



GLOBAL EDITION
September 2012
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Atlantic
Greenland Shark

Nova Scotia
The Arrow

Timor-Leste
Tasi Tolu

Tech
Sheck Exley

Diving With
**Humboldt
Squid**

KIMBE BAY. WITU. MILNE BAY. TUFU. NEW IRELAND

Papua New Guinea

Portfolio
Seth Casteel

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COVER PHOTO: Diver and Coral Garden, Papua New Guinea,
by Steve Jones

Crinoid on fan coral, Kimbe Bay, Papua New Guinea. Photo by Steve Jones



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Less risk, *more* fun

It was not too long ago that diving was perceived as an extreme sport, which insurance would either not cover or cover only at a premium. Fortunately, the world has since come to its senses. Nowadays, diving has become, for better or worse, just another leisure or holiday activity, which you can share with family or friends for an evening, weekend or vacation.

As statistics have abundantly documented, recreational diving is really quite safe a pastime and on par with many other outdoor activities—that is, when it is performed along the guidelines set forth by the training agencies.

This is thanks to decades of advances in technology and training but in no small measure also from lessons learned by past accidents and research.

I recently watched a Formula One race on TV. Barely had the cars moved off the starting grid before a massive collision

occurred, catapulting some of the racers into the air. In a matter of only a few seconds, a handful of very expensive high tech racing cars were ignominiously reduced to crumbled masses, with bits and pieces strewn all over the track.

One or two decades ago, an accident of such severity would surely have led to fatalities or serious injuries. But now, thanks to a number of modern safety features derived from accident analysis, all drivers were able to climb out of the wreckage, suffering no injuries other than a rather dented pride.

Diving has also become a lot safer.

However, it is not and will never be completely risk free—just as is the case with any other outdoor activity. But risk can be reduced and kept to an acceptable minimum.

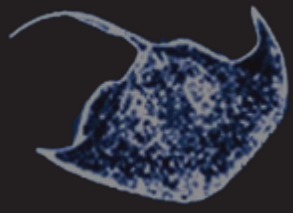
This is an ongoing process, which also depends on

whether we, as individual divers, are still prepared to listen and learn and constantly improve our skills and understanding. There is a lot we can do to minimize risk and avoid accidents. But while improvements in technology are all fine and helpful, they don't do it alone. Safety is also a matter of mind set.

In this issue, Gareth Lock addresses the issue of a 'Safety Culture' (see p. 61). His article is one of the most significant contributions we have seen in the magazine for a long while, so please give it a good read and some thought to the matter at hand.

Only you are in charge of your attitude and can decide whether you will let pride stand in the way of better, safer and, consequently, more enjoyable diving.

—The X-RAY MAG Team



News edited
by Peter Symes

from the deep
NEWS



Twenty-five new coral fish described



All images this story by Gerald Allen

Conservation International (CI) recently announced the release of the three-volume book set, *Reef Fishes of the East Indies*, by CI scientists Dr Gerald Allen and Dr Mark Erdmann, representing the culmination of a combined 60 years of effort to document the biodiversity of the mega-diverse coastal waters of the East Indies. The book set contains concise descriptions of each of the 2,631 currently known reef fish species from the region. ■



CLOCKWISE FROM LEFT: Fairy basslet, *Pseudanthias mica* (male); Tripod fish, *Pteropsaron longipinnis*; Beautiful blue dart fish, *Ptereleotris rubristigma*; Shrimp goby, *Tomiyamichthys gomez*, named after former Director of the Marine Sciences Institute at the University of the Philippines Dr Edgardo Gomez for his contributions to marine sciences; Fairy goby with iridescent blue eyes, *Tryssogobius sarah*

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Candy-striped clingfish (above), *Lepidichthys akiko*; Delicate tiny sand goby (left), *Grallenia baliensis*; Rare goby (below), *Acentrogobius cendrawasih*



Clingfish (left), *Aspasmichthys aloreensis*; Small coral bream (above), *Pentapodus komodoensis*; Red spotted sand perch (top), *Parapercis bimaculata*

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All images this story by Gerald Allen



MATTHEW MEIER

Giant kelp forest. This filephoto is from California

Australia list kelp forest as endangered

The giant kelp jungles in the waters off southeast Australia are gravely threatened by climate change. In some areas off the east coast of Tasmania, they have shrunk by more than 95%. Environment Minister Tony Burke has listed the forests as endangered.

It is the first time a marine ecological community has been given such protection under (Australian) federal environmental law. The only remaining kelp forests are around southeast Tasmania, southeast South Australia and western Victoria.

Listing the forests as endangered means that restrictions could be placed on activities that exacerbate the threat, such as overfishing, dumping waste and

land uses that wash too much sediment into the sea. Karen Gowlett-Holmes, a marine biologist with the CSIRO and co-owner of Eaglehawk Dive Centre on the east coast of Tasmania, told *The Sydney Morning Herald* the destruction of the kelp forests was having "a huge impact" on marine ecology.

CSIRO released a marine health snapshot that provided evidence for what scientists have long suspected: climate change has strengthened the East Australian Current, which moves down the

east coast, driving marine species south to seek colder waters. The warming sea temperatures are also influencing the distribution of marine plants and animals, with species currently found in tropical and temperate waters likely to move south. Giant kelp grows in dense stands known as kelp forests, which are home to many marine animals that depend on the algae for food or shelter. Giant kelp is one of the fastest-growing organisms on Earth. They can grow at a rate of two feet a day to reach over 45m (148ft) long in one growing season. ■

Cook Islands declares world's largest marine park

The 1,065-million-square-kilometre reserve will be the largest area in history by a single country for integrated ocean conservation and management.

Australia announced in June that it was creating a network of marine parks covering 3.1 million square kilometres, more than a third of its territorial waters. However, they are dotted around its huge coastline.

The new Cook Islands protected zone will be the largest single marine park in the world, taking in the entire southern half of the nation's waters.

Prime Minister Henry Puna called on other Pacific island nations to follow the Cooks' lead and create an enormous protected zone in the ocean.

Kiribati and Tokelau have already created large reserves, while the French Pacific territory of New Caledonia this week announced plans to set up a 1.4 million square kilometre park in the next two to three years. ■

Marine reserves give reef fish the best protection

Reserves perform significantly better than any other fishery management system for tropical reefs says a new study. Using fish counts and habitat measurement, the study tested how marine reserves in Guam contributed to the reproductive biomass of the thumbprint emperor fish (*Lethrinus harak*), a common and typical reef fish.

The team from University of Guam and Curtin University compared fish biomass across four sites: two fully

protected from fishing and two open to fishing. The total biomass from the fully protected sites was over five times greater than on comparable fished sites.

Such differences were even more pronounced in spawners, with 16 times more biomass. Furthermore, adults made up a higher percentage of the population in fully protected areas. ■



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Starfish evolved super fast

Two closely related "cushion stars," *Cryptasperina pentagona* and *C. hystera*, living on the Australian coast are identical in appearance but live in different regions. *Hystera* occurs on a few beaches and islands at the far southern end of the range of *pentagona*.

And their sex lives are very, very different. *Pentagona* has

male and female individuals that release sperm and eggs into the water where they fertilize, grow into larvae and float around in the plankton for a few months before settling down and developing into adult sea stars.

The researchers looked at the diversity in DNA sequences from sea stars of both species and

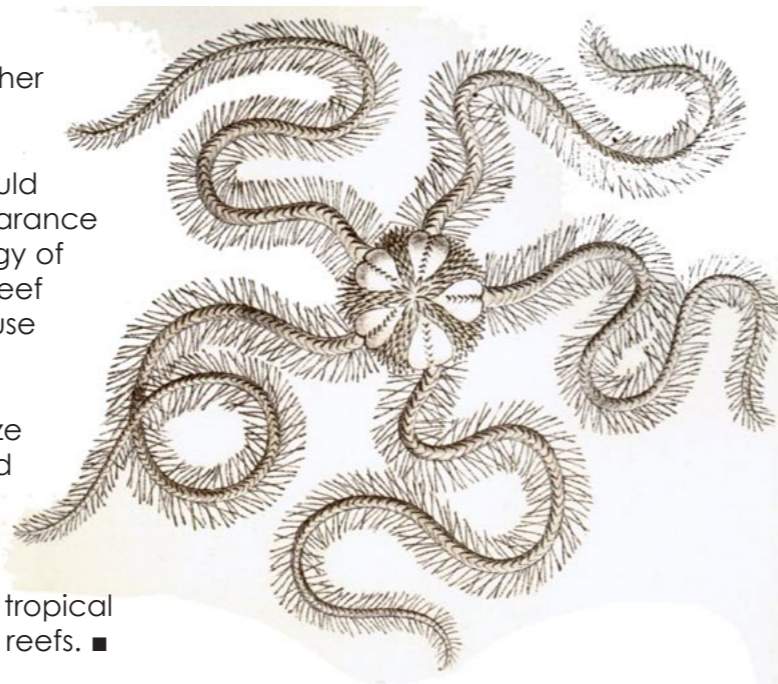
estimated the length of time since the species diverged. The results show that the species separated about 6,000 to 22,000 years ago. That rules out some ways new species could evolve. For example, they clearly did not diverge slowly with genetic changes over a long period of time, but were isolated quickly. ■

Pacific brittle star invades the Atlantic

Growing populations have established themselves at distant points in the Atlantic, its presence near Brazilian and Caribbean ports more than 4,500 km apart suggests it could have been spread by shipping.

Clonal, six-armed brittle stars (*Ophiothela sp.*), previously limited to the Pacific Ocean, have invaded Brazil and St. Vincent. Large numbers of the small stars, which can be readily visible on soft corals, sponges and other hosts, eventually may become abundant from Florida to South America. The impact of the *ophiothela* brittle star remains to be seen. Like most marine invertebrates (except for commercially important species) we know little about its biology, so it is difficult to envision how it will affect the ecology of its new

ocean. But further expansion of the range of *Ophiothela* could alter the appearance and the ecology of Atlantic coral reef habitats because *ophiothelas*, in multitudes, densely colonize gorgonians and sponges on Indo-West central Pacific and on tropical eastern Pacific reefs. ■



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The main reason that Indo-Pacific reefs are more resilient is they have less seaweed than the Caribbean Sea.

— Dr George Roff

Indo-Pacific corals are tougher

Coral reefs in the Indo-Pacific region, including the Great Barrier Reef, recover faster from major stresses than their Caribbean counterparts.

Seaweed and corals are age-old competitors in the battle for space. When seaweed growth rates are lower, such as the Indo-Pacific region, the reefs recover faster from setbacks. This provides coral with a competitive advantage over seaweed, and our study suggests that these reefs would have to be heavily degraded for seaweeds to take over, explained Dr George Roff from the ARC Centre of Excellence for Coral Reef Studies. The researchers also found that seaweeds in Indo-

Pacific region bloom four times more slowly than those in the Caribbean.

"We're not sure why this happens, but a plausible theory is that Caribbean waters are highly enriched in iron," they said. "For thousands of years, the Caribbean Sea has received dusts that blow across the Atlantic from the Sahara, and the dust contains iron—an essential element for algae to grow.

"This suggests that the difference between the Indo-Pacific and Caribbean oceans and their coral reefs is

fundamental, and occurs on a very large scale.

Indo-Pacific teeming with fish

"Another factor that protects these reefs is the abundance of herbivorous fish, such as surgeon and parrotfish that treat seaweed as a delicacy. The Indo-Pacific region has a lot of these fishes.

"For instance, the Indo-Pacific region has 70 species and six genera of parrotfish, while the Caribbean only has 13 species and two genera of the fish." ■

The Pacific is divided

The formidable Eastern Pacific Barrier virtually divides the vast ocean in two different biological zones.

The Eastern Pacific Barrier (EPB) is an uninterrupted 4,000-mile stretch of water with depths of up to seven miles, which separates the central from the eastern Pacific Ocean. In 1880, Charles Darwin hypothesized that most species could not disperse across the marine barrier, which he had

termed "impassable" in his writings. A recent study, by a team of researchers led by Iliana Baums, an assistant professor of biology at Penn State University, is the first comprehensive test of that hypothesis using coral and has confirmed that many species of marine animals seem unable to cross this

oceanic divide. "The adult colonies reproduce by making small coral larvae that stay in the water column for some time, where currents can take them to far-away places," Baums said. "But the EPB is a formidable barrier because the time it would take to cross it probably exceeds the life span of a larva." ■

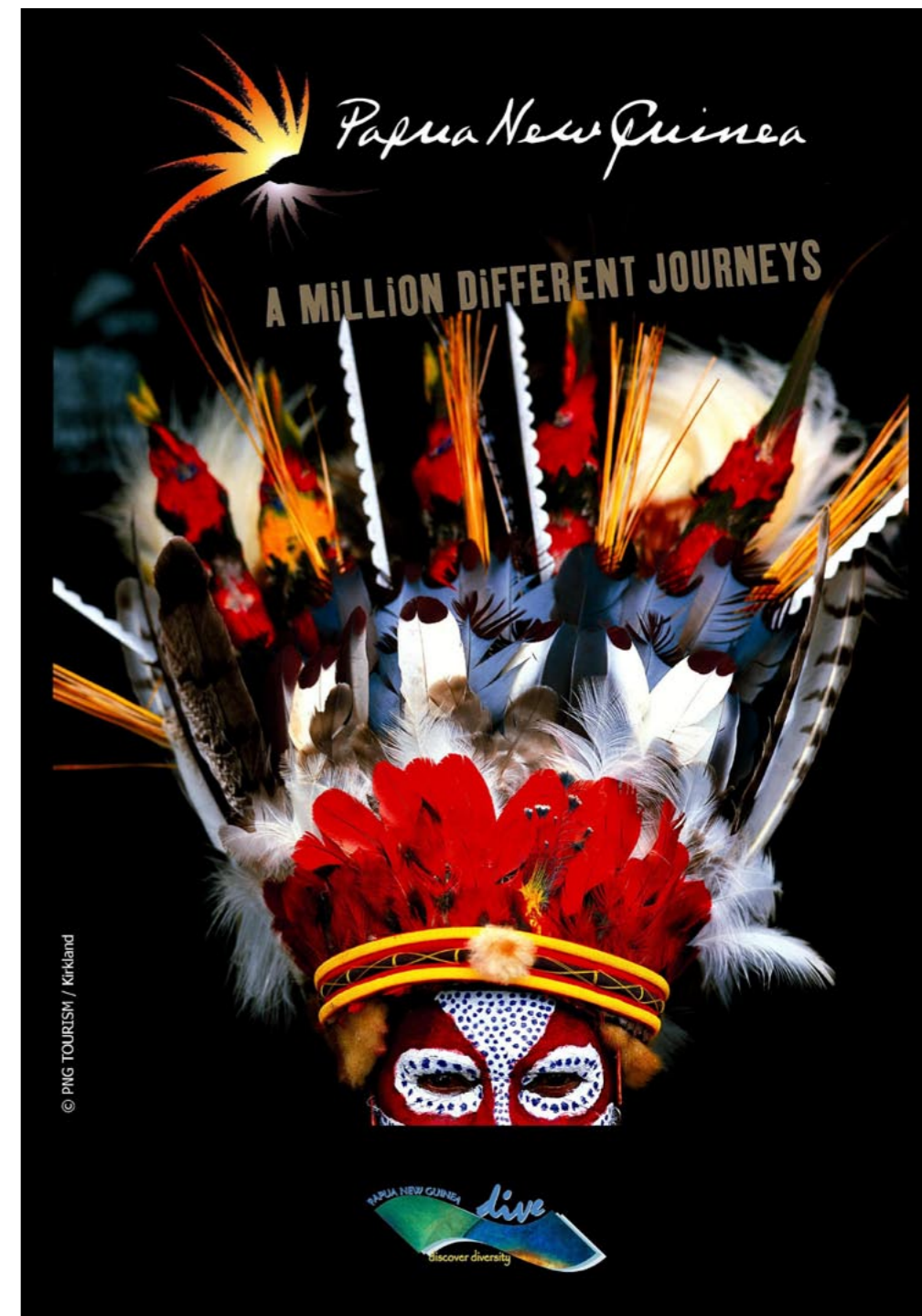
Increased growth responsible for color changes in coral reefs

Increased growth is the underlying physiological process associated with disease, wounding and stress-related colour changes in reef-building corals.

Locally accelerated growth in the presence of foreign biological material, represents a novel component of the innate immune response of reef corals in which the animals try to neutralise potentially dangerous organisms by overgrowing them, a new study finds.

The study conducted by researchers from the University of Southampton and National Oceanography, Southampton, just published in the latest issue of the journal *Coral Reefs* investigated distinct green fluorescent protein or GFP-like pigments responsible for the green, red and purple-blue colours of many reef-building corals.

By examining these GFP-like pigments in four coral species from the Red Sea, the Arabian/Persian Gulf and Fiji, researchers found that their presence indicates growing tissue in growing branch tips and margins of healthy coral colonies as well as in disturbed colony parts, compared to undisturbed areas. ■



PETER SYMES

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Diving the *Arrow*

Text by Robert Osborne
Photos by Ingo Vollmer

It's an unsettled kind of morning on Chedabucto Bay of Canada's east coast. The sun is shining—it's really quite pleasant—but there's a brisk wind blowing from the southwest. What that translates into here in the waters between Cape Breton Island and Nova Scotia is heavy seas. We're pounding through four to six foot swells in a 25-foot rigid hull inflatable boat. The ride out to the dive site is turning out to be a wild, you might say bone-jarring, experience. All this for a dive that I'm still not certain I want to do at all.

We're on our way to dive on the wreck of an oil tanker called the *Arrow*. But given the state of the sea I'm not sure whether we're going to be able to get down.



Getting out of the boat isn't going to be a problem. But crawling back in when the boat is swinging

through a three meter arc is a real question mark. The other question mark: What

am I going to find? When the *Arrow* went down on 4 February 1970, it was an environmental

disaster of catastrophic proportions—one that at the time rivaled the more recent Gulf of Mexico

disaster. Am I going to find a thriving artificial reef or a still leaking environmental killer?

wreck rap



Anita Vollmer looking at sculpin hiding in sea weed (right) and on deck of *Arrow* (bottom); Diver (below) by rudder. PREVIOUS PAGE: Mid ship on *Arrow*, looking at valves used to control oil flow



Arrow

20 years-old—the second oldest ship in the fleet—and the *Arrow* wasn't in a great state of repair. In fact, virtually all of her navigation systems, with the exception of her compass, were out of order.

As she entered the bay the *Arrow* encountered heavy rain and winds gusting to 60 knots. Slowly but

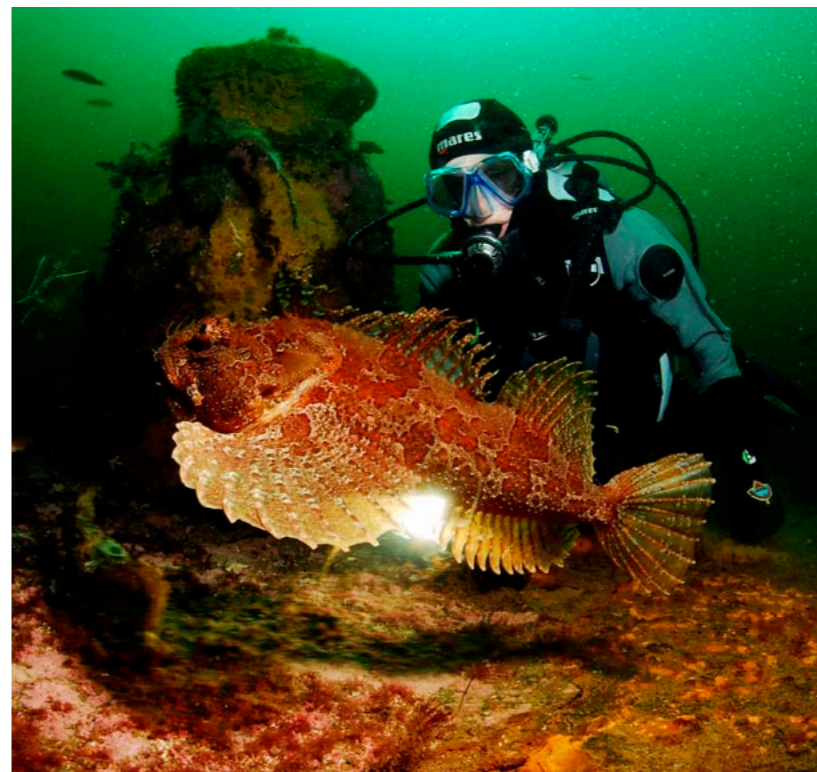
surely, as the ship made its way down the bay she drifted out of the shipping lane. By the time she was way halfway, the *Arrow* was well out of the safe zone. At 9:30 a.m. she struck Cerberus Rock and ran herself well up onto the reef. Initially officers and crew were not overly concerned. They tried full reverse to get off. No luck. But the captain, George Anastassopoulos, felt that they still

could work free at high tide. No distress signal was sent. The first step toward an environmental disaster had just been taken.

Diving the *Arrow*

After 20 minutes of pounding through the waves we arrive at the buoy that marks the location of the wreck. My host, Ingo Vollmer, casts a skeptical eye on the water conditions. Finally, he makes a decision: "I think it's possible." I slide into my dry suit and gear up. My dive buddy for the day is Ingo's wife, Anita. We roll backwards off the RHIB and swim over to the descent line. A quick check and we submerge. Right away I can tell this isn't going to be a promising dive. It's

only 30 meters deep here and the rough water has churned up the bottom. We descend to the wreck with only two to three meters of visibility and hit the top of the superstructure at about 20 meters.



How it happened

The weather was sunny but windy on that winter day when the Olympic Maritime ship *Arrow* entered Chedabucto Bay. She was hauling 108,000 barrels of Bunker C fuel oil for Imperial Oil, on her way to offload at Nova Scotia Pulp Limited. The *Arrow* was not what one would describe as the pride of Aristotle Onassis' fleet. She was

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CLOCKWISE FROM LEFT:
Diver examining plumose
anemone; Looking down
the port gangway; Finback
whales in Chedabucto
Bay; Inside the superstruc-
ture of the *Arrow*

though I have to admit I feel vaguely like a Navy Seal when it's all over. Ingo asks me how the dive went. When I tell him, he says: "We'll try again tomorrow." He fires up the engines and we head for shore.

History

Hoping tomorrow would bring a better day was something that Captain Anastassopoulos was relying on. He was certain that he could reverse his ship off the rocks. But after trying all day without success he began to realize this was more serious than he'd first thought. The weather was starting to turn really ugly. Finally, he sent out a distress call. A Canadian Fisheries vessel responded and removed most of the crew.

During the next day several attempts were made to tow the *Arrow* off the rocks. All attempts were unsuccessful. It was finally decided that to pull the ship off the rocks, the oil would have to be pumped out. But salvagers decided to wait until the following day—a decision that some see as the second major error in the catastrophe.

The next morning was too late. When crews arrived on site, a three mile-long oil slick had already spread out across the bay.

Overnight the *Arrow* had split and

nals me to follow. We manage to complete a circuit of the wreck—down to the rudder at 30 meters and around the hull—

but all I can make out are just vague dark impressions. After 30 minutes we give up and head for the surface.

And this is where the dive gets a

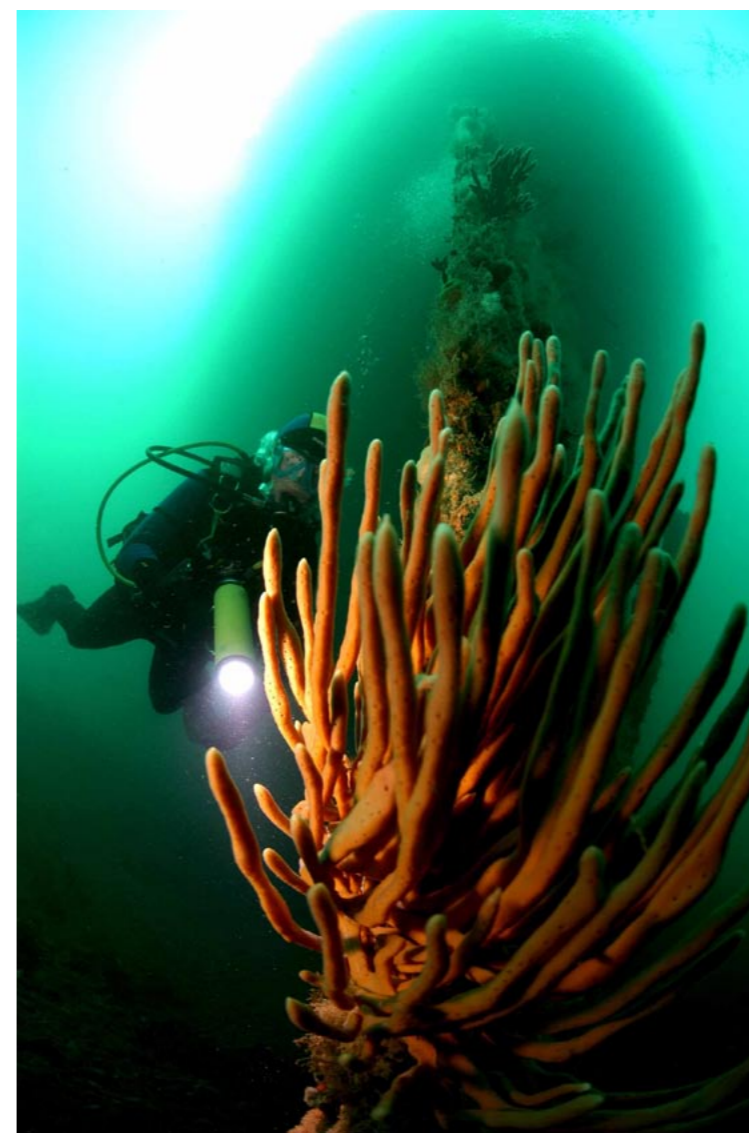
little tricky. The winds have picked up even more. The RHIB is bouncing up and down in a dangerous manner and there is no dive ladder. Getting back in is like something out of a rodeo. We have to catch hold of a rope and, while hanging on the side, remove our BCDs and weight belts, hand them up to the boat tender and then heave ourselves in. At the top of the arc my feet are nearly clear of the water, at the bottom I'm submerged to my neck. My arm and shoulder get severely yanked around and it takes some real work to hang on, but eventually I manage to get all my gear off and haul myself up over the side. I'm getting too old for this stuff,



I can see we're on a wreck, but not much more. Fortunately, Anita knows this dive site like I know my neighborhood; she could find her way around blind folded. She sig-



Arrow



CLOCKWISE: Inside *Arrow* just above engine room; Miniature sea anemone growing on sponge on wreck; Sponge growing on rudder plate; Sea anemone inside cargo hold

the bow section had already sunk spilling 3.5 million gallons of oil. The majority of the ship—the back two-thirds—was still intact on the surface. Most of the oil was contained in that section. Coast Guard ships tried to get a line on her to tow her into port. But again the weather drove them back.

The following morning the stern section was gone as well. An environmental time bomb was now sitting on the bottom of the bay. Within days, maybe even hours, that bomb could go off releasing millions of gallons of oil.

Back to the present

Day two and we head out once again. Again the winds are coming from the southwest and that means there's still a heavy swell. As we approach the reef where the *Arrow* struck, the seas flatten out—marginally. Ingo decides we're good to go and once again we're over the side and dropping down the descent line. This time Anita decides we'll do a circuit around the superstructure and top deck. Again the visibility is poor. But we're only at about 20 meters so the light penetration is excellent. I start to see more. Masses of


shaggy seaweed cover the gangways of the superstructure. Thousands of small bait fish, a kind of ocean perch called cunners swarm the top of the wreck. As we work our way down the length of the main deck, Anita points out a wonderful macro feature. The pipes and machinery that used to move the oil are covered in miniature orchid-like

sea anemones. As I approach, some of the pipes they look as if they're covered with frosty clouds of candy floss. We hit the far end of the wreck and I notice a couple of very promising points of penetration—old

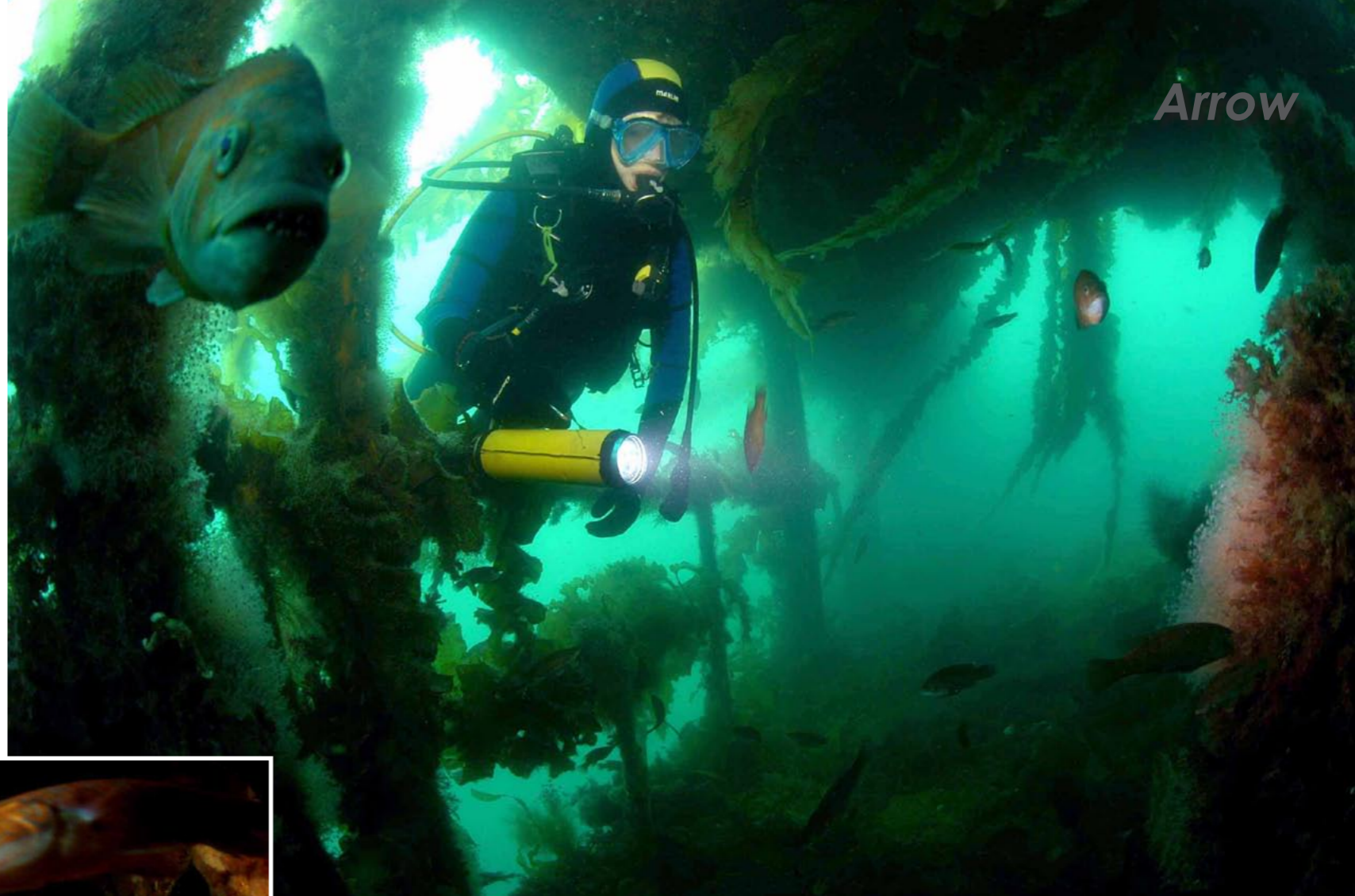


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CLOCKWISE: School of cunners (sea perch); Anita Vollmer penetrating gang way area; Small wolf fish in old pipe with wreck of *Arrow* behind; Diver at port gangway

hatchways that lead down to the forward hold and out the front of the wreck. I make a mental note to revisit them on the next dive when the visibility is better. We hit our turnaround time and head back for the boat. A more promising dive to be sure, but I can't help thinking there's more to this wreck than I'm seeing under these conditions. One thing I am sure of, this wreck is no longer an environmental time bomb.

Response

The first divers visited this wreck within days of her going down, but they weren't recreational divers. They were military—and with a tough job ahead of them. In response to the sinking, the Canadian government launched what amounted to a virtual military campaign. The spill from the bow section had already contaminated 190 miles of coastline and potentially destroyed the local fishing industry. They didn't want the rest of that oil leaking out and finish-

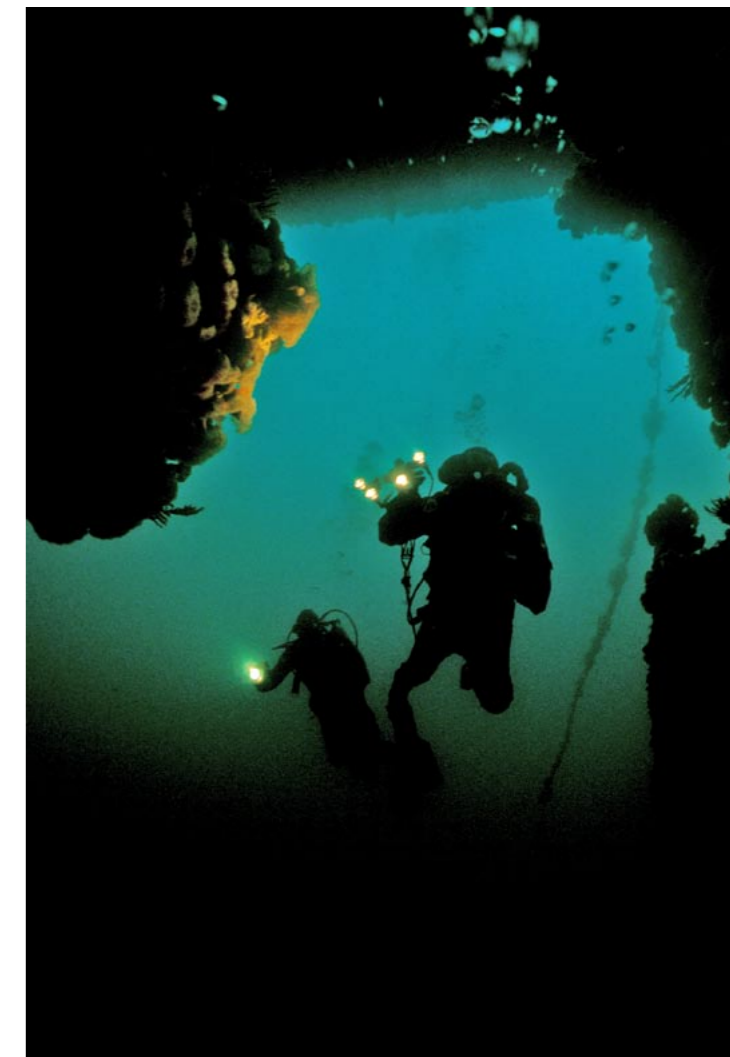
ing the job. So the Canadian military, with the assistance of the U.S. and Canadian Coast Guard, started a campaign to save the bay.

It was a two part operation: one part was to clean up and contain the millions of gallons already spilled. The second thrust was to get pumps down to the wreck and get the oil in the stern section safely into a barge. The operation went better than anyone could have expected. Within weeks divers had attached pumps to the outside of the wreck and, using an ingenious technique of pumping hot water into the holds to heat the oil so it would flow, they pumped the oil up to a waiting barge.

The clean up on the shore took a lot longer and the success of that part of the job drew mixed reviews. Eventually, the government declared the operation complete and gradually the disaster drifted from memory.

Faded away until, that is, 20 years





CLOCKWISE: Looking towards front of wreck across mid section of deck; Sea anemone; Penetrating front end of wreck; Close-up of flounder; Wolf fish hiding in wreck

later, local divers began to explore the wreck and found that a transformation had taken place. A transformation I'm still trying to see on my third and final day of diving.

Third time's the charm

It begins on a promising note. I poke my head out of my cabin; the sun is shining. What's even better is that the wind has died completely. I head up to Vollmer Lodge's dive shop and quickly pack my gear into the RHIB.

This time the journey out is magical. We blast along on a

calm sea past islands covered with sea birds. Eagles perch in the trees that line the bay. Every time I turn and look, a harbor seal is poking its head out of the water. Suddenly Chedabucto Bay has come to life.

Without the heavy swell, our trip to wreck takes only a few minutes. We're over the side in record time and as soon as I submerge I know this dive is going to pay off. I can see the top of the superstructure 20 meters below me. As I descend, I start to get a sense of the scale of the wreck. It's

massive—around 140 meters long, 20 meters wide and about 20 meters high. We swim past the superstructure and head deeper to do a circuit of the main hull. Swimming ten meters away from the wreck and parallel, I'm dwarfed by the size of the structure. With such great visibility I also start to notice a few other details—the bottom is covered with scallops and lobster.

We circle around to the front of the ship. This is where the bow of the *Arrow* tore away from the stern; jagged and

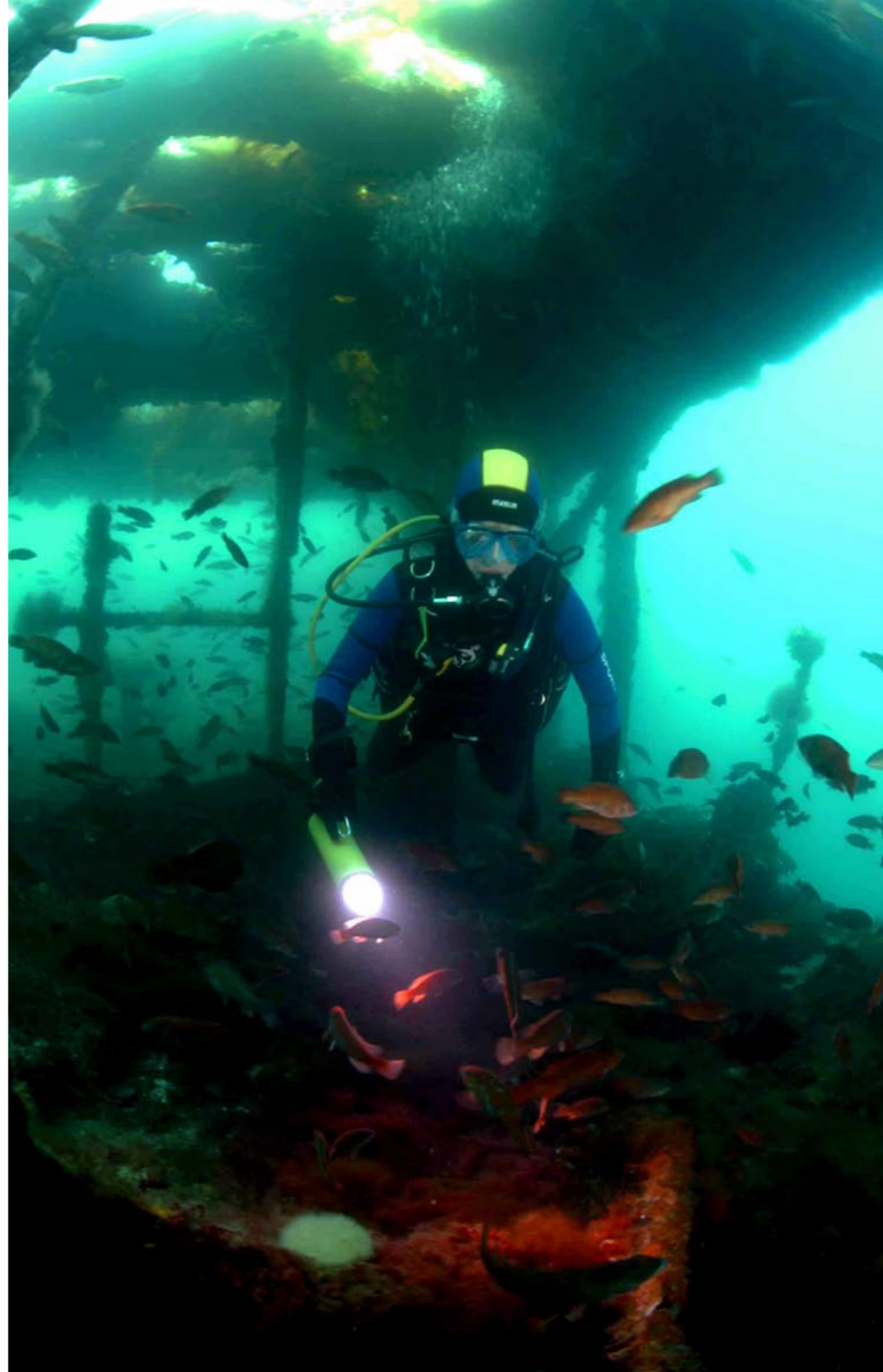
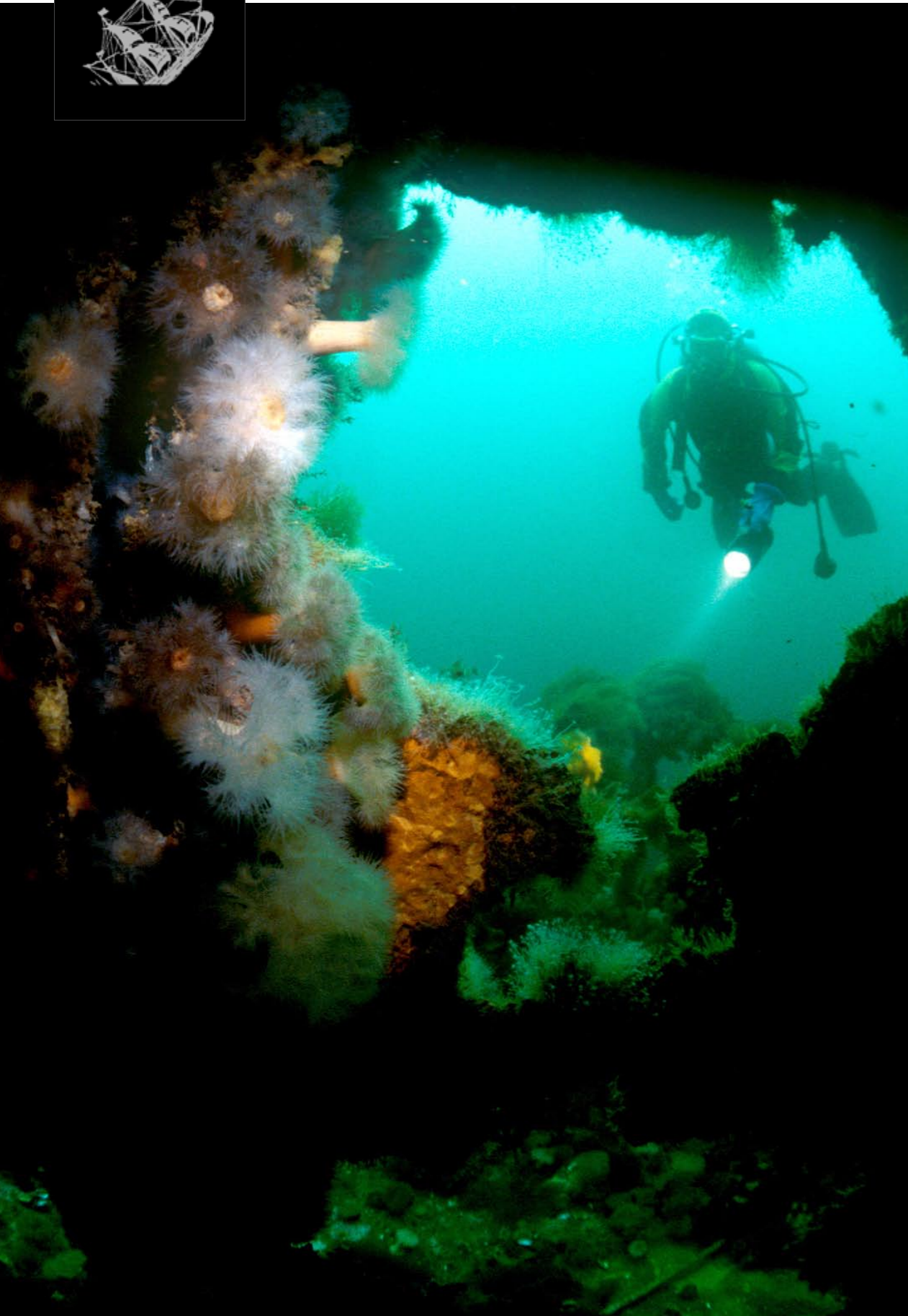
twisted plates and beams poke out from the hull looking vaguely like some surreal metallic space squid. Oddly there's enough clearance to swim in for a quick look. A mental note, next time I come I should bring a reel or two, there's clearly lots to explore inside the hull of the *Arrow*.

We pop back out and head for the main deck. Now I'm beginning to get a sense of just how alive this artificial reef has become. In the midst of the





LEFT TO RIGHT: Diver peers into superstructure of *Arrow*; Diver with school of fish in main superstructure of wreck; Atlantic lobster on sea floor by wreck; Location of wreck on map of North America



Arrow

came to see, the sunken oil tanker I was so curious about.

Research

In fact, the government of Nova Scotia is also curious about what's going on at the site of the *Arrow*. It just launched a study to assess the long term effects of the oil spill on the surrounding environment. Researchers may yet discover that what appears to be a thriving ecosystem is still only a thin veneer of life on a toxic sub-surface.

Certainly studies done ten years and even 20 years after the *Exxon Valdez* spilled 750,000 barrels of oil into Prince William Sound show that wildlife populations are



it could take 60 years before some wildlife populations recover fully.

