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July 2017
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NORTHERN PRIMORYE
East Sea

COVER PHOTO BY ANDREY SHPATAK

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photo by Andrey Shpatak

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Photo by: Brandi Mueller

Plastic is fantastic — just not in our oceans

It remains etched in my memory. In my early diving days, I found myself driving south through the desert on the coastal road that runs along the western seaboard of the Red Sea. Between the towns of Hurgada and Safaga, Quesir and Marsa Alam, there was just nothing out there but rows and rows of vast sand dunes on the right, with the craggy outline of a mountain range on the misty horizon; and on the left, there was the glistening blue sea, ever so beckoning.

Well almost nothing. Everywhere I looked, there were tufts of plastic bags—mostly the ubiquitous, opaque shopping bags handed out in grocery stores—sticking out of the sand, as well as many discarded clear, plastic water bottles. Plastic was present, mile and after mile, along the roads and out into the desert, as far as I could see—and probably beyond—apparently driven by the wind from faraway towns. Plastic waste was everywhere.

I recall that I pondered for awhile what it would take to pick up all this plastic trash, to make the landscape pristine again. But the enormity of such a task made me painfully aware that it was not an easy fix—to rectify what had first been shattered.

Plastic in the sea

Now, we have plastic in all our oceans too—a much larger problem on our hands. Plastic waste drifts ashore on beaches close to home and remote islands and Antarctica alike. Bags, bottles, six-

pack rings, strings, flip-flops, toys... You name it, it's out there—driven together by ocean currents into huge islands of garbage, floating in the middle of our oceans. Birds and marine mammals get ensnared, turtles mistake floating plastic bags for jellyfish and ingest them, and whales and sharks are found with bellies full of rubbish.

As plastic debris gets ground up into still smaller particles, it gets ingested and incorporated into organisms as small as plankton, whereby it enters the food chain and the food we consume—and that is just what the big bits cause.

Microplastic

A reader (thanks, Chris Ward) recently provided us with some background on microbead pollution. Microbeads are small solid plastic particles often made from polyethylene. Microbeads are used in cosmetics and personal care products including toothpaste. Being tiny particles, these microbeads, once they are washed out into the oceans, present a real danger to fish and shellfish, which mistake them for food. According to the sources provided, it is estimated that a total of 15 trillion to 51 trillion microplastic particles have accumulated in the oceans.

Microplastics, just from cosmetics alone, make up 4% of the plastic found in the ocean.

What you can do

There is probably little one person can do about the plastic already drifting about the oceans, but

we each can do our part in preventing more plastic from being washed out to sea, and support multi-national efforts to clean-up and prevent plastic pollution.

At our headquarters and residential complex, we sort our trash into various bins for recycling; refuse collection is fairly effective; and recycling has become a rather advanced sector. I trust that close to no plastic escapes into the waterways. However, it is quite evident that other countries still have some way to go.

As for the small stuff, such as microbeads, we consumers have

a lot of leverage. We can just stop buying products that harm our environment (or our health, for that matter), and let suppliers and stores know that we demand change. Consumer numbers count. In our local supermarket, the organic produce—which, not too long ago, was tucked away in an obscure corner—now takes up the main section.

Shopping responsibly has become the right thing to do. Let's keep that good trend going.

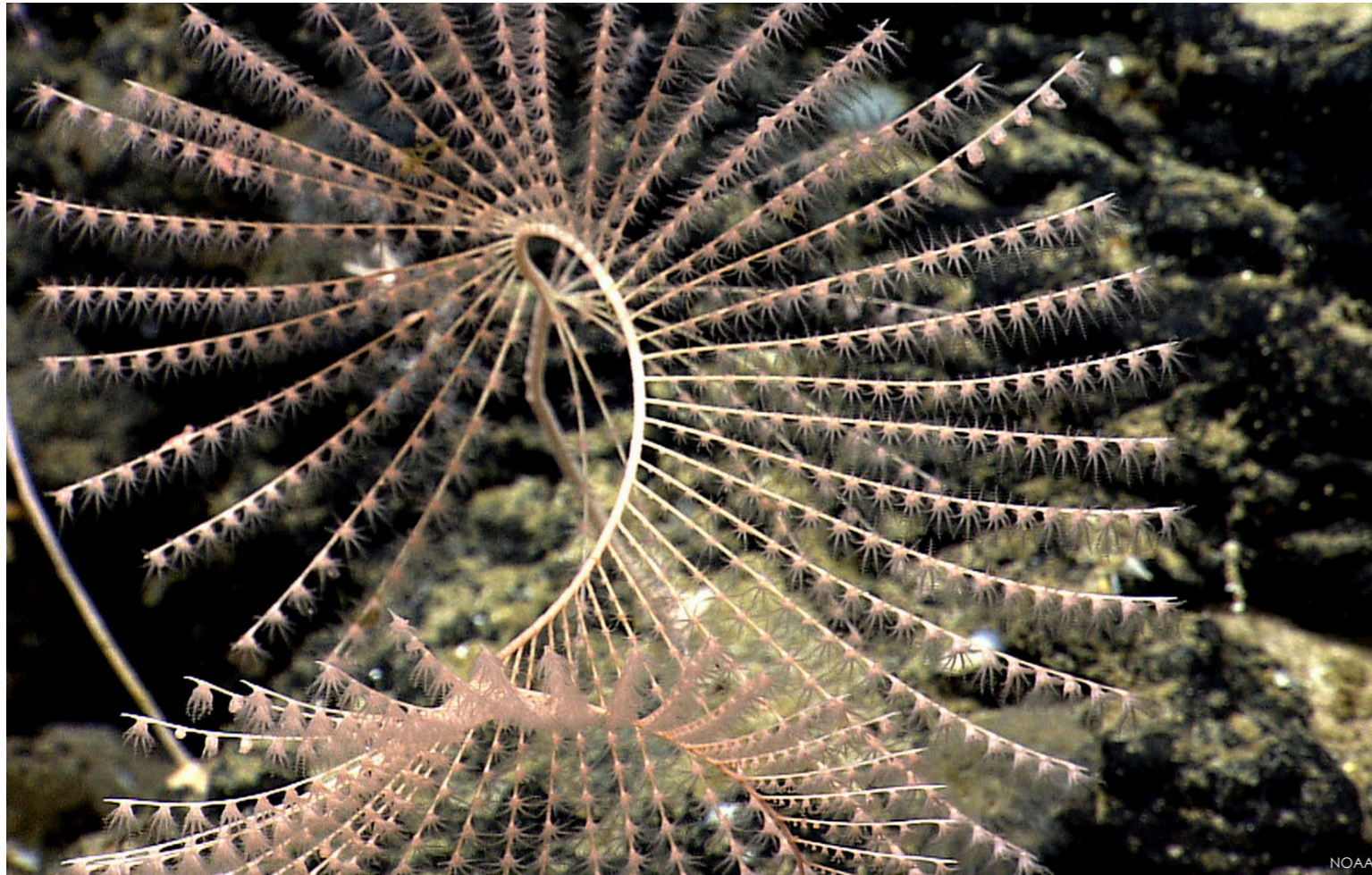
— Peter Symes,
Publisher and
Editor-in-Chief





News edited
by Catherine GS Lim

from the deep
NEWS



NOAA

Deep-sea spiral coral on the New England Seamount chain in the North Atlantic Ocean

New MPAs shoot up

The oceans have come under increasing threat from many different angles, but some governments have recently put in place legislation to protect them from the many threats that abound.

For instance, in Canada, the federal government has committed to protecting five percent of marine and coastal areas by 2017, and 10 percent by 2020.

"Contributing" 0.08 percent to the five percent target is St. Anns Bank in Nova Scotia, which became the province's largest Marine Protected Area (MPA) in June 2017.

This area is one of the world's most important feeding grounds for leatherback sea turtles. Activities like offshore mining and drilling, commercial fishing and bottom-trawling are forbidden in the 4,364 sq km area.

In addition, another area slated for conservation is an area roughly 150km west of Vancouver Island, spanning about 140,000 sq km. The Department of Fisheries and Oceans named it an Area of Interest with the intention of making it a MPA by 2020.

In a statement, Minister of Fisheries and Oceans Dominic LeBlanc said, "Our government is pleased to continue our work on protecting our oceans with the identification of a new large Area of Interest in the Pacific Ocean that recognizes the unique marine ecosystems that need to be protected in order to ensure the health of our environment, our communities and Canada's fishing industry."

Deepsea corals

In the United States, a federal panel voted in June 2017 to protect some deep-sea corals in the Atlantic Ocean. The proposals by the New England Fishery

Management Council focus on two areas in the Gulf of Maine—Outer Schoodic Ridge and Mt. Desert Rock—where some species of slow-growing corals are found. Covering a total of almost 40 sq mi, they would nevertheless remain open to lobster fishing. Bottom trawling, however, would not be allowed.

According to John Bullard, a regional administrator for the National Marine Fisheries Service and a member of the fishery council, "The goal is to protect as much coral as you can while minimizing impact on various industries that are fishing near the corals."

As commendable as these conservation efforts are, a balance would need to be struck with other parties that have opposing but equally valid viewpoints.

British Columbia

In the case of the proposed 140,000 sq km MPA off Vancouver Island, Veronika Brzeski, executive director of the Cape Breton Fish Harvesters Association, said that the new boundaries will mean a loss of about 15 percent of one of the region's groundfish harvesting areas: "That's a huge chunk. It's going to be difficult for fishermen to find adequate grounds outside of it." ■

SOURCE: NOAA, DEPARTMENT OF FISHERIES AND OCEANS (CANADA)

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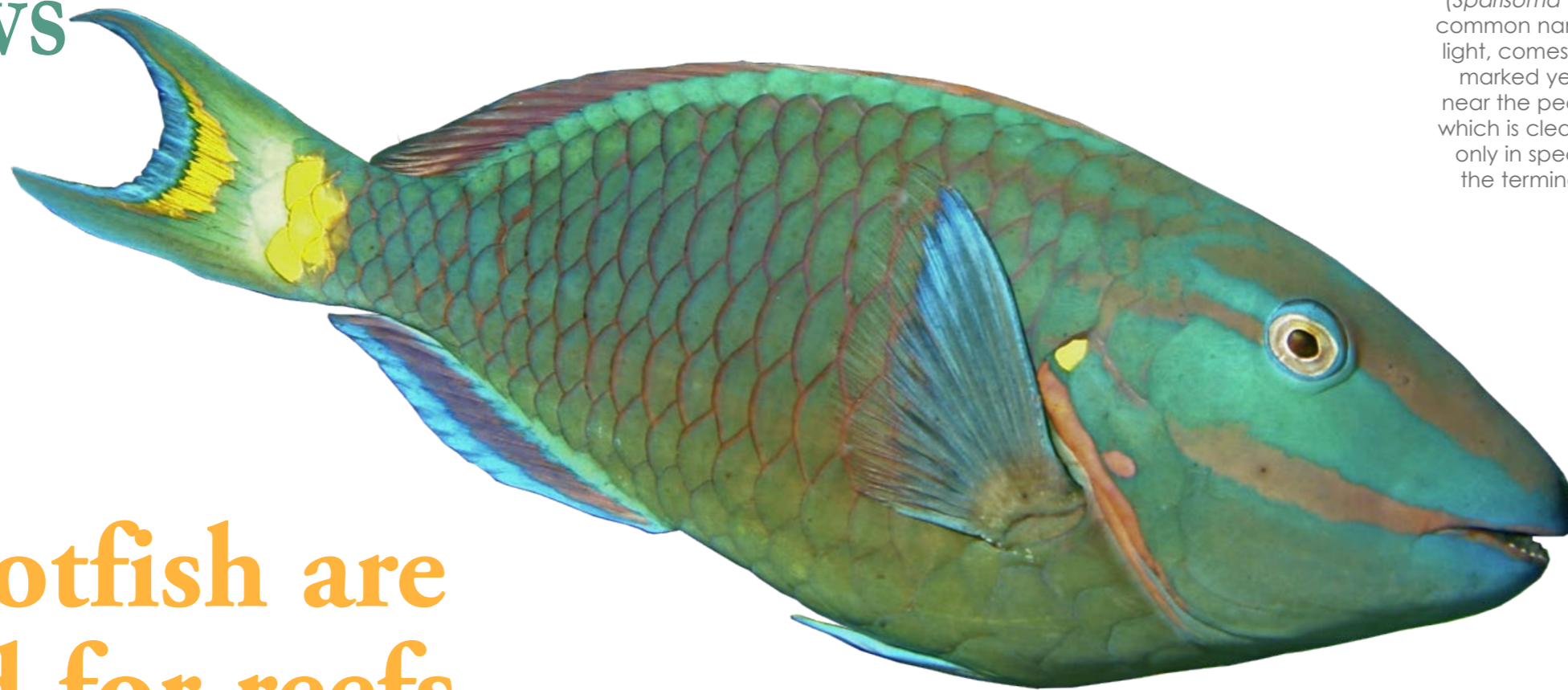
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Photo: Alex Dawson



Stoplight parrotfish (*Sparisoma viride*). Its common name, stoplight, comes from the marked yellow spot near the pectoral fin, which is clearly visible only in specimens in the terminal phase.

Parrotfish are good for reefs

Researchers have discovered that coral reefs grow faster if there are more parrotfish around, according to a study published in *Nature Communications*.

Most parrotfish are herbivores and are named for the dentition where their teeth are tightly packed to form a beak-like structure with which they rasp algae from coral and other hard substrates.

Fossil record

By analyzing fossilized parrotfish teeth and sea urchin spines from the past 3,000 years, researchers at the Scripps Institution of Oceanography at the University of California San

Diego have found out that the presence of parrotfish—and other herbivorous fish—at a reef encourages it to grow faster.

The research team, Katie Cramer and Richard Norris, had sought to find out the reason why coral reefs across the Caribbean have developed from being coral-dominated to being reef-dominated in recent years.

“Our reconstruction of past and present reefs from fossils demonstrates that when overfishing wipes out parrotfish, reef health declines,” said lead author Cramer, a postdoctoral researcher at Scripps.

This is because parrotfish—and other herbivorous fish—consume the algae that compete with corals. Unfortunately, overfishing has resulted in a decline in the quantity of parrotfish over the years.

Parrotfish more important than urchins

For the research, the team extracted sediment cores from three reef sites offshore of Bocas del Toro, Panama. They wanted to find out the original state of the reefs before the start of extensive fishing and land-clearing activities, and to assess the role these activities had in recent reef declines.

Based on their research, they discovered that the abundance of parrotfish, and not sea urchins, had a positive and important role in coral health. “Using the fossil record to analyze the natural state of reefs before human disturbance, we have conclu-

sively shown that if we want to protect corals, we have to protect the parrotfish from overfishing,” said Cramer.

The authors of the paper concluded that “these results confirm the critical role of parrotfish in maintaining coral-dominated reef habitat and the urgent need for restoration of parrotfish populations to enable reef persistence.”



Beach builders

Their pharyngeal teeth grind up the coral and coralline algae the fish ingest during feeding. After they digest the edible portions from the rock, they excrete it as sand. The green humphead parrotfish can produce 90kg (200lb) of sand each year. ■ SOURCE: SCRIPPS INSTITUTION OF OCEANOGRAPHY

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Edited by
Peter Symes

Wreck of the B-17F "Black Jack" off Cape Vogel in Papua New Guinea

Text and photos by Don Silcock

World War II came to the Australian territory of Papua New Guinea in January 1942 when the Imperial Japanese Army invaded Rabaul in New Britain, followed shortly after by the taking of Kavieng in New Ireland. The invasion turned Papua New Guinea into a major theatre of war in the battle for the Pacific, and there were many brutal encounters between the invading Japanese and the defending Allied forces.

Conditions were often appalling and the fighting was incredibly fierce, with many young lives lost on both sides. To this day, relics of those battles are part of the fabric of Papua New Guinea.

World War II was the first time that air power played a major role in combat and both sides had some formidable aircraft in action during what is now referred to as

the New Guinea Campaign. War is of course deadly by nature, but for the pilots and crew of those aircraft, the rate of attrition was particularly high, with many of them shot out of the sky. Some aircraft suffered mechanical failures, while others just got lost and simply ran out of fuel.

The majority of those planes have never been found because

they came down in remote jungle locations or far out at sea. However, some aircraft wrecks have been found. Each one has a special story. Of these, the underwater aircraft wrecks of Papua New Guinea offer us divers a unique insight into those heroic tales.

B-17F Black Jack

Lying undisturbed in the deep wa-

ter, just off the fringing reef from the remote village of Boga Boga on the tip of Cape Vogel, is what many consider to be the best aircraft wreck in Papua New Guinea and possibly the world. The wreck is the B-17F "Black Jack", serial number 41-24521. It was one of the first Flying Fortress bombers built at the Boeing factory in Seattle during WWII, which takes its

name from the last two digits of its serial number—a jack and an ace is a "blackjack hand" of 21 in the card game of Pontoon.

Black Jack's final flight was on 10 July 1943, when it left 7-Mile Airdrome in Port Moresby just before midnight, on a mission to bomb the heavily fortified Japanese airfields at Rabaul in New Britain. The flight was a troubled

one, soon after take-off, as both of the right wing engines developed problems during the flight over the Owen Stanley range and onwards to New Britain. However, the pilot, Ralph De Loach, and his crew of nine managed to reach Rabaul and successfully deliver their bombs on target.

De Loach turned the plane around to return to Port Moresby.



Aircraft Wrecks *Of Papua New Guinea*



Historical photo of Boeing B-17E Flying Fortress, c. 1942 (left); Wreck of the B-17F "Black Jack" (far left)

PNG



US AIR FORCE / WIKIMEDIA COMMONS / PUBLIC DOMAIN

which had remained undisturbed for nearly 60 years.

William was freediving for sea cucumbers when he noticed what seemed to be a large shadow on the seabed. Like many people in Papua New Guinea, he was very superstitious and thought that he was looking at a ghost lying face-up, with its arms outstretched, soaking up the sun. Terrified, he shot to the surface and the relative safety of his canoe, eventually summoning up enough courage to go back down to take a closer look—realizing that it was the wreck of a plane rather than some demon of the deep.

Kimbe Bay's Zero wreck

As the story is told around the bar at Walindi Resort, the day the Zero was found by local villager William Nui, was not long after a small plane had crashed on take-off

from Hoskins Airport in Kimbe Bay. So, when William saw a plane laying on the sandy sea floor, he thought he had found the wreckage of the recent crash—not that of a WWII Japanese fighter plane,

But on the way back, it ran into a violent storm on approach to the coast of New Guinea to the northwest of Cape Nelson, a situation the pilot later described as "the blackest of black nights... the worst flying weather I'd ever seen in my life".

Running low on fuel, and with two engines malfunctioning badly, De Loach decided against trying to get over the Owen Stanley Range to reach Port Moresby and turned Black Jack southeast towards Milne Bay, but was forced to ditch the plane at Boga Boga. The crew survived the crash landing and managed to scramble out of the plane before it sank down to the sandy seabed some 50m below, where it lay largely forgotten for another 43 years.

The discovery of Black Jack reads like something out of an adventure novel, with three Australians—Rod Pierce, Bruce Johnson and David Pennefather—stumbling on the wreck, almost by accident, in late December 1986, while searching for a completely different wreck. The villagers at

Boga Boga had told Pennefather that a plane had crashed near their reef in WWII and he believed it might be the Australian Beaufort A9, which had crash-landed off Cape Vogel in November 1942. Pierce, Johnson and Pennefather organized an exploration trip on Rod Pierce's liveaboard diveboat, *MV Barbarian*, to search for the wreck.

Pearce found the wreck when he spotted the large tail-plane, as he made his way along the edge of the fringing reef at Boga Boga. As someone who had dedicated his life to wreck diving, it must have been like finding the Holy Grail. Over the next few days, they dived the wreck as much as its depth of nearly 50m would allow, entering the inside of the plane and finding the Radio Call Plate with the 24521 serial number on

it, which later allowed them to positively identify it as the famous Black Jack.

Diving the Black Jack is a unique experience, as the plane is so intact. Sitting as it does on a sandy seabed in clear blue waters with visibility that can easily reach 40m, it is almost like a set from a Hollywood movie! The nose is badly crumpled from the impact of the crash landing and the propellers on the four engines are somewhat twisted, but the rest of the plane is all there. It is quite a remarkable sight after 73 years underwater.



US NAVY / WIKIMEDIA COMMONS / PUBLIC DOMAIN

Japanese Navy Mitsubishi A6M2 "Zero" fighter, 1941



Wreck of Japanese Navy Mitsubishi "Zero" fighter in Kimbe Bay





Wreck of Japanese Navy Mitsubishi "Zero" fighter (left and below)

who saw the plane come down helped him ashore and took him to the nearby village of Talasea.

What happened after that remains a mystery, but one theory is that losing a plane due to navigational errors would have been a very significant loss of honor, and Honda, unable to deal with such a loss of face, spent the rest of his life in the jungles of New Britain. An alternative but slightly more gruesome notion (which is very popular around the bar at Walindi) is that he ended up as the main course of a ceremonial feast for a head-hunting tribe—a practice still common in those days.

New Ireland's "Deep Pete"

While Rabaul was Japan's main base along the southern rim of the Pacific, Kavieng in nearby New Ireland also played a significant role in the grand Japanese plan for control of New Guinea, together with the isolation and possible invasion of Australia to the south. Kavieng's strategic location to the north of Rabaul meant that it could be used to protect both Rabaul and the Japanese supply convoys coming down to New Guinea from Japan and the huge Imperial Navy base at Truk Lagoon in the central Pacific.

At Kavieng, the Japanese sig-

nificantly expanded the original Australian-built airfield and set up a sea-plane base, which, when the tide of war turned, became an important target for the Allied forces. There are more known aircraft wrecks around Kavieng than anywhere else in Papua New Guinea, and my personal favorite is the "Deep Pete" because I think it is the most photogenic.

The plane is a Mitsubishi F1M float-plane, which was designed and built to be launched by catapult from battleships, cruisers and aircraft tenders and used for reconnaissance missions. However, it also saw service as an impromptu

William took his story to the local authorities and word of the discovery made it to Max Benjamin, the owner of Walindi Plantation Dive Resort, who although somewhat doubtful about its veracity, felt that it should be checked out. What Max found was a WWII Mitsubishi Zero in quite remarkable condition despite its six decades underwater.

There were no signs of bullet holes or combat damage to indicate that the plane had been shot down, rather the "off" position of the throttle lever and the pitch control set to reduce air speed clearly pointed to a controlled crash landing. In all probability, the pilot had got lost and ran out of fuel—a relatively common occurrence during the New Guinea campaign and confirmed by Japanese records showing that, in 1942, only 10 Zero pilots were shot down in air combat, but



16 had disappeared due to "unknown causes".

The aircraft's serial number and date were still visible on the wreck, and military records show that the plane went missing during

the battle of Cape Gloucester on West New Britain on 26 December 1944. The pilot on that day was Tomiharu Honda, but his fate remains a mystery, although a local story suggests that some locals



"Deep Pete," wreck of the Japanese Mitsubishi "Pete" floatplane in Kavieng, New Ireland



Historical photo of a Royal Australian Air Force PBV Catalina from 1944; Historical photo of Japanese Mitsubishi F1M1 "Pete" floatplane (lower right)



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fighter, dive bomber and patrol aircraft. The Mitsubishi F1M was a biplane, with a single large central float and stabilizing floats at each end of the lower wing. Early versions suffered from poor directional stability in flight, and were prone to "porpoise" when on the water, which may explain why the wreck is actually there.

The name "Pete" comes from the way the Allied Forces identified enemy aircraft during WWII, as the actual Japanese naming convention was difficult to understand and pronounce. Plus, there were two names for each aircraft—with one

being the manufacturer's alphanumeric project code and the other the official military designation.

So, the Allies used code-names instead: Men's names were given to fighter aircraft; women's names to bombers and transport planes; bird names to gliders; and tree names to trainer aircraft.

The wreck of the Pete float-plane is located on the western side of Nusa Lik (small Nusa) Island, which, along with Big Nusa Island, provides the shelter for Kavieng's harbor. The wreck lies on its back, with the remains of its main float

sticking up, on flat white sand in 40m of water—hence the name "Deep Pete". As it is on the Pacific Ocean side of Kavieng, diving it on an incoming tide means that the visibility is often exceptional and usually in excess of 30m.

Although its tail is broken, its biplane shape is remarkably intact, given the relatively lightweight and fragile nature of the aircraft. What makes the Deep Pete so photogenic is the resident school of yellow sweetlips that stream in and around the wings, as well as the batfish and barracuda, which patrol in the clear blue waters above the wreck. At just 31ft long, with a wingspan of 36ft, Deep Pete is not a big wreck, but given its depth of 40m and the square profile of the dive, there is rarely enough time to fully explore it, and at least two dives are required to fully appreciate and photograph it.

New Ireland's Catalina wreck

The wreck of the Royal Australian Air Force (RAAF) PBV Catalina A24-11 rests in 20m near the entrance to Kavieng's



Wreck of a Royal Australian Air Force PBV Catalina near the mouth of the harbor in Kavieng

harbor. The Catalina flying boat was developed by the US Navy in the 1930s as a long range patrol bomber. Although slow and somewhat ungainly, the Catalina flying boats served with distinction during WWII, both in the role for which they were designed, and as a very effective way of rescuing downed airmen. Their ability to land on water meant that they could be used to quickly and effectively rescue crews that had gone down in the Pacific. They are credited with saving the lives of thousands of Allied aircrews.

PBV A24-11 had taken off from Rabaul with six other RAAF Catalinas on a mission to attack the Japanese base at Truk Lagoon and had landed at Kavieng to take on fuel before heading north in to the Pacific. After refueling at Nusa Island, the Catalinas took off again one by one, but disaster struck when it was the turn of A24-11, as one of its wing bombs was hit by sea-swell causing it to explode. The force of the explosion

killed the crew instantly and sent what was left of the Catalina to the bottom of the harbor entrance, where it lay until 2000, when Rod Pierce found the wreckage.

The engines are what makes the Catalina wreck special, as they stand proud on the seabed, surrounded by those parts of the plane that were not obliterated in the explosion. Whenever I dive the Catalina, my thoughts always return to the brave crew suspended in the flimsy fuselage below those massive engines. Like all the crews of the aircraft wrecks of Papua New Guinea, they were simply doing their duty to their country. Some lived to tell the tale, but many did not, and the aircraft wrecks of Papua New Guinea are poignant reminders of the sacrifices these servicemen made. ■

Based in Bali, Indonesia, Don Silcock is the Asia correspondent for X-Ray Mag. Check out his website Indopacificimages.com for the extensive location guides, articles and images on the diving in Papua New Guinea and other diving locations in the Indo-Pacific region.

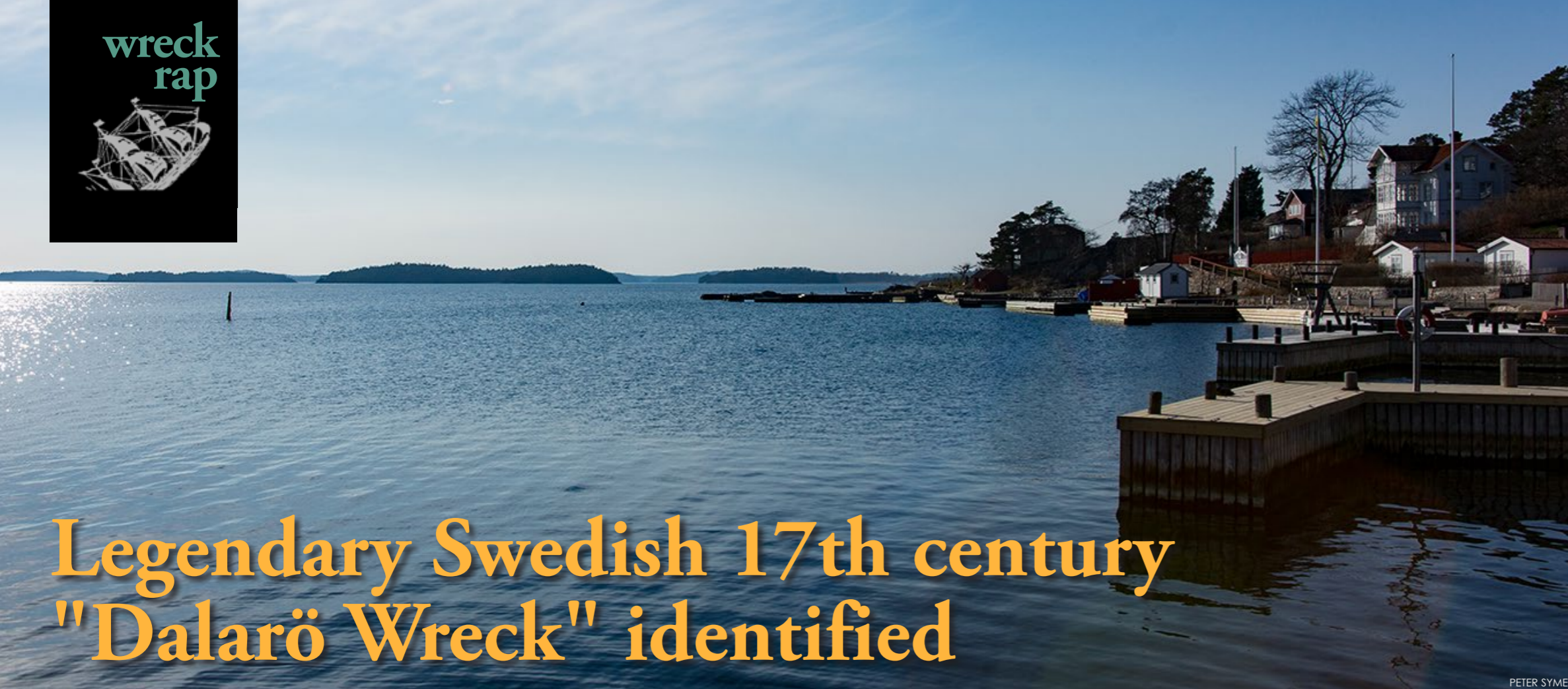


"Deep Pete," wreck of the Japanese Mitsubishi "Pete" floatplane in Kavieng, New Ireland



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Legendary Swedish 17th century "Dalarö Wreck" identified

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The Dalarö Wreck has been identified in documentary sources as the small Swedish naval vessel *Bodekull*, which sank in 1678 during the Scanian War, Swedish archaeologists announced.

The wreck was discovered in 2003 north of Dalarö in the Stockholm Archipelago. Artefacts indicated that the ship sank during the mid or later half of the 17th century.

Largely intact

With a coherent hull, intact deck and two masts still standing, the wreck is one of the best preserved 17th century ships in the world. Even if it is a small vessel, it has many details in common with large sailing warships, such as gun ports along the sides and a lion figurehead. Despite the massive attention the wreck has achieved

from researchers, media and others, the original identity of the wreck has remained an open question until now.

The answer was found by Niklas Eriksson, postdoctor at the Centre for Maritime Studies and the Department of Archaeology and Classical Studies. In the preserved minutes and letters of the Swedish Admiralty kept in the Military Archives. In 1659, Karl X Gustav ordered a number of small vessels to

be used for transport of horses and soldiers in his war against Denmark. After the unpredicted death of the king, the campaign against Denmark was cancelled and the unfinished ships ordered before his death were rebuilt in different ways.

One of these was *Bodekull*, which was built under supervision of the newly recruited English Master Shipwright Thomas Day between 1659 and 1661. As the design was changed during construction, several unique details that are also visible on the wreck, are mentioned in the preserved correspondence between the shipyard and the Admiralty.

Another war

In 1675, the war with Denmark broke out again. During the fall of 1678, the Swedish

fleet sought winter quarters just north of Kalmar instead of returning to Stockholm in order to take advantage of the earlier ice-break in the southern harbour. *Bodekull* was sent to grind cereals at a mill along the coast under the command of Olof Styff. Despite his instructions, he sailed to Fagerholmen in the Stockholm archipelago. On its way back, the ship hit a rock and sank. Twenty barrels of water soaked flour was sent to Stockholm. The story of *Bodekull's* foundering was written down in the documents thanks to the extensive discussions within the Admiralty on how to make bread out of the soaked flour.

The opportunity to study *Bodekull* through both material remains at the seabed and written documents in archives provides a unique opportunity to reveal previously unexplored aspects of the everyday activities of the navy as well as the crew's everyday life onboard. ■ SOURCE: SWEDEN'S NATIONAL MARITIME MUSEUMS



PHOTO COURTESY OF SWEDEN'S NATIONAL MARITIME MUSEUMS

Artefacts (above) on Dalarö wreck site (top left)

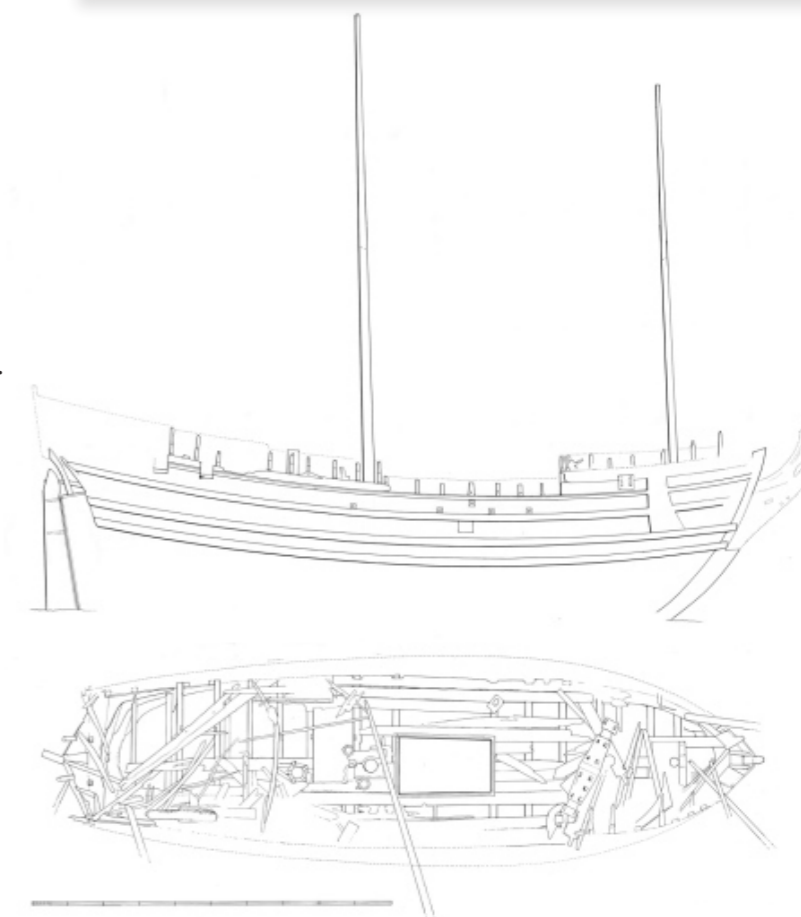


Illustration of Dalarö wreck site

ILLUSTRATION COURTESY OF SWEDEN'S NATIONAL MARITIME MUSEUMS





Historical photo of HMAS *Perth*



ROYAL AUSTRALIAN NAVY

Illegal salvage strip 60 percent of Australian wartime wreck HMAS *Perth*

On May 14 to 17, divers to the World War II wreck HMAS *Perth* made the shocking discovery that as much as 60 percent of the wreck was missing.

"The research team has found evidence of large-scale salvage on the site, including what appears to be recent removal of material from the wreck," said Kevin Sumption, Director of the Australian National Maritime Museum (ANMM).

It is believed that the wreck had been pillaged illegally for scrap metal. The magnitude of the loot-

ing was indicative of a large-scale commercial salvage operation.

Scrap metal from naval shipwrecks have a very high resale value. For instance, the phosphor bronze from the propellers is valued at about \$4,000 per tonne.

The HMAS *Perth* had sank off the coast of Java as a result of Japanese torpedo strikes in 1942. More than 350 navy personnel and civilians perished. Frank McGovern, one of the survivors still alive, said, "That's sad news all right." He added that he hoped the wreck could be declared a war grave.

Sumption gave the assurance that the ANMM was committed to working with the National Research Centre of Archeology

Indonesia (ARKENAS) to safeguard whatever was left of the wreck.

"As the site lies in Indonesian territorial waters, it is important that we continue to work in close partnership with our Indonesian colleagues," he said.

On their part, ARKENAS director, I Made Geria, assured that they would continue with efforts to obtain formal protection for the site.

The HMAS *Perth* is not the only shipwreck around Indonesia that have been pillaged. In 2016, three Dutch naval wrecks that sank in 1942 during the Battle of the Java Sea had completely vanished as a result of illegal salvage operations.

■ SOURCE: PS WORLD NEWS, SYDNEY MORNING HERALD



Century-old US Coast Guard cutter wreck discovered

Strong currents and thick sediment means USCGC *McCulloch* wreck to remain where it is.

In October 2016, a gathering of fish was the clue that suggested that the joint hydrographic survey off the Southern Californian coast might turn out to be more interesting than usual. This was because the unexpected congregation suggested the presence of a shipwreck.

Further investigations conducted via a remotely operated vehicle (ROV) revealed that the wreck was that of the USCGC *McCulloch*, which sank at the Point of Conception, 5km off the coast of Southern California.

History

Built in 1896, the ship was the largest cutter vessel at the time. The following year, it was drafted to serve under Commodore George Dewey in the Spanish-American War.

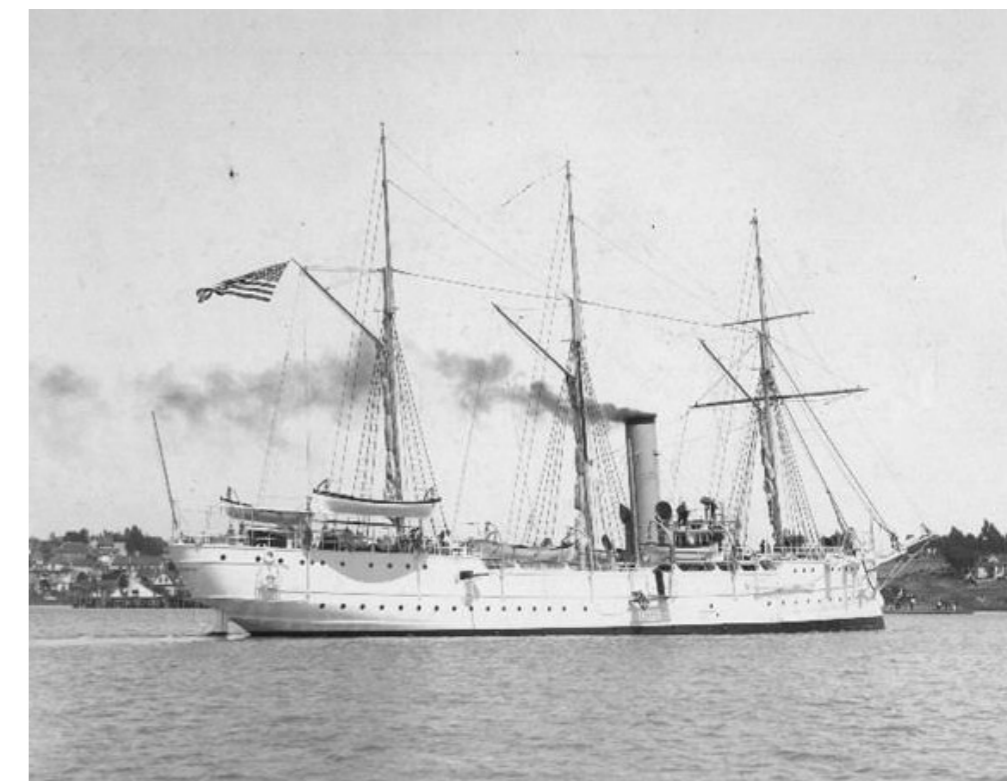
Then, in the early morning of 13 June 1917, the vessel collided with a civilian steamship and sank within 35 minutes.

Discovery

In June 2017, the US Coast Guard announced the discovery of the shipwreck. They also mentioned

their intention not to raise or salvage the wreck as the strong currents and thick sediment that had accumulated after a century would have made such efforts extremely difficult. ■

SOURCE: SCIENCE TIMES, WASHINGTON POST, WIKIMEDIA



Historical photo of USCGC *McCulloch*

US NAVY



PAULALLEN.COM

Italian naval ship discovered 77 years after it sank

A dive team led by Microsoft co-founder Paul G. Allen has discovered the Italian naval ship *Artigliere*, during an expedition in the Mediterranean Sea earlier this year.

The *Artigliere* was found along the Sicily-Malta escarpment in the Mediterranean Sea under about 3.66km of water in March 2017. The discovery was made by a dive team led by Microsoft co-founder Paul G. Allen.

The identity of the wreck was verified by video and photographic documentation, as well as the letters "AR"

WIKIMEDIA COMMONS



Historical photo of the Italian destroyer *Artigliere*

on the hull.

"The *Artigliere* is in amazingly good condition other than the fact she was sunk in a war," said David Reams, Senior Director for Allen's maritime operations.

"She's upright and easy to identify. At 3,700 meters down, the water is very cold and has little oxygen so there was

very little corrosion or encrustation."

The *Artigliere* was a Soldati-class destroyer that perished on 12 October 1940 after being damaged by forces from the



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Scenes from the wreck site of the *Artigliere* (above and top left)

British Navy in the Battle of Cape Passero.

The Italian government was notified of the



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discovery in April 2017. The precise location of the wreck was not disclosed to the public in respect of the victims and their family members. ■ SOURCE: FOX NEWS, PAULALLEN.COM

Edited by Peter Symes



PETER SYMES

Putting a stop to shrinking legroom

In recent years, airline seats have crept closer and grown narrower. This does not bode well for passengers—particularly those on long-haul economy flights—who have to contend with spending xx hours in cramped conditions.

As a result, congressmen Steve Cohen, democratic representative from Tennessee, and Adam Kinzinger, republican representative from Illinois proposed that the Federal Aviation Administration (FAA) introduce legislation to determine the minimum size that airlines have to provide.

"I am pleased the House Transportation and Infrastructure Committee recognized the serious safety and health concerns of shrinking airplane seats and passed this

amendment to determine how small is too small," said Cohen.

This proposal actually came hot on the tailcoats of a plan by American Airlines to have tighter space in the coach-class seats of their upcoming Boeing 737 MAX planes. Feedback from customers and team members subsequently led the company to drop the plan.

The distance between rows of seats—known as pitch—has dropped from 35 inches in the 1970s to about 31 inches today. The average width of seats has also been reduced, from 18 to 16.5 inches.

Apart from the obvious discomfort for passengers, shrinking legroom also gives rise to the risk of deep-vein thrombosis. In addition, Cohen raise some more concerns: "Emergency evacuation is a serious issue, as is the potential for air rage as tensions mount inside more tightly packed cabins." ■

IATA Guidelines on lithium batteries

Lithium batteries are found in practically all households, and they are used on many modern consumer goods, from toys, watches, mobile phones, and laptops to e-bikes and cars.

