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British Columbia
Critter Connection

Wrecks of
Bikini Atoll

Indonesia's
Ambon

Thailand's
Koh Tao

Profile
**Stig Åvall
Severinsen**

Switching to
Rebreathers

PACIFIC PARADISE
Galápagos

DIRECTORY

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by Nick Shallcross

Octopus, Ambon, Indonesia. Photo by Don Silcock



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Biased reviews

In the early days of my diving career there was a marked difference between a bad and a good regulator. When I got my first dive training with a local dive club, it had an assorted bunch of school regulators, some of which were nice top-of-the-line models and others were—uh—less fancy, shall we say.

The good ones were easy to breathe and delivered plenty of air even at depth. The cheaper ones, which we always dreaded, were like sucking through a straw filled with cotton at depth. Going deeper than 20m became hard work just trying to suck air. It certainly put limits on our ventures.

Needless to say, as we dreamt about purchasing our own regulators and painstakingly saved for it, we pored over magazine reviews and tests and whatever other information we could get our hands on. In those days, it was often commonplace that reviews included objective tests and measurements and had graphs on performance, so we could compare numerical data.

We haven't seen that kind of data in reviews for quite some time and for good reason. Regulators have become so much better, as they have had to adhere to quality standards—such as the CEN 250—in order to be marketed in the first place.

Nowadays, a badly performing regulator is most likely just a badly maintained specimen in dire need of a fix.

And, just as we seem to care a lot less about a car's top speed and horsepower—they can all break the speed limit these days—and more on the practicality, economy, look and feel of a car, our choice of diving equipment has also become a matter of other and often more subjective criteria such as taste, or bias, if you will.

So, how do we go about reviewing not just equipment but also destinations and operators today? We are no longer occupied with objective performance tests and data in a test rig. By virtue of being CE-marked, crucial tests have already been passed, and there is rarely much we could add as far as testing is concerned. Instead, we look into how well the equipment fulfills its design criteria and whether it is a good purchase for its intended target group—in other words, its value for the money.

Like comparing a VW Bug to a Rolls Royce when asking which car is the better design makes little sense (unless you specify the yardstick) it makes little sense to make direct comparisons of small family-driven dive operations to five star facilities run by upscale multinational corporations.

A family-run dive operation will probably offer a more relaxed and affordable holiday, thus being a better value for the money for many divers, compared to what one might get at a posh resort or on a fancy liveaboard, which would be the obvious choice for the well-off, busy executive looking for big pelagics.

And this is exactly why our travel reports are much longer and in-depth than the norm. We want our stories to help readers—divers of all levels—make informed choices. We therefore always ask and require our reporters and reviewers to give their honest opinion and not to shy away from possible less-favourable reviews or conflicts. It needs to be told.

Is it subjective, or possibly even biased? Yes, by virtue of human nature, the individual perspective always will be—we are not robots. But, by asking our contributors—many of whom have been with us for several years and have developed a recognisable style and standard upon which they elaborate and argue their cases—we aim to make our reviews as transparent as humanly and practically possible.

With that, we wish all of our readers a terrific, fun-filled season of happy diving.

—The X-RAY MAG Staff



News edited
by Peter Symes

from the deep NEWS

A Vaccine for Corals

Inoculation of corals with virus can protect them against white plague disease.

White plague disease is caused by the marine bacteria. It progressively destroys coral tissue, leaving an expanding area that appears bleached. It has been epidemic in the Caribbean.

'White syndrome' is a name given to a number of diseases exhibiting similar symptoms, such as white pox, white band and white plague disease. The causes of white syndrome are in many cases unknown.

White syndrome has increased in abundance 20-fold in the last five years, with increases on inner, mid-shelf and outer-shelf reefs along the length of the Great Barrier Reef. It also had a major impact on Caribbean reefs.

In areas of the Great Barrier Reef surveyed, white syndrome, along with skeletal eroding band, was the most common disease.

Testing a cure

Eugene Rosenberg of Tel Aviv University in Israel and his group have now found a potential cure—a virus named BA3.

To test its usefulness, they inoculated corals living next to infected ones with BA3. The odds of infection dropped to 5



DR GRAHAM BEARDS / WIKIMEDIA COMMONS

Electron micrograph of Bacteriophages (vira) in the process of infecting a cell. This is not the virus or bacteriophage in question but a generic photo

percent. Doing the same to infected corals stopped the disease in its tracks.

Rosenberg is now in talks with the Israeli government to treat large parts of the Gulf of Aqaba with BA3 by artificially introducing the virus to reefs.

The virus exists naturally in the Red Sea, so they think it's unlikely to have adverse effects. ■



This new coral species lives on the ceilings of caves in tropical coral reefs

Healthy White Coral

Coral without symbiotic algae dwells in holes and ceiling of caves where almost no light occurs.

The whiteness of *Leptoseris troglodyta* is no anomaly. This species has no zooxanthellae, the symbiotic photosynthesizing algae that delivers nutrients.

The newly described coral species lives on the ceilings of caves in Indo-Pacific coral reefs. Its distribution range overlaps with the Coral Triangle, an area that is famous for its high marine species richness.

Most reef corals generally do not occur over 40m depth, a twilight zone where sunlight is not bright anymore, but some species of the genus *Leptoseris* are exceptional and may even occur much deeper. At greater depths, seawater is generally colder, and corals here may be

less susceptible to bleaching than those at shallower depths. Despite the lack of zooxanthellae and its small size, the skeleton structures of the new species indicate that it is closely related to these *Leptoseris* corals, although it has not been found deeper than 35m so far.

The species is named *Leptoseris troglodyta*. The word *troglodyta* is derived from ancient Greek and means "one who dwells in holes", a cave dweller. The discovery sheds new light on the relation of reef corals with symbiotic algae. The new species has adapted to a life without them. Consequently, it may not grow fast, which would be convenient because space is limited on cave ceilings. ■



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Seagrass may help revive endangered coral reefs

Who would have thought that the simple seagrass may be the solution to saving endangered coral reefs around the world? This is the promise brought to light by researchers from Swansea University, Oxford University and James Cook University in Australia.

Headed by Swansea University's Richard Unsworth, the team discovered that some varieties of seagrass could reduce the acidity of the water around coral reefs by photosynthesising carbon dioxide quickly and efficiently into oxygen.

Elaborating on this, Dr Unsworth said, "Highly productive tropical seagrasses often live adjacent to or among coral reefs and photosynthesise at such rates you can see the oxygen they produce practically bubbling away".

This new oxygen can help to combat the increased acidity of the oceans caused by the raising levels of atmospheric carbon dioxide, which in turn has caused coral reefs to become eroded at an unsustainable rate.

The results of the research have been positive, showing that in shallow water reef environments, coral calcification downstream of seagrass had the potential to be 18% greater than in a place without seagrass.

However, Dr Unsworth warned that unless action is taken to protect them, the seagrass itself could be under threat from overfishing, chemical pollution and climate change. ■



DAVID BURDICK/NOAA PHOTO LIBRARY

Crown of thorns starfish are thought to be a major cause of coral destruction on the Great Barrier Reef

Half of Great Barrier Reef coral lost in 27 years

A study published in the journal *Proceedings of the National Academy of Sciences* shows that in the past 27 years, Australia's Great Barrier Reef has lost over half its coral cover. Data on the condition of 217 individual reefs were analysed by researchers who found that coral cover has declined from 28 percent in 1985 to 13.8 percent in 2012.

The cause for this decline is attributed to three factors: severe storm events; an invasive starfish, which eats coral; and coral bleaching, which is linked to climate change. There were 34 tropical cyclones since 1985 that caused 48 percent of the damage to the Great Barrier Reef, according to Glen De'ath from the Australian Institute of Marine

Science (AIMS) and colleagues. Outbreaks of crown-of-thorn starfish caused another 42 percent of the damage. In addition, there were two coral bleaching events—one in 1998 and another in 2002. Bleaching occurred due to ocean warming and had "major detrimental impacts" on the central and northern areas of the reef, putting its cost at 10 percent of the total damage.

"This loss of over half of initial cover is of great concern, signifying habitat loss for the tens of thousands of species associated with tropical coral reefs," wrote the authors of the study.

The study is a result of the world's largest ever reef monitoring project, compiling data from 2,258 separate surveys over 27

years. One of the researchers, Hugh Sweatman, said that the findings suggested that coral could recover from trauma but that recovery takes some 10-20 years. "At present, the intervals between the disturbances are generally too short for full recovery and that's causing the long-term losses," Sweatman said.

