar with lakes and mountains than the ocean. But after booking a vacation to Cozumel, my husband (and fellow adventurer) and I decided



Designs start with 3D papercuts, which are then redrawn as vector graphics, digitally.



Print ideas in progress—a close up of the initial design process for all the prints in the *Love the Water* series

on and coral reef management and how does your artwork relate to these issues?

PK: When we finally made our move to south Florida, we got to really indulge in our diving addiction, but diving that much also enabled me to see the changes that our local reefs are going through—and not always for the better. I also get to hear more stories about the glory days when sharks and other big critters were common sights, fish were so plentiful they practically leapt into the boats, and lobsters as big as toddlers could be found in every coral covered ledge. Now I see more lionfish than lobsters, and if I ever spot anything shiny, it's not gold, it's garbage.

I think it is pretty obvious to most of the public by now that we humans need to make some changes if we want to start to correct the terrible damage that

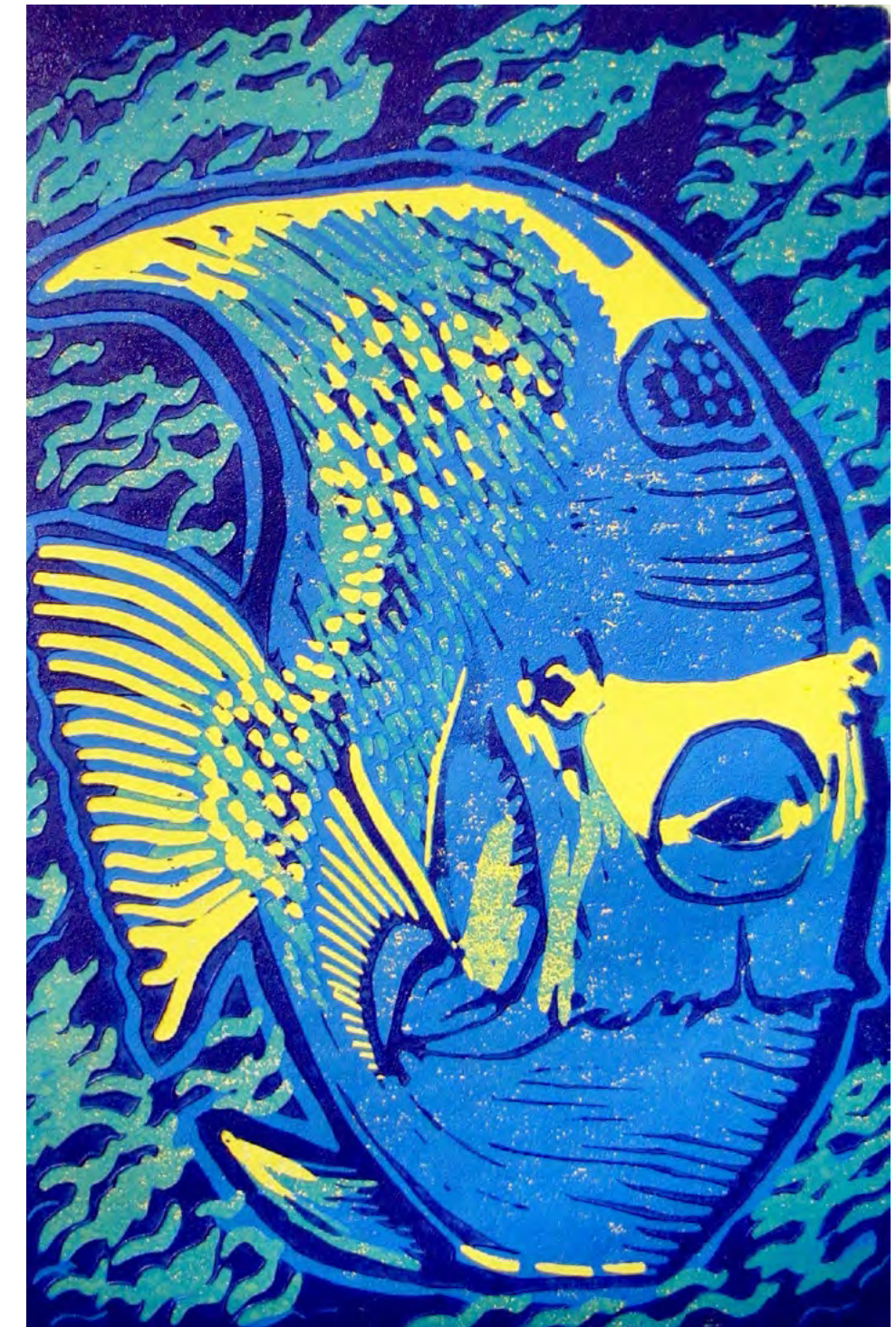


we needed to get our scuba certification before we went. After doing our final dives in a local quarry and some cold lakes, we were excited to explore more colorful and warmer waters. Cozumel did not disappoint, and we were hooked. I have been trying to capture that brilliant kaleidoscope of colors and shapes ever since, in my artwork.

You get to meet a lot of great people when you are diving, and I was lucky enough to meet up with a young woman who not only had a mermaid fin, but was also willing to model it, out in our local reef for an underwater photo shoot. It was so much fun to see the double-takes and wide eyes from both adults and

kids alike as we went by with our mermaid sitting regally on our front bow.

X-RAY MAG: What are your thoughts on ocean conservati-



Work-in-progress close-up (left) of the final color of the four-color reduction print, *Angel Face* (above)—a linoleum cut of a Caribbean queen angelfish by Patricia Knight. Linoleum and ink, 7.5 x 11.5 inches

Designs start with 3D papercuts, which are then redrawn as vector graphics, digitally.



Lionfish, by Patricia Knight. One color linoleum cut print, 11 x 7 inches; *Pink Tentacles* (right), by Patricia Knight. Digital illustration (vector drawing of 3D paper cut), 20 x 30 inches