But if there is any long term damage in and around the wreck of the *Arrow*, then I've certainly not seen anything to indicate this. What I've witnessed from my brief visits is an example of how, given time, the sea has an almost infinite capacity to be resilient. ■

Features editor Robert Osborne is an internationally published dive writer, television producer and reporter based in Toronto, Canada.

shaggy masses of seaweed are star fish, crabs, the usual schools of cunners and cod. Little wonder that the harbor seals make this a regular stop for feedings. It's an underwater smorgasbord.

Hard to imagine what this was like 40 years ago—an environmental disaster of staggering proportions. Later Ingo

tells me that inside the hull, you still come across globs of oil, but I see no evidence of any lasting environmental impact on this dive.

Long before I'm ready to surface I'm out of bottom time. This time it's an easy pull to get into the RHIB and a gentle ride back to shore. I've finally seen a good glimpse of the wreck I

not recovering quickly and signs of deformities from low levels of toxicity are common. High levels of leukemia have been recorded and anyone who digs down a few inches discovers globs of oil cropping up. Even in the Bay of Biscayne where the *Amaco Cadiz* went down in 1978 (spilling 1.6 million barrels of oil) scientists say



HMS Terror thrown up by the ice. Engraving after a drawing by Captain George Back, from his 1836-37 Arctic expedition



Franklin's lost ships

The Canadian government launches its largest search yet for the lost ships of Sir John Franklin's doomed 1845 quest for the Northwest Passage.

This year's search, led by Parks Canada, is the fourth government-led expedition over the past five years and is by far the biggest, involving a much larger alliance of federal departments and other public and private interests.

Parks Canada is expanding the scope of its investigation this year

with new partners, vessels and instrumentation to cover more area over an approximate four weeks rather than the six days of surveying done in past years.

UVic's Ocean Technology Lab's AUV is equipped with a bathymetric side-scan sonar system to gather three-dimensional data about the ocean floor that

can be used to identify items of archeological interest.

None of the 129 men on board survived, and although traces of the expedition have been found, the ships' final resting places remain unknown.

The ships were last seen entering Baffin Bay in August 1845. The disappearance of the

Franklin expedition set off a massive search effort in the Arctic.

The broad circumstances of the expedition's fate were first revealed when Hudson's Bay Company doctor John Rae collected artefacts and testimony from local Inuit in 1853. Later, expeditions up to 1866 confirmed these reports. ■

Robert Scott's ship found

The *SS Terra Nova*, the ship that took Captain Robert Falcon Scott and his team on their ill-fated expedition to the Antarctic a century ago, has been found on the seabed off Greenland. The famous polar exploration vessel was known to have sunk off the coast of Greenland in September 1943 after being damaged by ice.

A crew from the Schmidt Ocean Institute discovered the *Terra Nova* whilst testing echosounding equipment aboard its flagship vessel—the *R/V Falkor*.

Last month, during routine functional performance testing of the multibeam mapping echosounders on the Schmidt Ocean Institute's flagship, *R/V Falkor*, the team aboard—including

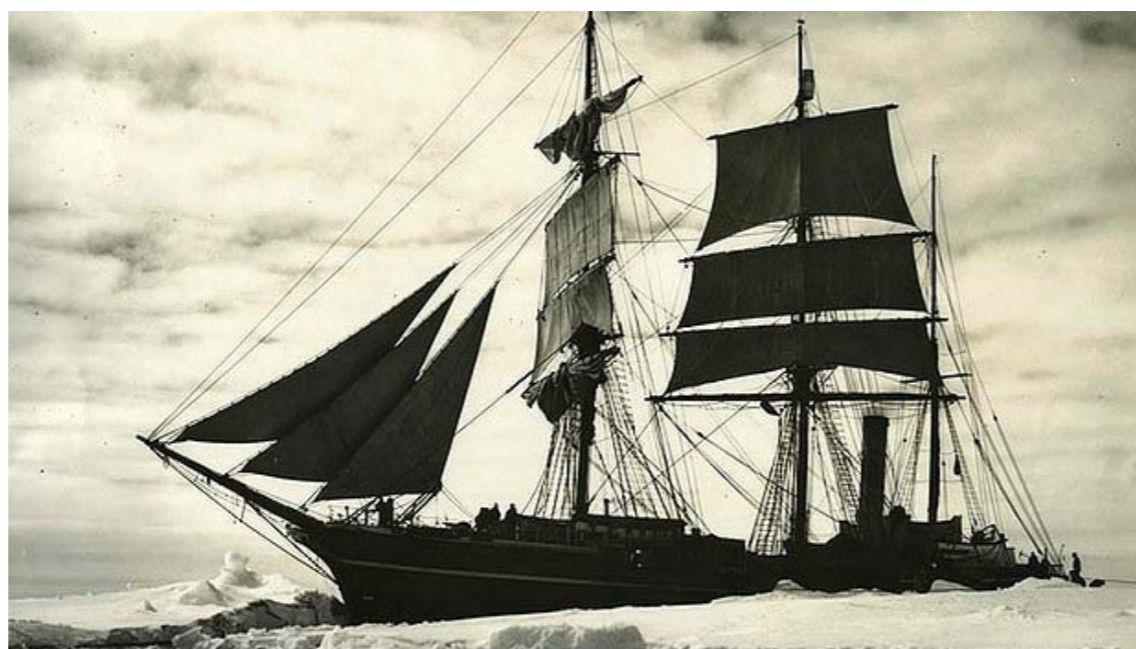
researchers from the University of New Hampshire, Ifremer, and Woods Hole Oceanographic Institution—discovered the *S.S. Terra Nova*, a whaler,

sealer and polar exploration ship that sunk off the southern coast of Greenland in September, 1943, after being damaged by ice. The crew was saved by the U.S. Coast Guard cutter *Southwind*.

On arriving at the geographical South Pole in January 1912, Scott and his party discovered they had been beaten to it by a Norwegian team led by Roald Amundsen.

The polar team led by Scott died on their return journey from the pole; their bodies were found by a search party eight months later.

Their endeavour became popularly known as the *Terra Nova* expedition. ■



The *SS Terra Nova*



Search is on for Capt. Cook's Endeavour

A marine archaeologist is hoping to find and recover the wreck of Capt. James Cook's famous ship the *Endeavour* in Newport Harbor.

HMS Endeavour, also known as *HM Bark Endeavour*, was a British Royal Navy research vessel commanded by Lieutenant James Cook on his first voyage of discovery to Australia and New Zealand from 1769 to 1771.

The *Endeavour*, which Cook sailed to Australia in 1770, was scuttled by the British in 1778 as part of its blockade of Narragansett Bay.

Endeavour's end came in August 1778 when the British occupation of Newport was threatened by a fleet carrying French soldiers in support of the Continental Army. The British commander, Captain John Brisbane, determined to blockade Newport Harbor by sinking surplus vessels in its approaches. Between August 3-6, a fleet of Royal Navy frigates and transports, including Lord Sandwich,

were scuttled at various locations in Narragansett Bay.

The Rhode Island Marine Archaeology Project (RIMAP) is engaged in a multi-year process to locate and identify the 13 British transports sunk in Newport Harbour on 5-9 August 1778.

RIMAP's research process is to find all of the transports that still exist, to study each site in turn and to determine how closely each fits the descriptions of the known transports.

Even if the *Endeavour* is not found, Rhode Island has discovered one of the largest Revolutionary War fleets of transports, and that is significant because little is known about this important (but usually overlooked) ship category of the American Revolution. ■



training bulletin

Edited by
Peter Symes

Even after 27 years working at PADI and nearly 40 years in the dive industry, I feel like I'm just getting started. There is so much opportunity ahead to authentically transform peoples' lives and leave a legacy for future generations

— Drew Richardson

Drew Richardson to take the helm at PADI Worldwide

Brian P. Cronin, PADI Worldwide CEO and Chairman of the Board for the past 17 years has announced his retirement. Dr Drew Richardson has been appointed as his successor.

Richardson joined the PADI organization 27 years ago and has most recently served as PADI Worldwide president and chief operation officer. A dive industry veteran, Richardson has been

involved in water safety, scuba diving and dive education since 1974, and his contributions have had an enormous effect on the dive community worldwide. ■



PADI WEBSITE

DEMA launches health & business insurance program for U.S. members

Members located in any of the 50 U.S. states can purchase a variety of health insurance products including a pharmacy benefits program, group employee and individual health insurance, business insurance and have access to workers compensation insurance at DEMA member-only rates.

Competitive insurance rates are avail-

able to DEMA members because DEMA has combined with more than 9,000,000 association participants from across the United States

Every company in the diving industry is faced with escalating health care insurance costs for their owners and employees, and in some cases these companies have had limited or no access to health insurance coverage

— Tom Ingram,
DEMA Executive Director

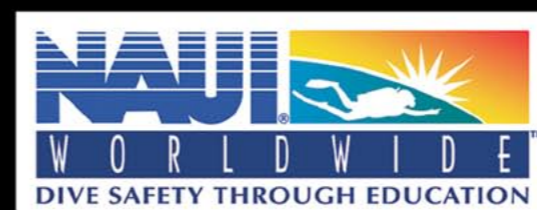
to make it possible for even the smallest DEMA member company to purchase health insurance when they become part of the association.

Getting a customized quote through the DEMA Member Insurance Program is easy. Members simply log on through the DEMA Member Dashboard and enter the Insurance Program portal. There, they are able to customize their desired plan by choosing the coverage, which works best for their business size, their state, their specific needs and budget. Members can even compare their quote with other carriers to make sure they are getting the best rate available for their needs. ■

What will you do with your certification?



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Edited by
Scott Bennett

Credit card fee for buying flights and holidays to be banned

The hidden fees, which cost customers more than £300 million a year, are imposed on flights, holidays and a range of other services.

New rules in the United Kingdom will soon outlaw the practice of charging customers to use cards. From the end of next year, almost all transactions will be covered. Companies that break the rules will be hit with multi-million-pound fines. The government decided to act after a damning report by the Office of Fair Trading earlier this year denounced the widespread use of card scams.

Under the plans, businesses will not be able to load on excessive payment surcharges. But they will be able to add a small charge to cover their real costs for using any particular form of payment. That is likely to cap credit card costs at a maximum of two per cent per transaction, or around 20p for a debit card payment.

Airlines regularly charge three or four per cent for credit card payments. From mid-2014, an E.U. Consumer Rights Directive will ban businesses in many sectors, including airlines, from imposing above-cost surcharges on any form of payment.

Airlines already scrapping fees

Meanwhile 12 airlines, including EasyJet and Ryanair, will no longer spring last-minute fees on customers paying by debit card, U.K. Office of Fair Trading has said.

The carriers have agreed to include debit card surcharges in the headline ticket price rather than surprise consumers at the end of the booking process. The airlines also agreed to make surcharges

clearer and easier to find during the booking process, the OFT added. ■

We want to make sure that consumers paying by card do not have to pay the excessively high surcharges being imposed on them by some airlines and other businesses.

— Consumer Minister
Edward Davey

Good to know



Even if you are not an E.U. citizen, the consumer protection outlined in the European Union's bill about pas-

senger's rights will apply if you happen to travel on either an E.U.-based airline or a flight departing the European Union. The main air passenger rights deal with the following issues:

- Long delays
- Denied boarding
- Cancellation
- Baggage
- Price transparency
- Identity of the airline
- Package holidays
- Identity of the airline
- People with disabilities and people with reduced mobility ■

► EU's Passenger rights

Purchase your rebreather on a trip

Siren Fleet is offering you the opportunity to purchase your own Poseidon Recreational Rebreather and combine that with a training course and liveaboard diving in the Philippines.

Board the S/Y *Philippine Siren* for a ten-night diving safari on any of our itineraries, and they will have your new rebreather waiting for you. Courses will be taught on board using the Poseidon Discovery MKVI, which is the fully automated closed circuit rebreather unit specifically designed for recreational diving.

Take the UWECO course with one of their certified instructors, continue to dive on your own unit for the duration of your trip, and then take your new unit home! ■

► More details



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Western Australia bans shark tours

Western Australia state said it would introduce rules to ban most shark tourism after four fatal attacks on bathers in the region over the past year.

Norman Moore, the fisheries minister of Western Australia, quoted research that suggests cage diving can change the behaviour of sharks.

“I have decided that Western Australia will not be the place for shark cage tourism,” he said, while recognising that the activity can bring in tourism revenue. He claimed Western Australia, in contrast to Southern Australia and South Africa, had no known areas where sharks congregated.

“The Commonwealth Scientific and Industrial Research Organisation’s research at shark cage diving sites in South Australia found that white sharks in the study area changed their distribution to align with areas of active berleying (baiting) and, while there was

no determination from the study about the longer term effects on shark behaviour or outside the study area, I would prefer to take no risks until more is known,” Moore told *Bloomsberg Businessweek*.

A total of AU\$13.65 million (£9 million) has now been allocated

to reduce the risk of attacks along Western Australia’s pristine coastline, which draws tens of thousands of tourists every year. The money will be used to fund increased shark safety awareness and research into shark activity in the region.

The existing satellite-linked shark monitoring project will be extended by two years, and additional monitoring equipment will be installed at locations in the southwest to help monitor shark movements. ■

I have decided that Western Australia will not be the place for shark cage tourism.

—Norman Moore, Fisheries Minister Western Australia



Cage diving with great white sharks off Gaudaloupe

Airline accidents at an all-time low

The 2011 accident rate for Western-built jets was the lowest in aviation history, surpassing the previous mark set in 2010.

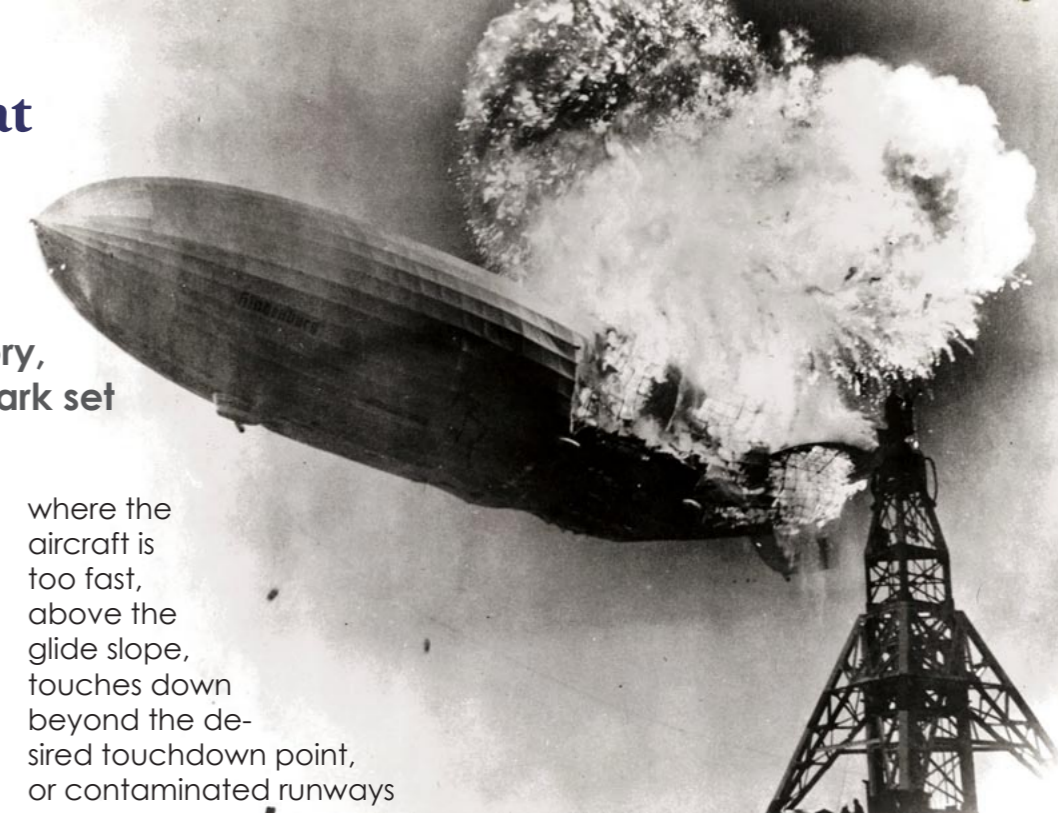
The figures released by IATA go on to show that 2.8 billion people flew safely on 38 million flights in 2011 with 92 total accidents, 22 of which were fatal, on both Eastern- and Western-built aircraft, down from 94 (23 fatal) in 2010.

The highest cause of accidents remains runway excursions at 18 percent. This is where an aircraft departs the runway on takeoff or landing, with 88 percent of the 17 accidents in 2011 coming on landing. Situations

where the aircraft is too fast, above the glide slope, touches down beyond the desired touchdown point, or contaminated runways are among the most common contributing factors to runway excursions on landing.

Similarly ground damage was the second most serious concern, accounting for 16 percent

of accidents. This includes incidents involving ground handling operations and incidents during taxi. ■



Oregon’s crater lake closed for diving

Threat of invasive species prompts U.S. Crater Lake National Park officials to temporarily close lake to scuba diving.


The lake—the centerpiece of Oregon’s only national park, and at 1,943 feet, the deepest and clearest lake in the United States—was temporarily closed to diving while park ecologists developed a plan to keep out invasive species. The most worrisome species are quagga mussels and spiny water flea; park officials are also concerned that



Crater Lake is deepest and clearest lake in the United States, created 7,000 years ago by the collapse of a huge volcano

the hemorrhagic septicemia virus, a deadly fish disease, could reduce native species and damage the lake’s ecosys-

tem. The lake won’t reopen to diving until 2013 and will likely require a permit and adherence to rigorous protocols. ■



Ed.—In this issue, we present comprehensive coverage of Papua New Guinea below and above the waves with reports from Steve Jones and Christopher Bartlett as well as an informative backstory on PNG by Don Silcock who has visited the country on a regular basis for 14 years. Enjoy!

Unity in Diversity

Papua New Guinea

Text and photos by Steve Jones

Spectacular reef scene with sea fan, anthias and diver at Barney's Reef, Witu Islands. PREVIOUS PAGE: Nudibranch (*Chromodoris coi*) on orange sponge, Fathers Reefs, Kimbe Bay

I've been on the road for 36 hours now, and I'm pretty much on the other side of the world from where I started back in rain drenched England. At last, I'm approaching the final legs of the journey—just a short one-hour flight to go. Things have gone smoothly so far, I'm thinking, as I wander up to the check-in desk for the last leg of my trip. "The flights full," the attendant tells me, "You'll have to wait until tomorrow."



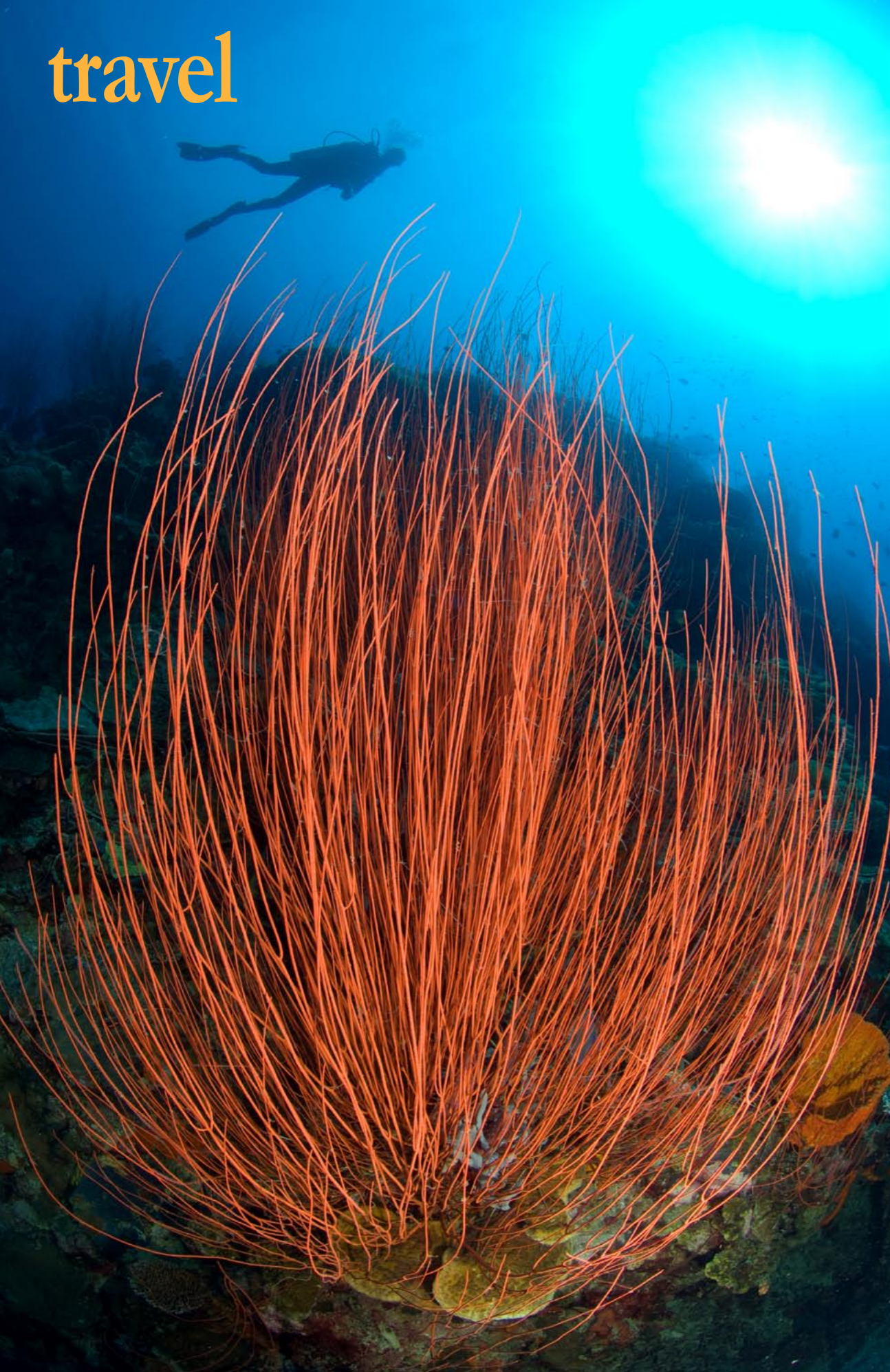
Commensal shrimp, Fathers Reefs, Kimbe Bay

Following a mixture of smooth talking and plain old pleading, I managed to "unoffload" myself, and I'm soon in the air heading for New Britain Island, Papua New Guinea. I should be out for the count, but I'm too excited to sleep. Ever

since I first learned of this country, from the pages of David Doubilet's, *Light in the Sea*, I've wanted to come here. I guess I'm a slow starter, for I read that book nearly 20 years ago! "Make sure you get a window seat!"

was the message from everyone who I knew who'd been here. The view really is staggering. Papua New Guinea is as raw and untamed land as you'll find. The landscape ranges from mountainous highlands to rich rainforest; its ecosystem

attracts scientists from the world over, and upwards of 850 languages are spoken here. With such extraordinary variety, how apt that the country's motto is, "Unity in Diversity". In no time, we touch down at Hoskins



Diver and red whip fan coral



Diver in archway with giant barrel sponge, Fathers Reefs, Kimbe Bay

airport, and from here, it's just a one-hour drive, through endless neatly ordered rows of oil palm, to my destination—Walindi Plantation Resort on the shores of Kimbe Bay. Characterised by a friendly atmosphere nurtured by the owners, Max and Cecilie Benjamin, this has long been the secret haunt of some of the world's best underwater photographers .

Diving

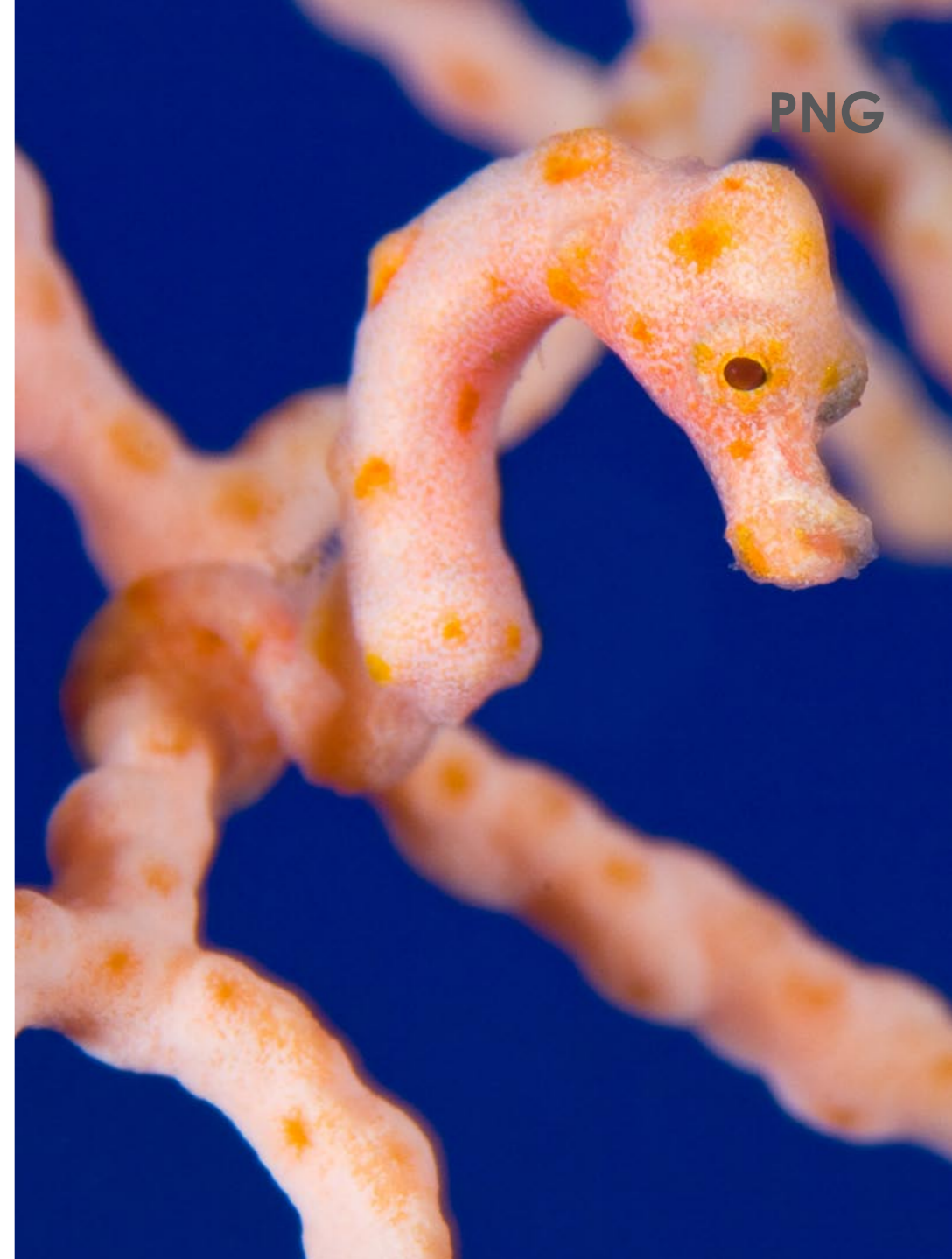
The next morning, I'm heading out to South Emma Reef. Descending into the crystal clear water, the first thing that strikes me is the sheer size of the corals and sponges here. Encircled by tall volcanic mountains, Kimbe Bay's reefs are protected from the fiercest storms, while the mooring buoys in turn keep the

reefs protected from anchors. This has enabled corals to grow undamaged to gargantuan sizes. My descent is checked only by a school of barracuda. Over the next days, it becomes apparent that just about every reef seems to have their own school!

Following Max over the drop off, we soon find a swim through filled with life; the walls are a mass of colour. Emerging through the other side to the upstream side of the reef, the scene is stunning—a wall of fusiliers are being hunted by tuna and huge barrel sponges protrude from the reef wall. The myriad of corals provide shelter for longnose hawkfish, scribbled leatherjacket and fire dartfish—just a few examples of the 900 plus species of fish that have been recorded



Tiny colourful tiger shrimp measures only 2cm



PNG

ABOVE LEFT TO RIGHT: Elegant squat lobster on crinoid; Close-up of a mantis shrimp, Volcano Crater, Witu Islands; Pygmy seahorse on sea fan, Kimbe Bay



Broadclub cuttlefish, Inglis Shoal, Kimbe Bay

in the bay. This reef already ranks amongst the best I've ever seen—and it's only the first dive!

The beautiful underwater formations can be attributed to the large numbers of reef building corals; there are at least 440 species present. Whilst we are moored on the picturesque Restorf Island, we are, however, reminded of the bird life that has made

Papua New Guinea as important for ornithologists as it is for marine biologists. The screech of sea eagles orbiting overhead emphasises the prehistoric feel of this place, whilst underwater, we find a reef adorned with giant elephant's ear sponges.

Reefs like this in places such as the Red Sea or the Maldives would be crowded with dive boats, yet here we are totally alone. I feel like I am discovering a place that has been untouched and unexplored—a sensation that I rarely experience anymore. As I dive these waters,

I am filled with the same enthusiasm and excitement that I used to experience in my youth. I am once again discovering the unsurpassable beauty that the underwater world holds.

Max operates three day boats from Walindi and just a few safari boats dive these waters—that's it! There are dozens of reefs to dive, and yet, not another boat in sight.

The Witu Islands

Venturing beyond the shelter of the bay requires one of these safari



Nudibranch, *Phyllidia ocellata*





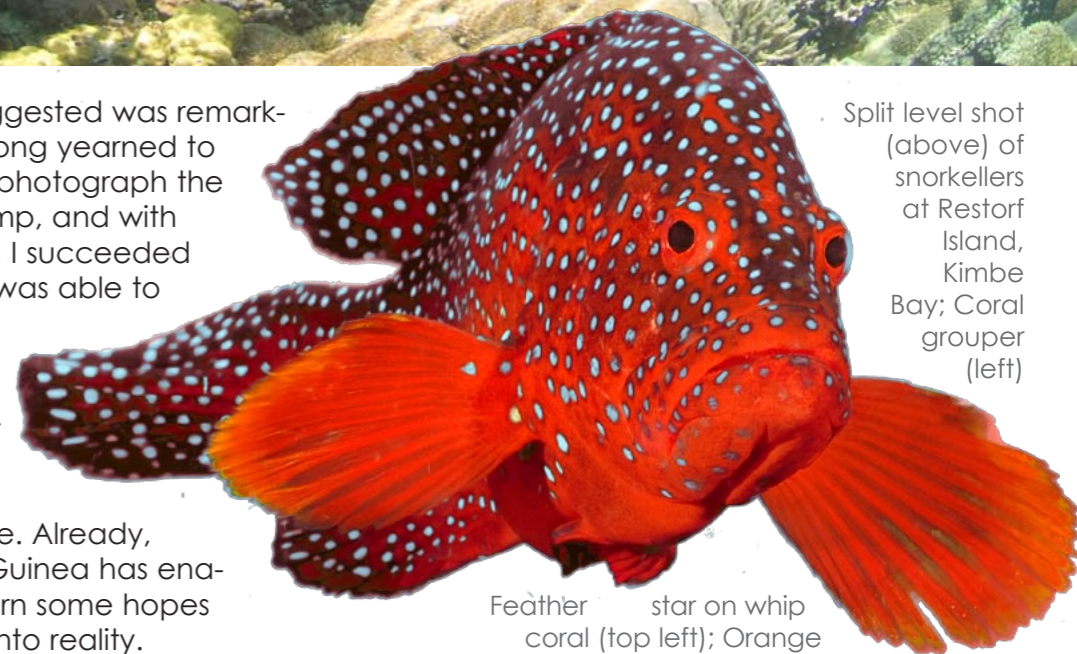
diving-focussed ship has both the safety and the enjoyment of the divers foremost on the agenda.

Diversity is everywhere in Papua New Guinea. Not just in the marine life but in the type of diving itself. On my first morning in the Witu's, I awaken moored inside a sheltered volcano crater within Garove Island. From the stunning reefs of Kimbe Bay, I am now in muck diving territory—this is the domain of the critters. The black volcanic mud of the crater is home to countless numbers of the weird and wonderful—ribbon eels, mandarin fish and various species of mantis shrimp.

My guide, Digger, has a passion for these creatures, and his ability to find

anything I suggested was remarkable. I have long yearned to observe and photograph the rare tiger shrimp, and with Digger's help, I succeeded in doing so. I was able to watch two of them move across the coral—a sight that I thought I would never be able to see. Already, Papua New Guinea has enabled me to turn some hopes and dreams into reality.

Returning to the *FeBrina*, I am greeted by the beaming smiles of children row-

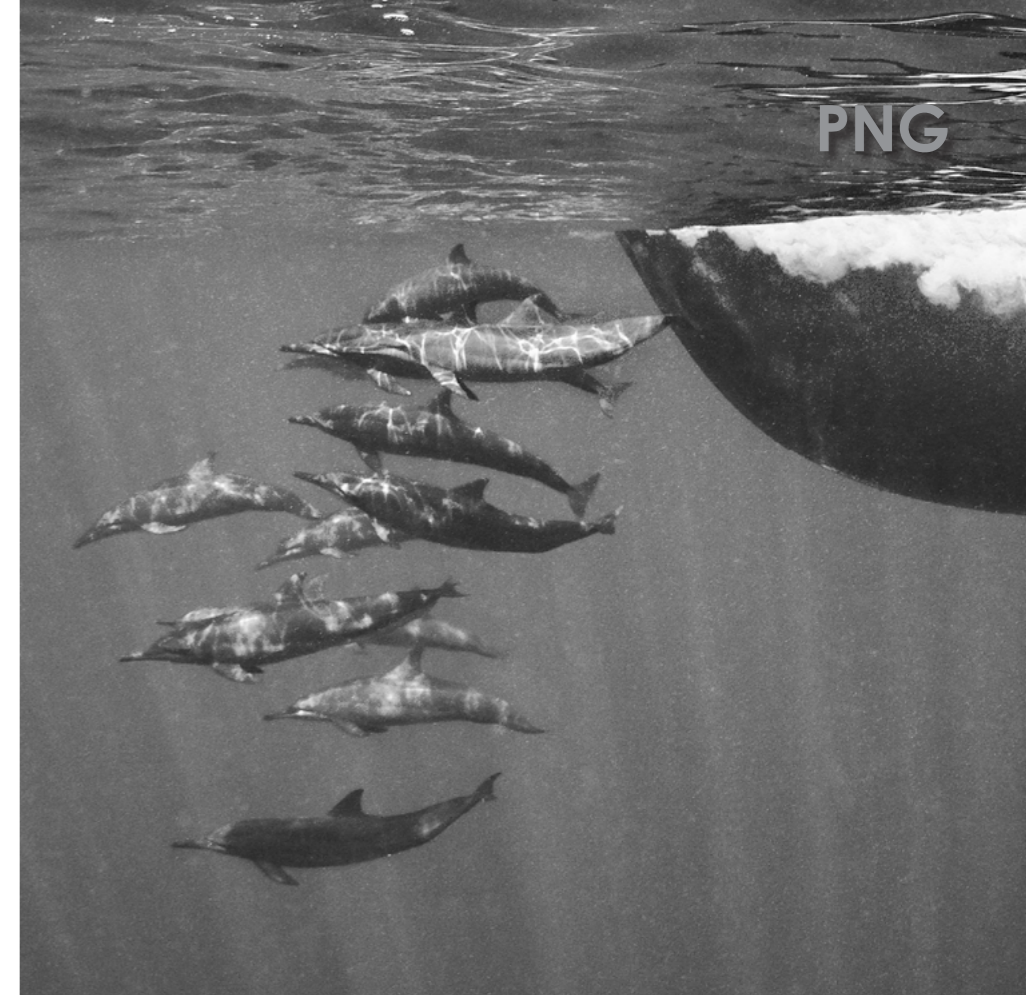


Split level shot (above) of snorkellers at Restorf Island, Kimbe Bay; Coral grouper (left)

Feather star on whip coral (top left); Orange mantis shrimp in volcanic sand, Volcano Crater, Witu Island (bottom left)

boats, and the *FeBrina* has become a firm favourite amongst serious divers all over the world. She's captained by Alan

Raabe, one of the industry's more flamboyant characters, whose personality is as colourful as the T-shirts he wears. This



PNG



CLOCKWISE FROM LEFT: Longfin spadefish, Fathers Reefs, Kimbe Bay; Diver amongst school of jacks on Lama Shoals; Dolphins ride the bow of the *FeBrina*; Silvertip shark; Local island children spend their days in the outriggers canoes

ing towards me in their canoes—a particularly enchanting experience. Upon their arrival, our respective modes of transport became trading posts. In exchange for the fresh fruit the group held out to us, we gave pencils, paper and other simple yet desired trinkets. As we followed them back towards land, the haunting songs of local tribesmen greeted us as they practiced for an upcoming festival.

In the thick of the action
The Witu Islands are not just about muck diving—in fact far from it. The offshore reefs build on the tempo of the diving from that experienced in Kimbe Bay—and that is no small feat. From stunning seascapes like the The Arches and the wonderful gorgonians of Barney's Reef, the frenzy of marine activity increases in a crescendo, finally reaching its peak at Lama Shoals, or Krakafat, as

it's more affectionately known . A dive at this site makes the senses roar, for in the thick of the action huge schools of jacks and barracuda orbit overhead, and batfish hover in the current before vast bushes of black coral. Grey reef sharks can be seen cruising back and forth, whilst fairy basslets perform a dance of death with the preying jacks, who work like a pack to bay their quarry. Whilst my mind spins from all this I





PNG



am given a window of tranquillity, as a turtle effortlessly glides down and settles on the reef.

Spectacular formations

After the pristine, coral rich reefs of Kimbe Bay, the Witu Islands had offered big fish school action at its best, tempered with superb critter diving. This is really what makes the diving here so

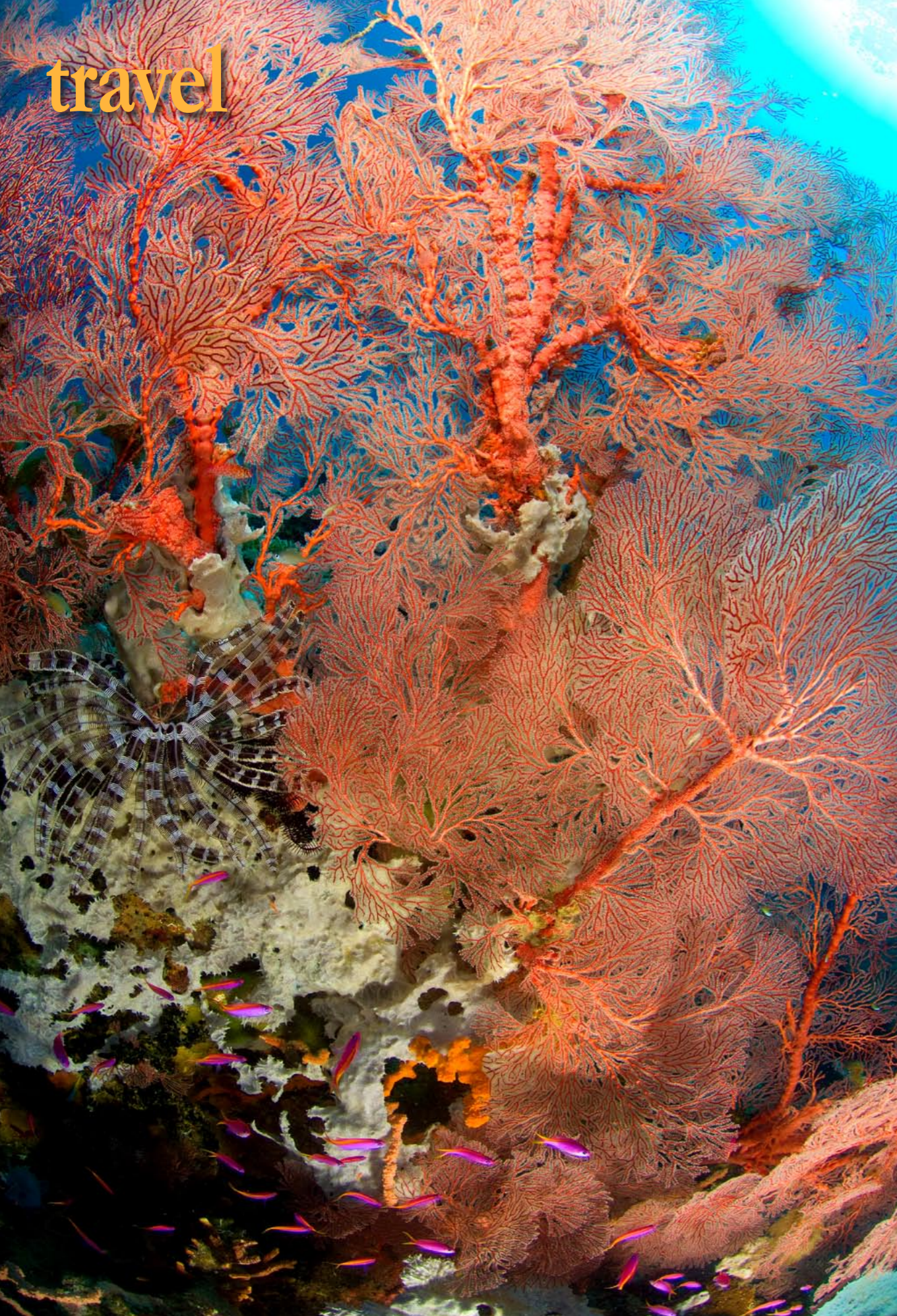
special—it's the variety.

The Father's Reefs don't buck the trend of offering something different. This reef group lies some 70 miles northeast from Kimbe town and are dominated by spectacular underwater formations and vast expanses of hard coral. Midway reef in particular has a reef top that is covered with stag horn coral as far as the eye can see, while

Fathers Arch is a beautiful grotto filled with countless soft corals and gorgonians.

Encounters with big animals are common in these waters—hammerheads and even orca have been seen in the region. Sadly, I did not witness them, however, three stunning silvertip sharks graced my entire dive on Shaggy's Ridge, whilst at least 15 white tip sharks

CLOCKWISE FROM TOP LEFT: Diver and huge red sponges on reef; Reticulate humbugs gather under stone coral, Fathers Reefs, Kimbe Bay; Scorpionfish resting on reef; Big barracuda (2m-long) patrolling under dive boat



Colourful sea fans at Restorf Island



Colony of red whip corals at Susan's Reef; Hawksbill sea turtle (right), Fathers Reefs

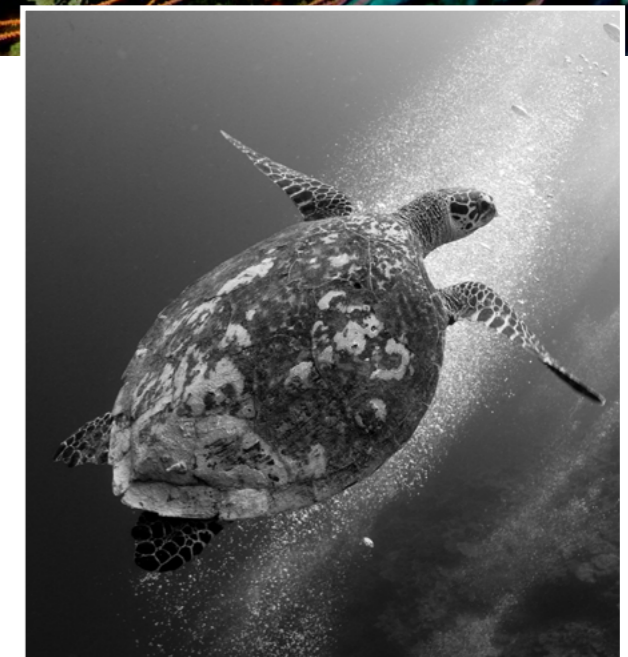


Leopard Blenny

accompanied me while diving Belinda's Reef.

It seemed that as the names of the dive sites became more obscure, so the diving got better and better. So I had high expectations for Killibob's Knob. Alan's sense of humour knew few boundaries when he was thinking of names for the sites!

A gathering place for an impressive number of grey reef sharks, it soon became clear that it was not actually the sharks that rule this reef at all, for the animal that stole the show was a great barracuda. At nearly two metres long, his boldness was in no doubt, after he sent a pair of juvenile greys packing, this bar-



racuda claiming the fish scraps thrown in by the kitchen staff as his own. There is only room for one boss on this reef!