While storms and bleaching events may be difficult to control, researchers could help reduce the devastating effects of the coral-eating starfish, said John Gunn, head of AIMS. As crown-of-thorn starfish larvae feed on algal blooms, which are caused by agricultural run-off, improving water quality would be critical in controlling the starfish's outbreaks, the study authors s. ■ SOURCE: BBC

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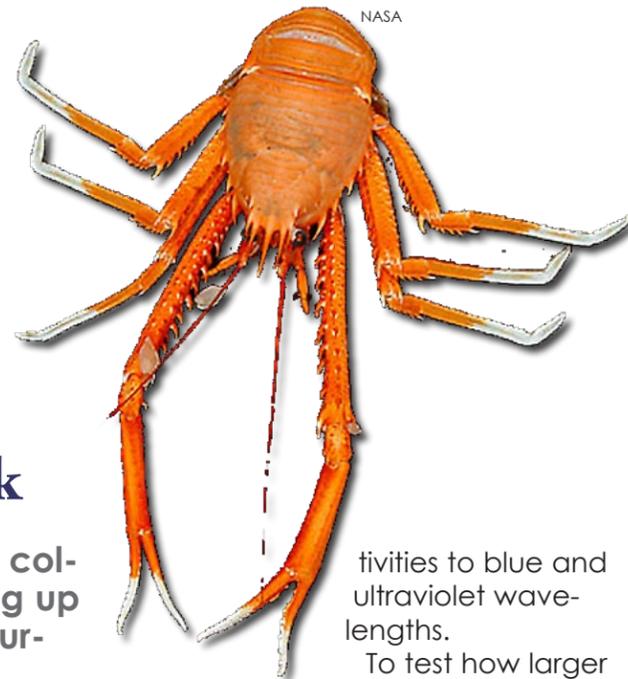


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They can see blue in the dark

Deep-sea crabs have colour vision despite living up to 1,000m below the surface, scientists find.

Measuring the spectral sensitivities of crabs' retinas, sensitivity peaks were in the blue region of the visible spectrum.

Investigating deep waters off Bahamas, U.S.-based researchers recorded the glow of tiny bioluminescent species using a submersible vehicle.

Descending to sites between 600 and 1,000m down, the scientists observed flashes of bioluminescence where plankton collided with boulders and corals.

The team also studied how crustaceans react to this light, and found previously unknown sensi-

tivities to blue and ultraviolet wavelengths.

To test how larger species perceive

their environment despite the lack of sunlight, the researchers used a specialist suction arm on the submarine to carefully collect crustaceans living at the sites. Of the eight species studied by the team, all were sensitive to blue light and two also reacted to ultraviolet (UV) wavelengths.

According to the marine expert, the species with the ability to detect two channels of colour could be using this to tell the difference between the green-glowing, often toxic, corals they live on and the blue-hued plankton they eat. ■

Animal movement mixes our seas to life

A study published in the journal *Biogeosciences Discussions* suggests that the movement of whales and other marine species is key to the health of the oceans. The researchers said that world-wide all that splashing around moves several tons of nutrients up through the dark layers of the oceans to surface waters.

In specific terms, the study stated that just 80 sperm whales near Hawaii can move 1,100 tons (1m. kg) of nitrogen per year through the pycnocline, a layer of the ocean below which it is too dark for light-loving plants to survive. This number may not appear to be very large at first glance, but multiply it by all the movement of the all the creatures that live in the world's oceans, and it amounts to quite a lot.

In fact, it is suggested by a 2006 study by William Dewar of Florida State University that animals and other organisms cause one-third of the mixing of nutrients that goes on in the world's oceans. If they did not do this, the sea would stagnate and die within a few thousand years,

according to Dewar.

It was previously thought that winds and tides were responsible for moving nutrients around, but Dewar told NBC that marine animals play just as important a role in mixing the seas. Nitrogen and iron are the two most important elements for plants to convert solar energy into food. These elements are abundant at depth but limited at the surface. Big animals such as whales and little animals such as krill moving in groups do a lot to transport the

good nutrients up and down the column of ocean layers throughout the day and night.

Indeed, according to marine biologist Stephan Nicol at Australia's University of Tasmania (unrelated to either study), groups of krill can create a collective updraft with the wakes from their tiny limbs, shifting nutrients along their migration.

Unlike large events like storms, which are less frequent, animals move continuously all day long, every day. ■



FILE PHOTO: PETER SYMES

Mantas affected by moon



MICHAEL AW

Manta rays are more likely to gather together under either a new or a full moon, according to new research published by researchers from the University of Queensland. The research by Fabrice Jaune and colleagues identifies environmental factors that predict the abundance and behavior of manta rays at Lady Elliott Island in the Great Barrier Reef.

The authors commented that knowing these factors is important for conservation efforts, "especially in the context of a changing climate and with targeted fisheries increasingly

threatening manta ray populations in various parts of the world."

Enlisting the help of volunteer scuba divers and tour operators on the island for a 'citizen science' approach, the authors monitored the relative abundance of manta rays indulging in three types of behaviour—foraging for food, cleaning by smaller fish and cruising—and correlated these with various environmental factors.

Their results show that manta rays visit specific sites around the island for specific activities. Aside from clean-

ing at dedicated 'cleaning stations', known to be an important activity for manta rays, foraging was the predominant activity at five of the seven sites surveyed and was the only activity during which large groups of 80 or more rays clustered together.

At other sites, rays were more likely to indulge in cleaning or cruising behaviors in addition to foraging. The overall number of manta rays at the island was higher in autumn and winter, around the new and full moon, and when wind speeds were lower, according to the study. ■

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Blind cave fishes, oceans apart, are closely related

Through comprehensive DNA analysis, researchers from Louisiana State University and the American Museum of Natural History determined that eyeless fishes from Madagascar and Australia descended from a common ancestor nearly 100 million years ago before being separated by continental drift.

The study, appearing in the journal *PLOS ONE*, identifies new species that add to the existing biological evidence for the existence the prehistoric super-continent of Gondwana. Cave fishes normally lack pigment, a substance that gives an organism its color and provides protection from ultraviolet radiation. The absence of eyes combined with enhanced sensory capabilities allows cave fishes to survive in complete darkness. As the fishes

have very restricted distributions within isolated limestone caves, the newfound genetic relationship between the trans-oceanic groups is a profound discovery.

"This is the first time that a taxonomically robust study has shown that blind cave vertebrates on either side of an ocean are each other's closest relatives," said Prosanta Chakrabarty, an assistant professor and curator of fishes at Louisiana State University's Museum of Natural Science. "This is a great example of biology informing geology. Often, that's how things work. These animals have no eyes and live in isolated freshwater caves, so it is highly unlikely they could have crossed oceans to inhabit new environments."

One of the new species discovered by the researchers is

unique, as it is fully and darkly pigmented. Analysis conducted for this fish's tree of life revealed it evolved from a pigment-free ancestor, indicating that some subterranean forms can "reverse" themselves. "Only two specimens of the new pigmented form were recovered from the first cave we searched in Madagascar, despite the fact that we spent hours in this sinkhole," said Chakrabarty. "Even the locals hadn't been inside of it before."

Because remote locales with caving opportunities exist worldwide, the researchers are eager to pursue other opportunities for discovery. "Conducting this research really developed my love for caving," said Chakrabarty. "You don't always find something exciting. But, when you consider how isolated many of these caves are, especially in places like Madagascar, and how unaffected they have been by the passage of time, you know that the fish in there are going to tell a really good story." ■

Typhleotris pauliani (top), a previously known species of Malagasy cave fish, and the newly discovered pigmented species (bottom)



AMNH/J. SPARKS



Ocean and climate change could lead to smaller fish

In a new study conducted by fisheries scientists at the University of British Columbia (UBC) and published in the journal *Nature Climate Change*, the first-ever global projection of the potential reduction in the maximum size of fish in a warmer and less-oxygenated ocean is provided.

Researchers utilized computer modeling to analyze more than 600 species of fish from oceans around the world and found that the maximum body weight they can reach could decline by 14-20 percent between years 2000 and 2050, with the tropics being one of the most impacted regions.

"We were surprised to see such a large decrease in fish size," said study lead author William Cheung, an assistant professor at the UBC Fisheries Centre. "Marine fish are generally known to respond to climate change through changing distribution and seasonality. But the unexpectedly big effect that climate change

could have on body size suggests that we may be missing a big piece of the puzzle of understanding climate change effects in the ocean."

This is the first global-scale application of the idea that fish growth is limited by oxygen supply, which was pioneered more than 30 years ago by Daniel Pauly, principal investigator with UBC's Sea Around Us Project and the study's co-author.