As ubiquitous as they appear, many people do not realize that these batteries need to be properly packed when air travelers bring them along.

The International Air Transport Association (IATA) has issued guidelines for passengers to follow so that they comply with safety and transport regulations.

Whether or not lithium batteries can be carried on board a plane depends on their configuration, and their Watt-hour (Wh) rating or Lithium Content (LC), for rechargeable and non-rechargeable batteries respectively.

For instance, batteries that are already installed in equipment can be placed both in the carry-on and checked baggage.

Spare batteries can be carried in the carry-on baggage (subject to a maximum of two batteries for those with capacities of >100 to ≤160Wh). They cannot be placed in the checked baggage. ■



More details can be found at: iata.org

KRZYSZTOF WOJNICA / WIKIMEDIA COMMONS / PUBLIC DOMAIN

JetBlue tests facial recognition for boarding

In June 2017, some JetBlue passengers opted to have their photos taken before they boarded their flight.

They were trying out the airline's new method of boarding, which uses facial recognition instead of a boarding pass to verify the passenger's identity.

Currently available only on flights from Boston to Aruba, passengers simply stepped up to a camera to have their photo taken. Once their identity is veri-

fied with the US Customs and Border Protection (CBP), they can proceed to board the plane.

"You will not need to take your passport out when you



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board a flight at the gate because your face will be essentially your boarding pass," said Joanna Geraghty, JetBlue's VP of customer experience.

As the entire process takes just five to six seconds, the airline believes

that it will score points in the area of customer satisfaction.

"The endgame is that, you know, in a few years time, you'll be able to go through the airport basically just using your face," said Sean Farrell, portfolio director for government solutions at SITA, the technology company that's running the experiment.

"If you have bags to drop off, you'll be able to use the self-service system and just have your face captured and matched. You'll then go to security, the same thing. And then you go to the boarding gate, and again just use your biometric," he added. ■

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Northern Primorye

Diving Russia's East Sea

Text by Andrey Bizyukin
Photos by Andrey
Shpatak



View of Rudnaya Bay, Primorye, Russia (above); *Janolus fuscus* nudibranch (right)

With sanctions in recent years placed on Russia by Western governments, divers, once used to traveling abroad to exotic dive destinations, turned to their own country for inspiration. In doing this, Andrey Bizyukin discovered a diving paradise practically in his own backyard.

What can a diver in Russia do in the era of Western sanctions? I thought about heading east, when rapturous tales told by divers in the '70s and '80s sprung to mind. Back then, divers who had traveled there told me about the amazing, wonderful underwater world of the Pacific Coast of Russia. It was then, after having traveled around half the world and nearly becoming bored of exotic wanderings, that I realized

that I did not know much about the underwater world of the far eastern end of my own country.

This area is called the Primorye province. It is huge and diverse in natural and climatic conditions. To choose the exact place to go in this vast territory, my dive buddy and I decided to re-read the classical books about places in the Far East written by the famous Russian explorer, Vladimir Arsenyev. I started with *Dersu Uzala* and immediately felt an uncontrollable desire to go the same way as the famous traveler to discover the modern Far East, to walk and drive to the places described in the book, to cross the Sikhote-Alin mountain range, head down to the city of Dalnegorsk and visit Tetyukhe (Ore Pier) in the East Sea Bay.

Getting there

We decided that we really wanted to dive this new destination! We began to plan the route. We got plane tickets to



Vladivostok, the eastern capital of Russia, with a flight time of 9.5 hours and at a cost of around US\$300 each way. Next, it was necessary to arrange transportation across the mountains, rivers and valleys of the Sikhote-Alin mountains and drive to the northern part

Barbed hunchbacked poacher, *Agonomalus proboscidalis*. PREVIOUS PAGE: Great Pacific octopus





Overlooking the East Sea is the Brynner lighthouse in Rudnaya Pristan near the city of Dalnegorsk, Primorye, Russia

of Primorsky—adding another 8-9 hours of driving time to our journey.

From words on a page to the destination before us, our dreams came true! After driving about 600km in a northeastern direction from Vladivostok, we came to the alluring and unknown sea. And nestled on the shore of this treasured bay was a cozy holiday village named Smychka where we found the small dive center called Lucky Octopus.

History

People have lived here since the ancient times. The evidence of their life here can be found in the local caves. Later, the ancient culture of the Bohai developed. Not much information remains about it today. It is thought that the Bohai were a freedom-loving and pretty educated people, with their own spoken and written language. To start a family, a typical Bohai man would probably

be a good archer, and be able to write. The Bohai people did not submit to the army of Genghis Khan and were destroyed in a war. When Russian explorers and settlers came here, very few people lived in this area, so the written history of Primorye practically started over from scratch.

The city of Dalnegorsk and Ore Wharf (Rudnaya Pristan) may be known to curious

American or Swiss readers perhaps only because it is the birthplace of the famous Hollywood actor, Yul Brynner, who played the main character in the 1960 film, *The Magnificent Seven*. The local cape and lighthouse is named after Brynner's family, and the lighthouse was built by the actor's grandfather.



Location of Vladivostok, Primorye, on map of Russia

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CLOCKWISE FROM LEFT: Gilbert's Irish lord, *Hemilepidotus gilberti*; Sea butterfly, *Limacina helicina*; Red king crab or Kamchatka crab, *Paralithodes camtschaticus*; *Hermisenda crassicornis* nudibranch; Horned shrimp, *Paracrangon echinata*, on ascidia tunicate; Sea angel, *Clione limacina*

interested in underwater photography, and since then, has never parted ways with his camera. He is a big fan of Nikon cameras, housings by Sea & Sea and Inon

strobes. Andrey told us about his love of the sea, which started in childhood when he often swam in local waters to collect scallop and hunt for fish.

When questioned about the features of diving in this area, Andrey told us that Northern and Southern Primorye are very different, underwater. In Southern Primorye (the Vladivostok area), there are warmer waters and it is even possible to dive in wetsuits. In this southern region, there are interesting underwater landscapes. But in Northern Primorye, the water is always cold, and therefore, there is greater biodiversity of underwater life. Here, even in late summer, water temperatures at a depth of 20m can be very cold—around 3 to 5°C (37-41°F). There are also harsher conditions here than in the south, with frequent fluctuations in weather, rough seas and



fog. In addition, it is often necessary to dive in open ocean, where there are no landmarks. Northern Primorye is indeed a zone for experienced divers.

Our host, Andrey, has been doing underwater photography in this region for over 39 years. In his vast photographic archives, there are photos of almost everything that can be found here, under the surface of the water.

Local knowledge

Local inhabitant and dive instructor, Andrey Shpatak, met us here. He is the owner of the dive center located in the small village of Smychka. He was born and raised here, and has dived the area for over 40 years. Since receiving his first dive certificate in 1977, Andrey has done more than 4,000 dives. Therefore, he knows almost every dive site and every stone in the local waters. In 1998, he became





Flabellina nobilis nudibranch

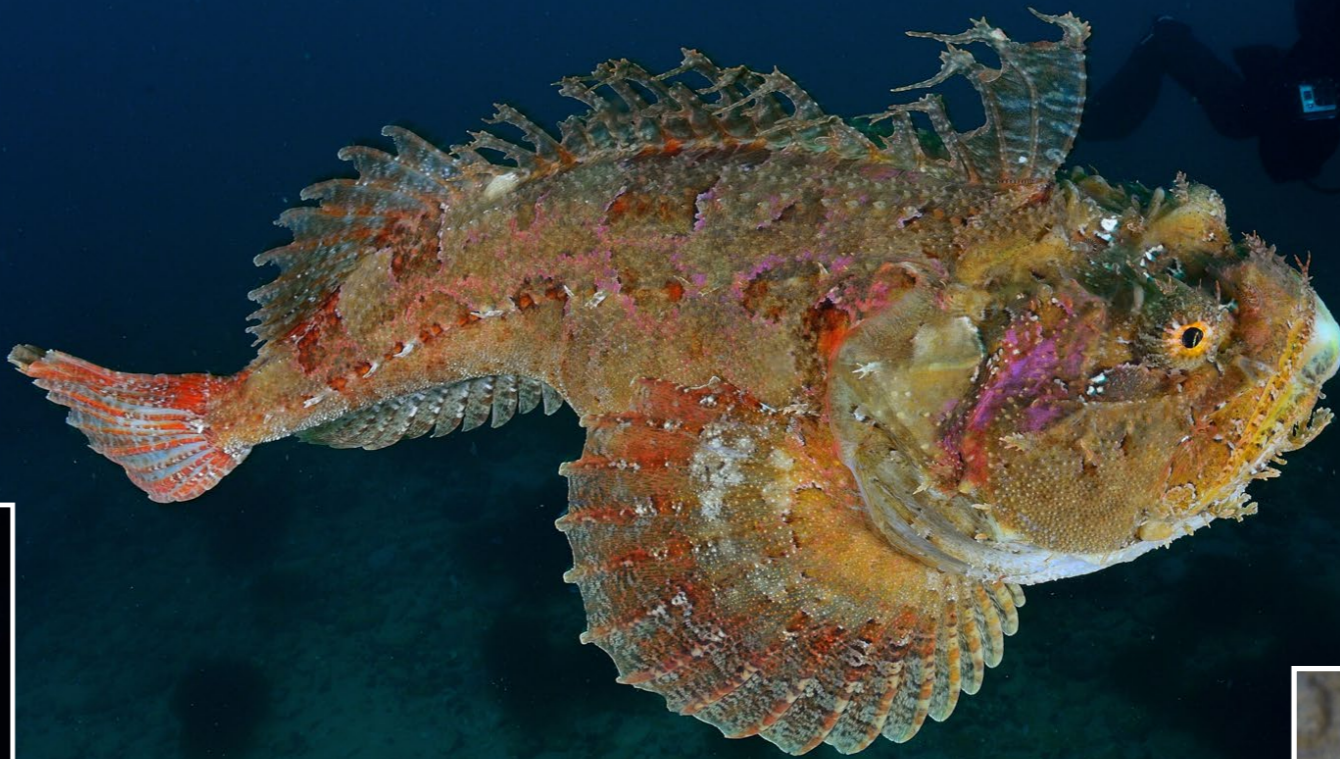
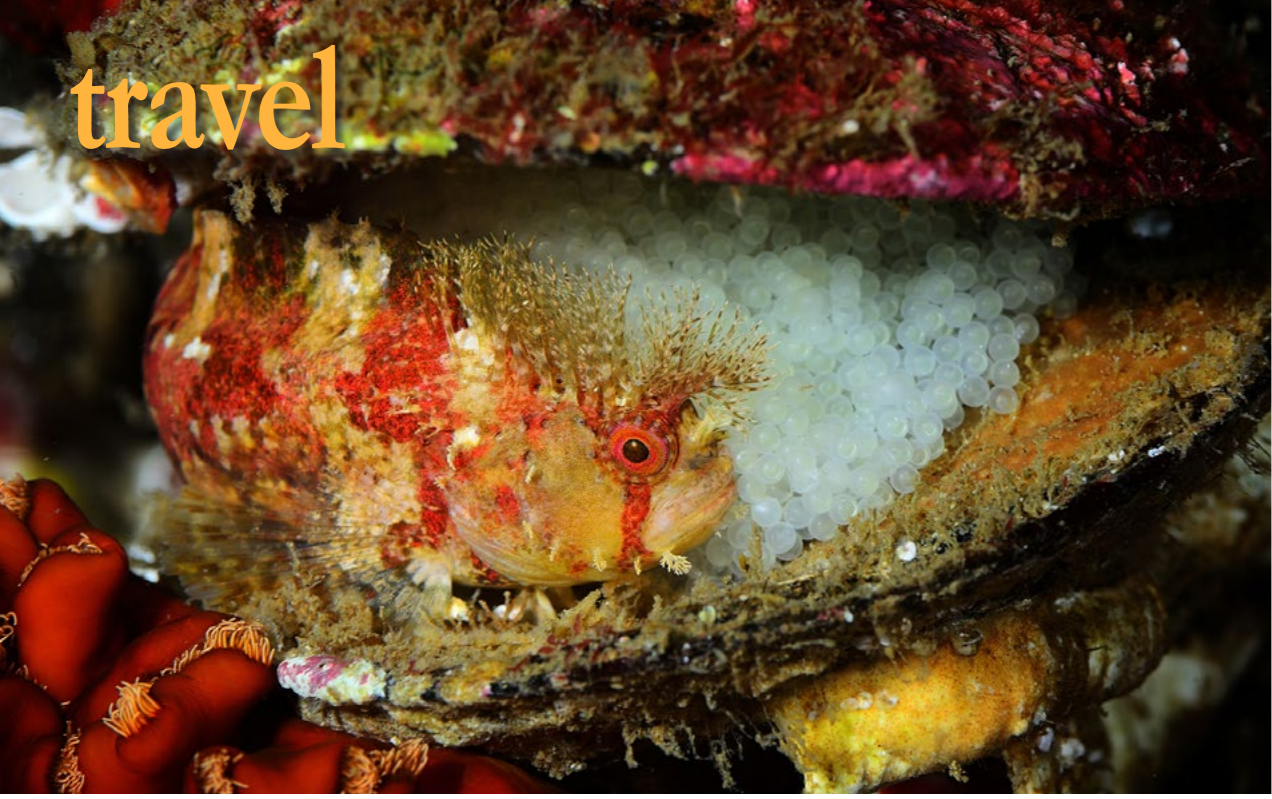
Critters and seasons

Crabs. According to Andrey, the months of April/May to June are a good time to photograph crabs. Hairy crabs and king crabs swim closer to the surface as cold water rises from the depths. Indeed, they can already be found at a depth of about 20m. These large crabs do not like warm water, so as summer approaches, they will return to greater depths. In wintertime, around February, when the temperature of the water is particularly cold, the crabs will rise almost to the surface. This is a rare moment when you can take pictures of these animated crabs at a depth of 1.5 to 2m.

Shrimp and nudibranchs. The month of May is the best season for macro photography, said Andrey. Huge numbers of shrimps arrive, including four to five species of mysis krill and countless species of nudibranchs. This is a period when a photographer can spend hours photographing a bright, colorful variety of miniature marine creatures, which are visible only to the keen eyes of a professional.



CLOCKWISE FROM TOP LEFT: Hairy crab in defensive display; *Caprella* sp. skeleton shrimp on laminaria kelp; Candy-striped shrimp, *Lebius grandimanus*, on actinia sea anemone; *Flabellina* sp. nudibranch (above); *Berthella californica* nudibranch (left); Isopod on eelgrass (center)



Akiginpo, *Chirolophis saitone*, protecting nest of eggs (top left); Sea raven, *Hemitripterus villosus* (above); Longsnout poacher, *Brachyopsis segaliensis* (far left); Bobtail squid, *Sepiolo birostrata* (left); Stubby squid, *Rossia pacifica* (right inset)



Black scraper, *Thamnaconus modestus*

Fish and cuttlefish. In the middle of summer, from June to July, it is the time when a lot of fishes come into the bay, said Andrey, and they will remain here until the end of October. You can take photos of triggerfish, filefish, pufferfish, squids and cuttlefish. There are two kinds of cuttlefish that can be found: a large cuttlefish called *Rossia pacifica* and a tiny one called *Sepiolo birostrata*.

Sea ravens and sculpins. At the end of summer and early autumn, from August to September, it is a good time to take photographs of sea ravens and sculpins of the family,

Myoxocephalus, which come here to spawn.

Blennies and pricklebacks. Late September is the mating season for big fringed blennies, warbonnets (Japanese warbonnet or *Chirolophis japonicus*) and ornamented pricklebacks (such as Akiginpo, or *Chirolophis saitone*). One may also find a couple of larger fish species hiding their eggs in clefts, as well as small fishes spawning in empty mussel shells, which protect their offspring from the many predators in the area.

Jellyfish. In the autumn, there is also



Silverspotted sculpin, *Blepsias cirrhosus*



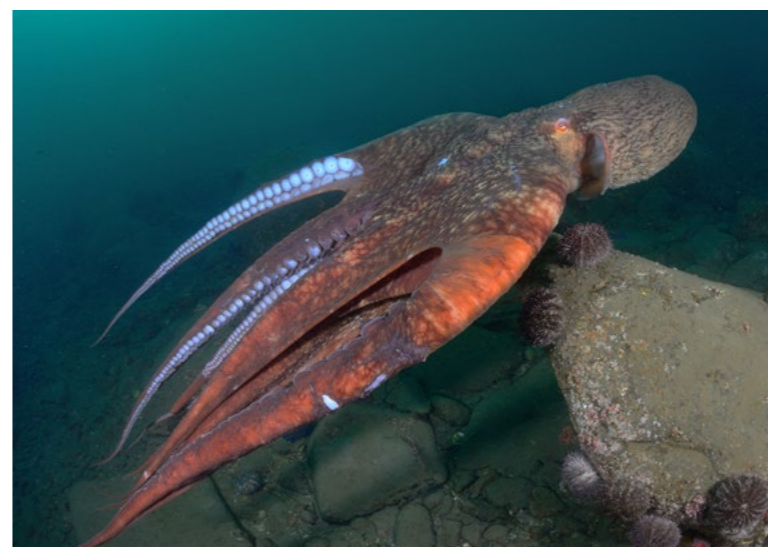
a huge number of jellyfishes such as *Aurelia aurita*, also called moon jellyfish; and lion's mane jellyfishes (*Cyanea capillata*), also known as the giant jellyfish, or the hair jelly, which comes close to the shore.

Giant Pacific octopus. The end of September and the beginning of October is when a lot of Giant Pacific octopi (*Enteroctopus dofleini*), also known as North Pacific giant octopus, come to the bay. Following the cold water, they can be found at depths ranging from 7 to 20m. Here in the bay, there are not many seals that like to eat octopi. That is why it is possible for divers to meet octopi just walking along on the

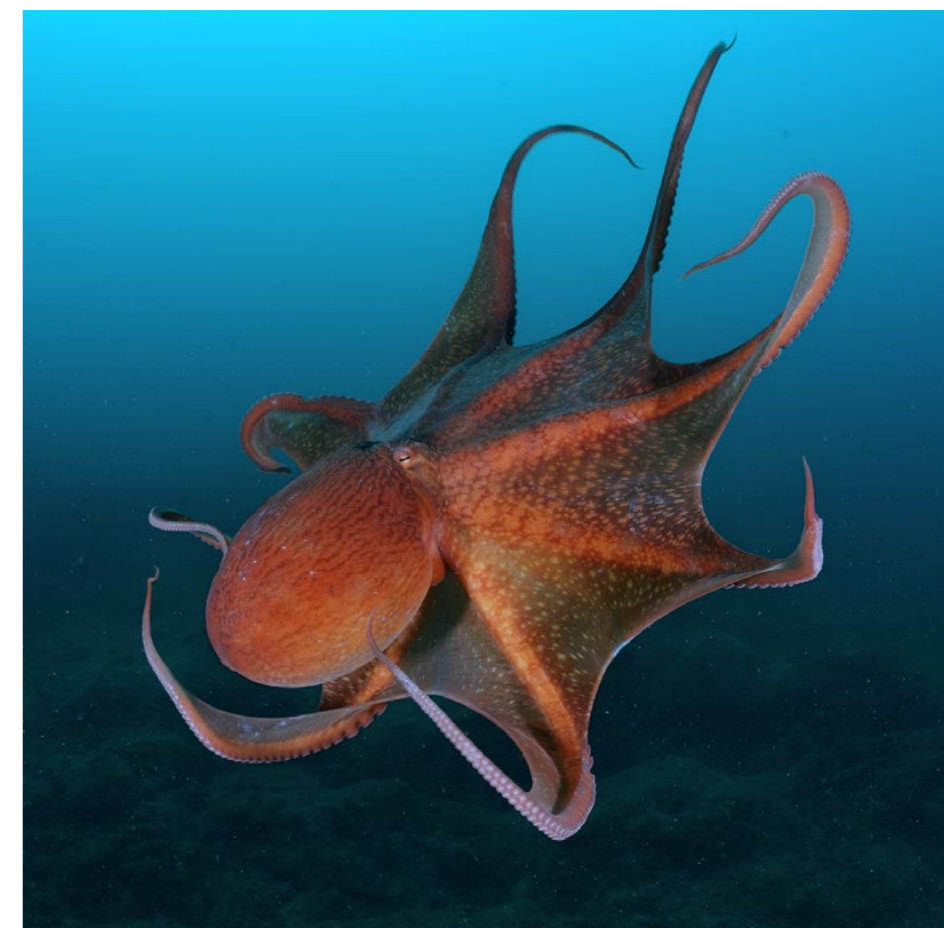
seabed, and not hiding in their burrows. It is a time when divers can find up to 10 to 15 large individuals. There are so many octopi! According to long-term observations, their populations have not decreased.

Andrey told us that he met his first octopus in 1975, and since then, has figured out, in detail, the peculiarities of their behavior. When the octopus sees you; it always seeks your attention and comprehension. The octopus is a very clever animal. It lives about five years. They swim very fast and are sometimes impossible to catch on camera. The largest Giant Pacific octopus reported was 65kg. These particularly large individuals were not found here in the East Sea Bay, but the largest one seen and photographed by Andrey weighed around 30kg.

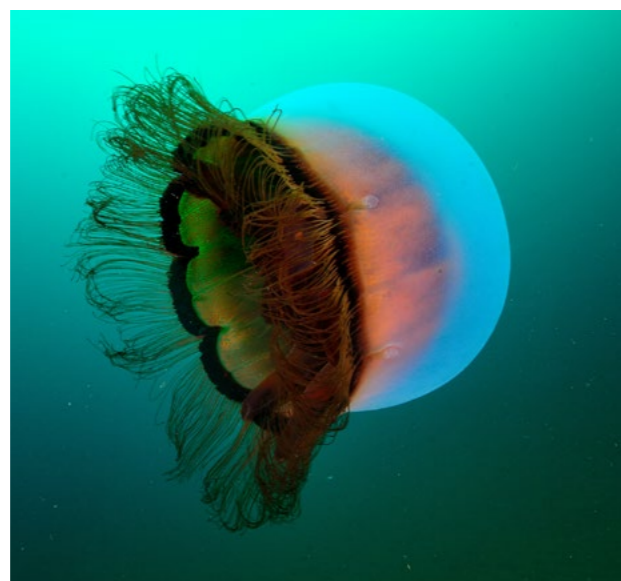
Caution: Divers should treat these octopi with great respect and not cause them any harm. This is the most important rule for the underwater photographer. Photogra-



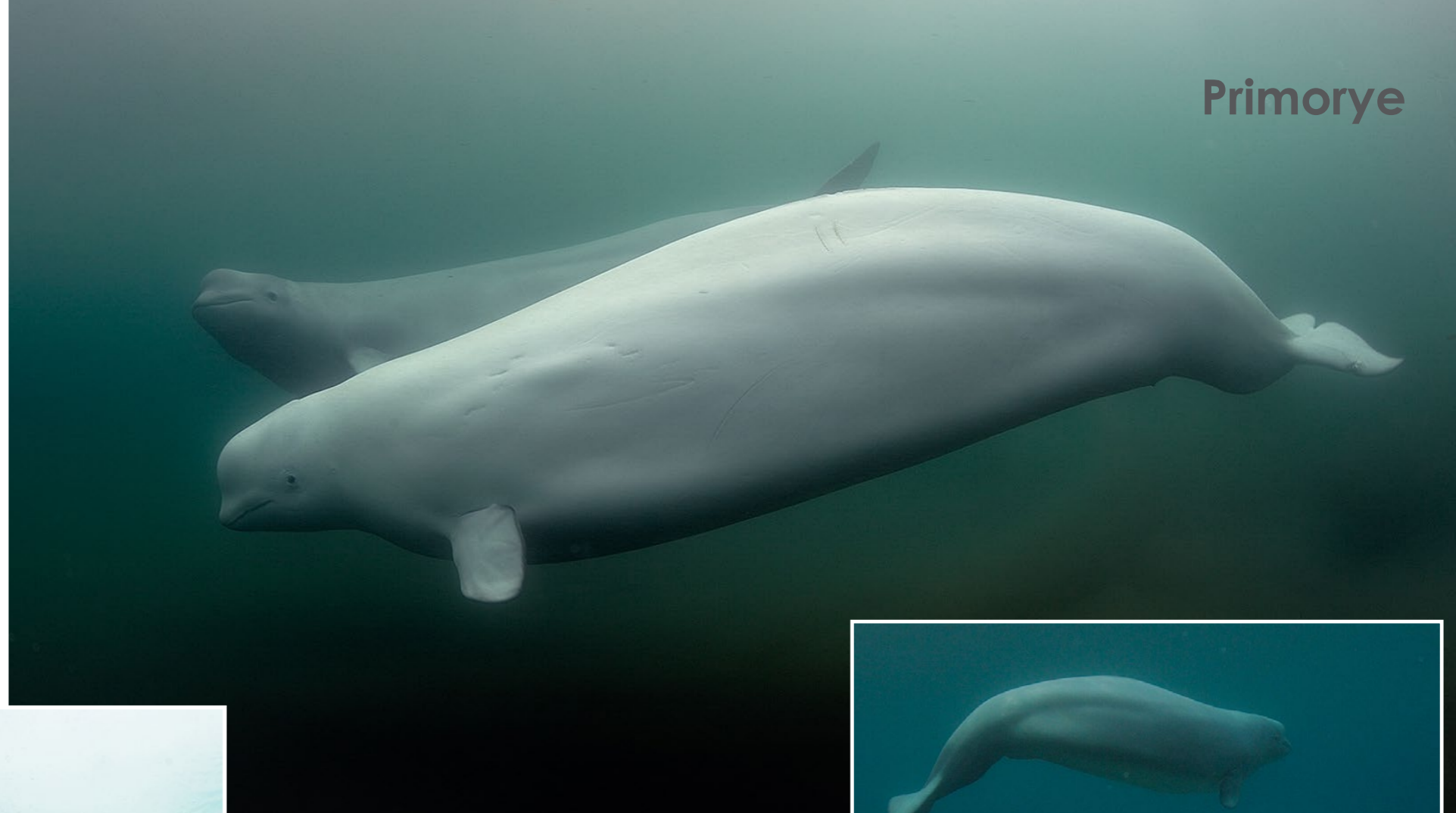
phers can dive with octopi here by buddying up with Andrey. One can take totally unique images of these clever animals, thanks to the great experience Andrey has and his knowledge of their behavior. Andrey finds the octopus and lures it out of its hole, plays with it and helps you to take photos. But this playtime with the octopus cannot exceed seven to 10 minutes. The octopus gets tired quickly, so after each ten-minute photo session, Andrey takes it away from the photographers and leads it back to the



same place, to the same hole where it was found, to let the octopus recover and take a break from the bright, blinding flashes of camera strobes. Andrey showed us his favorite photo in which an octopus folded



THIS PAGE: Diver with giant Pacific octopus, *Enteroctopus dofleini*; Lion's mane jellyfish, *Cyanea capillata* (top left); Japanese sea nettle jellyfish, *Chrysaora pacifica* (above); Brownbanded moon jelly, *Aurelia limbata* (right)



Steller sea lions (top left, left and below) and beluga whales (above and right)

Barbed hunchback poacher, or sea fox

into a shape of a lyre (ancient classical string instrument) as it departed from a diver.

Barbed hunchback poacher. In the bay, there are depths of 14 to 20m where it is often possible to find a small, bright red fish called a barbed hunchback poacher (*Agonomalus proboscidalis*), also known as the sea fox fish, from

the Chanterelle family. There are about 20 species of these small fish.

Steller sea lions. Sometimes, Steller sea lions come into the bay, said Andrey. Several years ago, he found them here and took photos of the species. But the sea lions do not always come close to divers. They love numerical

superiority. When a lot of them go into the water near a diver, they may come close and display their beauty, grace and perfection. But when they are in a small group opposite several divers, they prefer to remain at a safe distance. Therefore, Andrey advises

individual divers to watch and photograph sea lions, for the most part, alone.

Beluga whales. Once, two wild beluga whales (white whales) came into the bay, said Andrey. It was a mother and her calf. They

stayed all summer, from June to October. They seemed to feel completely free, floating wherever they liked, coming close to divers and allowing

divers to take photos of them in the shallow waters close to the shore. The beluga whales themselves initiated the contact. They seemed to be motivated by a natural curiosity, but after 10 minutes, they lost interest and left. But that period of time was more than enough for underwater communication and taking photos. Andrey said that it was quite a unique experience because

meeting them, let alone to take pictures of the beluga whales in the wild, was a great experience for any underwater photographer. These images are his pride and joy.

Larga seals. The beaches and cliffs of the bay are choice havens for Larga seals, also known as spotted seals. But these animals are frightened of divers, said Andrey, and prefer to stay away from bubble-makers and photographers. Over the years, Andrey has been lucky to be able



to photograph the seals when, on a very rare occasion, they came up to him, just one-and-a-half meters away, giving him an opportunity to take some good photos of this shy species.

Final thoughts

According to Andrey, the main thing is to maintain a certain calmness, and then the sea itself decides when and what you can see—this is the motto of the underwater

animal underwater. His principle is: If you have seen it but did not take a photo of it, then you did not really see it! So, it is necessary to dive again and again, to look for the next opportunity to capture everything on camera. As a photographer, Andrey is a maximalist.

When asked whether he had any funny stories from his underwater adventures, he told us a story about an encounter he had with an octopus. One day, at a depth of

18m, he was attacked by a small octopus (around 5kg). With two tentacles, the octopus catapulted itself from the sea floor, placing two more tentacles on Andrey's shoulders, and then placed two more tentacles on the valve of his second stage regulator. The octopus then removed the front cover of the valve on the front side of his regulator. The regulator membrane started leaking. Andrey took a breath and felt water entering his mouth. He then quickly placed his alternate second stage (which, ironically, is also called an "octopus") into his mouth, so he could breathe normally, while just in front of his eyes, the plastic lid from his main regulator drifted away. The sly octopus had taken it off! So many dif-

ferent skills and intelligence can these wily octopodiformes show us!

After listening to Andrey's compelling presentation, we realized that we might have been wasting a lot of our time and money traveling to distant, exotic locations and dive destinations, when diving paradise was, in fact, located very close to home, here in Primorsky, in the Far East of Russia. We immediately prepared all our diving gear and headed out to sea with our experienced and seasoned captain, Andrey Shpatak. See you in Primorye! ■

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For more information, please visit: shpatak.livejournal.com.

CLOCKWISE FROM TOP LEFT: Larga seal (top left and center); Yellow goosefish, or monk fish, *Lophius litulon*; Japanese warbonnet, *Chirolophis japonicus* (top right and far left); Bering wolf-fish, *Anathichas orientalis* (above); *Dendronotus frondosus* nudibranch

Invasion of the **King Crabs**

In Russia's East Sea

Text and photos by
Aleksei Kondratuk





King crabs were everywhere, moving slowly along the seabed, hiding in thickets of kelp, clambering over rocks (above, right and previous page)

King Crab



Rocky cliffs of Cape Orlova, East Sea, Primorye, Russia

In many science fiction movies today—those with alien spaceships—the aliens look very similar to some of the underwater inhabitants of our own planet. Indeed, there is no need to invent some mythical creature to stir up the imagination of the viewer; it is enough just to show an image of a jellyfish, an octopus or a giant crab. And this story is all about the king crabs. There is no need to make deep dives, requiring special training and techniques, to see these aliens underwater. All you need is a little luck and to be in the right place at the right time.

Over the years, my dive buddy, the local dive operator, and I have searched for king crabs many times. But on one particular occasion, we experienced a successful expedition and encounters we just did not expect.

The *Paralithodes camtschaticus* is known by different names around the world. The most common are the king crab, Kamchatka crab and giant crab. The last name is an accurate description, as the Kamchatka crab is the largest crab in the ocean. The leg span of an adult crab can reach 150 centimeters, and it can weigh up to 8kg (about 17.5 lbs). The king crab is actually more closely related to hermit crabs and belongs to the anthropod family, Lithodidae—it only looks like a crab. It is called a crab simply because it looks very similar to a crab.

Getting there

Our trip from Vladivostok to the northern part of the province of Primorye in Russia



took about 4.5 hours. We covered the long 420km journey by car. Most of the road was unpaved and led through several high mountain passes. At the end of the drive, we reached the village of Valentine, with its eponymous picturesque bay. Here, the steep cliffs, densely cov-

My buddy and I flew over them like heavy aircraft reconnoitering their movements (far right)

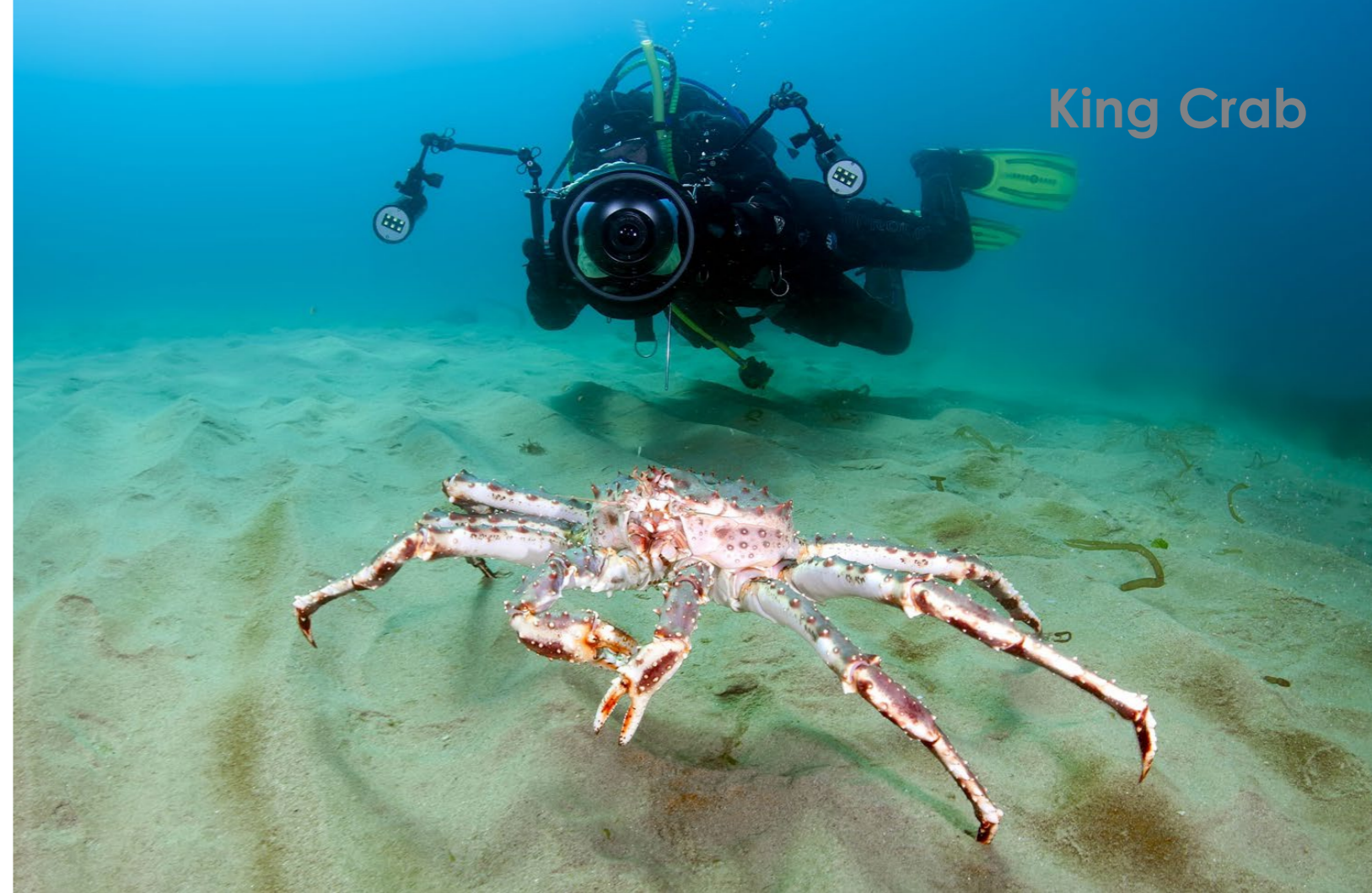
ered with pines, met the waters of the East Sea (Sea of Japan). The bay of Valentine is open and has direct access to the sea. Fauna of the northern part of Primorye is very different from the fauna in the southern part. The bay is not covered by ice in wintertime, which allows you to dive all year round.

Migration

The king or Kamchatka crab regularly migrates. The average speed of its movement is about 1.8km per hour (1mph). But the crab usually moves along the seabed in zigzags, which is why the distance traveled in a day is not more than

10km. Besides, individual creatures move in different directions, so the speed of movement of the entire shoal is only 3-4km per day.

Every year, fishers place their crab pots—the large steel cages used for crab fishing—along the same route within the crabs' migration area. The size of the whole area is about 200km². The crabs spend wintertime very far from the shore, at depths of



King Crab



up to 200-300m. In the spring, they move up from the depths to shallow water.

So why do the crabs make annual migrations? Their departure to the depths is due to the lower water temperatures in shallow waters and ice formation. Crabs come back to molt and lay eggs—or caviar as foodies would call it—but we will talk about that later.

Diving

We loaded our dive equipment and cameras into the boat, and headed to Cape Orlova. The midday sun hung high, and it was possible to view the sea bottom through the clear waters (which is a very

rare sight in this region). Finally, we got to the dive site and decided to start our search for king crab at a depth of 15m. When we reached 35m, we would head back.

When I reached the seabed, my regulator also dropped out of my mouth in surprise! I saw a tropical seascape with clear blue water and



Location of Vladivostok, Primorye, on map of Russia

The Kamchatka crab, or king crab, is the largest crab in the ocean; The males help the females to molt their shells (top)

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Here, the steep cliffs, densely covered with pines, meets the waters of the East Sea (top left); King crab touches the bottom with the ends of its claws (top right); Near the first pair of king crabs, we saw another pair, and then a few more. After 15 minutes, I stopped counting (right); Underwater videographer follows the crab (lower left); Selfie with king crab (below)



white sand. Visibility was about 20m. My brain refused to combine this picture with the sensations of my body. The water was shockingly cold. According to my dive computer, the temperature of the water was -1°C (34°F).

After a moment, my dive buddy

and I noticed the first pair of king crabs. These “kings of the sea bottom” met us with caution, exposing their claws in front of them. Near the first pair, we saw another one, and then a few more. After 15 minutes, I stopped counting. They were everywhere: moving

slowly along the seabed, hiding in thickets of kelp, clambering over rocks, displaying their claws in defensive postures in the light of our dive lamps.

How king crabs feed

Did you know that king crabs find food by touch? Some scientists conducted a small experiment

that yielded interesting results. In the experiment, food was immersed in a large aquarium with king crabs. It became clear that the king crabs felt their prey by moving their antenna. King crabs cannot determine their direction by smell, so they began to move, touching the bottom with the ends of their claws.

The king crabs lowered their claws, and performed cutting movements. These movements were very energetic. They moved along the bottom of the aquarium in complex loops. They then began to feel the bottom with their claws more often as they got closer to the food. But even when they were several centimeters away from the food, some individuals turned and continued searching in the opposite direction. The conclusion of this experiment is that king crabs can only find prey through touch, and the sense of smell and sight are of limited assistance to them.

Another interesting fact is that each crab claw carries a separate function. The left claw grinds small prey, and the right one serves to crush shells of mollusks and skeletons of sea urchins. Small prey is ripped out of shells with the king crab's claws, and ground and grinded with its feet and jaws. King crabs easily eat sea floor



polychaetes (segmented worms), mollusks, echinoderms and other benthic animals.

First impressions

The crabs moved slowly along the sandy seabed like tanks, while my buddy and I “flew” over them like heavy aircraft reconnoitering their movements. An hour later, we finished our dive and got on the boat. My dive buddy had filled a whole 128GB flash card with video. We shared our impressions and discussed the behavior of these aliens from the depths.

After admiring the landscape of the bay, we changed cylinders and went on a second dive after our surface interval. We decided





A horde of snow crabs, *Chionoecetes opilio* (top left); Suddenly, I realized that in front of me was a blue king crab, *Paralithodes platypus* (top right); Seen from above, the trunk and limbs of blue king crab are red-brown and blue (right); Pregnant female king crab carrying eggs (left)



them. Continuing the dive, I noticed a large female king crab bearing eggs, a couple of minutes later. What luck!

Female king crabs move up from the depths to shallow water to procreate. The mating season is in April and May. Males clamp their claws onto the females' claws. Coupling king crabs can remain in this position for up to seven days. The males help the females to molt their shells, and then they attach their "seed" (spermatophores) to the legs of the female. After a while, the female lays her spawn on her abdominal legs. The eggs will hatch during her migration to shallow depths the following year. The period of pregnancy of the female Kamchatka crab is 11.5 months. The males molt separately from the females, hiding among the stones.

During molting, the crab changes not only its shell, it also parts with old walls of its stomach, esophagus and intestine. Molting renews all its tendons too.

Second dive

Our second dive was no less interesting. In addition to the king crab, beautiful underwater landscapes with bright sea anemones and dense thickets of kelp, we saw different species of crustaceans. We found a small group of Opilio crab (snow crab) and several individuals of agile hairy crab. These small crabs, densely covered with hairs, can run very quickly. Indeed, one had to be very agile with the camera rig just to get a successful shot!

During the dive, I noticed a king crab with interesting coloration. In contrast to its pale pink color,

its claws were pearl-blue. Coming closer, I realized that in front of me was a blue king crab (*Paralithodes platypus*). And this was luck striking again, because it was my first time seeing this particular species!

In appearance, the blue king crabs are very similar to king crabs. Seen from above, the trunk and limbs are red-brown with blue, while seen from below, they are yellowish-white in color. On the sides of the body and limbs are yellow-orange spots. The blue king crab is slightly inferior in weight and size to the Kamchatka crab. An adult weighs up to 5kg. Another characteristic difference between the blue king crab and the Kamchatka crab are the rounded spines. Blue crab, like Kamchatka crabs, live around 20 to 25 years and often accom-



to explore the foot of the cape. I set the course on the compass, and we headed off.

Diving in cold water requires special preparation and equipment. But to foresee everything is simply impossible. At a depth

of 15m, both my regulator and octopus went into free flow at the same time. But the problem was quickly resolved when I took a big swig of water into my mouth and rinsed both regulators by blowing a powerful jet of water through

pany king crabs during migration. Female blue crabs are very rare guests in shallow waters, as they spawn once every two years.

Fishing history

Both types of king crab are fished

feature

because their meat is considered a delicacy and in demand all over the world. Far East crabs became famous as a delicacy in the early twentieth century. In the Russian Far East, canned crab has been produced since 1908, at the coastal canning plant in Bay Gaidamak. Later, in the '60s, canned crab with the strange name, "CHATKA", became known all over the world.