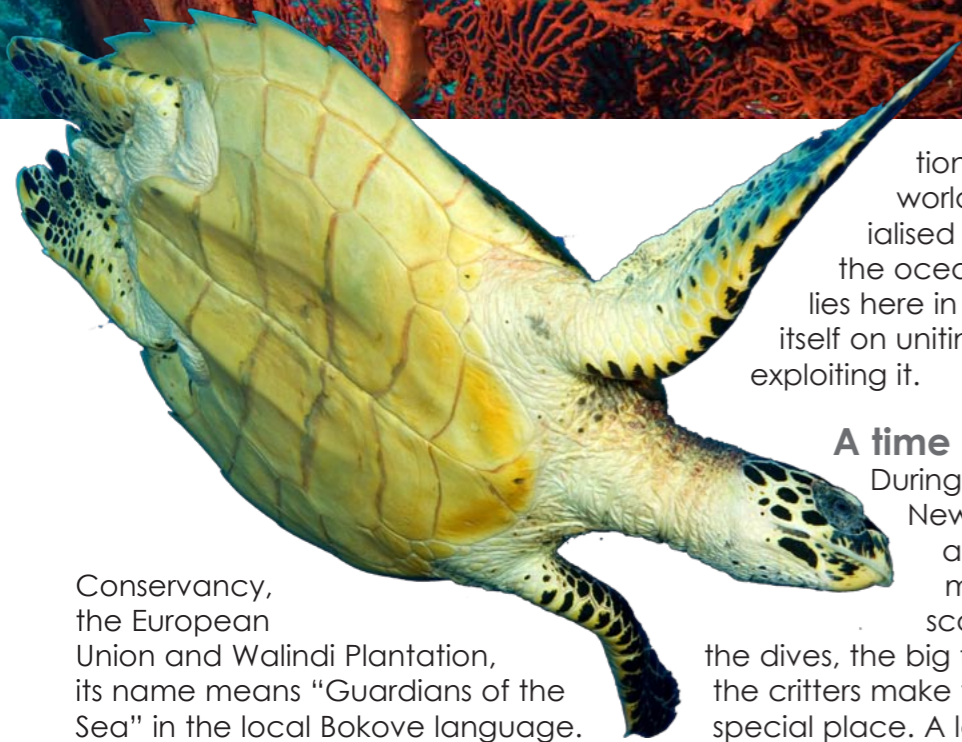
CLOCKWISE FROM ABOVE: Cockpit of a Mitsubishi Zero fighter plane wreck, Kimbe Bay; Diver in swim-through heavily decorated with corals and sponges; Striped blenny on pink sponge, Volcano Crater, Witu Islands, Kimbe Bay; Front view of wreck of a Mitsubishi Zero fighter plane with diver

Conservation through education

As I stand on the jetty of Walindi on my last night, I am joined by Pascal Waka. "I really worry about the state of the world," he says. "The ice caps are melting. The oceans are being fished out... Where will it all end?" His subsequent observations on the

human race's troublesome tenancy of ruining this planet belie his young 25 years of age. Pascal works at Mahonia Na Dari, a marine institute dedicated to protecting Papua New Guinea's reefs through education and research.

Opened in 1996, following a co-operative effort between the Nature



tion for marine scientists worldwide. While industrialised nations lay waste to the oceans, a glimmer of hope lies here in a country that prides itself on uniting diversity, rather than exploiting it.

A time capsule

During my last hours in Papua New Guinea, I reflect on all that it has shown me. The stunning seascapes, the variation in the dives, the big fish action along with the critters make this whole region a truly special place. A land that is caught in a time capsule, just like the World War II Japanese Mitsubishi Zero fighter plane laying silently on the sea bed in Kimbe

Bay, which we'd explored a few days earlier.

The area is a reminder of what coral reefs really can be if protected from humankind's overbearing influence. It's wonderful to see such healthy populations of sharks when they have all but disappeared from many other areas, succumbing to the obscene demand for shark fin soup. As I depart this land, I can't help wondering how much time the sharks of Killibob's have left? ■

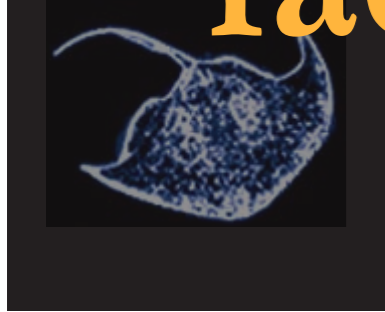
The author wishes to thank the team at Walindi Resort and MV FeBrina liveaboard for their help in creating this article. Steve Jones is an underwater photographer and journalist in the United Kingdom. See: www.millionfish.com

Conservancy, the European Union and Walindi Plantation, its name means "Guardians of the Sea" in the local Bokove language. It has provided courses for thousands of school children all over the country, as well as being an important research sta-

CLOCKWISE FROM TOP LEFT: Red sea fan with diver, Susan's Reef, Kimbe Bay; Diver with bright orange sponge at Kimbe Bay; Wreck of a Mitsubishi Zero fighter plane with diver, Kimbe Bay; Hawksbill sea turtle

fact file

Papua New Guinea



SOURCE: CIA.GOV WORLD FACTBOOK

History In 1885, the eastern half of the island of New Guinea, which is the second largest in the world, was divided between Germany, which held the north, and the United Kingdom, which held the south. In 1902, the latter area was transferred to Australia. During WWI, Australia occupied the northern portion and continued to govern the combined areas until independence in 1975. A secessionist revolt on the island of Bougainville ended in 1997 after nine years of violence, which claimed some 20,000 lives. Papua New Guinea's indigenous population is one of the most heterogeneous in the world. The country has several thousand separate communities, a majority with only a few hundred people. Over millennia, some of these communities divided by language, customs, and tradition, have engaged in local tribal conflict with their neighbors, which has been increased in large part by the introduction of modern weapons and migrants into the cities. Government: Constitutional parliamentary democracy and a Commonwealth realm. Capital: Port Moresby

Geography Papua New Guinea is located in Oceania, a group of islands including the eastern half of the island of New Guinea between the South Pacific Ocean and the Coral Sea, east of Indonesia. Coastline: 5,152km. Its terrain is mountainous, with rolling foothills and lowlands along the coast. Lowest point: Pacific Ocean 0m. Highest point: Mount Wilhelm 4,509m. The country shares the island of New Guinea with Indonesia.

Along the southwest coast, PNG has one of world's largest swamps

Climate Tropical. The northwest monsoon occurs December to March, the southeast monsoon, May to October. Slight variations of temperature are seasonal. Natural hazards: situated along the Pacific "Ring of Fire", PNG has active volcanism and experiences frequent and sometimes severe earthquakes, mud slides, and tsunamis.

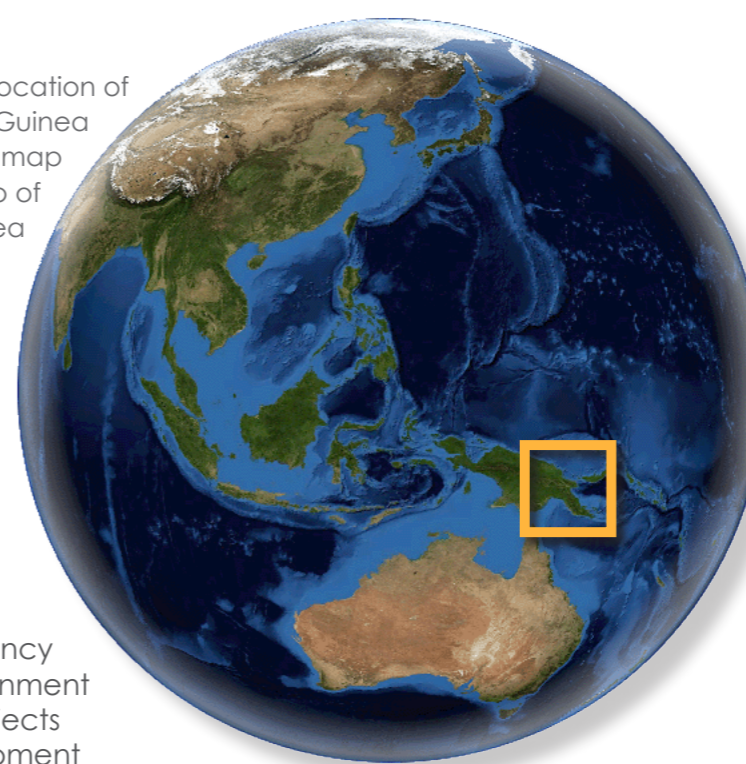
Economy Natural resources abound in PNG. However, getting to them has been difficult due to the rugged terrain, issues with land tenure as well as expensive infrastructure development. Around 85% of the population live on subsistence farming. Two-thirds of export income comes from mineral deposits such as copper, gold and oil. Estimates of natural gas reserves come to about 227 billion cubic meters. Construction of a liquefied natural gas (LNG) production facility planned by a consortium led by a major American oil company could develop export of the resource in 2014. It is the largest

project of its kind in the history of the country and could help the nation double its GDP. Transparency will be a challenge for the government for this and other investment projects planned. Other areas of development



by the government include more affordable telecommunications and air transport. Prime Minister Peter O'NEILL and his administration face challenges that involve physical security for foreign investors, building investor confidence, increasing the integrity of state institutions, bettering economic efficiency through

RIGHT: Location of Papua New Guinea on global map
BELOW: Map of Papua New Guinea



privatization of state institutions operating under par, and continuing good relations with Australia, which ruled PNG when it was a colony.

Environment Growing commercial demand for tropical timber is leading to deforestation of PNG's rain forests. There is pollution from mining projects and severe drought. PNG is party to: the Antarctic Treaty, Biodiversity, Climate Change, Climate Change-Kyoto Protocol, Desertification, Endangered Species, Environmental Modification, Hazardous Wastes, Law of the Sea, Marine Dumping, Ozone Layer Protection, Ship Pollution, Tropical Timber 83, Tropical Timber 94, Wetlands

Population 6,057,263 (July 2009 est.) Ethnic groups: Melanesian, Papuan, Negrito, Micronesian, Polynesian. Religions Roman Catholic 27%, Evangelical Lutheran 19.5%, United Church 11.5%, Seventh-Day Adventist 10%, Pentecostal 8.6%, Evangelical Alliance 5.2%, Anglican 3.2%, Baptist 2.5%, other Protestant 8.9%, Bahai 0.3%, indigenous beliefs and other groups 3.3% (2000 census). Internet users: 120,000 (2008)

Clown anemonefish in a purple anemone at the dive site Dickie's Place in the Witu Islands, Kimbe Bay

Language Tok Pisin, English, and Hiri Motu (official languages). In PNG, some 860 indigenous languages spoken, over one-tenth of all languages. Note: A creole language, Tok Pisin, is widely used and understood. English is spoken by 1%-2%; Hiri Motu is spoken by less than 2%

Health There is no risk of disease when eating at the resorts! The food is fantastic! However, outside the resorts, be aware that there is a very high degree of risk for food or waterborne diseases such as bacterial diarrhea, hepatitis A, and typhoid fever; as well as vectorborne diseases such as dengue fever and malaria (2009)

Currency Kina (PGK). Exchange rates: 1EUR=2.67PGK; 1USD=2.12PGK; 1GBP=3.37PGK; 1AUD=2.19PGK; 1SGD=1.70PGK

Decompression Chambers Melanesian Hyperbaric Services Jacksons Airport, Port Moresby Emergency tel: 6930305 or 6931202 (ISD Code 675)

Websites Papua New Guinea Tourism www.pngtourism.org.pg





Villagers from Bauwame, near Tufi in Oro Province, in traditional dress

Expect the Unexpected Papua New Guinea

Text and photos by Don Silcock
Supplemental photos by Steve Jones

Papua New Guinea is truly one of the last frontiers—the country is a wild and adventurous place and offers some tremendous scuba diving, combined with many unique and fascinating things to see above the water. One of the world’s most heterogeneous countries, Papua New Guinea (PNG) has a population of around 6.5 million people, but over 850 languages and nearly 1,000 traditional societies and ethnic indigenous groups. This tremendous diversity is the result of the country’s mountainous terrain and dense vegetation whereby tribes and clans formed as a self-defense mechanism—leading to thousands of separate communities.

Low-level conflict between neighboring tribes was usually (and in many places still is) the norm, which meant that each tribe tended to limit itself to its defined area and resulted in the large number of traditional societies and languages. Even today less than 20 percent of PNG’s population live in urban areas, with the remainder usually following a traditional

village and subsistence farming based lifestyle—many without power or running water, and where ‘luxuries’ such as soap, cooking oil and clothes are few and far between. Located north of Australia, PNG occupies the eastern half of the island of New Guinea, (the second largest island in the world), the Bismark and

Louisade archipelagos, the Admiralty Islands, Bougainville Island and numerous other smaller islands in the Bismark and Solomon Seas.

First contact
Possibly one of the most intriguing aspects of PNG is that it is only about 70 years since ‘first contact’ was made with

the highland people of New Guinea. Incredibly, that contact was made by an Australian prospector called Michael Leahy from rural Queensland, who not only extensively documented his experiences in a daily journal, he also took an extensive series of photographs using his Leica camera—thus providing a unique insight into an amazing series of events.

The discovery of significant gold deposits in 1926 at Edie Creek, near Wau on the north coast of New Guinea created a gold rush and spurred the Australian colonial government to venture inland and explore the very rugged interior. It had been assumed that the chain of mountains, that run east to west across the country, was so rugged that nobody

could possibly live there. Unknown was the fact that there are actually (in very simple terms) two parallel mountain chains and in between them are a series of fertile valleys, which were populated with a large number of highland people.

Equally ironically, the highlanders lived very parochially in thousands of separate small communities, each with its own network of allies and enemies. The fertile soils of the valley provided the communities with what they needed, and it was just too dangerous to travel outside the safety of their tribal territory, so there was a kind of 'Lost World' of people completely isolated from the rest of the world and living what was basically a Stone Age existence.

Michael Leahy, his brother Dan and Patrol Officer James Taylor were the people who made that first contact during the five years they spent exploring the highland region, from 1930 to 1935, looking for gold prospects.

World War II

Papua New Guinea was a major theater in the battle for the Pacific during WWII, with the Japanese forces landing first in Kavieng, New Ireland on 21 January 1942 and soon after at Rabaul in New Britain, which they proceeded to turn into a major base.

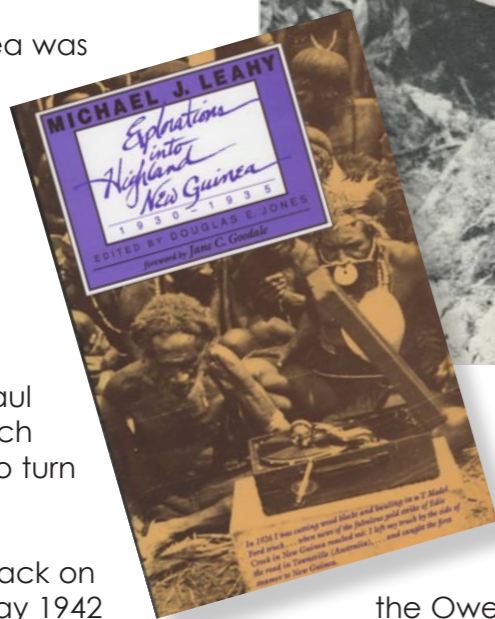
The Japanese launched their attack on Port Moresby in May 1942 from Rabaul, as the precursor to the invasion of Australia. But in the Battle of the Coral Sea, U.S. carrier-based aircraft and the Australian Navy

succeeding in forcing the Japanese armada back to Rabaul.

In June 1942, after suffering devastating defeat at the Battle of Midway, the Japanese abandoned trying to take Port Moresby by naval attack and launched a surprise landing near Buna



Michael Leahy, Australian prospector



on the northeast coast of PNG, using it as a base from which to launch an overland advance across

the Owen Stanley mountain range. These mountains reach a height of 13,000 ft and are like a spine that runs down the Papuan peninsula creating a formidable, saw-toothed, jungle barrier

that separates the northeast from the southwest of the country. The defeat of this attack by the Australian Army on the Kokoda Track is one of the finest moments in the military history of Australia.

The remnants of the war are to be found all over the country, both above and below the water, and make Papua New Guinea one of the best places in the world to dive on WWII wrecks—particularly aircraft.

Australian Colonial Rule and Independence

When the Japanese invaded Rabaul in 1942, the British colonial territory of Papua and German New Guinea were merged together in to a single entity and administered as a one colony by Australia. After the war Australia remained in control of the country until full independence was granted in September 1975.

When visiting Papua New Guinea, it's very easy to get the impression that it was 'happy days' all round during colonial rule, and Australia ruled with great wisdom and generosity. Many older local people who experienced those times will tell you that it was much better back then—'gut taim bipo' (good times before). But the truth is that PNG was just not ready for independence in 1975, and many of the problems that plague the country to this day can be traced back to the rushed nature of that transition point.

The Wantok System

An appreciation of the 'Wantok system' is important in gaining a better understanding of today's Papua New Guinea, as the system is both the social glue that binds the nation together, while probably being the largest single impediment to the country's develop-





Distinctive facial tattoos of female villagers in Oro Province

On their time off, locals relax on the sidewalk and enjoy watching the street life

PNG

The negative side is that the political system in PNG is such that anybody elected to the parliament has to basically promise the earth to all and sundry, but this is particularly so to any of their Wantoks, creating a situation where a great deal of public money is consumed but there is very little to show for it.

Is it safe to go there?

This is a very common question and one I have been asked a lot but generally only by those people who have not yet been to PNG. And well, the honest answer is no, it's not 100 percent safe, but in my experience, the risks are manageable and are far outweighed by the overall experience.

I have lived in Sydney for the last 14 years and can honestly say that I have never had a single situation where I felt threatened or in any real danger. Is that because Sydney is 100 percent safe? No, it's not. What it really means is that I use my common sense and avoid areas or venues where there could be trouble. Coincidentally, I have also been visiting Papua New Guinea on a regular basis for about 14 years and also not had a single situation there where I felt threatened or in any real danger—again, because I used my common sense.



STEVE JONES

expensive place, and personally I don't find it very appealing.



STEVE JONES

ment. PNG is basically a patchwork quilt of nearly 1,000 traditional societies and ethnic indigenous groups. There are over 850 different languages (one third of the world's total languages still used), and one common tongue—Tok Pisin, the lingua franca spoken by the majority of the population. Wantok is Tok Pisin for "one language" and refers to the language of the tribe a person belongs to. But Wantok

is much more than a language as it encompasses the basic philosophy of life for the people of PNG, and if one of your Wantoks is in trouble, needs money or is hungry, you are compelled to help them as much as you possibly can. The positive side is that because there are such limited basic services for the people in general, and no safety net for the poor, the Wantok system effectively performs that role.

Port Moresby

Unless your final destination is Loloata Resort in nearby Bootless Bay, all scuba diving trips to PNG involve either transiting through, or overnighing in, Port Moresby as the capital is the only international gateway into the country. In my experience, this is probably the most intimidating part of any journey to PNG, because there is definitely an element of danger in Port Moresby, plus it's also an

danger is principally from the Raskols, local gangs that have become a permanent and very negative feature of Port Moresby, and some other major cities in PNG such as Mount Hagen and Lae. Virtually every expat I have spoken to in Port Moresby seems to have a "near miss" story and some have stories that are really scary. But I really don't think the place is the "near death" experience these stories and the media tend to make it, and in reality, I believe it is actually the local people that suffer the most from the Raskols.

A violent crime against an expat will usually bring severe retribution from the police, whereas similar crimes against the locals appear to be much more common and not a lot seems to be done

THIS PAGE: Faces of the people of PNG



Underwater scenes from Milne Bay, PNG: Diver and giant elephant ear sponges; Coral grouper on reef; Rhinopias or lacy scorpionfish (below)

about them. Apparently very few, crimes against expats are planned—instead they tend to be random and opportunistic occurrences where a Raskol seizes the chance that has suddenly presented itself.

For visitors to Port Moresby, being involved in such a random event is probably the biggest danger you will actually face, and that is only likely to happen if you are particularly careless, such as walking around unaccompanied with an expensive looking camera or wrist watch, or maybe a visibly bulging wallet.

Local people in PNG tend to sit on the ground and watch the world go by when they have nothing to do, which can be very intimidating to the uninitiated visitor who will already be semi-paranoid about raskols just waiting to

pounce. While it is unlikely that they will be wearing a T Shirt with "Raskol" on the front to identify themselves, the fact is that you will probably know one should you cross paths with one—or more.

So, the trick is to use your common sense and get out and see the things Port Moresby has to offer but use the guided tours offered by all the hotels to do that. The guides will know the potential trouble spots, who the possible trouble makers are and steer you well clear.

Away from Port Moresby, in the bigger towns such as Alotau in Milne Bay and Rabaul and Kimbe in New Britain of Kavieng in New Ireland I have wandered around alone, and while I did not feel completely safe, I did not experience any problems.

Some excellent general safety tips I

picked up from the Lonely Planet are as follows:

- Use a Bilum: Bilums are the locally made colorful string bags that everybody seems to use in PNG and using one does a lot to neutralize the flashing "I'm a tourist" sign above your head that draws attention to you.
- Raskol money: Have some money ready in your pocket in case you do have a "raskol moment" and keep the rest of it well hidden.
- Pay Friday: The locals get paid fortnightly on a Friday, and the younger men get on the grog in a big way—stay well clear. ■

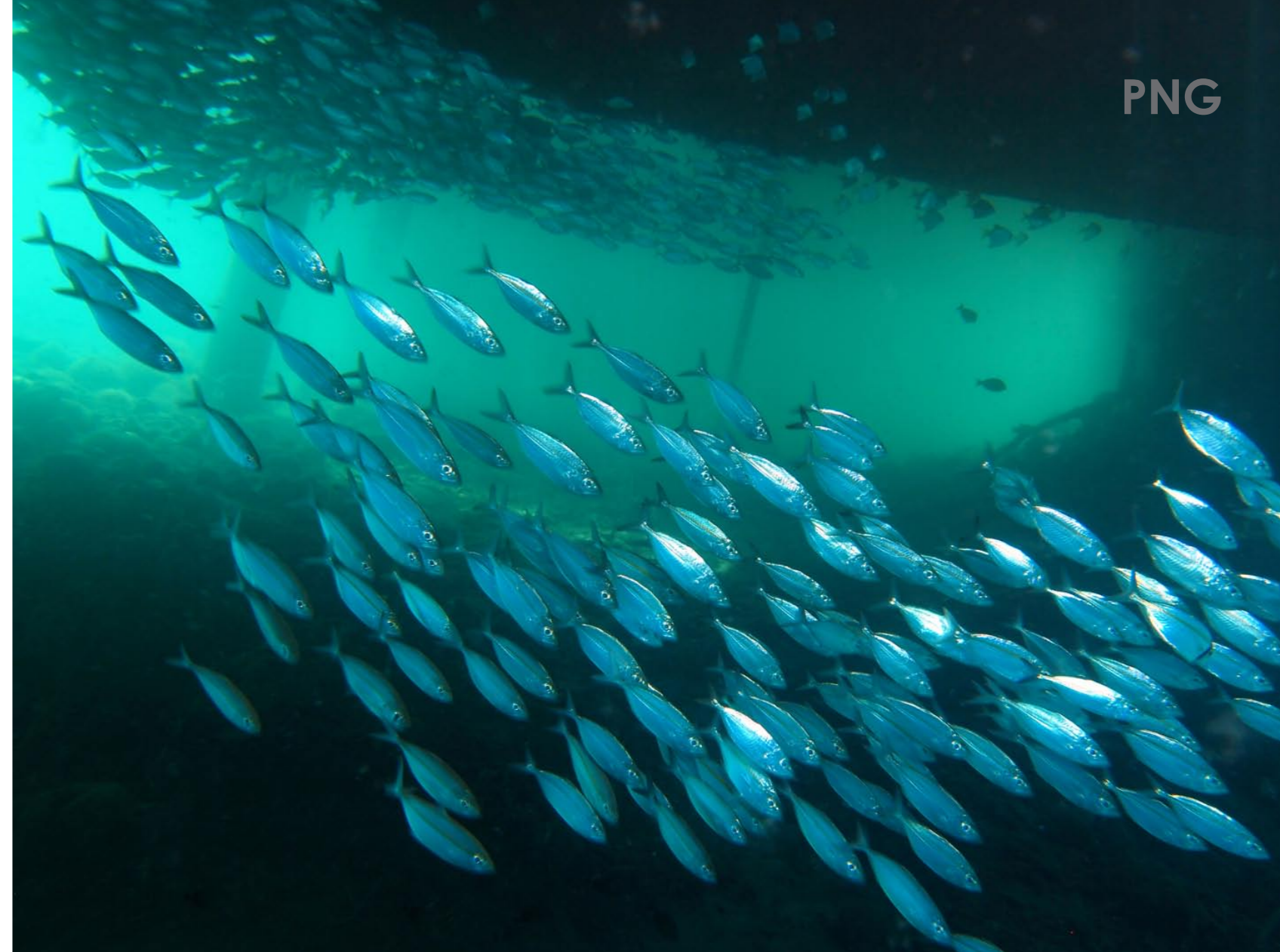
For more information, visit:
www.indopacificimages.com



Tufi, New Ireland & **Papua New Guinea** *Milne Bay*

Text and photos by Christopher Bartlett





PNG

Is there another country anywhere with so much diversity? The six million inhabitants of this nation of mountains and islands are spread over 463,000km² of mountainous tropical forests and speak over 800 different languages (12 percent of the world total). Papua New Guinea occupies half of the third largest island in the world as well as 160 other islands and 500 named cays.

Located just south of the Equator and to the north of Australia, Papua New Guinea (PNG) is a diver's paradise with the fourth largest surface area of coral reef ecosystem in the world (40,000km² of reefs, seagrass beds and mangroves in 250,000km² of seas), and underwater diversity with 2,500 species of fish, corals and molluscs. There are more dive sites than you can shake a stick at with many more to be discovered and barely a diver on them. The dive centres are so far apart that there is only ever one boat at any dive site.

It is one of the few places left in the world where a diver can see



Moorish idol (above); There are colorful corals everywhere (left); Schools of fish under the dive boat in the harbor (top). PREVIOUS PAGE: Clown anemonefish on sea anemone



CLOCKWISE FROM LEFT: Diver and whip corals on reef; Beach view at Tufi; View of the fjords of PNG from the air

the misty clouds at the swath of trees below, occasionally cut by the hairline crack of a path or the meandering swirls of a river. The jagged peaks of the Owen-Stanley range that run down the spine of the island weren't that far away, as we headed east from Port Moresby to Tufi. The landscape was rugged to say the least, and it was easy to understand why both Australian and Japanese troops had struggled during the Second World War battles there.

As we approached the east coast of Oro Province, the spectacular fjords of Cape Nelson came into view—a strange mix of gla-



PNG

macro critters, pelagics and big stuff as well as fantastic soft and hard corals. The often misused and abused adjective, 'pristine', is actually appropriate here due to low fishing pressure in the area in comparison to other areas of the Coral Triangle, no dynamite fishing and a system implemented by dive resorts whereby local reef owners receive a small fee for every diver who visit their reef. As a result, elders make

sure that the reefs are not fished.

So, where to go? We set off on a four-resort tour to the north and the south taking in the provinces of Milne Bay, Oro and New Ireland.

Tufi

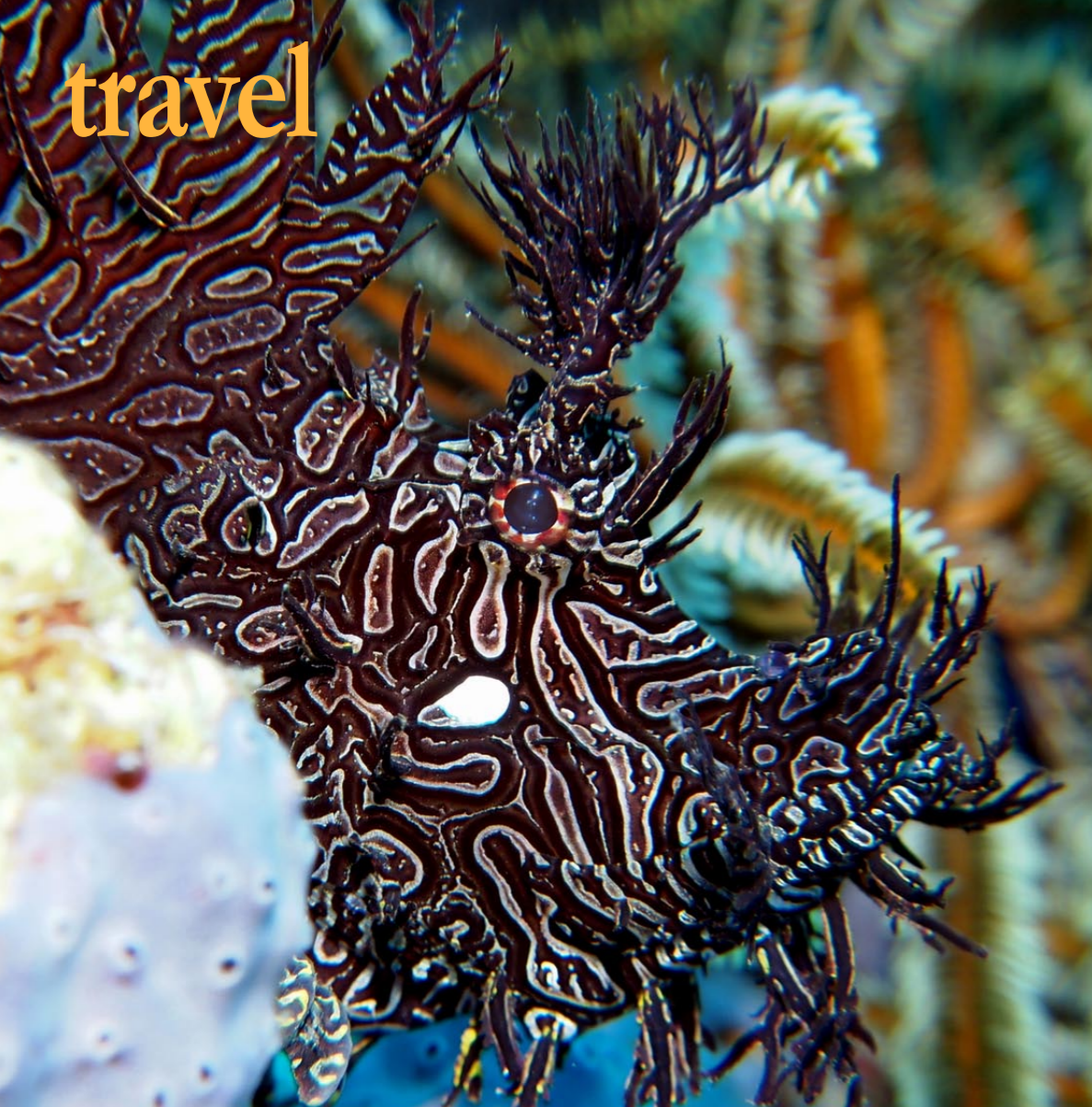
Sitting at the back of the De Havilland Twin Otter with my partner, Imi, and an American Mom-Dad-and-teenage-son-combo in front, I peered through



cial action now topped by lush tropical forest, with aqua coral reefs surrounding the headlands clearly visible in the cobalt blue of the Solomon Sea. Banking steeply, we lined up with the gravel airstrip and touched down. Two 4WD vehicles were waiting for us to take us on the one-minute drive to the resort.

With a fruit juice in hand, we whizzed through the usual paperwork and were asked to leave our dive gear outside our rooms in 20 minutes and meet at the reception area from where we were taken down to the dive centre. Less than 90 minutes after landing, the five of us plus instructor Glen and dive master Alex were in a boat and heading off across the flat sea to Bev's Reef—part of the mid-distance reef system and one of the several Tufi reefs with a manta cleaning station. Using a well-drawn dive site map, Glen laid out the plan for a drift dive, and off we went.





Bev's Reef. Imi hadn't dived for four months, and I had the new camera, so we were planning on just chilling and getting comfortable again—a wall dive seemed ideal. Rolling in, we both burst into grins not just from the simple pleasure of being in the water again, but because of the clear blue water filled with corals, reef fish and colourful purple, yellow and white sea squirts. There were nudibranchs and schools of fusiliers and snappers, whitetip reef sharks and three of the nine species of anemonefish found in PNG.

Wending our way slowly at the back of the group, coming over the top of a coral outcrop to have a gander for big stuff that might be hanging out in the current, I had to do a double take. Sitting there next to a crinoid was one of PNG's underwater grails—a black Merlet's or lacy scorpionfish (*Rhinopias*

aphanes) which has the peculiar habit off shedding its skin every three months or so. Photographers search for these for days and days, and here I was pointing an unfamiliar camera at one after barely 30 minutes in the water. It turned out to be the first of two that I saw, but it was the start of a long list of new sightings for me.

Veale's Reef. One of Tufi's signature sites is Veale's Reef, often dived on the same trip as Bev's. Veale's is often frequented by an albino hammerhead, but not on this occasion. Still, it was hard to grumble with all the schools of baitfish, barracuda, black and white snapper, batfish, some Spanish mackerel, as well as a swift-moving green turtle and a couple more whitetips swimming around. We certainly had enough to talk about over a late but delicious

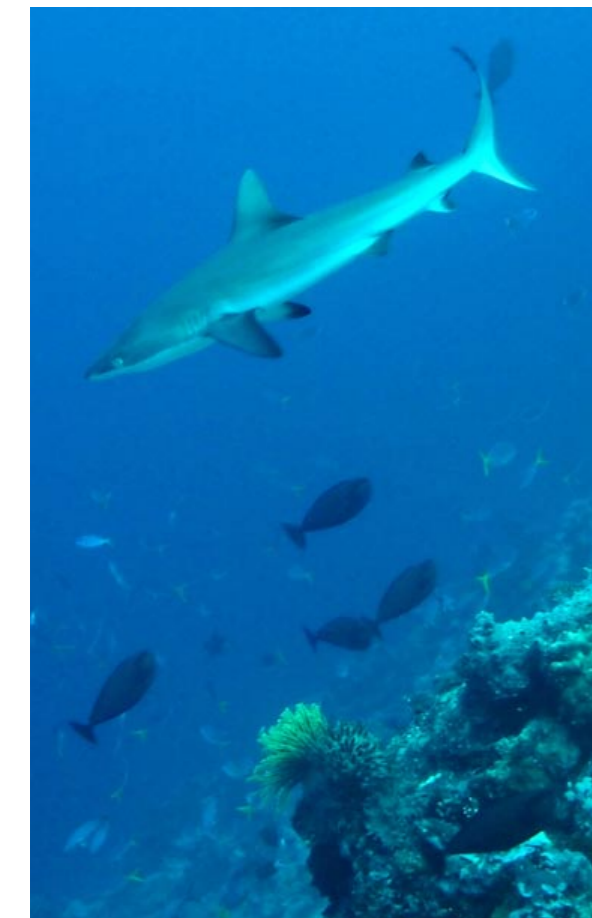


CLOCKWISE FROM LEFT: Outrigger trip; Lacy scorpionfish; Tufi Resort; Nudibranch flabellina; Barracuda





CLOCKWISE FROM FAR LEFT: Diver on Cyclone Reef; Life on Nuggets Reef; Diver exploring healthy reef; Grey reef shark on Jack Daniels Reef



lunch on the veranda.

Blue Ribbon Reef. Some reefs are just a short trip away, such as Blue Ribbon Reef just round the runway headland, which we dived during a tropical storm. The sea turned an atmospheric deep blue as we searched for, you guessed it, ribbon eels. Not all ribbon eels are blue—far from it, in fact. They are all born black with a yellow dorsal stripe; adult females are yellow with a black anal fin with white margins on the fins, and only adult males are blue with a yellow dorsal fin.

Outer reefs. The outer reefs are a 30-minute boat ride away, and Cyclone Reef is one of them. The story goes that it appeared from nowhere after a severe storm in 1972, brought up from the depths by the elements. Its very top breaks the surface of the sea and is a haven for mating seabirds. Over the edge, it drops away into a wall dive, once again buzzing with reef life, and out in the blue, we spied two hammer-

head sharks cruising past.

Minor Reef is nearby and often dived in tandem with Cyclone. The reef top sits a few metres below the surface, and its plate and staghorn corals bask in the sunlight illuminating the damselfish that adorn them, making it a great spot for no-flash photography. It is named after the large bright yellow and black *Notodoris minor* nudibranch that is often found there.

Back at the resort, looking at the maps on the walnut-panelled walls gives one a better sense of the remoteness and the size of the area. Whole swathes of the Solomon Sea, starting where Cyclone and Minor Reefs are marked, are uncharted. There are basically reefs everywhere out there.

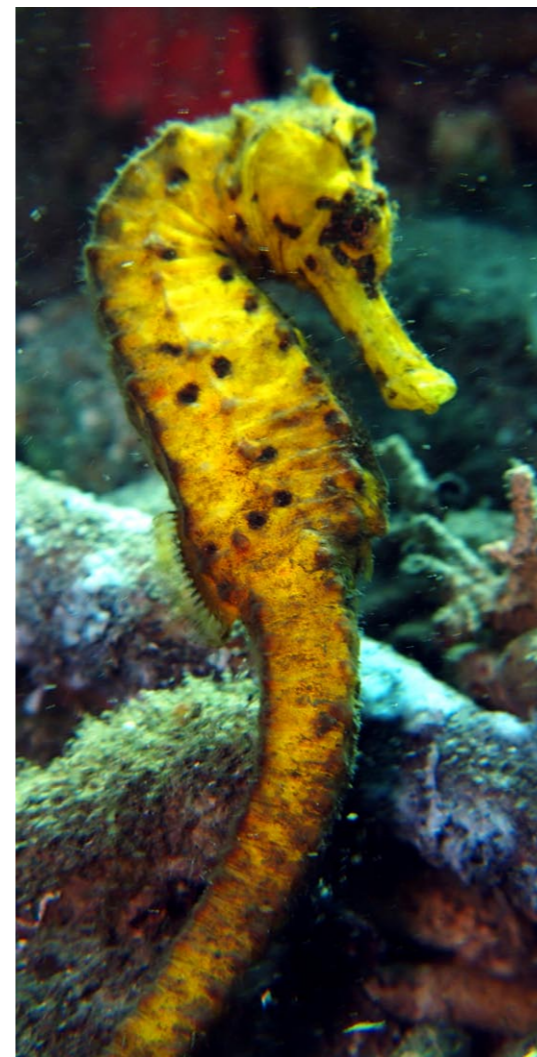
Jack Daniels and Nuggets are two recently discovered reefs, and Glen and his brother, Archie, were keen to get us out to them. Armed with a small plastic bottle with a little water in it, Archie began crunching and rolling it between

his hands as soon as we were down Jack Daniel's slope and onto the wall. Within a couple of minutes, he had attracted the attention of four grey reef sharks. They didn't seem very used to human interaction and kept their distance, as did a couple of sea turtles. The sharks occasionally darted a bit closer to recce us odd-looking, large, bubble-blowing creatures, and a couple of whitetip reef sharks came by for a look, too.

With our appetites for diving well and truly whetted, we went for an afternoon dive off the public wharf. It is talked up as a photographer's delight and one of the best spots in the world for so-called muck-diving. Muck-diving gets its name from apparently uninteresting sites that can be either silty, sandy, muddy or just rather barren-looking, but are actually home to a large number of small, weird and wonderful creatures.

Tufi Wharf. Tufi's wharf dive site is more of a junk dive than a muck dive. The





PNG



sloping wall of the fjord is littered with debris from the harbour's previous life as a torpedo patrol boat base during WWII, dumping of old bits of machinery, the odd fuel drum and some girders, which were no doubt formerly part of the jetty. There are also the remains of a PT boat and its torpedoes down at 45 metres. However, there was more than enough along the fjord slope and wall to keep us occupied, with ornate and robust ghostpipefish, frogfish, ringed pipefish, common seahorse, loads of nudibanchs, crab-eye gobies, anemonfish, mantis shrimp, cleaner shrimp and lionfish to gander at. Plus, 50 metres past the remains of the torpedo boat wharf were more walls, little caves and tons of sponges on the corner of the harbour.

If you fancy a fourth dive in a day, dusk dives are available, and Alex and Archie—the eagle-eyed guides—are experts at finding nocturnal action right by the wharf, including brightly-patterned mandarinfish.

Topside activities. If three or four dives a day is a bit too much, there is plenty to do to fill your surface time actively. On Sunday, we were paddled up McLaren Sound in an outrigger and advanced into the forest until it became too shallow to make further progress.

After a short walk, we were given an insight into village life, traditions, the uses of various plants and trees and viewed demonstrations of tattooing and sago-making before being paddled back to the dive boat, which whisked us to a white sand beach on the headland opposite the resort for a barbecue lunch and afternoon swim.

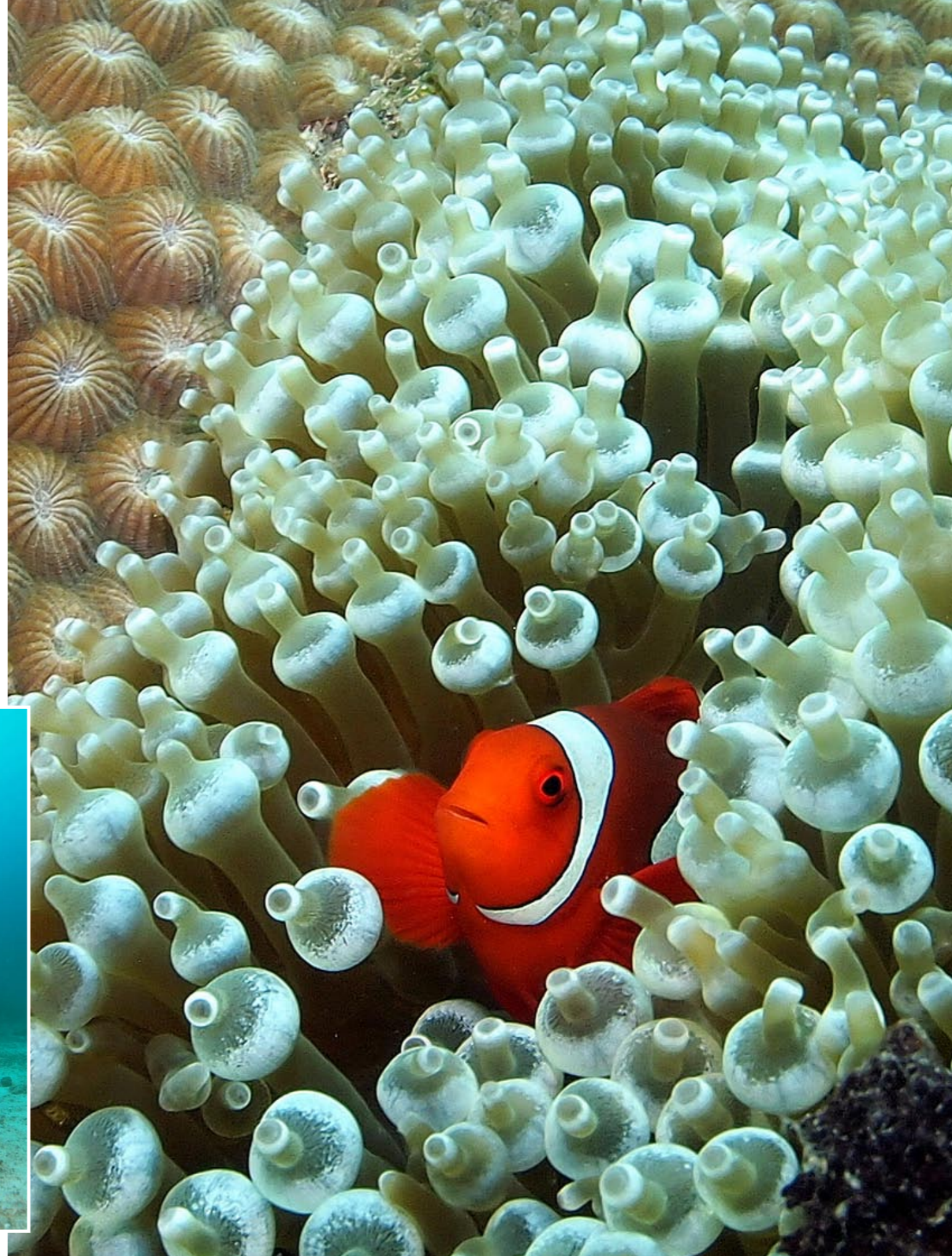
In the afternoon, you can also walk through the village, or amble down to the dock, and watch the locals from the surrounding area come in on their outriggers for a trip to the store by the wharf or to trade in the village. There is a steady trickle of comings and goings if people-watching is your thing, but the main event is the Saturday evening



CLOCKWISE FROM LEFT: Fang blenny; Nudibranch Kune's chromodoris; Ornate ghostpipefish; Seahorse; Map pufferfish cleaned by a wrasse; Crab-eye or twin-spot goby

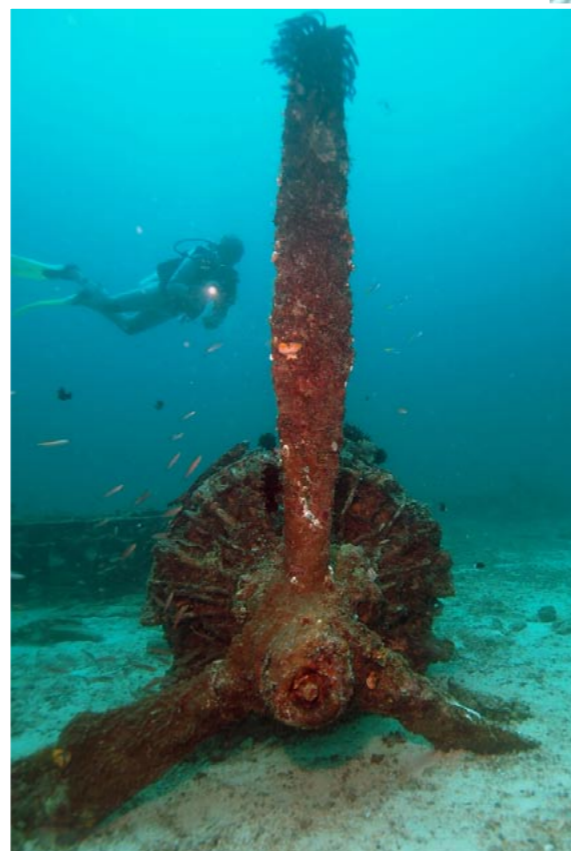


CLOCKWISE FROM TOP LEFT: Tiny anemone shrimp on tube anemone; Whip coral goby; Spinecheek anemonefish; Catalina flying boat wreck; Nusa Resort



and was another opportunity for us to experience the friendly nature of the locals.

New Ireland's diving has a reputation for pelagics and sharks that



the small beaches, we'd see an outrigger parked upon the shore and hear voices in the distance, mainly children whooping with laughter, frolicking unseen in the trees. It is certainly a place that should inspire happiness.