"It's a constant challenge for fish to get enough oxygen from water to grow, and the situation gets worse as fish get bigger," explained Pauly. "A warmer and less-oxygenated ocean, as predicted under climate change, would make it more difficult for bigger fish to get enough oxygen, which means they will stop growing sooner."



This study highlights the need to curb greenhouse gas emissions and develop strategies to monitor and adapt to changes that we are already seeing, or we risk disruption of fisheries, food security and the way ocean ecosystems work. ■

World's biggest geoengineering experiment 'violates' U.N. rules

Controversial American businessman Russ George has sparked outrage after dumping 100 tonnes of iron sulphate into the Pacific Ocean off Canada's west coast in July. Part of a geoengineering scheme he calls the "most substantial ocean restoration project in history", the act has been labeled a "blatant violation" of two international moratoria by lawyers, environmentalists and civil society groups.

Satellite images appear to confirm the Californian's claim that the iron has spawned an artificial plankton bloom as large as 10,000 square kilometres. A geoengineering technique known as ocean fertilization, the intention is for the plankton to absorb carbon dioxide and sink to the ocean floor.

George claims his scientists have been monitoring the results with equipment from U.S. agencies like NASA and the National Ocean and Atmospheric Administration.

"We've gathered data targeting all the possible fears that have been raised [about ocean fertilization]," George said. "And the news is good news, all around, for the planet."

Scientists are concerned iron fertilization can irreparably harm ocean ecosystems, produce toxic tides and lifeless waters, and worsen ocean acidification and global warming. "It is difficult if not impossible to detect and describe important effects that we know might occur months or years later," said John Cullen, an oceanographer at Dalhousie University. "Some possible effects, such as deep-water oxygen depletion and alteration of dis-

tant food webs, should rule out ocean manipulation. History is full of examples of ecological manipulations that backfired," he added.

The dump occurred 200 nautical miles west of the islands of Haida Gwaii, one of the world's most diverse ecosystems. George convinced the local council of an indigenous village to establish the Haida Salmon Restoration Corporation to channel more than US\$1m of its own funds into the project. Haida nation president Guujaaw said the village was told the dump would environmentally benefit the ocean, which is crucial to their livelihood and culture. "The village people voted to support what they were

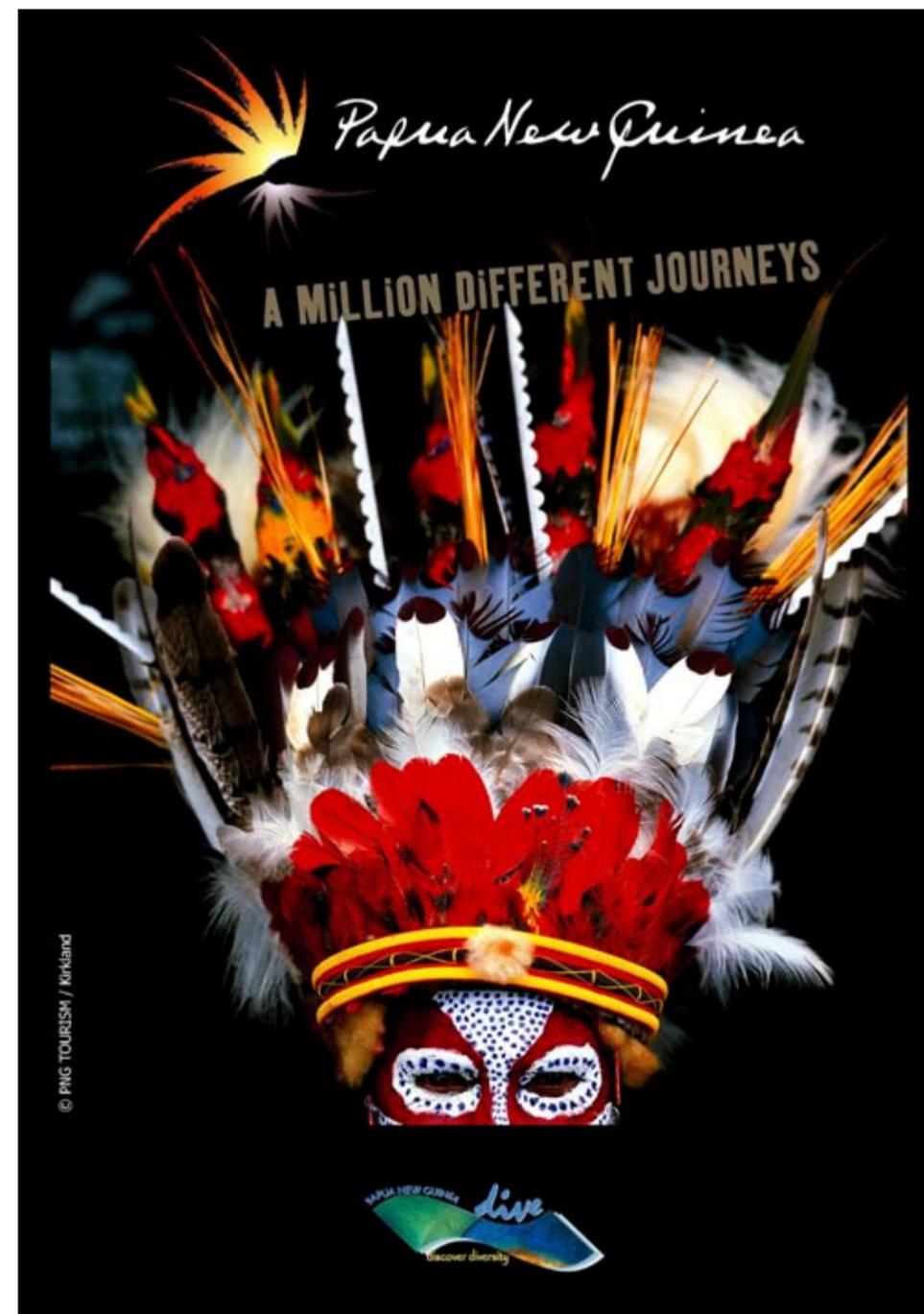
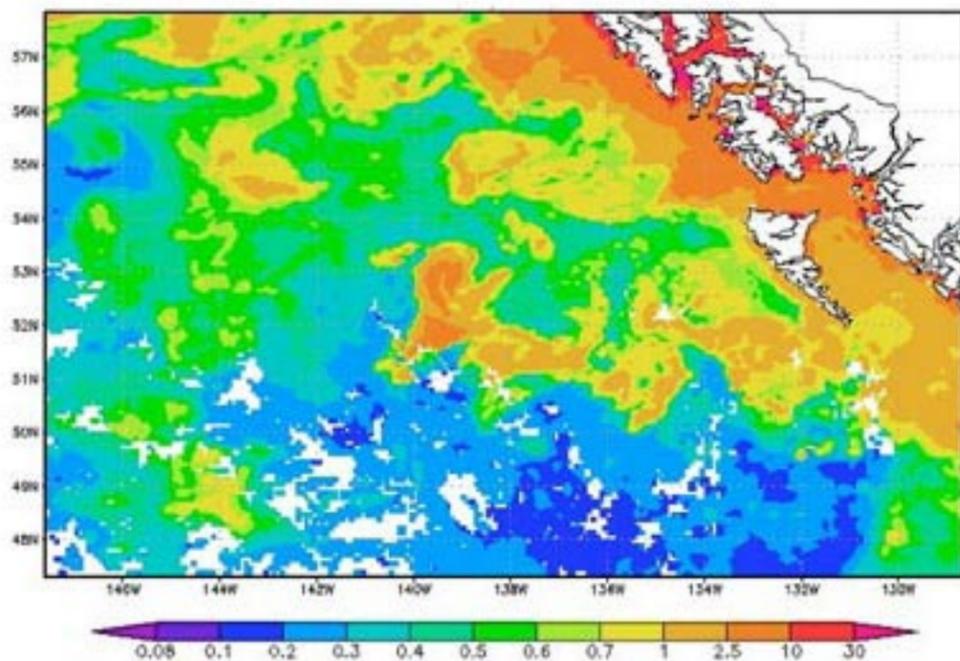
told was a 'salmon enhancement project' and would not have agreed if they had been told of any potential negative effects or that it was in breach of an international convention," Guujaaw stated.

International legal experts say George's project has contravened the United Nations's convention on biological diversity (CBD) and London convention on the dumping of wastes at sea, which both prohibit for-profit ocean fertilization activities.

"It appears to be a blatant violation of two international resolutions," said Kristina M Gjerde, senior high seas adviser for the International Union for Conservation of Nature. "Even the placement of iron particles into the ocean, whether for carbon sequestration or fish replenishment, should not take place, unless it is assessed and found to be legitimate scientific research without commercial motivation. This does not appear to even have had the guise of legitimate scientific research." George dismissed the two moratoria as "mythology" and do not apply to his project.

