



opinion

Diver on SMS Brummer wreck, Scapa Flow, and Red Arrows (below) of the Royal Air Force, United Kingdom

Text and photos courtesy of Gareth Lock

A diver had an oxygen toxicity seizure because an incorrect gas was filled in a cylinder by a dive centre. A baby died because the wrong dose of medication was injected. Who is to blame for the error and how do we try to make sure that these types of incidents aren't repeated?

This is the second article in a series of six looking at a safety culture and its component parts, and focuses on a *just culture*, the aspect of a safety culture which underpins everything. Some of the readers may remember an article I wrote on this subject a couple of years ago, but this one will go into much more



Just Culture

— *It Underpins Everything*



depth and give examples of the issues faced in both the scuba diving community and other environments, which have more established safety management system programmes and cultures.

As a quick recap, a *safety culture* is made up of five component parts: a *just culture*, a *learning culture*, a *reporting culture*, an *informed culture*

and finally, a *flexible culture*. Each one contributes to the wider improvement in safety, and to a certain extent, without each piece of the jigsaw puzzle being in place, a safety culture will struggle to develop and survive.

Developing a safety culture is a pro-active process and needs to be led from the top down, although

pressures from below may influence the speed at which it is adopted and develops.

So what is a just culture?

Sounds like some wooly description which means that people can get away with anything, i.e. a 'no-blame' culture in which errors and poor behaviours are accepted as

the norm without recourse. This isn't the case. The Royal Air Force defines a just culture as "an atmosphere of trust where people are encouraged, and even rewarded, for providing safety related information and where it is clear to everyone what is acceptable and unacceptable behaviour" (www.maa.mod.uk/linkedfiles/regulation/manualofairsafety.pdf).





This document contains details of the safety management system in place within military aviation, including a slightly modified and more detailed version of the flow diagram (on the following page), which describes how errors, mistakes and violations are dealt with in terms of culpability and responsibility.

You may argue that an operational organisation which has millions of pounds of equipment and personnel to deal with and a very formal organisational structure within which to operate, has very little relevance to recreational diving.

I would argue there is considerable relevance, if only because the fact that there are regulations and a structure in place means it is easier to 'draw the line in the sand' as to what is right or wrong. However, as will be shown, the lack of clarity of right and wrong certainly makes it harder to deter-

mine how to deal with errors, mistakes and violations.

A just culture is a difficult concept to grasp for the majority of people because our society is developing into one in which we are always looking for someone to blame and that personal responsibility is diminishing. The following examples will hopefully put just culture into context and maybe adjust your perspective on 'right and wrong'.

Exhibit A. A nurse gave an eight-month baby which had been diagnosed with severe heart problems 1.4 grams of calcium chloride instead of the correct dose of 140 milligrams. It was the only serious medical mistake that she had ever made in her 24-year career. Overnight, she realised the mistake and reported it. Unfortunately, the baby died five days later.

There were a number of contrib-

utor factors: poor handwriting in the medical notes by the doctor; the staff were tired; there was a change of shift, so there was poor communication between staff; and then there was the general poor health of the baby. After the baby died, the nurse was escorted off the hospital site and then fired a few weeks later.

After a number of harrowing court cases in which she tried to defend her innocence, the nurse committed suicide. A nurse is only one part of a much wider system covering doctors, other nurses, shift pattern schedulers, and equipment designers and manufacturers.

Unfortunately, where to draw the line for accountability and responsibility is not clear, especially when a fatality is concerned.

Exhibit B. Now consider this incident. A dive centre was running two courses from the same

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opinion

James Reason's decision tree for determining culpability

boat: an OC advanced nitrox and decompression procedures course, which was using 80% deco gas; and a CCR Mod 1 course, which had air in the diluent and bailout cylinders. At the end of the day, the OC divers went to one end of the kitting up area in the dive centre, and the CCR divers went to the other. Everyone dekked and left their cylinders in situ for filling ready for the next day's diving. The lead instructor told the dive centre staff member who was going to fill the cylinders, that all of the Ali7s were to be filled with 80%.