The story goes that when the canned Kamchatka crabs went on sale, export packaging was produced with the bright inscription, "KAMCHATKA". A major contract was signed for the export of the canned crabs, but the exporters designed and printed can labels with a larger diameter than required by the contract.



King Crab



Hairy crabs, densely covered with hairs, can run very quickly

Blue crab, like Kamchatka crabs, live around 20 to 25 years and often accompany king crabs during migration (above and top left)

The price of correcting this error could have cost millions. So, in order not to alter the label, the "erroneous" labels with the word "KAMCHATKA" were glued onto the smaller diameter cans. The first syllable simply did not fit and was cut off, so just the letters "CHATKA" remained.

Here's a well-known fact from the annals of history of crab fishery: In 1929, 22 Japanese ships came to the shores of Kamchatka. Along the way, they picked up 420,000 crab pots (or traps)—six times more than Soviet ships. In 1929, about 87 million specimens were caught. After that, there was a gradual decline in population. In order to prevent such cases from happening again, people decided to regulate crab catching activities. Today, there are a lot of restrictions on crab fishing.

Where to find king crab

So where can the "king of the sea bot-

tom" be found? The habitat of the Kamchatka crab is large enough: the northern regions of the Far Eastern seas, including Kamchatka, the Shantarsky Islands, Bristol Bay, the Okhotsk and Bering Seas, the coast of Sakhalin, the Kurile Islands, and the northern part of the Sea of Japan (including Peter the Great Bay and the coast of Hokkaido). In addition to the Far Eastern seas, the Kamchatka crab is also found in the Bering Sea.

In the '60s, the Kamchatka crab was transported from the Sea of Okhotsk to the Barents region. For over 30 years, the crabs did not show themselves; people determined that the experiment was unsuccessful. But after these long years, the crab in the Barents Sea formed a new self-reproducing population. After a while, environmentalists got bad news. Such a rapidly growing crab population would simply destroy the bottom fauna of the sea. The simplest solution to this prob-

lem was to allow the extraction of crab in the Barents Sea.

Afterthoughts

My story as well as my dive was coming to an end. Dive time: 59 minutes, with 50 bars left in the tank. I was at my safety stop, watching the movements of kelp in the sun. I reminisced over the episodes of the dive, blinking past like photo frames in my memory, one by one. I felt like I was on another planet: a mysterious planet full of extraordinary creatures—Planet Ocean. ■

Aleksei Kondratuk is an underwater photographer and naturalist born and raised in Vladivostok, on the shores of the East Sea, in the Russian Far East. After specializing in economics and mathematics, he became a divemaster and began photographing the underwater world. For more information, visit: uwvision.com.



Diving Coastal

British Columbia

Text by Barb Roy and Wayne Grant
Photos by Barb Roy and Ron Akeson





Rose anemone in Barkley Sound (above) and a diver on the wreck of the *Capilano* near Campbell River (previous page), British Columbia, Canada



Aeolid nudibranch found at Snake Island in Nanaimo, British Columbia, Canada

Referred to as the Salish Sea by local aboriginal people, the coastal inland waters stretching from Puget Sound to Johnstone Strait provide a vast and diverse area for scuba divers to explore. Not only are these temperate, nutrient-rich waters teeming with colorful marine critters of all sizes, visitors can enjoy underwater activities like photography, shipwrecks, deep walls and drift diving.

British Columbia (BC), located just above the US state of Washington, on the northwestern coast of North

America, provides all of this and more, along with countless topside activities like fishing, skiing, hiking and great wildlife viewing. I have listed below a sample of some of these areas and what you might see when exploring them.

Howe Sound

This vast body of water is North America's southernmost fjord, located northwest of Vancouver, between the lower mainland and the Sunshine Coast. Boat access is from Horseshoe Bay, at the end of Highway 1. From Horseshoe Bay, Highway 99 skirts around the eastern shoreline of Howe Sound to Squamish for 28 miles (45km), giving entry to several good shore dives.

Whytecliff Park and Porteau Cove are two of the favorites, providing plenty of parking and easy entry. Both are recrea-

tional in depth, but technical divers prefer Whytecliff Park for its protected cove (ideal for training) and its deep wall along the outer perimeter of the cove. Porteau Cove Provincial Marine Park is full of underwater enhancements identified with marker buoys, which include a tire reef, concrete blocks, pipes and several small boats. On many occasions, I have spotted lingcod, wolf eels, rockfish, and orange and white swimming anemones here.

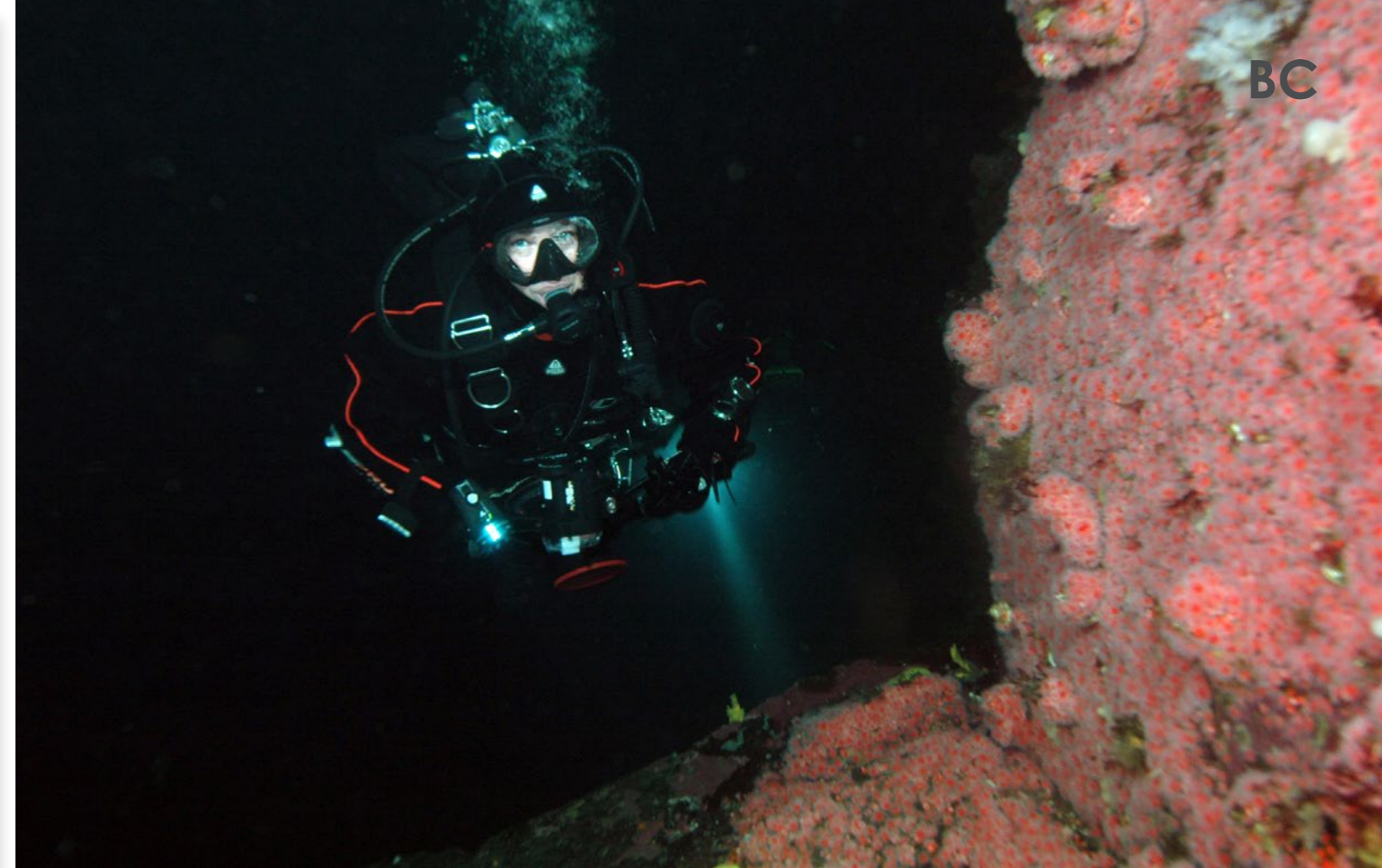
Boat diving options include over a dozen good sites around Bowen and Gambier Islands, Pam Rocks and numerous other small islets scattered throughout the Sound. Huge cloud and boot sponges are seen at Christie Islet, but smaller invertebrates like swimming scallops, plumose anemones and nudibranchs reside in the shallows. Copper



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BC

Underwater photographers find lots of interesting life to shoot under the surface along the coast of British Columbia.

rockfish and young lingcod are also plentiful at Pam Rocks, with playful sea lions occasionally appearing around the divers during the winter months.

The HMCS *Annapolis* is Howe Sound's newest wreck, sitting upright just off Gambier Island. At over 107m (350ft) in length, this ex-Canadian Navy vessel was scuttled in 2015 by the Artificial Reef Society of British Columbia (ARSBC). Divers can easily swim into the ship's huge helicopter hangar, travel down covered walkways or peer into the engine room because the depth is all within recreational dive limits. I have always enjoyed the bridge where the captain once stood looking out over the bow. Although large diver access holes have been cut throughout the ship's hull and decks for safe viewing, penetration

is only recommended for those with proper training and equipment. Like any wreck in BC, you might be surprised at how much life resides on the outside of the ship!

When not diving, check out one of the many trails along Highway 99, go kayaking or take a Sea to Sky Gondola ride up the mountain in Squamish for a breathtaking view of the Sound! You will also find the 100-meter-long Sky Pilot Suspension Bridge at the top. For a step back into history, check out the Britannia Mine and spend a fun day with the family learning to pan for gold, touring through old coal rail tunnels and exploring the museum.

Lower Sunshine Coast

This part of the Sunshine Coast stretches about 110 miles along

the Strait of Georgia, from Howe Sound to Desolation Sound, and is accessed via BC Ferries from Horseshoe Bay to Langdale (40 minutes sailing time) followed by a 30-minute drive north to the town of Sechelt. Within Sechelt Inlet is the wreck of the HMCS *Chaudiere*, a 366-foot (111m) destroyer escort scuttled in 1992 by the ARSBC. Since then, the ship has transformed into a gigantic condo complex for juvenile fish, wolf eels and assorted invertebrates. To top it off, the ship is on its side and stretches from 60 to 130ft (18-39m) of water.

Tzoonie Narrows, also in Sechelt Inlet, is a fun drift dive complete with a garden of photographic invertebrates, rocky overhangs and flat sections where orange and white giant nudibranchs hunt for tube-dwelling anemones. The



Cloud sponge (left) dwarfs diver Wayne Grant during a dive in Saanich Inlet at Senanus Island; Young copper rockfish (below) are found throughout BC waters

last time I dove here, my buddy and I encountered half a dozen 4-6ft (1-2m) dogfish (small sharks)—it was so exciting!

The site of Tuwanek can be accessed by boat or shore, and is great for photography and night diving, yielding wolf eels, nudibranchs, assorted anemones, crabs and rockfish. I always like to explore this site during the day, then return at night for another look because the critters are so different.

Skookumchuck Rapids is a breathtaking advanced dive with a collection of colorful white and pink anemones grouped together with purple sea stars and finger-like sponges, making it a photographer's paradise. When the current is running at full tilt, massive amounts of water pour through the

narrow channel, creating a cauldron of turmoil from the view above water. But during slack current, when the water slows or stops to change direction, this is when the divers jump in! Deeper sections underwater will portray entire boulders covered in red, green, yellow and orange sponges and anemones. I have found colorful rock greenlings and other rockfish resting at the bottom in the shallows near smaller boulders, ready to dart back to their shelter when the current once again picks up in speed.

Jervis Inlet, Narrows Inlet and Agamemnon Channel

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are especially good for boat diving. Technical and deep-range divers will love the deep walls of Agamemnon

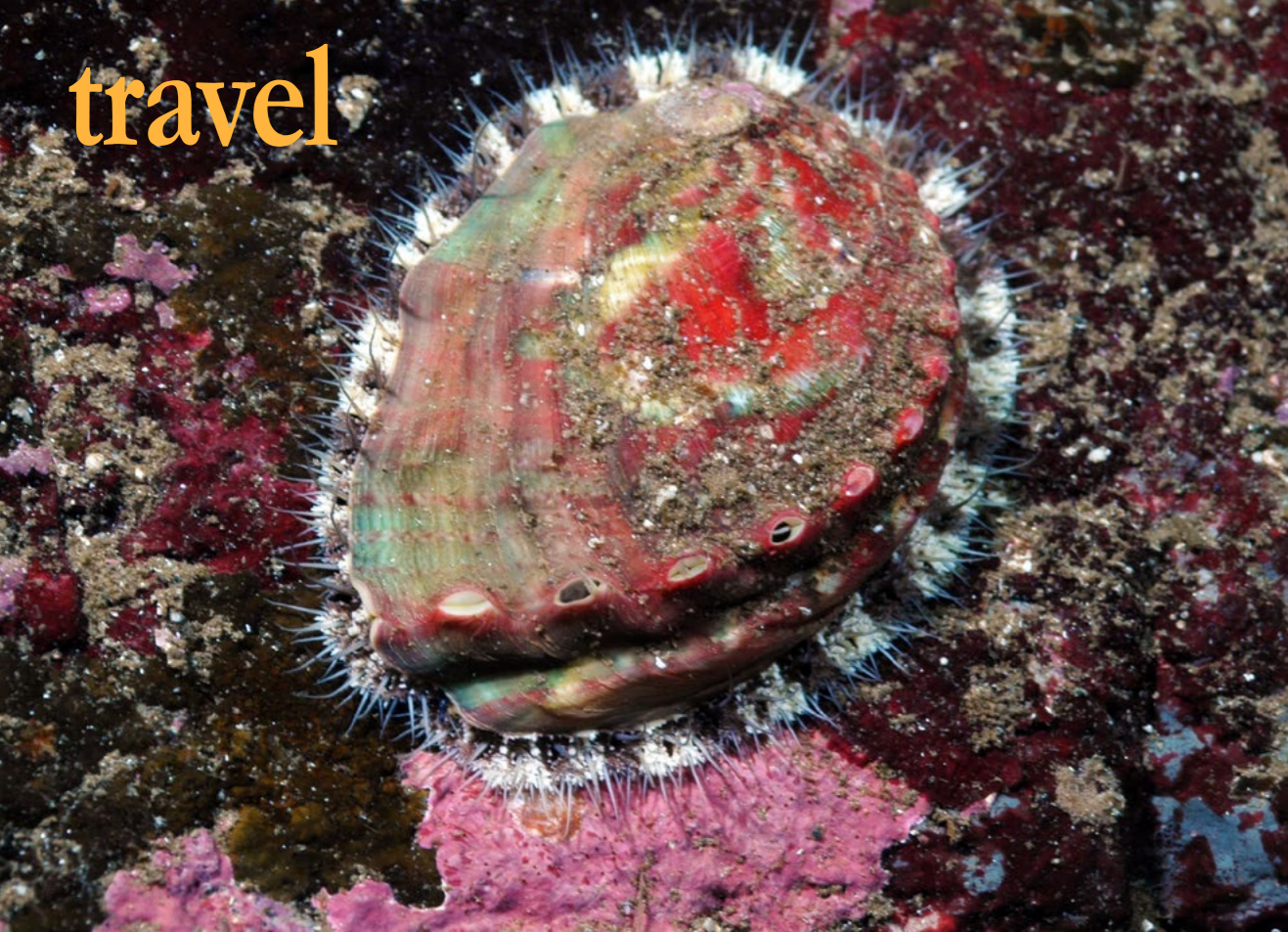
where huge red and pink gorgonian sea fans can be found among giant clusters of yellow cloud sponge. The motivation of photographing these unique fans is what encouraged me to take up technical diving. This in turn opened a whole new group of subjects for me.

When not diving, visitors can enjoy cultural kayaking tours, wildlife watching and mountain or trail hiking. Sechelt Inlet is a popular favorite for loading camping gear onto a kayak and paddling out for a few days. Don't forget the snorkeling gear!

Upper Sunshine Coast

Continuing north on Highway 101 from Sechelt, Powell River can be reached by taking another BC ferry from Earls Cove to Sallery Bay (a 50-minute ride). Between





Abalone can be seen all around Vancouver Island but are hard to find

nudibranchs and white-spotted rose anemones, with tiny shrimp living at their base. Macro photographers should keep an eye out for minute sea spiders, found covering some of the sea strawberry soft coral branches.

Seven Tree Island is another lush site flanking Nigei and where I have always found the illusive decorated war-



bonnets, mosshead warbonnets and colorful small fish. Barry Islet offers fields of miniature red, pink and white gorgonians and basket stars holding tight to them. Macro subjects at Dillon dive site include purple-ringed topsnails, several

species of nudibranchs and bright orange juvenile Puget Sound king crabs. Larger subjects at Dillon include octopi, ancient-looking ratfish and curious wolf eels.

The remains of the *Themis* can be found on the north side of

Crocker Rock, with half of the ship in a forest of kelp and the rest draped over a reef. Wolf eels, octopi and seals are commonly spotted here, along with Puget Sound king crabs and beautiful sponges.

Weather permitting, divers will enjoy a day across the Strait exploring Slingsby Channel. The outer walls are excellent for photography, hosting an array of invertebrate life worthy of a large memory card! Turret Rock (aka Tremble Rock) is another site, located in the middle of Nakwakto Rapids. Recorded at speeds of 22 knots, the life found here is amazing! Huge clusters of unique Nakwakto gooseneck barnacles with red coloration and six-rayed white sea stars are a few to be found.

When not diving, visitors might enjoy paddling around in kayaks in some of the calmer coves or fishing for salmon. I personally like the wildlife viewing opportunities, commonly seeing black bears, dolphins, sea otters and eagles.

Campbell River

Campbell River stretches close to 15 miles (24km) along the mid-eastern coast of Vancouver Island, and is located north of Nanaimo. Ferry access is from Powell River to Comox or from

Saltery Bay and Powell River, a diver can find Mermaid Cove (a shore dive) where a 9ft (3m) bronze mermaid welcomes all. Be sure to check out the base for a resident octopus. Just up the road is Octopus Hole, another easy shore dive, where one can find more octopi, orange and brown burrowing sea cucumbers, nudibranchs and sculpins.

Another interesting shore dive is the shallow wreckage of the *Malahat*, located at the old mill along a breakwater of ghost ships. The ship's skeletal remains provide superb habitat for nesting lingcod, cabezon, greenlings and young wolf eels.

By boat, divers can access the *MV Gulfstream*, which sank in 1947 at Dinner Rock. This advanced wreck dive is in 125-155ft (38-47m) of water. The wall is steep but hosts abalone, lingcod, rockfish, cup corals, and huge white and orange plumose anemones.

When not diving, it is fun to visit Lund for sightseeing, walk

along one of Powell River's many beaches or launch kayaks at several calm beaches. I have heard recently that the ARSBC has been in negotiations to help the local community sink the concrete vessels at the mill for a future dive park, accessible by boat.

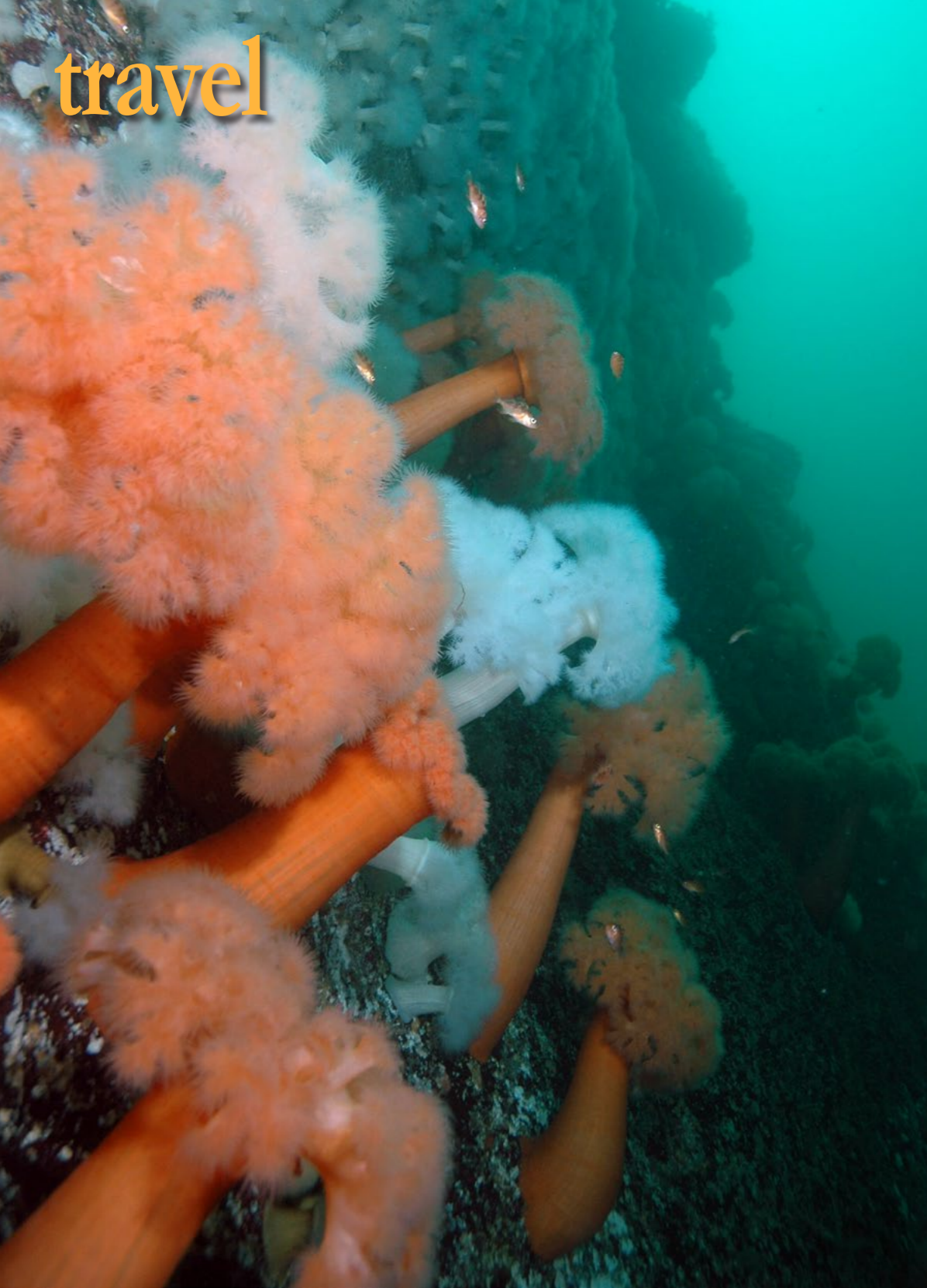
Port Hardy

This quiet fishing town is located at the northeastern end of Vancouver Island, opening to the Inside Passage and the Queen Charlotte Strait. Most of the diving is done from land-based resorts with fast boats.

Perhaps the most famous site is Browning Wall, located in Browning Passage on the southeastern side of Nigei Island. Divers will have difficulty finding a bare patch of rock at this current-fed site. Rest assured, however, all dives are conducted during slack current. Hordes of red, pink and orange soft coral flourish next to arm-length clusters of glove sponge, ruffled orange-peel



Waiting for the current to slack at Seymour Narrows, part of Discovery Passage near Campbell River



Harbor seals resting at Mitlenatch Island Nature Provincial Park near Campbell River (left); A wall of giant plumose anemones in Campbell River (far left)

sponges.

Copper Cliffs offers a colorful wall, ledges and huge purple algae covered boulders. Rose sea stars, juvenile box crabs, red Irish lords, multitudes of tunicates and cup corals can be found here. Massive clusters of giant purple-plumed feather duster worms are everywhere at Steep Island and a carpet of pink and red strawberry anemones cover the bottom at Whiskey Point. On a single dive here, I counted four large Puget Sound king crabs! The dive site, End-of-the-Road, reminds me of a nursery for young octopi and sculpins hiding amongst a blanket of invertebrates.

If weather permits, a day excursion south to Mitlenatch Island to explore the wreck of the *Capilano* (which sank in 1915) is well worth a trip. The 120ft (36m) ship sits upright in 100-145ft (30-43m), covered in a shroud of white plumose anemones. Lingcod, huge rockfish and cloud sponge also adorn the site.

In Coast Salish language, "Mitlenatch" means "calm water all around." Due to the excessive number of nesting sea birds, Mitlenatch was designated a Provincial Nature Park in 1961. Otters, harbor seals, Steller and California sea lions love to lounge on smooth warm boulders

along the eastern coast, and will often join divers underwater.

When not diving, visitors might want to participate in a snorkel float down the Campbell River to see salmon during their migration upstream from mid-July through early October.

Nootka Sound

Nootka Sound is located on the western side of central Vancouver Island. This rugged coastal area can be accessed by road from Gold River or Tahsis, both over an hour's drive from Campbell River. The surrounding mountainous landscape and glacier-scarred valleys were created during the Pleistocene ice age, leaving behind deepwater crevasses throughout the Sound. Today, lush forests of Douglas fir and Western Hemlock (some towering to over 70m) thrive in the area.

Most of the diving is done in Nootka

Inlet and the neighboring Esperanza Inlet, yielding exceptional life. On the outer edge of Nootka Sound at McQuinna Point, I explored a huge kelp bed with



Blood sea stars are easy to spot at Nootka Sound

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Nanaimo, crossing at Horseshoe Bay or Tsawwassen on the mainland. Quadra Island lies parallel to Campbell River, with Discovery Passage separating them. Since this is a high current area, slack times must be followed and are well known by local dive operators.

In 1996, the ARSBC scuttled another retired warship, the HMCS *Columbia*, off

Maud Island. The six mortar guns are very impressive and I have photographed large giant Pacific octopi next to and on the ship! Around Maud island is Seymour Narrows where whirlpools and standing waves form at peak flow. Anemones are everywhere underwater, as well as staghorn bryozoans, urchins, China and quillback rockfish, and orange tennis ball



Author Barb Roy heading to dive site at Nootka Sound (left); Nootka Sound is a great place to photograph vermillion rockfish (below)

nudibranchs, frosted and opalescent nudibranchs can also be seen here.

I have always thought of Renate's Reef, one of my favorites, as "Wolf Eel City" because of its numerous long gray residents of varying length and age. Octopi, china and tiger rockfish and medium-size lingcod also reside here.

Sixgill shark sightings are possible at Tyler rock, although they are rare. But Barkley Sound is one of the regular places the sharks frequent in BC, and the dive operators will all have their choice spots. Plenty of rattfish, orange sea pens, octopi and sculpins can be seen between Tyler's two submerged pinnacles when the sharks are not around.

Barkley Sound has several shipwrecks to explore: the *Vanlene* and the abandoned Chinese migrant



Sunsets and smiles included dive vacations!

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my buddy, just below Yuquot Lighthouse (built in 1911). For a while, we were surrounded by a dozen curious dogfish. Alas, we must have been boring to them as they disappeared as quickly as they appeared. Tiny proliferating anemones decorate the base of each kelp stalk and Tealia (mottled) anemones were the size of dinner plates! Yellow sponges, shiny orange sea squirts, painted greenlings and red Irish lords also thrived here. Instead of the usual ochre sea stars, there was a multitude of bat stars.

There are many exploratory sites in Nootka, some with kelp beds and others on deep pinnacles or in sheltered coves. It is easy to find walls or boulder-covered terrain with hiding octopi and wolf eels. These sites also host several species of rockfish, lingcod, sculpins and a few rattfish. Huge sections might be covered with strawberry anemones, scallops, nudibranchs, aggregated vase sponges, purple encrusting bryozoan and more huge anemones.

When not diving, visitors are encouraged to go for a paddle around the calm waters near Tahsis. Hiking, whale watching and salmon fishing are equally as fun.

Barkley Sound

Located within the boundaries of the Pacific Rim National Park Reserve on the western coast of Vancouver Island, Barkley Sound is a unique wild coast wonderland. Divers can access the area by boat from Port Alberni, via the narrow 25-mile-long (40km) Alberni Inlet, or by car down a 56-mile (89km) gravel logging road from Port Alberni to Bamfield. Diving is available year-round from several operators offering both day and multi-day excursions. With over 100 islands in the Broken Group alone, it's easy to find a dive site, even if the weather is bad.

Chup Point is a good place for fish photography, usually yielding more than five species of rockfish on a single dive. Yellow and white dorids, orange-peel



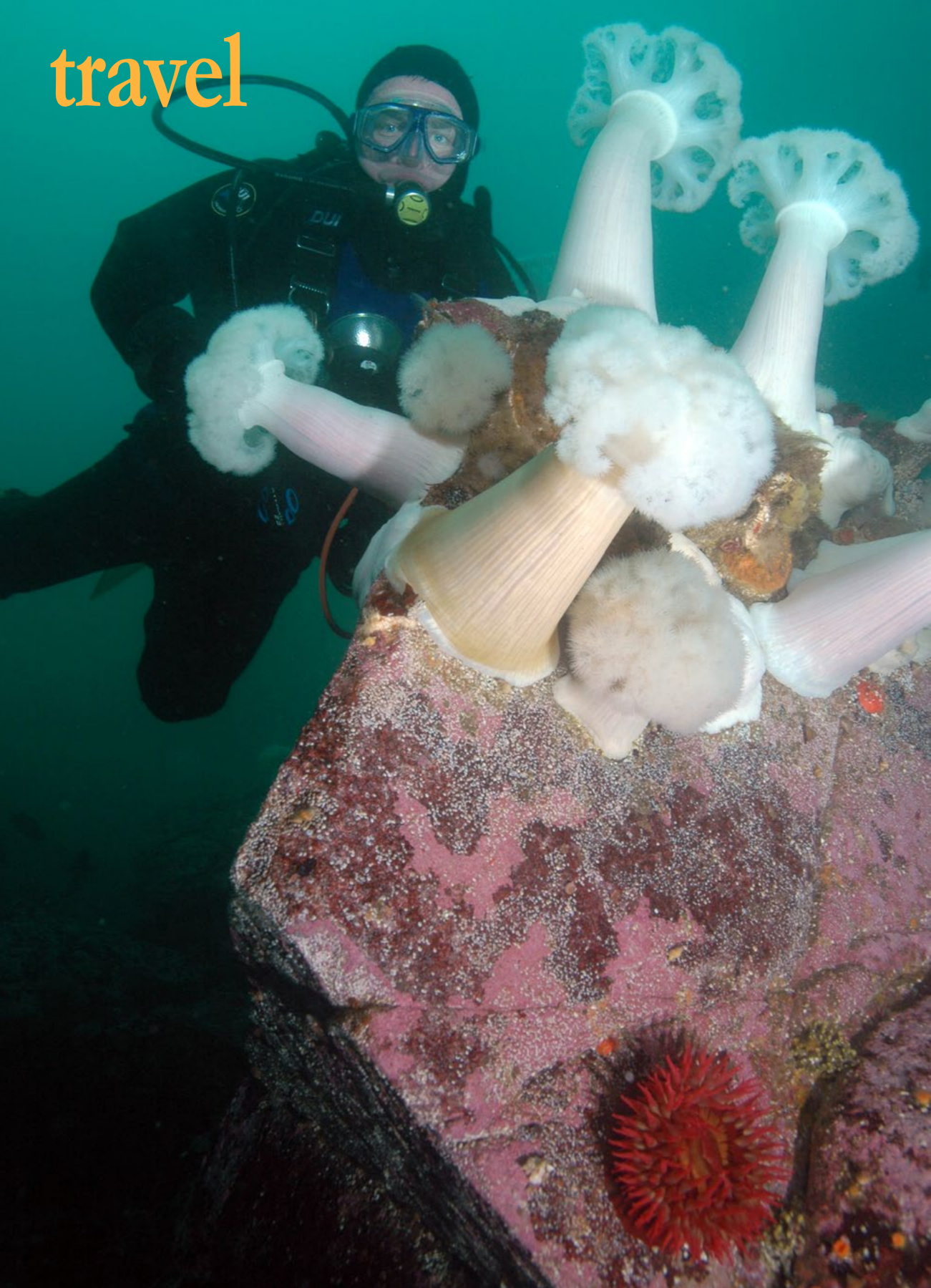
ship scuttled as an artificial reef in 2003. Not much remains of the 473ft (142m) *Vanlene* since it went down in 1972 near Austin Island. I have spotted adult Puget Sound king crab, multi-colored sunflower stars, rockfish, California sea cucumbers and abalone to photograph. The *Vanlene's* bow can be found in the shallows, but the rest of the ship unfolds over the rocks like a broken puzzle to over 100ft (30m) in depth. The migrant ship is approximately 100ft in length and sits upright in 95ft (28m) of water near Canoe Island in Sechart Channel. The hull and wheelhouse are easy to explore, with the majority of its marine residents growing on the outer hull and bow area.

When not diving, humpback and gray whale watching is popular, as are leisure paddling trips to take in the magnificent scenery and wildlife.

Nanaimo Area

Nanaimo is centrally located on the eastern side of Vancouver Island and acts as a hub for incoming mainland air and sea traffic. There are 8-12 excellent boat dives





Diver Wayne Grant exploring Barkley Sound (left); Six gill sharks are seen in Barkley Sound and around Hornby Island (below)

all. Currents are not usually a problem, but better visibility usually occurs on a falling tide, especially during winter months.

Enormous white plumose anemones cascade down a sandstone wall dotted with bright pink crimson anemones on the northern side of Snake Island, along with red blood stars and orange finger sponges. I have also seen wolf eels out in the open and clusters of cloud sponge at deeper depths. Snorkeling with resident harbor seals is always fun during surface intervals here.

Orlebar Point, another steep wall on Gabriola Island, hosts an array of odd-shaped chimney sponges, tiger and quillback rockfish and an assortment of crustaceans. This shore-accessible site is also utilized by technical divers.

As for drift diving, there are two narrow passageways where the currents commonly reach eight knots at full flow. This in turn provides a rich environment for a

multitude of invertebrate life to flourish. Both sites can be explored during slack. Dodd Narrows has brilliant giant green anemones and pink tipped anemones in the shallows, while yellow zoanthids, orange cup corals and small white anemones cover the boulders below. Gabriola Passage is equally as picturesque, hosting an array of red sea urchins, gray-encrusted lobed ascidians, cabezon fish, grunt

and several good shore dives to pick from. Popular wrecks include the 366ft (111m) HMCS *Saskatchewan*, the 400ft (122m) HMCS *Cape Breton* and the 157ft (47m) North Sea rescue tug *Rivtow Lion* scuttled as artificial reefs. Technical and extended-range divers like to practice their skills in and on the two larger wrecks, while photographers and naturalists enjoy them



sculpins and painted greenlings.

When not diving, sailing is one of the many fun activities to do. Malaspina Galleries (sandstone overhangs) and the aboriginal petroglyphs can be found on nearby Gabriola Island, or visitors might want to stroll along the water down an easy boardwalk downtown.

Chemainus Area & Porlier Pass

Porlier Pass, Trincomali Channel and Stuart Channel offer divers something different at each site. I was quite impressed with the historical wreck of the 190ft-long, dual paddle-wheel steamer *Del Norte*, which sank in 1868. Not much of the wreck remains, except for the ship's

two paddle-wheel bases with protruding spokes and a couple of boiler stacks with chunks of coal everywhere.

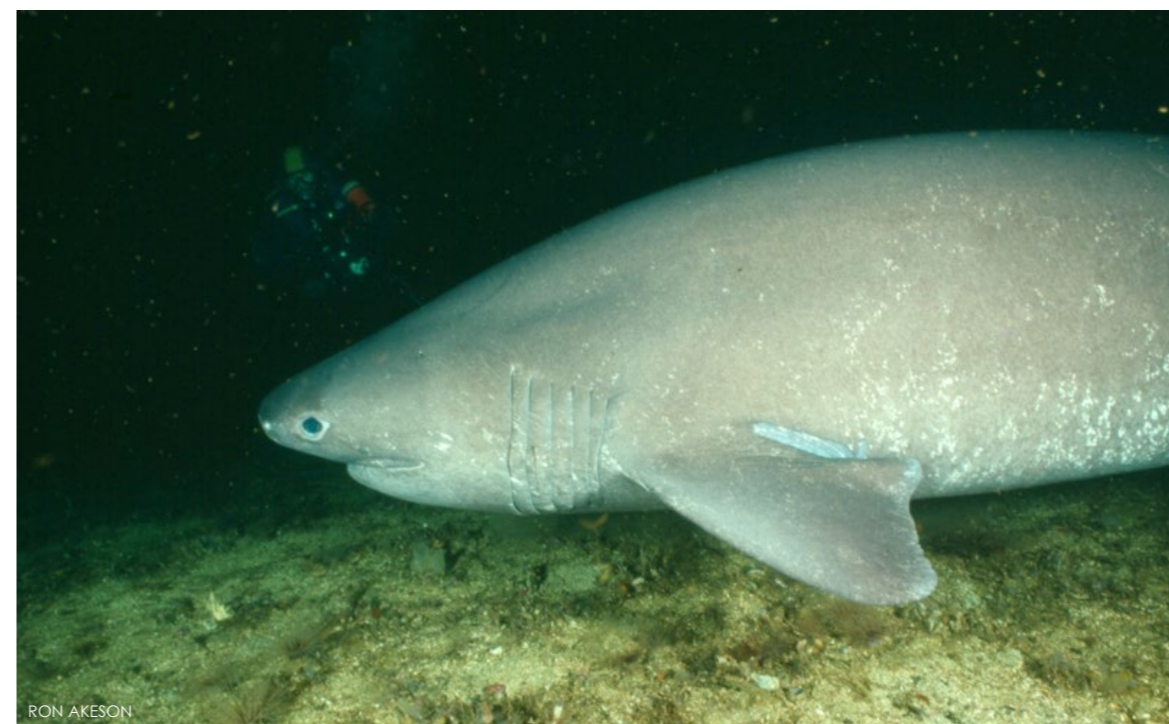
Another easy dive is the 737 plane near the town of Chemainus. This unique airframe sits on a stand in 70ft (21m). Currently, over 100 species have been identified living on the wreck by local diver and book author, Andy Lamb.

Wolf eels, basket stars, huge lingcod and rockfish are common in Porlier Pass at one of several wall dives, or around the wreck of the Point Gray.

Victoria, Sidney & Saanich Inlet

Victoria is the capital city of BC, located at the southern end of Vancouver Island, accessed by air or ferry from Tsawwassen to Swartz Bay (Sidney) or Port Angeles (WA) to Victoria.

Strong nutrient-rich currents support an assortment of large and small marine residents. From a photographer's point of view, the marine biodiversity is enough to stagger the imagination. There are numerous shore and boat diving sites around the city, as well as Sidney and all along Saanich Inlet.



RON AKESON



One of the most popular shore spots is along the Ogden Point breakwater, five minutes from downtown Victoria. An assortment of rockfish, kelp greenlings, nudibranchs, perch and sea stars can be found. Octopi and wolf eels also enjoy the protection of the blocks for their dens. Several large reef balls have also been placed here to provide more habitats.

Race Rocks is located about three nautical miles from Pedder Bay in the Strait of Juan de Fuca, where great quantities of flowing water create a fast-paced high-energy advanced dive. This caldron of boiling turmoil supports a huge concentration of life, which is best explored during slack current. Pink and white clusters of soft corals, bunches of finger sponges and colorful nudibranchs share this underwater rocky terrain with lavender tinted coralline algae and overlapping leaves of ground-covering kelp. Multi-colored brooding anemones cover the lower portions of kelp stalks, resembling a garden of flowers.