"If rogue geoengineer Russ George really has misled this indigenous community, and dumped iron into their waters, we

Yellow and brown colours show relatively high concentrations of chlorophyll in August 2012, after iron sulphate was dumped into the Pacific Ocean as part of a controversial geoengineering scheme. Photograph: Giovanni/Goddard Earth Sciences Data and Information Services Center/ NASA



hope to see swift legal response to his behavior and strong action taken to the heights of the Canadian and U.S. governments," said Silvia Ribeiro of the international technology watchdog ETC Group. "It is now more urgent than ever that governments unequivocally ban such open-air geoengineering experiments. They are a dangerous distraction

providing governments and industry with an excuse to avoid reducing fossil fuel emissions."

A former chief executive of Planktos Inc, his previous failed efforts to conduct large-scale commercial dumps near the Galapagos and Canary Islands led to his vessels being barred from ports by the Spanish and Ecuadorian governments. ■

wreck rap



Diver
inspects
torpedo
tubes in
the mid-
ships of
the *USS
Lamson*,
Bikini Atoll

Text and photos
courtesy of Pete Mesley

Bikini Atoll—without a doubt—is the undisputed top wreck diving destination on the planet. I remember when I first started diving back in 1989, I would sit around the table and listen to members of our dive club in South London, salivating at the concept of diving Bikini Atolls' *Saratoga*, an aircraft carrier and one of the world's largest dive-able wrecks. Only a brave few divers ever ventured to this remote place deep within the Marshall Islands. Costing a small fortune to get to, Bikini was only a destination for the elite (and stinking rich!). It was a place every diver dreamed of getting to.

This was my third trip to Bikini but this didn't lessen my enthusiasm to getting back there. Traveling to this Atoll, deep within the Marshall Island group, takes some doing. Getting there from Auckland, New Zealand, I flew to Cairns, then Guam, then

onto Kwajalein via an island hopper, which stopped at four other Micronesian islands. Some 27 hours later, getting into Kwajalein meant that we were only half way there. Kwaj is an American Ballistic Missile testing base, so you can imagine that the Americans just don't want peo-

ple to be there, but under the Marshall Island agreement, they have to offer through fare for travelers.

We were met by Brian and Eddy from the charter boat at the ferry terminal where we loaded all our gear onto a water taxi. Within 20 minutes, we were

alongside the *MV Windward*—our home for the next two weeks.

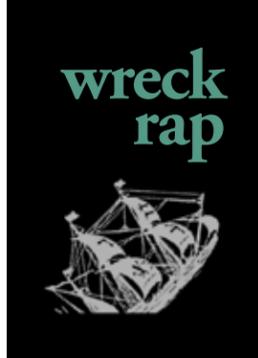
We had two guys who were coming in the following day via Honolulu. This gave us the perfect time to do our check-out dive on the German heavy cruiser, *Prinz Eugen*. The 18,700 ton ship

served an impressive career in WWII with direct conflicts with the *HMS Prince of Wales*, *Bismark* and *HMS Hood*. The vessel was later handed over to the British as part of the German surrender. The *Eugen* remained in drydock until January 1946 when she was handed over to the



Wrecks of **Bikini Atoll**





Map of our route from Kwajalein to Bikini (left). A diver looks over the 8-inch turret of the German heavy cruiser, *Prinz Eugen*, which had numerous engagements with the *Bismark*. She sits completely upside down (below)

Americans. Later, she was allocated to the target fleet for Operation Crossroads. She survived the Able and Baker tests (July 1946), but was too radioactive to have leaks repaired. In September 1946, she was towed to Kwajalein Atoll and capsized on 22 December 1946 over Enubuj reef.

This massive 212-meter wreck sits upside down in 32 meters of water, stern sitting out of the water with the bow at the

deepest section. What an impressive introduction to the trip!

Once everyone was on board, we stopped everything down and set sail for Bikini. It took us a little over 28 hours steaming to cover the 240 miles to our destination. On the way, we sailed past Wothe Atoll. This was a short distance away from Rongerik Atoll. This is where the Americans relocated the entire population of 167

Bikinians in March 1946, in preparation for Operation Crossroads.

Rongerik was originally uninhabited because the Bikinians believed it to be too small to live on (it is one sixth the size of Bikini), and there wasn't enough food and water on the island to sustain life.

Well, they were right. By July that same year, medical officers from the United States visited the islands. They were shocked to find that the people were critically malnourished and literally starving to death. Immediate prepa-

rations were made to transfer them 300 miles west off Bikini to an atoll known as Ujelang.

It just so happened that the Americans chose another nuclear testing ground in Enewetak Atoll, 120 miles north east of Ujelang. Even after all the buildings were erected for the Bikinians to move into on Ujelang Atoll, it was decided that the Enewetak people would, instead, be moved to Ujelang Atoll. It took two years of suffering on Rongerik until the Bikinians were finally moved to Kwajalein. They were housed in tents beside an airstrip until an island was finally found for them to live on.

Diving the wrecks

We arrived in Bikini in the late afternoon the next day. On the way, we dragged a couple of lures over the side. On the last attempt, I got a massive dogtooth tuna. This time, I ended up hooking a 100kg black marlin.

It was taking over an hour and a half to get the fish close to the boat, so we decided to release it once we could get it close enough to unhook it. But just as we got the massive fish close to the stern of the boat, a shark promptly removed the tail section of the fish.

Bugger! We didn't have much choice then but to eat it. This is what it's all about with expeditions like this to far corners of the Earth. Just being here, sitting in 4,000 meters of water with no sight of land anywhere to be seen—I just loved it!

HIJMS Nagato. The first dive was on the *HIJMS Nagato*. Launched on 9 November 1919, the *Nagato* was the jewel of the Imperial Japanese Navy. She was the lead ship of her class and the only battleship in history to mount 16.1-inch guns on her decks. She displaced 42,850 tons, and was 221m long, 34m wide and capable of doing 27 knots.

Descending onto this historical ship was very humbling. Knowing that this was the ship that Admiral Isoroku Yamamoto gave the order to lead the attack on Pearl Harbor back in December 1941 made history more tangible. We got our first sight of the ship with its huge hull and four props as we descended into the crystal clear water. We dropped over the port side of the ship and under the hull. There, looming out of the darkness, were two massive 16.1-inch guns. My dive buddy, Nick, swam up towards the barrel ends. His body was dwarfed by its massive size.



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We came back out and swam along the port side of the hull at deck level at a constant 45m depth. Then, as we swam along, the bridge came into view. What used to tower above the surface of the ocean, some 30m high, now sits perfectly placed along the sand to one side of the ship. I swam forward towards the bow section, turned around and just hung there in the deep enjoying the view of the entire bridge section.



Penetration is possible but extreme care must be taken. All the wrecks are over 60 years old and very brittle, so with all the heavy gear above your head, you

tend to take care when venturing down passageways. The areas that we penetrated were not as spectacular as the vistas around the outside of the ship—a massive propeller, breathtaking bridge section and impressive bow section.

USS Saratoga. The majority of our afternoon dives were spent on the *USS Saratoga*. She is the shallowest of the ships in the atoll. The top of the bridge ranged in depth from 14m of water down to 50m on the sand.

The *Saratoga*, first commissioned in 1925, was a 40,000-ton, 268-meter-long aircraft carrier. She did tours in the Pacific, Nicaragua, San Diego, Hawaii, Guadalcanal and the Marshall Islands.

In 1944, she was commissioned to train aviators for night operations. In February 1945, she carried night fighters during the Iwo Jima invasion and raids on the Japanese home islands. After the war in 1945, she transported servicemen back home to the States, was then decommissioned and brought in for target duty for atomic testing in Bikini.

Diver at bridge of the *Nagato*

Diver (left) with massive 16-inch gun of the *HIJMS Nagato*, the pride of the Japanese High Seas Fleet. Diver (below) at the bow of the massive *USS Saratoga*, 267m long!

The interior of the ship is vast, to say the very least. Permanent lines have been laid in some areas from a past operation and still hold well after six years of inactivity. With seven decks of passageways, rooms, storerooms, accommodations, galleys, etc, you could spend the rest of your diving career on this ship and never

was covered in the finest red rusty silt, probably highly radioactive if you dug deep enough into it.