New Ireland

Two hours' flight north-east of Port Moresby, with a ten-minute stop in West New Britain near the site of PNG's last volcanic eruption, lies Kavieng, the capital of New Ireland Province. Located at the northern tip of a 380km-long island, sleepy Kavieng and its 11,000 inhabitants hold few attractions for most of the trickle of tourists who venture here to dive and to surf and no accommodation worth staying in. Yet, if you like wandering around dusty betel nut-stained streets and dim and musty shops, an afternoon in town after a dive is an interesting experience



wharf market that springs up when the weekly ferry comes in from Popandetta. That said, I would have gladly dived the sites we did over and over again; every dive was a "Wow dive".

On our final afternoon, we took a two-seater canoe and paddled up the fjord, hearing the sounds of the forest as we went. We canoed the deep blue in the centre of the fjord, apparently bottoming out around 200 metres below, and would pop over to the shallow reef tops for a dip and a snorkel. At many of



CLOCKWISE FROM FAR LEFT: Dwarf hawkfish; Diver and large purple branching soft coral; Wreck of the Japanese Jake WWII airplane; Der Yang wreck; Chalet at Nusa Island Retreat; Diver and large cuttlefish



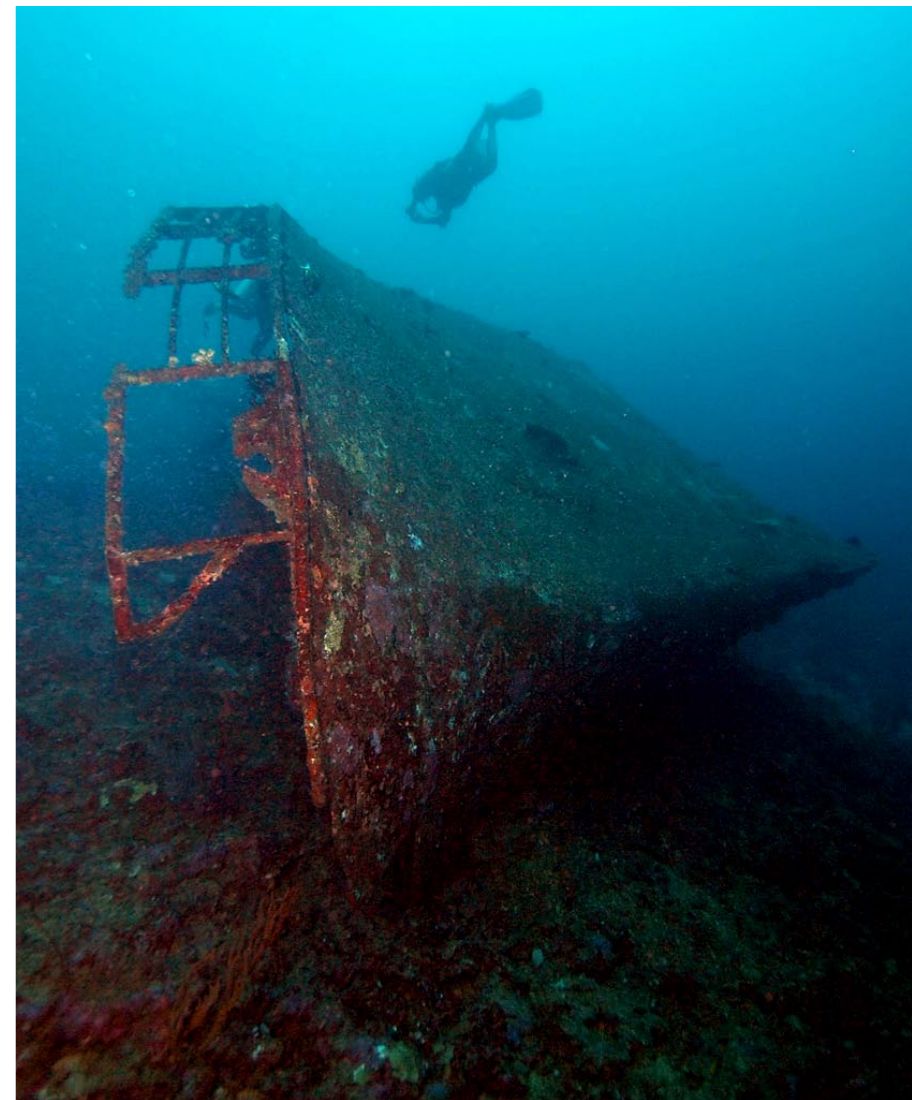
opposite Kavieng harbour in the morning, he and his wife, Cara, took us to sites in both the Bismarck Sea and South Pacific Ocean. Some of the South Pacific sites such as the trevally- and anemone-festooned Echuka Patch and the *Der Yang* shipwreck were less than a ten-minute putter away. The Japanese Pete and Jake float planes stationed here when Kavieng was under war-time occupation, were so close we'd arrived before we could kit up, as were the remains of a Catalina flying boat and several unexploded bombs.

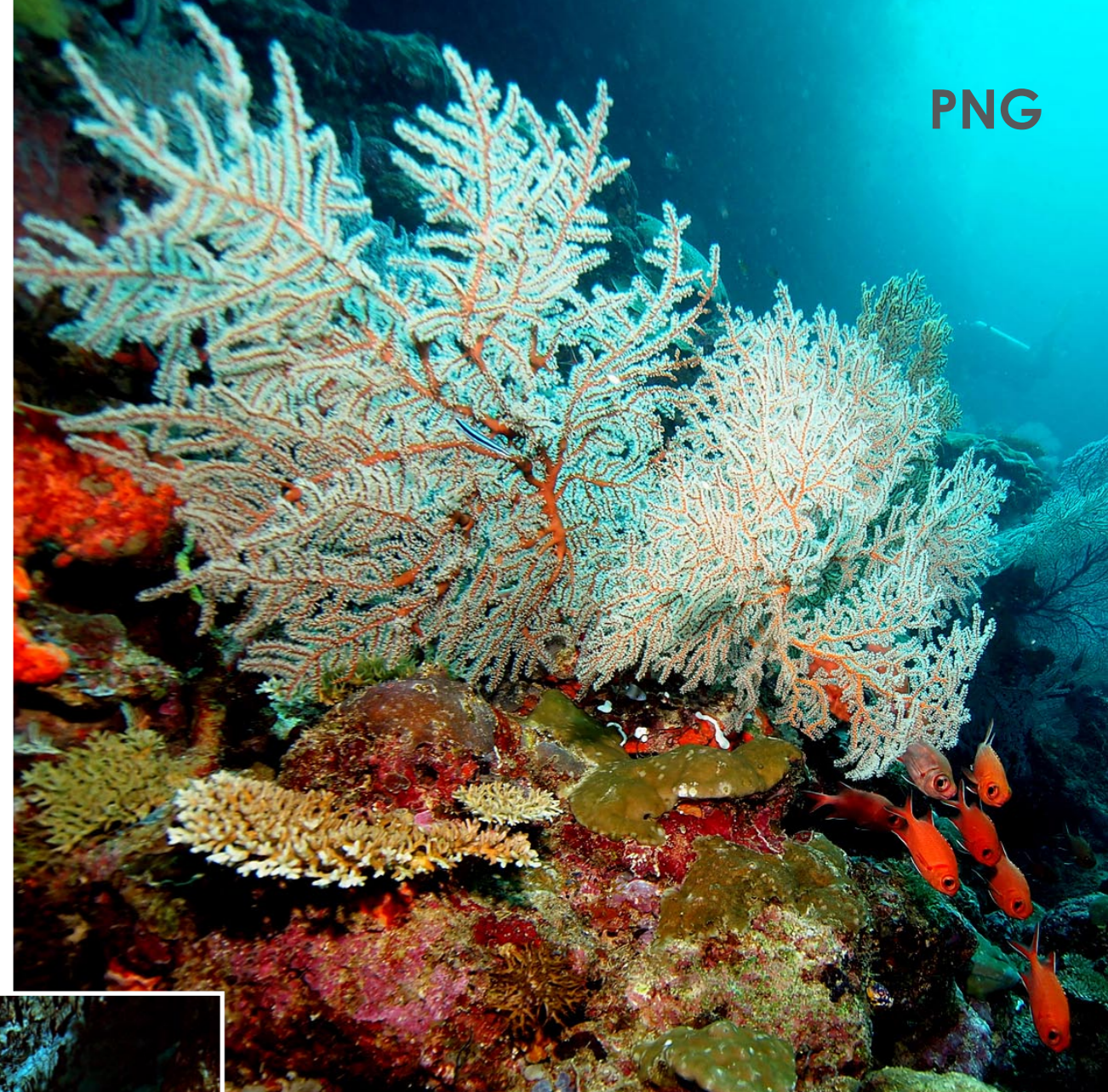
are attracted by the fresh deep water that is flushed between the multitude of small islands and passages making up the area; dogtooth tuna, Spanish mackerel, trevally, barracuda and blacktip, whitetip, silvertip and grey reef sharks all came out to play. New Ireland also has a good mixture of vibrant and colourful reefs, a few interesting muck-diving sites and WWII plane wrecks aplenty.

Dorian Borchers, joint-owner of Kavieng Scuba Ventures, has a wealth of knowledge of both the Japanese and Allied planes found in the area. Picking us up from the doorstep of our villa on the water's edge, under the palm trees at Nusa Island Retreat

Bismarck Sea dive sites. The Bismarck Sea sites were a little further—about half-an-hour away—but are well worth the trip through the islands and mangroves. Albatross Passage has stunning soft coral coverage and a wide range of fish, with pygmy seahorses, cuttlefish, dogtooth and sharks. On an incoming tide, it is a truly excellent dive. Down by the wall and on the sandy shelf, it is calm but ends with a safety stop on reef hooks watching the action below as the current pumps past.

On the way back, the B-25 *Stubborn Hellion* awaits in 12 metres of water on the edge of the mangroves. Sixty-eight years after crashing into the sea after sustaining





THIS PAGE: Scenes from freshwater cave diving; Fan coral at Nusa (above)



twin-machineguns in the top aft turret. The current can also adversely affect visibility on occasion, and we caught what was described by both dive centres as unusually poor viz. It is all relative, though, and a measure of how good it usually is. The very worst we had was 15 metres!

Cave dive. Dorian is a positively affable chap with a fun sense of humour, a John Holmes moustache,

and will, at some point, have you laughing till your mask fills, and you can barely keep your regulator in. But he takes his

diving seriously. It was only after we'd been diving together for three days that he asked if I'd like to do an afternoon freshwater cave dive half an hour inland. You bet! Despite having well over a 1,000 dives in my log-book, I'd never done a penetration dive, so was a touch nervous, as we clambered carefully down inside the mouth of a cavern.



With two torches each, we carefully slipped into what appeared to be nothing more than a large puddle, mindful of not disturbing the fine silt on the bottom, and followed an orange safety line down and in to the cave. After an initially narrow section, we emerged into a series of huge caverns draped in stalactites

and stalagmites full of gin clear water, troubled only by the odd halocline.

The environment and total stillness were enthralling in their own right, but it was even more thought-provoking with the knowledge that the water level was once much lower and the caves surely inhabited. Close to the entrance and exit, in six metres of water, lie the remains of Japanese rice bowls and a clay bottle made in the late 1800s in the Netherlands. It begs the question what older relics might lay further in.

As well as being home to Nusa Island Retreat, Big Nusa is inhabited by a local community who chat happily with visitors taking a walk around the island. During the windy months from October to March, the multitude of small islands and channels are dotted with appar-





PNG

Lissenung Island. The other accommodation option is Lissenung Island, an even smaller island 20 minutes' boat ride towards the Bismarck Sea. Owned by Austrian ex-engineer Dietmar Amon and his wife, Ange, its seven rooms are ideally located for diving the Bismarck sites

like Peter's Patch, with its batfish and pelagics; Helmut's Reef; Danny's Bommy, with its leaf fish and white-bonnet anemonefish; the long wall at Kavin II; Matrix, with its whip and soft branching coral; and, of course, Albatross. Several times a year, Lissenung's twin-engined 26-foot Ozycat heads northwards to New Hanover on expeditions to explore virgin reefs and a Japanese two-man submarine, as well as Chapman's Reef, with its resident giant groupers.

Divers on the expeditions stay in guesthouses on different islands depending on the itinerary. They are all excellent sites with varied topography, amazing tiny critters like halemeda and orang-utan crabs, abundant longnose hawkfish, schools of one-metre humphead parrotfish, more pygmy seahorses, tiny crinoid-dwelling squat lobsters and horned shrimps, and panda anemonefish. We dived some of them several times and would happily return to them repeatedly. Although, if a choice had to be made, Albatross and its wall overgrown with big fan corals, black corals and sponges just pips the others.

ently excellent surf breaks, and accommodation is often taken up by surfers. The resort's owner, Sean, is a keen wave rider himself as well as the provider of a good yarn and even better tucker. He also likes a party, and night owls will feel at home.

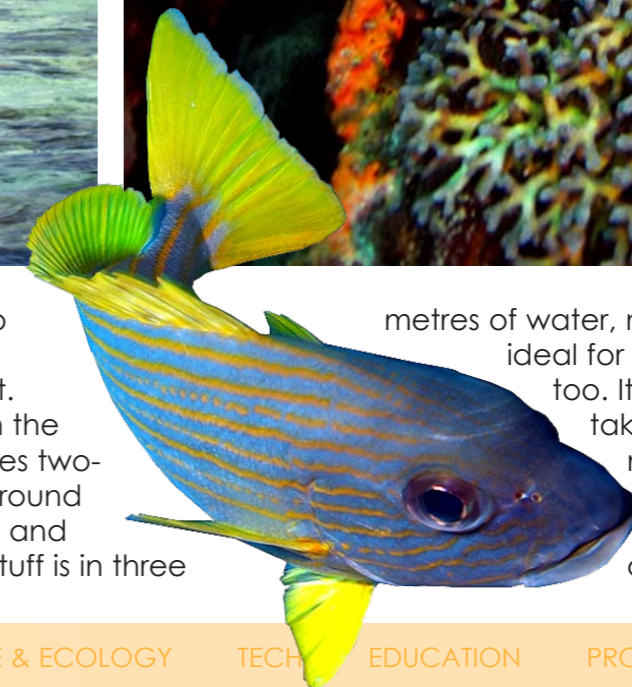
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They are all excellent sites with var-



CLOCKWISE FROM FAR LEFT: Beach at Lissenung Island Resort; Tiny orangutan crab; Clingfish and horned shrimp on feather star; Diver and barrel sponge; Pijama cardinalfish





Contrary to Nusa, Lissening Island is only occupied by the seven-room resort, has a "no guests under 12" policy and can be walked around in ten minutes. Basically, guests share Dietmar and Ange's private island paradise, with sandy and well-kept gardens, a small but per-

fect white sand beach with several seahorses basking in the shallows, and each room facing the sea. The staff live on the neighbouring island of Eruk, and tours can be arranged to the village and school, the development of which the philanthropic owners have been

heavily involved in. In the evening the office doubles up as a clinic, as locals come in to have a variety of minor injuries dealt with. The usual diving routine sees the dive boat leave after breakfast and return for lunch. Afternoon and dusk dives leave daily, and a secret

location is home to more mandarinfish mating after sunset. Afternoon dives on the house reef that goes two-thirds of the way around the island are free, and much of the best stuff is in three

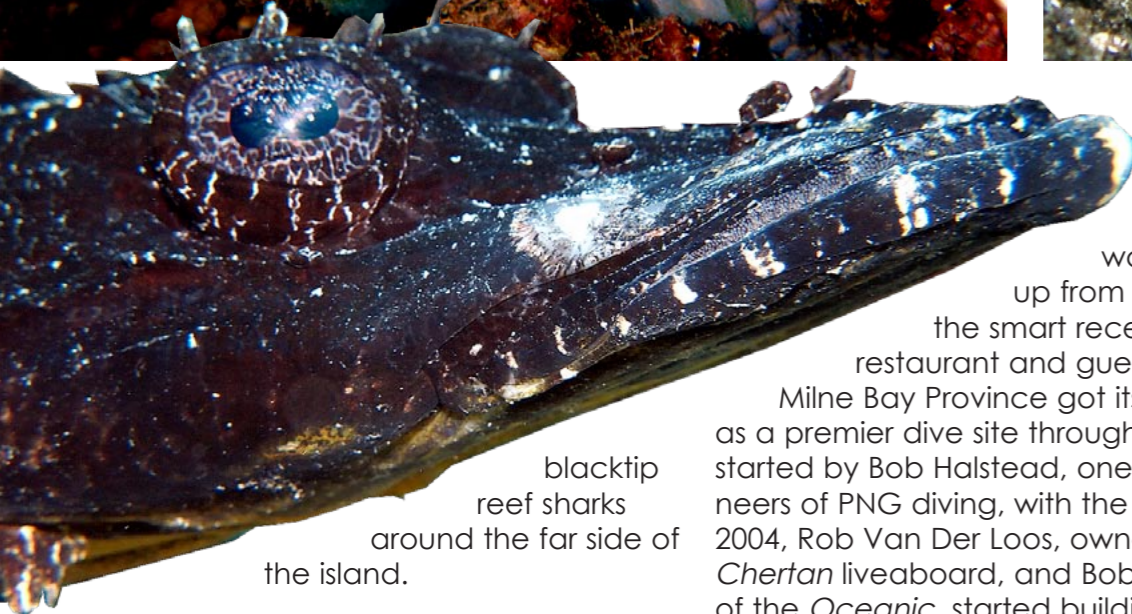
metres of water, making it ideal for snorkelling, too. It doesn't take too much luck to get a glimpse of juvenile

CLOCKWISE FROM FAR LEFT: Pink anemonefish on large anemone; Pair of mandarinfish; Whip corals in reef garden at Lissening; Sweetlips; Local fishermen fishing the reef at Lissening; Nudibranch chromodoris



PNG

LEFT TO RIGHT: Octopus; Nudibranch; Squat lobster; Banded boxer shrimp



blacktip reef sharks around the far side of the island.

Milne Bay

Purpose-built Tawali Resort is hidden in the tropical forests on top of the limestone on the eastern cape of Papua New Guinea. It is a two-hour drive and ten-minute boat

ride from Alotau Airport. A wooden walkway leads up from the jetty to the smart reception area, restaurant and guestrooms.

Milne Bay Province got its reputation as a premier dive site through liveaboards started by Bob Halstead, one of the pioneers of PNG diving, with the *MV Telita*. In 2004, Rob Van Der Loos, owner of the *MV Chertan* liveaboard, and Bob Hollis, owner of the *Oceanic*, started building a resort to cater for divers who prefer a more luxurious between-dive setting.

Arriving late in the afternoon and only having three days left for diving, genial dive centre manager and instructor Alfred

organised a house reef dive for us as soon as we had dropped off our bags. The house reef is large enough to occupy curious divers for several days. As with Tufi's house reef, a plethora of the ocean's most intriguing creatures can be found very close to the jetty. Warty frogfish, a rather bold octopus and another mandarinfish-inhabited coral head were all within 15 metres of the ladder.

Crinoid City. Diving is conducted from a converted tuna fishing boat, and seemed like considerable overkill when we walked down the next morning with two other divers. It could have comfortably taken five times our number. Still, it soon proved its worth in the chop, as we ploughed along for an hour to Crinoid City. The surface current was pretty strong, but a

judiciously placed rope running the length of the hull and down to the mooring point made hand-over-hand progress easy. The aptly named site is a good place for Merlet's scorpionfish, as it likes to hide amongst the crinoids, and Alfred soon spotted a green one.

Dinner at Tawali had a slightly more formal feel to it than the other resorts, partly because it is the only one where couples have their own table, and partly because the topside staff, on the contrary to their dive crew counterparts, were more reserved than at the other resorts. They paid less attention to details, with the drawing pin in my soup that I almost swallowed being the most memorable.

Deacon's Reef. The next day, the sea was totally flat, like an oil bath, though the cur-



Tiny warty frogfish; Crocodilefish (left)



unique topography and more sheltered nature, the stand-out site that we visited. Located next to the shore of the mainland, it starts as a sheer wall dive that ends in a series of shallow stone gullies and passages and gives a feeling of flying through a mini underwater mountain range or a moonscape dotted with clumps of long whip coral strands.

rent still made for fast drift dives and challenging photo composition. It was clear to see where the area got its reputation with more fish-and-coral-covered reefs.

Local guides Jacob and Charlie also had a keen eye for pygmies, and pointed out three different sub-species that morning, before spotting a bamboo shark snoozing under a small coral head.

Whilst these reefs were all good, Deacon's Reef was, due to its

Lauadi. Just round the corner lies Lauadi, Tawali's best muck-diving site. Devoid of any coral, the anthracite grey volcanic sand slopes down into the depths on a 30-degree angle. Lurking in the sand, hiding behind tiny bits of rubble, and sitting on wood debris, a Pacific seahorse, a 1cm-wide squat lobster, an emperor shrimp, a pasta-like flabellina nudibranch and several more

anemonefish allowed themselves to be digitally captured. It was the last dive of the trip, ending our adventure with another great dive.

The other three divers and two guides had gone, and even Charlie was starting to look a little bored. I had been down 65 minutes already. It was time to go back to the boat.

Unfortunately, close to the shore at a depth of five metres, we went past a three metre by three metre patch of rubble and coral. I tried not to look at it. I failed, and a zebra dwarf lionfish caught my eye and so did an eel, as a peacock mantis shrimp scurried under two more lionfish. I shrugged apologetically, and Charlie emptied his BC and lay down on the sand. Papua New Guinea had turned out to be highly addictive.



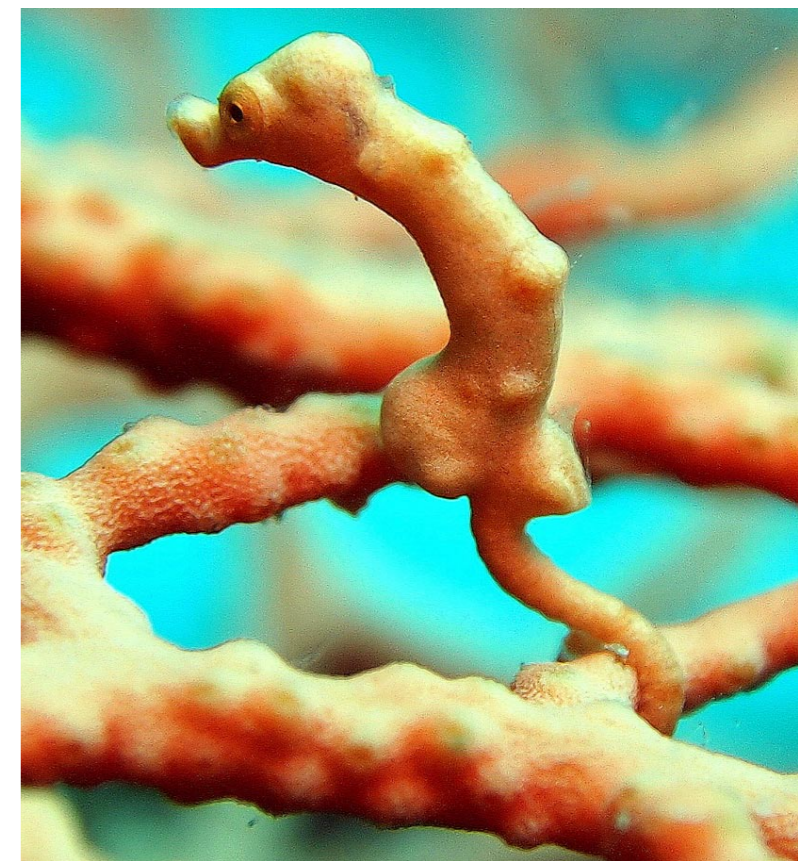
PNG



Moray eel at Tawali



Flagella nudibranch at Lauadi



Where to stay and dive

- Tufi, Oro Province: www.tufi-dive.com
- New Ireland Province: Nusa Island Retreat www.nusaislandretreat.com.pg
- Kavieng Scuba Ventures www.scubakavieng.com
- Lissenung Island Dive Resort www.lissenung.com
- Tawali, Milne Bay: www.tawali.com

Multi-resort itineraries and visits to the annual Goroka cultural festival (see next page) can be organised by Indigo Safaris info@indigosafaris.com. The author will gladly answer any questions sent to cb@christopherbartlett.com ■

CLOCKWISE FROM FAR LEFT: Lizardfish at Tawali; Crocodilefish at survey location; Checking measurement estimation skills; Pigmy seahorse on coral; Colorful shrimp; Peacock mantis shrimp



of their cultural diversity. Only a couple of hundred foreigners attended this spectacular and unique event. Last year, I was one of them. It was my first time, but I was sure to be my first time. Amidst a riot of singing, dancing and feathers, I wandered through the field of performers taking pictures and trying to chat with the different tribes.

Although the dancers were keen to pose for the camera and readily struck a pose, it is far from a show designed for tourists—quite the opposite in fact. The first Goroka show was held in 1957, the

implemented by Australian Patrol Officers (PNG was under Australian administration until peaceful independence was arranged in 1975). Instead of fighting over ancient feuds and cultural differences, the idea was to get together and celebrate diversity, take part in competitions and intermix peacefully.

As unlikely as it sounds, the idea worked, and 53 years on is still going strong. There are no longer any competitions (I can imagine the archery and spear throwing competitions were hotly contested and probably not the best way to promote peace), not even for dancing or singing. Quite rightly, the organisers feel that one cannot say that one cultural dance is better than another without giving the feeling that the culture itself is being judged. Nowadays, each group has a section of the show-

grounds and dances and sings there from 10 am to 4 pm each day.

There were a considerable number of women's groups, wearing more birds in their headdresses than you'd find in a Filipino smuggler's suitcase, their glimmering breasts sporting as many kina shells as they possess in order to display their wealth. Fierce-looking Silimbuli warriors with blackened faces in huge hair-woven berets jumped up and down in unison to the rhythm of their kundu drums, dissuading any challenge. Brightly coloured Mount Hagen warriors formed a formidable spear line, but chanted and whistled cheerily whilst grass-skirted Engan ladies danced and sang as their men beat out a tune on bamboo (and hardware store PVC) pipes with flip-flops. One tribe had giant bird and butterfly frameworks on their backs in a sort of Rio Carnival style, others acted out stories

about spirits and ancestors in song, shaven headed children with their hair made into beards playing the roles of pygmy ghosts. Hornbill beaks and wild pig tusks were proudly worn, and grasses and leaves used as dress and decoration in a myriad of ways. Every tribe was stunning, with one exception.

The famed Asaro mudmen, with their white clay-covered bodies and giant clay masks used to make victims believe they were being attacked by spirits, mainly sat in the shade and tried to sell masks and clay models despite the cajoling of the organisers. They seemed to do little trade, the 200-odd foreign visitors were mainly engrossed in the rest of the action.

You can stay in the madly expensive Bird of Paradise Hotel in town, or use the basic but clean and safe accommodation provided by the National Sports Institute right next to the show grounds and save about 150 euros each per night and eat for about 5 euros per day. ■



ANNUAL GOROKA CULTURAL FESTIVAL

Over the three-day weekend closest to the September 16th Independence Day, nearly 100 tribes gather at Goroka in the Eastern Highlands for a celebration



THE FACTS AND VIEWPOINTS IN THIS SECTION ARE NOT NECESSARILY THE VIEWS OF X-RAY MAG. EQUIPMENT PRESENTED IN THIS SECTION HAS 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

POINT & CLICK ON BOLD LINKS



Equipment *in the news*



Edited by Peter Symes & Rosemary 'Roz' Lunn



SD3

Waterproof claim their latest offering, the SD3, successfully bridges the gap between a wetsuit and a drysuit. As you'd expect coming from Waterproof, plenty of attention has been given to the small details. The result is an anatomically designed and cut 7mm beautiful semidry. It's dry enough to keep a diver warm in colder waters, whilst giving the diver that snug warm feeling of a decent wetsuit. Features include super-stretch neoprene seals, hard-core rubber knee guards, and a gas-proof shoulder dryzip complete with a zip cover.

waterproof.se



iGills

According to iGills the most powerful dive computer is already in your gear bag—you just didn't know it. Simply grab your iPhone, download the free iGills app and configure your dive. (Air, Nitrox, Gauge). Then dock your iPhone into the SE-35 lockable case, dive your adventure, capture the moment and share your stories. The high strength polycarbonate housing is rated to 40m / 130ft and should be impact resistant. Meanwhile the iGills app runs the Bühlmann ZH-16, 16 compartment algorithm. It can be configured for metric or imperial and has a gyro stabilised digital compass. igills.com



Pioneer

The Pioneer suit is Oceanic's most advanced wetsuit to date and is available in 3/2mm, 5mm, and 7mm. The suit combines an anatomic design paired with core thermal protection material "Lavaskin", Oceanspan neoprene, Liquid Seams, Skin-in seals, and Spandura. Lavaskin assists in thermal protection by trapping water in the indices of the knit, minimizing water movement throughout the suit, Oceanic writes. Skin-in neck, wrist and ankle seals prevent water flow in from the neck minimizing or even eliminating water flow. Skin-in on the backside of the zipper and along the back keep water out from entry points and also serve as a spine pad.

Oceanic's Pioneer

Get a grip

The popular Sola light range from Light & Motion now come with a range of new grips. First there is a hand strap which comes in sizes small and large. Next there is the pistol grips shown on the image and finally a T-Handle hand strap which comes in small, medium, and large. All options includes a lanyard. **Light & Motion**



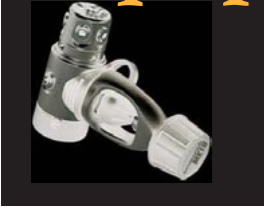
a300

The new AERIS A300 is designed with a simple premise – using a dive computer doesn't have to be difficult. The A300 distinguishes itself with the use of NORM and TECH modes. NORM mode is selected by default as an out-of-the-box solution that provides all the necessary settings and information for divers who just want to get in the water. When switched into TECH mode, the advanced features and fine-tuning become available that will satisfy any experienced diver.

Aeris a300



equipment



Pico

The 'Pico' is the smallest Kowalski to date, weighting in at a mere 223 grams (with batteries). This aluminum bodied torch has a decent burn time of up to 18 hours, with the 3 x 1.5V AAA batteries producing an impressive 6,000 Lux / 490 Lumens. It seems that Kowalski has produced a natty light that will be ideal for the entry-level diver and, as their diving progresses, evolves to become a suitable redundant torch. However, we can see the Pico also being popular with more established divers because this dinky light (128cm long) has a decent depth rating (200m / 656ft) and will be easy to stash.

Kowalski



Alpha 9

If you're looking for a budget regulator, check out the Oceanic Alpha 9 CDX5. This pretty downstream regulator promises to be economical to service, too—standard replacements parts should come in as little as half of those in other regulators in its class. The Alpha 9 CDX5 comes with two High Pressure and four Low Pressure ports, a patented orthodontic mouthpiece and a light-weight braided hose. **Oceanicuk.com**

Ice

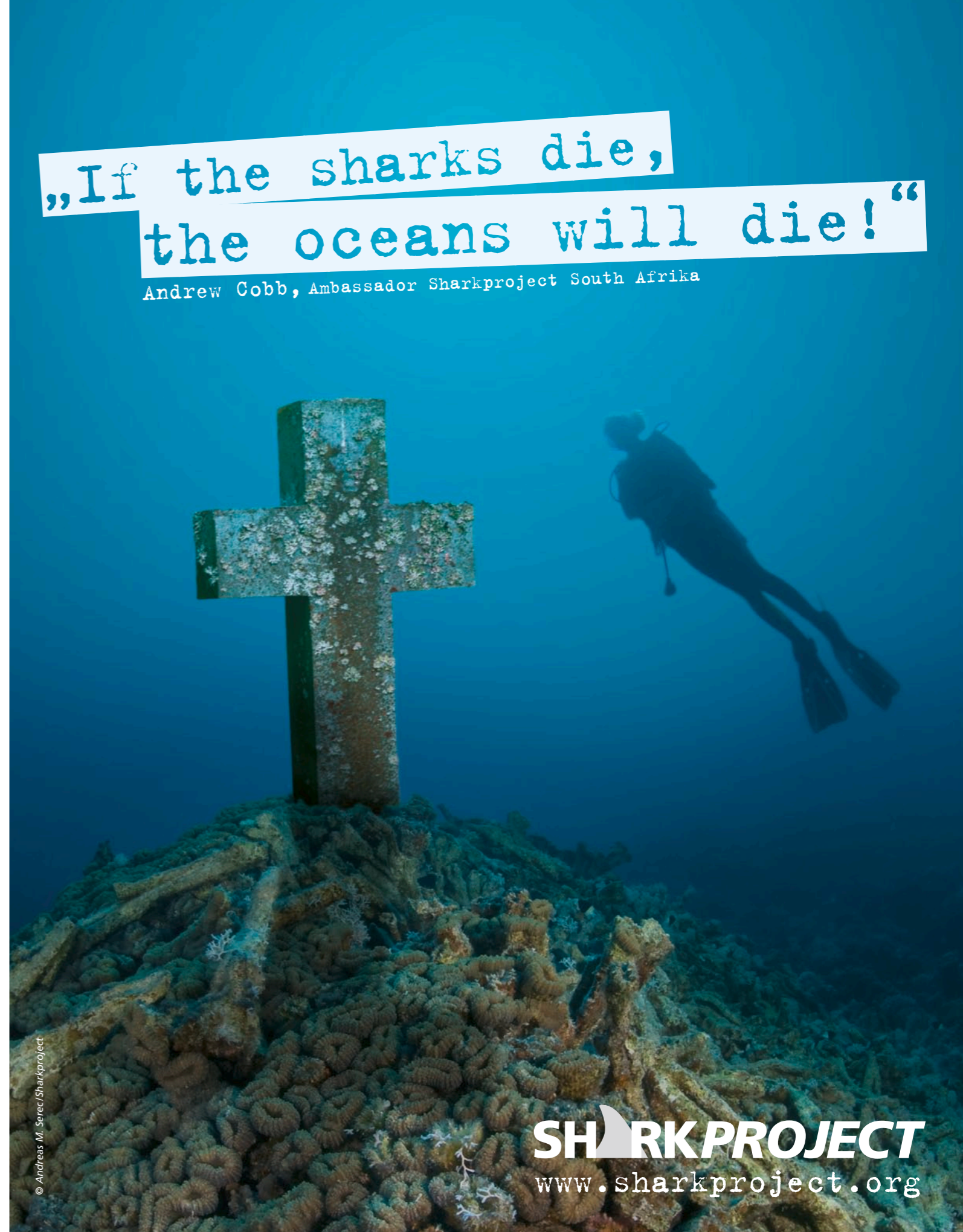
Camaro states that their Omega Ice wetsuit is virtually watertight, thanks to the double-sealing G-lock zipper system. Apparently, this is a fast drying and an easy-to-don suit thanks to the super-elastic Terry lining. Features include an integrated 'Ice Vest'—giving the torso double protection, and double-sealing wrist and ankles with elongated zippers. The Omega Ice is available in 24 different sizes and comes in 5mm and 7mm.

Camaro.at



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

Andrew Cobb, Ambassador Sharkproject South Afrika



© Andreas M. Serec / Sharkproject

SHARKPROJECT
www.sharkproject.org

ed.—It's been said that in the near future, most recreational divers will be diving on user-friendly, dummy-proof, easy-to-use closed-circuit technology. So, today's recreational divers can get a headstart on the trend by staying abreast of the current talk on safety culture now being discussed in technical diving circles. We looked to U.K. technical diver and writer Gareth Lock—an officer of the Royal Air Force—to break down the concept of a safety culture into digestible bits and how human error can and should be less of a fatal factor in diving today.

Text by Gareth Lock
Photos courtesy of Gareth Lock

“Thank [beep] for that! How lucky were we? We better not do *that* again. Don't tell anyone though, we don't want to look like amateurs...”

This was a mistake that could have cost them their lives, but fortunately, the divers spotted it and corrected the issue before it went too far. The current culture we have in diving means that the probability of the divers telling anyone outside their buddy pair, or maybe the divers present on the boat, is pretty much zero.

The problem with not letting people know what happened is two-fold. Firstly, others can't learn from your mistakes; and secondly, the 'authorities' don't obtain the evidence to show that there is a problem with whatever it was that went wrong.

Many of the more experienced divers lay criticism on the dive education agencies for not providing adequate training, and yet there is extremely limited hard evidence to show that there are problems with such things as lack of buoyancy control or gas

management. There is, however, plenty of anecdotal evidence, when you speak to divers on boats or in the pub.

Everyone makes mistakes, even

world leading divers—those at the top of their game, the sort of people we aspire to be. So, if *they* have made mistakes, there is a very high probability that you

or I have made similar mistakes, or errors, on a dive. Unfortunately, those who didn't recognise the threat, or risk, until it is too late are no longer here with us

today taking part in a fantastic sport exploring our underwater world.

The following is a series of actual incidents that have ended

with fatalities.

- Entering the water with O₂ turned off on a rebreather; the diver died shortly afterwards.
- Switching to 50% when at

Safety Culture *Diving in the Zone*



36m depth and carrying on the dive down to below 50m because the diver hadn't followed correct protocols for gas switching; the diver died after approximately an hour on the 50% bottle at depth.

- Incorrectly labelling an emergency bailout cylinder so that it was placed at an incorrect depth leading to it

being breathed at 3.2 ppO₂; the diver had a seizure and died very shortly afterwards.

- Task fixated in lifting an artefact, using backgas to inflate the liftbag as the original inflation cylinder had already been sent to the surface, and consequently running out of gas at depth, and then the diver did not



Without knowing what prevalent problems are and why they occurred, it is very hard for training agencies to know how much emphasis to place on certain activities during training courses. It is also very hard for divers to accurately quantify the risks they are taking when they 'break the rules'.

use established protocols to use the dive buddy's gas; the diver died following a rapid ascent to the surface.

These are all simple mistakes and maybe the sort of thing that some of the readership might have done and 'gotten away with'. If you did make a mistake like this, did you tell anyone or report it to the wider diving community through BSAC or another reporting system such DISMS?

Without knowing what prevalent problems are and why they occurred, it is very hard for training agencies to know how much emphasis to place on certain activities during training courses. It is also very hard for divers to accurately quantify

the risks they are taking when they 'break the rules'.

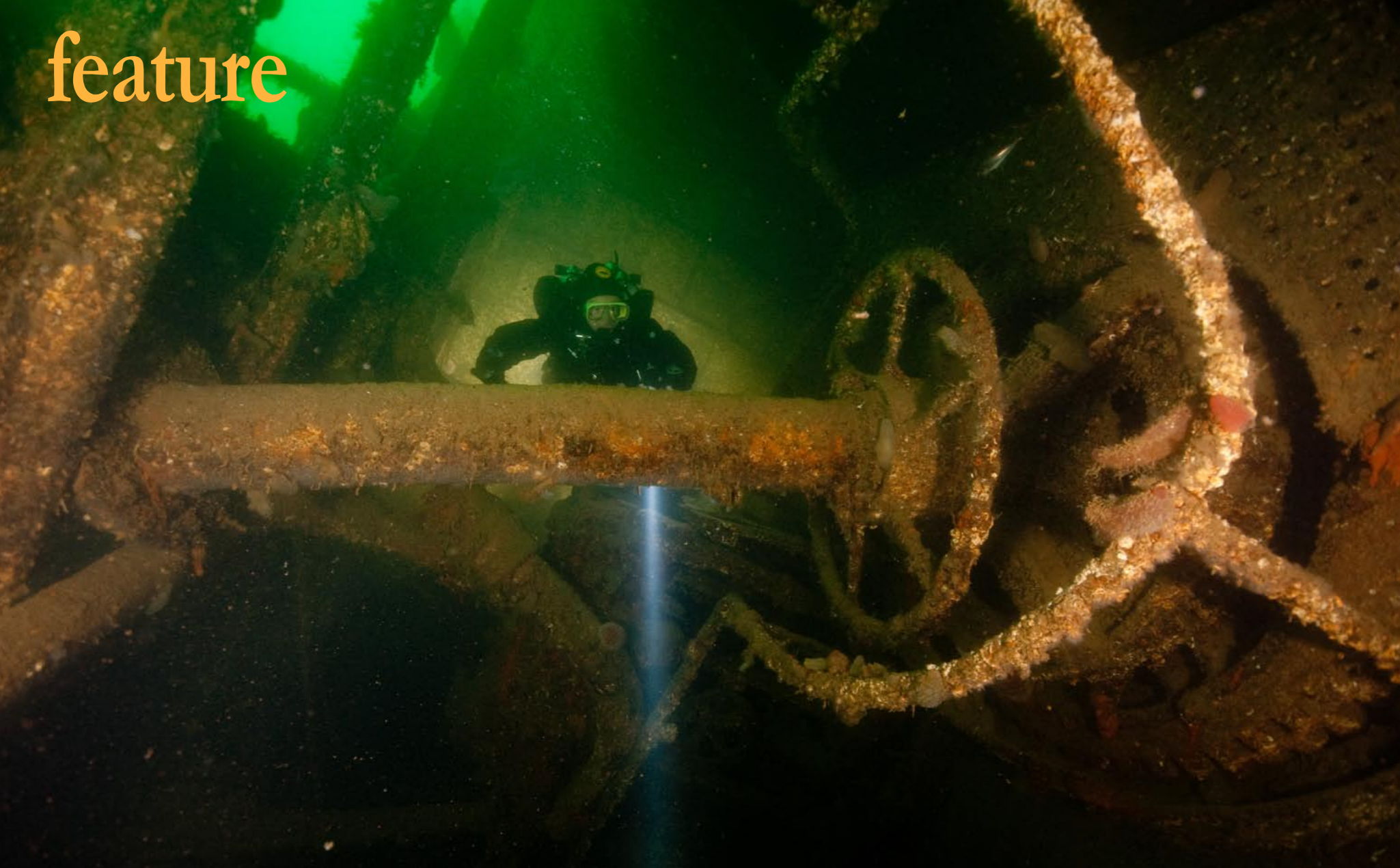
In addition, before you personally mitigate a risk (in risk management terms—tolerate, treat, transfer or terminate) you need to be able to identify it. However, from the commercial standpoint of the diving industry—that diving as an activity that needs to be promoted as a 'safe' sport in order to continue feeding new divers into the system—'promoting' these risks is not necessarily good for business.

Providing an environment where divers, instructors and those involved in management of diving and diver training operations can report honest mistakes and

near misses is essential. This environment is one where it is accepted that we all make mistakes due to the limit of our experience, knowledge, training or the situations in which we are placed—an environment where the reporting of those mistakes, or near misses, is to be encouraged.

But at the same time, it is an environment where negligent or malicious behaviour is not condoned and allowed to continue. This environment is known as a 'Just Culture' environment and is part of the wider 'Safety Culture' that this sport should embrace if we are to reduce the number of injuries and fatalities occurring.

However, calling it a Safety Culture



society is now taking less personal responsibility for actions, appearing to look for someone to blame, rather than undertaking some sort of 'personal risk assessment'—the so-called 'Elf and Safety' culture we now live in. Despite this, divers can be given training via a range of agencies and courses about how to undertake diving safely.

During that training, they should be taught to exercise caution as well as what the implications are of going beyond their trained limits, as they expand their experience and knowledge. Unfortunately, when a diver breaks these rules, and something goes wrong, there is a tendency to look for someone to blame for the incident, rather than understand why that diver made the mistakes they made.

This 'blame culture' means that companies are less willing to be involved in such a 'hobby sport'—especially supporting closed-circuit rebreather (CCR)

CULTURES

INFORMED CULTURE: The collection and analysis of relevant data and the active dissemination of safety information to all required parties, both inside and outside the organisation. Part of this involves active risk management, ensuring that risks are identified and their mitigations provided.

REPORTING CULTURE: An environment in which divers have the confidence and security to report where safety has been compromised without fear of blame or retribution. Divers must know that confidentiality is at the forefront and, most importantly, know that something will come of the data that is submitted. Without the latter, use of the system will wither and ultimately die, as there is no perceived need.

LEARNING CULTURE: This is the ability to learn from the mistakes which have been made, make changes in a timely fashion, improve safety and operational outputs. In diving terms, having more fun, understanding the risks and mitigating them. A learning culture is also fundamental to ensure that divers are aware of what the safety management system is and how they can interact with it.

JUST CULTURE: Fundamentally, this boils down to an environment where honest mistakes and errors will not be punished if the error was unintentional. On the other side, those who take unjustifiable risks or act recklessly or negligently will still be subject to disciplinary action. It is not a blame-free culture.

FLEXIBLE CULTURE: This is where an organisation and its people are capable of adapting effectively to changing demands. As an organisation becomes larger and more unwieldy, its flexibility is decreased or eliminated. ■

might have connotations of a 'nanny state', and as a consequence, the more experienced or independent divers may want to rebel against it. The discussion on a well-known internet forum following the Rebreather Forum 3.0 consensus position that checklists should be produced and used for closed circuit rebreathers to improve safety is a classic example of this.

The Just Culture aspect

A Safety Culture is not one entity, but rather is made up of a series of component 'Culture' parts. These include an Informed Culture, a Reporting Culture, a

Learning Culture, a Just Culture, and finally, a Flexible Culture (see green box at right)

A Just Culture cannot exist on its own, but rather is interlinked with the other cultures. You cannot understand who has done what, when or why without an established reporting culture, and you won't get those subjects to report if they think there isn't an issue and don't understand the risks that may occur if the situation conspires against one (informed culture).