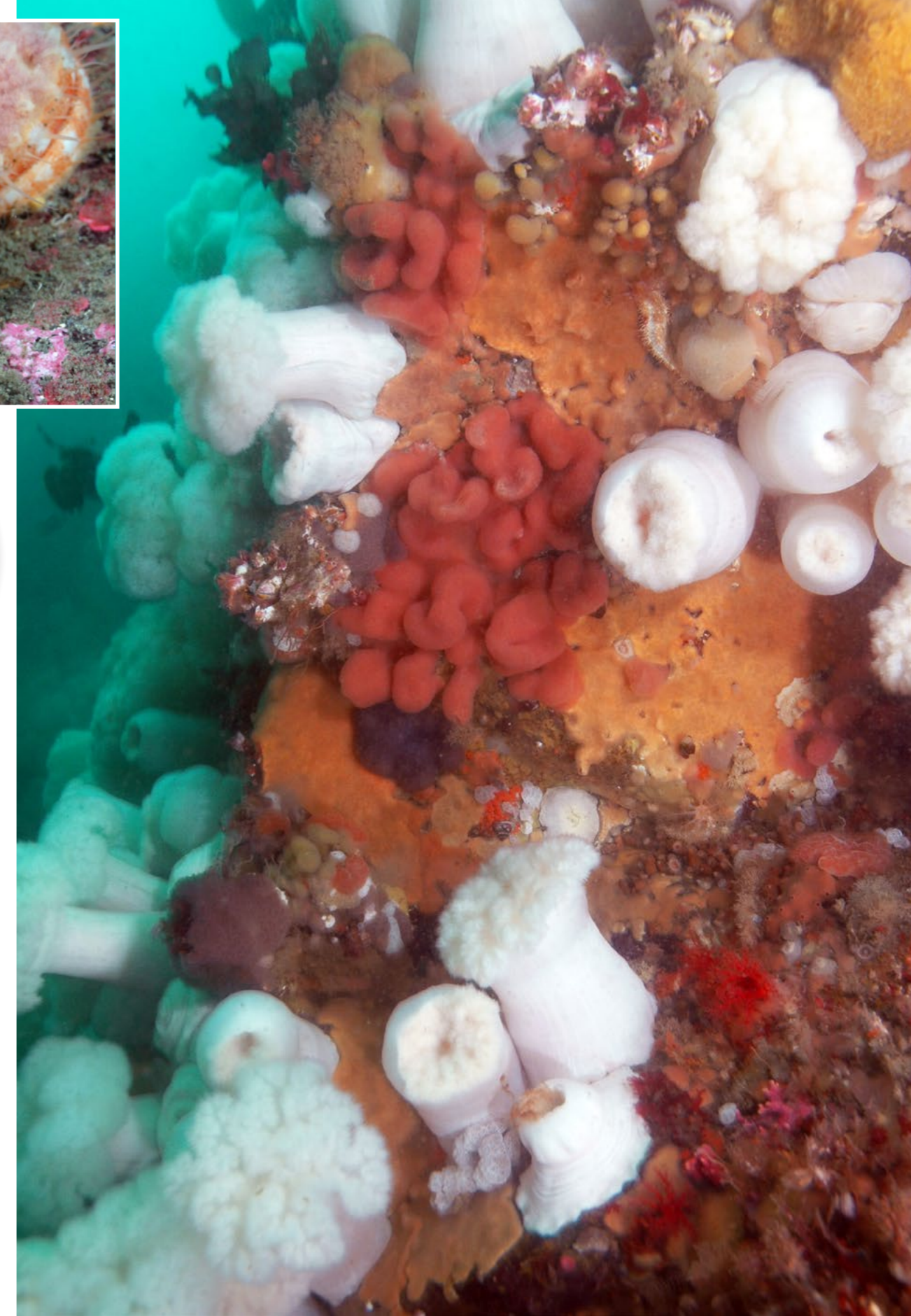
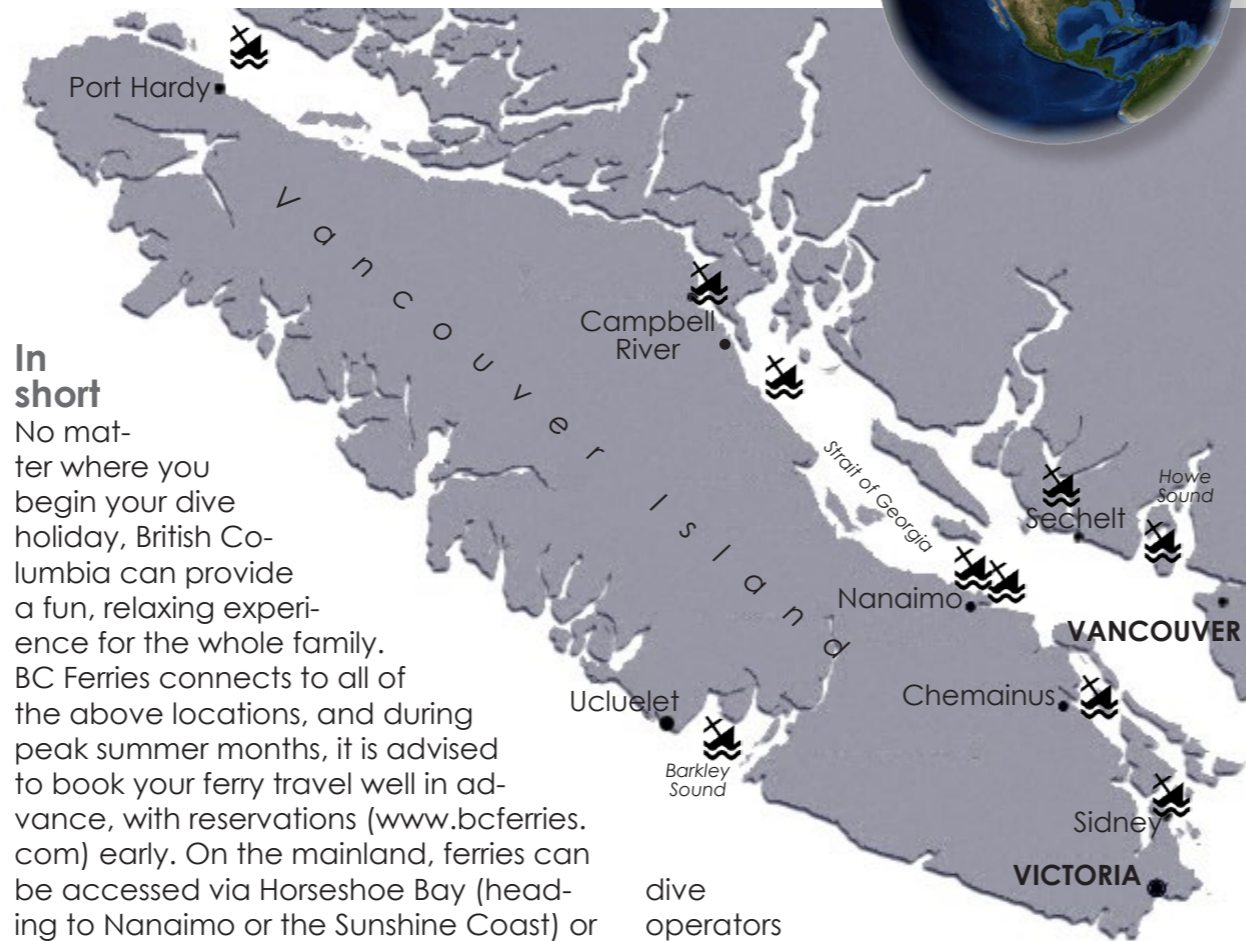
The 175ft (52m) *GB Church* and the retired ex-naval ship *HMCS Mackenzie* are within minutes from Sidney. Both sit upright in relatively moderate current areas. Keep an eye out for nesting lingcod, rockfish, swimming scallops and an endless supply of invertebrates.

In short

No matter where you begin your dive holiday, British Columbia can provide a fun, relaxing experience for the whole family. BC Ferries connects to all of the above locations, and during peak summer months, it is advised to book your ferry travel well in advance, with reservations (www.bcferrys.com) early. On the mainland, ferries can be accessed via Horseshoe Bay (heading to Nanaimo or the Sunshine Coast) or from Tsawwassen (Victoria or Nanaimo). When visiting Canada, you will need a passport and/or proof of citizenship.

Water temperature averages 46-55°F (7-13°C) throughout the year, requiring thick exposure protection (a drysuit). Many BC and Washington State dive stores and BC

dive operators offer complete dive packages with accommodation. Gas mixtures of nitrox, trimix and argon are also available. So, enjoy your holiday, stay within your skill limits and have some fun in the northwest!



Nutrient-rich water feeds this wall of life (above) at Race Rocks dive site near Victoria; Map of Vancouver Island (left), with location of some of the accessible wrecks along the southwestern coast of BC; The dive site Race Rocks is found underwater here (top left); Sponge covered with scallops at Race Rocks near Victoria (top center inset)



POINT & CLICK
ON BOLD LINKS



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Edited by
Rosemary E. Lunn
and Peter Symes

Equipment



SI Tech Balder

Swedish manufacturer Si Tech has further refined some of the small inconspicuous details that make the life of a drysuit diver a little easier. The company's new low pressure hose attaches more readily, and has less o-rings and components. Therefore, it is easy to use and maintain. This hose comes in various lengths—15cm (5.9in) to 130cm (51.1in), with the standard length being 80cm (31.4in). SITech.se

Mares Loop XP

Are we looking at a smart innovation that will prevail? Will this regulator design provoke a rash of "me too" products from other manufacturers—a trait of which Mares is also guilty—or is this a "wacky fad" that will fall by the wayside? Why was the Loop conceived? It was originally designed specifically for the technical diving community, as a stage regulator. However, during trial dives, the Mares test divers reported that the Loop was comfortable to dive, and the mouth was not stressed by the hose pushing on the right-hand side of the second stage; hence, it has been also rolled out to recreational divers. I can, however, see some merit in the Loop as a stage regulator. A bailout cylinder is generally sidemounted (as opposed to chest- or back-mounted). Depending on how the cylinder is rigged, how it is attached to you, and how much gear you are wearing, it is possible for the bailout regulator to pull a bit, in your mouth. I think the hose routing on the Loop may well make decompression stops more comfy for techies because there is no kink in the hose. It is a straight run from the first stage and into the mouth. Mares.com



XS Scuba Switch

The Switch mask has been designed to allow divers to change filter colors on the fly. This mask has a slot that sits in front of the mask's permanent face plate, and because there is no "back" or "front" to the lens, you can slide in a filter using either hand. Three filters come as standard: red, amber and dark tint. Divers can additionally purchase magenta (for green-water diving) and black (which simulates no-visibility conditions). XSscuba.com



Galileo G2

The G2 benefits from a high contrast, user-configurable color display. Hence, this model is lighter and smaller (205g / 5.6cm, or 2.2in) than the current Galileo (290g / 8cm, or 3.15in). Key features have been retained, such as the simple three-button control system and body monitoring, i.e. heart rate, skin temperature, breathing rate and water temperature. Users should note this is not Nirvana; the data provided is very basic, but it is a step in the right direction to full physiological monitoring. The rechargeable G2 comes programmed ready-to-dive for trimix, apnea, CCR and sidemount or un-manifolded twinsets, with divers able to download their data using Bluetooth. Other features include the choice of different languages, integrated bungee or retractor clip mounts, and CNS warnings when oxygen update reaches 75 percent. Scubapro.com



BARE AquaTrek

BARE—the Maltese drysuit manufacturer—has launched a lightweight trilaminate drysuit. Apparently, it is meant to be lighter than a traditional trilam suit. However, we cannot find any data on just how lightweight it is. BARE states that its exclusive Cordura nylon Oxford 4-Layer breathable fabric "offers enhanced flexibility over current butyl trilaminates." This suit is fitted with a low profile plastic zip, which offers good flexibility on the front entry suit. While there certainly have been problems with plastic zips in the past, the zip manufacturers have worked hard to get a lot of these issues solved. The telescoping torso has a field-replaceable crotch strap. Where BARE deems there to be "critical wear" at key points along the seams, the manufacturer has double-taped them with a flexible material to provide additional durability. Other features include braces (suspenders), 2mm nylon/smoothskin warm collar and knee pads. Baresports.com





Introducing the COSMIQ+ by DeepBlu

Text by Matthew Meier

The COSMIQ+ is the world's first dive computer with its own social network and app. I had the pleasure of diving with the COSMIQ+ on recent trips to French Polynesia and the Philippines, and it performed beautifully.

The computer itself has a big 2.2-inch LCD screen with large, bright colorful numbers, making it easy to read, even at night. In scuba mode, the display shows depth, dive time, no-deco time, time of day, water temperature and maximum depth—all on one screen. So, there is no

need to push buttons, or jump between screens, to be fully informed. Nitrox can be set from 21 to 40 percent, and this may be changed either on the computer or through the app.

Conservatism

A safety factor may be set through the app so that the computer performs in either a conservative, normal or progressive manner, and the ppO₂ may be set from 1.2 to 1.6. In comparison to my normal dive computer, the COSMIQ+ was more conservative, thus adding another layer of safety to the dive. Depending on your preference, the computer can start in scuba mode, gauge mode or freediving mode as soon as it is submerged in water. While underwater, the COSMIQ+ will beep if you are ascending too fast,

nearing decompression limits, low on battery or if you have hit a user-defined maximum depth or dive time, which you may set through the app. At this time, it is not possible to change or turn off these alarms.

Synchronization

The COSMIQ+ syncs wirelessly, via Bluetooth 4.0, to the Deepblu app installed on either a smartphone or tablet. The app allows the user to change various settings on the computer that cannot be accessed through its two buttons, when not connected. Once synced, you may set the measurement units to imperial or metric, and the pressure display to Psi or Bar. You may also set the safety factor, ppO₂ level, nitrox percentage, salinity, altitude, starting mode when submerged, screen timeout duration, backlight intensity and alarms.

The app is constantly being improved, and these upgrades are passed along for free to users via frequent firmware updates. Since Bluetooth does not need the Internet to function, the app and the computer can still communicate perfectly while you are on a liveaboard or in some remote corner of the globe with no contact with the outside world.

Charge

The battery life of the COSMIQ+ has been improved with the most recent firmware update and the new smart power-saving mode, now allowing up to 12 hours of dive time between charges. Even before the update, I had no prob-

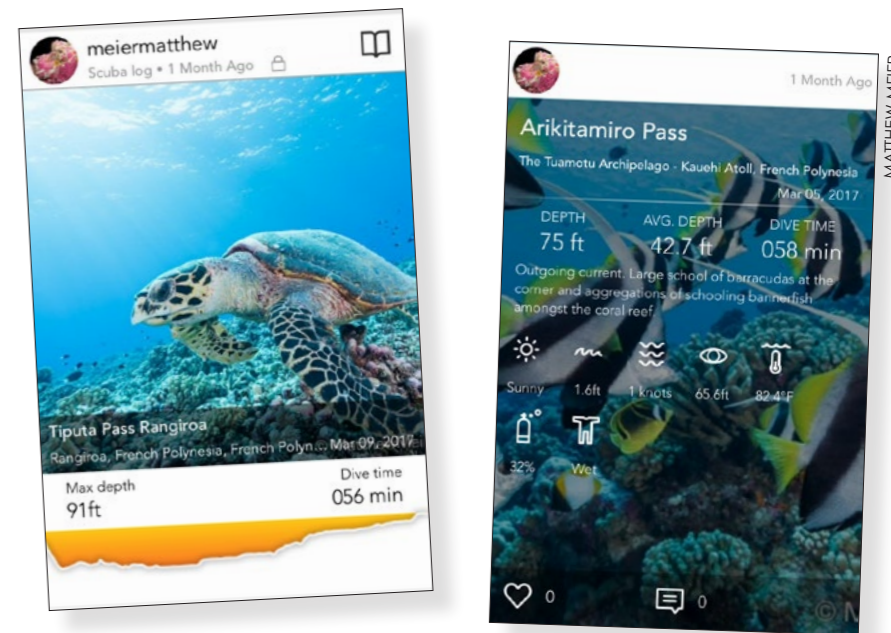
lems getting four to five dives per day out of a single charge. The unit charges with a magnetic USB cord that attaches to the gold-plated charging pins on the back of the computer. Simply rinse in fresh water, dry the contacts and it is ready for charging. In my experience, the recharging time was less than two hours, and I found it easy to do nightly, while downloading my dive logs, so the computer was ready for the next day.

The Deepblu app is intuitively easy to use and navigate. Data transfers from the computer quickly and wirelessly via Bluetooth, so there are no extra cables to worry about. Each dive is logged in the app and contains dive times, depth and water temperature. The user can then go in and edit each dive log to specify dive sites, dive buddies, dive gear used, plus water and weather conditions.

It is also possible to attach photos and videos to each log, and they will post at the appropriate spot on the dive timeline, as long as your camera and computer are set to the same time. Just like you would in a hand-written logbook, a written description of the dive may be added through the app. Another nice feature, if you happen to make a dive without the COSMIQ+, is that you can manually enter a dive log into the app as well.

Logging

Dive logs may be posted privately or publicly on the app, and other COSMIQ divers may comment on your posts or



individual photos. This is a great way to interact with fellow divers, underwater photographers and videographers. You can use the app to search for dive buddies or dive destinations, and even share your dive logs on other social networks such as Facebook. The app is a great resource to research a location for a future trip, or find out what kind of underwater life has been seen recently in a particular area.

The original Deepblu app has been expanded into a full-fledged social network, with dive-related news and content. This online community may still be accessed through the app on your tablet or smartphone, but now also exists on a web browser platform so you can surf from the comfort of your home computer or laptop (Deepblu.com/discover/live). Here, you can share your stories with other like-minded individuals, read original news content and join special interest groups within the community. Making it even easier for divers and businesses in the dive community to stay connected.

Verdict

The COSMIQ+ is a well-designed, stylish and affordable dive computer that comes with the added bonus of connecting you to an extensive network of divers from across the globe. If you are in the market for a new dive computer, the COSMIQ+ is a great choice. ■

Deepblu.com



COSMIQ+ dive computer, with its own social network and app, by DeepBlu





Putting Buddy-Watcher to the test

Text and photos by Massimo Boyer
Adaptation by Peter Symes

From our first basic dive training, it is impressed upon us that we should always keep an eye out for our buddy and be within reach in case assistance is required.

During that same first course, we are, however, also taught emergency procedures such as the Controlled Emergency Swimming Ascent (CESA), which is to be performed if we estimate the safer option is to reach the surface rather than waste time trying to get the attention of a distracted companion. In that regard, to be fair, we also have to acknowledge that we could ourselves be this distracted diver who does not pay attention to the well-being of his or her buddy, because we get too absorbed with our activities and find ourselves out of reach and unable to provide immediate support if so needed.

Let's be honest with ourselves: Haven't we all been in the situation where we wanted or needed the attention of our

dive buddy but found ourselves unable to get it right away? After countless shakes with a rattle or vigorous banging on our tank, possibly accompanied by some expletives, our buddy finally turns around, looks at us with a puzzled expression as if asking, "Yes, what do you want?" before swimming towards us in an all-too-leisurely pace.

Hitherto, the dive industry has not come up with any great solutions as to how you get your buddy's immediate attention.

The various devices invariably use sound in some form or other, although as we all know, or should know, noises are not the best means of communicating underwater. Sound may travel fast, but underwater, it is difficult, if not outright impossible, to establish the direction from which it originates, and wearing a hood, or being a little distracted, is all it sometimes takes not to hear a signal.

Add to this the noise that the various shakers, bangers and

other noisemakers cause, often drives diveguides bonkers. It may be quite convenient for the divemaster to have such a device when guiding, in order to call the attention of his or her group, but imagine if every single diver in the group carried one and put it to good use. What a racket! It might well be the end of tranquility underwater as well as the start of a major headache for the poor divemaster.

Enter the Buddy-Watcher, which is a wrist-worn electronic gadget that synchronizes

with units worn by other divers. Using ultrasound, signals can be sent between paired units, causing the receiving unit to buzz and vibrate. Thus, other divers are not disturbed. Units are paired by pressing and holding down the main button on each unit for some seconds, in order to turn them on. A buzzing sound is heard, and the pairing process starts automatically. After a short pause, both units will vibrate to signal that they have been successfully paired. It is also possible to perform a manual pairing.

A master device (bought separately) allows a dive leader or guide to silently call several members of a team simultaneously.

According to stated specifications, these units have a range of up to 80m and also work around obstacles, where there is no direct line of sight between the divers.

As the units, however, do not provide any directional information, it can just be used to call for attention, and divers wearing these must still, at all times, be aware of the whereabouts of the other diver. Tip: If separated by some distance, the bubbles of your buddy can often be spotted by looking towards the surface. The units are depth rated to 60m.

Verdict

The unit is quite handy and useful in many contexts. For example, safety matters aside, it allows an underwater photographer who spots a skittish subject to silently and discrete-

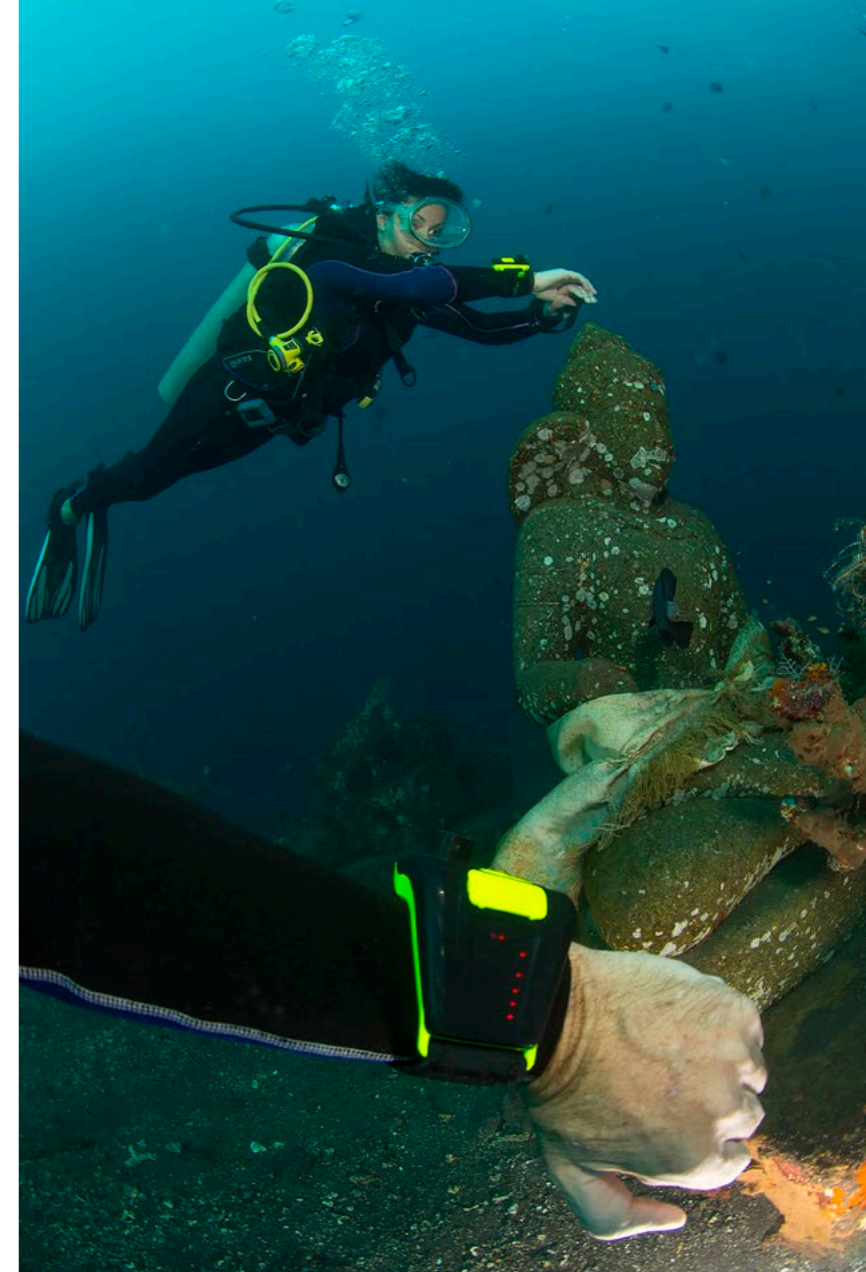
ly signal his or her buddy, simply by pressing a button. It is quite straightforward to use.

At a first glance, the finish on the unit seems a bit plasticky—perhaps due to those big green buttons on its shiny black body. But it does appear otherwise robust.

The units are charged via a (mini) USB cable. Citing environmental concerns, USB chargers are not included; just a cable is included, as ubiquitous standard mobile phone chargers can be used.

Also in the box (the standard box comes with a pair of units) are straps of various lengths, so the units can also be fitted around drysuits. ■

Communication underwater is not easy.





Annual cylinder inspections are not that bad

The article, "UK under pressure to test cylinders annually," published in the previous issue (#79) was informative, but appeared to be unfairly attacking standards in the United States. Without getting into some of the specific arguments, since they are subjective, I would like to address the misinformation on how annual cylinder inspections are conducted in many countries.

Text by Don Kinney

I understand in the United Kingdom, a scuba cylinder undergoes a visual inspection every 30 months and a hydrostatic requalification every five years. The UK dive industry was upset that the ISO (International Organization for Standardization in Europe) was looking at an annual visual inspection standard for cylinders. The process that the Inspectorate for Diving Equipment Servicing and Testing (IDEST) requires for a scuba cylinder inspection is a very thorough inspection, and I support all the steps. My concern with the aforementioned article is how it describes how cylinders are inspected in the United States: "...the valve is whipped off, a technician takes a look and puts the valve back in." This could not be further from the truth.

Same procedure

We follow all the steps listed by IDEST, apart from the mandatory use of a Go/No Go gauge (see info box right) for the threads and mandatory valve rebuild.

I am not saying that the use of a Go/No Go gauge is not beneficial. There have been several incidents when the wrong valve is placed in the wrong cylinder. That, in turn, damages the

threads and makes the cylinder unsafe, creating the possibility of a rupture. However, if an untrained person forces the wrong valve on the cylinder, at some other point in its use after the inspection, then no training can predict that error. During a proper visual inspection, with or without a gauge, the damage to the threads should be obvious to any properly trained inspector.

Rebuilding valves

We also train inspectors in the process of rebuilding valves. It is not mandated to rebuild the valve if it is working properly. The cylinder inspectors are trained to test the valve and determine their continued safe use. They can voluntarily take it upon themselves to repair or rebuild the valve or tell the owner that the valve did not pass and therefore was not placed back on the cylinder. In either circumstance, it is documented on the inspection form and final determination is made by the inspector and user.

I was also bothered by the statement: "This new ISO standard is being driven by a number of nations, including those that primarily dive with aluminum diving cylinders, where there have been issues with cylinder necks cracking."

I do not know of a nation that pri-

marily dives with aluminum cylinders. There are currently steel, aluminum and composite cylinders approved for diving. Each one of these materials has its positives and negatives, and the diving consumers generally drive the market.

Some like steel for the buoyancy characteristics, others like aluminum because of its corrosion characteristics and others enjoy composites because of their weight and increased pressures. However, all cylinders have their concerns when placed in the hands of users.

GO / NO GO Gauge

A go-no (or go/no-go) gauge refers to an inspection tool used to check a workpiece against its allowed tolerances. Its name is derived from two tests: the check involves the workpiece having to pass one test (go) and fail the other (no-go).

It does not return a size or actual measurement in the conventional sense, but instead returns a state, which is either acceptable (the part is within tolerance and may be used) or unacceptable (the part must be rejected).

Source: Wikipedia

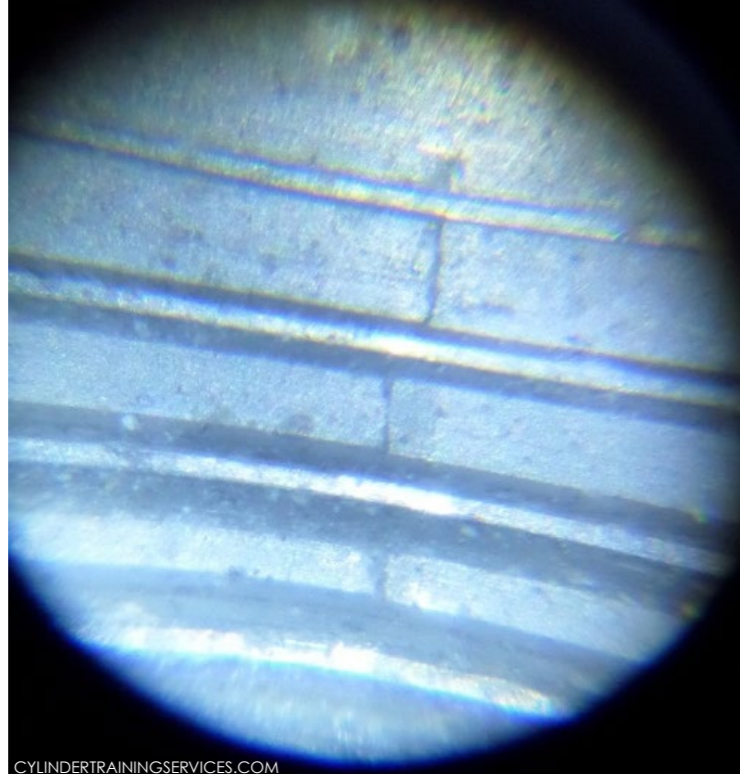


Photo of tap stop marks in threads. These are simply machining marks and has no effect on the structural integrity of the cylinder.

CYLINDERTRAININGSERVICES.COM

Cracks are rare

The stated issue of cracks in the necks of aluminum cylinders was years ago and involved only one specific alloy. Even within that alloy, ruptures are rare. Out of over 40 million cylinders manufactured with the 6351 alloy, only 20 were suspected of rupturing due to cracking (web stats). So, using the math, that is less than a .0000005 percent chance of a rupture with that one specific alloy. I'd like to state that ALL cylinders are safe—if inspected regularly, used properly and removed when they become unsafe.

Tap stop marks

The article also stated that 75 percent of cylinder failures are due to issues with the threads. I cannot dispute that claim without seeing the data being mentioned. Without seeing the specific data, I would guess that part of the issue is machine marks in the threads.

There is a common concern when inspecting a cylinder's threads and interpreting the results. We find that many people see a *tap stop mark*, and unjustly name it a crack or flaw within the threads. A tap stop is simply a machining mark and has no effect on the structural integrity of the cylinder.

I would say that tap stop marks are common on many cylinders, and not a reason to fail a cylinder. I state that all cylinders have

a rare probability of cracking; whether they are aluminum or steel. Other flaws in the cylinder threads (improper valves) are normally caused by the user and should be caught by the inspector during the visual inspection process.

All treated equal

Furthermore, it was stated in the article that in the US, cylinders are not all treated the same way, and there is a classification for "sport and recreation." I have never heard that phrase and have no idea where it would have been found.

In fact, when we train visual inspectors, we train them to inspect all cylinders regardless of usage. A cylinder may be used in scuba, fire service, beverage or scientific industries. It does not matter what industry; all that matters is that the cylinder is safe to use.

This is determined by wall thicknesses, obvious dents, threading concerns or other safety concerns noted during the inspection. I can more easily argue that most cylinders are "commercial cylinders" since they are all used in industries that exchange commerce.

A question of cost?

I do not know if the proposed standard would have put the divers at risk.

The argument is made that with an increased cost of an annual inspection, divers would have found ways to avoid the new procedures. The question should become: What fee is the consumer charged for the annual inspection?

Since the article has already

focused on the United States, I will use some pricing from that region. Depending on the inspection facility, the consumer pays US\$15-25 for an annual inspection. They then pay an additional fee of \$20-25 every five years for the hydrostatic requalification.

It has been my experience that most divers have no problem paying \$25 every year to ensure the safety of their cylinders. And I can also say that paying \$25 per cylinder per year is a *lot* less expensive than buying and maintaining a personal compressor system.

Corrosion can happen fast

The final point I will make about the article is for the benefit of an annual inspection. In my experience, many issues have developed within a cylinder within a year's period. The photo (left) shows excessive aluminum hydroxide corrosion I found in a cylinder within 365 days of its previous inspection.

Also, back in the 1970s, the University of Rhode Island found that corrosion in a steel cylinder can affect its gas content, and corrosion factors in as little as 100 days. A well-maintained cylinder can go years with no issues. A misused, neglected or abused cylinder can be compromised well within a 30-month inspection cycle.

Frequent

The annual visual inspection process for dive cylinders in the United States is a voluntary procedure developed by divers back in the 1970s; no government agency mandated the process. US divers have been getting their cylinders annually inspected for decades, with no obvious financial concerns.

It is not a perfect system, and some try to get around the practice, but most do not. The more



Aluminum hydroxide corrosion

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W32 CANOPY
High Pressure Compressor
Charging Rate: **180, 250 or 300 lt/min**
Working Pressure: **225/310 bar**
Dimensions (CM): **W70 L100 H130**
Weight: **280, 290 or 300 kg**



W31 MARINER
High Pressure Compressor
Charging Rate: **105 or 140 lt/min**
Working Pressure: **225/310 bar**
Dimensions (CM): **W44 L81 H52**
Weight: **65 kg**



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Opening Times: Monday to Friday 9.00 am - 17:00 pm
Saturday and Sunday - Closed

often a cylinder is inspected, the greater chance of catching an issue before it becomes dangerous. It takes a proper visual inspection on all cylinders to help prevent ruptures and other catastrophic events. ■

Don Kinney is the owner of Cylinder Training Services and has been teaching cylinder inspectors since 2001. He has developed training programs for using and inspecting cylinders, and has developed tools for conducting a proper inspection of those cylinders. He is the author of the ITI manual for visual inspection procedures and helped develop the ITI visual cylinder inspection program. He has authored over 12 articles on inspections, cleaning and rules and regulations involving high-pressure cylinders.



The Azores

Text and photos by Don Silcock

— *Where the Whales Roam*





View over the coastline of the island of Pico in the Azores. PREVIOUS PAGE: Mother sperm whale and calf diving

Like the tips of icebergs, the islands of the Azores archipelago are just the visible peaks of a remarkable chain of underwater mountains that rank among some of the highest in the world. Those mountains rise up from the Azores Platform, a huge area of nearly 6 million km², which in itself is just a small part of the amazing Mid-Atlantic Ridge that runs the complete length of the Atlantic Ocean—from the far north and the Arctic Ocean, to the deep south and the Southern Ocean.

The Azores Platform is some 2,000m below the ocean surface, but the Mid-Atlantic Ridge is grounded on to the seabed another 2,000m below that, while the tip of Pico (the tallest island

of the archipelago) is 2,350m above sea level, making the mountain that is Pico about 6,500m high in total elevation. Situated as they are, roughly halfway between the edge of southern Europe and the tip of North America, the nine islands of the oceanic archipelago offer the only shelter from the notorious seas of the North East Atlantic. Underwater, that archipelago sustains an incredible ecosystem because those nine visible peaks are just a fraction of the 100+ underwater mountains and seamounts that are both a beacon to marine life and a catalyst for the interaction between the many pelagic species that aggregate there.

Location, location, location...

Situated at the junction of the North American, Eurasian and African tectonic plates, the Azores Platform and its underwater mountains were created by intense seismic and volcanic subductive interaction between those plates. Swept by the warm tendrils of the southern Gulf Stream, rich



Loggerhead sea turtle in the deep waters of the Azores



Church of white plaster and volcanic stone in the Azores



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Information on boats, routes, schedule, brochure, videos... look it up on www.maldivesblueforce.com



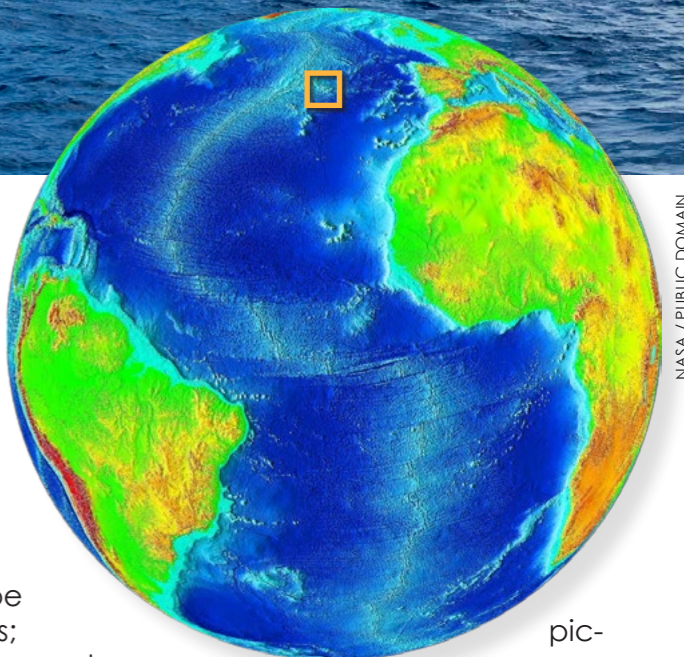
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Azores

Rugged coastline (above) of the Azores, located on the Mid-Atlantic Ridge (right)



NASA / PUBLIC DOMAIN

in tropical nutrients and dissolved organic nitrogen, the archipelago is far enough south from the frigid winter waters of the Arctic that even in midwinter, the area can support the food webs necessary to sustain a complete marine ecosystem.

So, while the rest of the North Atlantic is practically barren at that time of the year, the Gulf Stream creates rich upwellings around the mountains and seamounts of the Azores that become fertile oases to which the large pelagic animals of the region aggregate. Come spring and rising temperatures, the Azorean waters burst into life with huge planktonic blooms and krill spawning events that create the perfect feeding conditions for the hungry great whales of the northern hemisphere, which are migrating north to their Arctic summer feeding grounds.

Great whales

The deep waters, undersea mountains and overall ecosystem of

the Azores make it an almost perfect location for sperm whales—deep-diving animals that hunt and feed on the giant squid that abound in the depths around the archipelago. It is also one of the few places in the world where, under a special permit from the Regional Environment Directorate, it is possible to be in the water with the sperm whales; and in September 2016, I made the marathon journey from Sydney to do just that.

September is the optimum month to experience the Azores underwater as the onset of autumn brings the best visibility, the water temperature is still reasonable and most of the tourists have departed. It is also the end of the main calving season (which starts in July) and this means there is the highest chance of encounters with curious juvenile sperm whales.

I was based in Madalena, the pleasant main town of the incredibly

picturesque island of Pico in the central area of the Azores, which is dominated by its volcano, Mount Pico—the highest point in the archipelago and in all of Portugal. Mount Pico was thankfully dormant during my visit, having been so since its last eruption in 1718, but a drive up to the flanks of the volcano on a clear day affords a view that seems to stretch to eternity and puts into perspective the isolation of these incredible islands, far out in the North Atlantic. It is that very view, combined with the nature and tenacity of the



Azorean people, which allowed a shore-based sperm whaling industry to succeed, because from up on high, it is possible for an experienced whale-spotter to not only see the “blow” of a whale at the surface up to 50km out at sea, but also tell what type of whale it is. The whale look-outs are called “vigias”, and they are distributed around the islands of the Azores at strategic locations to provide virtually complete panoramic coverage of the waters. Somewhat ironi-

cally, the same methodology is used to this day to spot the whales and guide the whale-watching boats to them—although mobile phones have long replaced the elaborate small rocket firing and white sheet signaling that were originally used.

But it is not just sperm whales that frequent the archipelago. At various times of the year, the other great whales can be seen with the leviathans of the ocean—the blue whale—appearing in March,

and followed by fin, sei and hump-back whales. The rich waters of the Azores are also one of the best places to see blue sharks, pilot whales, false killer whales, mobula rays and multiple species of dolphins.

Whaling history

The people of the Azores are known for their quiet, peaceful but industrious nature, and it was those characteristics that struck the captains of the American whal-



ing ships that visited the islands at the end of the 18th century. The American ships of that time were in many ways the precursors of the infamous “factory ships” of the early 20th century, which so devastated the global whale population. They were highly evolved vessels that could catch whales, using small open boats launched from the main ship, and then process the whale carcasses using an on-board brick furnace called a try-works to boil the blubber.

But most prized was the spermaceti wax-like liquid in the whale’s head, which was used to make what we would now call “designer candles”, which were in great demand among the wealthy class of the time because of the clear, brilliant light they gave off when burned.

Many Azorean men signed on with the American ships, quickly earning strong reputations as good “whalemen” who excelled as lookouts, boatmen and har-



The Azores has a whaling history that dates back to the 18th century. Today, whales are protected and whale-watching is a main tourist attraction

Groups of gregarious sperm whales can be found in the rich waters of the Azores (far left); Historical photo of whale spotter, or *vigia* (left)

Designed to pursue the deep-water whales out in the open ocean, they specifically targeted the sperm whale because of its highly-prized oil, which was lighter and purer than that of other whales. Plus, the high-quality ivory teeth of the sperm whales were used to make decorative objects and their intestines sometimes contained ambergris, which was valuable as a fixative in perfumes.

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View over the coastline at Madalena, the main town of the incredibly picturesque island of Pico in the central area of the Azores

me realize what I did not know. Many things left a strong overall impression upon me from this trip, but probably the most indelible were the people and culture of the Azores, together with just how hard it can be to get close to and photograph sperm whales.

People and culture

The islands of the Azores are a long way from everywhere, and although discovered in the 14th century, it was nearly a century later before the first settlers arrived—bringing with them everything they needed to survive, while they built houses and cleared land to plant the crops that would sustain them. Life was tough, which is most probably why the men who signed onto the American whaling ships did not complain much. That toughness and resilience was the

first thing that struck me about the people of the Azores. No matter how repelling whaling is, the basic fact that their men took to the open seas in small boats to catch and kill by hand such huge creatures is quite an amazing story.

I did a lot of reading and research with “Dr Google,” as I wrote this article and stumbled on two significant pieces of information in the process. The first was a Discovery Report by British marine biologist Dr Robert Clarke, who spent 10 weeks in the summer of 1949 assessing the sperm whaling industry in the Azores. His excellent report “Open Boat Whaling in the Azores” makes fascinating, but somewhat harrowing, reading and puts the whole thing into a clear historical perspective.

Then, there is the short film made in 1969 by William Neufeld called

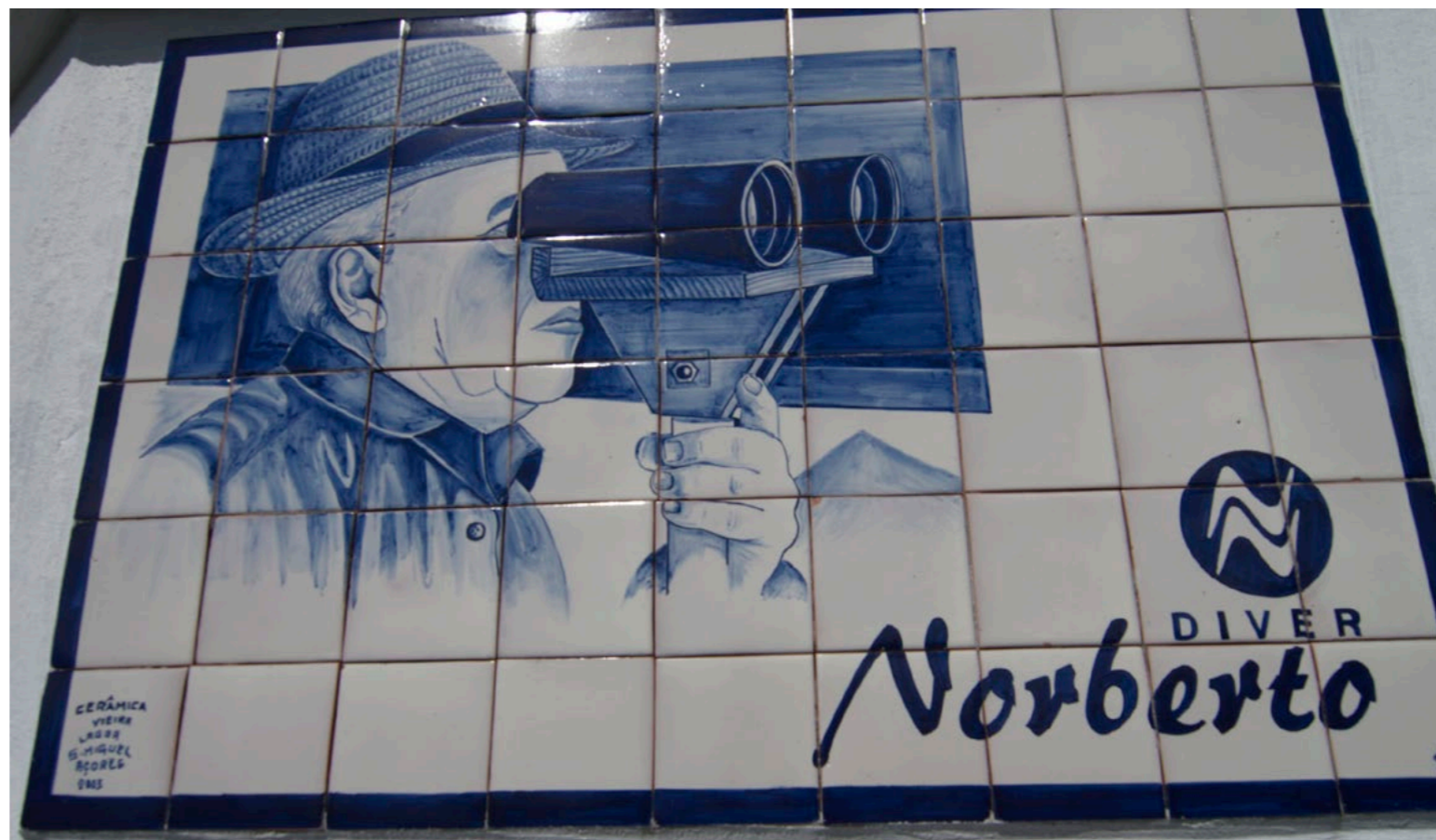
pooners; plus, they did not complain about the low pay, poor conditions and extended trips that often stretched out to two to three years at sea. In the second half of the 19th century, when the American whaling industry went into steady decline, the Azorean whalers brought their acquired skills home and established land-based whaling in their own islands, with the first known whalery being built on the island of Faial in the 1850s.