The wreck is just so impressive. Countless planes, bombs, artifacts, plates, bowls, jugs, etc, lay untouched since 1946. Even Mk 5 standard dress helmets sit alongside each other in one

Bikini Atoll

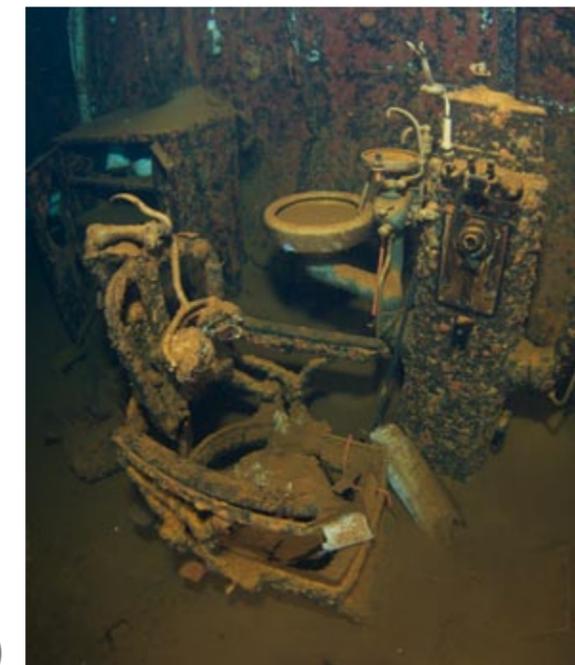


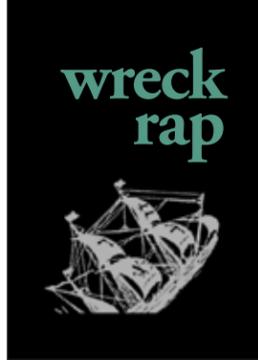
grow tired if diving her.

One of the dives that totally blew my mind was the dentist's surgery and sick bay. We entered through the bomb loading door situated on the starboard side of the ship just forward of the bridge area, dropped two decks into the middle section, swam 50 meters down long corridors, then dropped down a staircase into the second and hangar decks. We then back tracked and swam another 15 odd meters, passing the sick bay on our right. Then, finally, we entered the dental office.

Three dentist chairs sat in the room, completely kitted out with drills, rinse bowls, even head phones for the patients. Perfectly preserved. Everything

Dentist's chair in the *Saratoga* (bottom right)





Fat Man Bomb (left)—one of the atomic bombs used for Operation Crossroads

The Baker nuclear blast (below). The dot on the right of the water column is the vertical hull of the *USS Arkansas*

Bikini Atoll

of the hundreds of store rooms in the ship.

Saratoga, along with another 20 odd other ships, sank as a result of nuclear testing after the abrupt end of the Second World War, with the United States dropping atomic bombs on Hiroshima (6 August 1945) and then on Nagasaki three days later. These were the second and third atomic bombs ever detonated on Earth. So little was known about atomic warfare.

Atomic history

The U.S. president at the time, Harry Truman, issued a directive to army and navy officials that joint testing of nuclear weapons would be necessary "to determine the effect of atomic bombs on American warships". This project was to

be held in Bikini Atoll named Operation Crossroads. Two hundred forty-two ships (150 support and 95 detonation ships), 42 thousand men, 156 airplanes and hundreds of thousands of tons of equipment, ordinance and materials were shipped to Bikini Atoll.

This was to be the most public and most reported nuclear tests ever undertaken. Even though there was considerable interest by scientists excited about assessing the full effects of atomic energy in the field, it was still undertaken for the sole benefit of the military. Their main goal: to make stronger, deadlier nuclear weapons.

Ninety-five ships were to be prepared for the blast, four battle ships, two aircraft carriers, two cruisers, 11 destroyers, eight submarines, numerous amphibious/auxiliary vessels and three surrendered German and Japanese vessels. Twenty ships would be placed in square mile clusters from the drop zone.

The initial 23 kiloton bomb, named Able, was to be detonated 158 meters above sea level. This test was to assess the effects of pressure, impulse, shock wave, velocity, optical radiation and nuclear radiation of this particular bomb. This air burst was meant to duplicate the conditions of the Hiroshima bomb drop, this time, over water. With an air burst, the radioactive matter would rise high into the stratosphere and become part of the global environment with little significant local fallout. Many of the closer ships received doses of neutron and gamma radiation, lethal to anyone onboard the ship during the blast, but the ships themselves did not become radioactive.

Within a day, all the surviving target ships had been re-boarded by personnel for inspection and data analysis. Able sank five ships, *Gilliam*, *Sakawa*, *Carlisle*, *Anderson* and *Lamson*.

The second explosion, Baker bomb, was detonated 24 days later on 25 July 1946. This bomb was suspended 27 meters underwater. The underwater fireball took the form of a rapidly expand-



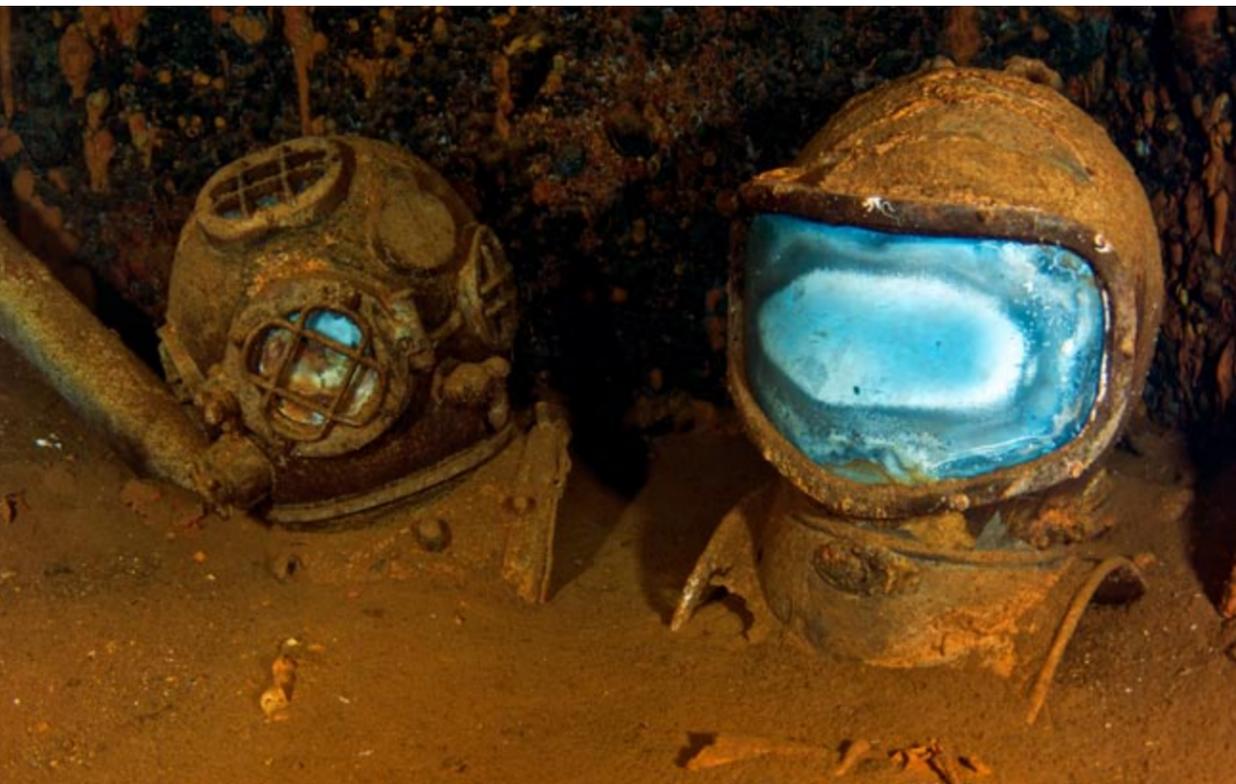
ing hot "gas bubble" that pushed against the water, generating a supersonic hydraulic shock wave, which crushed the hulls of nearby ships as it spread out. On the surface, the shock wave was visible as the leading edge of a rapidly expanding ring of dark water. Close behind the slick was a visually more dramatic, whitening of the water surface.

At the bottom, it started digging a shallow crater, 9m deep and 610m wide. At the top, it pushed the water above it into a "spray dome", which burst through the surface like a geyser.