The following day, the dives were undertaken with the CCR divers conducting bailout drills at around 35m. One of the divers, after bailing out, didn't feel quite right so went back onto the loop. At this point, his loop pO₂ went really high, so he bailed out. Again, he felt wrong and went

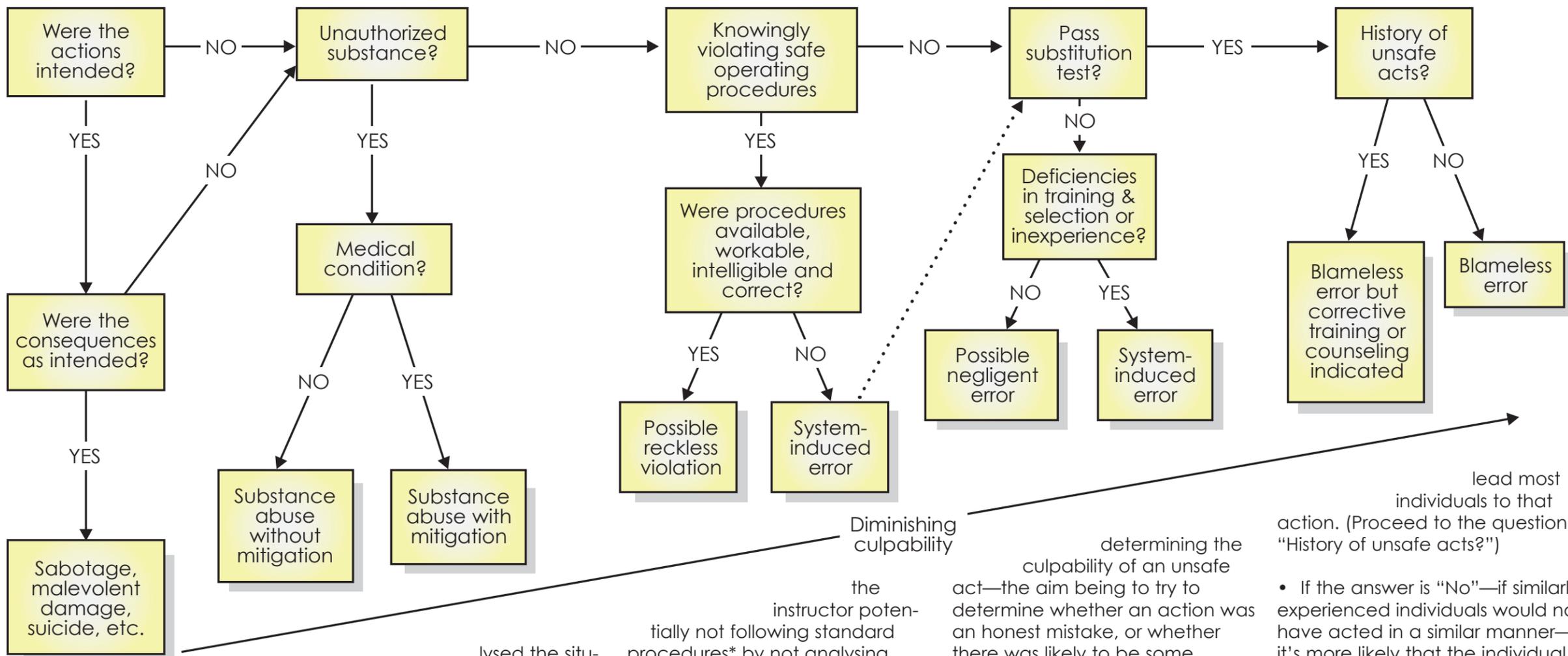
back onto the loop. Again, he had high pO₂ in the loop. He bailed and then had an oxygen toxicity seizure. Fortunately, his instructor lifted him to the surface and he survived.

Once back on shore, they ana-

lysed the situation. It transpired that the staff had filled *all* of the Ali7s, which included the one attached to the rig belonging to the CCR diver who had the seizure. A staff member had turned the cylinder off, depressurised the regulator, bled the cylinder down, filled it with 80%, put the reg back on and repressurised it, and put it back where he found it without marking the cylinder or letting anyone know that this had been done.

None of the CCR divers, including the instructor, had analysed their bailout gases before diving, and therefore, the issue was not picked up before they got in the water.