By the early 1900s, Azorean whaling was well established, and at its peak in the 1940s and early 1950s, there were a total of 21 stations in operation across the nine islands of the archipelago. At one point, 40 percent of the world’s take of sperm whales was from the Azores.

In a remarkable piece of living history, the techniques of the American whalers—fashioned and

honed as they were in the early 18th century to hunt, harpoon and kill sperm whales from open boats—were in use in the Azores through to the end of whaling there in the mid-1980s. The only concessions to modern technology the Azorean whalers made was the introduction of motor tow boats in the early 1900s, so that the open boats used for the hunt could get to the whales much quicker—but the hunt itself was conducted by oar power. Secondly, radio telephones were introduced in the 1940s to allow direct communication between the whale boats and the spotter up in their cliff-side vigias.

I must admit that I had virtually no knowledge of either the Azores or the local whaling industry before I went there—basically, I went for the sperm whales, figuring that (as normally happens on my travels) the experience would make



Whale spotters, or *los vigias*, are an important part of the history and culture of the people of the Azores

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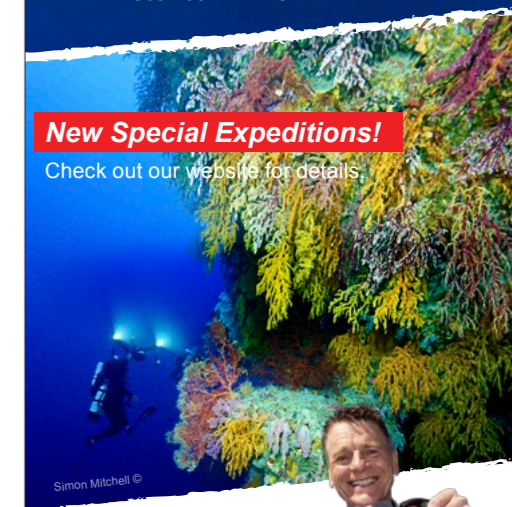
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A mother sperm whale with her calf; A playful calf dives after a breath at the surface (below)

780,000 animals. From then on, there was a slight but slow recovery through to the end of WWII and the introduction of industrial-scale hunting, which completely devastated the global population of sperm whales, reducing it to the estimated 360,000—32 percent of its original number!

Whitehead also attempted to estimate the possible rate of recovery for the global sperm whale population and concluded that one percent per year was the maximum possible, which if correct, would mean that in 2016, there were just under 420,000 whales—38 percent of that original estimated population. The general scientific consensus seems to be that a one percent increase per year is

overly optimistic, because it does not—and cannot possibly—take into account the ratio of male and female whales taken by the whalers and the inevitable impact that this would have on the social and reproductive behavior of the global population.

So, the best guess seems to be in the region of 380,000 to 400,000 sperm whales alive today, and explains why they are still classified as “Vulnerable” on the IUCN Red List of Threatened Species.

Photographing sperm whales

The total number of sperm whales in and around the Azores archipelago is also not known, but from the results of various surveys that have been conducted, and referencing that data back to the seminal work of Dr Clarke, it seems that a reasonable estimate is about 2,500. That number includes the small, but unknown, number of whales that are year-round residents and those that are known to migrate between the Azores and other

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“The Last Whalers”, which is available on Vimeo. Although dated in format, it provides an overall vignette into whaling in the Azores that was both horrific and heroic. I have always viewed whaling as a greedy and evil thing. I still do, but seeing it from the perspective of the Azoreans, who were basically doing what they had to do in the only non-agricultural industry there was at that time, allowed me to personally come to terms with what happened to the sperm whales of the Azores.

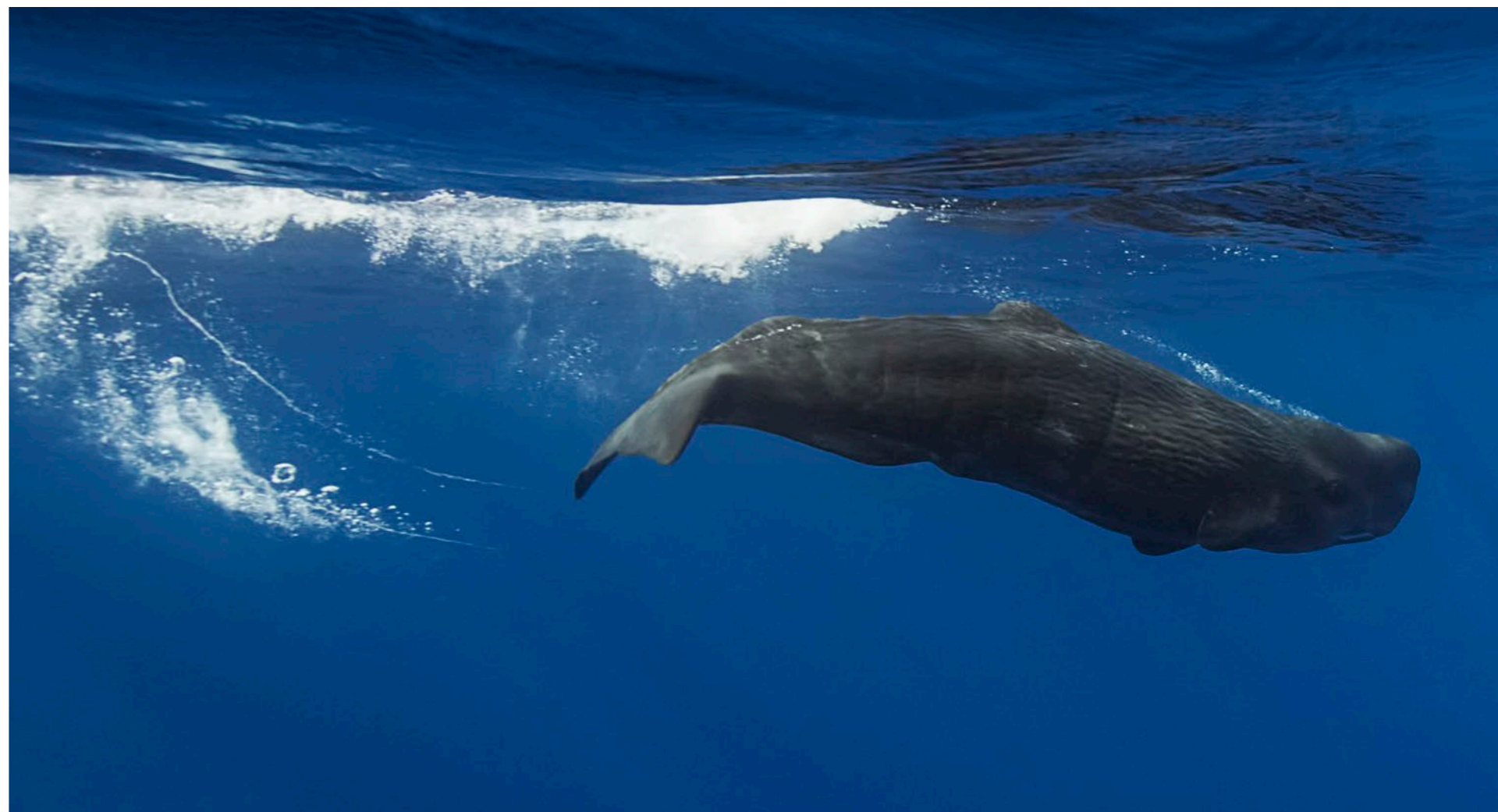
Overlay on that the many religious festivals, patron saint and traditional holidays that are integral to the archipelago, the islander’s way of keeping their culture strong and alive while offering thanks to their gods, and it is easy to understand

why the Azores are indeed a very special place.

Sperm whale population

So, how many sperm whales are there? The total number of sperm whales globally is not known, but the most commonly used estimate is 360,000—a number extrapolated in 2002 by Hal Whitehead, Professor of Biology at Dalhousie University in Nova Scotia, using an innovative mathematical model and a variety of existing data.¹

He also estimated that the number of sperm whales before hunting began was probably about 1.1m, and early open-boat whaling had reduced that number by some 29 percent by 1880 to around



areas of the North Atlantic, with most males going north in the winter months while the mothers and their calves head south.

Put in very simple terms, the total area of the Azores is just under 2,400km², so if there really are 2,500 whales, that would be roughly one per km²—but sperm whales are very gregarious animals, and females usually gather with their calves in social groups, typically with one or two males. Then, allowing for the fact that sperm whales socialize at the surface for about 25 percent of their time, and the other 75 percent is spent foraging in the depths for food—you quickly get the picture that when a group is encountered, the chances of spending much time



Azores



THIS PAGE: Mother sperm whale with her calf

with them is limited, to say the least. Add to that the fact that whaling ended in the Azores less than 30 years ago, plus the average age of a sperm whale is believed to be at least 50 years, and you can understand their reluctance to linger at the

surface when they hear boat engines approaching.

So, while we had many encounters with the sperm whales of the Azores, there was virtually no close interaction or intimate moments of connectivity with them, as they typically would move away at best, or dive as we got close—meaning we were limited to drive-by photography most of the time.

Other big animal encounters

The really great thing about being out on the open waters around the island of Pico and neighboring Faial in the search for sperm whales is the fact that you are just a phone call away from other big animal encounters, because of the spotters high up in their vigias. The same technique they used back in the whaling days is used to spot and

identify the large mammals as they surface to breathe.

One day, when we were out to the far northwest of Faial, looking for a group of sperm whales that had been spotted earlier, a call came through that there were three pods of false killer whales to the south-east of the island. Cameras were quickly secured, and we took off at full speed in the RIB, which normally

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Wild dolphins (left) and pilot whales (lower right) were spotted just north of Pico Island; Mobula rays (below) were spotted at Princess Alice Bank.

Azores



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carries a full load of whale watchers instead of four whale swimming photographers—fast! Within 40 minutes, we were dropped into the water with the first pod, which was below us in the blue hunting tuna at an incredible pace.

No Kodak moments were forthcoming, so we got back on the boat and tried the second pod, quickly coming face-to-face with a pretty aggressive false killer whale that proceeded to charge me several times and then ominously circled one of the other swimmers. They were a tense and quite exciting few minutes, but the false killer apparently decided against any further moves towards us and returned to the tuna hunt. Similarly, on another day, we were just north of Pico and the call came through that there was a pod of pilot whales about 10km south of our current position. We

were able to get in the water with them within minutes.

Princess Alice

This large submerged seamount is probably the most famous dive in the whole of the Azorean archipelago because of its remote location, depth, challenging conditions and the potential encounters that can happen there. The area was discovered in 1896 during an exploration of the Azorean archipelago led by Prince Albert I of Monaco aboard his research yacht *Princess Alice*, which was named after his American wife Marie Alice Heine.

Prince Albert I, an accomplished oceanographer and explorer, named the area Princess Alice Bank. What makes the location special from the many other underwater mountains and seamounts of the Azores is that its tip

is just 35m below the surface, so it is possible to dive it—just so. It is a large area of about 100km², but the shallow seamount is located just over 90km southwest of Pico Island, which means a journey of around three hours each way, in the open ocean.

So, good conditions are required to make the trip, and by the time you get back to Pico in the late afternoon, your thoughts may well be concentrated on arranging an appointment with the local chiropractor.

It is an adventurous dive, to say the least. As the boats anchor onto the tip of the seamount, the only way to safely do it is to use the anchor line for both the descent and ascent, because if you let go, the strong currents and upwellings that swirl around the seamount can sweep you off into the blue. A typical dive





Divers heading out to dive with whales (left) and at Princess Alice Bank (lower left); Blue sharks can be found in the deep waters around the Azores (top left)

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to be in the water with them near the surface and makes for some great photo opportunities. Their size, intense curiosity and apparently fearless nature makes for some interesting and very close encounters, plus the fact that it all takes place in open blue water makes the overall experience quite something!

12-ORAC-2016 issued by the Government on 25 July 2016.

Don Silcock is the Asia Correspondent for X-Ray Mag, based in Bali, Indonesia. For extensive location guides, articles and images on some of the best diving locations in the Indo-Pacific region, please visit his website at: Indo-pacificimages.com.

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¹ WHITEHEAD, H. 2002. ESTIMATES OF THE CURRENT GLOBAL POPULATION SIZE AND HISTORICAL TRAJECTORY FOR SPERM WHALES. MARINE ECOLOGY PROGRESS SERIES, VOL. 242.

Conclusion

It is a really long way from where I live to the Azores—involving five flights and almost two days of travel. I did it because I really wanted to experience the sperm whales in the water, and I did just that, but it was not really the intimate experience I was hoping for.

However, over the three weeks I was there, I developed a deep interest in the islands, the people and their culture, and particularly the creatures that come to the deep waters of the archipelago. The more I read and researched this article, the more intrigued I became with the Azores and the more determined I am to go back to those special islands in the remote North Atlantic! ■

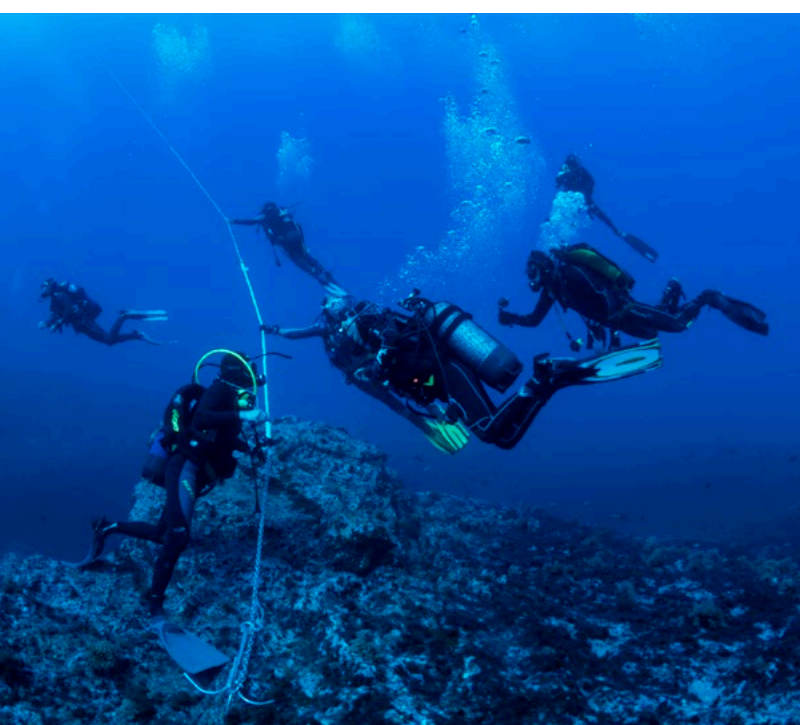
All images in this article were taken under a special permit granted by the Regiao Autonoma Dos

ascend, but this is where the show usually happens, when the open water pelagics come and strut their stuff—manta and mobula rays are commonly sighted, but many other large creatures like tuna, barracuda and marlins often put in an appearance.

Blue sharks

No visit to the Azores would really be complete without experiencing the blue sharks that frequent the deep waters around the islands. Large, slender-bodied pelagic animals, mature blue sharks grow to about 3.5m in length and are found in multiple locations across the Atlantic, Pacific and Indian Oceans and are known to go as deep as 600m below the surface.

In the Azores, they are enticed up from the depths to the northeast of the islands of Pico and Faial using chumming techniques, which allows divers



will allow you to spend a few minutes exploring the area around the peak of the seamount at depths of at least 40m and the surrounding deep blue water, together with the sloping sides of the seamount, hints at the extreme depths around you. The rest of the dive is spent on the anchor line, as you slowly

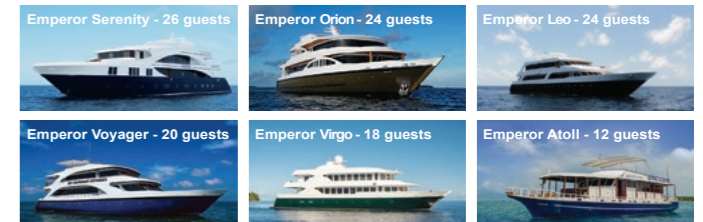


False killer whales were found at Faial Island, one of the central group of islands in the Azores

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opinion

Text by Simon Pridmore

—ed. This is the first in a two-part article, adapted from a chapter in my book *Scuba Professional: Insights into Sport Diver Training and Operations*. Part two will be featured in the next issue.

In 2005, Pulitzer Prize winner Thomas Friedman wrote his book, *The World is Flat*, describing the epoch-defining effects of technological globalisation in the early 21st century. He explained his use of the word “flat” as meaning “equalising.” That is, equalising power, knowledge, opportunity and the ability to connect, compete and collaborate. One consequence of this flattening that Friedman did not cover in the book is the worldwide expansion of scuba diving as a recreational activity.

In the last couple of decades, people all over the world in countries where the sport was previously almost completely absent have started scuba diving. Furthermore, new businesses in many of these countries have become significant players in the international scuba diving industry. Planet Scuba is much bigger these days than it was and it is growing fast.



Scuba Confidential:

The Future of Scuba Diving

In a Flat World — Part I

PIXABAY

This may come as something of a surprise to readers who live in the scuba diving heartland of the United States and Western Europe where the diving population has aged and the number of new divers has been falling for a while. But in Central and Eastern Europe, Russia, parts of South America and especially in Asia, scuba diving is booming!

It's the economy

People learn to scuba dive when they have time for leisure and money to spend on leisure activities. In the 1990s, the growth areas for the sport were the so-called tiger economies of Southeast Asia: Singapore, Hong Kong, Malaysia and South Korea. Over the turn of the century, a decade after the Iron Curtain dropped,

scuba diving exploded in Russia and former Soviet Bloc countries like Poland, the Czech Republic, Hungary and the Baltic nations, as people embraced new wealth and unprecedented access to free markets and travel.

In the first two decades of this century, the countries where scuba diving has shown most growth, in some cases astro-

nomical growth, are again those where flourishing economies have created a middle class with free time and aspirations to enjoy it. You now meet Chinese, Indian, Brazilian and Mexican divers in resorts and on liveaboards all over the world. The latest arrivals at the scuba banquet are young Indonesians, mostly from the thriving urban centres of Java and Sumatra.





opinion



PETER SYMES & PIXABAY

Gear shifts

From the 1950s right up to the 1990s, most scuba diving equipment was manufactured in only a very few countries, the United States, the United Kingdom, Australia, France, Italy, Switzerland, Finland and Japan. However, when the forces of globalisation started flattening the world, many manufacturers moved production to China or Taiwan to reduce costs and improve profits.

As new markets for scuba diving opened in Central and Eastern Europe, the established manufacturers were well placed to benefit. Their famous names carried weight, and although they did not adjust their prices for the less affluent new markets, they nevertheless dominated, establishing franchises, branches, agencies or subsidiaries in the new regions. However, as the number of divers grew, local businesses evolved, producing equipment at cheaper prices, which domestic consumers could better afford—much of it made in the same factories in Taiwan and China, where the well-known brands were made. In many cases, the products were identical.

Eventually, the new manufacturers began to take their businesses internationally, to compete with the big names on their own turf. No longer did

professionals and businesses from the new scuba nations come to dive shows in the United States and Western Europe only to buy and learn. Now they were coming to show and sell as well.

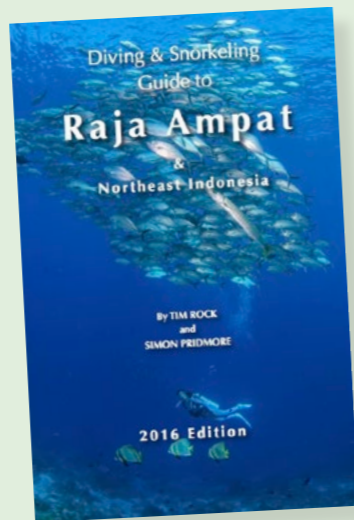
No-name brands

The process of change continues. Imitating supermarket chains, Internet retailers have started selling “No Name” unbranded equipment manufactured in the same factories that the name brands use and, obviously, this enables them to cut out all the middlemen and sell at bargain basement prices. This not only has an impact on the established industry leaders, it affects companies in the new scuba nations as

well. Two years ago, a friend who owns a dive equipment manufacturing company in Central Europe showed me a tough, powerful, lightweight torch that a Chinese factory had made for him. It swiftly be-

came the best-selling item in his catalogue, but success was short-lived. Within 18 months, almost every manufacturer had similar torches for sale and unbranded models had appeared on the market as well.

New Dive Guide to Raja Ampat



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

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

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Chinese market

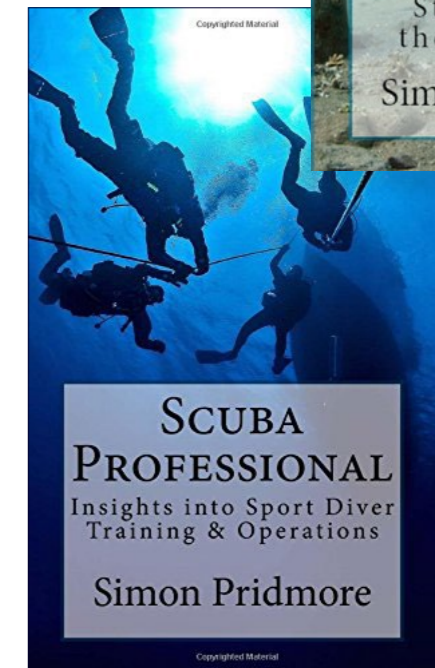
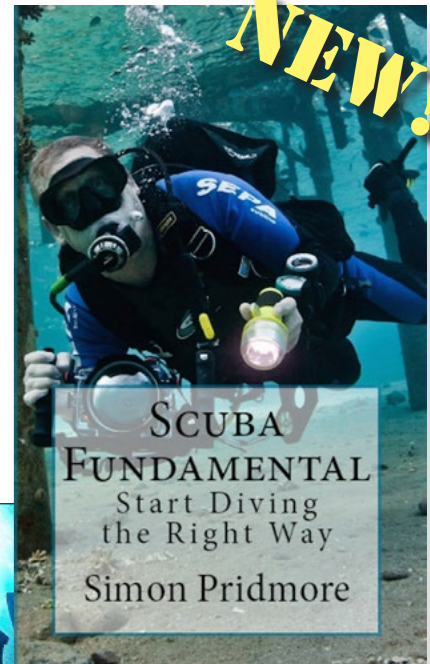
Today, with more and more Chinese people becoming scuba divers, the sequence of events that took place in Central Europe is being repeated there. This time, the process is much faster as the domestic production infrastructure already exists in the form of the factories, which have been manufacturing equipment for a decade or more for other companies to sell. Now that there is a local Chinese market to which to sell, the manufacturers are creating new brands of their own. In 2015, there were three major scuba diving trade shows in China and, at the time of writing this book, a search for Chinese diving equipment products on the Alibaba trading website produces over 28,000 results, and the website lists over 1,000 Chinese diving equipment suppliers.

Corporate take-over

Perhaps in response to the new business climate, many of the big names in dive equipment manufacturing are being taken over by large corporations, creating mutually supportive stables of companies, almost as if they are huddling together for warmth, as a cold wind of change blows in from the east. One major manufacturer has reacted to the new

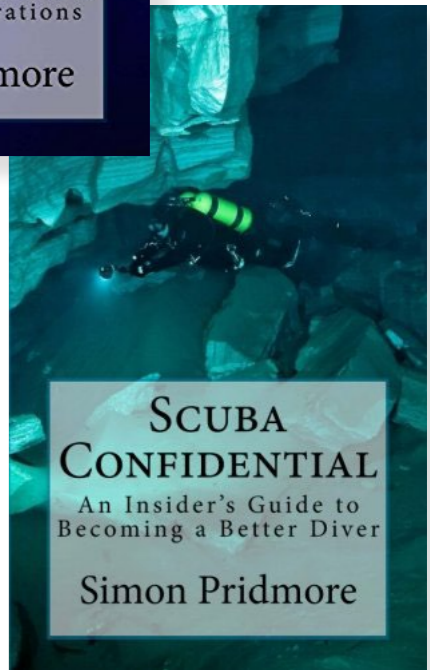
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opinion

ADEX Show in Singapore



CATHERINE GS LIM

environment by purchasing an international training agency. This is not the first time that a training agency and a manufacturer have worked together. It is, however, the first instance of a single company both recruiting divers and selling them equipment. It will not be the last.

Training trends

As well as the China expos in Hong Kong, Shanghai and Beijing, there are now annual dive shows in Singapore, Tokyo, Okinawa, Taipei, Manila, Jakarta, Kuala Lumpur and Bangkok. The first dive show in India is planned for Mumbai in 2018.

All these events have one thing in common: They are swarming with crowds of young new divers. The ADEX show in Singapore in 2015 reported an attendance of 41,000 people, the majority of them young urban professionals. Compare this with the annual Scuba Show in Long Beach, California, one of the major US consumer shows, which boasts of averaging 10,000 visitors a year. Singapore has a population

of 5.4 million, whereas there are 17 million people who live within an hour's drive of Long Beach. In case you think I have picked a particularly low scoring US show to which to compare the Singapore figures, Beneath the Sea in New Jersey attracts 14,000 visitors a year, and in Europe, the London International Dive Show reports an attendance of just under 12,000.

Just as the established dive equipment producers benefitted from the flattening of the scuba world, so did the major training agencies. In a clear indication of how the fulcrum of scuba diving is moving eastwards, for one US-based agency, in 2014, Korea was its largest source of certifications. Ten years earlier,

the number one market was Central Europe (Poland, Slovakia and the Czech Republic). Before the year 2000, the top market had always

been the United States. For all the training agencies, the flattening of the scuba world meant that their business continued to grow, despite the decline in the traditional heartland of the United States and Western Europe.

However, like the manufacturers, developing technologies, expanding markets and customers with different backgrounds and expectations have presented the training agencies with challenges as well as opportunities. In the second part of this article, I will discuss this in more detail. ■

Simon Pridmore is the author of the international bestsellers, Scuba Confidential: An Insider's Guide to Becoming a Better Diver, Scuba Professional: Insights into Sport Diver Training and Operations and Scuba Fundamental: Start Diving the Right Way. He is also the co-author of the Diving and Snorkeling Guide to Bali and Raja Ampat and the Diving and Snorkeling Guide to Northeast Indonesia. This article is adapted from a chapter in Scuba Professional. For more information, please visit: SimonPridmore.com.

Divers browse equipment on display at the Malaysia International Dive Expo (MIDE) in Kuala Lumpur



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Text by Gareth Lock

Diving is a sport which has an inherent risk of death or serious injury due to the aquatic environment in which the activity takes place. These risks are not just limited to drowning or decompression sickness, but many other issues like entanglement, injuries from the flora and fauna, or trauma. However, the positive side is that there are massive benefits that can be realised, including exposure to amazing underwater creatures from macro-level fauna to whale sharks and everything in between, wrecks full of interesting artifacts and life, cave systems with unique and marvelous geology, or just the serenity achieved by floating in the water, watching the world go by.

It is this balance of risks that is often hard to understand when something goes wrong and a diver is killed, injured or has a really "scary" moment. We often forget that there are ever-present, low probability, high consequence risks whenever we go diving. This article will explain some of the challenges divers face when



Risk-Taking in Diving

— *Is it Worth it?*

asked to take "personal responsibility" when they go diving and why. As with many things involving human factors and decision-making, the simplistic approach does not always help divers make the best choices. The knowledge within this article will help the diver make better decisions when it comes to risk manage-

ment, or at least understand why they made a bad decision if they look back in hindsight.

What is risk?

This might appear to be an odd question, but there are many definitions of risk. Indeed, the Royal Society in 1983

published a paper, which took a number years to write, trying to define it. Their definition was: "the probability that a particular adverse event occurs during a stated period of time, or results from a particular challenge. As a probability in the sense of statistical theory, risk obeys all the formal laws of combining prob-

abilities". Unfortunately, there was much disagreement within the academic and practitioner communities about how to apply this, especially given the conflict between objective risk and perceived risk. The revised 1992 paper did not close the gap, and John Adam's, in his book, Risk, highlights the point quite clearly

PIXABAY / PUBLIC DOMAIN





opinion

when talking about ice on the pavement:

“Slipping and falling on the ice, for example, is a game for young children, but a potentially fatal accident for an old person. And the probability of such an event is influenced both by a person’s perception of the probability, and by whether they see it as fun or dangerous. For example, because old people see the risk of slipping on an icy road to be high, they take avoiding action, thereby reducing the probability. Young people slipping and sliding on the ice, and old people striving to avoid doing the same, belong to separate and distinct

cultures. They construct reality out of their experience of it. They see the world differently and behave differently; they tend to associate with kindred spirits, who reinforce their distinctive perspectives on reality in general and risk in particular.”

At a very simplistic level, risk can be defined as “something with a level of uncertainty (that) happens at some point in time, with an outcome”. This is not too helpful when it comes to day-to-day risk management, but often risk management is rather vague at the personal or small group level, and in many cases, takes place subconsciously. These uncon-

scious processes will be looked at below.

Types of risk

Risks do vary, and we cannot use certain metrics from one domain in another. Bassam Salem in his article, “All risk is not created equal,” describes three key types of risk which we encounter during our lives, one of which is particularly relevant to diving.

Calculated risk. Calculated risk is where we look at the positive and negative, and weigh up the benefits, assuming the benefit will be realised and the likelihood of the negative outcome is small. Simple

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examples could be buying a car, hoping that it will be reliable and safe, or in aviation that the aircraft will not crash, or in diving that the equipment will not fail.

Mandatory risk. This is where we are willing to sacrifice an ever-present risk to achieve a successful outcome. Firefighters and police face this type of risk all the time. Those undertaking an emergency diving rescue are also in this situation, because the longer the hazard is present, the less chance that the victim will survive, and therefore, certain mental and physical shortcuts will be taken.

Luxury risk. This kind of risk is purely about self-satisfaction and does not need to be faced. Scuba diving, especially those types of diving with greater exposure to risk

such as cave diving or rebreather diving, is a perfect example of this. The easiest way to mitigate the risk is not to get in the water, but that would deny us the benefits, the value of which are very much at a personal and subjective level. Bassam explains: “Unlike a calculated risk that we’re taking in the hopes of a clear upside, this sort of risk typically has little quantifiable upside and only subjective, lifestyle-related benefits. The downside, on the other hand, may be quite quantifiable.”

So, if the negative side is an incident or accident, how do you determine the likelihood of such an event occurring if there are so many variables?

How we make decisions

At the most basic level, we use biologically developed processes such as the fight/flight/freeze

response or from learned experiences. These learned experiences can be either a direct experience of the situation, which is followed through to an outcome and subsequently stored in our long-term memory, or via indirect means such as story-telling, or from processing training and learning materials, which again goes to inform our long-term memory stores.

In the 1970s, two researchers, Kahneman and Tversky, conducted significant research in the topic of decision-making and came up with a two-part model of how we make decisions. They named them System 1 and System 2. System 1 is the fast and intuitive part of decision-making, much of which takes place subconsciously and is based on the mental shortcuts we have developed over time, and System 2



is where we break the task down into logical steps and process each one in slower time with conscious thought and effort.

System 1 is great because it allows us to operate at high speed, without thinking about the activity or the decisions we are making. However, there are times when this fast process should be slowed down, engaging System 2. These include the times we encounter a novel topic (to us), or when there is no "undo" option. The difficulty is that we often do not recognise these decision points until it is too late and something bad happens, and then we look back and say, "If only we'd spotted that..."

Over time, System 2 practices can move into System 1 through deliberate practice and feedback to determine what works and what does not. System 1 operations are informed by developing mental shortcuts, and it is these mental shortcuts, or biases and heuristics, that allow us to operate at the speed we do.

Biases

Unfortunately, some of these biases have a direct impact on our decision-making processes when we encounter risky circumstances. These include recall bias, outcome bias, availability bias and severity bias. We also need to recognise that the encoding and recall of memories is

"What should I be looking for to give me a clue that the dive is going, or will go, pear-shaped?" Just because it went okay the last time, it does not mean it will this time round.



PIXABAY / PUBLIC DOMAIN

influenced by emotional significance. This means that those events that have a high level of emotion associated with them—e.g. fear, happiness, joy, sadness—can be recalled more easily due to the availability bias.

The reason why an understanding of these biases is important is because they all influence us as to the meaning of the risks we face and how likely we perceive the risk will reach its full potential. These biases can be summarised by this four-part model from Buster Benson that condenses the 200+ biases he identified (See Figure 1).

Decision-making model

The biases and heuristics we use to



Fig. 1. Buster Benson's reduction of 200+ biases to 4 themes

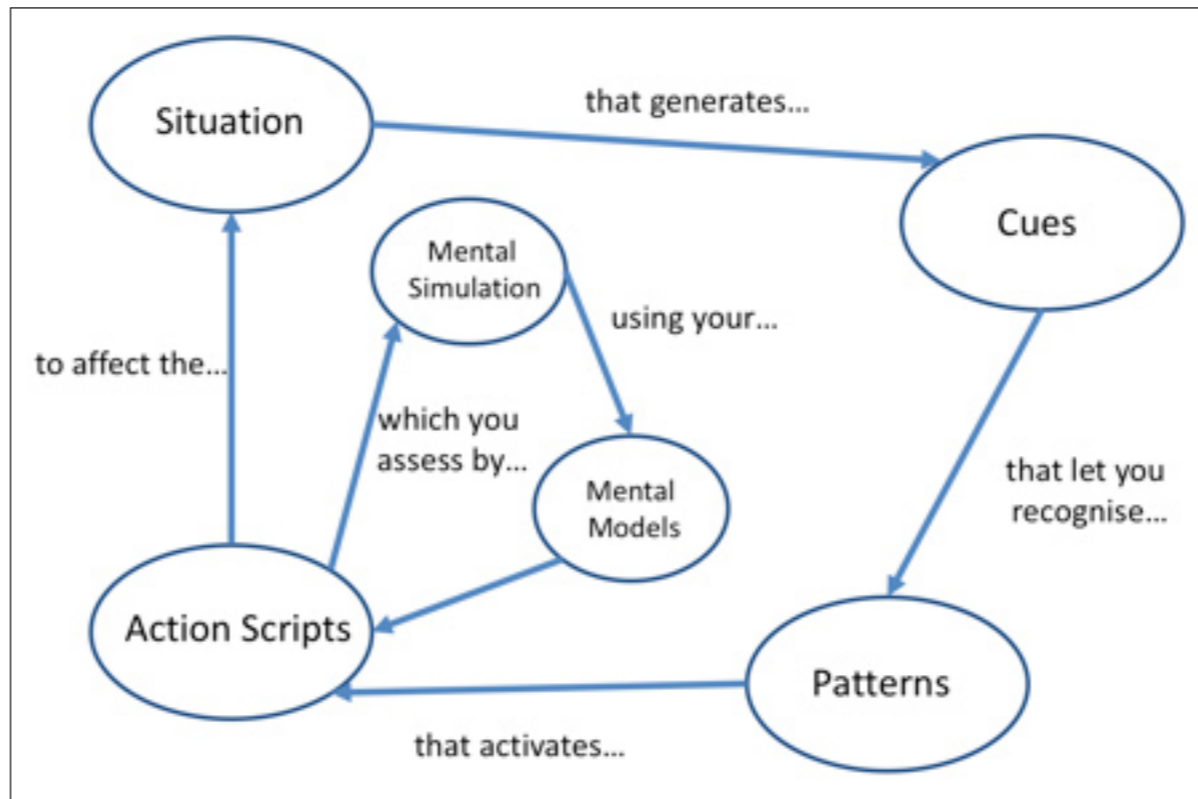


Figure 2. Recognition Primed Decision-Making Model. Streetlights & Shadows. Klein, 2009

make rapid decisions are not the whole story. Gary Klein and his associates have spent decades researching this subject and have produced a simplified model of how we make decisions, which looks at the models we create based on our previous experiences. This is known as the recognition primed decision-making model (as shown in Figure 2).

Klein understood that whilst the research community could isolate the biases identified above in experimental situations, the real world is far more messy and complex, and the interactions that take place between people and systems were not as simple as had been made out. This was the case when it came to time-limited and ambiguous circumstances. To this end, his research focused on those who operated in high stress/high stakes/short time domains such as firefighters, paramedics and military commanders to determine how they made their decisions. Contrary to what many had thought at the time, decisions were not made by looking at all the options, lining them up and then logically

deducting the best choice, but rather by referring to mental models that had been developed over time, selecting the most relevant pieces of information from the stream coming in, and making decisions.

What he found was that experts made better and quicker decisions than novices for two reasons. Firstly, they had more mental models to refer to, and secondly, they were able to isolate the relevant pieces of the puzzle faster than novices who waited for more information to come in. If you do not have a mental model, you cannot run an "accurate" simulation of what will or might happen, and so our decisions about risk can be flawed. Or more correctly, they were correct for the mental model we held at the time as we had no prior experience to which to refer, or we were unable to pull the memories out of our long-term memory store because they did not appear to be relevant at the time.

Personally responsible

So, how does this inform how one becomes "personally responsible" for the risks one takes? To start with, by understanding that we are subject to considerable biases when we make decisions

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opinion



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in diving (and life in general). Consequently, we can start to look out for them and when they might be critical in terms of time or space. A couple of examples are given below.

• If you have encountered a similar situation before and nothing went wrong, despite there being a significant likelihood that this time it could end up really badly, then maybe pause and think, "What should I be looking for to give me a clue that the dive is going, or will go, pear-shaped?" Just because it went okay the last time, it does not mean it will this time round.

• If you see a situation and it looks like something you did previously, you will likely make a mental shortcut and make the same decision, even if you do not have all the facts. An example of this could be visiting a dive site, and the previous time you were there, the visibility from the surface looked good and it extended all the way to the bottom. When you look now, you make an assumption that because

the surface visibility looks good, it will be good on the bottom.

Developing mental models

The only way to address risk management in a dynamic environment is to develop your mental models. You can do this by talking about the dive afterwards and why you made certain decisions, looking for cues or clues as to why it made sense to you at the time, or looking at resources like the Divers Alert Network or British Sub Aqua Club annual reports and try to make sense about why divers did what they did. Whilst the reports often lack detail, they are the most prevalent data sets out there, and at some point, those who appear in those reports must have determined that the risk of diving—whatever form that took—was greater than the perceived negative outcome.

In summary, to make better decisions involving risks, we need to reflect on the activities and the sense-making of those involved, which includes ourselves. By doing so, we can build new models, or

reinforce or correct our existing ones, which will allow us to run more accurate mental simulations. These simulations are the "what-ifs" that we often hear about in diving safety literature. The problem is, if you do not have any idea what might happen, how do you run a "what-if"? And even if you do think it might happen, how do you determine what is an acceptable level of risk (likelihood) when risk acceptance is determined at a personal level. Ultimately, the choice is yours, even though those choices may be informed by your subconscious! ■

Gareth Lock is an accomplished technical diver based in the United Kingdom. Recently retired from the Royal Air Force, he is now teaching human factors in the oil and gas sector. Lock is also undertaking a part-time PhD examining the role of human factors in scuba diving incidents. For more information, visit the Cognitas Incident Research website at: <https://cognitasresearch.wordpress.com>.

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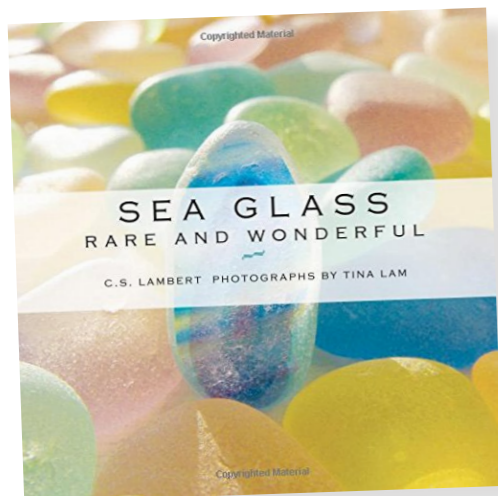
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Edited by
Catherine
GS Lim



Sea Glass

Sea Glass: Rare and Wonderful, by C. S. Lambert.

Remember those carefree days of combing the beach in search of a trinket or colorful shard of weathered glass? For sea glass aficionados, such discarded

remains of trash, battered repeated by waves and ocean currents, can be appreciated as something beautiful and artistic. Author C. S. Lambert shares her personal collection, unveiling the histories, stories and original purposes of the sea glass. Not to be missed are some rare specimens, of which only one or two are known to be in existence.

Hardcover: 112 pages
Publisher: Down East Books
Date: 1 May 2017
ISBN-10: 1608936538
ISBN-13: 978-1608936533



Pacific Ocean

Big Pacific: Passionate, Voracious, Mysterious, Violent, by Rebecca Tansley.

The Pacific Ocean covers a third of our world's surface and holds half of its water. This book presents an insight into the many facets of this fascinating realm, alongside stunning photographs that showcase the Pacific Ocean and its inhabitants as you have never seen them before. A companion book to the five-part PBS series produced by Natural History New Zealand.

Hardcover: 240 pages
Publisher: Princeton University Press
Date: 6 June 2017
ISBN-10: 0691177481
ISBN-13: 978-0691177489



Nudibranchs

Sea Slugs of India, by Deepak Apte and Digant Desai.

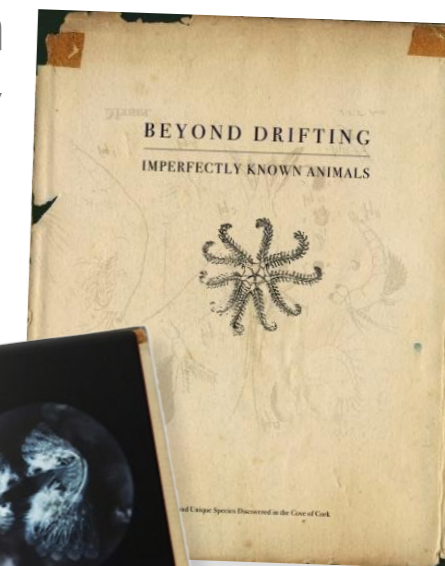
Most sea slugs in India are brilliantly colored. They use an assortment of defences to keep predators at bay, and some even reuse their toxic chemicals and stinging cells. Because they possess specific feeding and dwelling needs, they can present a gauge of a habitat's environmental status. Containing 666 color plates of live animals, this up-to-date field guide covers about 361 species, detailing their geographical range and identifying features.