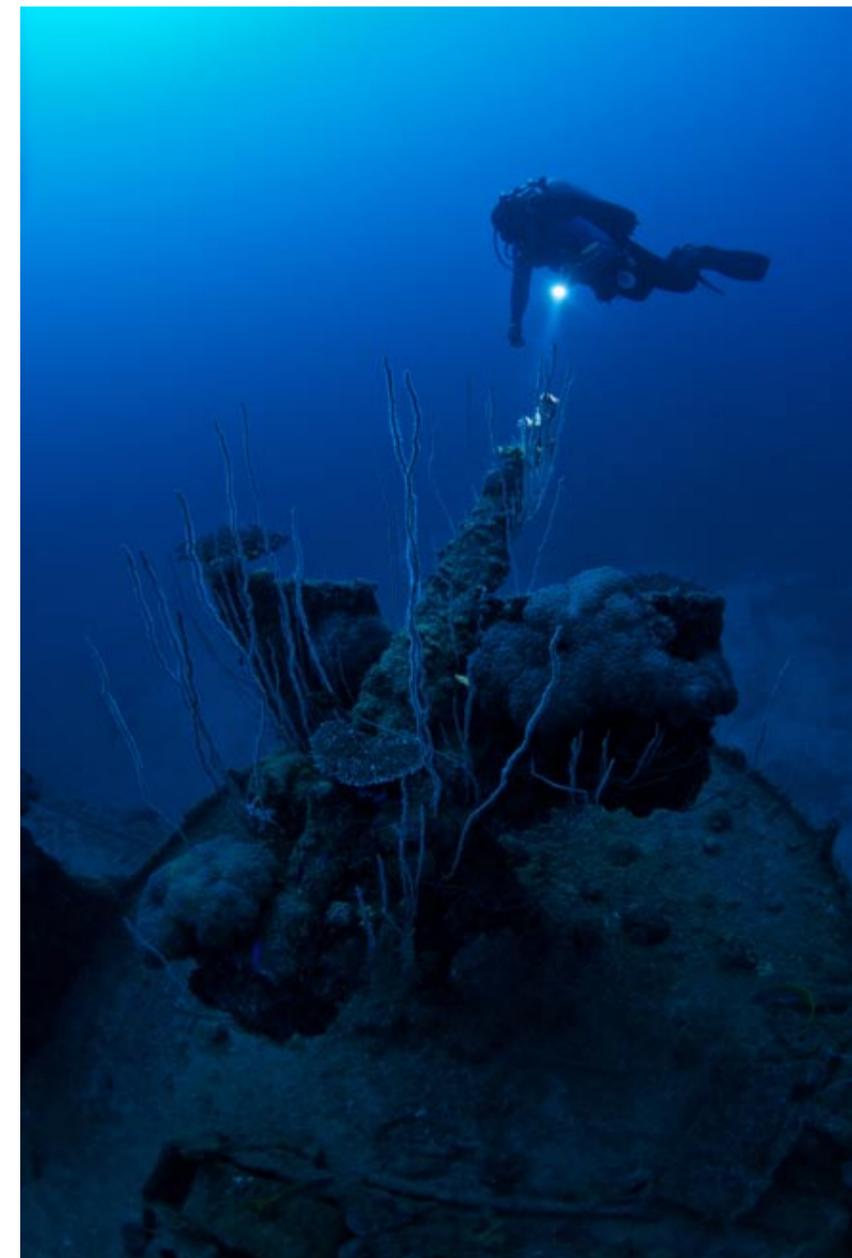
During the first full second, the expanding bubble removed all the water within a 150m radius and lifted two million tons of spray and seabed sand into the air. As the bubble rose, it stretched the spray dome into a hollow cylinder or chimney of spray 1,800m high, 610m wide, and with walls 90m thick.

As soon as the bubble

reached the air, it started a supersonic atmospheric shock wave, which, like the crack, was more visually dramatic than destructive. Brief low pressure behind the shock wave caused instant fog, which shrouded the developing column in a "condensation cloud", obscuring it from view for two seconds. The Wilson cloud started out hemispherical, expanded into a disk, which lifted from the water revealing the fully developed spray column, then expanded into a doughnut and vanished. The Able shot also produced a Wilson cloud, but heat from the fireball



Standard dress helmets can still be easily seen within the *Saratoga*



Diver inspects anti-aircraft gun on the *USS Lamson*





Propellers (right) of the *Nagato* wreck; Diver (far right) at the stern of the *Lamson* wreck; A *Saratoga* Hellraiser rests in the sand (below)

dried it out more quickly.

Ten ships were sunk as a result of Baker bomb. They were *LSM-60* (the ship that the bomb was positioned under), *Arkansas*, *Pilotfish*, *Saratoga*, *YO-160*, *Nagato*, *Skipjack*, *Apogon*, *ARDC-13*.

USS Lamson. Another outstanding wreck that we dived was the *USS Lamson*. A 1,500-ton, 104m-long Mahan Class destroyer, first launched on 17 June 1936. The *Lamson* did tours in the Caribbean, Pacific and Hawaii.

On that ill-fated day on 7 December 1941 when Pearl Harbour was attacked, the *USS Lamson* was returning from patrol duty out at sea during the Japanese attack. After an unsuccessful search for the Japanese task force, the destroyer patrolled Hawaiian waters, departing Pearl Harbor on 6 January 1942, later



heading to Guadalcanal, moving onto doing tours in Papua New Guinea, New Britain and the Philippines. After fighting off numerous suicide plane attacks and being patched up after being badly damaged, she spent the rest of her term on patrol and air-sea rescue work off Iwo Jima Island. She would soon participate in Operation Crossroads in Bikini.

With consistently good visibility in the Lagoon, the *Lamson* could be seen as we descended down the shotline. Secured in the midships, I made my way

down towards the stern

of the ship. First landmarks that burst out into view were the amazing 21-inch torpedo tubes. The ship had a total of 12 torpedo tubes on the deck of the ship. Moving on, I came across two Oerlikon

20mm AA anti-aircraft guns, mounted on each side of the narrow destroyer. It was easy to see that in this ship's heyday it could hold its own with all the armament it carried.

Heading further towards the stern I swam past two 5-inch/38 Cal dual purpose anti-aircraft guns. Their dual purpose allowed them to shoot not only low angle, surface targets but also high angle aircraft targets.

I finally got to the stern of the ship—she was an awesome sight alright. The depth charge racks were still fully intact with even a few depth charges still laying on the deck. The wreck was silhouetted perfectly against the talcum powder-like white sand.

Over the following days, we made numerous dives on the *Saratoga* and

Nagato, *Anderson*, *Arkansas* and *Sakawa*. We also dived a submarine, one of the three sunk during the blasts, the *USS Apogon*—a 95m-long, 2,390-ton, Balao-Class submarine first launched in March 1943. She sits perfectly upright on a lifeless sandy bottom. Not a lot of life is encrusted on the wrecks, just long sea whips and tight sponges, which give the wrecks a little colour. Here, my dive buddy, Eddy, looked at one of the stern torpedo tubes with a loaded torpedo in the spout.

Afterthoughts

Bikini Atoll, was everything I ever dreamed of and more. But the wrecks are starting to show their age. More and more parts of the ships are collapsing, so if you want to see these wrecks in all their

glory, I suggest you start planning your journey here in the near future. During the trip, we completed over 38 hours in the water over nine days, diving seven of the 16 odd wrecks in the lagoon. A place certainly worthy of multiple trips. ■

Pete Mesley is a prolific wreck diver and seasoned photographer, who organizes specialized trips to some of the most spectacular and out-of-the-way locations, globally. His excursions offer full technical support for rebreather and open circuit divers. Not to mention, he is one of the only dive operators who brings qualified hyperbaric physicians with him as medical support on all of his trips. For more information about his "Lust for Rust" diving excursions visit his site www.lust4rust.com.





New Zealand wreck may pre-date Cook

While speculation remains as to the identity of a North Island shipwreck discovered 30 years ago, recent radio carbon dating reveals it to be New Zealand's oldest shipwreck. Preliminary findings indicate the ship sank around 1705, pre-dating Captain Cook's voyages by some 65 years. Speaking at the Dargaville Museum, dendrochronologist, Dr Jonathan Palmer cautioned the findings required additional work before his research could be confirmed and published.

The wreck was discovered in 1982 by a local team led by Kaipara shipwreck explorer Noel Hilliam. A portion of a cross-member and rib was salvaged,

before the wreck was lost to the sea under 30 metres of sand. The wood has been confirmed to be teak and crepe myrtle, tropical wood likely used for refitting at either Genoa or Java, which suggests the possibility of the area being visited earlier than previously thought.

It is widely accepted that Dutch explorer Abel Tasman discovered New Zealand in 1642. Palmer said bitter competition for discovery during the 16th-18th centuries meant voyages were kept secret, with many ships sailing with hidden or documented evidence. British Admiralty maps of 1803 refer to New

Zealand being known to the Portuguese in the 1550s. A Spanish helmet discovered in Wellington Harbour and a Tamil bell used by a Maori tribe as a cooking pot in the mid 1880s suggests other tantalizing possibilities.