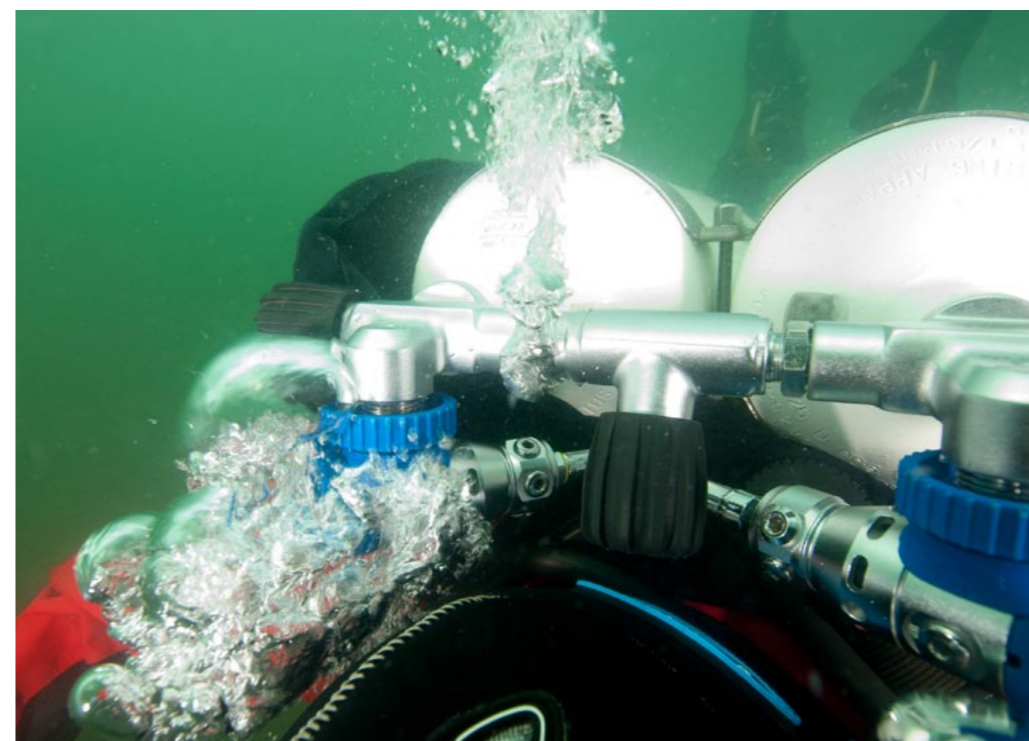
The puzzle is not complete unless you have a Just Culture, as divers will not report an incident if they think they are going to be unjustly or

“A lesson is not learned until something has been changed or a conscious decision has been made to not change it.”

inappropriately blamed for the incident or accident. Finally, a learning culture is required to know more about the risks that are out there—simplistically, gluing the pieces together.

Responsibility... personal responsibility

Looking at the tabloids, one could argue that



equipment—and safety will be reduced as a consequence.

Diving is considered a relatively safe sport considering the environment in which we undertake it, with a fatality rate of approximately 1:200,000 dives per year. However, those figures are not precise, with between 10 and 24 fatalities and more than 350 divers treated for decompression illness (DCI) each year.

In addition, from recently presented material at Rebreather Forum 3.0, CCR diving is considered to have ten times greater fatality risk than open circuit (OC) diving. Despite these numbers being relatively low, divers need to be aware of the risks they are taking; we are undertaking a sport that cannot be conducted without technical and mechanical life support equipment, and if this fails, there is a real risk of death. Partners and family members

need to know the risks we are taking, and most importantly, that human error is the most prevalent root cause of diving fatalities.

Fortunately, mistakes don't always lead to a fatality and much can be learned from non-fatal incidents; the prevalence of these compared to fatalities is likely to be in the order of 1:600, as per previous engineering studies. Consequently, there needs to be a means by which the outcome and solution can be discussed in an open and non-critical manner, thereby allowing others to learn from non-

fatal episodes.

If mistakes aren't corrected, they can become the norm—*because-I-got-away-with-it*—turning into bad habits. These bad habits need to be checked in a non-confrontational manner to bring the diver back to baseline.

Diving is a fun activity, but these bad

Partners and family members need to know the risks we are taking, and most importantly, that human error is the most prevalent root cause of diving fatalities.



habits could be as simple as dragging or dangling equipment, poor buoyancy control or not analysing gas to ensure that the maximum operating depth (MOD) is known. If these habits are not corrected by the training organisation (or the diving community at large), there is implicit acceptance that what the divers are doing is correct and acceptable. Simple things like asking divers if they have analysed their gas—it maybe that a diver is relying on it in an emergency—or what their gas consumption, or planned pressure, is for leaving the bottom can help a lot.

What YOU can do to help the wider diving community
In the United Kingdom, there are a

couple of reporting systems available to the diving population: the BSAC Incident Report, which is open to all divers from all agencies wherein an annual report summary is produced, and the Diving Incident and Safety Management System (DISMS at www.divingincidents.org), which is an online open and confidential reporting system independent of all agencies and manufacturers.

DISMS allows a search to be conducted against the live public

dataset, producing results then and there. So, if data is updated after the annual report (covering January 1 to December 31) is published, the revised data can still be accessed.

If mistakes aren't corrected, they can become the norm—because-I-got-away-with-it—turning into bad habits. These bad habits need to be checked in a non-confrontational manner to bring the diver back to baseline.

By reporting your incidents and accidents, the sport will be better informed of the risks that are occurring, and training agencies can focus their efforts more accurately.

I have been quoted many times as being able to provide numbers

on why incidents occur. However, until people start submitting reports in

feature

meaningful numbers, the data is will not be there. In addition, the reports need to be relatively detailed to allow the 'why' to be determined' rather than just the 'what'. The following is an example of why the backstory is required.

An experienced advanced trimix diver and instructor who had been using a KISS rebreather for a while had made a habit of turning his rebreather unit off when on the bench while taking off his kit—because he had left the unit on several times in the past only to return and find an empty O₂ bottle. This practice gradually backtracked, evolving from turning the valves off while de-kitting on the bench, to turning off the O₂ while walking to the bench, to turning it off already when he was getting out of the water, as his gear was being lifted onto the back of the boat after his dive.

On the day in question, he was waiting in que behind another diver to get out of the water at the pick-up point. He presumed that the diver in front of him would be out of the water in a couple of minutes. At this point, he turned off his O₂. Unfortunately, the boat had to circle around again in order to pick up the diver in front of him.

He was, however, still breathing off the loop. Once he finally got picked up, the pO₂ was a little low!! He felt rather unwell standing on the lift, looked down at the handset and noticed that the partial pressure of O₂ had

fallen all the way down to 0.07! He spat out the loop and started to feel better. A few seconds more and he would have had major problems [ed.—because he was so close to fainting from hypoxia. The reason why he didn't get a suffocating sensation due to lack of oxygen

Simply speaking, in a safety culture, we choose to do the safe things all the time, not just when someone is watching or assessing us.

was because this sensation is caused by CO₂, which was still being removed by his rebreather canister. So essentially, he was depleting his oxygen without noticing it.]

If this had been reported as just, "A diver switched off his O₂ in the water",

people would have (rightly) thought he was a fool and should have known better. However, if the backstory had been reported, it would have become clear what led the diver to complete the actions he did, even if they were wrong.

It's your attitude!

Simply speaking, in a safety culture, we choose to do the safe things all the time, not just when someone is watching or assessing us. A Just Culture is only a part of the wider 'Culture'.

While articles like this one can highlight what a Just Culture is to the diving community, it really takes the organisations of the dive world to actively promote it at the top level, so that it cascades down to the instructor trainer staff, the instructors, and ultimately, the divers themselves.

Learn from your mistakes. Better still, learn from someone else's.

Safety Culture

Diving is a recreational activity with limited legislation (and rightly so). Consequently, it is much better to encourage and lead by example—i.e. more carrots, less sticks.

For example, a leading U.K. rebreather instructor Paul Haynes has been promoting the use of mouth-piece retaining straps for rebreather users, so they can maintain a gas source even if they happen to go unconscious. This has led to an effective campaign on one CCR forum where at least 20 CCR divers have bought them, and the subject was added as a consensus position at Rebreather Forum 3.0 this May— a small, simple and cheap change, which has the potential to reduce fatalities.

A Just Culture does not have to be mutually exclusive to a recreational activity, nor does it have to cost a substantial amount of money to implement. However, what it does require is an attitudinal change within the industry and educational organizations as well as those partaking in the sport.

Hiding something away because you made a mistake doesn't help anyone. However, divers' concerns about being treated fairly—without judgemental attitudes and with their circumstances taken into account—need to be addressed before reporting will be widely adopted.

In closing, learn from your mistakes. Better still, learn from someone else's. ■



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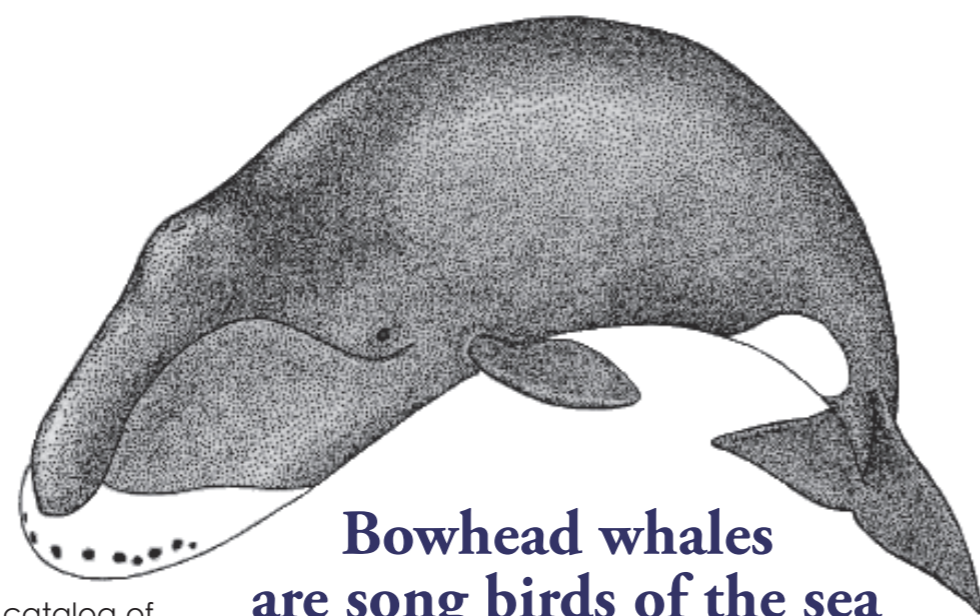
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marine mammals



DAVID G. STANTON / NOAA

Bowhead whales are song birds of the sea

catalog of tunes to that of song birds. The bowhead whales' singing is unique in that they seem to sing with "two voices," producing high- and low-frequency sounds at the same time.

Stafford's initial mission was to find out if any endangered bowhead whales passed through a brutal ice-covered stretch of sea called the Fram Strait. It is located between Greenland and the northern islands of Norway. The elusive whales, hunted almost to extinction, have been seldom spotted since the 1970s.

The research offers hints about the whales' migration path, breeding season and behavior. "For such a critically endangered species, it's really important to know that there's a reproductively active portion of the population ... As Arctic sea ice declines, there may

be some places like this that are important to protect in order to preserve a breeding ground for the bowhead whales," Stafford said.

Bowhead whales can grow to over 60 feet long and may live to 200 years old. They can weigh 200,000 pounds.

The research was funded by NOAA and supported by the Norwegian Polar Institute and the Alfred Wegener Institute. The team of researchers co-authoring the paper include Sue Moore and Catherine Berchok of NOAA, the University of Oslo's Øystein Wiig; Edmond Hansen, Kit M. Kovacs and Christian Lydersen of the Norwegian Polar Institute; and Dirk Kalmbach of the Alfred Wegener Institute of Polar and Marine Research in Germany.

■ SOURCE: WILDLIFEEXTRA.COM

Whales singing for five months straight? That's what oceanographer Kate Stafford of the U.S. University of Washington heard when she listened to undersea microphones during a year-long research expedition off the coast of Greenland.

The undersea song birds were bowhead whales (*Balaena mysticetus*) which are critically endangered; The new recordings suggest a rebound in their numbers.

Stafford was stunned by the remarkable variety of the songs the whales sang, picked up over the winter months by a recording device lowered into the icy waters of the North Atlantic. "We hoped to record a few little grunts and moans," Stafford said. "We were not expecting to get five months of straight singing." In fact, more than 60 unique songs were documented, leading researchers to compare the

Forty blue whales spotted off California coast



DAN SHAPIRO / NOAA

In August, one of the largest groupings of whales ever sighted occurred in the waters around San Diego in southern California on the U.S. West Coast. Veteran aerial photographer and marine biolo-

gist Eddie Kisfaludy spotted the whales and recorded the event.

Kisfaludy found the company of whales while flying a fixed wing aircraft conducting surveys for National Oceanic and

Atmospheric Administration and the Sportfishing Association of California. The group was 15 miles west of La Jolla and was comprised of 40 blue whales and six fin whales. ■ SOURCE: WILDLIFEEXTRA.COM



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Dolphins Are Good At Math

Flipper may be a math genius, according to a new study that suggests that dolphins are a lot more clever than we thought. Indeed, they may be using complex nonlinear maths when they hunt.

Apparently, researcher Tim Leighton, a professor of ultrasonics and underwater acoustics at the University of Southampton in the United Kingdom, was inspired to do the study, which was published in *Proceedings of the Royal Society A*, after watching an episode on dolphins in the *Blue Planet* series on Discovery Channel. In the episode, he observed the dolphins blowing a lot of tiny bubbles in proximity to prey they were hunting.

"I immediately got hooked, because I knew that no man-made sonar would be able to operate in such bubble water," said Leighton. "These dolphins were either 'blinding' their most spectacular sensory apparatus when hunting—which would be odd, though they still have sight to reply on—or they have a sonar that can do what human sonar cannot ... Perhaps they have something amazing," he said.

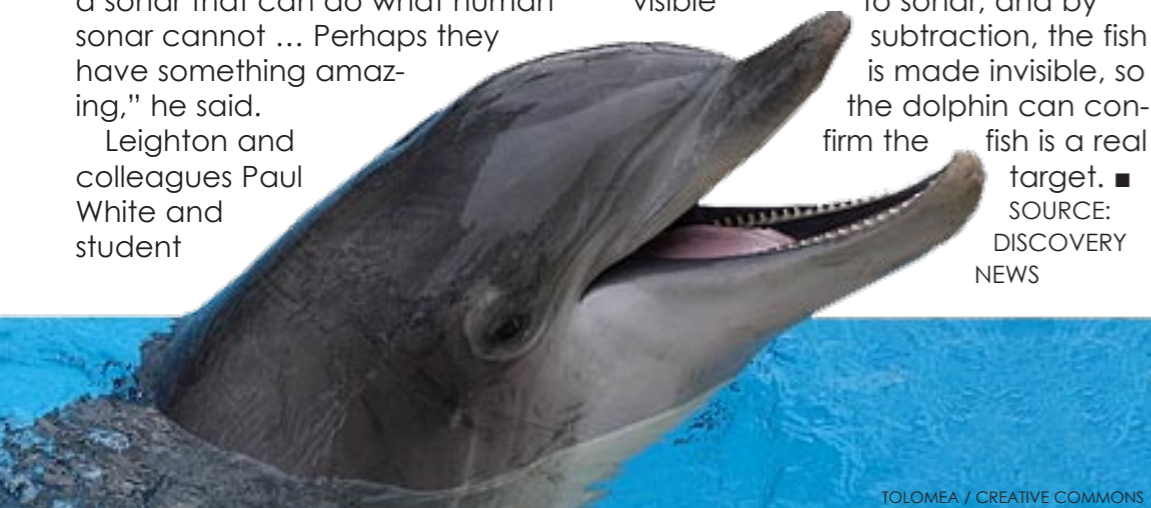
Leighton and colleagues Paul White and student

Gim Hwa Chua began their investigation by modelling the types of echolocation pulses emitted by dolphins. Then they processed these pulses using nonlinear mathematics rather than the conventional way sonar returns are processed. This method paid off, leading to a possible explanation.

It's complex math. The dolphins have to remember various amplitudes of pulses they send out, such as a value of 1 on the first, and on the second, a value of 1/3 of the first. "So, provided the dolphin remembers what the ratios of the two pulses were, and can multiply the second echo by that and add the echoes together, it can make the fish 'visible' to its sonar," said Leighton. "This is detection enhancement."

It is theorized that after this, the dolphin has to subtract the echoes from each other, making sure the echo of the second pulse is first multiplied by three. Thus, by addition, the dolphin's process makes the fish visible to sonar, and by subtraction, the fish is made invisible, so the dolphin can confirm the fish is a real target. ■

SOURCE: DISCOVERY NEWS



TOLOMEA / CREATIVE COMMONS

Whale Poop Power

When you gotta go, you gotta go, and blue whales are no different. But when they go, they go really, really big. They are the largest animals to ever have lived on the Earth, so when they poop, it's colossal. But their excrement also functions as a fertilizer for surface waters, according to researchers.

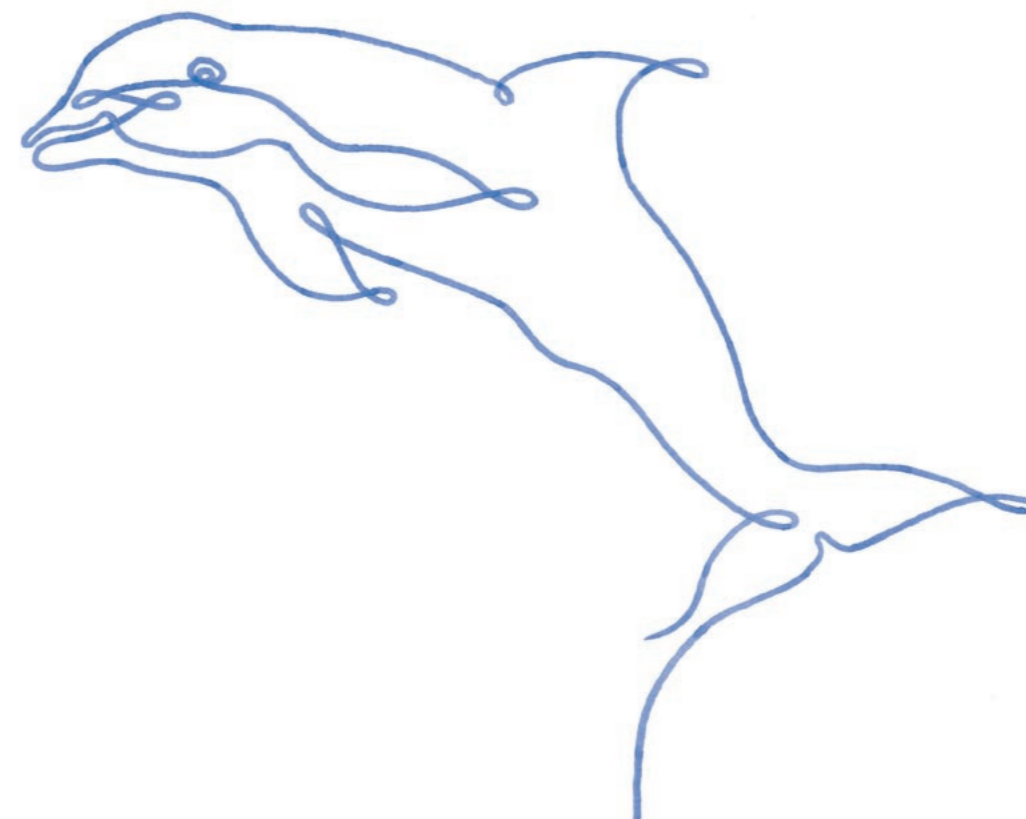
Blue whales feed on krill, tiny crustaceans floating in the seas, and the orange hue of their prey colors the fecal plumes the animals deposit in the oceans. Considered by marine biologists to be the unappreciated gems of the aquatic world chugging along. Playing an enormous role in nutrient and carbon cycles, their huge skat deposits, which can be as large as an adult whale, result in an increase in plankton, fish and thereby, whales, says Joe Roman, a conservation biologist at the U.S. University of Vermont.

Roman and Harvard zoologist James McCarthy proposed what they called the "whale pump" in 2010—a term for the process whereby whales that feed at depth carry nitrogen to warm, energy-rich waters at the surface, discharging their excretions in "flocculent fecal plumes". That's longhand for saying that whale poop floats. It serves to continually recharge surface waters and foster plankton growth as well all the creatures that feed on them. ■

SOURCE: WIRED.COM



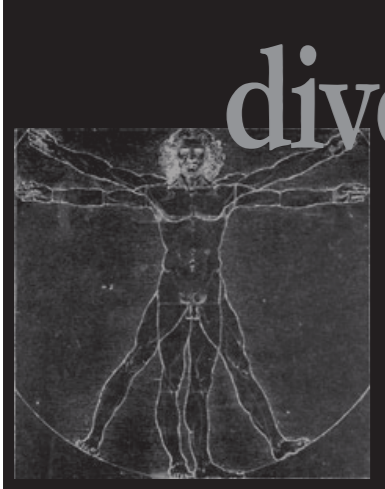
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ED.— ALWAYS CONSULT A PHYSICIAN FIRST BEFORE BEGINNING ANY EXERCISE OR FITNESS PROGRAM.



Are You Scuba Fit?

Text and photos by Gretchen M. Ashton, CFT, SFT, SFN, NBFE Founder of ScubaFit®

Long after the jet lag and the first day back to work, you slip into your favorite dive T-shirt eager to keep the essence of your most recent underwater experience pulsing through your mind and body. Proudly wearing large print logos across your chest is a way of celebrating your passion for diving and sharing it with the rest of the world. And why not? Beyond the obvious comfort of a cotton dive T, diving is a recreational activity that quickly becomes a way of life. Now imagine if you pulled on your favorite dive T-shirt and someone had changed the slogan to express other aspects of your lifestyle. Would you be as enthusiastic about your cholesterol or body weight in large print for the rest of the world to see?

While scuba diving is a recreational activity almost anyone can enjoy, many participate with disregard for any number of unhealthy conditions. Exercising to enhance recreational activ-

ity is a positive way to take responsibility for your health, bring focus and motivation to a fitness routine and improve your overall diving performance. Be concerned more with what's under your T-shirt than what is on it. It was five years ago research discovered it primarily described the medical condition of divers. To create a distinction in early discussions, it was necessary to specify physical fitness for diving.

Fortunately, because of opportunities such as this, fitness for diving is being redefined to include a greater awareness and more detailed discussion of the importance of physical fitness in the health and safety of divers. What does it mean to be physically

fit for diving? Is there a 'best' workout? Where do divers begin a fitness lifestyle? Who do divers trust for advice?

Health profile of the diving community

My research began with a review of 18 years of Divers Alert Network (DAN) annual reports where I found *Reported Medical Conditions by Divers*. In order of prevalence, heart disease/cardiovascular illness, high blood pressure, obesity, diabetes, smoking, asthma and allergy are all consistently present in the diving community. First and foremost, exercise programming for divers helps prevent, reverse and manage these conditions greatly reducing health-related risks when diving.

Training for diving performance and safety

It was significant to discover and incorporate Dr Glen Egstrom's work at the University of California in Los Angeles,

USA. His practical research included studies

a healthy body composition, determine current fitness level, evaluate diving activity, and identify and accomplish specific goals.

What follows is an overview of

such as measuring a diver's heart rate while putting on a wet-hot summer sun.

suit in the His kinesiology discussions are helpful in understanding and emphasizing the importance of training to improve diving performance and safety.

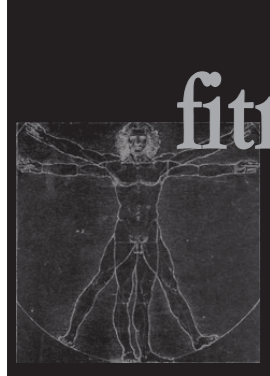
Scuba diving itself should not feel like a workout. Developing a healthy heart and lungs, muscle strength and flexibility, overall endurance, and eating well for diving are, for very important reasons, accomplished on and above the surface.

Getting started

My surveys reveal that less than 30 percent of all divers exercise. For divers who are new to exercise, it is important to as much as possible be in good health, consider orthopedic conditions, maintain

a workout specially designed for divers. It is performed in a fitness center, but may be transferred to a home gym or outdoors by using a few exercise bands and free weights. This is an intermediate workout and a good goal for healthy, injury free divers that have been exercising consistently at least two times per week for three months to a year, or at least three times per week for six months. **It is important to remember not to exercise 24 hours before or after diving.**

To begin, it is recommended to read through the entire program for an introduction to interval training, review the exercises to determine which ones are best for you, and use the formula pro-



fitness

vided to determine your training heart rate or aerobic training zones.

The custom program simulates the physiology and biomechanics of diving in an exercise program. This synergistic workout stimulates your mind and body with timed intervals of functional body weight and resistance exercises alternated with timed intervals of aerobic heart rate training. Therapeutic considerations for the knee, shoulder and low back are built into the program.

Consistent participation in exercise promotes weight loss, supplements lean muscle mass, helps prevent osteoporosis, may reverse clinical conditions such as hypertension and high cholesterol and can be an excellent pain management tool for all forms of arthritis. As a diver, you may

Ball Reach on Feet starting position



Ball Reach on Feet extended position



directly benefit with improved endurance on land and in the water, more stability on the boat and for shore entry, reduced risk of injury and illness, more efficient use of air, and ease of handling gear and tanks.

Aerobic training zones

To maximize the benefits of training, it is necessary to establish your heart rate training zones. These training zones are based on your maximum heart rate, which is the highest number of times your heart can contract in one minute. Working within 60-80 percent of your maximum heart rate is most beneficial for overall health. The 70-80 percent heart rate training zones improve the ability of the body to take in and distribute adequate amounts of oxygen to working muscles during physical activity.

If you have heart conditions, it is recommended that you measure your maximum heart rate by taking a max stress test administered by a physician. Otherwise,

the most respected fitness standard for calculating your training heart rate zones is the Karvonen Formula developed by internationally renowned physician and exercise physiologist, Martti Karvonen.

As soon as you wake up in the morning, before you get out of bed, take your resting pulse by placing two fingers under the back corner of your jaw or on your wrist and count your heart beat for one minute. This number is your Resting Heart Rate.

Use this number to perform the following Karvonen calculation. Subtract your age from 220. From this result subtract your Resting Heart Rate (RHR). Then multiply this number by your training intensity of 70 percent (repeat the formula for 80 percent).

Lastly, add your Resting Heart Rate back in to get your Training Heart Rate (THR). An example looks like this: $220 - (\text{AGE}) 45 = 175$; $175 - (\text{RHR}) 68 = 107$; $107 \times 70\% = 75$; $75 + (\text{RHR}) 68 = 143$ (THR).

Using this example, while training in your 70 percent heart rate training zone, you will attempt to maintain a minimum pulse of 143 beats per minute. Your 80 percent heart rate training zone provides a maximum

pulse of 154 beats per minute. However, if you are a beginner, work at 60 percent intensity until these higher percentages can be performed while still able to carry on a conversation.

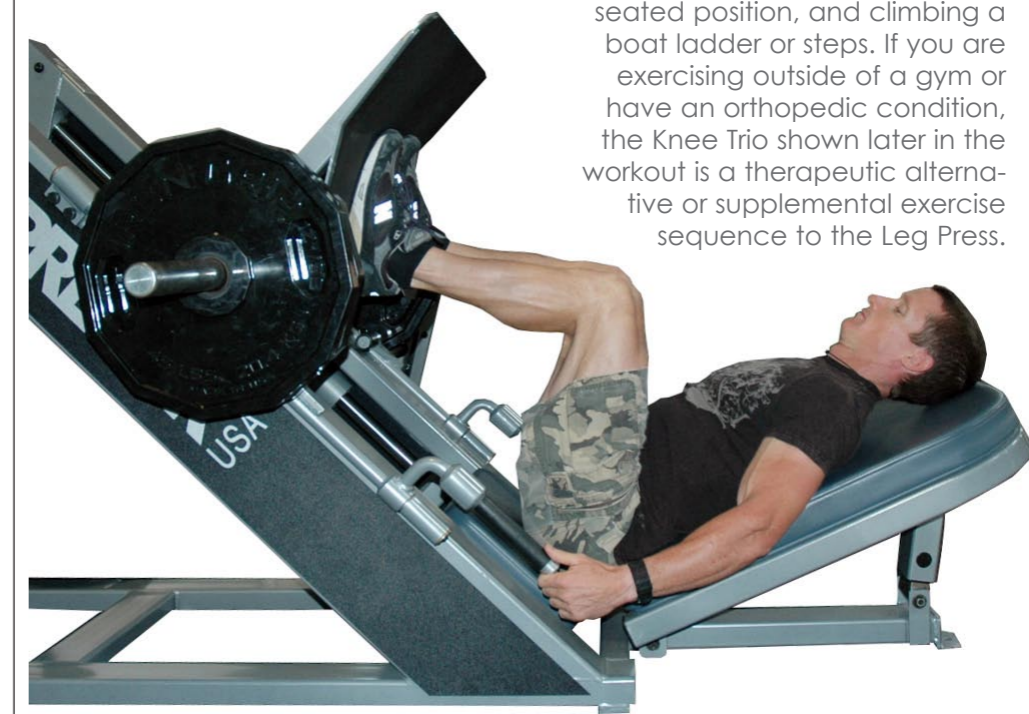
The custom program I describe here applies the 70 percent heart rate training zone primarily to improve the muscle cells ability to utilize oxygen. This zone trains the heart to pump more blood, metabolizes stored body fat as the primary source of energy, is preferred for weight management, and is a healthful intensity in preparation for moderate scuba diving conditions.

Training in the 80 percent zone is most effective for overall cardiovascular fitness. The following custom program uses this heart rate training zone to improve the body's ability to transport oxygenated blood to the muscle cells and carbon dioxide away from the cells. This zone is also effective for increasing overall muscle strength. A training zone of 80 percent of your maximum heart rate is similar to the work of swimming against a moderate current.

Notably, the 90 percent zone, while sometimes used for short periods to train for high levels of athletic performance, is not considered a healthful zone for recreational activity. However, of considerable importance is that exercising with consistency in the heart rate training zones of 70-80



The Leg Press combines all major muscles of the legs and buttocks along with the abdomen and low back. It is foundational in nature and recommended as an alternate to the squat to reduce risk and accommodate certain knee and back conditions.

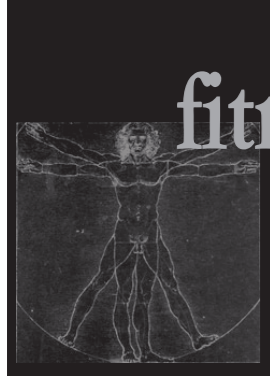


Direct advantages include all movements under the load of gear, especially standing from a seated position, and climbing a boat ladder or steps. If you are exercising outside of a gym or have an orthopedic condition, the Knee Trio shown later in the workout is a therapeutic alternative or supplemental exercise sequence to the Leg Press.

percent may prepare you for a time when you may need to exert beyond usual conditions.

Training with a heart rate monitor is a great way to easily know if you are working in your training zone and is recommended for individuals with heart disease or

pulmonary conditions. It is recommended to rely on heart rate monitors primarily during aerobic intervals. During resistance training intervals your heart rate will naturally fall slightly below your target training zones.



The “Basic Six” Exercises

The program designed for divers employs functional exercises, which systematically involve muscle combinations and sensory adaptations associated with body position and movement during scuba diving. Utilizing both dynamic and static positions, this workout is designed around six basic exercises. Alternate exercises are provided for the most common conditions of the shoulder and knee. Substitute alternate exercises for Basic Six exercises as indicated.

The Leg Press combines all major muscles of the legs and buttocks along with the abdomen and low back. It is foundational in nature and recommended as an alternate to the squat to reduce risk and accommodate certain knee and back conditions. Direct advantages include all movements under the load of gear, especially standing from a seated position, and climbing a boat ladder or steps. If you are exercising outside of a gym or have an orthopedic condition, the Knee Trio shown later in the workout is a thera-



Ball Reach on Knees starting position

Ball Reach on Knees extended position



Push Press start position



Push Press and Straight Arm Plank

peutic alternative or supplemental exercise sequence to the Leg Press.

The Push Press and Plank incorporates muscles of the chest, shoulder and triceps along with the abdomen and low back. A combination of static and dynamic exercise, this movement provides a foundation of upper body strength, especially for women. Divers benefit with arm strength for lifting and holding on firmly, and enhanced ability to change direction while the body is in motion. The Shoulder Combo is a therapeutic alternative or supplemental exercise sequence for the Push Up portion of this exercise. You may still be able to perform the Plank position to work the chest without involving the shoulder.

The Ball Reach provides a unique combination of abdominal, low back, hamstring and gluteus (buttocks) strength. This exercise also includes some integration of static chest and shoulder. Swimming, staying in one place during strong currents, putting on fins in the water, and

back-roll entry are just a few examples that contribute to diving.

Dolphins integrate low back, hamstrings, gluteus and abdominal muscles in a prone position using the lower body as resistance instead of the upper body. Walking backwards, kicking through strong currents, turtle swimming, wave action, surf and sand are all conditions where this exercise will enhance performance and prevent injury.

The Pullover combines the chest, shoulders, triceps, and abdominal muscles and expands the chest improving breathing capacity. The ability to safely reach over and behind your head and back is the greatest benefit of this exercise. The Shoulder Combo is a therapeutic alternative or supplemental exercise sequence for the Pullover.

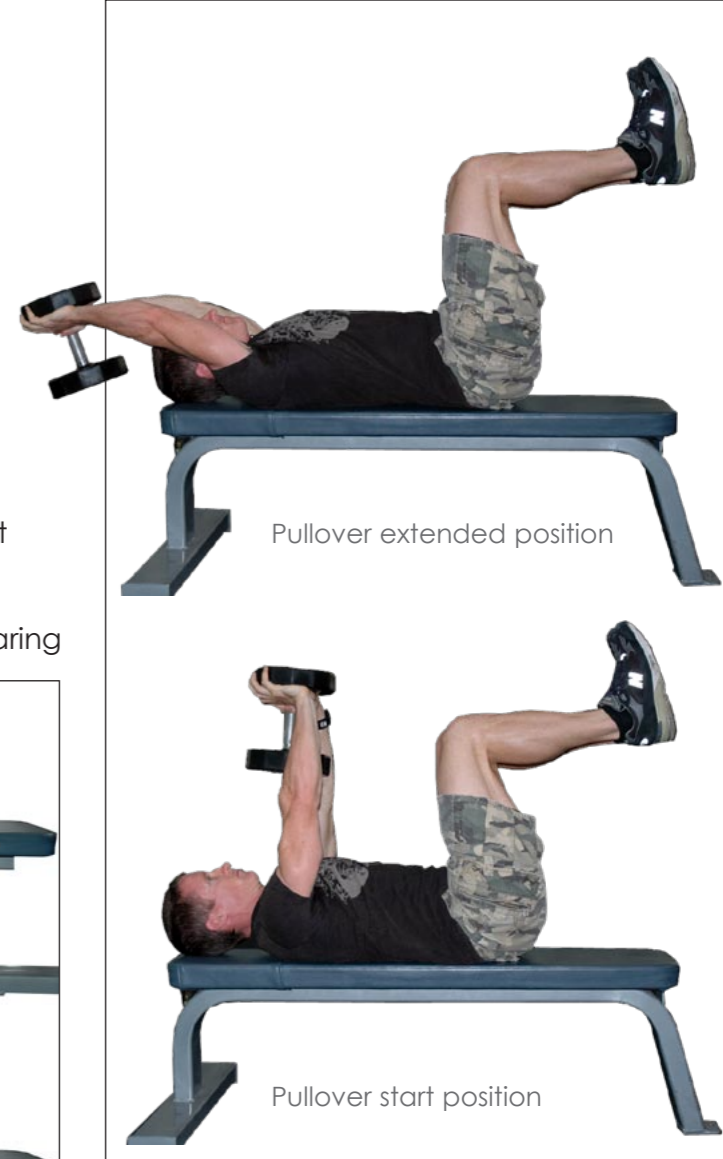
A Row of any fashion incorporates five muscles in the back and shoulder and is assisted by the biceps to perform pulling activities. Large back muscles as a group, are second only in size to those of the legs and likewise apply to foundational strength. The row requires a greater demand for oxygen than other upper body exercises and you will notice a slightly higher heart rate during this resistance training interval.

Knee Trio: Bun Wrapper, Wall Sit with Ball Squeeze. The Bun Wrapper is a combination of leg raises throughout the full complement of hip rotation, which targets the medial muscles of the gluteus and provides weight bearing



Dolphin flexed position

Dolphin extended position



Pullover extended position

Pullover start position

your resistance training in this workout. Instead of counting repetitions, you will perform timed sets of each exercise.

To prevent injury, begin your workout with a six-minute warm-up of aerobic exercise (i.e. walking outdoors, treadmill, elliptical, bicycle). When performing resistance training exercises remember to breathe properly. Inhale through the nose and exhale through the mouth. Do not hold your breath at any time under resistance and exhale on the exertion. Do not rest between exercises unless absolutely necessary. Remember to check your heart rate about half-way through each Resistance Training Interval.

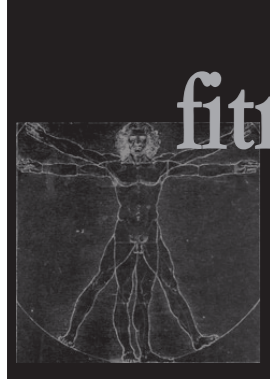
Each Basic Six Exercise Sequence will take six minutes to complete. If you are performing an exercise requiring a single leg or single arm movement, per-

work to improve bone density in the hip and low back. The Wall Sit with the Ball Squeeze between the knees is a static variation to the Leg Press.

Shoulder Combo: Internal / External Rotation for the Rotator Cuff. These exercises are provided to both rehabilitate and prevent injury of the shoulder.

Interval Training

The program comes to life with the unique application of “interval training”. Typically used to enhance running performance, interval training is applied to



fitness



Bun Wrapper start position



Bun Wrapper extended back position



Bun Wrapper side position



Wall Sit side view



Wall Sit front view

form each side for one full minute. Replacing pullovers or push-ups with the Shoulder Combo or replacing Leg Press with the therapeutic Knee Trio will require from six to 12 minutes to complete.

After your warm-up, perform your first resistance training sequence consisting of one-minute intervals for each exercise. Then return to aerobic training for six minutes in your 70 percent training heart rate.

Perform a second full sequence of resistance training intervals followed by a second session of aerobic training. Continue to train in your 70 percent training heart rate for this aerobic interval.

Repeat two more resistance training intervals alternating with two more six-minute aerobic training sessions in your 80 percent heart rate training zone.

Your goal is to complete four full intervals of both resistance

training and aerobic training in less than 90-minutes. If all your intervals are in the six-minute range, you will finish within an hour. Alternate exercises require about an hour and 15-minutes.

The program is designed to strengthen and condition the body in a safe manner. Consistency is important with this workout. Establish a good foundation by training all year to support diving activities. Now, pack a gear bag with a stopwatch or timer, hydrating drink, and a towel.

Put on your favorite dive t-shirt and take your enthusiasm for scuba diving to the gym. It's time to get scuba fit!

In the next issue, we will discuss training for the arms in the fitness column, *Neptune's Triceps*. ■

Gretchen M. Ashton is registered with the National Board of Fitness Examiners. An advanced diver, International Sports Sciences Association Elite Trainer, and world champion athlete, Ashton developed the ScubaFit® program and the comprehensive FitDiver® program, which includes the first mobile app for scuba diver fitness. Ashton is the co-author of the PADI ScubaFit Diver Distinctive Specialty course and is an Expert Speaker for Los Angeles County's Advanced Diver and Underwater Instructor Certifications in California, USA. She is the Health and Fitness Editor of California Diver Magazine, has been published in Divers Alert Network, Alert Diver - United States and Asia-

Pacific, on Divetime.com, and is a Scuba Fitness Examiner at Examiner.com. Ashton has appeared on Scuba Radio, presented at the Scuba Show, has been featured in the President's Council of Physical Fitness and Sports newsletter for inspiring and innovative accomplishments in fitness, and in the Margaritaville Key West website culinary column. As an athlete, she set 21 World and American records and was the second woman inducted into the Amateur Athletic Union (AAU) Power Lifting Hall of Fame: See: Scubafit.com



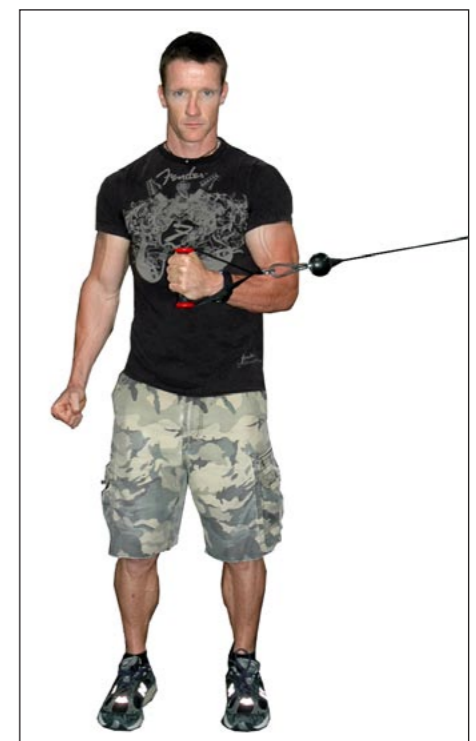
Gretchen M. Ashton



Shoulder Combo: External Rotation starting position; External Rotation ending position;



Shoulder Combo: Internal Rotation starting position; Internal Rotation ending position



turtle tales



Edited by
Bonnie McKenna

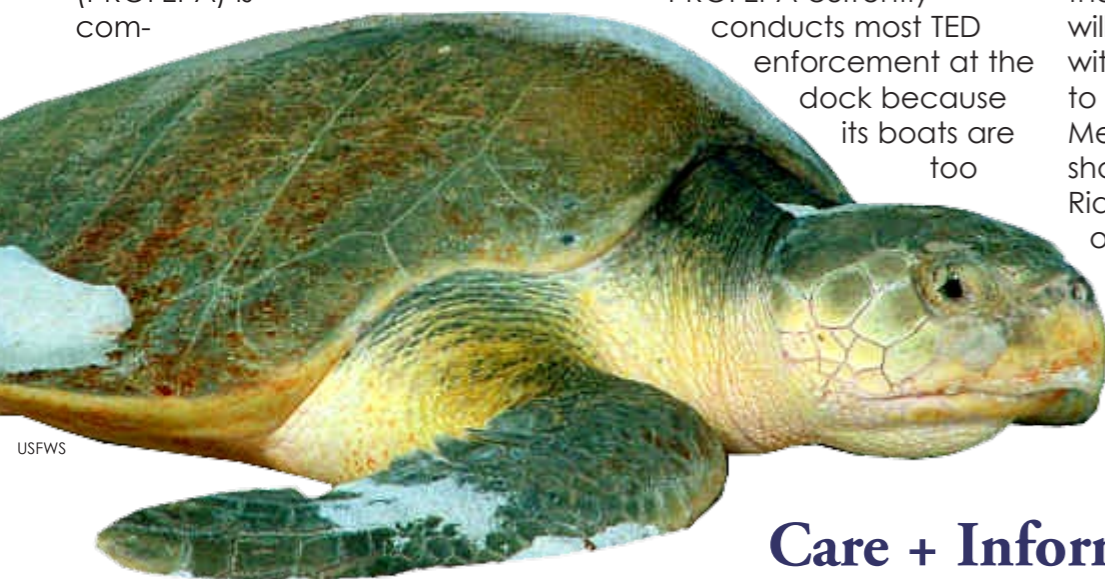
National Fish and Wildlife Foundation donates boat to Mexico's fishery authorities

As part of an ongoing effort to minimize harmful impacts from commercial fisheries, Mexico's Federal Attorney for Environmental Protection (PROFEPA) is com-

mitted to enforcing Mexico's regulations for turtle excluder devices (TEDs) to ensure shrimp-ers do not accidentally drown sea turtles.

PROFEPA currently conducts most TED enforcement at the dock because its boats are too

small to go to sea. Without observing fishing practices on open waters, enforcement officials cannot identify and correct those not complying with the use of TEDs. The new boat will provide PROFEPA personnel with a safe boarding platform to ensure TED enforcement. Mexico and the United States share jurisdiction for the Kemp's Ridley sea turtle that is found only in the Gulf of Mexico and along the Atlantic seaboard. More than 30 years of conservation efforts have helped increase the Kemp's Ridley populations. ■



Care + Information = Results

In 2008, the Born Free Foundation in Italy was notified by tourists visiting the Alghero Aquarium in Sardinia that two loggerhead sea turtles were being kept in appalling conditions.

The turtles were seized, at long last, in 2011 by the local authorities and transferred to Oristano, Sardinia to the Sinis Rescue Center (CRES) at the Institute for Coastal Marine Environment –

National Research Council and placed the turtles in a 3,000 liter rehabilitation tank. Both turtles were suffering from malnutrition, underweight, their shells were covered with algae, parasites and injuries. The absence of sunlight in the subterranean tank where the two turtles were kept caused them to have calcium assimilation deficit.

Since rehabilitation started, the turtles' weights have

increased and their diet is regular. The turtles will soon be moved to a 14,000-liter tank for rehabilitation and their pre-releasing phase.

CRES plans to release the turtles in the near future and monitor them through satellite tracking. When people care enough to pass along information, then action can be taken. ■

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Sea turtle migration answered by scientists

Immediately after hatching, Florida loggerhead sea turtles scramble into the sea and embark alone on a migration that takes them around the entire North Atlantic basin.

Kenneth J. Lohmann, a marine biologist at the University of North Carolina, recently published a scientific study on how loggerheads navigate their transoceanic migration.

"Young turtles probably rely on a strategy of 'smart swimming' to optimize their energy during migrations," Lohmann said. "The new results tell us that a surprisingly small amount of directional swimming in just the right places has a profound effect on the migratory paths that turtles follow and on whether they reach habitats favorable for survival."