Hardcover
Publisher: BNHS
Date: 2017
ISBN-10: 9384678031
ISBN-13: 978-9384678036

Plankton Photography

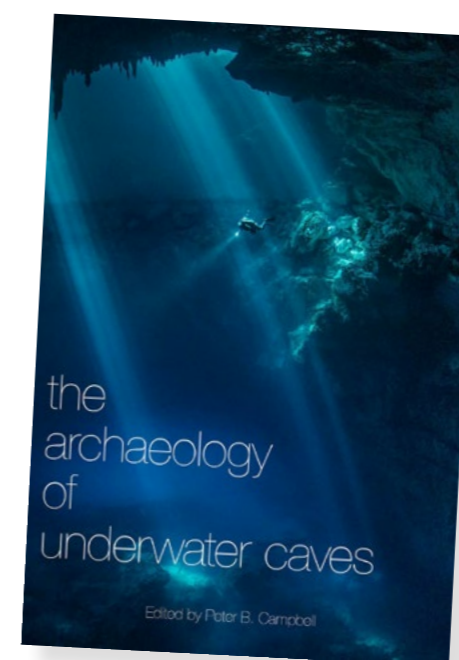
Beyond Drifting: Imperfectly Known Animals, by Mandy Barker

Aimed at raising awareness of the micro-plastic pollution of our oceans, often ingested by tiny plankton mistaking the plastic particles for food, this unique book is a compelling compilation of what the artist Mandy Barker satirically calls the new "microorganisms" in our oceans today. Mirroring the discoveries made by naturalist JV Thompson in Cork Harbour in the 1800s, Barker presents a range of marine plastic debris recovered in contemporary beach clean-ups at the same location. Each piece comes complete with its own made-up



scientific name, and is beautifully presented as if it were a live specimen viewed through a microscope, photographed on expired film and with faulty cameras.

Hardcover: 104 pages
Publisher: Overlapse
Date: 1 May 2017
ISBN-10: 0994791917
ISBN-13: 978-0994791917
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Underwater Caves

The Archaeology of Underwater Caves, edited by Peter B. Campbell.

This book draws on the last 60 years of underwater cave research, with chapters authored by principal researchers responsible for the development of this field. The scope of the subject matter is international, spanning the Paleolithic to the present. The authors touch on topics like human origins, sea level and climate change, ritual and religion, and subsistence in many different cultures.

Paperback: 250 pages
Publisher: The Highfield Press
Date: 31 May 2017
ISBN-10: 0992633672
ISBN-13: 978-0992633677

Diving with a Defect

— Understanding the PFO

Text and photos courtesy of DAN

The patent foramen ovale (PFO) has been a point of research and concern for divers since it was introduced as a possible risk factor for DCS by researchers in Great Britain and at Duke University in 1989. The relatively benign cardiac defect creates a passage in a wall of the heart that normally separates the left and right upper chambers of the heart. It can be found in as many as 27 percent of adults and normally causes no symptoms. In divers, it may provide a path for venous gas bubbles to bypass the lungs and enter into arterial circulation, which increases a diver's risk of DCS.

Modern discussion has led to a wide variety of recommendations on the topic from a number of sources, leading to some confusion. While some agencies and physicians recommend diving conservatively with a known PFO, others recommend surgical closure, and still others advise that there may not be a benefit to closure and that divers should just be aware of their condition.

Advanced and technical divers who may perform long or deep dives that promote post-dive bubbling should be knowledgeable of the condition and its potential risks. An informed decision on screening and surgical closure can only be made with a physician's consultation, but here is what you should know about

the condition and how it can affect your risk of DCS.

What is a PFO?

Normal passage of blood in an adult travels from the great veins of the body, through the right atrium, into the right ventricle, then to the lungs via the pulmonary artery. The lungs oxygenate the blood and filter out venous bubbles, and the blood is returned to the heart via the pulmonary veins. From the pulmonary veins, blood travels into the left atrium, and then is pumped into the left ventricle and back into various body tissues via the arteries.

A PFO is a communication, or opening, between the right and left atria of the heart. In a developing fetus the lungs are not open and blood bypasses them through this communication, called a foramen ovale in a fetus. After birth, this opening is closed by a flap of tissue that acts as a valve—because pressure in the left atrium is slightly higher than the right, the flap stays closed.

In most people, the flap eventually seals over and the foramen ovale completely disappears. In as many as 27 percent of individuals however, this flap never closes and results in a patent foramen ovale, or an incompletely sealed foramen ovale. The condition poses little or no risk to non-divers, but because the passage can open and allow blood to flow directly from the right to the left side of the

heart, divers with a PFO may be at an increased risk of DCS. Normal post-dive bubbles can theoretically pass through the opening and directly into the arteries, bypassing the lungs, which would normally filter them out, and travelling back into the tissues of the body.

What are the risks?

It is important to recognize that the incidence of DCS in recreation and technical divers is extremely low, and that many divers with a PFO will never get DCS. There is, however, a strong association with the existence of a PFO and repeated or serious DCS.

Divers without a PFO can still get DCS, and the risk can be mitigated in many situations by avoiding dive profiles that are likely to generate significant post-dive bubbling and physical effort post-dive that could cause the PFO to open. Studies have found that divers who suffer from DCS have a PFO prevalence



of twice that of the general population. Divers who suffer from neurological DCS symptoms have been shown to have a PFO prevalence of twice that again, almost four times prevalence of the general population. On the other hand, pain-only DCS does not appear to be associated with the PFO.

It is generally accepted that the risk of DCS seems to increase with the size of a PFO, and that divers with a PFO are at greater risk of DCS than their counterparts without. Studies on the relative risk of DCS in divers with a PFO are still ongoing, but the association is fairly well established and deserving of consideration.

Is there a treatment?

Because a PFO causes no symptoms, the condition is typically undiagnosed. It is possible to detect the communication between the atria with non-invasive contrast transthoracic echocardiography (TTE), or transesophageal echocardiography (TEE), but both methods have some weaknesses.

TTE involves placing an ultrasound probe on the outer wall of the chest,

but it detects a PFO only in half of the estimated population that has the condition. However, it catches most large PFO, which are considered an increased risk for DCS, and thus is recommended as a standard test for PFO in divers. TEE is more sensitive than TTE, but it is an invasive procedure that requires anesthesia, and is used only for special indications.

Current recommendations are that only divers with potentially indicative symptoms get tested for the condition. Divers with several incidents of DCS involving neurological or cutaneous symptoms should consider undergoing an evaluation and PFO screening.

PFOs can be closed with a transcatheter closure procedure, but the surgery is not without risks and there is no data on the outcome of PFO closures in divers. Recommendations on what acceptable indications for PFO closure may be vary, and divers with a suspected PFO should consult with a physician familiar with diving medicine to discuss the risks and benefits pertinent to their specific case. Divers with a diagnosed PFO who do not wish to undergo surgery can opt to dive more conservatively and avoid deep or long dives to minimize their risk of DCS. ■

For more information on the relationship between patent foramen ovale and diving, visit: DAN.org/Health.



marine mammals



JANE COGAN

Pod of orcas off San Juan Island, Washington

High pregnancy failure in killer whales due to nutritional reasons

A study has shown that the high failure rate in the pregnancy of southern resident killer whales is linked to their diet.

From 2007 to 2014, 35 pregnancies were detected among the endangered southern resident killer whales in the inshore waters of Washington State and British Columbia. Eleven of these were successful and resulted in the birth of a calf. The other 24 pregnancies—69 percent—were unsuccessful, as no live calf were seen.

A study, published in *PLOS ONE*

on June 29, focused on the factors responsible for the failed pregnancies. It was conducted by researchers from the Center for Conservation Biology at the University of Washington, along with partners at the NOAA's Northwest Fisheries Science Center and the Center for Whale Research.

Their findings?

"Based on our analysis of whale health and pregnancy over this seven-year period, we believe that a low abundance of salmon is the primary factor for low reproductive success among southern

resident killer whales," said lead author Sam Wasser, a UW professor of biology and director of the Center for Conservation Biology.

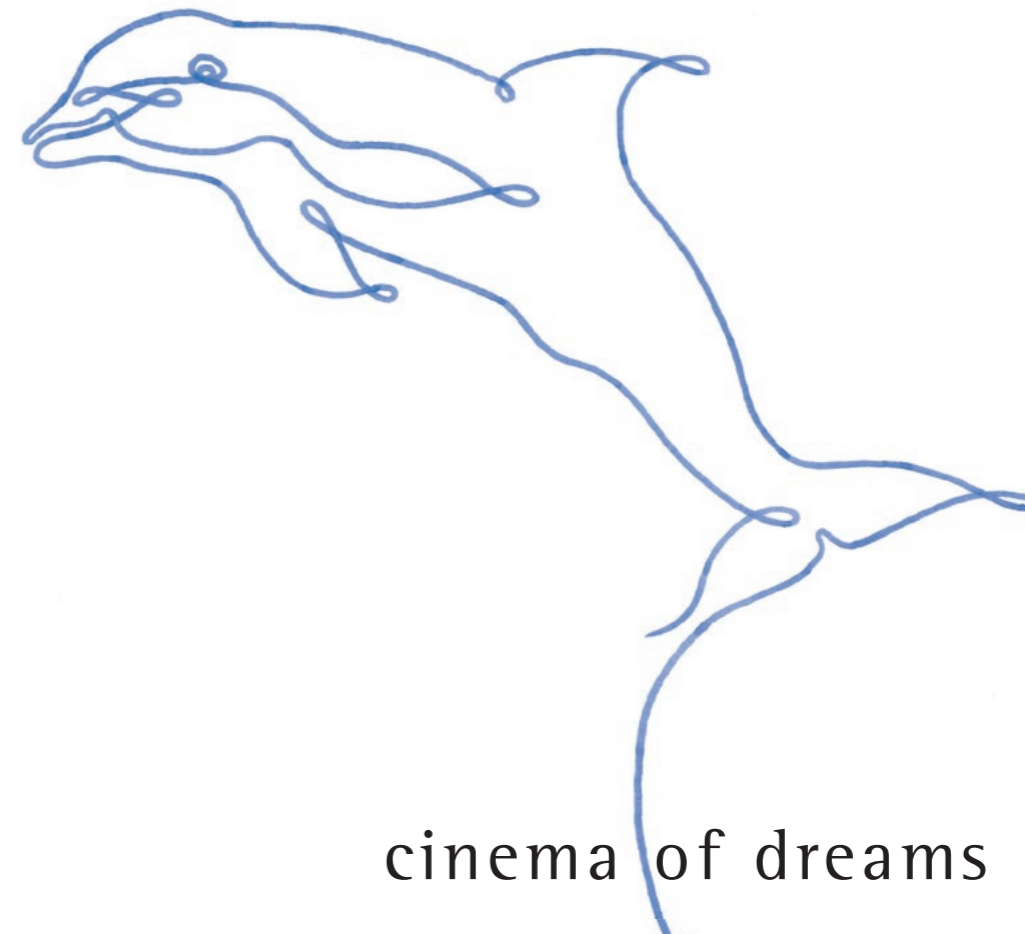
He added that when there was low salmon abundance, they detected hormonal signs that indicated the advent of nutritional stress and a higher rate of pregnancy failure—a trend that has become increasingly common in recent years.

More than 95 percent of the diet of southern resident killer whales consists of salmon, with the Chinook salmon making up about 75 percent of their diet. ■

SOURCE: UNIVERSITY OF WASHINGTON



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Extinct whale species discovered in 2000s may be missing link

In the early 2000s, a diver went looking for shark teeth in Wando River, in the US state of South Carolina. What he discovered was something much more—the remains of an extinct species of whale that may be the missing link to explain how baleen whales lost their teeth.

evolved to become filter feeders that prey almost exclusively on small crustaceans such as krill.

How did that happen?

A theory had emerged that baleen whales lost their teeth and subsequently evolved to possess sieve-like teeth. However, the discovery in the early 2000s of the skull of an extinct species of baleen whale suggests another possibility.

Found at the bottom of South Carolina's Wando River, the 30-million-year-

old skull had sharp, pointed front teeth, and saw-like back teeth.

"Unlike its front teeth which were used to snag prey, the wear on *Coronodon havensteini*'s unusually large molars showed no evidence of shearing or cutting food," said Associate Professor Brian Beatty, Ph.D., from the New York Institute of Technology's College of Osteopathic Medicine. He is a co-author of a newly published paper in *Current Biology* that describes the discovery.

He added that this suggested that the whale's molars were used to filter food.

According to lead author and Associate Professor Jonathan Geisler, Ph.D., "The transition from teeth to baleen is widely contested, but our research indicates that ancient toothed whales relied on the spaces between their complex and enormous teeth for filtering. It appears that over millions of years, the teeth were retained until baleen became sufficiently large and complex to take over the role of filter feeding."

Hence, this newly discovered species may be a transitional species between the earlier whales that hunted prey with the teeth and the modern baleen whales.

■ SOURCE: NEW YORK INSTITUTE OF TECHNOLOGY



PETER SYMES

Foraging behind shrimp trawlers may be socially learned behavior

It is not uncommon to spot schools of bottlenose dolphins swimming behind commercial shrimp trawlers in the waterways around Savannah in the US state of Georgia.

The reason they do so is they can eat the by-catch discarded by the fishermen on board the trawlers, or any fish or invertebrates caught or stirred up by the fishing nets dragged behind

the boats.

However, not all bottlenose dolphins engage in this behaviour. In fact, it is so distinct that a study by scientists at Savannah State University were able to categorize the bottlenose dolphins based on whether or not they followed shrimp trawlers.

For three consecutive summers from 2009 to 2011, they conducted photo-identification surveys of non-calf dolphins in the estuarine waterways. They then focussed on 137 dolphins, observing whether they begged or followed the shrimp

trawlers. They also took note of how often individual dolphins were together based on statistical analysis of groups observed.

The findings revealed that the dolphins belong to six specific clusters—half of them followed trawlers while the others did not.

"Bottlenose dolphins interact with humans, which puts them at risk of injury or death," said co-author Robin Perrtree.

Findings of the study was published in the *PLOS ONE* journal.

■ SOURCE: PLOS ONE JOURNAL

The earliest fossil cetaceans, which existed 50 million years ago, had teeth. However, baleen whales have



The humpback whale is a filter feeder that consumes lots of krill daily.



Seagrass can make up more than 50 percent of a bonnethead shark's diet.

Why are sharks eating grass?

A bonnethead shark's diet of seagrass has researchers stumped.

According to a post on National Geographic's website, new research has shown that seagrass can make up more than 50 percent of a bonnethead shark's diet. "Even if it is incidental, it is a very large amount of grass, so they have to be able to process that somehow," commented Samantha Leigh, a Ph.D. candidate at the University of California, Irvine and a National Geographic explorer.

An analysis of nutrient content conducted by Leigh showed bonnetheads were digesting 56 percent of the organic matter in seagrass, similar to young sea turtles. However, in order to be considered true omnivores, an animal must obtain nutritional value or energy from the plants they eat.

According to Leigh, it is conceivable the sharks have some sort of microbiome living in their gut that is producing some of the enzymes that they need to break down this plant material, which is something we commonly find in omnivorous and especially herbivorous species.

Incidental capture

In 2007, Dana Bethea, a research ecologist with NOAA Fisheries in the US

state of Florida found younger bonnethead sharks have been found to have more seagrass in their stomachs than adult bonnetheads.

Bethea's research team hypothesized that the seagrass found in the stomachs of bonnetheads is just a result of incidental prey capture. Young-of-the-year stomachs from northwest Florida contained a mix of seagrass and crustaceans, while juvenile stomachs contained a mix of crabs and seagrass, and adult stomachs contained almost exclusively crabs. Crabs made up the majority of both juvenile and adult diet in Tampa Bay. Juvenile stomachs from Florida Bay contained seagrass and a mix of crustaceans while adult stomachs contained more shrimp and cephalopods. ■

SOURCE: RESEARCHGATE.NET



Bonnethead shark



GONZALO ARAUJO, LAMAVE

A school of *Mobula japonica* encountered by the team while on survey in the Bohol Sea

Krill is the main food source for mobulid rays, study finds

Mobulids (family *Mobulidae*), commonly referred to as devil rays, includes the genus *Manta* and the genus *Mobula* with 11 identified species. Five of these species have been confirmed in the Philippines. All mobulids are filter feeders that probably target zooplankton and small fishes, but the prey types and sizes could vary among species due to differences in their anatomy and ecology.

The Bohol Sea, Philippines, is a deep, topographically isolated basin connected to the Pacific Ocean by the shallow Surigao Strait (58m). The intensification of the Bohol Jet during the north-east monsoon (November–April),

combined with inflow from the Agusan river, results in high primary productivity and a concurrent plankton bloom, which coincides with the mobula fishing season.

Stomach content

Stomach contents analysis of mobulid rays landed in the Bohol Sea, between November and May in 2013–2015 shows the mobulids feed heavily on euphausiids (ed.—shrimplike, planktonic marine crustaceans of an order that includes krill) while they are in the area for approximately six months of the year. The larger mobulids also contained small mesopelagic

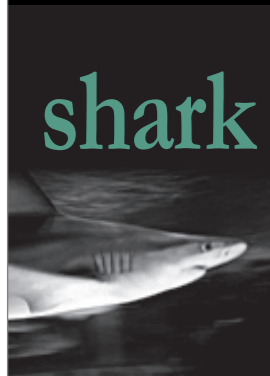
(ed.—"inhabiting the intermediate depths of the sea") fishes in their stomach in addition to krill.

Krill migrates vertically staying deep during the day and near the surface at night where the mobulids are caught.

"Our results show . . . some mobulids had empty stomachs, while others had just finished a huge meal, which shows that tropical mobulids have a boom-and-bust strategy, feeding in dense prey patches when they are available and then undergo a period of starvation until they find the next prey patch," said Dr Chris Rohner, principal scientist at the Marine Megafauna Foundation. ■

SOURCE: ROYAL SOCIETY OPEN SCIENCE





shark tales

What is affecting leopard sharks in San Francisco Bay?

The root cause of repeated die-offs of leopard sharks continues to elude researchers.

The cause of dead, disabled or disoriented sharks along the beaches and shorelines areas of San Francisco Bay—the largest along the Pacific coast of the United States—remains a mystery and has resulted in considerable public concern, with numerous articles continuing to appear in local newspapers.

With deepwater channels, shallow mudflats, and marsh sloughs and channels, San Francisco Bay supports a variety of elasmobranchs including leopard shark (*Triakis semifasciata*). These small sharks—which eat crabs,

other small fish and mollusks, and can grow to up to five feet in length—are an important part of the bay's marine food web. The abundance of small prey items for newborn leopard sharks inhabiting marsh sloughs and channels, as well as near-shore eelgrass beds, may simply outweigh the risk of predation for this species.

Dr Mark Okihiro, a fish pathologist with the California Department of Fish and Wildlife who has been working tirelessly to investigate why leopard sharks are stranding, released his preliminary findings last week, which indicated that a

common pathogen was found among the three leopard sharks necropsied so far. He suspects that a fungal pathogen could be infecting the meninges—the tissue covering the brain—disorienting the sharks and causing them to strand themselves on land. But he says that the fungus is most likely not the only pathogen that is affecting the sharks.

Sean Van Sommeran, executive director and founder of the Pelagic Shark Research Foundation, believes the source of the infections comes down to the city's use of tide gates in resi-

dential areas near inland waterways. To keep from flooding during the rainy season, Redwood City closes its tide gates during low tide. That way, when there are heavy rains, the extra precipitation does not combine with high tides to flood homes along the water.

The stagnant water in these inland waterways quickly goes foul (just like a home aquarium would if not regularly cleaned) and sickens the sharks. "The water becomes toxic and the sharks can't cope with it," Van Sommeran said. ■ SOURCE: CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE



ANDY MURCH / ELASMODIVER.COM

The **TRUE NATURE** of **SHARKS**

ILA FRANCE PORCHER

If you love discovering new, intelligent wildlife behaviour, you will love The **TRUE NATURE** of **SHARKS**

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How did great white sharks end up in the Mediterranean in the first place?

Genetic analysis of the population of great white sharks in the Mediterranean revealed a close relationship to populations in the general region near Australia.

An international team of scientists who performed the first genetic analysis of the Mediterranean great white shark community speculates that a group of wayward female pregnant sharks may have been swimming down the east coast

of Africa when a strong current pushed them around the tip of the continent. Extreme climate change some 450,000 years ago, in the middle or late Pleistocene epoch, produced strange currents that confused them during navigation or uprooted their

prey, forcing them to follow their food to distant shores. The sharks continued west along with the current and ended up in the Atlantic Ocean.

Taking a wrong turn
The sharks tend to swim east

to birthing grounds. But this time, instead of ending up near Australia, they moved through the Strait of Gibraltar and into the Mediterranean. Because these sharks remain loyal to their breeding grounds, the females quickly settled into their new

surroundings. The researchers also discovered that the Mediterranean dwellers lack genetic variability. All we are seeing today are the descendants of a few individuals that survived. ■ SOURCE: PROCEEDINGS OF THE ROYAL SOCIETY B



Text by Matt Jevon
Photos by Andrey Bizyukin

Over the years, I have had the privilege of being involved in some fantastic teams, sometimes in a leadership role, sometimes as an advisor helping to form a great team, and in others, as a team member. These teams have been engaged in pursuing objectives in sport, from international rugby to motorcycle racing and rally driving, through to high-performing teams in business. Over the last few years, I have enjoyed being part of dive teams, particularly in technical diving.

People often talk about teamwork as if it is a given—that is, if you gather a group of people together, with a little desire and intent, they will form a team. It is a dangerous assumption. High-performing teams have very defined characteristics, they operate in a very distinctive way, and they have many different cultures,

values and styles. There is not a “one-size-fits-all” way of creating a team.

There is also a significant difference between a team we would consider cohesive and a team that is cooperating. I do not mention dysfunctional

teams, as they are pretty easy to identify and, frankly, are not a team but just a group of people arguing and pulling in different directions. Cooperative teams are interesting to study, though.

Cooperative teams

Here, we have a group of people who work well together, who “get along”, often suborning personal beliefs and desires for the good of the team. What is wrong with that, I hear? Well, this team

tends to follow one leader or gets behind the first credible idea, without really buying into it, without having really examined alternatives, without having challenged the thinking of the idea creator. In order to avoid intra-team conflict, they



There may not be an 'I' in
Teamwork
— but there is one in 'win', 'live', 'first' and 'dive'!

ANDREY BIZYUKIN

hold back their own ideas and desires, and often are not fully committed to the idea's execution. These teams can operate well, but it does create frustrations among the team members, which at some point, will surface and fracture the team's effort and motivation—usually when the soft and smelly hits the round and whirly.

Cohesive teams

In contrast, cohesive teams actively encourage the argument, discussion and deconstruction of ideas that lead to all feeling they have contributed, and therefore, are invested in the

team's activities. Personal beliefs and desires are never subordinated for the benefit of the team, as clearly if this has happened, the team composition is wrong and there is no role for the person expected to act and deliver against their desires. Cohesive teams perform consistently at a high level, whereas cooperative teams struggle to reach both high performance levels and certainly are inconsistent.

Recently, I have been diving with some GUE divers on some deep Croatian wrecks. GUE is very focused on the team ethos, and I have had to adapt my more independently-minded

approach to deep technical diving. It has been a different but pleasurable experience. Just because I am used to a team approach with different values does not mean I cannot contribute effectively to another team culture. What is important to allow me to do that is to understand the culture and expectations the team has of me within it; I need clarity.

This clarity is what, in my opinion (and in a fair bit of elite sports research), allows us to identify the key elements of a high performing team. These elements can easily be set in a variety of cultures and adapt to a variety of appropriate leadership styles. So, what are the elements?

Clarity of purpose. This is the most important element and the purpose cannot be doing whatever the leader tells them. Each team member must understand what the team wants to achieve, must believe in the possibility of success and be motivated and excited to play a role in achieving that success. There should be no doubt

in all the team members' minds what that clarity of purpose is and they should be able to articulate it clearly and succinctly.

Clarity of member and leadership roles. It does not matter what your role is, what is important that both you as leader and team member, as well as ALL the other team members and leaders, understand is what that role(s) is. The role will probably be related to particular skills and/or experience, but should also be related to the more team-oriented needs. Is your role to challenge through innovation, analysis or practicality? For example, one board of directors with which I work has the Chief Financial Officer challenge

everything, not just from a numbers perspective, but also by looking at things not normally within the CFO role—where the person's analytical thinking can challenge and add value.

Clarity of understanding of the power distribution in the team. As we are not living in a utopian society and most teams have some sort of formal or informal hierarchy, we cannot just wish this away. There is a distribution of power and influence in teams. This can be based on organisational position, ability, experience, etc. What this is must be understood exactly, by all team members. Only in this way can the "less powerful" understand their

ability to challenge even the most powerful. And the "most powerful" can then realise the barriers to challenge and debate, which their authority creates. They can then work to demonstrate that they are open to be challenged and to have their thoughts, actions and desires critiqued by the less powerful. There is no need for one big charismatic leader either. If appropriate in small teams, such as we have in diving, it is more useful for different members to take the lead in different areas as befits their style, skills, knowledge and ability.

Clarity of communication. Once roles and power are understood, it becomes easier within the team



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for open and honest communication pathways. Often the biggest difficulty here is not with the message sender, but with the receiver. If emotion or arrogance get in the way of listening—i.e. “They can’t say that to me! Don’t they know who/what I am?”—then problems occur and communication barriers are raised. This is why it is easier to communicate by voice on contentious issues rather than by email, etc. The tone of challenge can be heard. The disengagement from listening can be seen and challenged. Anyway, there is potential for an entire book to be written on communication!

Clarity of culture and values. The word “culture” comes from the Latin word *cultura*, which means “to cultivate.” A shared culture is vital for cohesion.

Values are what make up the team. Often in business, I see values talked about in a very trite fashion. For example, take “honesty.” It is a great value to have, but what does it mean in the context of this team and organisation? How is it applied? Measured? Upheld? If the team cannot use the values as a set of aspirational standards which guides their behaviour and actions, then those values have little true value! (Herein lies another book...)

A balance of approaches in terms of thinking. I do like George Patten’s quote, “If everyone is thinking alike, then someone isn’t thinking.” I like to ensure that people, who make up the teams that I am in, can bring different thinking styles. I like someone strong in creative thinking, someone strong

in operational thinking and someone strong in analytical or reflective thinking. In that way, we get information from the analyst from which ideas can be generated by the creative thinker, a practical “how can we make that work” approach from the operational thinker and an ability to refine and challenge the process development from all. No one is 100 percent dominant in a style, but high-performing people tend to have a dominant style, and a strong secondary, plus often a considerable weakness in a third. It does not matter which one is dominant.

There is often an assumption that it is better to be creative. But as a creative person myself, I can tell you this is not necessarily true. We creative per-

sons have difficulty sticking to a task if something new comes along.

Congruent motivational styles and directions. We have touched on this in a previous article, but suffice it to say, if you have three people, all highly externally ego-focussed, then trouble lies ahead. Think about whether people are ego- or task-driven and whether that is internally or externally focussed by them. Imagine what this means with regards to what they may want by way of reward, recognition, feedback and satisfaction.

Unnecessary elements Interestingly, some of the elements that high-performing and cohesive teams do not need are often things inexperienced team builders or leaders try to create. They do not need to like one another. They do, however, need to respect one another’s abilities and desires to contribute to the team.

Social compatibility is of little relevance. I know people I get on well with socially that I would hate to work with, and vice versa.

Similar motivational reasons for achieving the team’s goals are not required. One team member might be ego-motivated, while another is task-motivated. What is important is that both persons can understand and appreciate the direction and intensity of the effort being put in by the team members.

To always be working with other team members. For some people, their best contributions are made through individual, focussed effort. It is their output that the team needs, not their companionship on a task or objective.

Lots of meetings... This is a real bugbear of mine. I hate lots of sit-downs where information is exchanged, but no deci-

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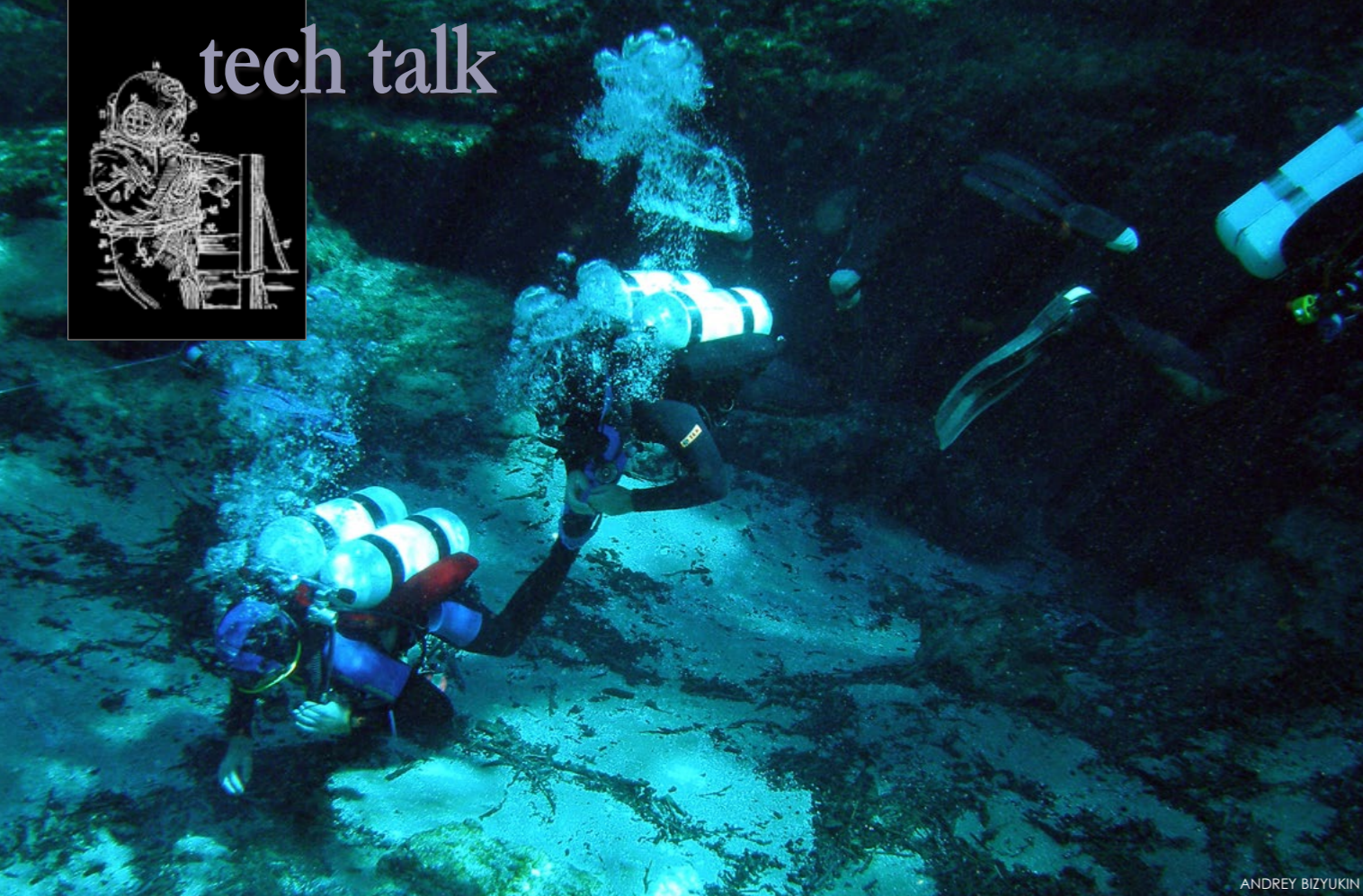
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sions made or actions decided upon. All this does is interrupt people. These days, with modern technology, we have so many ways of sharing information more efficiently without a meeting. Share the information, then only meet if desired, to argue out the course of action. A decision is something you have to make if you do not have enough information! Hewlett-Packard has for many years operated some amazingly successful global teams across multiple time zones and cultures.

Team-oriented personalities. I am more independently-minded than team-focussed, but, when I see the reward for success being dependent on me being an effective team member or leader, I will be as valuable a team person as I can be. It's all in the motivation!

Psychometrics. Psychometric testing, Belbin team roles analysis, etc—the degree of social compliance in psychometrics for me is unreal, and the academic models of roles are often reductionist, trying to either oversimplify or put people in boxes! Frankly, roles will change based on what the team is focussed on, at that place on the path to its objective or purpose. Sometimes people will lead, at other times, they need great followership skills. Make sure the box you put people in has an open lid!

Safe and effective diving Well done if, as a diver, you have got this far and wondered... what does all this got to do with diving? Well, to me, all these components are essential for safe and effective diving, at both recreational and technical levels. We know problems occur in diving when team

members step outside of the plans, but do we really consider why they do this?

It is easier to be annoyed and to berate them than it is to consider why they disconnected from the team. Perhaps they did not know, in the first place, what their roles were and why these roles were so important in achieving the team's objective.

Let's also remember our first objective in diving is always to come back alive and well from every dive. Perhaps they felt overwhelmed by more experienced divers who have become sloppy on planning or dive discipline, and they did not feel they could speak up, because they felt less powerful. I know this is a big issue for the "just culture" researcher and fellow *X-Ray Mag* contributor Gareth Lock is working so hard to establish in diving (see: <http://www.xray-mag.com/content/just-culture>).

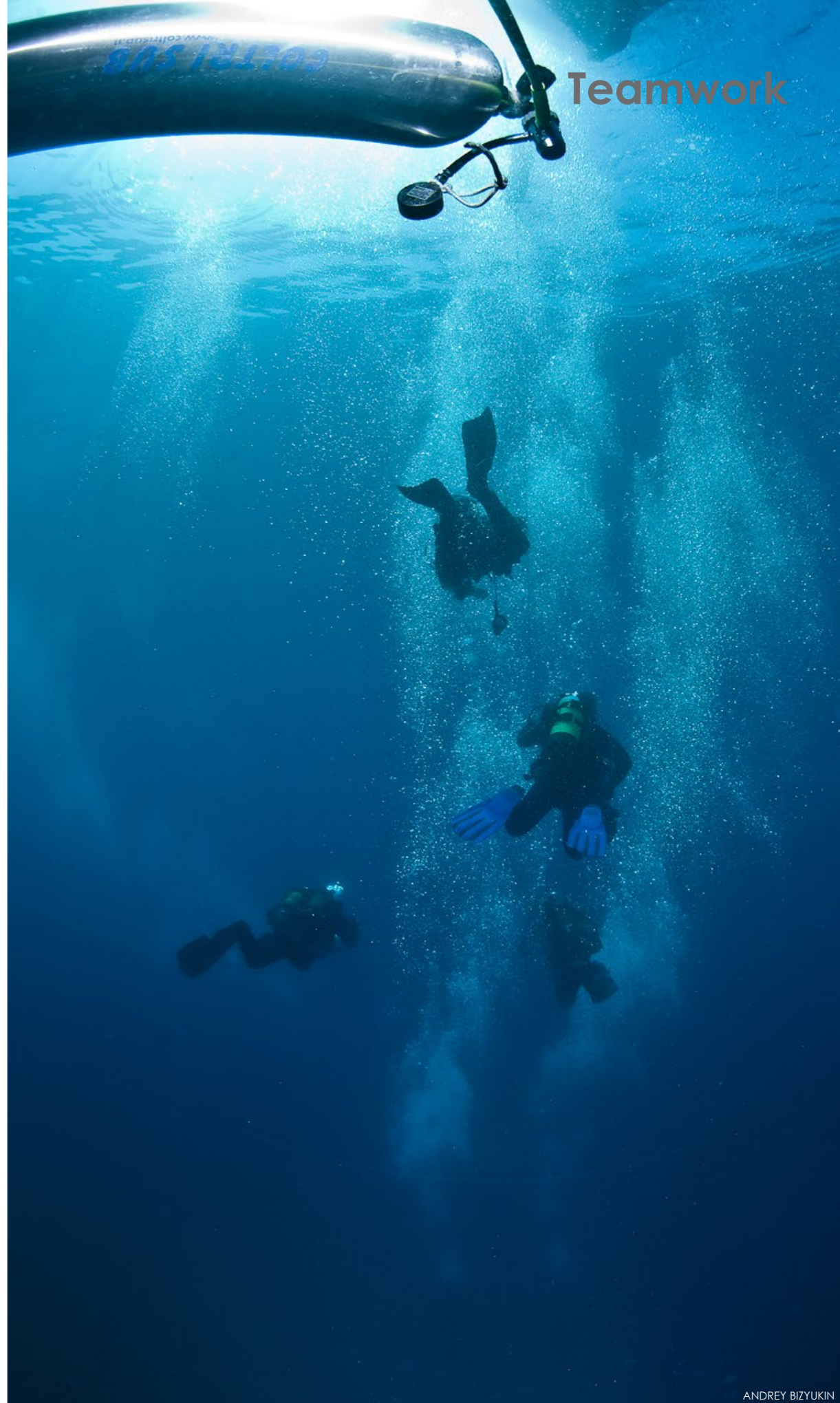
All I can do is encourage you, if you dive within a team, to discuss the characteristics of a high-performing cohesive team described above with fellow divers. Answer for your team the questions that it raises. Establish the clarity or purpose, roles and communication. Look at the leadership and followership roles. Get the whiteboard or flipchart out—it will make a huge difference.

Perhaps you might identify the need to recruit a new member with desired and currently missing characteristics. Perhaps it will make you realise there are issues in your team you want to address or even that your team is not working. These are all good results and will strengthen your dive team and make it safer and more effective. Observe teams you admire and benchmark them against the team elements above.

I am up for answering questions or even helping teams work through these issues if desired: just pm me.

When all is said and done, have fun, dive safe. ■

Matt Jevon is a technical and cave diver, and is a technical and CCR instructor with TDI, IANTD and PADI. He is also the JJ-CCR instructor and dealer for Ireland. He held accreditations as an interdisciplinary sports scientist, sports psychologist and was a British Olympic Registered Strength and Conditioning Coach. For more information, please visit: Swf.ie and MattJevon.com.



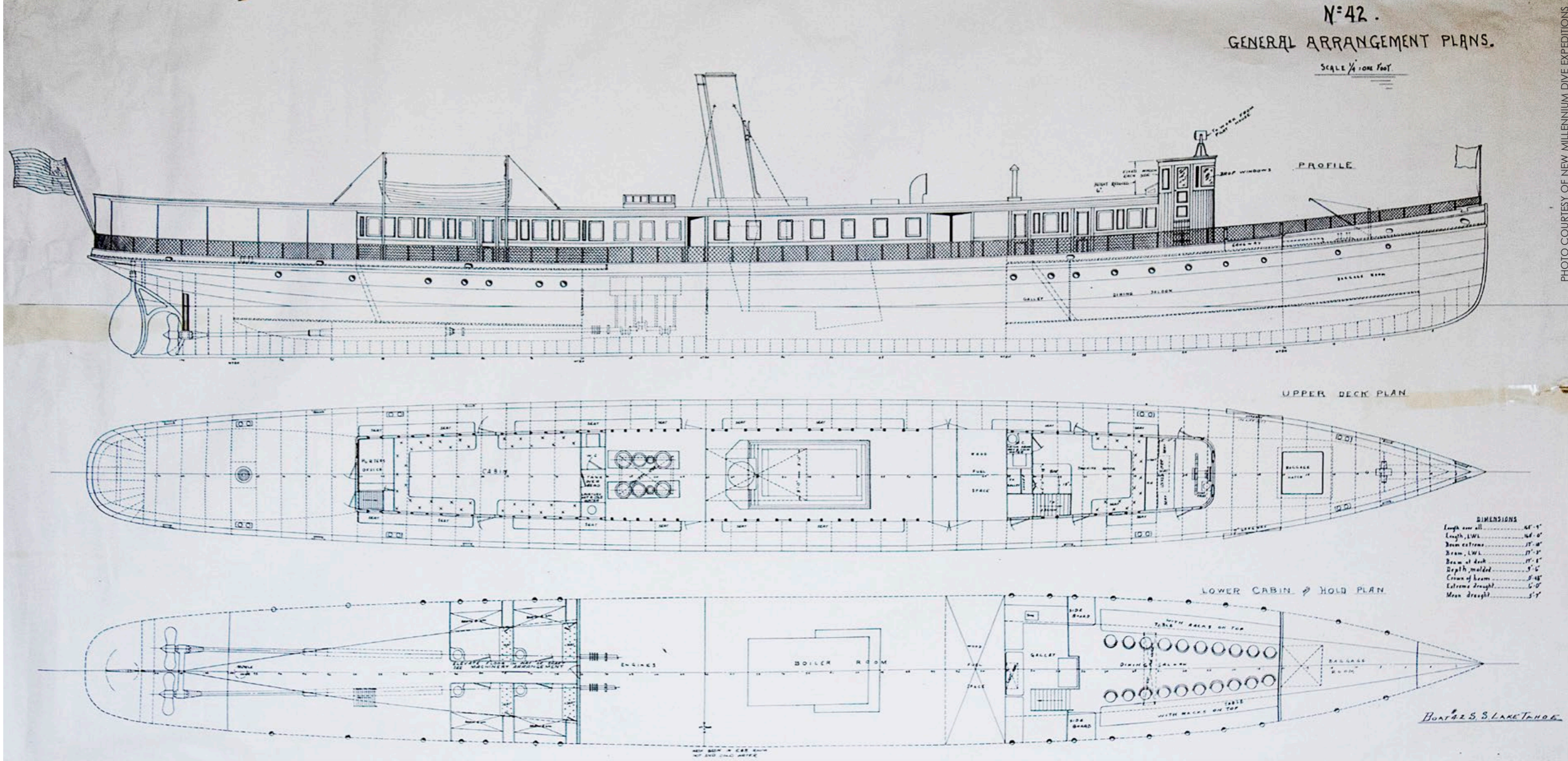
ANDREY BIZYUKIN





tech talk

Historical blueprint of SS Tahoe



N=42.
GENERAL ARRANGEMENT PLANS.
SCALE 1/4" = 1' 0" 0"

DIMENSIONS

Length over all	169'-0"
Length LWL	162'-0"
Beam extreme	37'-0"
Beam LWL	37'-0"
Beam at deck	37'-0"
Depth, molded	5'-0"
Circle of beam	5'-0"
Extreme draught	5'-0"
Mean draught	5'-0"

PHOTO COURTESY OF NEW MILLENNIUM DIVE EXPEDITION

Text by Michael Menduno

June 2017 — Fifty-six-year-old explorer Martin McClellan is determined to revisit the SS Tahoe to conduct an extensive photogrammetric survey of the wreck. The 169ft (52m)-long 19th century steamship, which was scuttled in 1940, rests intact on a steep underwater slope at a maximum depth of 470ffw (144mfw) beneath Glenbrook Bay in Lake Tahoe, Nevada, USA.