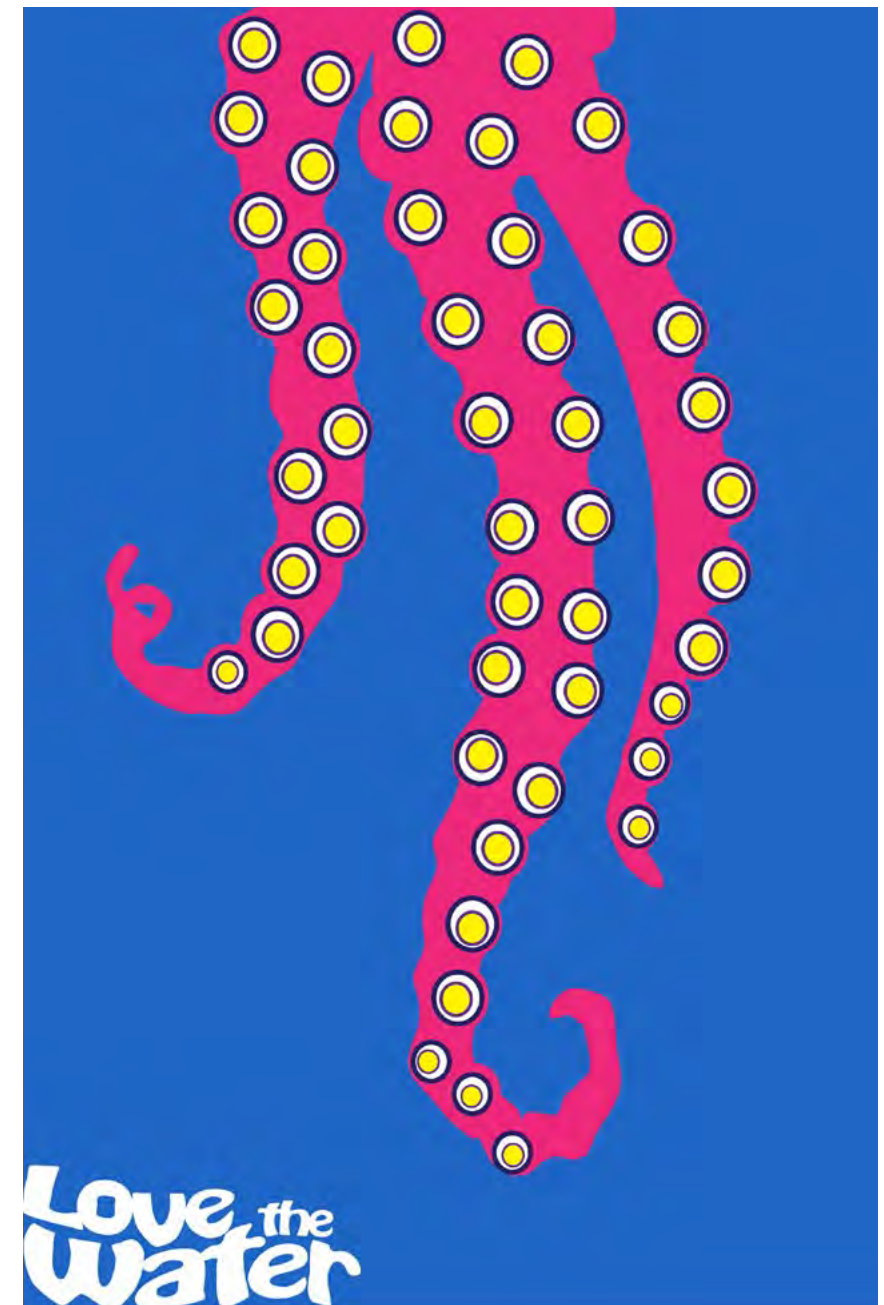
Patricia Knight

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

PK: Printmaking is one of the oldest forms of art. In fact, it was with the invention of the printing technique that information could finally be shared among the masses, and one could argue that it kickstarted civilization as we know it. Just because it's