"The research team's results have important implications for 'weakly moving animals' including larval fish, butterflies and ballooning spiderlings," said David Stephens, a program di-

rector at the National Science Foundation.

The discovery may be useful in understanding commercially important creature, such as fish and crab that have weakly swimming larvae that, like turtles, have often been assumed to drift passively. Improved understanding of movement may lead to better fisheries management.

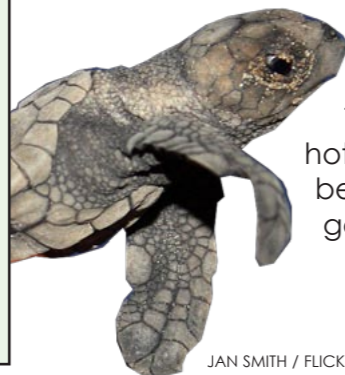
Lohmann's team explains how young Florida-hatched loggerheads know where



they are and in what direction to steer as they migrate around the North Atlantic basin. ■

Turtle meat vendors caught

The police in Galle, India, busted a lucrative trade in turtle meat. Thirty-five kilos of turtle meat was seized while being transported to hotels and eateries. Two men were arrested. They said that they had been dealing in turtle meat and eggs because they could make a good living out of supplying hotels at a very good price. ■



JAN SMITH / FLICKR / CC BY 2.0



Pacific leatherback turtles hurt by jellyfish hunt

With leatherback turtles, the world's largest sea turtle, there is a conundrum: The species itself is critically endangered, but at least one population is stable, and perhaps on the rise, while the others are plummeting.

Researchers have discovered the reason. After studying two leatherback populations they say the answer is simple: food.

"We saw very big differences in their traveling speeds from their nesting beaches to their foraging grounds," said Helen Bailey, an ecologist at the University of Maryland who led the study. "We take that to mean one population is stopping to forage on a nice dense patch of prey, while the other group kept moving because it's constantly in search of food."

The difference in the swimming and foraging habits may hold the clue to help the leatherbacks recover and thrive.

Leatherbacks the world over are often victims of bycatch, but leatherbacks in the Pacific Ocean face another problem. Climate patterns like El Niño-Southern Oscillation cause huge variations in temperature and productivity of the ocean, making it difficult for some animals to find food supplies. To figure out the differences between the two groups, Bailey looked at how the turtles swim. Through satellite tracking, she found that Atlantic leatherbacks have two speeds: fast (12-28 miles per day, or 20-45km) and slow (less than nine miles per day, or 15km). Pacific leatherbacks have only one cruising speed of about 13 miles per day or 21km.

Atlantic leatherbacks are stopping at dense patches of jellyfish to eat until it is gone. Pacific leatherbacks never find dense patches of jellyfish, so they swim at a constant speed the entire time. ■



USFWS

The Philippines go after sea turtle restaurants

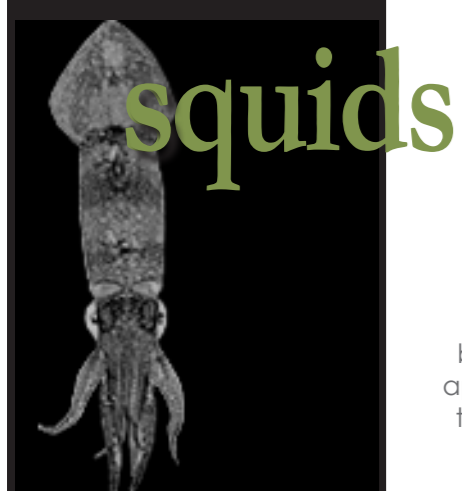
The Philippines said it will form a special task force to go after restaurants serving the meat of protected sea turtles.

"The task force is created to pursue and initiate an aggressive protection and conservation movement of the endangered marine turtles, which are now on the verge of total depletion," said regional environmental chief Maximo Dichoso.

News reports said numerous small eateries in the coastal district of Cebu City were serving dishes made from sea turtle. The mayor of Cebu City said that the practice had been going on for a long time, and there had been no effort to stop it.

Those caught trading, hunting, collecting or killing sea turtles and other protected marine species face a fine of 100,000 pesos (US\$2,350) and one year in jail.

The discovery of Chinese fishermen catching sea turtles and other protected species in the South China Sea recently triggered a high-profile maritime standoff between Philippine and Chinese ships. ■



squids

Bright red Humboldt squid approaches the surface of the Gulf of Mexico

Diving with Humboldt Squid *—The Devil is not black, he is painted*

Text and photos by Bartosz Stróżyński

The rather dark reputation of Humboldt squid has been readily reinforced by various wildlife television programs and other media which present these creatures as giant animals hungry for blood or ruthless monsters, uncompromisingly attacking their prey. The Humboldt squid may be scary, but they can also be a very intriguing and inspiring subject for the underwater photographer who wants to verify in reality the commonly accepted stereotypes.

Humboldt squid live in the very deep waters of the ocean. Knowledge about their lives in the abyss is very limited. Most of the research concerning their behaviour has been done in shallower waters. They are found in the eastern part of the Pacific Ocean, near the western coast of the Americas. Until recently, they have been observed mostly off the coasts of Central America, but more and more, they have been seen migrating north, even into the waters around Alaska.

Humboldt squid live in large colonies in the deep blue, at depths of 200m to 700m. During the day, they stay in

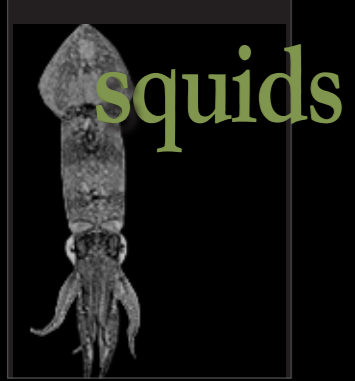
the depths, but around midnight, they approach the surface for feeding. The squid usually feast on small fish and krill.

An adult individual may grow up to 1.75m in length and reach a weight of 50kg.

The Humboldt squid is a real underwater predator. Its arms are armed with numerous hooked tentacles. It

has exceptional intelligence, which is characteristic of all cephalopods. It has a sharp beak and can manage incredible





squids



Humboldt Squid



CLOCKWISE FROM LEFT: A captured squid may attract the whole colony of squid to the surface—it is a fishing technique adapted for scuba and research purposes; The rainbow colours of Humboldt squid glow in the black water of the Gulf of Mexico; Cacti on the rugged yet beautiful Gulf coast

swimming speeds (24km per hour) with amazing agility. These characteristics give the Humboldt squid a highly efficient arsenal. The creature's voracity is unlimited. When hungry, it simply eats, even other squid—cannibalism is common behaviour among the Humboldt.

The Humboldt squid is considered an underwater chameleon. It can change its colour rapidly from pure white to bloody red, traipsing through all the colours of the rainbow, even fluorescent. It is thought that their changing of colours is a type of communication tool used by these animals.

Catching Humboldt squid has become a profitable alternative to fishing for local people. Their good taste and relatively high price make the squid good business.

The area where squids are commonly caught, as well as studied, is the Gulf of Mexico, particularly in the area of Santa

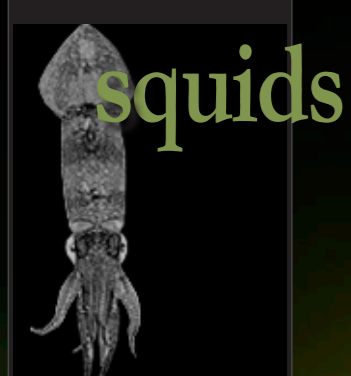
Rosalia, but most recently, due to migration, also the Bay of Los Angeles.

To catch the squid, fishers use special cylindrical, fluorescent hooks. The hook looks like a rotated conifer twig with steel needles. The fishing technique appears quite simple. The hook is attached to a fishing rod and dropped into deep waters. Then, fishers move the hook up and down to mimic the behaviour of squid. This provokes a Humboldt squid, which starts following the hook. The squid finally attacks the fluorescent bait by wrapping its arms around the needles. At the same time, the imprisoned squid becomes bait for another one. After some repetitions of moving the hook up and down, a whole colony of squids may appear close to the surface.

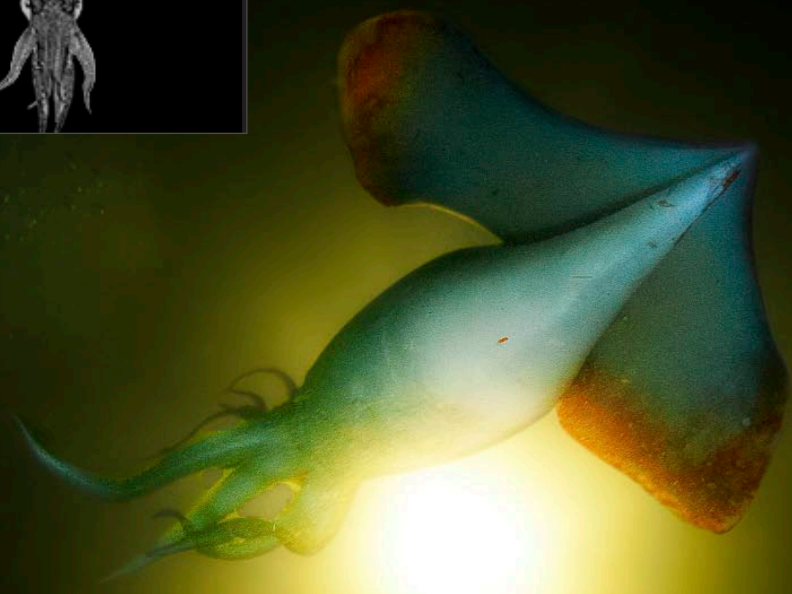
Humboldt squid eyes look like human eyes. It is an unforgettable experience when, during the cannibalising act, a squid



Haunting—Humboldt squid looking at photographer while being eaten by another squid



squids



LEFT TO RIGHT: Humboldt squid in dark water backlit with boat light; Humboldt squid cannibalising another squid; Fishing boat getting ready at sunset for another go at catching Humboldt squid

Fortunately, that one day was enough to capture a couple of satisfactory shots.

Humboldt squid move very fast. Their flashing, colourful bodies appearing rapidly from nowhere and disappearing even more rapidly into the abyss are like passing missiles. One's first impression may be an unpleasant one, but the threats seen previously in wildlife films on TV—such as attacks in which the squid remove divers' masks—did not happen here. During the dive, I did not experience any aggression from the squid. I did not use any protection, and I got no impression that they considered me particularly as food. I saw in their big eyes more a sense of fear or curiosity than a desire to attack me. I am sure I was a more frightening predator to them than they were to



Humboldt Squid

being eaten alive is looking at you. Another thing that entices squids to ascend to the surface is red light. Research states that it stimulates them a lot, but I was not able to observe the effects underwater.

The same techniques used by fishers have been adapted for research and scuba diving purposes. Entry into the water is preceded by time-consuming efforts in the enticement process.

Diving with Humboldt squid is very specific. All activity takes place during the night. When daylight wanes, the whole crew must be ready to start. Nature is very unpredictable in this region, and the risk that the whole expedition ends up with no success is high. So, each day, each attempt, each

chance to take a picture is critical, since it may be the last. Bad weather, storms, a full moon may keep the squid in deep waters, laying waste to all our efforts.

The continuous unexplainable migration of the animals increases uncertainty even more. When night comes, divers with cameras need to be ready to go and believe, that out of the batch of photographs taken in very unpleasant conditions—darkness and low visibility—there will be some images good enough to share.

During my trip, we had only one day when diving with Humboldt squid was really possible. All the remaining nights were lost due to bad weather, strong waves or the lack of squid at the surface.



me. So, it turns out that Humboldt squid are not demons, devils or killers of humans, proving that the widely accepted stereotypes of these creatures are unfounded.

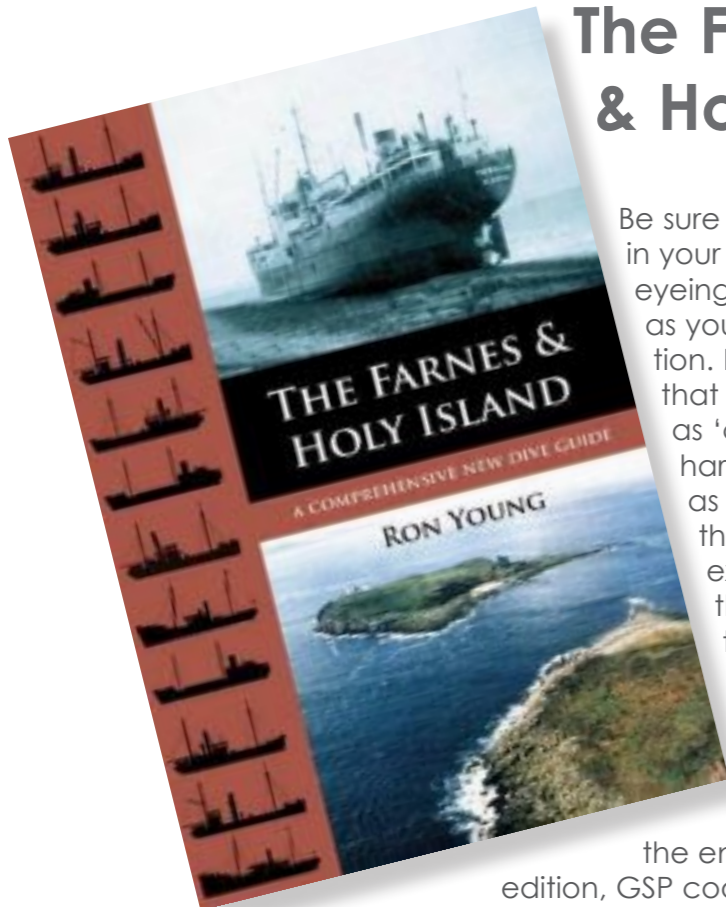
After this kind of expedition and experience, I often wonder if the media is distorting reality by showing wildlife in misleading ways. Are they producing nature thrillers with the intent of protecting the environment, limiting tourism to these locations, or are they just aiming for an increase in sales and profits? I leave the question open for all to consider. ■

Based in Poland, Bartosz Stróżyński is a nature and underwater photographer with several awards including the European Wildlife Photographer of the Year, the International Photography Awards, International Nature Photo Competition Asferico and the Great Photographic Competition of National Geographic. For more information, visit: www.fimufo.com





The Farnes & Holy Island

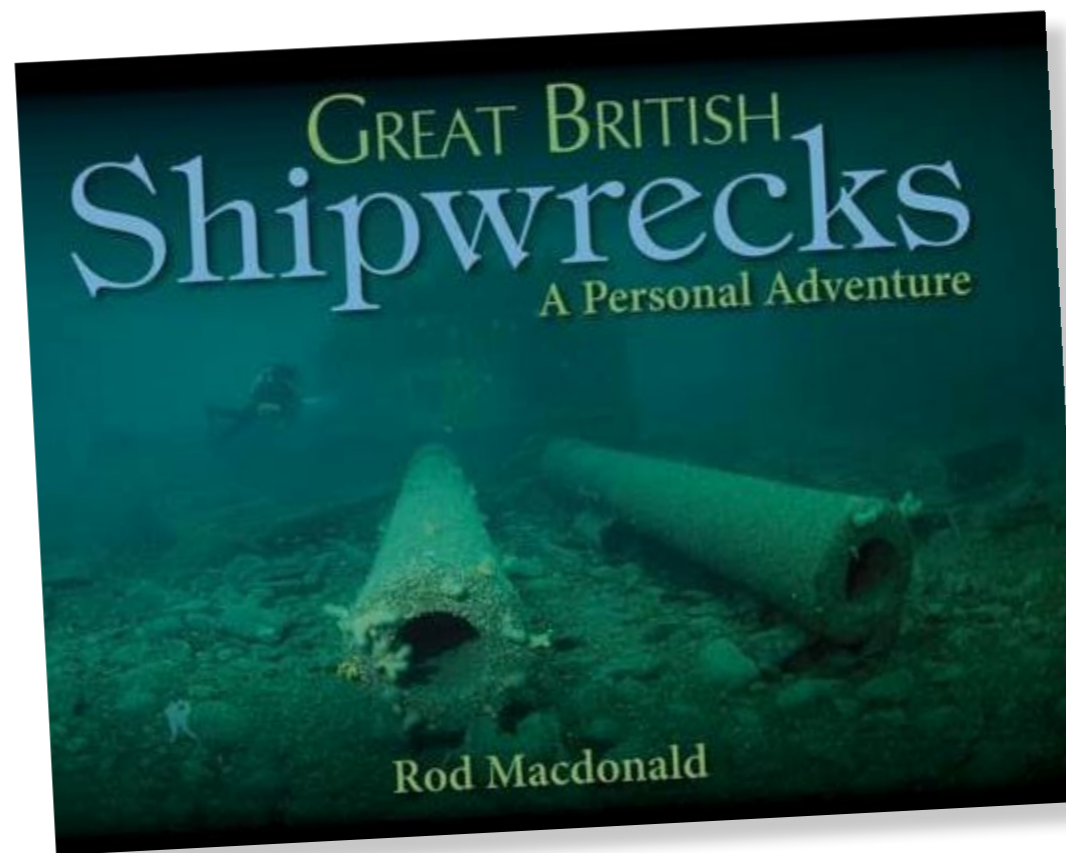


Be sure to have this book in your dive bag if you are eyeing the Farn Islands as your next dive destination. Readers would find that describing the book as 'comprehensive' is hardly an exaggeration as the 178 sites around the islands are detailed extensively, covering the areas' wildlife, tide, currents, general depths and wrecks. Where applicable, interesting bits of local history are added to spice up

the entries. In this updated edition, GSP coordinates of the sites are included, making it easier to locate them.

The writer, Ron Young, has actually dived at every one of the sites described in the book, so rest assured that you won't be diving into parts unknown.

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ISBN-13: 978-1849950411



Great British Shipwrecks

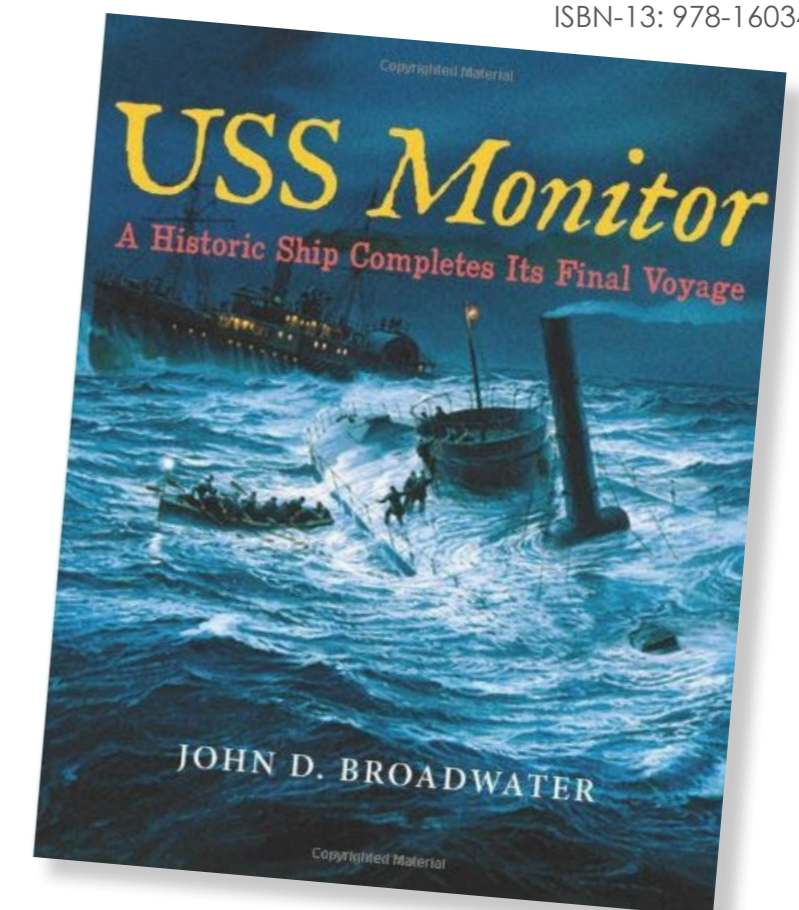
With more than 30 years experience in diving wrecks and writing about them, Rod Macdonald has highlighted 37 of the more famous and revered wrecks lying in British waters in his new book *Great British Shipwrecks*. The story of every wreck is described in detail, and its image beautifully captured by marine artist Rob Ward. From recreational shipwrecks at Scapa Flow in the Orkney Islands, to the technical wrecks in the North Channel in the Irish Sea, and all the way to Scotland and the North Sea. Readers are taken on a journey that details the vessel's time in service, and the circumstances of its final voyage. Some of the wrecks described in this book include German WWI battleships, to the upside-down half-buried *Bayern* 15-inch gun turrets, the submarine *HMS/M M2*, to the White Star liner *Justicia*, *HMS Audacious* and the *SS Empire Heritage*, which had been carrying a cargo of Sherman tanks from New York when it sank. So, if you harbour an interest in the wrecks within the waters of Great Britain, be sure to check out this book the next time you are in the bookstore.

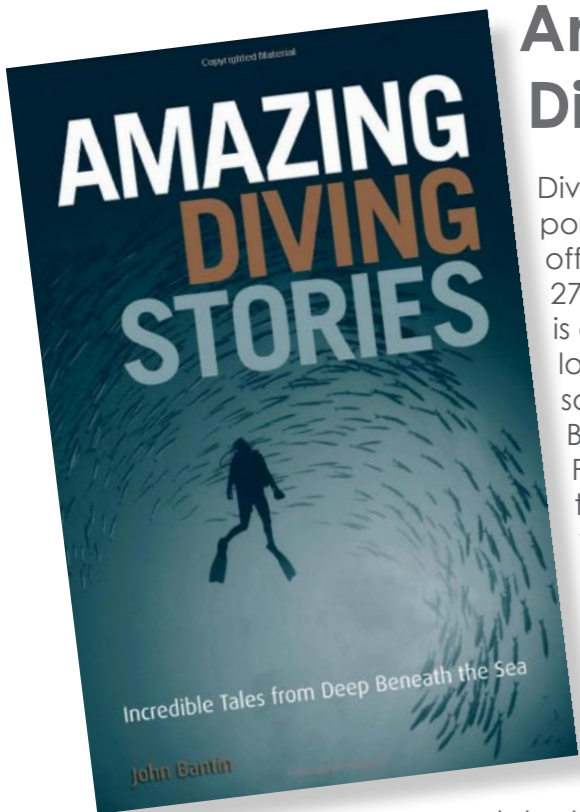
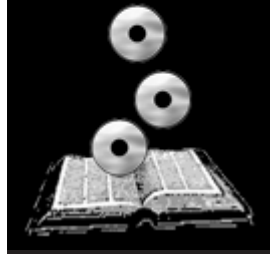
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Publisher: Whittles Publishing
Publication Date: 31 Oct 2012
ISBN-10: 1849950776
ISBN-13: 978-1849950770

USS Monitor

During the 19th century U.S. Civil War, a new class of armored warships was developed of which the *USS Monitor* was a prototype. The *Monitor* fought the Confederate ironclad *CSS Virginia* at Hampton Roads, Virginia, just a day after *Virginia* had devastated the Union fleet, which was blockading the James River. These events changed the navies of the world. Wooden, sail-powered warships no longer ruled the seas. Yet, *Monitor's* reign was short-lived. About nine months later, she sank in heavy seas with 16 of her crew while being towed south to Beaufort, North Carolina. The vessel's final resting place was a mystery until 1973 when the inverted hulk was found. Later, in 1995, NOAA and the U.S. Navy initiated a partial recovery of the wreck. *USS Monitor: A Historic Ship Completes Its Final Voyage* by John D. Broadwater (chief archaeologist at the Office of National Marine Sanctuaries of NOAA from 2007-2010) is a book published with support from the National Marine Sanctuary Foundation and lays out the story of the process of protecting and managing the *Monitor* in an account sure to please wreckies and history buffs. It is accompanied by lots of photographs, site drawings and artifact sketches.

Hardcover: 338 pages
Publisher: Texas A&M University Press
Publication Date: 14 February 2012
ISBN-10: 1603444734
ISBN-13: 978-1603444736





Amazing Diving Stories

Dive tales told in bite-size portions—this is what this book offers. Despite the fact it is 276 pages thick, every story is about three to six pages long, making it a palatable sampling at every reading. Be it in Indonesia or the Pacific reefs, readers travel the globe, even all the way to the chilly waters of Northern Europe. The stories allow you to come face-to-face to a myriad of colourful characters (human and animal), including a diver who could

put sharks into a trance, a politician who was attacked by a turtle, as well as a saltwater crocodile that lost a sub-aqua scuffle. Ships from the past also make their appearance, particularly the famous (infamous?) wreck in the Red Sea, and the Titanic's sister ship that continues to claim divers' lives. Be it quirky and bizarre, to the technical and serious, the stories within these covers resonate with themes of courage and triumph, discoveries and disaster. Ideal for those times when you want to squeeze in some time for some leisure reading.

Hardcover: 276 pages
 Publisher: John Wiley & Sons
 Publication Date: 27 July 2012
 ISBN-10: 1119969298
 ISBN-13: 978-1119969297



Wreck of the Huron

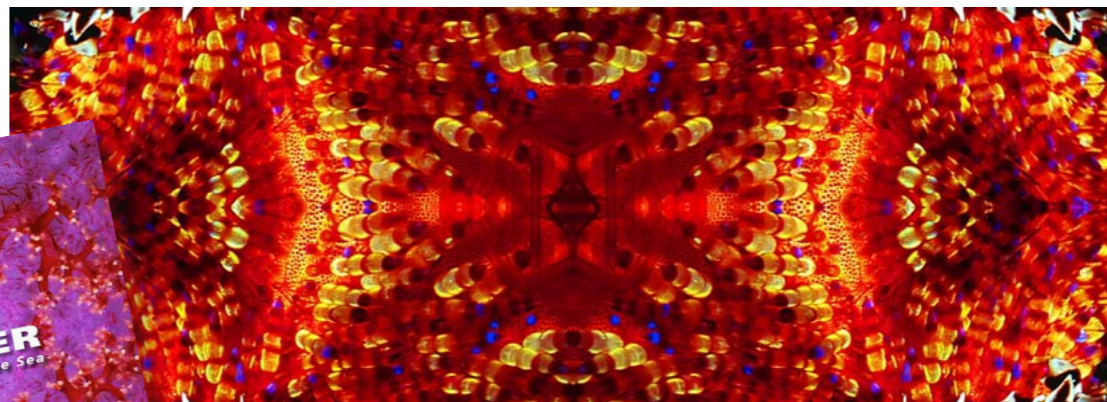
The *USS Huron* was a ship that sank off the coast of North Carolina on her way to Havana, Cuba, in November 1877. Now, writer Eric Douglas has made the shipwreck the premise of his latest novel, *Wreck of the Huron*. "I was intrigued by the story of the *Huron* when I first heard about it. [...] It's a great story and a tragic shipwreck all rolled into one," said Douglas on his novel, the fourth in the Mike Scott series. The adventure starts when a storm uncovers part of the wreck, allowing the captain's lock box to be discovered by photojournalist Mike Scott and his friends. This sparks off a series of events—from the discovery of a coded message inside the box, and the disappearance of the archeologist who discovers it—leads Mike to the Isles of Pine in Cuba, right into the tracks of a looming hurricane and also onto the radar of unscrupulous men determined to keep the secret of the *USS Huron* for themselves.

Kindle Edition at Amazon
 File Size: 409 KB
 Print Length: 253 pages
 ASIN: B008N3TJ0S



Eye Candy for Divers

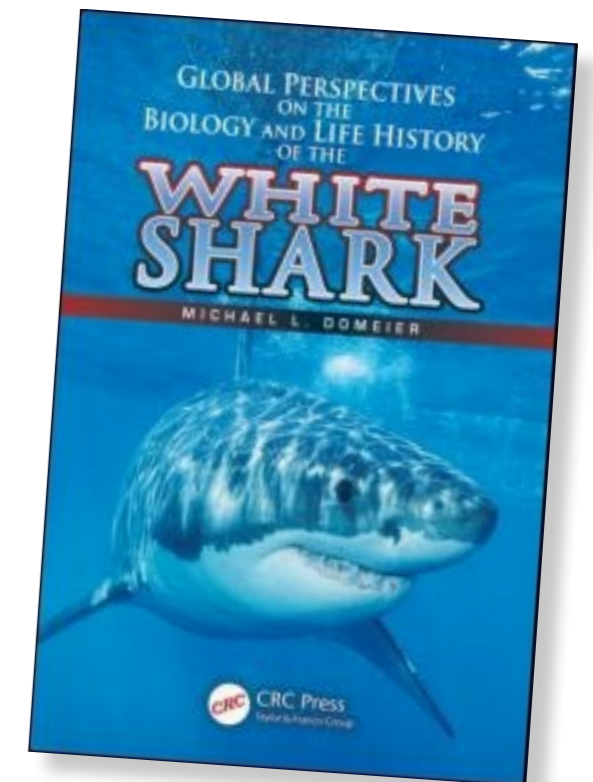
Marine life kaleidoscope—Get a glimpse into a new twist in underwater imagery in a teaser for the latest book by French underwater photographer Henri Eskenazi, *Vitreux de Mer (Jewels of the Sea)*. View the unique video, *Cinquième Concept*, online, with its graphic and aesthetic perspectives of the underwater world. Eskenazi takes us on a geometric journey through the colorful forms of the strange and the surprising. It's a short five-minute film with a soundtrack by Gerald Olivier. Go to: Vimeo.com/30636703



White Sharks

The idea behind this book, *Global Perspectives on the Biology and Life History of the White Shark*, came from the International White Shark Symposium, held in Honolulu, Hawaii, in February 2010. It brings together a comprehensive range of topics involving the white shark species, from its physiology, biology, behaviour, migratory patterns and molecular biology to population monitoring, policy options, etc. The book's 32 chapters are written by different scientists, and backed up by statistics, data, charts, photos and a lot of detailed information and analysis. It is edited by Michael L Domeier, PhD, of the Marine Conservation Science Institute in Fallbrook, California, who had chaired the 2009 International White Shark Symposium.

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 ISBN 10: 14398948408





Timor-Leste's Tasi Tolu



Thorny seahorse; Seaside view of Tasi Tolu in Timor-Leste; Tiny tiger shrimp just under 2cm (right)

Text and photos by Don Silcock

There can't be many dive sites that owe their existence to the direct intervention of the country's president, but Tasi Tolu, on the outskirts of Timor Leste's capital Dili, can claim that unique patronage.

Tasi Tolu gets its name from the three fresh water lakes just inland from the beach and below the nearby foothills. During the rainy season, the lakes tend to fill to capacity and then overflow, flooding

the nearby road and villages. To prevent that from happening, the government commissioned a project to provide a drainage channel for the overflow to run off into the sea. This design, which took the most logical path, would have dumped the outflow right onto the Tasi Tolu site.

In my experience, there are typically three basic ingredients for a critter site to flourish—a sheltered area (critters don't like surf); close proximity to deeper waters with nutrient rich currents; and a source of organic run-off such as a large stream. The organic run-off is a kind of Goldilocks-and-the-three-bears deal, because it needs to be just right—not too hot and





CLOCKWISE FROM LEFT: Entwined nudibranchs; Commensal shrimp, *Periclemenes magnificus*; Cleaner shrimp hiding in coral; Banded boxer shrimp

not too cold, because too hot means siltation which the critters don't like very much, and too cold means not enough organic nutrients. Tasi Tolu is obviously just right, because it's a great site with lots of critters to see, but the drainage channel would have raised the temperature to the boiling point during the wet season and effectively decimated the site.

The local diving community waged a

campaign to get the drainage channel relocated and ultimately got the issue on the radar screen of Dr Ramos Horta, the urbane and erudite Nobel Peace Prize winning president of Timor Leste.

Horta saw tourism as part of the potential solution to one of Timor Leste's most pressing problems—lack of employment opportunities—and accepted that destroying one of the

best critter dive sites in Dili was not a great idea. He was eventually able to stop the project.

Shore dive

Tasi Tolu is a shore dive and a pretty straightforward affair. Kit up on the beach from the back of your transport, close to the now defunct and partially constructed drainage channel, then walk





Tasi Tolu

dive guides from Dive Timor Lorosae who I dived with in Timor Leste. Not that the site is particularly hard to find, rather that it looks nothing like a photogenic one.

One of the highlights of Tasi Tolu were the resident pair of Rhinopias. The yellow one posed nicely for me, as seen below (right). There was an assortment of other critters in and amongst the marine growth, ranging from seahorses to spiny tiger and tozeuma shrimps. ■

CLOCKWISE FROM LEFT: Leaf fish (or Paperfish); View over village, bay and steep hills at Tasi Tolu; Gaping weedy scorpionfish; Tiny squat lobster measures just 2cm; Porcelain crab in sea anemone



straight down the sloping sand at about 15m where you will find a flat patch of marine growth and in amongst it, you will find a wide variety of photogenic critters.

I did several dives at Tasi Tolu and eventually got to know it like the back of my hand, but I

down the beach and enter the water just by the group of small boulders. Heading

have to say that I would have missed the site completely if I had not been shown it by the



fact file



Timor Leste

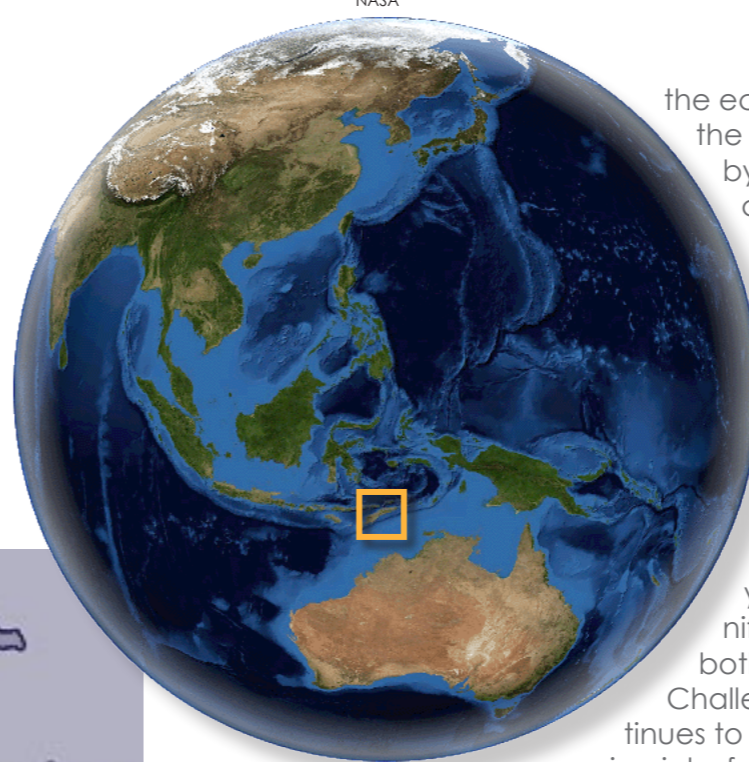


SOURCES: US CIA WORLD FACT BOOK, STARFISH.CH

History In the early 16th century, the Portuguese began to trade with the island of Timor and colonized it by the mid-century. After clashes with the Dutch in the area, Portugal ceded the western portion of the island to them in a treaty in 1859. From 1942 to 1945, imperial Japan occupied Portuguese Timor, but after the Japanese defeat in World War II, Portugal resumed colonial authority. On 28 November 1975, East Timor declared itself independent from Portugal. Nine days later, it was invaded and occupied by Indonesian forces. In July 1976, Indonesia incorporated it and designated the region a province of Timor Timur (East Timor). Over the next 20 years, an unsuccessful campaign of pacification followed. An estimated 100,000 to 250,000 individuals lost their lives during this period. On 30 August 1999, an overwhelming majority of the people of Timor Leste voted for independence from Indonesia in a popular referendum supervised by the United Nations. In retribution, Indonesian militias supported by the country's military began a large-scale scorched earth campaign as the Timorese awaited the arrival of a multinational peacekeeping force in late September 1999. Around 1,400 Timorese were killed by the militias and 300,000 people were forcibly pushed into western Timor as

refugees. Destruction was rampant and affected most of the country's infrastructure, including nearly all of the country's electrical grid as well as homes, irrigation systems, water supply systems, and schools. The violence was brought to an end on 20 September 1999, when an Australian-led force of peacekeeping troops—called the International Force for East Timor (INTERFET)—were deployed to the country. Timor Leste was internationally recognized as an independent state on 20 May 2002. However, internal tensions threatened the new nation's security again in 2006, when a military strike sparked violence leading to a breakdown of law and order. Once again an Australian-led peace-keeping force—this time called the International Stabilization Force (ISF)—was deployed to Timor Leste at the request of Dili. In addition, an authorized police presence of

RIGHT: Global map with location of Timor Leste
BELOW: Detail map of Timor Leste



ern end of the Indonesian archipelago in the Lesser Sunda Islands. The country includes the eastern half of the island of Timor, the Oecussi (Ambeno) region on the northwest portion of the island of Timor, as well as the islands of Pulau Jaco and Pulau Atauro. Terrain: mountainous. Lowest point: Timor Sea, Savu Sea, and Banda Sea 0m. Highest point: Foho Tatamailau 2,963m. Coastline: 706km

over 1,600 personnel was organized and deployed in Timor Leste by the U.N. Security Council in what was called the U.N. Integrated Mission in Timor-Leste (UNMIT). Stability was restored in the region by the ISF and UNMIT, thereby allowing peaceful presidential and parliamentary elections to be held in 2007. Since then, the country has experienced stability except for one incidence in 2008 when a rebel group tried and failed to stage a coup. Government: republic. Capital: Dili

Geography Timor Leste is located in Southeastern Asia, northwest of Australia. It lies at the east-

the economic infrastructure of the country was devastated by Indonesian troops and anti-independence militias by late 1999. Refugees numbering 300,000 fled westward. A massive international program of 5,000 peacekeepers (up to 8,000) and 1,300 police officers helped to stabilize the country over the next three years. This led to significant reconstruction in both rural and urban areas. Challenges the country continues to face includes generat-

ing jobs for young people entering the work force, rebuilding its infrastructure and strengthening the civil administration. Oil and gas resource development in offshore waters has helped to increase government revenues, but not jobs, since there are no production facilities in the country. The economy continues to improve despite the outbreak of violence and civil unrest in 2006. By 2009, most of an estimated 100,000 internally displaced persons came back home. Government increased spending significantly in 2009-2010, for the most part on basic infrastructure, roads and electricity leading to first time national debt in late 2011.

Population 1,177,834
Ethnic groups: Austro-nesian (Malayo-Polynesian), Papuan, small Chinese minority. Religions: Roman Catholic 98%, Muslim 1%, Protestant 1% (2005). Internet users: 2,100 (2009)

Currency U.S. Dollar

Language The official languages are Tetum and Portuguese. Indonesian, English and about 16 indigenous languages are spoken. Tetum, Galole, Mambae and Kemak are spoken by a large part of the population.

Health There is a very high degree of risk for food or waterborne diseases such as bacterial and protozoal diarrhea, hepatitis A, and typhoid fever as well as vectorborne diseases such as chikungunya, dengue fever and malaria (2009)

Decompression Chambers
BALI: Sanglah General Hospital Hyperbaric Medical Department. Tel: 62-361-227911

MAKASSAR (SULAWESI):
Rumah Sakit Umum Wahidin Sudirohusodo. Tel: 62 - 0411 (584677) or 584675 ■



Leaf fish (or paperfish)



Text and photos by Jeffrey Gallant and Chris Harvey-Clark, PhD. Additional photos by Andy Murch

One of the dreams of any naturalist is to be the first to find and detail the life of a hidden or unknown animal first hand. Since 2003, scientific divers with the Greenland Shark and Elasmobranch Education and Research Group (GEERG) have begun to unravel the mysterious life of the Greenland shark, which at over seven meters in maximum body length and exceeding a ton in weight, is the second largest carnivorous shark after the great white.

Primarily a deepwater shark of the northern boreal oceans, *Somniosus microcephalus* is the only shark that patrols beneath the ice of the Arctic Circle. Hundreds of thousands of these sharks have been caught in directed fisheries, and yet little is known scientifically about the species. As GEERG scientists, we have been engaged in non-traditional research since 1998 of the ecology and behavior of the Greenland shark in order to elucidate some of the mysteries surrounding this enigmatic animal.

Historical aspects

The Greenland shark was well known to the Inuit peoples of Canada's Arctic, Greenland and Scandinavia, who hunted it through ice holes using bait and lanterns as a light attractant. Once lured to the surface, the sharks were harpooned or simply hauled from the water. The Inuit used the hide, teeth and flesh and called the shark, "Skalugsuak". In an ancient legend, the shark originated from a

urine soaked rag used to wash an old woman's hair that blew from her head, fell into the sea and swam away in the form of the shark.

The Inuit noted the shark's pungent smell, and that dogs fed with its meat became intoxicated and even died. This poisoning is due to very high levels of trimethylamine oxide, an osmotically active product of nitrogen metabolism found in high concentration in the shark's flesh where it is neurotoxic when

eaten.

Greenland people used the razor sharp dental bands of the Greenland shark set in wooden handles for cutting human hair, especially in the case of children where the use of metal implements was considered taboo. More recent evidence from 15th century house mounds in Greenland indicates that sharks were both consumed and used for household applications such as leather by coastal fishing people of



Upper and lower jaw of the Greenland shark are lined with razor sharp dental bands

Unlocking the Secrets of the Greenland Shark





Nordic fisherman stand by their catch of Greenland shark (below)



Nordic origin.

In more modern times, peoples of Iceland and Greenland learned to ferment shark meat to destroy the toxin, and this "shark cheese", known as Hákarl, is a pungent and prized delicacy in Iceland where it is washed down with an equally powerful locally made liquor called Brennivin.

Commercial fisheries for Greenland sharks have existed since the late 19th century, and Arctic whalers from Scotland noted the presence of hundreds of these voracious sharks

Inuit people used harpoons to hunt the shark at ice holes



"Shark cheese", or Hákarl, is made from fermented Greenland shark meat, an acquired taste and prized delicacy in Iceland where it is served with a potent local liquor called Brennivin

around freshly killed whale carcasses during flensing and trying out operations. One of the earliest scientific drawings of a Greenland shark was made to illustrate whaler Captain William Scammons 19th century treatise on marine mammals, showing the shark with its characteristic spiracle and a copepod parasite attached to the eye.

By the late 19th century, an artisanal fishery for Greenland sharks had developed in coastal communities in northern Scandinavia, Greenland and Iceland, primarily for their livers. The huge organ (up to 150 kg) was placed in a container and would naturally ferment and separate into an oil-rich layer that could be extracted and used as a fuel for lamps, or could be rapidly rendered using heat to make a more pure form of combustible oil.

Modern times

The North Atlantic fishery for Greenland sharks peaked in the early 20th century when up to 32,000 tons per year were harvested. The fishery failed as fossil fuels

became the chief source of inexpensive light and heat. In the latter part of the 20th century, Inuit people on Baffin Island developed ice fisheries for Greenland halibut, and found that Greenland sharks consumed their catch if gear was left in the water for too long. Scientist Aaron Fisk estimated several hundred sharks a year were killed as bycatch in this fishery.

Longline vessels in the winter fishery for Atlantic halibut off the coast of Nova Scotia have reported occasional catches of large Greenland sharks as bycatch, as have bottom trawl fisheries in the Gulf of St. Lawrence. Beck and Mansfield reported in the 1960s on Greenland shark depredation of Inuit net-based fisheries for narwhal, with spectacular photos of the lesion created by shark bites on the whales.

Biological aspects

The natural history of the Greenland shark is not well understood. A handful of publications exist in the scientific literature, and these have mostly focused on geographic distribution, diet and stomach contents, as well as the eye parasite that infects these animals.

The Greenland shark is large, heavy-bodied and has a reduced first dorsal fin, small second dorsal, smaller D-shaped pectoral fins, and a large, paddle-like heterocercal tail equipped with a water splitting caudal peduncle. The ground colour of the shark can vary from grey to mottled grey and white to dark brown or black; it's lighter on the underside. The skin is extremely rough, with large visible dermal denticles that easily cause lacerations when handling the animal.

The eyes are large with a pucker at the



Greenland Shark

caudal corner and a prominent reflective tapetum that glows green in dark conditions when a light is shone on it. The head has large nares terminally, and the upper and lower surfaces of the head are liberally covered with electrosensory ampullae. The mouth is underslung and

hard to visualize unless the observer is at the same level or underneath the animal. It is relatively small compared to the large size of the shark. When closed, the lower dental band is not visible. When open during ram ventilation or feeding, the band everts and becomes visible

ANDY MURCH



and directed in a forward orientation. The upper teeth are not usually visible. The lower dental band consists of rows of small flat teeth oriented in a stacked narrow blade, which forms a knife edge, while the upper teeth are small, narrow and pointed, and primarily serve a gripping role during prehension.

When the shark bites, it everts the lower jaw, thrusting its head into the prey and locking the jaws in place with the upper teeth. It then rocks its entire body in a back-and-forth corkscrew motion while closing the jaws through the prey and scooping out a neat, concave ice-cream scoop lesion that may weight several kilograms. Sleeper shark bites to elephant seals in the Antarctic have been identified based on the characteristic smooth contour and lack of lacerations or punctures seen with other shark species (vanDenHoff and Morrice, 2008).

The Greenland shark has a large, muscular pharynx com-

municating with the gills, esophagus and small dorsal spiracles above and behind or medial to the eye. Spiracles may be useful when the animal is feeding or when gills are close to the bottom, as they permit water entry or exit from the pharynx through the top of the head. The five gill slits are sited ahead of and ventral to the pectoral fins. Intact, unmarked bottom dwelling fish are frequently found in the stomach of Greenland sharks and it is possible that this species may engage in suction feeding of buried or benthic fish while cruising over the bottom, which they detect using well developed electro-sensory capabilities.