McClellan was the first to dive the *Tahoe* with Brian Morris under the banner of his organization New Millennium Dive Expeditions (NMDE) in 2002, and has conducted 10 open-circuit dives on the wreck over the last 15 years. The burly six-foot-two tech diver was instrumental in getting the shipwreck listed on the National Park Service's National Register of Historic Places in 2004.¹ He now wants to return with a team of GUE rebreather divers and high-definition video cameras to create a detailed 3D image of the wreck.

But finding a team of divers with the experience to conduct the dive, which is arguably an exceptional exposure, safely, along with raising the US\$10,000-

15,000 he estimates will be needed for gas, logistics, accommodations and an appropriate vessel has proved to be a formidable task. McClellan was forced to postpone the expedition, which was scheduled for August when several initial team members pulled out, plans for a sufficiently large dive vessel dematerialized, and there was not enough time to resolve other logistical issues, including having sufficient time to complete work

up dives for team members. He also got some pushback from GUE leadership regarding the potential riskiness of the dives.

This after printing six-dozen, dated expedition t-shirts using funds donated by local NMDE supporters. "I'm disappointed, but it's only made me more determined to see this thing through," said McClellan, who called it a learning experience. "The problem is I can't do it

alone."

McClellan's expedition to establish a baseline of the historic shipwreck will be conducted in support of Global Underwater Explorers' (GUE) Project Baseline,² and represents the second deepest shipwreck exploration by technical divers in North America. The deepest was Terrence Tysall and Mike Zee's record three-hour, open-circuit

² Projectbaseline.org

dive on the SS *Edmund Fitzgerald* at 530ffw (162mfw) in Lake Superior in 1995. Worldwide the project is the tenth deepest wreck exploration; Leigh Cunningham and Mark Andrew's 2005 open circuit dive to 668fsw (205msw) on the MV *Jolanda* near Sharm El Sheikh, Egypt, was the deepest.³

However, unlike the dives on the

³ Watch for an upcoming article, "The twenty deepest tech shipwreck dives," by Michael Menduno.

Pushing the Altitude

— The Quest to Document the SS Tahoe



Table 1. Dive Metrics: Note that various metrics are used to describe depth and distance as shown. Note also that feet of seawater (fsw) and feet of freshwater (ffw) and their metric equivalents are pressure metrics.

Explorer Martin McCellan (right and left) has been actively involved in Project Baseline

DIVE METRICS

34 ffw = 33 fsw = 1 atm
 1 ffw = .975 fsw
 1 ffw = .306 mfw
 1 mfw = 3.263 ffw
 1 mfw = 0.975 msw
 1 msw = 3.268 fsw
 1 fsw = 0.306 msw
 1 meter = 3.28 feet

In addition, the alpine lake's bone chilling 39°F (4°C) sub-surface water temperature means that the divers will need active heating for their planned six- to eight-hour rebreather dives, which while keeping the divers warm, could impact their decompression status in ways that are not fully known.

"They [the divers] need to realize that they won't be in Kansas anymore," cautioned dive physiologist Dr Neal Pollock, a researcher in hyperbaric and diving medicine at Université Laval, Quebec, upon learning about the project. "They're a natural experiment, and I would be happy to be there if appropriate planning and readiness is established."

McClellan is hoping to engage Pollock, whose research interests include altitude decompression and active heating, to monitor

and record the dives. "It's an important opportunity to capture novel data," the diving scientist explained.

High on diving

It is fair to say that McClellan and Brian Morris, who are both long time Nevadans, spent nearly 20 years developing the needed skills and knowledge for their first dive on the *Tahoe*. Their first challenge was the altitude.

At altitude, atmospheric pressure is lower than at sea level, so surfacing at the end of an altitude dive produces a greater relative reduction in pressure, and consequently, an increased risk of decompression sickness, compared to the same dive profile at sea level. This is not a problem altered by prolonged stay at altitude. In other words, it is not an acclimatization-related phenom-

enon, purely a relative pressure phenomenon.

While initial time on the surface at altitude allows the diver to eliminate excess gas and restore equilibrium with the surrounding (ambient) pressure (just like off-gassing after any dive at sea level does), time spent at altitude does alter the implications of greater pressure swings experienced with any dive at altitude. The change in pressure caused by water is stable (with a minor change due to the absence of salt in freshwater), but the surface pressure being returned to is much less, thus increasing the decompression stress associated with any actual depth.

Though Hans Buhlmann and the Defense and Civil Institute of Environmental Medicine (DCIEM) did some work on altitude diving, the most common modifications for diving decompression tables at altitude are the "Cross Correc-

tions," first presented by legendary columnist E.R. Cross in a 1967 *Skin Diver* magazine column,⁶ and later validated by researchers⁷ and adopted by the US Navy. The corrections use the ratio of atmospheric pressure at sea level to the pressure at the relevant altitude to calculate an equivalent sea level depth that represents the same relative pressure changes.

However, the Cross Corrections have rarely been applied to aggressive technical dives at altitude like the *SS Tahoe* and there is almost no data regarding

⁶ Cross, E. R. 1967. "Decompression for high-altitude diving." *Skin Diver*. 16 (12): 60. See also: Cross, E. R. 1970. "Technifacts: high altitude decompression." *Skin Diver*. 19 (11): 17-18, 59.

⁷ See: Bell and Borgwardt. 1976. "The theory of high-altitude corrections to the US Navy standard decompression tables." UHMS. See also: Toner and Ball. 2004. "The effect of temperature on decompression and decompression sickness: A critical review." NMRC.

its efficacy. "The Cross Corrections have been in every *US Navy Diving Manual* revision since the 1970s. But you can't rely on them for edgy dives. It's unclear if the math is sufficient," Pollock said.⁸

The atmospheric pressure at Lake Tahoe is 0.79atm, for example, so a dive to 100ffw (31mfw) is the equivalent of making a dive to 100ft x (1atm/0.79atm) = 127fsw (39msw) at sea level. Using the same logic, a dive to 470ffw, the maximum depth of the *SS Tahoe*, is equivalent to a sea level dive to 594fsw (182msw).

Decompression stops also need to be recalculated deeper, using this method. For example, the 20ft oxygen stop would be pulled at 20fsw (6msw) x (1atm/0.79atm) =

⁸ According to Pollock, the data for diving and altitude decompression also doesn't mesh fully. "It is good to be conservative until we have more high quality data to resolve the questions."



PHOTO COURTESY OF NEW MILLENNIUM DIVE EXPEDITIONS

Jolanda or the "Fitz," which were conducted at sea level, Lake Tahoe is situated at 6,229 feet (1,899m) of altitude, making the *SS Tahoe* a no-man's land in terms of decompression knowledge; there is almost no data to validate procedures for aggressive dives at that altitude. Only Sheck Exley and Nuno Gomes' series of sub-500ffw (153mfw) open circuit dives in 1992-1996 at Boesmansgat⁴ sinkhole that lies at an altitude of 5,000ft (1,500m) in South Africa were possibly more extreme.⁵

⁴ <https://en.wikipedia.org/wiki/Boesmansgat>

⁵ High profile technical diver David Shaw died on a rebreather dive at Boesmansgat in 2005.



PHOTO COURTESY OF NEW MILLENNIUM DIVE EXPEDITIONS

Click to see a video of McClellan's first touchdown on the *Tahoe* wreck (2002)



PHOTO COURTESY OF NEW MILLENNIUM DIVE EXPEDITIONS

SS Tahoe





BLAKE EVERETT / WIKIMEDIA COMMONS / PUBLIC DOMAIN

Lake Tahoe is a deep freshwater lake in the Sierra Nevada mountain range, on the border between the US states of California and Nevada

25ffw/8mfw. Note, however, that the partial pressure of oxygen is only $PO_2=1.52$ (= 25ffw/34 ffw/atm + 0.79atm) not 1.6atm, at the adjusted depth.

Though Cross's articles on altitude diving were useful, they were not a text book, which is what McClellan, then a 21-year-old, newly minted PADI instructor based in Reno, Nevada, needed. So in 1982, he and his math-savvy 18-year-old divemaster, Brian Morris, set out to write a book on altitude diving, which they could use in their classes.

Morris did the math and McClellan simplified the text, and in 1984, they published, *Practical Altitude Diving Procedures*, which included the first altitude diving tables for Lake Tahoe. They also created a PADI specialty course on altitude diving, at the time when a solid course outline and \$25 was all you needed, and began teaching classes at Sierra Diving Center in Reno, Nevada.

McClellan and Morris continued their altitude diving education. In the mid-80s, they ran a series of tests to see how well

current dive computers could handle altitude decompression calculations. The Orca EDGE⁹ led the pack, and Morris created a plastic overlay on the EDGE decompression graphic to correct it for Lake Tahoe diving.

In 1990-91, McClellan opened a dive school and store—Tropical Penguins Scuba in Reno Nevada (later sold)—and continued training divers, at a time when the technical diving was just coming out of the closet. McClellan and Morris got nitrox certified in the mid-90s and began experimenting with trimix.

Subsequently, Morris wrote "Departure," a Buhlmann-based, desktop decompression program that could handle mix calculations at altitude, and the two began making progressively deeper altitude decompression dives using trimix, and validating the program and procedures. They also started experimenting with pre-breathing oxygen before the dives. Eventually they were conducting

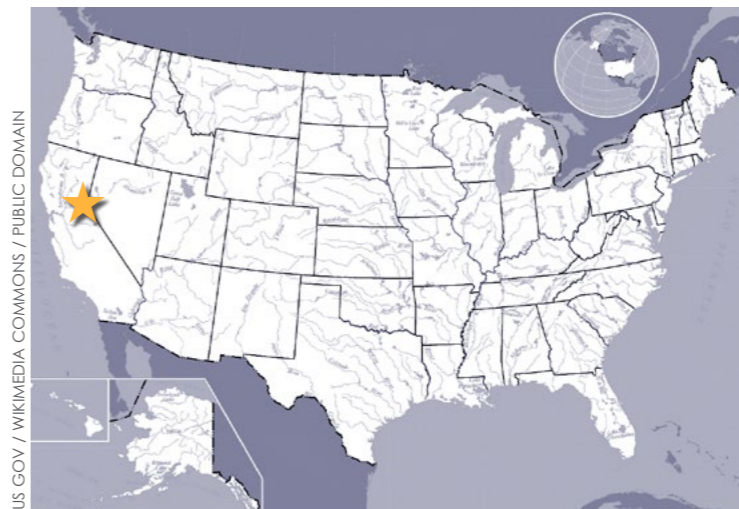
⁹ <https://www.shearwater.com/monthly-blog-posts/on-the-edge/>

trimix dives to 325ffw-350ffw (106mfw) on the slope directly above the Tahoe in Glenbrook Bay.

Beneath Lake Tahoe's waters With a depth of 1,645ft (501m), Lake Tahoe,¹⁰ which straddles Nevada and California, is the second deepest lake in the United States after Crater Lake (1,943ft, or 592m) in Oregon and occupies 191 sq mi (495 sq km)—enough water to cover the state of California to a depth of 14 inches (36 cm). By the late 1800s, the lake supported a vacation resort with a handful of hotels and communities scattered around its shores, which were serviced by a number of steamers.

In 1884, lumber magnate Duane Leroy Bliss ordered the steel-hulled SS *Tahoe* from San Francisco's Union Iron Works. The vessel was shipped by rail in pieces to Carson City, then by wagon to Glenbrook, reassembled, and launched in June 1896. It was the largest of the lake steamships. She was propelled by two

¹⁰ [Google.com/maps/place/Lake+Tahoe](https://www.google.com/maps/place/Lake+Tahoe)



US GOV / WIKIMEDIA COMMONS / PUBLIC DOMAIN

Location of Lake Tahoe on US map

SS Tahoe

she lay unused for several years.

In 1940, Bliss's son repurchased the vessel from Lake Tahoe Development Company; his intent was scuttle her in shallow water off Glenbrook where she would be visible to the glass-bottomed boats that operated on the lake as a memorial to a bygone era. The *Tahoe* was

scuttled on August 1940, but Bliss didn't take into account the steep 32-degree underwater slope in Glenbrook Bay, and the ship slid down out of sight and came to rest along the slope with the bow at 360ffw (110mfw) and the stern at 470ffw (143mfw).

Tech Target Tahoe

Having a deep technical diving target in their backyard, and a reliable altitude decompression program, proved a compelling combination for McClellan and Morris, who, by 2001, had completed their mix diving certification along with GUE training, which McClellan said was key in preparing them for their 2002 expedition.

"The SS *Tahoe* was a real motivation," McClellan recalled. "It was an opportu-



Historical photo of SS *Tahoe*, courtesy of the US National Park Service

US NPS / PUBLIC DOMAIN



Bathymetric scan of the SS *Tahoe* wreck site in Glenbrook Bay in Lake Tahoe, Nevada, USA

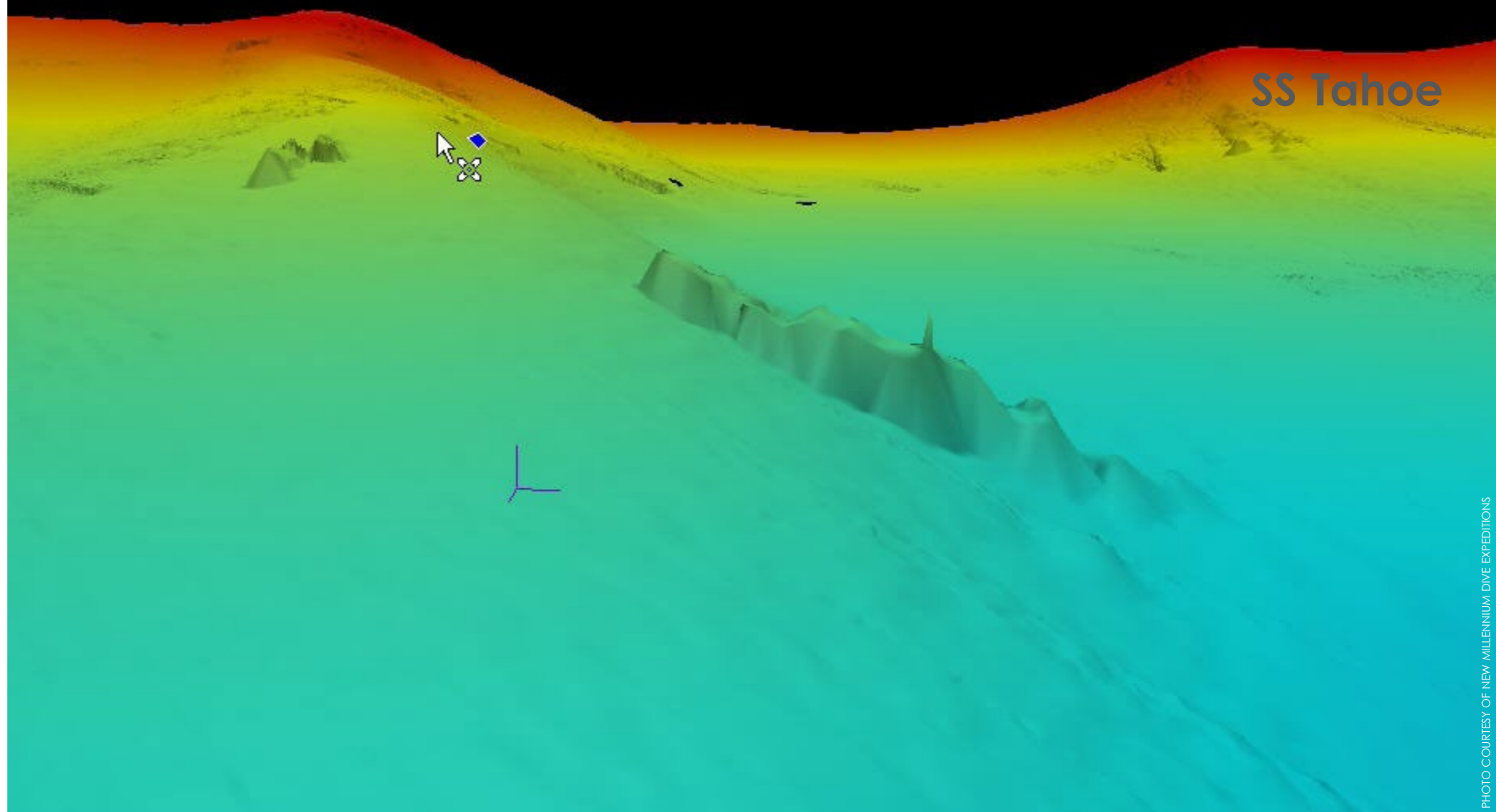


PHOTO COURTESY OF NEW MILLENNIUM DIVE EXPEDITIONS

nity to test our deco software, and then we got into the ship's history. At that time, we had no idea of the effort that would be required to make the dives and secure the necessary funding. Even locating and setting a line on the wreck was difficult [he chuckles]. It became a massive challenge and that became motivation in itself."

On 20 June 2002, McClellan and Morris made their first attempt to reach the *Tahoe*, after some 20 hours surveying the wreck with an ROV. The pair got within 40ft (13m) of the wreck but had to call the dive due to an equipment problem. They returned a month later and successfully touched down

on the bow of the wreck, and laid a plaque thanking the Bliss family for their contribution. "Touching the wreck finally made it real," McClellan said.

The divers spent approximately five minutes descending, and five to seven minutes on the wreck, followed by three hours of blue water decompression with six gas switches, based on their Department software and GUE standard gas mixes (See Table 2).

The team pulled all of their stops deeper to achieve a $pO_2=1.6\text{atm}$, for example, pulling their 20ffw (6mfw) oxygen (O_2) stop at 27ffw (8mfw), which equated to a pO_2 of 1.6atm at the 6,229ft (1,899m) altitude in fresh water. However, in doing so, they "technically" violated the maximum operating depth (MOD) markings on the cylinders. McClellan described it as a "cluster" and discontinued the practice on the subsequent expeditions.

McClellan said that the cold was "a pain but not debilitating." The team used argon, but wore wet gloves and did not have active heating—or P-valves!! "The

excitement of the 2002 dives and the relative short bottom times did not stand out as being a negative," he offered when asked about the cold.

During the summer of 2002, McClellan and Morris completed three more dives without incident, to a maximum depth of 410ffw (126mfw), the site of the *Tahoe's* collapsed superstructure, at a cost of about \$1500 per diver per dive.

In 2003, NMDE received a grant from the state

of Nevada to further document the wreck and gather baseline data. However, Morris decided to give up deep diving, leaving McClellan without a dive buddy. McClellan was forced to give the money back. Fortunately, he had enough documentation and images to complete registering the *Tahoe* with the National Register of Historic Places,¹¹ which was accepted the following year, and became Nevada's first "Submerged Cultural Resource."

Return to the *Tahoe*

McClellan returned with a second expedition in 2009-2010 to gather more data and complete their survey of the wreck. This time he teamed up with former commer-

¹¹ <https://npgallery.nps.gov/pdfhost/docs/NRHP/Text/04000026.pdf>

cial diver James Novaes, Merlin Rhoda and three other support divers. McClellan received support from the State of Nevada's Historic Preservation Office (SHPO) and a Historic Preservation Fund grant through the National Park Service that SHPO managed, and delivered to the state a detailed bathymetric scan of the wreck site.

Again, the team would be diving open circuit. However, based on their experience in 2002, McClellan made several changes to the dive plan. First, rather than descend and ascend on a down line system, the plan took advantage of the *Tahoe's* 0.5mi (0.8km) distance from shore. The team would scooter to the wreck from shore along a transit line that had been laid previously, begin-

ning their bottom time when they reached 70ffw (21mfw) where they descended about 0.25mi (0.4km) from shore.

The entire transit was expected to take approximately 12 to 13

minutes. Upon reaching the wreck and completing their bottom time, they would return the same way, conducting their decompression while traveling along the transit line that ran from the bow

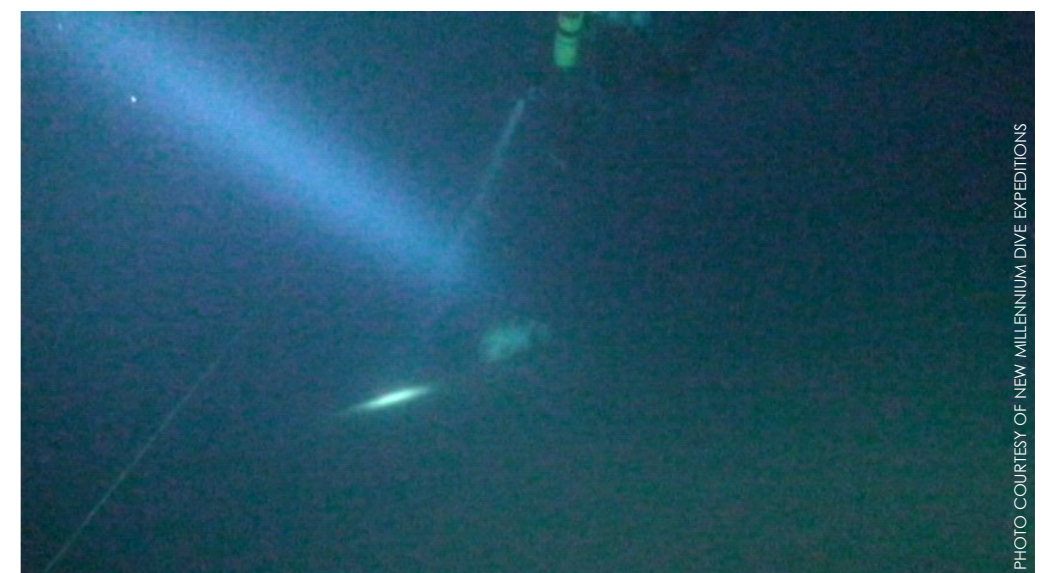


PHOTO COURTESY OF NEW MILLENNIUM DIVE EXPEDITIONS

Click the image to see a video of McClellan scootering to the *Tahoe* (2009)

Table 2: GUE Standard Gases

GUE STANDARD GASES	
BOTTOM GASES (Average $pO_2 = 1.2 \text{ atm}$)	
Gas	-> Working Range
32%	-> 0-100ft
25/25	-> 90 – 130ft
21/35	-> 100 – 160ft
18/45	-> 160 – 200ft
15/55	-> 200 – 250ft
12/60	-> 250 – 300ft
10/70	-> 300 – 400ft
DECO GASES ($pO_2 = 1.6 \text{ atm}$)	
Gas	-> Working Range
100%	-> 20 – 0ft
50%	-> 70 – 30ft
35/25	-> 120 – 80ft
21/35	-> 190 – 130ft
18/45	-> 240 – 200ft



tech talk

of the *Tahoe* to shore. The support team would stage extra decompression gas along the line, making the dive into more of a cave dive.

"The vertical ascent was too manpower-intensive," McClellan explained. "In addition, the traverse makes the decompression

SS TAHOE DIVE PROFILE (11 SEP 2010)

Max depth: 497 ffw

Average depth: 420 ffw

Bottom time on trimix 8/80:
25 minutes (12 minutes transit, plus 13 minutes on the wreck)

Ascend to 240ffw/m: 6 minutes

240ffw to 200ffw: Switch to trimix 18/45: 12 minutes

190-130ffw/m: Switch to trimix 21/35: 25 minutes

120-80ffw/m: Switch to trimix 35/25: 50 minutes

70-30ffw/m: Switch to trimix 50/25: 100 minutes

20ffw (6mfw): Switch to O₂ (5-minute air breaks every 30 minutes): 100 minutes

Ascend from 20ffw: 10 minutes

Runtime: 328 minutes, or 5 hours 28 minutes

Table 3: SS *Tahoe* profile

much easier than hanging on a line for three hours or more."

Second, the team switched to dry gloves and added p-valves making the dives much more comfortable. Finally, instead of relying on the deco software, McClellan used "ratio decompression" to calculate the team's decompression plan using trimix 8/80 (8% O₂, 80% He, balance N₂) along with GUE's standard decompression gasses at 240, 190, 120, 70 and 20 feet. "I decided we should go to ratio decompression because it was simpler and more conservative from the research and modeling I conducted," he explained, acknowledging it as his belief, not fact.

Decompression by the numbers

Originally developed by GUE's George Irvine and Jarrod Jablonski, ratio decompression¹² allows a diver to construct a decompression schedule on the fly using average depth and simple ratios whether it is a simple recreational profile using nitrox 32 (GUE does not encourage air diving), or a deep trimix decompression dive.

It was designed as a contingency tool to get divers out of trouble, for example, in the case that dive computers failed or the dive team lost their tables. Note that ratio decompression is not a decompression method or algorithm in itself, rather it is a means to approximate the stair-stepped

¹² https://en.wikipedia.org/wiki/Ratio_decompression

time/depth curve of a suitable decompression schedule.

For example, a diver's no-stop time diving nitrox 32 can be calculated as 130 minus the average depth of the dive. If the average depth is 80 fsw (24msw), the diver has 50 minutes at 100 fsw (31msw) and the diver can make a 30-minute no-stop dive.

Similarly, for trimix dives in the 80 to 150 fsw (46msw) range using GUE's standard gases, the required decompression time can be calculated as a 1:1 ratio with bottom time, with a first stop at half of the average dive depth. Deeper dives have increased ratios, 2:1, 3:1, etc. The method, once learned, can be applied to any diving situation at sea level. McClellan literally took Jablonski and Irvine's method to new heights.

Over the previous decade,



PHOTO COURTESY OF NEW MILLENNIUM DIVE EXPEDITIONS

View over Lake Tahoe (right); In planning the *Tahoe* dives, McClellan (below), who is likely one of the world's most experienced altitude divers, experimented with different ratio calculations



MICHAEL MARFELL / WIKIMEDIA COMMONS / CC-BY 2.0

McClellan spent countless hours simulating high altitude dives and what-ifs on programs like Departure, GUE's DecoPlanner or V-Planner, as well as experimenting with different decompression procedures, such as oxygen pre-breathing, and said he developed a second sense about altitude decompression profiles.

"I got to the point where I

could create an altitude decompression schedule in my head on the fly," he said, while acknowledging there was no science behind it. "It was all based on trial and error, but my method was right in there compared with the models."

McClellan, who is likely one of the world's most experienced altitude divers, experimented with

different ratio calculations in planning the *Tahoe* dives. Initially, he began planning schedules with a 3:1 ratio of "oxygen time" to the bottom time and completed the rest of the schedule accordingly. However, at altitude, he was concerned that divers were not getting the full benefit of gas switches, particularly shallow stops.

For example, Mc-

Clellan reasoned that since the pressure at their 20ffw (6mfw) stop in Lake Tahoe was only 1.37atm (=20ffw x 1/34atm/ffw + 0.79atm) compared to a pO₂ of 1.6atm 20ft stop at sea level, the stop was 14 percent less efficient. Accordingly, he experimented by adding 14 percent more time at their 20ffw stop.

However, he later increased the time to 25 percent beginning on their 70ffw (21mfw) to after getting a minor decompression sickness (DCS) hit in 2010, which was successfully treated with O₂. [The nearest chamber is in Reno, about an hour away.] McClellan eventually settled on a 4:1 ratio of O₂ time to bottom time.

During the 2009-2010 expedition, the team made a total of six dives on the wreck: five with McClellan and Novaes; and one with McClellan, Novaes and Rhoda. A profile of one of McClellan's September 2010 dives to the slope just below the stern of the *Tahoe* is shown in Table 3. McClellan calculates that he burned





tech talk

GUE Instructor Trainer Karim Hamza emerging from a dive in his JJ CCR



PHOTO COURTESY OF GUE

approximately 750f³/21kL of gas over the course of a *Tahoe* dive, consuming eight cylinders and his double 112s. He estimates that the dives cost about \$1,750 per diver per dive.

The right tools for the job

McClellan, who has served in a variety of roles for Project Baseline, is eager to revisit the *Tahoe* with better tools and has been planning the expedition with the help of fellow GUE divers: Graham Blackmore, Kevin Dow, Karim Hamza, and GUE co-founder and director of Project Baseline, Todd Kincaid. He will be sending out a notice later this year seeking

qualified GUE divers, and it is likely that some members of the team may dive the wreck this summer to scope it out.

Currently, the plan is to have one or two 4-person photographic teams that would conduct up to six dives on the wreck. The divers will likely be diving JJ-CCRs, which are GUE's rebreather of choice, charged with trimix 8/80 bottom gas, along with onboard Shear-

water Research computers and scooters for propulsion. Note, that the computers automatically calculate the dives based on the relative pressure changes at altitude similar to the Cross Corrections.

The plan is for the divers to descend vertically from a boat, complete their photographic mission on the *Tahoe*, and then conduct their decompression along the half-mile transit line that runs from the bow of the wreck to shore. Additional bailout gas (standard gases) will be stationed along their route.

McClellan is planning for a five-minute descent with a total of about 30 minutes of bottom time, followed by about 5.5-7.5 hours of decompression for a total run time of six to eight hours. They plan to run their set points at $pO_2=1.2\text{atm}$, and use the Shearwater (Buhlmann algorithm-based) computers with gradient factors set to 40/70—40 to get them off the lake bed quickly and 70 for added conservatism. They will also run a series of simulations with decompression software and have a set of back-up tables. Ironically, GUE's DecoPlanner software does not yet accommodate CCR profiles (GUE only sanctioned CCR



PHOTO COURTESY OF ROSEMARY E. LUNN

Dive physiologist Dr Neal Pollock is a researcher in hyperbaric and diving medicine at Université Laval, Quebec

diving in 2014).

As noted above, altitude algorithms, particularly for aggressive decompression dives have not been validated. If McClellan has his way, Pollock and his team will be there to monitor the divers for bubble formation using two-dimensional ultrasound for two-hours post-dive (producing video records of bubbles that may be moving through both right and left sides of the heart), which will generate much needed



PHOTO COURTESY OF GUE

GUE technical diver Karim Hamza



PHOTO COURTESY OF GUE

GUE co-founder and director of Project Baseline, Todd Kincaid (center), talking to BGL sub pilot Randy Holt (left), Todd Kincaid, Russel Hughes of TechDive NZ (right)





PHOTO COURTESY OF GUE

GUE co-founder and director of Project Baseline Todd Kincaid

Historical photo of SS *Tahoe* (on right side), circa 1906, at Tahoe City pier, which had train tracks, allowing passengers to disembark from the train and immediately board the steamboat



US GOV / WIKIMEDIA COMMONS / PUBLIC DOMAIN

data. "We want the project to deliver as much data as possible," McClellan said.

McClellan estimates that they will be able to do these dives for under \$10,000 or about \$800 per person per dive, about half of what it cost for their 2009-2010 expedition. Gas and sorb cost will run about \$4,000.

The team will also use active heating systems, both gloves and body, developed by Santi Diving Equipment and Diving Unlimited

International (DUI). The plan is to use heating during the long decompression phase of the dive so as not to increase the risk of DCS.

The associated battery packs have approximately a two-hour burn time, so the team would stage battery packs along the line with the bailout gas and swap out batteries as needed. "Cold water is very much a factor that is not well studied," said Pollock, who recently started a research project on active heating. "The Navy

has looked at the issue and found that thermal loading has a huge impact on decompression.¹³ It can keep the divers comfortable but it can also dramatically alter their decompression status. The effects are not subtle and can be problematic if ill-timed."

Bringing home data

Hamza—who, in addition to being a GUE Technical Instructor Trainer, is a co-

¹³ Active heating during the working phase of the dive can increase the risk of DCS. See Gerth, Ruterbusch, and Long. 2007. "The influence of thermal exposure on diver susceptibility to decompression sickness." Navy Experimental Diving Unit Panama City, Florida. *Technical Report 06-07*. See also: "The effect of temperature on decompression and decompression sickness: A critical review." NMRC.

owner of Hollywood Divers Inc., in Los Angeles, California, and leads monthly expeditions to recover abandoned fishing nets from southern California waters with his wife Heather Hamza¹⁴—has been sorting out the expedition's photogrammetric mission. He has no illusions about the enormity of the task. "I have healthy respect and anxiety about the project. It's a daring dive and exciting, but it's also very challenging," he explained to me.

In addition to the many challenges of the dive itself, Hamza is concerned about capturing enough photographic data to create a robust 3D model of the wreck, during the planned six 30 to 35-minute exposures on the wreck and coordinating the teams to produce consistent images.

As currently envisioned, the teams would operate thusly: one diver would operate the Canon EOS 5D Mark IV camera with 16-35mm lenses; two divers would each man a 30,000 lumen Big Blue VL30000P Light; and the third a Halcyon HMI light—one positioned to the left of the camera, one to the right and one above.

Thus equipped, the photographic team(s) would conduct synchronized swims across the wreck and

¹⁴ http://www.xray-mag.com/pdfs/articles/Feature_GhostFishingII_HeatherH_59_locked.pdf

the surrounding lake floor, while maintaining a 45-60 percent degree camera angle at a maximum distance of one to two meters from the *Tahoe*. Following the filming, the photogrammetry team would extract high-resolution still images from the video, roughly one every five seconds, which will be fed into the Agisoft PhotoScan for rendering. In total, Hamza said he hopes to be able to extract about 50,000 images (about three hours of video) to produce the 3D image. The rendering will likely take several hundred hours of compute time.

Interestingly, visibility is also likely to be a factor on the expedition dives. Currently, visibility can be 20f/6m or less in the alpine lake, which used to boost 80-100f/25-30m of visibility, as a result of number of factors including run-off

from the surrounding community. Visibility is a hot issue among environmentally aware Nevadan residents and government officials, and "Keep Tahoe Blue" bumper stickers are common around the lake. One problem is what and

"I'm excited to support Martin's work. However, my main interest in the project is leveraging the attraction of shipwrecks to help build a team of divers attuned to environmental aspects of Lake Tahoe and bring more attention to the issue."

— Todd Kincaid

how to measure visibility and a second is what to do about it.

The issue is particular concern to Kincaid, a professional hydrologist, who confesses that he's more into water quality and fish than shipwrecks. "I'm excited to support Martin's work. However, my main interest in the project is leveraging the attraction of shipwrecks to help build a team of divers attuned to environmental aspects of Lake Tahoe and bring more attention to the issue," Kincaid told me. "That's what Project Baseline is all about."

Beginning with his work with the Woodville Karst Plains Project

(WKPP) to help improve Florida water management, Kincaid's long time focus has been marrying diving with science. "Touching down on a wreck, or laying line to the back of a cave by itself, doesn't really cut it. It's about what you can bring back something of value for other people. That's how you demonstrate the prowess of a dive team," he explained. "If divers aren't going to be the voice for the underwater world, who will?"

It's unlikely that McClellan's voice, which has been calling out for nearly two decades, will be silenced. Watch this space. ■

Michael Menduno is an award-winning reporter and technologist based in California, USA, who has written about diving and diving technology for more than 25 years and coined the term "technical diving." He was the founder and publisher of aqua CORPS: The Journal for Technical Diving (1990-1996), which helped usher technical diving into the mainstream of sports diving, and organized the first Tek, EUROtek and AsiaTek conferences, as well as Rebreather Forums 1 and 2.



DOUGLAS BRANDON

Martin McClellan between dives



A green hairy shrimp mimics a small green tunicate. With the tight working distance of a dipter, lighting becomes essential. One of the hidden benefits is less particulates coming between the lens and the subject, decreasing backscatter dramatically.

Text and photos by Mike Bartick

Supersize your macro images by going beyond 1:1. In the past, going beyond the limits of shooting true 1:1 macro seemed nearly impossible. Homemade magnifiers increased the subject size for sure but lacked in quality, while other “wet lenses” did not offer much in the way of magnification. However, with the surge of wet lenses in the market over the past few years, diopters in varying strengths have managed to achieve both magnification and increased quality, making super macro readily available to anyone wanting to go beyond 1:1.



Super Macro *Supersize your macro*

Diopters or wet lenses are attached on the outside of the housing, giving the name “wet lens” to the dipter. A wet lens increases your magnification while decreasing the working

distance of your camera lens. This makes longer camera lenses such as the 100mm or 105mm the best choice for several reasons. Getting greater than 1:1 can also be achieved using a 60mm lens,

and both combinations of lens/diopters have their place in this area for different reasons.

Setup
The most popular setup for seri-

ous super macro shooters is the 105/100mm lens with an external wet lens attached with a flip adapter. This combination allows a shooter to shoot long for nervous critters or to flip their dipter

down and zero in on the really small subjects. Options are good underwater, and this combination will give any shooter a lot of room and space for creativity.





photo & video

This hard coral crab was so well camouflaged, it was impossible to see for the untrained eye. My guide pointed it out to me and it was not until I flipped my diopter down, over my lens, before I could see it was a crab. I tried the stacked method but found I could not get the matching coral polyps in the frame too. Sometimes, backing off slightly can make a more visually appealing image. After all, it is not just about magnification.

Challenges and skills

Super macro will relentlessly challenge you in every aspect of shooting from the technical aspects of the camera settings to your dive skills. To paraphrase a quote by David Doublet, "If you can't shoot exotic subjects, then shoot the common subjects in an exotic way." Shooting super macro will certainly deliver in that

arena and create an exotic flavor for anyone looking to add some punch to a plain vanilla portfolio.

Your main objective or goal for shooting supersized, super macro images should be set at "capturing the image in the camera using true magnification"—this achieved by using said diopters or wet lenses, not through post processing. This lofty goal allows you the



Limenandra barnosii. Image taken using stacked macro, Nikon 105mm lens + super macro converter + multiplier. Nudibranchs are an ideal subject for super macro as they are colorful, cute and often very calm. This combination makes a perfect package for punchy images. With proper lighting and a lot of practice, you will soon be pushing your guide for smaller slugs. Many nudibranchs have a crude eyespot (right) that is also revealed when going beyond the standard 1:1 magnification. The striking neon colors of the *Limenandra* (above) are what makes this minuscule slug so different. Watching and waiting for your subject to move towards your lens, working into the frame, is a great technique for critical focus and depth of field.



greatest freedom of dissemination of your images and results in high-quality, high-resolution image files in the finished product. Cropping should be kept to a minimum for purity, but depending on what your final output will be, the choice is ultimately yours.

Shooting super macro and making small subjects appear to be larger (pardon the pun) is the smallest aspect of this style of shooting. Framing, composition and lighting are all key factors to consider, as they will greatly affect all areas of your final product and become the natural jumping-off point to expand on this secretive world of shooting super macro and going beyond 1:1.

Magnifying your subject and shooting super macro images comes at a high price, affect-

ing the following:

- Depth of field
- Composition
- Lighting
- Stabilization

Let's break it down and consider each of these key factors to gain a better understanding of how each of them dovetails into the next. Addressing them in a simple systematic manner will also allow



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photo & video

Nemo eggs (Nikon 105mm lens + super macro converter + multiplier). Whenever I see a brood of well-matured eggs or embryos of fish, I try to take advantage of the situation and capture a special image. This patch of nemo eggs is a perfect example of what magnification and lighting can achieve. The secret is to locate an egg that can be singled out from the rest and then finessing your focus so that it passes through the clear egg wall. Reflective lighting bounces away, so front flash on the eggs does not work so well. Try experimenting with side or back lighting for something special.



us to strategize and assert better control over vital elements.

Depth of field

Our first inclination to increase depth of field is always the f-stop. Stopping down to the maximum of your lens' ability will certainly give you a better depth of field, but it will also leave your images dark and eventually soften the details due to diffraction. Opening the f-stop will give you plenty of light but kill your depth of field and blow out the high-lights. You will find that the best

f-stop for super macro is in the upper ranges of your lens and usually hovers between f/29 and f/36. Your f-stop really needs to be pushed to fight the extremely narrow depth of field created by greater magnification. Use your ISO to amplify the light if needed and push your f-stop.

Composition

Composition, on the other hand, can be limited depending on your diopter, and this is really where a higher quality diopter leaves the rest behind. Consider

the fact that all lenses have a sweet spot, generally dead center of the lens. There are a couple of ways to get around a bullseye shot so that we can focus, recompose and shoot in a more creative way. Critical focus is paramount, so to achieve the desired composition, you must again assert control over your system by restricting the lens from hunting.

Lighting

When shooting macro and super macro images, your lighting technique might also need an

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Whip coral gobies (Nikon 105mm lens + super macro converter) can be a great target for macro and super macro, depending on the subject's willingness. Some will allow for the close approach, while others simply shy away, just as the camera gains focus. This particular goby has some grotesque parasites that have not only attached themselves to its side but are also carrying eggs.



overhaul. Like in other forms of photography, lighting is critical in super macro. Due to the tight working distances, backscatter is often not an issue, but correct exposure is.

I like to keep things simple, so in most cases, I use the fastest shut-

ter speed possible to eliminate any ambient light, e.g., 1/250. This allows me to concentrate on f-stop, strobe angle and composition. My strobes are angled in, so that I am not directly flashing the subject—using a modeling light is extremely important for this. In

many cases, I use a single strobe over the top and aimed back at my housing (not into the lens) so that most of the light is actually blocked by my camera housing. Just a small curtain of light illuminates my subject. This strobe angle helps to eliminate back-





Crown of thorns (left) are not very well-regarded as they have populated dramatically in some areas, causing severe damage to coral systems. But they are also beautiful subjects to investigate for passengers. The thorns remind me of a forest of some kind, with the shrimp hiding away within the trees. The extra magnification can push your images towards an abstract level easily and help to create something a little different than the norm.



Photo of porcelain crab (left) was taken with INON UCL67 + super macro converter. Size can be deceiving when shooting super macro, and most viewers would never guess that the subjects are so extremely small. I found this porcelain crab sheltering in the anus of sea cucumber. It moved up and down with the rhythm of the sea cucumber's slow undulations. Using the autofocus lock is a great tool for this type of situation. Shoot an image to check the exposure, adjust, then wait for the subject to move into the plane of focus.



The copepod parasites in the image above (taken with Nikon 105mm lens + super macro converter + multiplier) are seen with macabre clarity when stacking the diopters. I could actually see the pods sucking blood from their host to nourish itself and the eggs.

ground light even on a tight reef.

In some cases, I might also use a light-shaping device to help eliminate the distracting background altogether. For dual strobes, I use a similar method of reversing the strobe angle so that just a slight curtain of light flashes my subject.

In other situations, I want big, bright macro images. In this case, I designate a primary strobe in the foreground, and the second is used as a fill light for shadows. Even backlighting with a third light can give your photo an additional layer of interest that will set your photos apart from the pack.

Prior to your next dive, get to know your system a little bit. Find your camera's weak points and learn how to work with them, not against them. Every camera has a weak point, so buying the latest

and greatest is not always the solution. Learning how to squeeze a little more horsepower out your existing system could be as simple as experimenting. Here are a few of the ways that I have revved up the power of my camera system through logic and experimentation.

Stabilization

Stabilizing your camera and yourself when shooting super macro might be one of the toughest, multifaceted elements for shooting super macro that is frequently overlooked. Consider using a quality float arm to give your heavy system enough lift, allowing you to use a lighter shutter finger. Once you have locked the focus, the system should be light enough to adjust with just your fingertips. Super macro is delicate work and

having a lighter system will allow you to finesse your bulky housing.