Hilliam, who was present at the meeting, believes the vessel to be the

Portuguese Cicilla Maria, but ongoing research of the Spanish and Portuguese archives is ongoing. Palmer argues the wood's age suggests it is not the Cicilla Maria, which had sailed a century earlier. Once Palmer's findings are confirmed and published, a display will be erected at the Dargaville Museum. ■



Mazotos shipwreck shed new light on ancient shipbuilding

The excavation of the Mazotos shipwreck sheds light on very important issues such as seafaring in Cyprus in antiquity, commerce between the Aegean and Cyprus, the types and sizes of the period's cargo ships. According to the press release, this year's results, in combination with the findings of previ-

ous field seasons, indicate that the keel and a considerable part of the ship's

planking is preserved to a length of at least 15 meters.

The Mazotos ship was a late classical period (mid-4th century B.C.) merchant ship that was located in the sea of the modern village of Mazotos, at a depth of 45m.

The ship was carrying wine amphorae mainly from Chios but also from other north Aegean islands. Previous research at the site, which began in November 2007, focused on the photographic and drawing documentation of the shipwreck.

This year's findings are of prime importance, as it places this wreck among the very few in the Mediterranean that can provide information on shipbuilding during the Classical period.

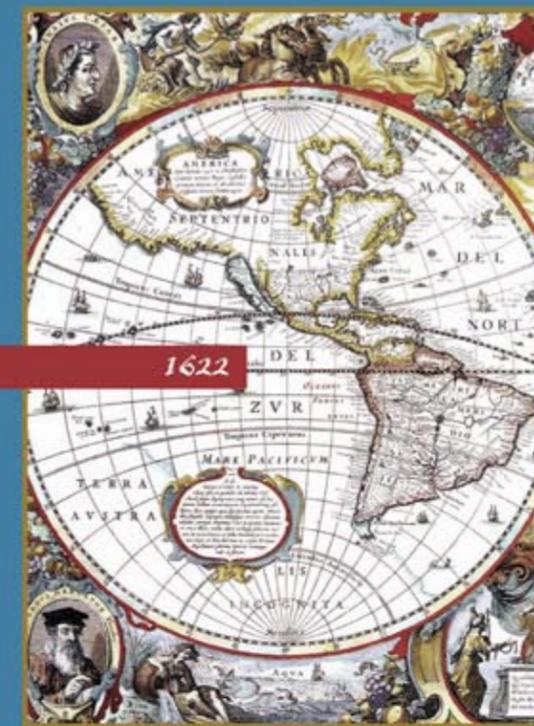
Together with the Chian wine ampho-

rae, the ship's main cargo, a secondary type was also transported on the Mazotos ship: wine jugs, which were stowed among the amphorae found in the aft part of the hold.

Furthermore, small fine ware pottery was recovered from the stern cabin, which was also partly excavated. These vessels must have belonged to the crew or the passengers of the ship; one of them bears two inscribed letters, most probably the initials of someone's name.

An interesting piece of evidence which provided information on the conditions under which the sailors of antiquity lived, are the large numbers of olive pips that were found during excavation, since these pips must have been part of the crew's food supply. ■

Treasure Coins of the *Nuestra Señora de Atocha* & the *Santa Margarita*



Carol Tedesco

In 40 succinct pages, *Treasure Coins of the Nuestra Señora de Atocha & the Santa Margarita* answers all the most frequently asked questions, including what the coins look like when first discovered, the meaning of the various markings, how they are cleaned, conserved and graded, what they were worth in the 17th century, and the most up-to-date information on the names and periods of office of the men who made them. Of particular interest to 1622 fleet coin enthusiasts is a section devoted to the exceedingly rare Old World minted coins discovered on the Atocha and the Santa Margarita.

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Ex-NRP Oliveira e Carmo sank in less than three minutes

Text and images by Barb Roy

A new record was set when two ships were scuttled as artificial reefs in one long day. On Tuesday, 30 October 2012, the ships were placed in Algarve off the coast of Portimao in southern Portugal as the first of four ships, part of the Ocean Revival Project. The 85-meter-long Corvette Ex-NRP Oliveira e Carmo went down in less than three minutes without a problem, and the Ex-NRP Zambeze, a 44-meter-long patrol vessel, slipped under the surface not long after. Both ships were donated by the Portuguese Navy.



Portugal

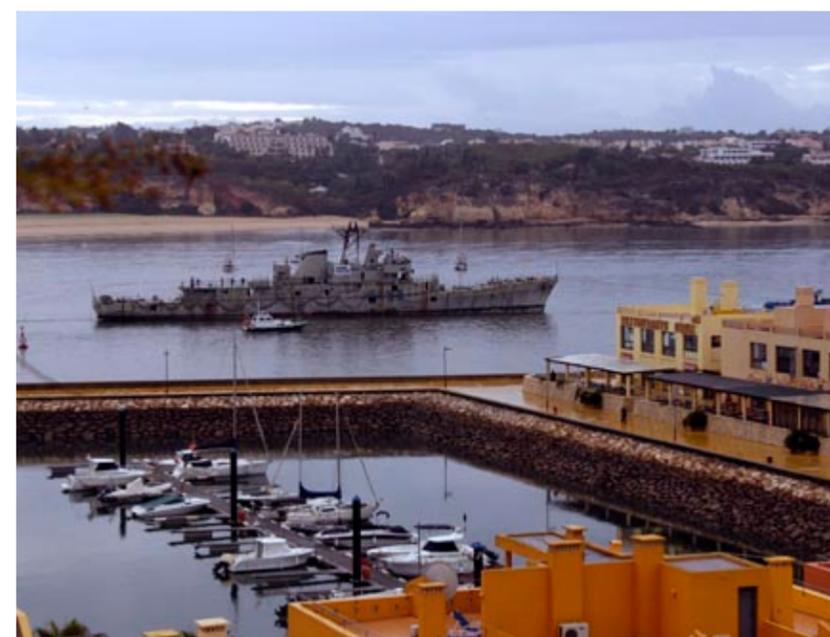
A Tale of Two Ships

A first for sinking in one day

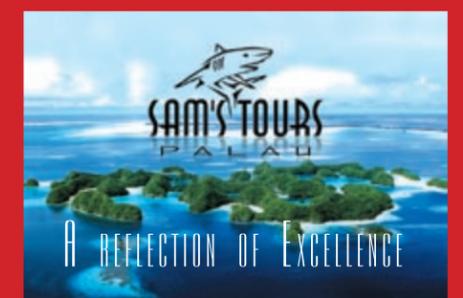


Demolition teams from CARC and the Portuguese Navy

To help prepare the ships for sinking, Luis Sa Couto of Sub Nauta Dive Center and coordinator for the Ocean Revival Project solicited the assistance of the Canadian Artificial Reef Consulting company from British Columbia, Canada, which has prepared over a dozen ships around the world. Together with the help of several Portuguese Navy Demolition Instructors and a few local key recruits, the first part of the project (five years) took only six months in the actual ship preparations. After both ships were resting on the ocean floor and the okay was given by the Navy Clearance Divers, visiting divers eagerly jumped in to check out the new site. The second part of the project will take place in the Spring of 2013. It involves the scuttling of a frigate and a hydrographic ship. All ships will be placed parallel to one another and the beach.



Ex-NRP Oliveira e Carmo as it passed the port of Portimao on the way to the sinking site



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The Zambeze with its stern in the air, as the demolition crew looks on (top); A large fireball lifts off the back of the Ex-NRP Zambeze (bottom); Bruno Freitas, a dive instructor for Sub Nauta dive facility in Portimao, Portugal (right)

For more information on the project and diving in Portugal, see: Sub Nauta, www.subnauta.pt Ocean Revival Project www.oceanrevival.pt Canadian Artificial Reef Consulting www.artificialreefs.net



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Edited by
Scott Bennett



Organised crash of unmanned Boeing 747 reveals cheap seats could be safer

Budget conscious travellers will be reassured to hear the cheap seats could be safer. As part of an experiment, a Boeing aircraft was fitted with cameras and crash-test dummies to help scientists determine the safest seat location. While none of the first-class passengers would have survived, it was concluded those sitting furthest from the cockpit would have the greatest chance of survival.

To experiment with the safest sit-

ting position during impact, three dummies were placed in different positions. The dummy in the classic 'brace' position with seat belt fastened would have survived; another with just the belt fastened would have suffered severe head injuries. The third dummy, which had neither, would have died.

"Planes are sold entirely on comfort, food, entertainment systems, space in your business class seat. They are never sold on the

safety indications," stated Sanjay Sigal from production company Dragonfly, which produced the programme. On a more positive note, he added, "It's never been safer to fly."