The shark's lateral line is dorsally oriented, which may reflect the ability to detect prey in the water column laterally and above the animal, which has a bottom dwelling habit at least part of the time. The pelvic fin is prominent, and in males, the claspers can extend another 10cm. Males have been observed minus a clasper, as well as with puffy and edematous claspers, perhaps the result of nuptial activity at the GEERG study site in northern Quebec, Canada.

The age of the Greenland shark cannot be established using the standard means

for other shark species, as their notochord lacks the ring-like annulations seen in other sharks, and an early tagging paper suggested the growth rate of large adults might be only 0.5-1cm per year, meaning adult sharks could be centuries old. Males can be sexually mature at 2.5 meters total length, while limited dissections of stranded females have shown even animals at 3.5 metres total length do not yet have mature ovaries. Year-to-year observations underwater using laser measurement of animals by GEERG indicate there is little length change over a period of three years in at least one animal. GEERG has also established that Greenland sharks in the St. Lawrence Estuary exhibit filopatry, with at least one animal found within 100m of the same site over two consecutive years.

Deep sea predator and scavenger

The Greenland shark is among the deepest dwelling sharks and has been found to depths in excess of 2,200 metres, where it is thought to be an important whale carcass and deepsea squid scavenger.

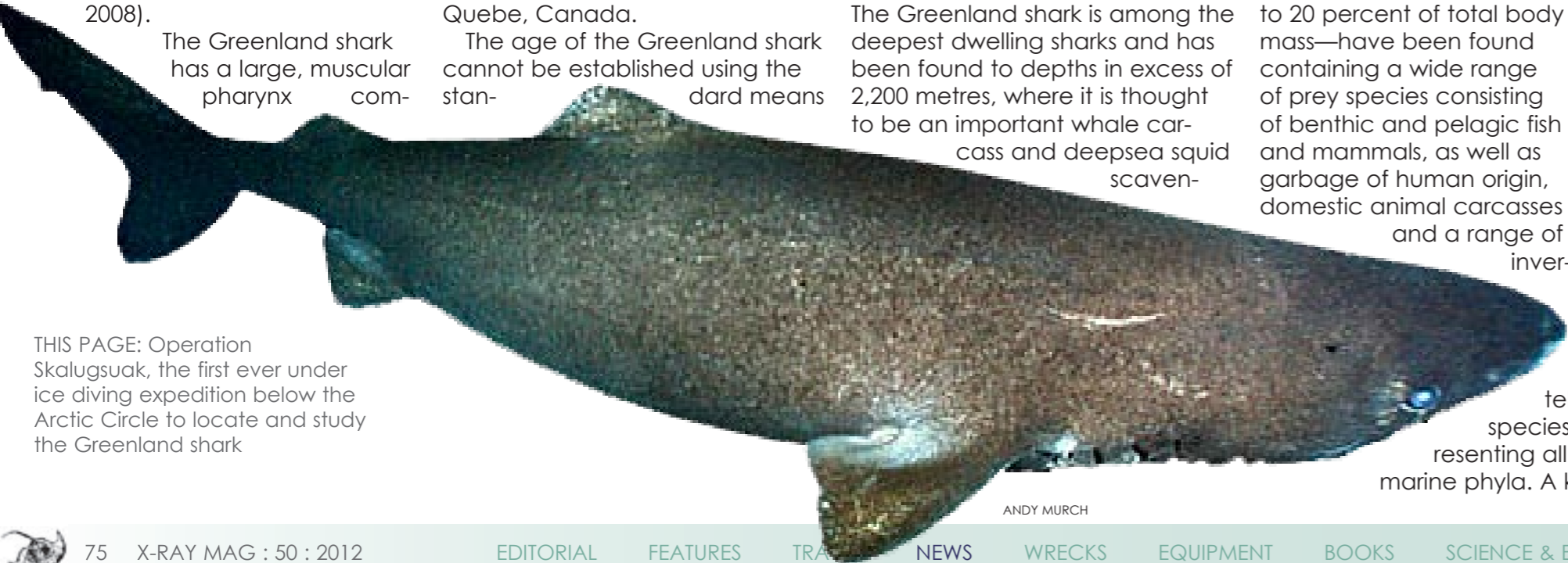
In the Arctic, it has been observed in shallow water at the sites of beluga and narwhal kills, literally almost beaching itself to get to carcasses. This species has a varied diet and stomachs—up to 20 percent of total body mass—have been found containing a wide range of prey species consisting of benthic and pelagic fish and mammals, as well as garbage of human origin, domestic animal carcasses and a range of inver-

tebrate species representing all major marine phyla. A key

mystery has been whether these seemingly slow-moving sharks can capture fast-swimming fish such as salmon, and agile large

brained prey such as seals, or whether this is the result of scavenging dead carcasses. Although there is no conclusive

Greenland Shark



THIS PAGE: Operation Skalugsuak, the first ever under ice diving expedition below the Arctic Circle to locate and study the Greenland shark

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Research photographer with Greenland shark; GEERG team readies for research dive at Baie-Saint-Pancrace (bottom right)

proof, GEERG scientists are fairly convinced that the Greenland shark does occasionally predate live seals. However, the victim would probably be an inexperienced or sleeping pup, or be distracted, injured, in an ice hole or in poor visibility offering the seal no warning of the incoming shark's presence. The Greenland shark is more likely to feed on an already dead seal, which requires no energy output and offers no risk of injury, for even small seals have sizeable teeth with which to defend themselves.

Agility and stealth

The Greenland shark is nonetheless capable of swift movement. GEERG divers have observed this underwater on numerous occasions while attaching tags to sharks with a spear-like device. Sharks were also observed bolting when touched or approached too closely by divers. They can no doubt swoop on prey, although it would probably amount to no more than a few quick bursts.

The Greenland shark is also capable of stealth. We experienced this firsthand when a four-metre shark surprised us in low visibility right under the boat and at a depth of only five metres. It isn't hard to imagine how an unsuspecting seal could be taken in such conditions. After surfacing from a night dive four years later, we shook our heads when VideoRay's Brian Luzzi asked,

"How big was that shark?" The sonar-equipped ROV pilot had seen a large shark swimming behind us, but we had been completely oblivious to its presence.

These incidents shed light on how a Greenland shark could potentially attempt to take an idle or slow-moving seal. However, easier prey is usually available, and it's even better if the victim is already dead or requires little effort to consume. A lingering chase and the ensuing battle waste much energy, and this is something the shark needs to avoid. This is one of the reasons why we do not believe that the Greenland shark is associated with the so-called "cork-screw" kills at Sable Island and in the United Kingdom.

Study

Locating an accessible study population of Greenland sharks has been challenging. Prior to work by GEERG, most observations of Greenland sharks had been as fisheries bycatch. In the late 1990s, researcher George Benz and National Geographic photographer Nick Caloyianis filmed the animals



in the Arctic near Baffin Island, Canada. Environmental toxicologist Aaron Fisk studied contaminants and stable isotopes in sharks caught in the Inuit Greenland halibut fishery while conducting similar studies in ringed seals in the 1990s. However, the logistics and costs of working with the Greenland shark in the Arctic remained daunting, and a study site closer to Central Canada with good infrastructure remained elusive.

In 1999, I identified the Saguenay Fjord on the northern shore of the St. Lawrence River (in the vicinity of La Baie, Quebec) as being a site of historic Greenland shark capture in ice sport fishing. Local interviews revealed a number of sharks had been caught sporadically with the last captures having been in 1996, while in the 1980s, the mouth of the fjord was subject to commercial fishing efforts, and a large num-

ber of sharks were caught off the town of Bergeronnes at that time.

Typically, the sharks caught on baited hook and line between 120 and 200 metres depth were retained for photos and then discarded, dead. Several animals were found in the homes of local people. In one case, three-metre male and female sharks had been stuffed and retained by a local private museum. In another case, the head of a large three-metre specimen was stuffed and mounted on a plaque. These observations and grey literature reports in natural history, hunting and fishing magazines—primarily in the French language—confirmed that the Greenland shark had been historically present in this region back to the 19th century.

Expeditions

The result of this finding prompted GEERG



Jeffrey Gallant, Dr Chris Harvey-Clark and staff on expedition





and the Musée du Fjord at Ville de Saguenay to mount Operation Skalugsuak, the first ever under ice diving expedition below the Arctic Circle to locate and study the Greenland shark. For a week, scientists were based at an ice camp near the community of La Baie where they conducted several dives, ROV surveys and experimental fishing to locate the Greenland shark.



Although no sharks were seen during this expedition, many visitors to the camp were able to corroborate and supplement information on the number of sharks caught over the years in this region, and the expedition received national media coverage. GEERG received the first reliable report of a diver encounter in the area from commercial diver Roland Tremblay who, in 1981, encountered a large shark upriver from La Baie while working on a sewage outfall.

In winter 2002, GEERG mounted Skalugsuak II, a similar ice-based diving expedition in remote Baie-Éternité, approximately 45km from La Baie, in a National Park that had seen previous captures of Greenland sharks. Again, despite the best efforts of the team, no sharks were seen. By now, the GEERG team was dispirited, and considerable funds and efforts had been expended in an apparently fruitless and physically demanding operation.

In 2003, GEERG had a major break. In late May, divers near Baie-Comeau, nearly 200km downriver from the Saguenay Fjord, encountered several large, unidentified slow moving fish in poor visibility and reported this finding on a diver list-serve.

Within 24 hours, I was at the site—a waterfall-fed bay 6km from Baie-Comeau called Baie-Saint-Pancrace. Diving from a seasonal dock, and only seconds after entering the water, I sighted and filmed, for the first time below the Arctic Circle, a four-metre-long female Greenland shark with which I had a lengthy encounter in water depths from 10-25m at a sea temperature of 3°C. The following day, I was joined by fellow GEERG researcher Chris Harvey-Clark, and we sighted two more sharks simultaneously and filmed them.

At least four different animals from three to four metres in length were sighted at a variety of locations to the northeast of Baie-Comeau during the early part of June 2003. A number of interesting natural history observations were noted by our GEERG team, and subsequently, we published a CFN paper on them. The sharks were slow-moving at 0.3m per second but could rapidly accelerate and turn quickly, unlike their sluggish reputation.

All the sharks observed lacked the copepod parasite that is prevalent in Arctic sharks and were visually responsive to the presence of divers, avoiding them and changing

course at long distance to do so. Male sharks appeared to be sexually mature with prominent claspers.

The sharks had extensive scarring, which, in subsequent years, has proven to be persistent and is useful in visually identifying individuals. Much of this scarring appears to be linear white healed incisions likely caused by fishing gear around the caudal peduncle and along the flanks. Scarring and notching was also noted on the trailing edges and around the dorsal, pectoral and caudal fins, and appeared to be more prevalent in females, which may be related to nuptial behavior.

Sharks did not rapidly leave the area when encountering divers but frequently left the visible area and doubled back, re-appearing from another quadrant. In at least one case, a shark left the bottom to follow a diver who was going to the surface, but all sharks mostly stayed within two meters of the bottom.

Greenland Shark



ANDY MURCH



CLOCKWISE FROM LEFT: Getting ready for research dive; A non-invasive laser measurement tool devised to estimate the total length of Greenland sharks allows researchers to accurately measure the sharks underwater, a procedure that usually required hook and line capture or was done on dead specimens; Underwater photographer with Greenland shark; Research site at Baie-Saint-Pancrace





Sharks closely approached by divers (within one metre of the head) frequently performed a stereotyped behavior, which consisted of deceleration, raising the posterior part of the body, and depressing the pectoral fins, which was held for several seconds in some cases. Then, the shark would re-assume normal orientation and swim away. This was likely a form of agonistic behavior.

A GEERG publication written at this time concluded: "Greenland sharks remain in the same shallow bay water areas for multiple days, repeatedly visit potential prey, ascend from the bottom to investigate divers in mid-water, circle and maintain contact rather than fleeing, and exhibit unusual motor behaviors when approached closely. These findings are consistent with the behavior of sharks which have the potential to act as an

CLOCKWISE FROM RIGHT: GEERG research vessel, *Skalugsuak*, at Baie-Saint-Pancrace; Greenland shark sniffing flowers, no, anemone; Do Greenland sharks grin?

opportunistic predator as well as scavenger."

The sharks disappeared by mid-June and were not re-sighted for the rest of the summer. GEERG recruited a number of local volunteer divers who continued to dive regular transect locations. Despite this, further sightings did not occur in 2003. A television documentary was made about this unusual event, *Searching for a Monster*, for Canadian Geographic Presents on Discovery Channel Canada.

Further study

In 2004, on the anniversary dates of the initial 2003 discovery, GEERG returned to the Baie Comeau region and recommenced search operations for the presence of sharks. Thirty man dives over a six-day period failed to establish the presence of sharks in the region, and the GEERG team felt that the previous year's

events may have been unique because of the normally deep water habit of this species. Oceanographic conditions were altered due to a rainy and stormy spring with water temperatures inshore above 10°C, visibility underwater limited often to 1-2 metres and rough seas of 1-2 metres. On the final day of searching, a 3.5-metre male shark was encountered in five metres of water in visibility of 0.8 metres, moving very quickly after making a chillingly close pass at a diver. Water temperature at this location was 13°C, and the shark had a thick mucus coating.

Within two weeks, large numbers of sharks were being encountered in shallow water, and this continued until August 2004 when numbers diminished, with diver encounters in as little as two metres of water and up to 11 different animals being sighted during a single 200m transect.

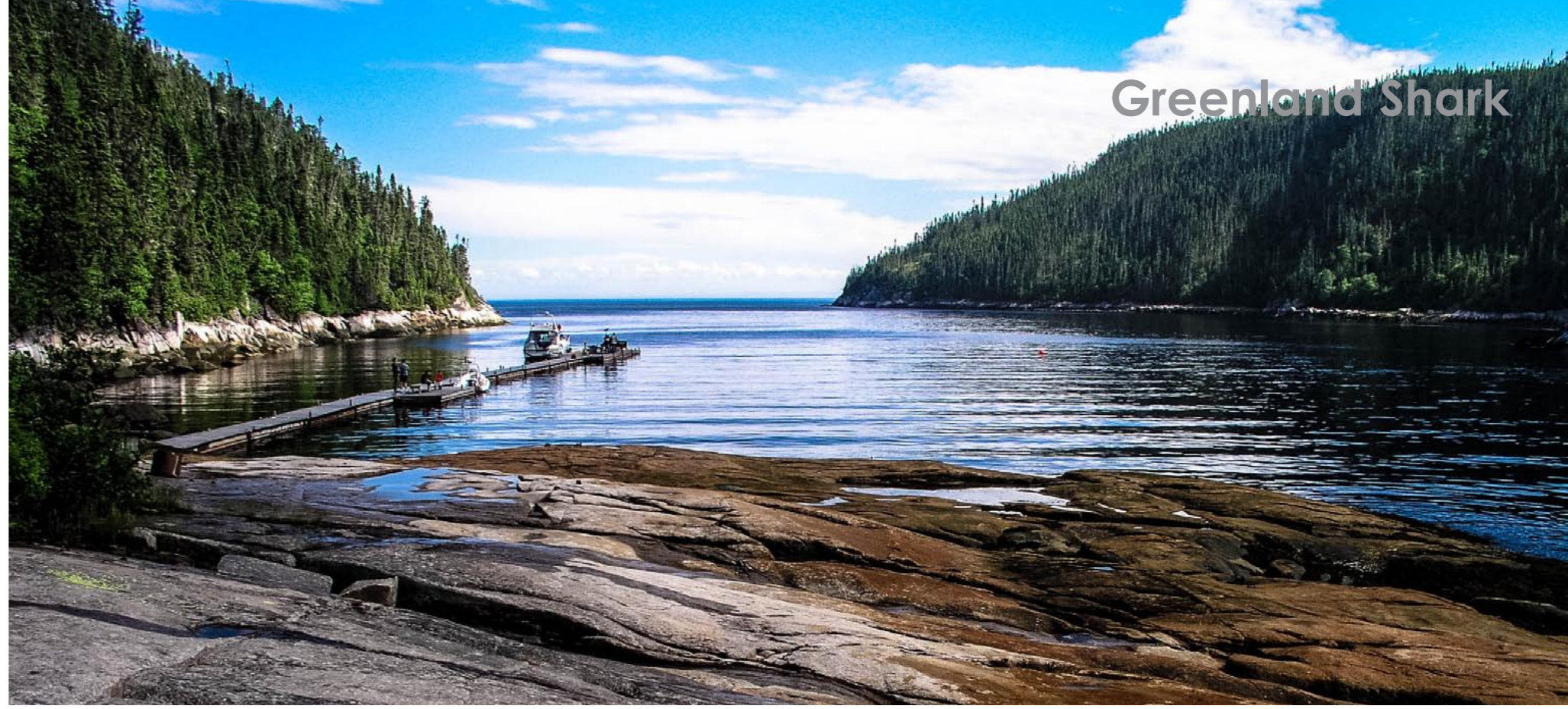
Aggressive behavior including close approach of divers requiring striking the animals to deflect their course was encountered for the first time. On one occasion, five sharks rapidly converged on a group of four divers in 10 metres of water from multiple directions and depths and repeatedly passed close by.



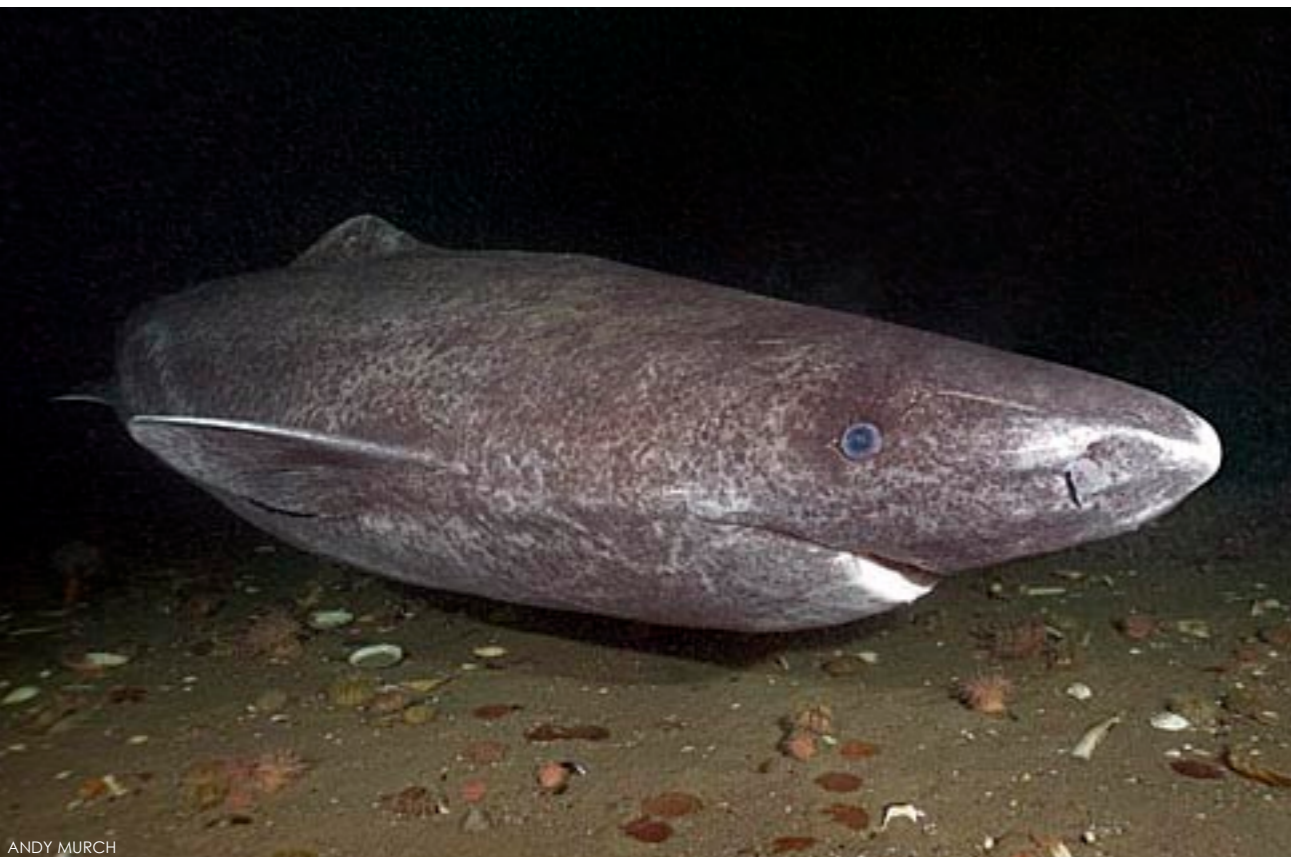
A number of sharks were encountered swimming well off the bottom and using the entire water column during this period. Sharks were encountered swimming in groups of up to five animals, often nose to tail or in echelon, and the same animals were associating in the same aggregations for multiple days, leading to questions regarding the social significance of this behavior.

A non-invasive laser measurement tool was devised for estimation of total length of animals. Over 30 animals have since been accurately measured underwater, a procedure that normally, at the very least, requires the hook and line capture of animals, and in shark research, often is done using dead animals.

In 2004 and 2005, a number of animals were diver tagged with hydroacoustic



Greenland Shark



shark tales



tags using biocompatible superficial tissue darts without injury to sharks or divers.

Data compiled by Michael Stokesbury of Dalhousie University and I showed that the sharks had a highly diel activity pattern. During daylight hours, the sharks stayed close to the bottom, moving slowly and remaining in deep water. In the evening, the sharks became much more active and began to leave the bottom and patrol the entire water column, traveling to shallow depths and then back to the bottom every 20-40 minutes, possibly in a hunting pattern, which continued until dawn.

These studies also revealed that although the sharks could tolerate higher temperatures, their preferred thermal window was between 1-2°C. In addition, sharks were tagged with "pop-up" satellite tags.

These tags are pre-programmed to remain attached for a period of

months and then detach and float to the surface where they uplink to a satellite and send a data burst, which has information on the movement history, environmental temperature and depth of the tag over time.

The sharks tagged were a female and male. The female remained in the same area where she was tagged for two months, while the male swam over 100k up the St. Lawrence River where its tag detached from a depth of over 300 meters in an area noted for tremendous marine mammal abundance.

In 2005, I produced the first pho-

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tographic evidence that sea lampreys (*Petromyzon marinus*) attack *Somniosus* in the cloacal area. In 2008, GEERG used a sonar-equipped VideoRay ROV for the first time to identify, track and direct divers to Greenland sharks at night and under conditions of extremely reduced visibility.

Status

The status of the Greenland shark, in terms of basic normative biology including population size, distribution, migration, abundance, movement and behavior is largely unknown. Despite being the only true Arctic shark and giant in size, its role as a putative peak predator and scavenger in Arctic and boreal waters has not been elucidated. Recent reviews continue to indicate this species is taking live pinniped prey; however, it remains unclear how this large, sluggish and slow-moving giant predator

The Greenland shark is a giant of the deep

Can't resist the call of the unknown?



...neither can we!

Photo courtesy of Jason Brown
www.bardophotographic.com

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Tony Howard
EUROTEK Delegate

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"I have only ever worn a Tuxedo twice, both at the EUROTEK Gala Dinners. What a fantastic evening, where you get to eat great food, whilst talking to unknown and well-known divers, swapping advice and contact details. And of course the presentations, prizes and excellent atmosphere make the evening a must for any diver's diary".

Lex Warner
EUROTEK Delegate

The (Black Tie/Long Posh Frock) Gala Dinner is truly good humoured and fun. It's the perfect opportunity to network and socialise, catch up with some old friends and meet new people. You'd be made most welcome - we're all divers.

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Martin Parker, Managing Director
Ambient Pressure Diving

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is capable of catching agile, fast-moving large-brained mammals.

As the Arctic ecosystem and its mammal assemblage changes with global warming trends, it is likely that the Greenland shark, because of its high trophic level, may represent a sentinel species in Arctic ecosystems. Recently, a polar bear foot—likely scavenged—was found in the stomach of a Greenland shark, showing that knowledge of the basic biology of this species may prove very valuable in mapping ecosystem change on a warming planet.

In the years since 2003 when GEERG first discovered and studied this unusual population in the boreal St. Lawrence River, our thoughts on this species and its ecological role have continued to evolve and our research continues. These animals are not the sluggish, carrion-eating giant swimming noses that armchair theorists thought they were.

Swimming in the environment with this unique creature has taught us that it is behaviourally plastic. When the water is warm and murky, it moves fast and could easily take seal prey by surprise. We believe these animals

may be "pediovores", predators that specialize in the taking of young, inexperienced and predator-naïve marine mammals.

The diel behavior pattern demonstrated in our telemetry studies fits with our own behavioral observations: in the daytime, these animals patrol slowly over the bottom where they are likely locating and vacuuming up benthic fish and invertebrates using advanced electro-reception and a suction feeding adapted pharynx; at night or in dark conditions, they speed up, leave the bottom and become stealth predators of larger fish and marine mammals, sampling the water column in the same depth bandwidth (60 metres to the surface) where they are likely to encounter marine mammals. They can find prey in pitch-dark conditions due to superior acoustico-lateral and close range electroreception capabilities. The past ten years have taught us that the Greenland shark is perhaps more like a hyena of the sea, both a scavenger and, under the right circumstances, a predator. ■

For more on the Greenland shark and GEERG go to www.geerg.ca

Greenland shark can grow to 6.4m (21ft) and weigh up to 1,000kg (2,200lbs), maybe even up to 7.3m (24ft) and over 1,400kg (3,100lbs), but most grow to 3–4.8m (9.8–15.7ft) and weigh up to 400kg (880lb) SOURCE: WIKIPEDIA

SELECTED READING:

Gallant, J., Harvey-Clark, C., Myers, R. A. and M. J. W. Stokesbury. 2005. Sea lamprey (*Petromyzon marinus*) feeding on a Greenland shark (*Somniosus microcephalus*) in the St. Lawrence Estuary, Canada. *Northeastern Naturalist*.

Stokesbury M.J.W, Harvey-Clark, C.J., Gallant, J., Block, B.A. and R. A. Myers. 2005. Movement and environmental preferences of Greenland sharks (*Somniosus microcephalus*) electronically tagged in the St. Lawrence Estuary, Canada. *Marine Biology* 148: 1159-165.

Harvey-Clark, C.J., Gallant, J.J., and Batt, J.H. 2005. Vision and its relationship to novel behaviour in St. Lawrence River Greenland sharks (*Somniosus microcephalus*) (Bloch and Schneider 1801) *Canadian Field Naturalist* 119: 355-358.

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Exley On Mix

Text by Michael Menduno
Photos by courtesy of Michael Menduno and Ann Krislovich

Prologue: I first spoke with Sheck Exley in the summer of 1991. I had begun publishing *aquaCORPS: The Journal for Technical Diving*, a year earlier and I was working out of the office at Capt. Billy Dean's dive shop in Key West, Florida, the first technical diving training center in the United States. "Technical diving", a term we had just coined to describe this new style of diving, was just in its infancy.

Billy was out running errands and Chris, the store manager, called out for me pick-up the phone in the office: someone was interested in our deep diving program. "Hello, my name is Michael. May I help you?" I said.

"I'm interested in your deep diving program and diving the *USS Wilkes-Barre*," said the caller with a distinct southern drawl.

"Do you have any deep diving experience?" I asked.

"Some," said the caller.

"What's your name," I queried.

"Exley."

"Sheck???"

Later that fall, Sheck and his partner Mary Ellen Eckhoff visited Key West to dive the *Wilkes-Barre*, a 610-foot U.S. Navy Cleveland-class light cruiser sunk in 1971 in 250-foot of water, which served as one of our training sites. We stowed our gear on board the *Key West Diver One* and motored 45 minutes out to the wreck.

Billy stayed on board and I dove the wreck with Mary Ellen. Sheck decided to make the dive by himself shadowed by one of our support divers. We planned a 20-min exposure to 250 followed by approximately an hour of decompression. Mary Ellen and I surfaced, while Sheck was still on the decompression line with a support diver. In the distance, we noticed that there was a large cargo ship bearing down on us

on a collision course. Billy repeatedly tried to raise the ship on the radio warning them that we had divers in the water. To no avail—the freighter never responded. As it drew closer with no signs of changing course, Billy decided that we had to move the boat though we still had divers on the line. We sent a support diver down to Sheck who was decompressing at something like 60-feet, to tell him to hang on, we were moving the boat to avoid a collision. It took Billy about five minutes to maneuver out of the way of the freighter which blew its whistle at us as it went past.

Forty minutes or so later, Sheck sheepishly climbed back on board. The freighter, which had passed us, was still visible in the distance. Sheck asked if this sort of thing happened often. Billy replied it was not uncommon. Sheck, who acknowledged he was not too comfortable on boats, said that he was going to stick to cave diving after that.

Later that fall, I interviewed Sheck for the magazine. Here is a reprint of the original interview, which appeared in *aquaCORPS*

Journal, #3, MIX, published in January 1992. Two years later on 6 April 1994, Sheck drowned during a failed attempt to bottom out the Zacatón cave system in Mexico, which was more than 300 meters deep.

Exley on mix

I glanced over at Sheck. He was again lost in thought, staring blankly into the night. It had been fascinating listening to him discuss the facts and figures of the dive, but what I really wanted to hear about were the things that go on inside his head when he's buried under hundreds of feet of water, inside a rock crevice, on the very edge of life, and still going on.

"How are you going to decide when you have gone deep enough?" I asked.

"Fear," Sheck answered immediately as if he had been patiently waiting for such a question."

—from *The Deepest Dive*
by Ned Deloach



To say that Sheck Exley is not your average 42-year-old high school algebra teacher is a bit more than understatement. By vocation, he is in fact a teacher at Suwannee High School in Live Oak, Florida. By avocation he is an explorer, pioneer, educator and diving legend.

Certified in scuba at the age of 16, Exley became the first person to log a thousand cave dives accomplishing this feat in less than seven years. Over the nearly two and a half decades that followed, Exley explored and surveyed most of the world's known deep water cave systems,

ANN KRISLOVICH



tech talk

pioneered many of the methods and techniques of deep air and special mix scuba, and in doing so, has repeatedly redefined the limits of self-contained diving.

His exploits and verve have earned him the reputation of being one of the finest divers in the world, and have shaped the development modern cave diving, which is regarded by many as a model for specialized dive training. A teacher and soft-spoken educator, Exley helped to establish the National Speleological Society's Cave Diving Division (NSS-CDS) in

1973, has published over 100 articles and six books on the subject of his passion, lectures extensively, and currently offers a mixed gas training program for experienced divers.

Perhaps pioneers like Exley will always remain an enigma. An explorer and athlete of the highest magnitude, combining physical ability with the psychological stamina necessary to venture where few will ever go, to others, perhaps, he is seen as a daredevil and risk taker seeking a thrill.

Recently aquaCORPS caught up with Exley hoping to try and explain and reconcile the many stories that have grown up around the man, to understand his motivation, to get inside his head. The results were more than we had anticipated.

MM: When did you start diving Sheck?

SE: I got started in 1965 but I didn't really start keeping a log until February 1966 when I went on my checkout dive with Ken Brock. He taught me how to dive. That first dive we went down and I stuck my head under a coral ledge, what you might call a coral cave, maybe 16 feet deep [chuckles]. Wasn't much of anything, and I really didn't enjoy it. But then Ken took me to Crystal River and I really got turned on. I didn't have a light or anything so I kind of wandered off into the cavern there, my

Exley

eyes adjusted and I swam a little bit further, peering off into the darkness. I guess I've been peering off into that darkness ever since.

MM: You've made some incredible dives in your career; your "Salute the Flag" dive at Diepolder II to 360 feet on air, Wakulla, El Nacimiento de Rio Mante to 870 feet, your 10,939 foot penetration at Cathedral, why do you do what you do?

SE: I'm not sure. My motivation has changed a lot over the years. I grew up diving, and as a teenager I wanted to be important and to be thought of as important. I went through a stage where I wanted to see how deep I could go. Then I went through a stage to see how far I could go. I still enjoy that.

There are places that no one else has been to since the dawn of time. We can't see what's there. We can see what's on the dark side of the moon or what's on Mars, but you can't see what's in the back of a cave unless you go there. There's a special feeling when you know no one else has been there before. And it's an extra special feeling when you know no one has ever been that far. I enjoy that feeling.

MM: Your Nacimiento Mante dive must have been like that?

SE: It was frightening. I'd use the term "physiological roulette" to describe my four Mante dives. The first to 520 feet in 1987 was probably the most frightening. It was really stepping out into no-man's land as far as the western hemisphere was concerned. Jochen Hassenmayer of course had been deeper at Fontaine-de-Vaucluse.

MM: Was Mante your first big mix dive?



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SE: I had done practice dives of course: 130 feet at Cathedral and 260 feet at Holton Springs. Dale Sweet's 360 feet trimix dive at Diepolder back in 1981 was the only dive in the western hemisphere that was close to it. In the eastern hemisphere, there were Jochen's dives. He had been to 660 feet, which gave me a lot of confidence.

MM: You knew it was doable?

SE: I knew it was doable. I had dived with Jochen. He's an extremely impressive diver, as good as any I have dived with. The fact that I had actually met the man and dived with him made me feel a bit more confident. Decompression tables were a problem of course. There was nothing available. I had never heard of Bill Hamilton at the time. Fortunately I was able to get a hold of some commercial tables that Jim Melton got for me as a model.

MM: You used commercial tables?

SE: No, I had to extrapolate them; the tables stopped at 400 feet. I had to take the model and extrapolate beyond that. I did the same thing on the 660 feet dive two months later.

MM: You know a lot of people would say, "Sheck is nuts." Why would he construct his own



decompression tables; isn't that just foolhardy and crazy?

SE: Isn't that basically what everyone does?

MM: Ha! Good point.

SE: I may not be the world's greatest mathematician, but mathematics is my profession and I have a degree in computers; both of them lend themselves quite well to figuring out a decompression schedule. I'm sure Bill Hamilton wouldn't do it quite the way I did. But then I did have a vested interest in doing a good job.

MM: You were the one on the line.

SE: I wouldn't begin to say that I could construct better decompression tables than Bill Hamilton, Angel Soto or Randy Bohrer, all of who later worked with me. I don't

have the information to make that statement. But it was all I had to work with at the time.

MM: There's a myth out there—a subtle one, but it's still there—that decompression tables represent some kind of truth, as opposed to what they are: people's guesses as to what will work based on experience.

SE: That's exactly right. I tell people early on in my mixed gas course that it's important to realize that any decompression table is just a mathematical model based on poorly understood physiological phenomena. The degree that the model is valid for a given exposure is the degree to which you do or you don't get bent. A lot of the early models were very simple, like a kid with building blocks—not much to them. Of course, they've become more sophisticated now, but their



tech talk

success still depends on whether or not they work.

MM: Have you ever been bent?

SE: Never. Well, sometimes when I'm wearing a dry suit and woolen underwear, I've surfaced with what may have been skin bends, but I don't know. I've never had

anything other than skin bends. It's a combination of a lot of luck, probably some unique physiology when I was younger, and a lot of conservatism as I get older. Fear.

MM: The decompression times you pulled on your Mante dives are so amazing, ten hours plus for your 780 foot jump and more on your last one to 870 feet.

SE: [Exley pulls out his log] My 520-foot dive required seven hours and 30 minutes of decompression for a 15-minute bottom time. Two months later, the 660-foot dive for 24 minutes took 11 hours and 13 minutes. The following year I made my dive to 780 feet using Bill's tables, which were only 10 hours and 43 minutes for a 24-minute bottom time. Besides the fact I was more confident in the safety factor in his tables, he got me out of the water quicker. My most recent dive to 870 feet for 23 minutes had a decompression of 13 hours and 30 minutes.

MM: How do you prepare for decompression like that? It must have physically and mentally grueling?

SE: From the standpoint of getting my tissues prepared, Bill Hamilton suggested that I make a deep dive, but not too extensive, the day before just to get my tissues limbered up. That worked out real well with my plans

because my profile called for me to stage three bottles of decompression gas at 330 feet. We didn't want to do any mix dives before the big one because of the possibility of getting bent which would mess up the whole expedition, so I did the dive on air and got my tissues ready.

As far as being psychologically ready for the tedium of the thing, I was just coming off a record penetration at Chip's Hole near Tallahassee, Florida, for 10,444 feet, which was the longest dive I ever made—14 hours in 69 degree water with a wetsuit.

MM: You survived!

SE: What made it worse was that I was in a current the whole time. I got cold. Fortunately the chemical heaters I was using kept me alive. After that, decompression at Mante, in 78-degree water seemed pretty easy as far as time went. As you know, with helium mixes I was making about 50 odd stops all of them relatively short. The time passed very quickly and I had plenty to keep me busy including wondering if all the little twitches were going to be bends, CNS toxicity, or just my old bones getting tired.

MM: You did it in a wetsuit?

SE: No, in a drysuit.

MM: Diapers or a catheter?

SE: No, I just cut it loose. Those are the only dives I use that drysuit for. And I enjoy having the back-up buoyancy compensation the dry suit provides. I sure wouldn't want to be down at 900 feet without buoyancy.

MM: Are you scared or anxious before your big dives?

SE: Up until the time I get in the water, I'm scared. I'm sure I get as scared as any diver there was. In fact, I got so scared the night before my Mante dive—I'm not sure what caused it—I actually became physically ill. I don't know whether it was a short little bug or what. The way I control it is through meditation. I meditate for ten minutes back in the cave before I start down; that clears my head of all that stuff.

MM: When you were in the water did you think about all the things that could go wrong or do you just deal with things as they happen?

SE: I spent roughly nine months in preparation for my last dive at Mante, in addition to my previous dives there. You play "what if" and try to think of every possible thing that could go wrong, and figure out all the little variations. You make plans and redundant plans to handle those things, and rehearse, rehearse, rehearse. And then when you make the dive, it's all business. Your mind is totally occupied with everything that has to happen. A lot of it has to happen very quickly. It's mental conditioning. I wouldn't be alive today if it wasn't for that.

MM: I heard that your watch went dead during one of your deep decompression stops?

SE: It was the 520-foot dive and it didn't stop; I lost my watch on the dive and I wound up counting all my deeper stops from 260 feet in my head. Fortunately, I've known CPR since I was 16, so that second, "one-one-thousand, two-one-thousand, three-one-thou-



Exley

sand..." is ingrained in my memory; but when your talking about a 30-minute stop, you're counting on your fingers. Eventually my safety diver, Mary Ellen Eckoff, who's probably one of the best cave divers in the world, and by far the best female, came to check on me at my 80-foot stop and brought me a watch.

MM: Let me ask you the obvious question; why weren't you wearing a back up?

SE: It was dumb on my part. After that, I carried three watches on each dive, and I had another one waiting for me at 520 feet with an additional depth gauge. Back up, back up, back up!

MM: What about the cave itself?

SE: It's real involved. What helps is having gone there before. I don't think anyone's going to down and add to my line anytime soon, although it's only a matter of time before someone goes out there





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you'd like. That's where you have to hang your decompression tanks. The passages are very narrow; some of them too narrow to go through. If you drop anything it's gone and you have to plan your gas carefully.

I try to design everything around the thirds rule. I overestimate my breathing rate at all levels and provided a third cushion based on the deepest possible dive profile/ diving time combination I thought I'd get. I also design my mixtures to stay within the oxygen toxicity envelope, both CNS and "whole body",

and does it. It would be very difficult however for someone who's never been there before to jump in the water at Mante and go to the bottom. You really have to build up to it. And then there are a lot of intricacies. For example, the cave is not really designed for decompression. You have a strong current blasting upwards and very jagged sharp ledges, but not as many as

raising the oxygen and nitrogen levels as I go up. Generally I try to run my nitrogen levels as high as tolerable, and switch over at 280 feet from air to deep mix on the way down, and from deep mix to air on the way up. I used two deep mixes this last time, 13 mixes in all. And I do a lot of other things as well. I worry about diet before the dive and during the dive.

Exley

MM: How about your support team?

SE: I had lots of help. Jochen shared some information. Dale Sweet shared everything he knew and supported me with equipment. Paul De Loach, my regular diving partner, maybe the best cave diver we have, helped me; Mary Ellen Eckoff, Tom Morris, Paul Smith, Paul Heinerth, Mexico's top two divers, Sergio Zambrano, and Angel Soto, who headed up my support teams, Randy Bohrer, and of course Bill Hamilton, the list just goes on and on.

MM: You know there's an old joke running around. People ask me all the time, "What kind of regulators did Sheck use on his Mante dives?" Answer: Every one he could get his hands on. Obviously rigging 30 some cylinders took a fair bit of equipment, not to mention gas. Did you have any sponsors?

SE: Early in my career, I guess it was around December 1970, I was involved as a safety diver in a record deep air dive attempt down in the Bahamas. There was a lot of those going on at the time—sponsorships, calling in the news media, getting official Bahamian folks to come and witness the thing, all that kind of stuff. It put a lot of pressure on the divers. As a result of the pressure, two divers never came up. That's when I made my famous air dive to 465 feet, which almost cost me my life. I couldn't reach them and nobody else could either. They knew going into the dive that their profile was not ideal. There were safety factors that they had counted on that were compromised at the last minute under the pressure from the sponsorship, the media and this

go quietly, amid the noise and haste...

[3 hours @ 20m - no deco]



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whole expedition scenario. They compromised their safety procedures and died as a result.

I never want to be in that situation. That's why I keep my involvement small. I don't want a lot of big sponsors. I don't want a lot of divers around. Those that are involved are close friends and I tell them up front, "We might just be going to Mexico for a long drive, turn around and come back. If I'm sick, or just don't feel right, or if a light goes out at the wrong time, whatever, the dive's over."

MM: I understand you were nervous about getting involved with mix in the beginning.

SE: My best friend back in the early 70's was probably Lewis Holtzendorf. Gosh, he was one of the best we had back in the early and mid-70's. Lewis made a mixed gas dive at Wakulla with Court Smith. They were diving heliox, and using the U.S. Navy helium/oxygen tables, which called for the use of pure O₂ at 50 feet. We know now, that was asinine, but back then they thought the profile was safe, and discussed it with one of the Navy people at the Experimental Dive Unit (EDU). As it turned out, Lewis convulsed and died. His partner almost did, too. That was 1975.

There were other incidents. Hal Watts had tried to do a body recovery in an open sink in Orlando on heliox and got severely bent in the process. After that, Frank Fogarty, Terry Moore and Rodger Miller made a 325-foot run in a Missouri sink, in 1978,

on trimix and got severely hypothermic. We were all looking and thinking, my God, what's going on. You have to understand, the world depth record for cave diving was only 340 feet back in 1977 and it stayed that way until Sweet made his successful trimix dive at Diepolder in 1980. It was Jochen's dives that got me thinking that mixed gas might be done safely.

MM: Sheck, you've done a lot of deep air diving over the course of your career; you've mentioned quite a few deep air dives over the last half hour. What are the practical limits of air?

SE: You have to understand, I've built up a lot of experience and tolerance to nitrogen over the last 25 years, and what works for me might not work for everyone. In the early days air was all we had and we didn't have the knowledge we had today. If I were starting again, I'd probably do things a lot different.

Today, I think you have to look at each individual environment and application and judge it on that basis. There are quite a few people who are teaching deep air technique these days. I know Hal Watts, Tom Mount and I do and there are others. With those techniques, basically anyone can be taught to dive to 200 feet. Beyond that it becomes an individual thing.

Nowadays, the only rational recommendation is to build yourself up to where you can do your air dives to 200 feet; than after 200 do your helium diving. There's no longer any point to build ourselves up to 300-

foot dives on air, because most people can't possibly handle it to that extent; it's just one of those individual things. Trying to build up beyond 200 feet, you're taking chances. Maybe you can handle it, maybe you can't.

MM: Physiological roulette?

SE: Exactly. I was one of the lucky ones, or perhaps, unlucky ones.

MM: Is air technology dead?

SE: I don't think so. I think there will always be a use for air. Hal Watts really got the deeper air stuff started from the viewpoint of trying to acclimate to higher partial pressures of nitrogen, but as we continue to learn more, like some of the amazing stuff Bret Gilliam's doing, it will make it easier for the rest of us to dive to 200 feet, maybe more. Let's face it: we have a lot of experience with air and we're more comfortable with the decompression. I'm not aware of any helium tables that are as reliable as some of the air tables that are available. The decompression is more reasonable and you can decompress closer to the surface. If you can do a dive on air, or an appropriate enriched air mix, and do it safely, you ought to do it.

MM: What about people going deeper?

SE: It's obvious that there's an enormous amount of interest that has been generated, particularly now with the advent of mix gas diving. Back in the 60's and 70's we used to try as instructors to tell everyone there's not much to see beyond 130 feet. Of course it depends on what you're inter-

Exley



ested in seeing. We've all known from the beginning of cave diving in Florida, that the most beautiful and interesting caves are all deeper than 130 feet. It's sad. You know we tell people, "Don't go below 130," and then we turn right around and do it ourselves. All cave diving instructors dive deeper than 130 feet.

I think it's more realistic to try to establish some guidelines for peo-

ple who want to venture deeper, rather than say "Don't" and be seen as hypocrites. Otherwise people will begin to think, "Well, if that rule isn't worth paying attention to, maybe they all aren't."

MM: Deep diving is getting more expensive. Do you think that will limit people?