The way you hold your housing is also critical. Try using your left hand to hold

the housing under the lens port. The system should feel natural and light in your hands underwater, not heavy.

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photo & video

Cowry. Composition and technical quality are equally important when shooting super macro. I often like to fill the frame with either the subject or the habitat in which they are found. Big, bright macro images are fun to make and will add yet another dimension to your portfolio. Many macro shooters concentrate on shooting with a black background so much that the natural habitat is often overlooked. Subjects that are slightly larger make for great big macro images and they are fun to shoot.

Technique revealed

Amplifying the incoming light is the first order of business when pushing your f-stops into the higher ranges, achieved by using your native ISO settings. This will also enable you to have some flexibility over your exposure for fine tuning and to retain control over the highlights and to bring back some of the color in an otherwise dark exposure.

Check your camera functions for focus locking or back button focus.

This becomes a powerful tool for split-second shooting. Once correct focus is achieved, you can restrict the lens from hunting and adjust the critical focus with subtle in and out camera movements or allow the subject to move to you. In addition, you can fire your camera at any time, when the focus is locked. This handy tool is perfect for any environment



Image taken with Nikon 105mm lens + super macro converter + multiplier. "Stacking" diopters is always an option to gain extra magnification, but the image can suffer greatly if you are not using quality glass. Ghosting or achromatic aberrations are typical of a lesser quality lens and can appear as a colorless haze or a colored gloom on all, or portions, of your subject, creating a funky halo effect. Buyer beware when purchasing your diopters.

that has any surge whatsoever, by allowing the subject to move in and out of your focal plane. Resist hunting and minimize your movement.

Focus, lock, adjust and fire while paying close attention to critical focus.

Remember what we see through the lens and diopter is equivalent to a 2.8 or less due to the extreme magnification. We only see the depth of field returned after the photo is made, no matter what f-stop we use while shooting the photo.

Visualize your sensor plane as a three-dimensional, rectangular space, in which your subject will be photographed. The plane of field is linear, but the depth of

the image should not be neglected and will help create stronger compositions if the subject is working into the image.

After locking your focus, you can re-compose in a linear method.

As long as you do not move your plane of field forwards or backwards, the image will remain sharp—which is easier said than done. Getting low is also important to expose the little critters' habitats and getting a closer look into their world. Shooting anything from front to back or head to tail will always create a greater fall-off of acceptable sharpness, while a slightly horizontal approach will allow for more of the subject to be sharp.

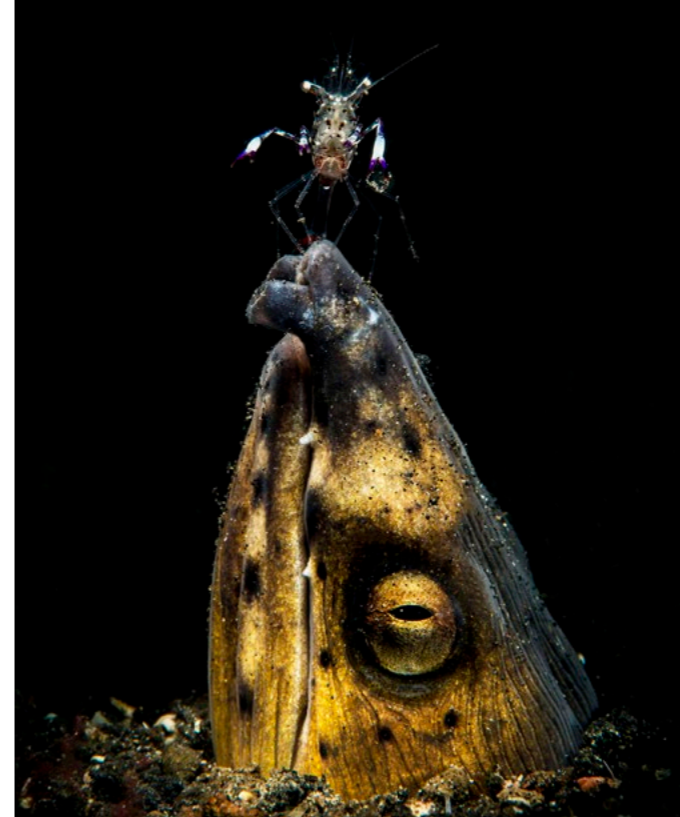
Going beyond 1:1 is not as difficult as one would think. All it takes is a little practice and determination. Remember to be patient with yourself, have a little fun and try to apply a few of the techniques discussed to help you along. Now get out there and have an adventure! ■

Mike Bartick is a widely published underwater photographer and dive writer based in Anilao, Philippines. A small animal expert, he leads groups of photographers into Asia's underwater realm to seek out that special critter. For more information, visit: Saltwaterphoto.com.





Macro: Marchione Giacomo, Italy (right); Compact Camera: Dragos Dumitrescu, Romania (top far right); Young Talent: Garri Immanuel, Philippines (lower right); Wide Angle: Yen-Yi Lee, Taiwan (below); Freediving: Cendric Peneau, Reunion Island (bottom left)



Creative: Kenji Cheow, Malaysia (right)

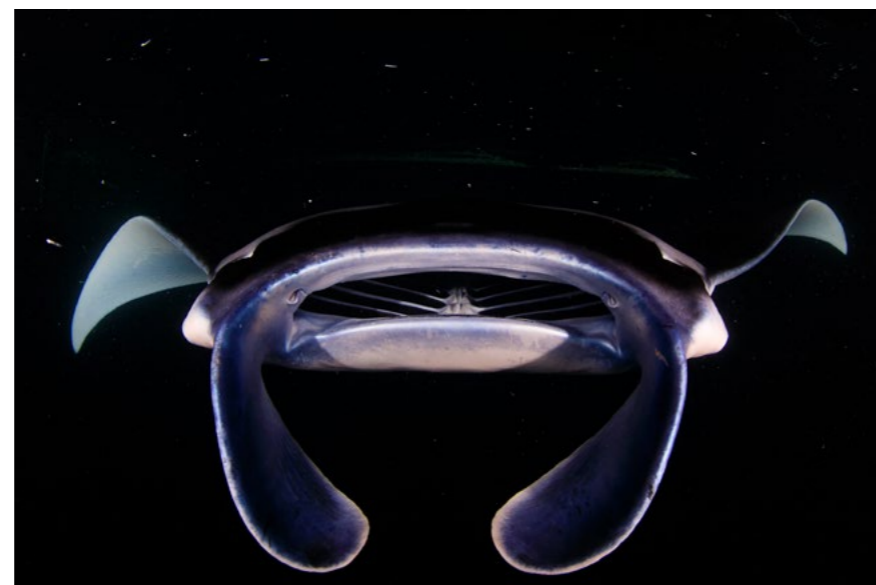


Lens Beyond Ocean 2017 winners featured at MIDE

Winners of the 5th annual international underwater photography competition, Lens Beyond Ocean, were featured in an exhibit at the Malaysia International Dive Expo in Kuala Lumpur 12-14 May 2017. The competition received an overwhelming response, with entries from 46 participants from 13 countries.

Macro. The Macro category was won by Marchione Giacomo of Italy, with the Memorable Photo honor going to Wu Yung-Sen of Taiwan. The prize for this category was a 5-day/4-night dive package at Nusa Ceningan Resort in Bali, Indonesia.

Wide-Angle. The Wide-Angle category was won by Yen-Yi Lee of Taiwan, with the Memorable Photo



honor going to Tang Mun Phun of Malaysia. The prize for this category was 4-day/3-night dive package at Sangalaki Dive Resort in Indonesia.

Creative. The Creative category was won by Kenji Cheow of Malaysia, with the Memorable Photo honor going to Masmawi Rahim of Singapore. The prize for this category was a 4-day/3-night dive package at Seaventures Dive Rig in Sabah, Malaysia.

Compact Camera. The Compact Camera category was won by Dragos Dumitrescu of Romania, with the Memorable Photo honor going to Aliah Roslan of Malaysia. The prize for this category was a 4-day/3-night dive package at 7SEAS Dive Resort on the island of Gili Air in Lombok, Indonesia.

Freediving. A new category this year was Freediving, which was won by Cedric Peneau of Reunion Island, with the Memorable Photo honor going to Yen-Yi Lee of Taiwan. The prize for this category was a 4-day/3-night dive package at Tenggol Coral Beach Resort in Malaysia.

Portfolio. The winner of the Portfolio category was Lillian Koh of Singapore, with the Memorable Portfolio honor going to Iyad Suleyman of Ukraine. The prize for this category was an interview for a feature editorial article in X-RAY MAG, which you can read on the next page.

Young Talent. The Young Talent category was won by Garri Immanuel of the Philippines. The prize for this category was a 3-day dive package at Nusa Penida, Manta Point, Bali, Indonesia sponsored by AquaMarine Diving Bali.

Judges included marine biologist and editor-in-chief of *Scubazone*, Massimo Boyer (Italy); founder of *ScubaPortal.it*, Marco Daturi (Italy); underwater photographer Eric Goh (Malaysia); and publisher and editor-in-chief of *X-Ray Mag*, Peter Symes (Denmark). ■

MIDE thanked the sponsors of the contest prizes, the judges and the participants. For more information, please visit: Mide.com.my/lensbeyondocean

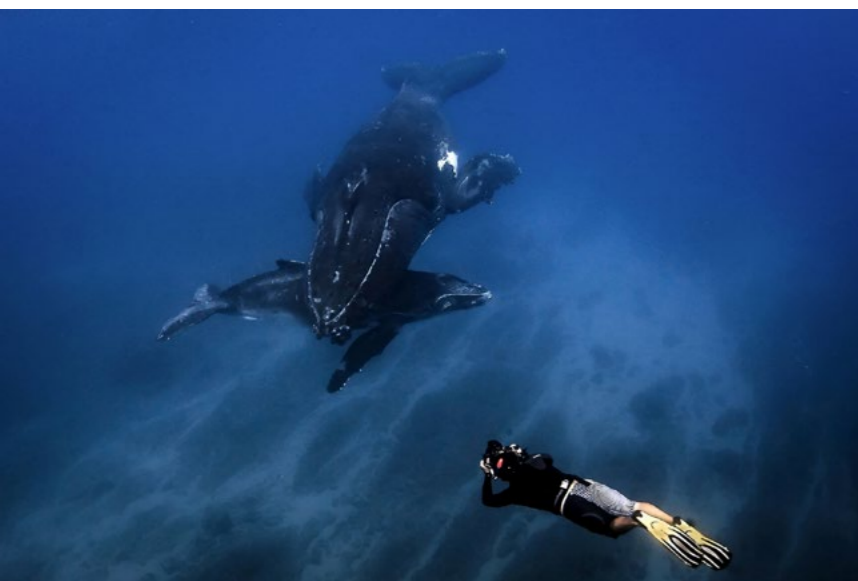




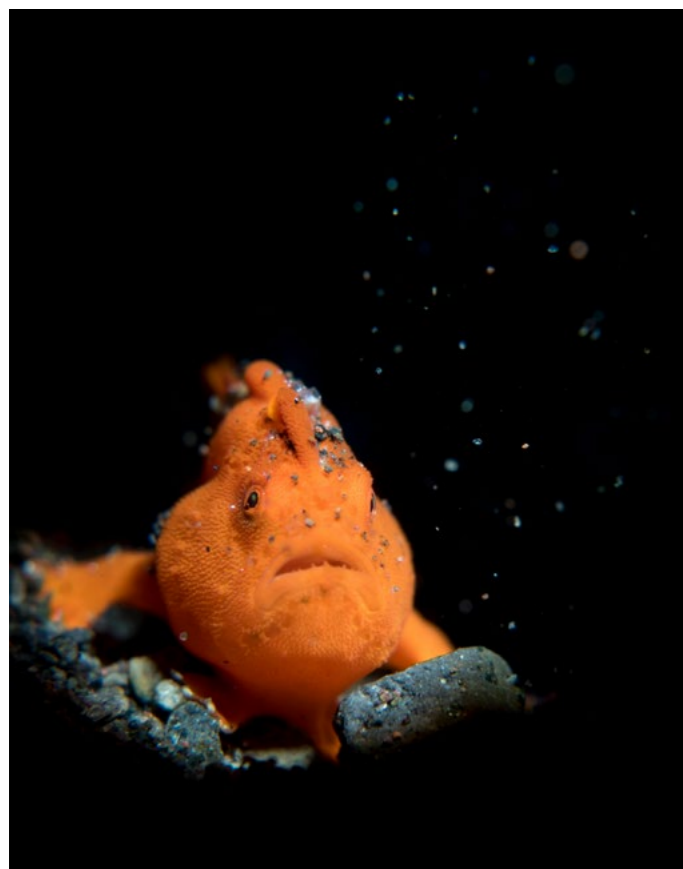
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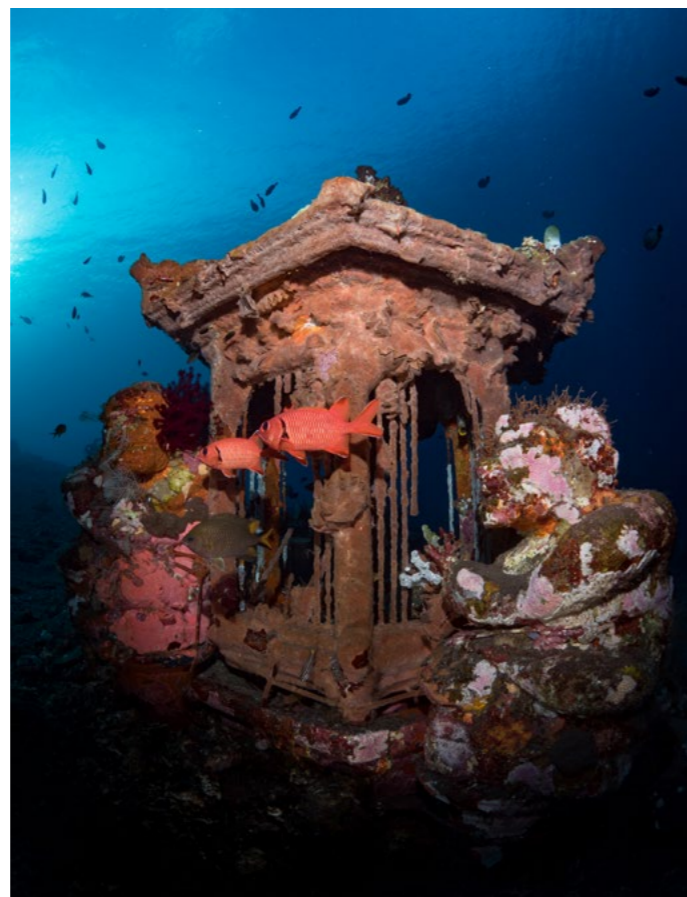
Lilian Koh

— *Lens Beyond Ocean Portfolio winner*

A close encounter with manta rays in 2000 inspired Lilian Koh of Singapore to take up scuba diving and underwater photography. Also drawn to tiny critters, her macro photography has won top awards.



Snowing – Frogfish at Kuwanji, Tulamben, Bali. ISO100, f5.6, 1/250



X-RAY MAG: Tell us about yourself, your background and how you became a diver and underwater photographer.

LK: I am from Singapore and formally worked in the banking sector as an executive assistant, with an interior design background. Currently, I

Underwater
photographer
Lilian Koh of
Singapore



JOHN GOODRIDGE

Swoosh (right) *Favorinus mirabilis* nudibranch with eggs, Kuwanji, Tulamben, Bali. ISO100, f8, 1/250; Shrine (left) Temple at Coral Garden, Tulamben, Bali. ISO200, f6.3, 1/250

dive and shoot whenever I can, after quitting my job many years ago.

I did my Discover Scuba program in the Great Barrier Reef, and it took me more than two years after that to be certified. I was on a dive trip as a non-diver and had a close-encounter with manta rays, which peaked my interest to discover more. I signed up to be a scuba diver within a couple of weeks. My brother was the first one in my family to be certified and I continued where he left off.

My first big trip was to Sipadan where I was armed with a tiny camera with a one-inch display. From then



Keyhole – *Costasiella kuroshimae*, affectionately known as the “Shaun the Sheep” nudibranch, at Malesti, Tulamben, Bali. ISO100, f10, 1/200



onwards, I have always dived with a camera to capture beautiful marine life.

X-RAY MAG: What is the backstory behind each of your winning images. How did you get the shot?

LK: For Keyhole (left) I was exploring a variety of ideas while using a snoot and wondering how to shoot everyone’s beloved Shaun the Sheep nudibranch (*Costasiella kuroshimae*) differently. The idea was conceived during a surface interval. Simple materials like duct tape and a penknife helped me to execute my idea and get the shot I wanted.

For Shrine (center): When in Bali, it's hard not to pay a visit to a temple. These magnificent structures were placed underwater and acted as sanctuaries for marine life. This image was taken during one of my visits. I picked a location and waited for the right moment for the fish to appear in my frame.





photo & video

Underwater photographer Lilian Koh with her camera rig (below)



BENEDICT SEAH

For *Snowing* (previous page, far left): This image was taken using a snoot. While I was shooting it, several divers swam passed and kicked up some sand. As you can see in the image, the sand added another element and created a snowing effect.

For *Swoosh* (previous page, top right), I found this nudibranch feeding on a ribbon of eggs. At the time, the surge was strong. Every time the ribbon of eggs moved along with the surge, it created different compositions. While shooting and snooting in these kinds of conditions, usually I

Nauticam housing, with Inon z240 strobes, plus a Retra LSD snoot.

X-RAY MAG: How did you develop your style of photography?

LK: Personally, I love isolation. That is why I am addicted to snooting. Able to control light, illuminating and isolating a subject from a busy environment, snooting helps the subject to pop in your images. Normally, during a dive, I do not have a specific critter to shoot. I will have a few ideas in my mind and look for critters and a suitable environment, which is



would have given up. I am glad I persevered and managed to get a series of images.

X-RAY MAG: What camera and lighting equipment do you use?

LK: I use an Olympus EM5 Mark II camera with a M.Zuiko ED 60mm f2.8 Macro lens or a M.Zuiko ED 8mm f1.8 Fisheye PRO lens, housed in a

but a truck load of patience as well.

X-RAY MAG: Who are your role models in underwater photography or diving and why?

LK: Basically everyone who takes photos underwater. Critters might be similar, but how photographers

Transparent,
photo by
Lilian Koh

Co-exist,
photo by
Lilian Koh

best-suited to executing the image. I will always bring my snoots during my dives and make sure they are always available when I need them. Setting up and positioning them requires time. Shooting critters with snoots requires not just time,

see them and what they see translates to their images. By studying other photographers' photos, one will start to explore how they shoot and compose. It is always good to learn from others.

X-RAY MAG: In your relationship with reefs and the sea, where have you had your favorite experiences?

LK: It has always been my dream to dive with dolphins. Most of the time, I saw them from afar, while on a boat. Finally, during a trip to Cocos Island, Costa Rica, I encountered a small pod, swimming and playing around me. I just stopped taking photos and took in those moments just to enjoy their presence.

X-RAY MAG: What are your



thoughts on ocean conservation and how does your photography relate to these issues?

LK: I hope that through my photography I am able to show people the beauty of Mother Nature and her creations. I want viewers of my photography to see the amazing critters we can see and find in the ocean. From pelagic to macro critters, we divers need to do our part in protecting them.

X-RAY MAG: What are the challenges and benefits of being an underwater photographer in the world today?

LK: Too many places, too little time to explore them all. I will slowly tick each location off the checklist.

X-RAY MAG: How do people respond to your works?

LK: I get positive comments from fellow photographers. I am very glad they like the way I present

my images and are inspired by my art.

X-RAY MAG: Do you teach photography?

LK: I'll be at the Anilao Photo Academy (Philippines) as an in-house coach for a month, from 21 June until 21 July 2017.

X-RAY MAG: What are your upcoming projects or events?

LK: I am thinking of running workshops, so stay tuned for any updates. I am constantly looking for and learning new techniques. I recently upgraded my whole camera set-up from a mirrorless camera to a DSLR so there are new and exciting adventures ahead, which I will share on my social media pages. ■

Please visit the photographer's webpages on Facebook at: [Facebook.com/liliankohphotography](https://www.facebook.com/liliankohphotography); and Instagram at: [Instagram.com/liliankoh](https://www.instagram.com/liliankoh).



Tiger, photo by Lilian Koh



photo & video

Edited by Don Silcock



Paralenz

The Danish-designed Paralenz is a newly developed tough little video and stills action camera, which has been specifically designed for divers. As such, it is a world's first. Part of the design philosophy, the company stated, was to create a product that would allow anybody—regardless of their diving experience or photographic expertise—to take quality underwater pictures and record high definition footage of their diving experiences. Some of those key features include: temperature and pressure sensors, which log your dive and display this information in your videos; automatic depth-controlled color correction, eliminating the need for lens filters; long battery life, allowing recording of 4K video at 30fps for over two hours; Paralenz Dive App, allowing you to display dive profile information alongside recorded footage and share it all with other divers; 200m depth rating, with no additional housing—a first in the recreational dive market. The Paralenz dive camera has a retail price of US\$599.00 and EU€649.00.

Paralenz.com



Nauticam Arri Alexa Mini Housing

Nauticam has released its new housing for the Arri Alexa Mini, the highly regarded, super-lightweight carbon bodied, m43 format, film and commercial video camera. Produced in collaboration with HydroFlex, the underwater cinema equipment rental house, the Nauticam housing features an array of interesting and innovative features focused on the professional film maker. Nauticam.com

Ikelite Mark II Housing for Canon 7D

US manufacturer Ikelite has released a completely re-designed housing for the popular Canon 7D DSLR. The housing incorporates Ikelite's new Dry Lock (DL) port system, which it said is much more robust and easier to assembly than its legacy Four Lock (FL) system. The new DL ports are lighter than the FL ones and able to accommodate extremely large diameter lenses such as the Canon 16-35mm or Canon 11-24mm. Ikelite stated that the DL and FL system ports are not interchangeable, but the DL port mount can be removed and replaced with old style FL port locks for legacy users. The housing also features a new, large, soft-touch lobed zoom knob, which makes changing the focal length of the lens much easier. Ikelite.com



BS Kinetics Leica S Housing

BS Kinetics has released its new housing for the Leica S-Series medium format digital cameras. The company, which is based in Germany, uses an innovative combination of carbon fiber and epoxy to manufacture its housings, which are then provided with stainless steel and the advanced plastic material POM fittings. BS Kinetics stated that manufacturing its housings this way allows them to be very light but also very strong and capable of depths up to 160m. The housing for the Leica S-Series features a LiveView-Finder, which allows the screen of the camera to be viewed, plus the shutter release, mode dial and shutter speed are controlled by the right hand. On the back of the housing is a wheel control that is accessible by the right-hand for the camera's aperture and four buttons that provide access to all the other camera's functions.

BSKinetics.com



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Derek DeYoung



P O R T F O L I O

4 Panel Barracuda, oil on four canvases (below), Trout Confetti, oil on canvas (right), Smallmouth Bass – Hawk Lake, oil on canvas (center); and Abstract Cutthroat – Spring in the Mountains, oil on canvas, 12x26in (previous page), by Derek DeYoung. Signed archival limited edition prints up to 40x60in (ca. 102x152cm)



American artist Derek DeYoung creates unique and spell-binding paintings of fresh and salt-water fish, which spur viewers to see and appreciate marine life in a different way. *X-Ray Mag* interviewed the artist to find out more about his work and his perspectives.

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

DD: I am the youngest of three boys, and we were just incredibly competitive with each other. Growing up, right at the get-go, I was the artist of the three. My middle brother did minor in art in college, but it was one of those things, where he had too many other opportunities. He was such a smart kid, he was going to go into the business world. But for me, from

a really early age, probably before I was six years old, everybody knew that I was going to be an artist when I grew up. And I think there was even a little too much optimism in that regard, because we all thought I was going to be an extremely famous artist. So (laughing) I bought into that early on and totally believed that it was going to happen.

I grew up in West Michigan on a small bayou just up river from Lake Michigan. Lake Michigan was my ocean. We spent every spare second just exploring the water, and wading around in the shallows. In the spring, there would be little baby northern pike, minnows, bluegills... We were just amazed with that, and I laugh because every effort in my life since then, and as an adult, has been, in a big way, to put me on the water as often as possible. And I really attribute it to that



time when I was such a young boy and knee-deep in the water everyday. I just can't even imagine a quality of life that wasn't spent on the water.

X-RAY MAG: Why fish? How did you come to this theme?

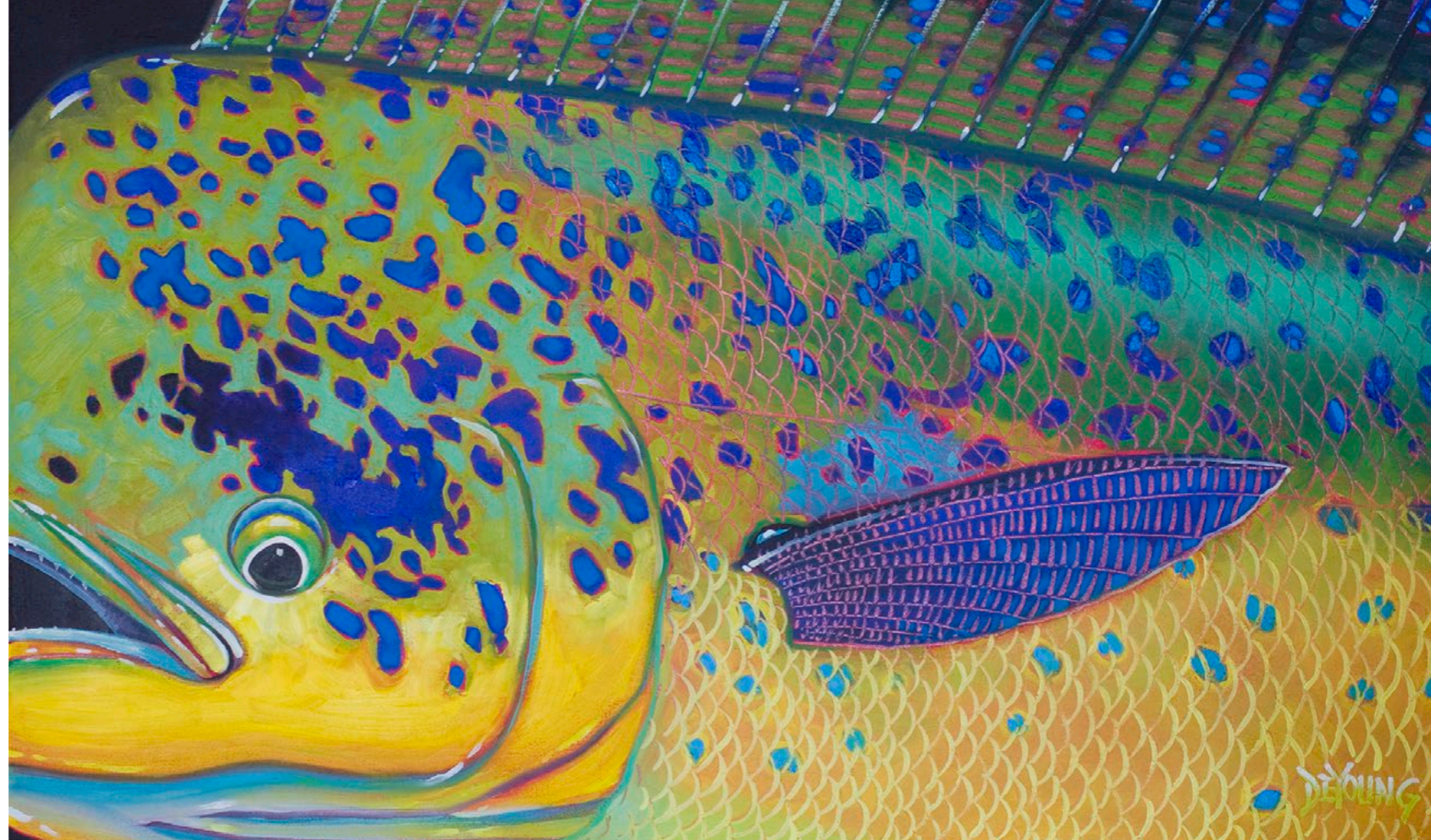
DD: As a kid, my focus was a little less organized, but one of the things that I constantly drew was fish. I come from a family of fishermen, going generations back—not in a commercial sense, but a lot of the people in my family subsidized the meat that they ate during the year by fishing. They hunted deer in the fall. They hunted

ducks and they fished, and I would say some of them didn't buy any meat at all from the grocery store. So I was influenced by that but with the sensitive artist soul, I tend to be much more catch-and-release oriented.

X-RAY MAG: What is your creative process? How do you create your artwork?

portfolio

Abstract Mahi Mahi, oil on canvas (right); *Bluewater Confetti*, oil on canvas (below); *Brookie Flank*, oil on canvas (lower left); and *Tailing Permit*, oil on canvas (lower right) by Derek DeYoung. Signed archival limited edition prints up to 40x60in (ca. 102x152cm)



DD: Well, it sounds cliché, but I would say the bulk of it is mental. And then through practice, through years of honing my craft, I can turn that mental process into an actual, physical piece of art. But to this day, my process starts if I'm sitting out on the water, or if I am sitting in an airplane seat at 30,000ft, or if I am laying in bed and can't sleep—all these times, I let my mind start working on my next painting. And by the time I have kind of moved through it—step by step—I've got it both drawn and the palette worked out; I've got the style in which the paint will be applied worked out. As quickly as I can, I'll get to my sketch book, and I'll actually do a sketch of my ideas, and I will write notes next to them with my thoughts on the palette, which is the colors I will be using.

The overall goal in my entire body of work, and my entire reason for doing art in my life, is that I believe my gift in art is to conceptualize and think of things that have not been done before. To me, there is no greater thrill in art than to lead people to see something in a new way, and to get that little bit of a rise out of

them, like, "Oh, my gosh! This is cool!" Many people have said to me—those that have no background in fishing and no background in looking at fish or diving—that they've never really looked at a fish before seeing my paintings.

I often hear fellow fishermen talking about the effects of my artwork. It has

shows and festivals, people come up to me and say, "I always take a close-up photo of the side of fish now. I don't need a picture of me with the fish anymore. I just am enamored with the color and the pattern of the fish."

You know, I remember what one of my art teachers said, back in my Kendall

College days (Kendall College of Art and Design in Grand Rapids, Michigan). Entering art school, I had already developed into a pretty good painter, but that really didn't mean

anything as far as being able to create a career from it. You needed more than that, and she (my teacher) knew that. She knew I had the opportunity to succeed.

So every time I turned in a project, she would say, "Are you doing what's already been done, but better than it's ever been done? Or are you doing this in a new way and blazing your own trail? You have to put a check mark by

one of the those. If you are doing what's already been done, and not better than it's been done, then why are you even doing art?"

And that really stuck with me throughout my early days as a professional artist, trying to make it, and it just became my mantra... looking at what's been done, looking at inspiration from other artistic genres, and trying to bring them into a new place or bring a completely new idea to canvas. That's been fun, and it's been good for me to have that strong focus to my work.

X-RAY MAG: What is your relationship to the underwater world and marine life? How has it influenced your art?

DD: As an artist and as a lover of the underwater marine world, I have been having a blast setting GoPro cameras in areas where fish live. By doing that, I'm able to get film and images of fish in their absolute relaxed, tranquil state, with no pressure from me being there at all. The images that I collect during this



Abstract Rainbow – Summer Sunset, oil on canvas (below), and *Starry Night Tarpon*, oil on canvas (right), by Derek DeYoung. Signed archival limited edition prints up to 40x60in (ca. 102x152cm)



process are so valuable to my understanding of how fish move and what they look like in different light and different depths. As I set that camera, I am trying to set the stage, if you will, for a painting. So, I can't just set the camera anywhere or in any direction. There's a lot of consideration as to what the light is doing, what time of day I am out there, what direction the fish come from... What kind of shots do I really want? How high off the bottom will the camera need to be? If it's too high, I will get mostly their backs. If it's too low, I will get mostly their bellies. Fish swim at different depths depending on the species. So, those are all things I try to think about when I'm setting a camera.

X-RAY MAG: *In your relationship with the underwater world, where have you had your favorite experiences?*

DD: Well, right here in Grand Traverse Bay, there's a 100ft 1890s cargo ship that sank, and it's a wreck in shallow water. You can swim down and along the giant wooden ribs of the boat, and there are all kinds of creatures that have made it their home: big bass, gobies, crayfish... This has become one of my favorite stops as I bring family and friends fishing and snorkeling around my home waters.

Then, my wife and I spend the winter months from December 1st through May 1st down in the Florida Keys. We do some snorkel-

ing at a local reef called Looe Key. I'm told it's the second largest reef in the world. I also snorkel around the mangrove islands and along the channels, too, and it's just amazing the things that we see.

I'll tell a little story about the coolest thing I've ever seen on the water. This was in 2015, and I was down in the Florida Keys. It was typically so windy that you really couldn't see very clearly to the bottom, even in fairly shallow water, because of the ripples (on the surface). But then we had two days in a row that were absolutely dead calm, and I went out on the water with my friend to find tarpon, probably a half hour before the sun came up. And as the sun came up and started to

light the water up, there were tarpon rolling everywhere!

What rolling tarpon are actually doing is taking a breath of air. They are able to breathe with a lung, which they have in addition to gills. The tarpon are in schools of sometimes over 50 fish, and as they start rolling, it's an amazing thing to see.

So as the sun came up and we could see more clearly, we began to move silently across the flat. My friend was using a 20ft-long pole to push the boat quietly across the water. What that allows you to do is to sneak up and see the fish without them knowing you're there. There's absolutely no sound from the boat at all.

We came upon a 20ft deep hole, in the bottom, in the middle

of the flat, which we had never seen before. It was about 50ft wide and 70ft long, and it had probably a hundred tarpon down in it. Along the sides of it, you could see caves that went back under the ground. We paused there and just observed them. The water was so clear, you could see every detail.

At that moment, a giant bull shark swam into that hole. Big bull sharks follow the schools of tarpon as they migrate, and they feed on them. So, we just sat and watched, to see what was going to happen next.

The biggest tarpon in most schools are the old females, sometimes weighing over 150 lbs



Abstract Brookie – Summer Night (left); *Pumpkinseed Sunfish* (below); and *Bass in the Pads* (bottom left), oil on canvas, by Derek DeYoung. Signed archival limited edition prints up to 40x60in (ca. 102x152cm)

Derek DeYoung

DD: Anytime you truly celebrate the visual beauty of something through art, you give it an importance that it may not have had for a lot of people—helping them appreciate it in a new way and start to consider how valuable that thing is. I think that is the overriding message of my work—just to get people to realize how fragile and beautiful fish are and how worthwhile the effort is to save these environments in which these fish live, so they can be around for generations to come. I think the saddest thing that I encoun-

DD: I would say that social media is something that I deal with everyday that the artists that came before me didn't. I'm able to share my experiences and my artwork with thousands of people, every day. And because I am of the generation during which, to some degree, all this social media started—when I was in my twenties—I've accepted it and embraced it. Some of the older generation of artists find it to just be terrible. They hate how exposed we are now. But I think younger artists have learned to

(68kg) each. They are the leaders of the school.

Four or five of these 150+lb tarpon immediately swam up and met that shark, before it could corner any of the tarpon and attack them. Two tarpon got along side it; one was biting its tail; one was biting up underneath its stomach; and they ushered the shark right out of that hole. We watched those tarpon move that shark right across the flat, away from the school.

Later, we were at a barbecue with a lot of long-time Florida Keys guides, and we told them what we saw. Most of them didn't believe us, but one of the guys, who had been guiding down there for 30 years, said that many years ago, he saw the exact same thing happen. There are things going on that are so far beyond what we know of these fish.

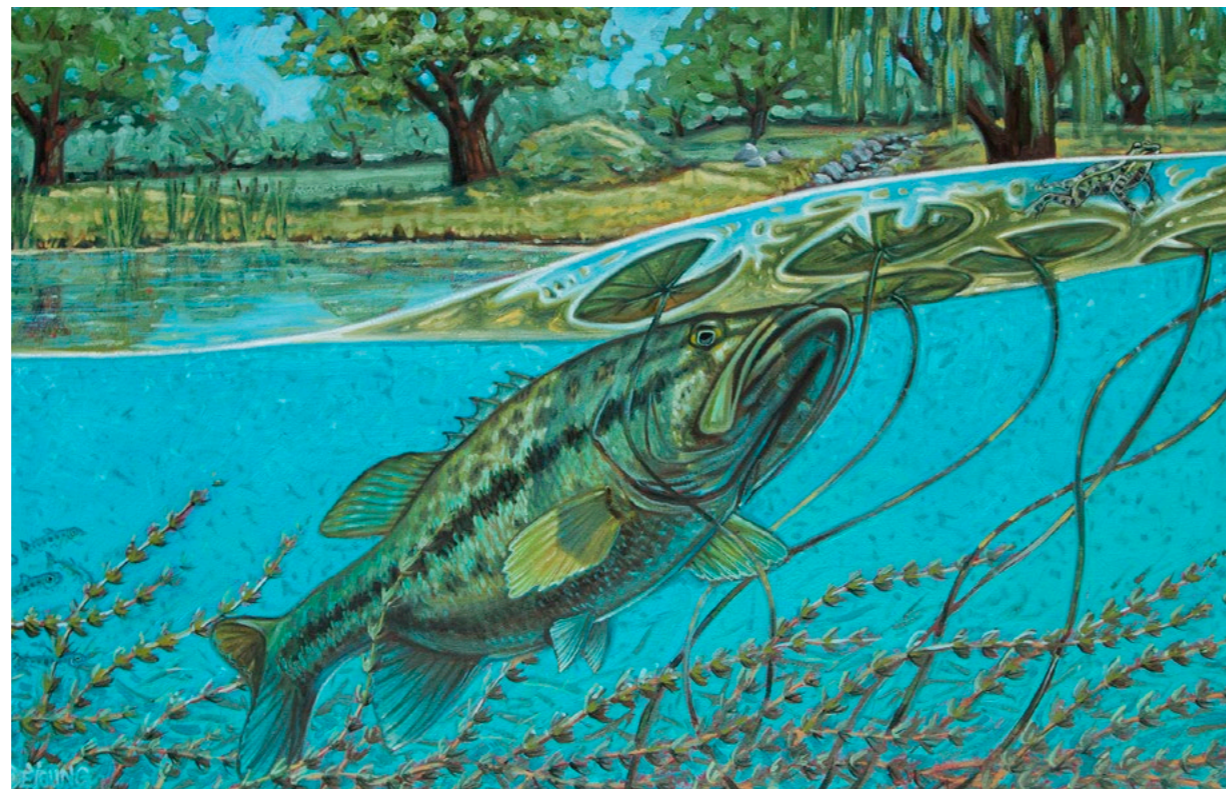
X-RAY MAG: What are your thoughts on ocean and freshwater conservation and how does your artwork relate to these issues?

DD: You know, I think the longer that I'm in these environments, the more I realize how pressing our effects are on

them, and on the animals that live there. I think it's of utmost importance that we—whether we live on the ocean or the lake, or not—realize that it is up to each of us to, in some way, give back to those environments, because without our help, the toll that these places take, in so many different ways, just from our cultural

pressures—boating or over-fishing—will diminish (the ecosystems) to the point of not being the spectacular things that they are today.

X-RAY MAG: What is the experience or message you want viewers of your artwork to get?



ter is a beautiful lake with amazing trees and forests around it and no fish in it, because of some kind of environmental impact. I just think about the special quality these creatures bring to the environment. It's amazing how cool water is, with fish in it. Without fish in it, it really ceases to be that special.

X-RAY MAG: What are the challenges and/or benefits of being an artist in the world today?

thrive with it. They've learned to use it to create an audience.

Everyday, I post something to do with the lifestyle of being a fisherman and an artist. So, there is more to marketing art than there was in the past. But I think it is a really positive thing—social media and my website being updated almost daily—versus what artists, about the time I was born in the '80s, were doing: primarily shows, openings, and being promoted by galleries or magazines. But



portfolio

4 Panel Parrotfish, oil on four canvases, 26x48in (right); Brown Callibaetis, oil on canvas (below); and Abstract Cutthroat Flank, oil on canvas (lower right) by Derek DeYoung. Signed archival limited edition prints up to 40x60in

in between those short spurts of being in the limelight, they were completely left alone and didn't have to continue coming up with new content. It was just three shows a year or so.

Now, it's daily. Now you're letting the people who follow your work into the process and the thoughts behind pieces, and I think that adds to the enjoyment of the end product.

X-RAY MAG: How do people or children respond to your works?

with some of my folk art-looking work.

X-RAY MAG: Any upcoming courses, projects or special events?

DD: I'll touch on the teaching part, but it'll be a little different answer than you were probably expecting, because I don't teach classes.

As an artist in my late teens and early twenties, trying to figure out how do this, I mailed a lot of different artists whose work I liked. I told them that I was a big



DD: It's funny you should ask, because I think with children, there's no filter, there's no agenda with anything they say. They say the absolute truth. So that being the case, I love hearing kids' reactions to my work, and I really do value those basic, elemental parts that appeal to a kid's eye. I think they are elements that make art successful for everybody. I love the idea of tapping into the kid in all of us,

fan, that I am an artist and asked them what they could tell me as far as advice? What did they think of my work? I sent them a few examples. Of 20 artists, only one responded.

The one that responded gave me a lot of great critique on my work, a lot of positive words about it, and a lot of encouragement. He sent me his entire marketing package that he sent to clients.



He was a fish and sporting artist out of Minnesota named Bob White. He did hunting and fishing artwork.

It had an extreme impact on me, to have a famous artist respond to me, giving so much to someone who was not going to be able to return anything. Since then, I've gone out and stayed with Bob at his studio. We showed art at the same show, and we drove together to it.

Since then, I've stayed in contact with Bob White, and over the years, I've had a lot of commercial opportunities with my artwork. Now Bob calls me, on occasion, and asks for my advice on commercial applications of his work.

So, to have it come full circle has been so cool. But it taught me to help any artist who contacts me with questions about how to do something, about what manu-

facturer I use to make a product, about lawyers, or about commercial royalty rates. I take great pride in helping other artists with the tricky parts of the business. I really attribute this approach to the experience with Bob White, and what it meant to me that he helped me.

I don't really see other artists as competition or people who will possibly steal work from me. I see us artists as a group, going on a similar adventure, and we need to help each other.

No matter how successful any artist is, it's not easy to sell artwork. It's a lot of work. It's a lot of hours per sale. There's a lot of disappointment that comes before achieving success. ■

For more information, or to purchase original paintings and archival prints, visit the artist's website at: DerekDeYoung.com.