If economy seats begin to adopt premium price tags for safety, Business Class comfort might just be in the realm of affordability for the average traveller. However, Boeing's own site states that one seat is as safe as another. ■

Sleeping with the fishes in Sweden

For those who have tired of beaches, a floating hotel in Sweden offers a room with a decidedly different view: ten feet beneath the surface. Situated on Lake Malaren, the Utter Inn features windows on every wall revealing a lake teeming with fish.

In operation since 2000, the 'floatel' is the brainchild of artist Mikael Genburg, known for his unique hotel designs including one in a tree in a city centre park tree house and another in a sunken villa. Designed in the style of a traditional Swedish cottage, the little

hut features an above-surface kitchen with the sleeping quarters below.

"It's like a reverse aquarium—the fish like looking in at the guests and are fascinated by them," said Genburg. "I don't think there is an experience quite like sleeping underwater, and many people have come to find out if they like it."

After being taken out to the floating hut by Utter Inn staff, visitors can relax on the deck or use the hotel's inflatable dinghy to explore one of the lake's uninhab-



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Apps

SAS Crew Guide 2012

With the new Crew Guide, Scandinavian Airlines continues to recognize and promote the voice of their crew, giving you the chance to benefit from their unique knowledge and passion for travel. It is 352 pages and written in English.

The result is a book and an app packed with travel tips to hotels, restaurants, shops and sights in 22 cities around the world.

With more than 500 tips from the crew of SAS and nine other Star Alliance airlines, Crew Guide has it covered.

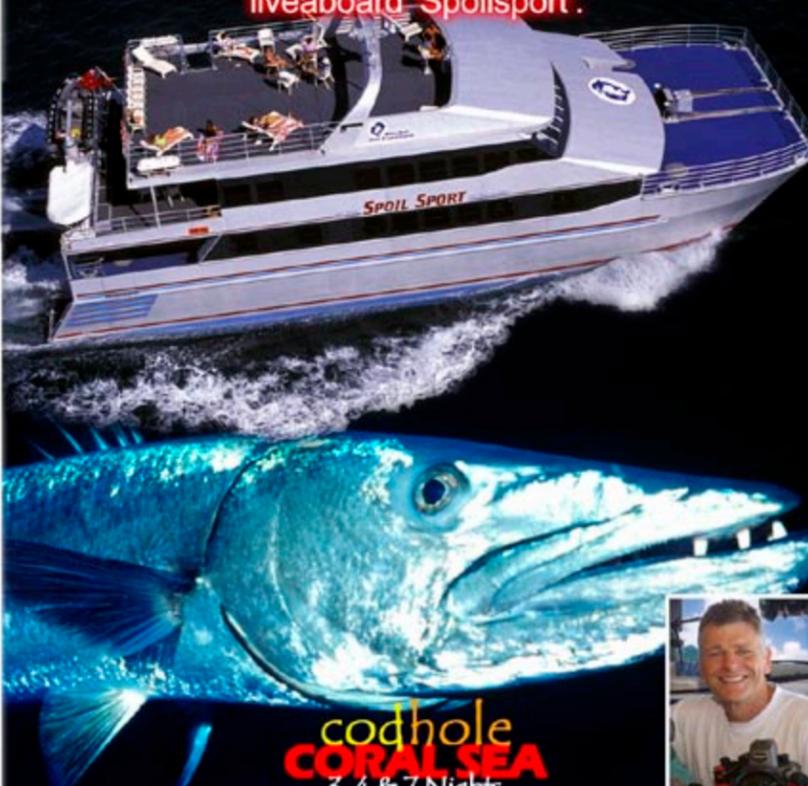
From Beijing to New York and beyond, Crew Guide will open your eyes to the best neighbourhood restaurants, bargain shopping, great sights and true local experiences. ■

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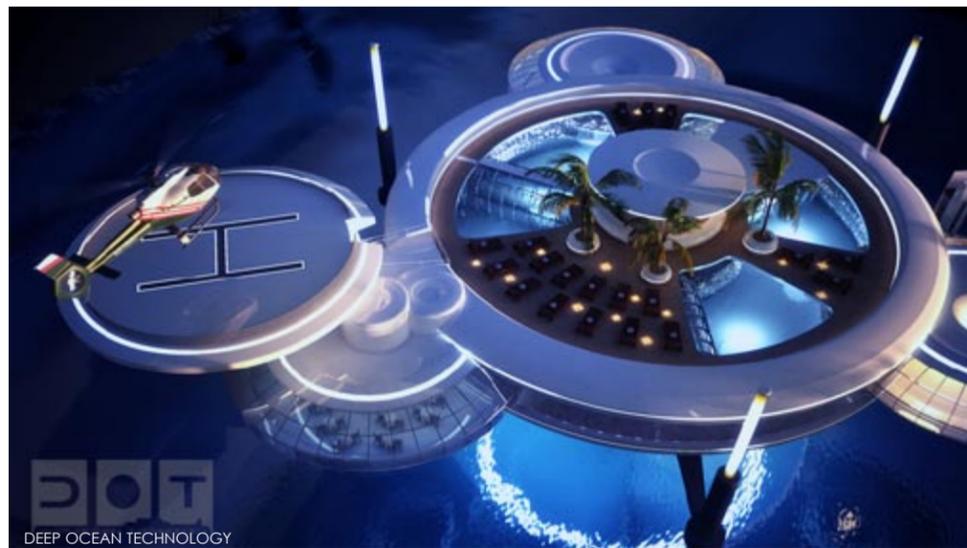




Oman to build luxury underwater hotel

A new underwater luxury hotel is going to be built in Dubai by a Swiss-based consulting, engineering, and brokerage firm, BIG InvestConsult. It's called the Water Discus Hotel (WDH) and has a revolutionary design with patent-protected concept and technology, which is new to the hotel and tourism industry, developed by Deep Ocean Technology of Poland.

The ground-breaking structure consists of two parts -- a residential disc underwater and a water leisure disc above water, which has two satellite extensions. The hotel of 21 luxury rooms ten meter below sealevel will offer guests a chance to live among the reefs and fishes in a magnificent tropi-



cal ocean environment. Stunning views of the flora and fauna can be seen through huge windows.

So, what if there's an emergency and you have to get out quick? Well, the underwater disc can surface immediatly, as rescue boats always at hand speed in to assist. There's also a helicopter pad on the top of the above water disc, which can transport guests and crew to safety.

Sustainability

But is it sustainable? Bogdan Gutkowski, President and CEO of BIG InvestConsult, told the Observer that the Sultanate of Oman is an ideal location for the underwater hotel and assures that the building has been con-

ceived to protect the marine environment. "Oman has been chosen precisely because of its natural underwater life. Of course, the exact location of the Water Discus Hotel will be a considerable distance from coral reefs in order to safeguard them from any impact. BIG Invest Group is experienced in the delivery of investments with respect for the natural environment. We are experts in this and we take care of environmental issues with the greatest attention."

In fact, in line with the company's commitment to the environment, they are in the process of developing an international program for coral reef restoration and protection. In this plan, the hotel could be modified into an underwater lab and become a base for coastal marine studies for scientists and research students.

Diving

But can we dive there? Yes, and there's more. Gutkowski said, "What is important is that the Water Discus Hotel will make it possible for all guests (even those who do not go diving) to observe life in an Animal Coral Garden (that will be created around the underwater disc of the hotel). The WDH will be equipped with a Diving Centre (located in the bot-

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tom disc) as well as other equipment for marine life observation, for example, three-person submarine vessels that enable (non-diving) hotel guests to travel underwater a few miles from the hotel and admire the natural underwater environment. WDH will also be a place for diving courses, starting with the swimming pool on the sundeck. Indeed, the Water Discus Hotel will be a fantastic showcase of Oman's living marine treasure," he said.

However, marketing is still an important ingredient. Gutkowski said that the project with its immense scale and appeal could have a positive effect on Oman's tourism industry. "Today, we are aware of the huge global interest in the Water Discus project. We expect the Water Discus Hotel will arouse great interest in the media as well as among the tourists, when it will be constructed. In the opinion

of the marketing specialists of BIG InvestConsult AG, the Water Discus Hotel may become a symbol or signature of the city, region or country where it is built."

So, when will the Water Discus Hotel project in Oman com-

mence? Gutkowski said: "The project is still in the conceptual stage. However, we have planned to find an exact location within 3-4 months. Then we will start to develop the project and look for a co-investor." ■



DEEP OCEAN TECHNOLOGY

DEEP OCEAN TECHNOLOGY