old, doesn't mean it's a dead technique, which I hope I showcase when I display both types of printing outputs at the same time. A thousand years later, printmaking is still doing its original job—bringing information to the people.

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

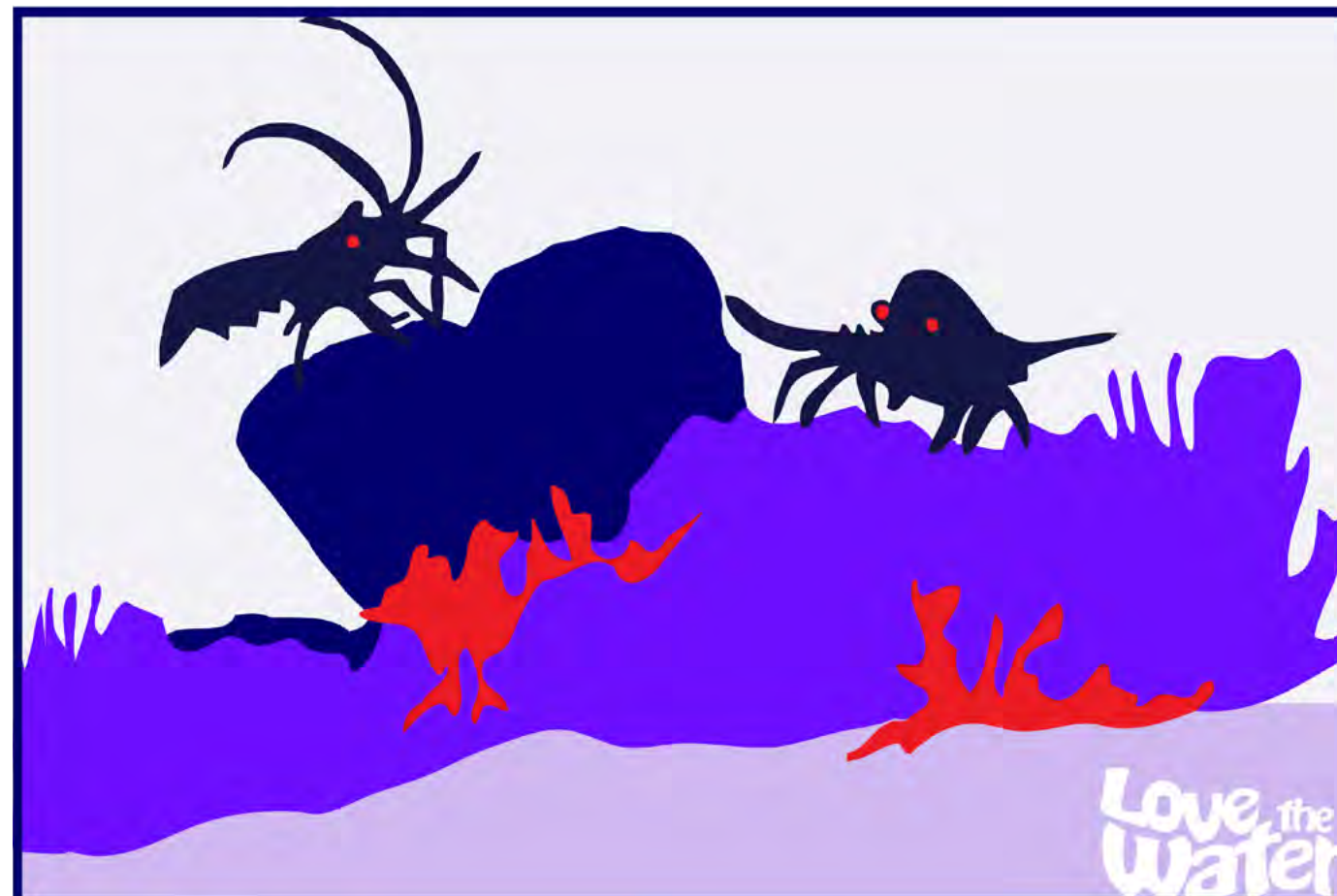
PK: Our current digital age means that I