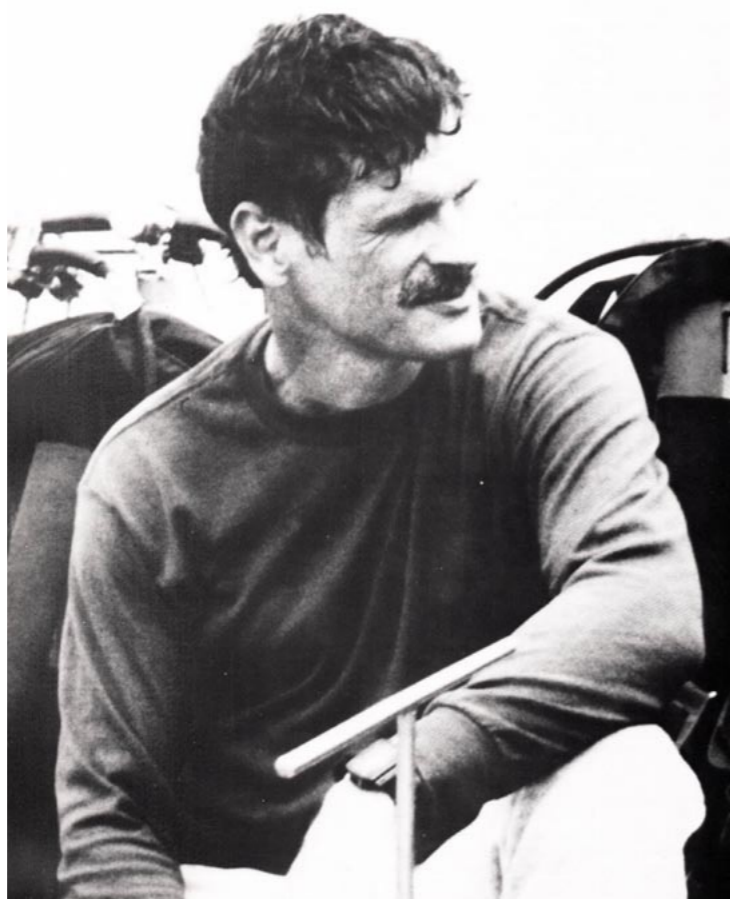


tech talk

SE: Diving is a much more expensive pursuit now than it's ever been. And when the rebreathers start coming out—Bill Stone's probably real close to having a fully redundant closed circuit system now—it's going to be even more expensive. Quite frankly, the people who want to do these dives are going to find the money to do them. I remember when scooters first came out. Shoot, I didn't have any money. But I realized if I wanted to continue to do the type of diving I wanted to do, I had to step up, borrow the money and buy one. I did. Bill Stone once made the observation that he wasn't aware of any explorers that died rich.

MM: *What does it take to be a cave explorer?*

SE: You have to love it. You have to love the diving. Loving recognition is not enough. That wears off. That's why you see such a high instructor dropout rate. The ones that got in it because it's another merit badge and everyone around thought it was a big deal—it wears off. You see it over and over again in diving. When I got started in diving back in the 60's, I wanted to be special. I grew out of that and got to where I just loved diving, and that's what kept me going. If I hadn't I would have quit a long time ago.



MM: *Love. Perhaps that really is the key to it all. What's your advice for people who want to expand their diving capabilities?*

SE: Don't forget the basics. Make sure you have plenty of gas, make sure you know the way back, and make damn sure if you're going into nitrogen land or helium land, you know what you're doing.

MM: *How about you? Who do you look to for inspiration?*

SE: There's a book by Roland Huntford called, *The Last Place On Earth*, which contrasts the exploration styles of Robert Falcon Scott and Roland Amundsen in their drive to reach the South Pole. Scott was the guy with all the money, recognition, power and supplies, which he arrogantly

threw at the problem. Amundsen was poor and didn't have much, but he carefully thought out everything, every little step of the way with infinite preparation. He listened to everyone for advice, even the Eskimos who Scott thought were ignorant savages who couldn't possibly have any ideas. The end result was that Amundsen got to the South Pole first and Scott wound up killing himself and a lot of other people. I think Amundsen provides a tremendous role model for explorers and divers.

MM: *What are your diving plans Sheck?*

SE: I have a cave real close to me here on my property. In fact, it's under my feet as we talk. The last time I went diving there I was over two miles underground and the thing was still 50 feet wide and 20 feet high and going strong. No telling how far it goes. I haven't seen that anywhere else. All these other Florida caves start branching out, getting smaller; this one just keeps on going and going and going. I'd like to see what's back there, but I'm not sure I'll be able to do it with the technology we have right now. A lot of our technology may be obsolete here in a short while.

MM: *I guess you're going to have to borrow some more money and plunk it down on one of Stone's rebreathers.*

SE: And then there's hydrogen. From what I've

Exley

been learned there seems to be some real potential for hydrex [an oxygen, helium, hydrogen mix] though no one has looked at its use for deep bounce dives. With the kind of compression rates I was dealing with at Mante, you need the heavy nitrogen to avoid HPNS, but I'd rather have the hydrogen.

MM: *What about Mante? Are you planning to dive any deeper?*

SE: I've had opportunities to go deeper, but it looks real unlikely with my advancing age that I'll go back down there. I'd like to see more people go as deep as I've been in Mante before I go too much further. Since Jochen got the bends so bad he had to quit diving, there is no one else who's been beyond 500 feet.

You know it's funny, on my last two Mante dives, my first decompression stops were at 520 feet. Only one other person had ever been that deep and here I was making a decompression stop. How crazy can I be? I'd like to see Jim King and some of the others start diving to 500 feet, then I'd feel better about going a little deeper.

MM: *Five hundred feet, a thousand feet? That's pretty heady stuff. What do you think the ultimate limit will be?*

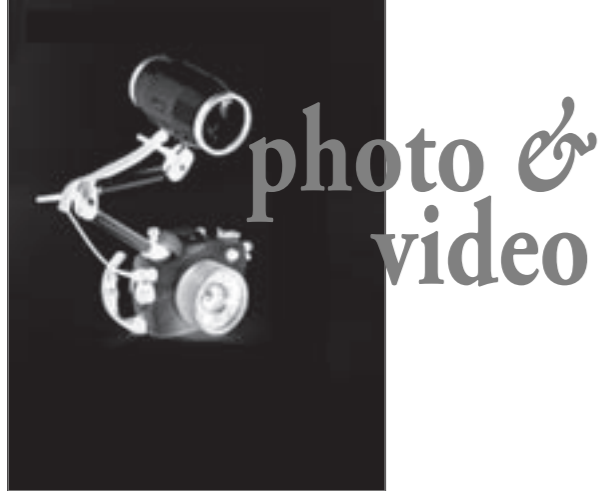
SE: There is no limit. We'll always find a way to go deeper and deeper. That's been the pattern all along. Ten years from now, 20 years from now, people will be doing things we've never dreamed of. And I see no reason for it to change.



Writer, diver and technologist Michael Menduno has written about science, technology and diving for Alert Diver, DIVER, Newsweek, Scientific American, Outside and WIRED magazines. He was also the founder, and editor-in-chief of aquaCORPS: The Journal for Technical Diving

(1990-1996), which helped usher tech diving into the mainstream of sports diving, and coined the term "technical diving." Menduno recently completed his GUE Fundamentals and is based in Berkeley, California, USA. He can be reached at: michael@menduno.com. ■





Point & Shoot

Step-By-Step Images With Today's Gear

Text by Larry Cohen. Photos by Larry Cohen and Olga Torrey

In order to create images with point-and-shoot digital cameras that are a step above snap-shots, we have to use the same techniques used with DSLR cameras. By using a few different techniques, one can get outstanding results no matter what size camera is used.

Get close wide-angle

This is the most important rule in underwater photography. When you think you are too close, get closer. Water is denser than air, and even the clearest water has particles floating in it. So, the less water we put between our lens and our subject the better. It is best to never be more than two feet (0.6m) from the subject. The closer one is to the subject the better the images.

So, how does a photographer fit a large underwater scene in the frame? He or she needs to use the widest lens possible. Most point-and-shoot cameras have lenses around 28mm to 24mm. Since everything looks 25 percent larger and closer underwater, this is not wide enough. Photographers need housings that allow them to use accessory lenses.

Many point-and-shoot housings have 67mm or 46mm filter threads on the lens port. So, by using an auxiliary wide-angle lens, photographers can move in close and still photograph a large area. Wide-angle lenses are impractical on some camera



Olga Torrey on *Carbisea* shipwreck in North Carolina with Olympus XZ-1 in Olympus PT-050 housing, Dual Sea & Sea YS-01 strobes, Beneath The Surface tray and arms, Olympus PTWC-01 100 degree wide-angle lens





photo & video



housing rigs due to vignetting. These rigs make use of auxiliary domes. The dome corrects for the size distortion that happens underwater. This way the camera will have the same angle of view underwater as it does on the surface.

In most cases, this equipment will not have an angle of view as wide as a DSLR with a prime wide-angle or fisheye lens. The trick here is that one has to pick subjects to match the lens. If one concentrates on smaller subjects and scenes, one will get better results.

Get close macro

Small subjects are much easier to photograph with a point-and-shoot

camera. All point-and-shoot cameras have a macro mode, so one can move in and document all the tiny creatures on the reef. If the housing allows one to attach accessories, a close-up lens could be helpful with really tiny subjects. It is best to be four to eight inches (10-20cm) away from the subject. This way one has room for lighting and is less likely to frighten the subject.

When working close, depth of field has to be considered. Because point-and-shoot cameras have lenses with very short focal lengths, photographers usually are able to keep the whole subject in focus. If a photographer has aperture control, he or she will want to stop

The author on a small wreck in Dutch Springs. Photo by Olga Torrey. Shot with the Olympus XZ-1, in the PT-050 housing with Sea & Sea YS-01 strobes

the lens down to keep everything sharp. Most of these cameras will only stop down to f/8.

Shoot RAW

RAW files are uncompressed files that capture more color tones. When working with RAW files, photographers will be able to make better corrections including color in post-production. Since these files are larger than compressed jpeg's, many point-and-shoot cameras are slow when shooting RAW. So, photographers have to decide if having more control is worth losing the speed.

Correcting color in available light

As one goes deeper underwater, one loses the warm colors in the spectrum. Warm salt water acts as a blue filter over the lens, while cold and fresh water acts like a green filter. Using the

camera's custom white balance setting along with adding filters can bring back the subject's natural color. This is usually effective in water no deeper than 80 feet (25m).

Many housing manufactures make either screw-on or push-on filters for both blue and green water. Magic filters are gel type filters that are easy to cut. They can be cut to size and placed inside the housing in front of the lens.

When using a filter, it is important to make sure that one is not using any artificial light. So, don't forget to turn off the camera's built-in flash.

Many point-and-shoot cameras have an underwater white balance. This sets

Point & Shoot

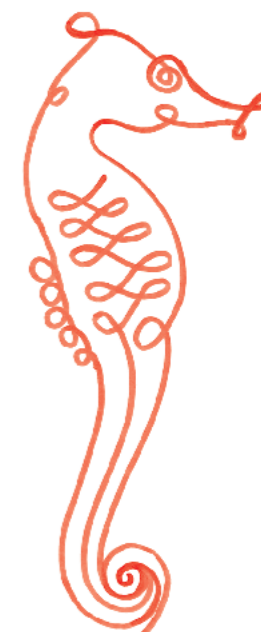
up a digital blue water filter. Aquarium mode can be used as a digital green water filter. Not all water has the same colorcast. The color will also change with how deep you are and the time of day. So, these filters and underwater modes will give images a general but not perfect color correction. As a quick easy fix, underwater mode is effective.

All digital cameras have a custom white balance feature. By pointing the camera at a neutral colored object, capturing color data, the camera will correct the colorcast caused by the lighting and environment. This is a more accurate method of correcting color, but takes more skill than adding a filter. It is important to fill the entire frame with the object and not to cast a shadow. Putting neutral colored duct tape on a fin makes for a convenient target. One can also use a large slate. Using a custom white balance and a physical filter together will give us the best available light color.

When photographers use filtering and



Duct tape on a fin makes a good target for doing a custom white balance



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photo & video

The author, Larry Cohen, on the *Carbisea* shipwreck in North Carolina. Olga Torrey took this photo with the Olympus XZ-1 in the Olympus PT-050 housing

white balance techniques, they are correcting the background and the subject. So the backgrounds in these images will not have the same vibrant blue or green color one gets when using strobes. The exposure value of the background and the subject will be close. This will flatten out images, and they will have less contrast. These available light techniques are suited to certain subjects, including wreck scenes and are effective in less than stellar visibility.

Using strobes

Another effective way to bring back natural color is to use a color corrected light close to the subject. For still images, strobes (flash) are the best solution. Strobes have other advantages besides color. A photographer can work in very low light, letting subjects be illuminated by just the strobe light, or he or she can balance the available light to get vibrant backgrounds and create

dramatic images.

In the past, SLR housings would fire the strobes with a hard wired sync cord system. On the outside, a sync cord connects the strobe to the housing's bulkhead. On the inside of the housing, there is a connection from the camera's hot shoe to the bulkhead. Most point-and-shoot cameras don't have a hot shoe, but typically they do have a built-in flash.

So, firing the external strobes with a slave sensor is the solution. On some strobes, a slave sensor has to be added to where the sync cord would plug into. Other strobes have built-in slaves. In some systems, the slave sensor is exposed, and a reflector is used to block the light from the built-in flash from hitting the subject and redirecting the light to the slave.

Other strobes have the slave set back, and one needs to connect a



Hot shoe connection inside housing

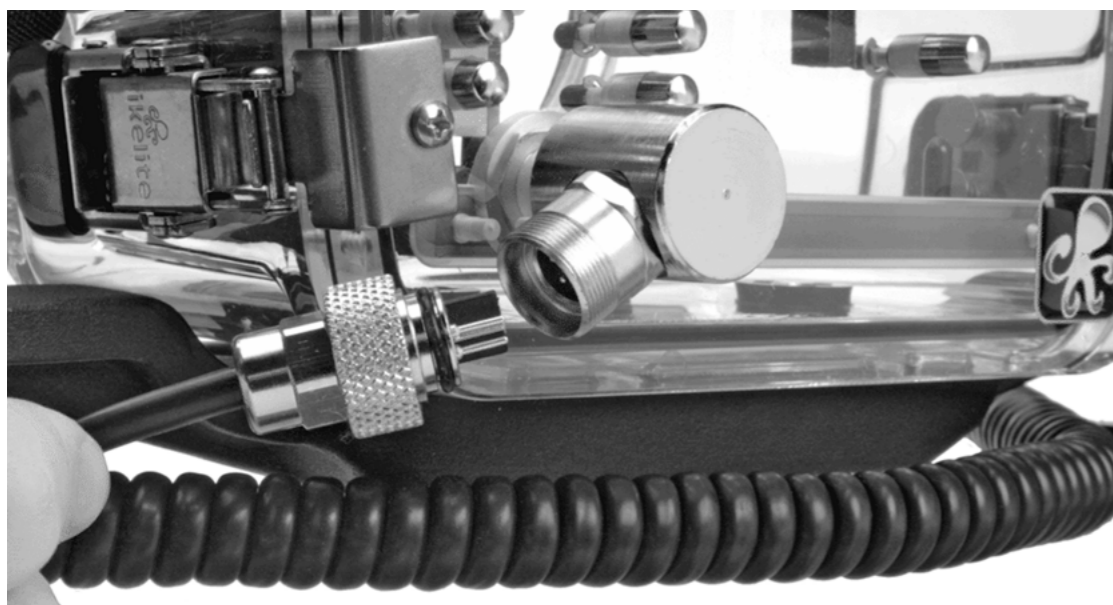
fiber optic cable to move the light from the camera's built-in flash to the slave on the external strobe. Using fiber optic cables has become the preferred method on point-and-shoot camera rigs. There are a few point-and-shoot housings that use a sync cord, but even if the camera has a hot shoe, many housings just use fiber optics. Using fiber optics has proven to be much more reliable than sync cord systems. Today, high-end DSLR housings have fiber optic cable ports if the camera has a built-in flash.

When working with strobes it is best to use the camera in manual exposure mode. When the f-stop is changed, it will affect both the strobe and the available light exposure. So, it is best to pick an f-stop and keep it constant. Changing the shutter speed will have a greater affect on the available light exposure. By controlling the shutter speed one can lighten or darken the background. Changing the power on the strobe will affect the strobe exposure, having an affect only on the subject.

This is why having a strobe with a power dial is best. Use an f-stop that allows you to have the strobe dial in the middle of the dial, when the subject is about one foot (30cm) away. This way if you move closer, the dial gets turned down. If you move farther away, the dial gets turned up.

Pick a shutter speed that has the cameras light meter reading around one and half stops underexposed. This will produce a dark background, but it will still have color. If a lighter background is desired, use a slower shutter speed. For a darker background, use a faster shutter speed. By doing this, one can create images that have contrast and separation between the subject and background.

It is best to start every dive photographing



Sync cord connecting into housings bulkhead

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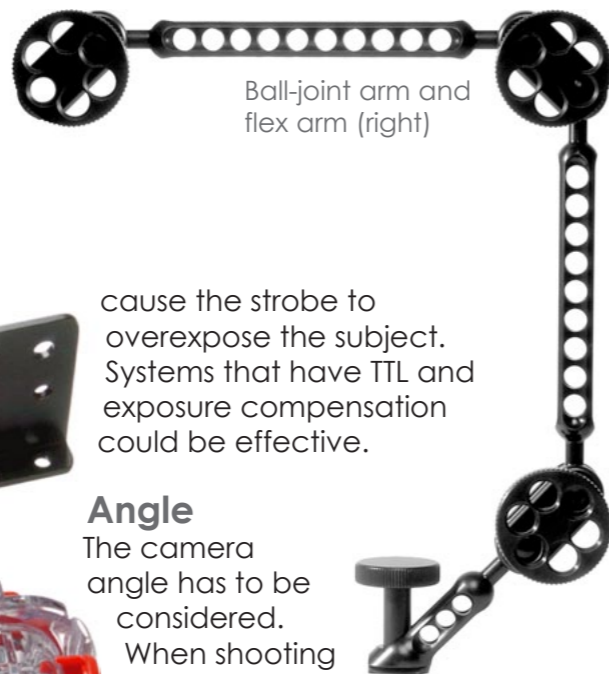
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Ball-joint arm and flex arm (right)

cause the strobe to overexpose the subject. Systems that have TTL and exposure compensation could be effective.

Angle

The camera angle has to be considered. When shooting upwards underwater, backgrounds will appear lighter. Subjects will also look bigger and more majestic. Shooting eye level will produce darker backgrounds. If shooting downward, the background will be closer to the subject and will be textured.

Last but not least, one needs to pay attention to the strobe angle. As a starting point the strobe should be out to the side at a 45-degree angle. From this point, the strobe can be moved further to the side to show texture in the subject. For some subjects, top lighting may be more effective.

Since everything looks closer underwater, a common mistake is to aim the strobe where one thinks the subject is, instead of where it really is. When this happens, the strobe will be lighting the water in front of the subject. This lights up all the particles in the water, enhancing backscatter when one is trying to minimize it.

In order to position the strobe where desired, an arm system is used. All point-and-shoot housings have a 1/4"-20 socket on the bottom. One can use this socket to attach a tray to the housing. The tray can be used to attach a number of different kinds of strobe arms. Ball joint



arms allow the most flexibility in postponing strobes. These systems do get expensive and are used primarily with DSLR systems. Flex arms are reasonably priced and are easier to adjust. Most photographers that use point-and-shoot rigs go with a flex arm.

Once you've got your point-and-shoot camera in a housing with strobes attached to an arm system, it's time to get wet. Digital photography allows us to see our images instantly, so experiment and take chances. Look at the image, adjust and shoot again. Photographers are no longer limited to 36 frames on a roll of film. So, go out and shoot and shoot some more. The more photos we take the better we will get. Have fun, and bring back images that tell a story and show non-diving friends why we spend so much time underwater.

Today's gear

The lifespan of today's digital camera is very short, as new models come out daily. Let's talk about camera models, housings and accessories that are available today, which allow photographers to capture images underwater. By no means is this a complete list.

Nikon COOLPIX P7100

The Nikon COOLPIX P7100 has all the features we look for in a camera to use

The author inside the helicopter at Dutch Springs. Photo by Olga Torrey. Shot with the Olympus XZ-1, in the PT-050 housing with Sea & Sea YS-01 strobes

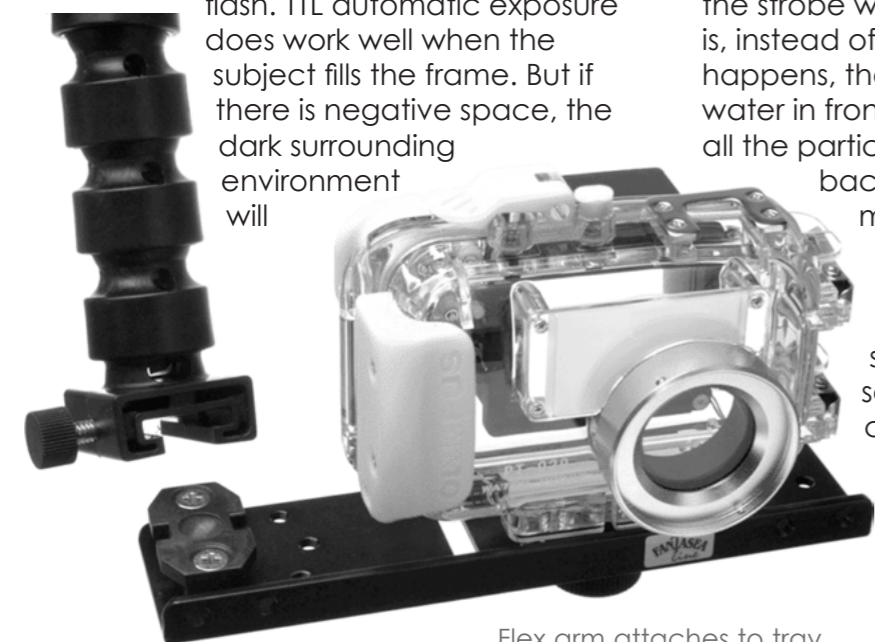


Tray attaches to the bottom of the housing

a stationary subject. This way photographers can get settings for the current conditions.

Some point-and-shoot housings that use a sync cord support TTL (through the lens) automatic exposure control with certain strobes. In recent years, a few fiber optic housing/strobe combinations will support what is being called D-TTL. In this system, the external strobe mimics the auto setting of the camera's built-in

flash. TTL automatic exposure does work well when the subject fills the frame. But if there is negative space, the dark surrounding environment will



Flex arm attaches to tray

underwater. The camera has a 1/1.7 CCD sensor with an effective 10.1 megapixels. Having a sensor larger than most point-and-shoot cameras, and having fewer pixels, means the pixels are larger. So, image quality is better, especially in low light and when using high ISOs. The camera can capture RAW files and has complete manual controls. It also captures 720p HD video, and the manual control and optical zoom does work during video capture. One very cool feature is that when doing a custom white balance, the camera auto-

atically zooms to a 200mm equivalent. So even if the target is a few feet away, it fills the frame.



Nikon COOLPIX P7100

Fantasea Line FP7100 Housing

This housing for the Nikon COOLPIX P7100 is very compact and allows access to all controls. The controls are marked just like the controls on the camera. It has a double o-ring seal and is rated to 200ft (60m). The housing features dual fiber optic cable ports. The ports are designed for Sea & Sea style cables, and adapters for Inon style cables are included. There is an accessory shoe above the lens port

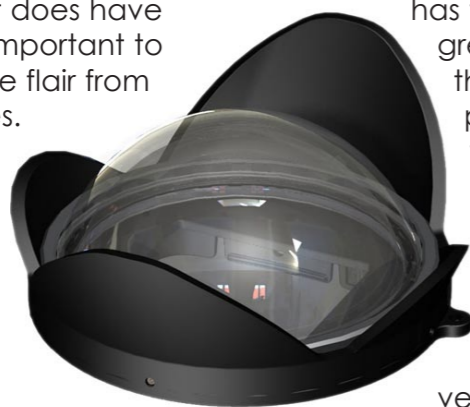


Fantasea Line FP7100 housing for the Nikon COOLPIX P7100

for a focus light. Fantasea has a number of accessories to enhance the images captured with this housing.

Fantasea Line BigEye Wide-Angle Lens

The Fantasea Line BigEye Wide-Angle Lens is not really a wide-angle lens. It is an auxiliary dome. This optic corrects the 25 percent size distortion that happens underwater. So, the P7100's 28mm equivalent lens will have the same angle of view underwater as it does on land. When using dual strobes, flair could be a problem with this dome. It does have a built-in dome shade. It is important to turn the shade to reduce the flair from both the sun and the strobes. At this time Fantasea Line is testing a dome with better anti-flair coatings. This should reduce the problem significantly. Fantasea Line also produces these domes for many Canon, Sony and FujiFilm housings. They also manufacture them with a 67mm and 46mm filter thread.



Fantasea Line BigEye Wide-Angle Lens

Fantasea Line SharpEye M67

The Nikon COOLPIX P7100 does focus down to 0.79 inches (2cm) in macro mode. But, in order to have some room for lighting and to not scare skittish subjects, a macro lens could be handy. Fantasea Line SharpEye M67 UW Macro Lens will allow the photographer to get some distance from the subject but still

have the magnification.

The SharpEye has a 67mm filter thread. Since the port on the FP7100 is not round we need the EyeDaptor FP7000 - F67 in order to add this or any other macro lens with a 67mm thread to the housing.

Fantasea Line RedEye and PinkEye

The best way to bring back natural color underwater is to bring a white light source close to the subject, but in water no deeper than 60ft (18m) a filter could be effective. For blue water, Fantasea has the RedEye Filter; for green water, they have the PinkEye. Fantasea produces these filters for a number of different housings and filter threads. The filters for the FP7100 housing come with a holder that snaps onto the housings lens port. A very nice feature is the filter can be removed from the holder and slipped into a filter pocket on the BigEye dome.

Ikelite's housing for the P7100

Ikelite takes a different approach to manufacturing housings. They have a few different size polycarbonate boxes. They then take the box the camera fits best and creates the controls for that camera model. With this method of manufacturing, Ikelite can produce new



Ikelite housing for the Nikon COOLPIX P7100

housings faster than any other company. All Ikelite housings are rated to 200ft (60m).

The Ikelite housing for the P7100 is slightly larger than the Fantasea Line housing. Instead of using fiber optic cables, Ikelite uses a bulk-head, sync cord system to fire the strobes. On the outside, a sync cord goes from the strobe to the housings bulkhead. On the inside of the housing, there is a connection from the camera's hot shoe to the bulkhead.

When using Ikelite DS strobes, photographers have real TTL automatic exposure control. In order to use dual strobes, a dual (Y shaped) sync cord is employed. The housing includes a single release handle. Purchase a dual release handle if you want to use two strobes.

Ikelite accessories

Due to the camera's optics, Ikelite also uses a



Olympus XZ-1



Ikelite WD-4 wide-angle conversion dome

dome for wide-angle work. The WD-4 wide-angle conversion

dome snaps onto the housings lens port. For macro work, one can use the Ikelite external macro adapter on the housings lens port. Once this is in place, the Fantasea Line SharpEye M67 or any other close-up lens with a 67mm filter thread can be used.

Ikelite produces both blue and green water filters for all their housings.

For the Nikon P7100 housing, a filter #6441.46 is needed for blue water and #6441.86 for use in green water.

Olympus XZ-1

The current advanced point-and-shoot Olympus camera is the XZ-1. This camera has all the features needed for shooting underwater. Complete manual control, captures RAW files and has a large 10 megapixel 1/1.63 inch CCD sensor. The camera also captures 720p HD video and has a fast f /1.8 (W) - 2.5 (T) lens with a zoom range of 28-112 mm 35mm equivalent. There are a number of options for taking this camera underwater.

Olympus PT-050 Underwater Housing for the XZ-1

Olympus does a better job than most



Olympus PT-050 housing for the Olympus XZ-1

camera manufactures in meeting the needs of the underwater photographer. All camera controls are easily accessed from the housing. The controls are marked just like the controls on the camera. The PT-050 housing has a 67mm filter

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Olympus PTWC-01
100 degree wide-angle lens



thread on the lens port, so an auxiliary wide-angle lens, macro lens or filter can be added directly to the port. The housing is rated to 130ft (40m). Olympus includes a single fiber optic cable port in front of the camera's built-in flash. This is one of the housings weak points. Firing dual strobes becomes a challenge. Sea & Sea Strobe Mask Set is a fiber optic cable port and mask set for adding a port to housings that don't have one. Photographers can use two of these Mask sets on the housing's included diffuser.

Accessories for the Olympus PT-050

For wide-angle photography, the Olympus PTWC-01 100 degree wide-angle lens can be attached directly to the housing's lens port. The lens has a magnification of 0.6x. So, the 28mm 35mm equivalent lens of the XZ-1 becomes a 16.5mm lens. This allows one to get really close to large

subjects. For macro work, the Olympus PTMC-01 can be used. This auxiliary lens will double the subject's image size. The XZ-1 does have an underwater white balance setting. For available light photography, this is the same as using a digital blue water filter. If you still want to use a blue or green water filter, Equinox has them available with 67mm threads.

The Olympus UFL-2 underwater Strobe is designed to work with many Olympus cameras, including the XZ-1. In remote mode, photographers can control the strobes power from the camera. This allows for easy and creative lighting. The beam angle of the UFL-2 is on the narrow side, but by adding the optional diffuser, one strobe could cover a scene shot with the PTWC-01 wide-angle lens.

Ikelite Housing for the Olympus XZ-1

The Ikelite housing for the XZ-1 is very close in design to the Ikelite housing



Olympus UFL-2 strobe



Sea & Sea Strobe mask



Nauticam NA-XZ1 housing for the Olympus XZ-1

for the Nikon P7100. They share the same polycarbonate box and lens port. The WD-4 wide-angle conversion dome, external macro adapter, #6441.46 and #6441.86 filters can all be used with this housing. The housing utilizes the camera's hot shoe, using a bulkhead and sync cord for firing the strobes. When using Ikelite DS strobes, photographers have real TTL automatic exposure control.

Nauticam NA-XZ1 for the Olympus XZ-1

Nauticam NA-XZ1 housing is machined from solid aircraft grade aluminum. Usually this material is reserved for DSLR housings not ones for point-and-shoot cameras. This housing is rated to 300ft (100m). This depth rating and small size makes it perfect for the deep tech diver. Nauticam PowerShot S100 uses fiber optic cable ports to connect strobes and has a 67mm filter thread on the lens port. They also manufacture a similar housing for the Panasonic Lumix DMC-LX5.

Canon PowerShot S100

The Canon S100 is the smallest of

the advanced point-and-shoot cameras, but it is large in features. This camera has a 12 megapixel 1/1.7 inch CMOS sensor, captures RAW files and has complete manual control. The lens has a 35mm equivalent 24-120mm.

Canon WP-DC43 Underwater Housing for the S100

Canon produces a number of underwater housings for their cameras. These are inexpensive plastic housings with very few features. Photographers are able to access the important camera controls, and the buttons are marked just like they are on the camera. A diffuser so one can get some decent results with the camera's built-in flash is included, and the housing is rated to 130ft (40m). There is a standard 1/4"-20 socket on the bottom, which can be used to add a light. What is missing is a way to attach lens accessories and to use fiber optic cables.

The WP-DC43 is very popular, and with a little bit of effort, one



Canon

S100

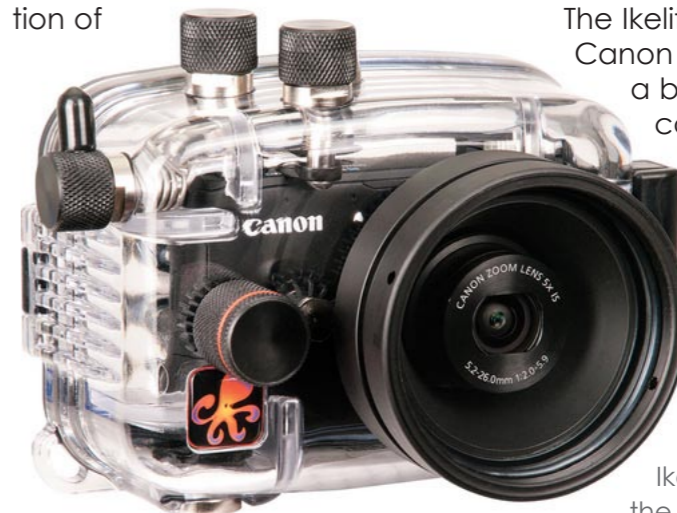
Canon WP-DC43 housing for the Canon S100



can still add the accessories needed to take professional underwater images. By using the Sea & Sea Strobe mask set, a fiber optic port can be added to the housing. Fantasea Line does have a BigEye dome and an EyeDaptor for this housing. With the EyeDaptor, macro lenses and filters with a 67mm thread can be used.

Ikelite Housing for the Canon S100

This Ikelite housing is very compact and form fitting to the camera. It is rated to 200ft (60m) and allows complete camera control. The lens port has a 67mm thread. For wide-angle photos, the Ikelite W-20 wide-angle conversion lens can be used. This lens has a magnification of



Ikelite housing for the Canon S100

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0.56X. When used on the S100, you will have a 13.45mm lens equivalent, but you will get vignetting. To avoid this, you have to zoom the lens to a slightly more telephoto setting. This will still give you an angle of view of a 16mm lens. Macro lenses with a 67mm thread can be attached directly to the lens port. For available light work, Ikelite has the push-on #6441.41 filter for blue water and the #6441.81 filter for use in green water.

The Ikelite housing for the Canon S100 does not have a bulkhead or fiber optic cable ports. The housing includes a diffuser and reflector. The diffuser is for trying to get decent results with the camera's built-in flash. The reflector is used to bounce the light from



the camera's flash to a slave sensor. The sensor on the Ikelite AutoFlash AF35 is positioned to fire the strobe with this system. This strobe is designed for Ikelite's compact housings and other manufacture housings. It includes the tray and flex arm with the slave sensor attached. The strobe can be used in auto TTL mode. This works by mimicking the auto exposure of the camera's built-in flash. The strobe has exposure compensation, so the flash exposure can be fine-tuned. The AF35 also features manual control with six power settings.

Fix Housing for Canon S100

The Fix housing for the Canon S100 is manufactured from aluminum alloy and is rated to 230ft (70m). The housing allows for complete camera control including the camera's rear control wheel. All camera functions can be accessed with one hand. The housing has dual fiber optic ports and includes 52mm and 67mm filter adapters. The Fix UWL-28 Fisheye Conversion lens can be used on this housing. This will give you an angle of view of 168 degrees.



Fix housing for the Canon G12



Canon WP-DC34 housing for the Canon G12

Canon PowerShot G12

The Canon G series has been the advanced point and shoot digital camera to get since the year 2000 with the G1. These cameras have always been a favorite to take underwater. The Canon Powershot G12 is the current model. The camera features a 10 megapixel 1/1.7 inch CCD sensor, manual controls, shoots RAW files and has a 28-140mm 35 mm equivalent zoom.

If you want to keep it simple and inexpensive, the Canon WP-DC34 is the way to go. This housing shares all the same traits as the Canon WP-DC43 housing for the Canon S100. To go high-end, the Fix Housing for the Canon G12 has the same specs as the Fix for the Canon S100. There is a version of this housing rated to 300ft (100m). The Ikelite housing for the G12 is very similar with the Ikelite housings for the Nikon P7100 and Olympus XZ-1.



Canon PowerShot G12

Strobes

We discussed the Olympus UFL-2 and the Ikelite AF35. The Ikelite DS-51, DS-160 and the DS-161 strobes should be considered when using Ikelite housings for the Canon G12, Olympus XZ-1, and the Nikon P7100. These strobes are available in a kit with Ikelite arms that are compatible with the quick release handle that is included with these housings. All of the strobes could be attached to the housings bulkhead and will provide TTL exposure control.

The DS-160 is a powerful 160-watt seconds strobe, that has a beam angle of 90-degrees without a diffuser. It recycles in 1.5 seconds at full power, and the strobe is powered by a NiMH battery pack that provides 225 flashes per full charge.

In manual mode, the strobe has nine power settings. There is a 5-watt LED aiming light that turns off when the strobe fires. This way, you won't get a hot spot when shooting with a slow shutter speed. The DS-161 has the same features but has a 15-watt LED video light. The LED



Ikelite AF35 strobe for compact cameras

Ikelite DS-51 strobe



fires. The DS-51 has 50-watt seconds and has a beam angle of 70 degrees without a diffuser. It is powered by four AA batteries and recycles in 3.5 seconds at full power. The strobe does not have an aiming light, but it is compact and affordable.



Ikelite DS-161 strobe

The Sea & Sea YS-01 and YS-02 can only be fired with a fiber optic cable. These very compact powerful strobes have a 100-degree beam angle and are powered by four AA batteries. For manual exposure control, there is a dial with ten settings. The YS-01 also has DS-TTL, which mimics the camera's built-in flash; it has a LED aiming light.

Video Lights

Since some point-and-shoot cameras can be used to capture video, many images makers want to add a video light to their rig. The Ikelite Pro-V8 is a compact LED light designed to be used with compact cameras. This light has three 5-watt LED diodes that produce 510

lumens. The light has a 45-degree beam angle and produces 500 lumens of light. This light can also be used as an aiming light and will shut off when the strobe

fires. The light has a 45-degree beam angle.

The Light & Motion 1200 is an excellent to use with a point-shoot camera. This compact, you could next to a strobe with ball clamp. The light wide-angle and spot produces 1200 lumens a built in rechargeable battery. The light has three power settings and has a one-hour run time at full power. ■



Ikelite Pro-V8 LED video light



Sea & Sea YS-01 strobe



Light & Motion Sola 1200 LED video light

Seth Casteel



P O R T F O L I O

Edited by Gunild Symes
All images by Seth Casteel

Move over human divers, you're not the only ones who love to dive. Apparently, divers these days are not just of the hominid kind—American photographer, Seth Casteel, has captured the astounding and often humorous side of our canine companions who love to dive underwater. We caught up with the world famous photographer after some of his underwater dog images went viral and asked him about his unique perspective on man's best friend underwater.

Outer Space, Golden Retriever by Seth Casteel
PREVIOUS PAGE: *Sharing is Caring, Nevada the Border Collie & Bardot the Yellow Lab* by Seth Casteel



Seth Casteel



underwater photography. In 2010, I was photographing a Cavalier King Charles Spaniel named Buster in his backyard. The shoot was meant to be 'on-land', but Buster decided it should be 'in the pool' when he began diving in over and over again after his mini tennis ball. I wondered, "What does he look like under there?" If he never jumped into the pool, I doubt I would have pursued this!

X-RAY MAG: Do you freedive or scuba dive or both with your dogs and why?

SC: I freedive so that I have better mobility. It's necessary for me to move fairly fast through the water to achieve some of the photos, so having heavy scuba gear on me would make it quite difficult.



Sunken Treasure, Bardot the Yellow Lab (above) Haunted Surprise, Buster the Cavalier King Charles Spaniel (right). All images by Seth Casteel

X-RAY MAG: How and why did you get into underwater photography?

SC: I've never really been interested in underwater photography—only animals, especially dogs. And dogs are, in fact, the reason why I began to explore



X-RAY MAG: What inspires you about the underwater world, about dogs underwater?

SC: The underwater world is such a mystery. From the depths of the oceans to just below the surface of your neighbor's swimming pool, there is a hidden world of opportunities. Uniting this world with our best friends is just exhilarating! Water is surprisingly natural for most dogs, and it presents them with opportunities to explore their wild instincts and allow their brilliant range of emotions to shine through. It's also unpredictable. You never know what's going to happen. Unpredictable subjects in unpredictable situations result in super unpredictable moments!

Lulu, a Parson Russell terrier, plays underwater fetch in a Phoenix, Arizona, pool. The quintessential shot required a friendly rapport between dog and photographer, around ten dive attempts, agility underwater and perfect timing. Featured in *National Geographic—Visions of Earth* August 2012





X-RAY MAG: Do you work just in the pool or also in open water, ocean, lakes, etc.?

SC: I've worked mostly in the pool, but have started shooting in salt water and fresh water. One of the photos in [my new] book was shot in the Puget Sound. Super excited about that one!

X-RAY MAG: Do you photograph critters other than dogs underwater?

SC: I have, but I'm definitely most interested in dogs. I think Mermaids would be cool to photograph, if we can find some one day. If not, maybe dogs

dressed up as Mermaids.

X-RAY MAG: What's it like to have dogs as models? What did you do to prepare or approach the shots?

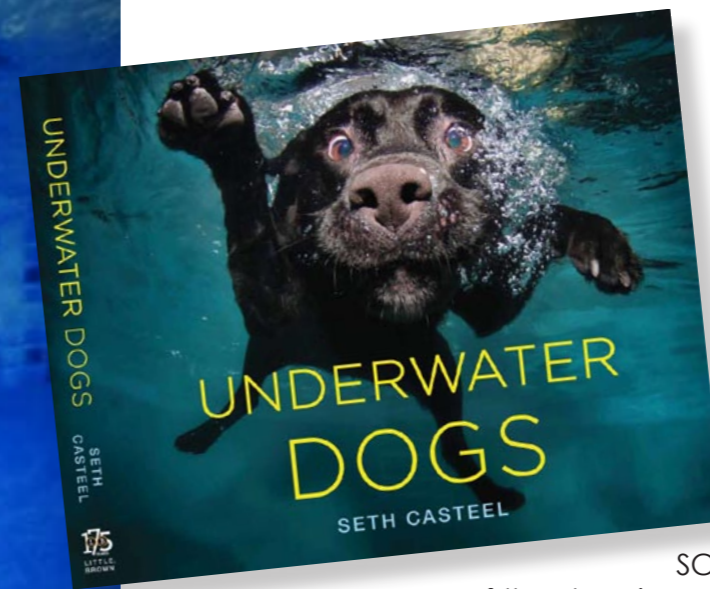
SC: I don't do much to prepare—I like to keep it as spontaneous as possible! Show up. Befriend the dog, earn their trust. Play some games in the pool. Snap some photos. It's really all about the dynamic of the relationship I have with the dog and how interested the dog is in playing games. Some dogs are certainly on-land photo shoot kind-of-dogs, but it's amazing to see how many dogs will dive into the water and

check things out. Many of the dogs I've worked with have never even been swimming before. It's unreal!

X-RAY MAG: Describe your artistic vision or aesthetic approach/philosophy.

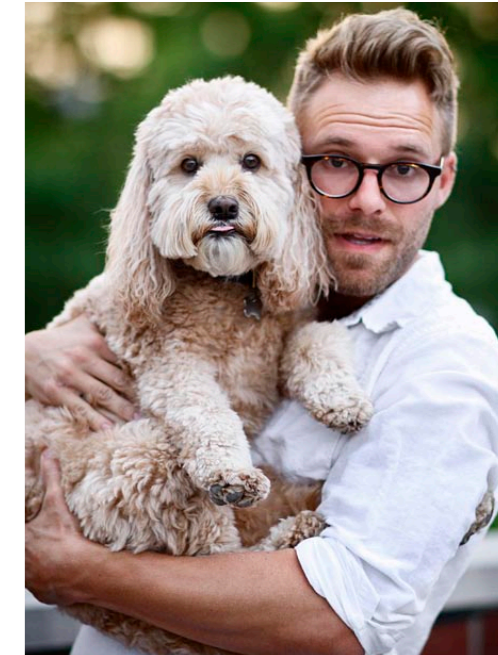
SC: My vision is to showcase the brilliance and complexity of the emotion of dogs. My approach is to embrace the lifestyle of dogs on-location and keep things super positive and fun. I don't shoot in the studio because I personally don't know any dogs that just LOVE to be in a weird, sterile studio environment with strobes flashing off. And I know a lot of dogs.

Paws First, Yellow Labrador Retriever (above); Mr. Beefy, the Olde English Bulldogge (top left). Images by Seth Casteel



Seth Casteel

CLOCKWISE FROM FAR LEFT: *Buster the Cavalier King Charles Spaniel*; Cover of Casteel's new book; Casteel and friend; *Focus, Bardot the Yellow Lab & Nevada the Border Collie* by Seth Casteel



SC: All of the dogs in my book have chosen to go in the water and under the water of their own free will. And they all had fun. The experience has been inspirational for me—to watch a dog that has never been swimming before choose to jump in, retrieve a ball and emerge victorious. Dogs teach us all about life in the strangest of ways. If you just jump in, you might have fun along the way.

For more information, visit Seth Casteel's website and gallery at: www.littlefriendsphoto.com To preorder his new book, *Underwater Dogs*, see: www.amazon.com ■

X-RAY MAG: What underwater equipment and camera gear (any extra staff?) do you use and why?

SC: Canon 7D/fisheye lens with a variety of housings. No extra staff, although I do often collaborate with the dogs' human companions. I love the 7D for the tracking and frame rate. The fisheye lens is [used] to achieve that "Wow, that dog is really close!" effect. Have had good luck with a number of housings—each definitely has its advantages.

X-RAY MAG: Now that you have the underwater gear, what do you want to do with it? What are your future plans for your underwater work?

SC: I'll keep working with dogs in the water, and we'll see where else that takes me! I have some other ideas...

X-RAY MAG: Tell us about your background that led you to photography and to your work underwater.

SC: I got started in photographing dogs through volunteer work at Los Angeles animal shelters. I snapped improved photos to help increase adoption rates. One thing led to another, and all of the sudden I had a career! Helping animals in need is still a big part of my photography—I started a non-profit called SecondChancePhotos.org. Definitely check it out—one photo can save a life!

X-RAY MAG: Tell us about your new book and what divers might like about it.

SC: The book is called, *Underwater Dogs*, with a release date of October 23. It features dozens of never-before-seen underwater photos starring new 'underwater models'. A Pug. Twelve-week-old puppies. A Wolf. That's just the beginning. Divers appreciate the hidden world underwater and the various surprises that present themselves. Every page in this book offers just that!

X-RAY MAG: What else would you like our readers to know about you and your work/adventures underwater?