we've done to our global waters. But most people have no idea what they could possibly do to help.

I began my "Love the Water" prints so that I could start a dialogue with people about the importance of our oceans. I meet a lot of people during art shows—most of them tourists—and it's easy to connect with them through my illustrations.

I avoid lectures about conservation, and instead, bring up some interesting facts that might intrigue them: Do they know how much parrotfish play a part in making sand for our beaches? Do they know that the pop-up fences on those same beaches are actually protecting turtle nests? If helping the environment and these wonderful creatures could be as easy as changing the brand of sunscreen you apply so it doesn't pollute the ocean or picking up just an extra bit of garbage at the beach as you leave, why not try? Love the water!



Lobster Fest, by Patricia Knight. Digital illustration (vector drawing of 3D paper cut), 30 x 20 inches

can easily stay in contact with customers and fellow artists around the world. On the other hand, there are the unfortunate consequences of putting your work out there where it can be readily accessible for copying. Today, artists walk a fine line between promoting ourselves and keeping our work our own. It can also be difficult to keep up with social media when all you would like to do is make art, but these are the tools that a working artist must be able to employ to thrive in our world today.



Blue Tails, by Patricia Knight.
Linoleum and ink, five-color
reduction print, 12.5 x 9.5 inches

Patricia Knight

artificial reef and diving destination for our area. It's a gorgeous wreck for diving, and I hope to be a part of some of the promotional activities coming up.

X-RAY MAG: Any final words to share with our readers about yourself and your artwork?

PK: I have been a working artist and an art teacher for most of my adult life, but I still find new things to learn and wonder at and be inspired by. Everyday, I hope to pass on that same sense of experimentation and joy to my students. And if my artwork and underwater adventures can also be used to further some knowledge of ocean conservationism—even better. ■

For more information, please visit the artist's websites at: ArtCatStudio.com and Etsy.com/shop/ArtCatStudio.



Reef Wall, by Patricia Knight. Linoleum and ink monoprint, 12 x 18 inches

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

PK: Most people understand how a digital print is made. But when I sell at a show, I have learned to bring along a piece of linoleum to carve, and I encourage people to make a print for themselves. They are fascinated by the physical carving and delighted by the final print. It also gives them greater understanding of the physical work that goes into block printing and how it gets made.

Of course, this certainly helps me promote my art. I could be

demonstrating to one little girl, but then she will run off with her small print and bring back her parents, who then call over their friends, and before I know it, there is a crowd at my booth that will bring more people over just to see what is going on.

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

PK: I always have the seasonal art shows here in south Florida to get new pieces ready for. But this past summer, the local casino and city worked together to sink a 300ft ship called the *Lady Luck* only about a mile off shore, as a new



Hogfish Says What? by Patricia Knight. Linoleum and ink, three-color reduction print, 14 x 10 inches