Now, how would you treat the staff member who had done what he had been asked to do but didn't necessarily understand the consequences? What about



PREVIOUS PAGE: Divers in briefing before a dive. ABOVE: Debriefing after a dive

the instructor potentially not following standard procedures* by not analysing gas before each dive? (*I don't know which agency in this case, so it might not be in the standard procedures, but the majority of agencies state that gases must be analysed once one is dealing with nitrox or trimix in any of the gases being breathed.)

So, even in diving and non-fatal incidents, there isn't a clear cut answer about what is right or wrong, and who should be to blame. Trying to understand the reasons why the incident occurred is the first step in reducing the emphasis on 'blame' and trying to work out how to make things safer the next time around.

Determining culpability

Professor James Reason of the University of Manchester recognised this problem and proposed a decision tree for

Diminishing culpability determining the culpability of an unsafe act—the aim being to try to determine whether an action was an honest mistake, or whether there was likely to be some responsibility for the outcome. The diagram on this page shows the original version of this decision tree, but a more updated version is shown in the afore-mentioned link to the RAF site.

Bear in mind that for such a decision tree, or substitution test, to work properly, the analyst must not know what the outcome was (hard, I know) for a variety of reasons. This is because of hindsight and confirmation biases.

Note: when you come to the box entitled "Pass substitution test?" use the question "Would three other individuals with similar experience and in a similar situation and environment act in the same manner as the person being evaluated?"

- If the answer is "Yes", the problem is not the individual, but more likely the environment that would

lead most individuals to that action. (Proceed to the question, "History of unsafe acts?")

- If the answer is "No"—if similarly experienced individuals would not have acted in a similar manner—it's more likely that the individual being evaluated is more culpable or accountable and in need of action—whether it is counselling or removal or whatever. (Proceed to the question, "Deficiencies in training and selection or inexperience?")

This picture makes it all appear so easy when looking at culpability, but Dekker, in a number of pieces of work, describes the fact that "the legal characterisation of behaviour as negligent is extremely complex, subject to many judgment calls, and in reality an after-the-event social construction. Those evaluating the behaviour are subject to bias, particularly outcome bias and hindsight bias." (Dekker SWA, *Just Culture: Balancing Safety and Accountability*. Ashgate, Aldershot, 2007.)

So in actuality, it is only after the



Diver firing delayed surface marker buoy

Standards?

Interestingly, the majority of research and published literature looking at just culture considers the formal disciplinary or accountability approach in how to deal with the individual(s) or the group(s) that have made the mistake, error or violation. However, the majority of diving that takes place is done outside a formal organisational structure. Indeed, there are very few actual rules with the majority of the basis for 'safe diving practices' defined as guidelines or best practice.

Whilst diver training organisations do have their own standards which instructors have to adhere to, and national legislative bod-

ies like the Health and Safety Executive (HSE) in the United Kingdom have their legal regulations, these don't impact the majority of divers.

Indeed, in the UK, you could walk into a dive shop, buy a complete set of scuba equipment, fill the cylinders with air, and then go and dive to whatever depths you like without *any* training or certification.

Even though there is a national governing body (The British Sub Aqua Club—BSAC), they have no governance or authority over any of the other diver training organisations operating in the UK or any diver diving outside of a BSAC club-environment. Consequently,

REGULATION: a rule or directive made and maintained by an authority.

STANDARDS: an idea or thing used as a measure, norm or model in comparative evaluations.

RECOMMENDATIONS: a suggestion or proposal as to the best course of action, especially one put forward by an authoritative body.

GUIDELINES: advice or information aimed at resolving a problem or difficulty, especially as given by someone in authority. □

this means that the judgement of what is right or wrong is very

effect that you can determine whether an error or violation has taken place, and it is a subjective exercise when it comes to motivation.

Now back to the real world where there are significant shades of uncertainty and we are dealing with real people, some of whom may have been injured, how do we improve matters and create the environment where divers can talk about their mistakes, either anonymously or in public?

Barriers

We need to understand what the barriers are to preventing a just culture from developing.

Given the emotional roller-coaster we ride in the event of a serious incident or fatality, it is easy to see why it is difficult to discuss fatalities in an immature safe-

ty environment. Those involved are grieving for those who have been lost. There is a need or want to protect the dignity or reputation of those involved (even if they did make a silly mistake that cost them their lives). And finally, there is often a lack of detailed data to understand what happened and why.

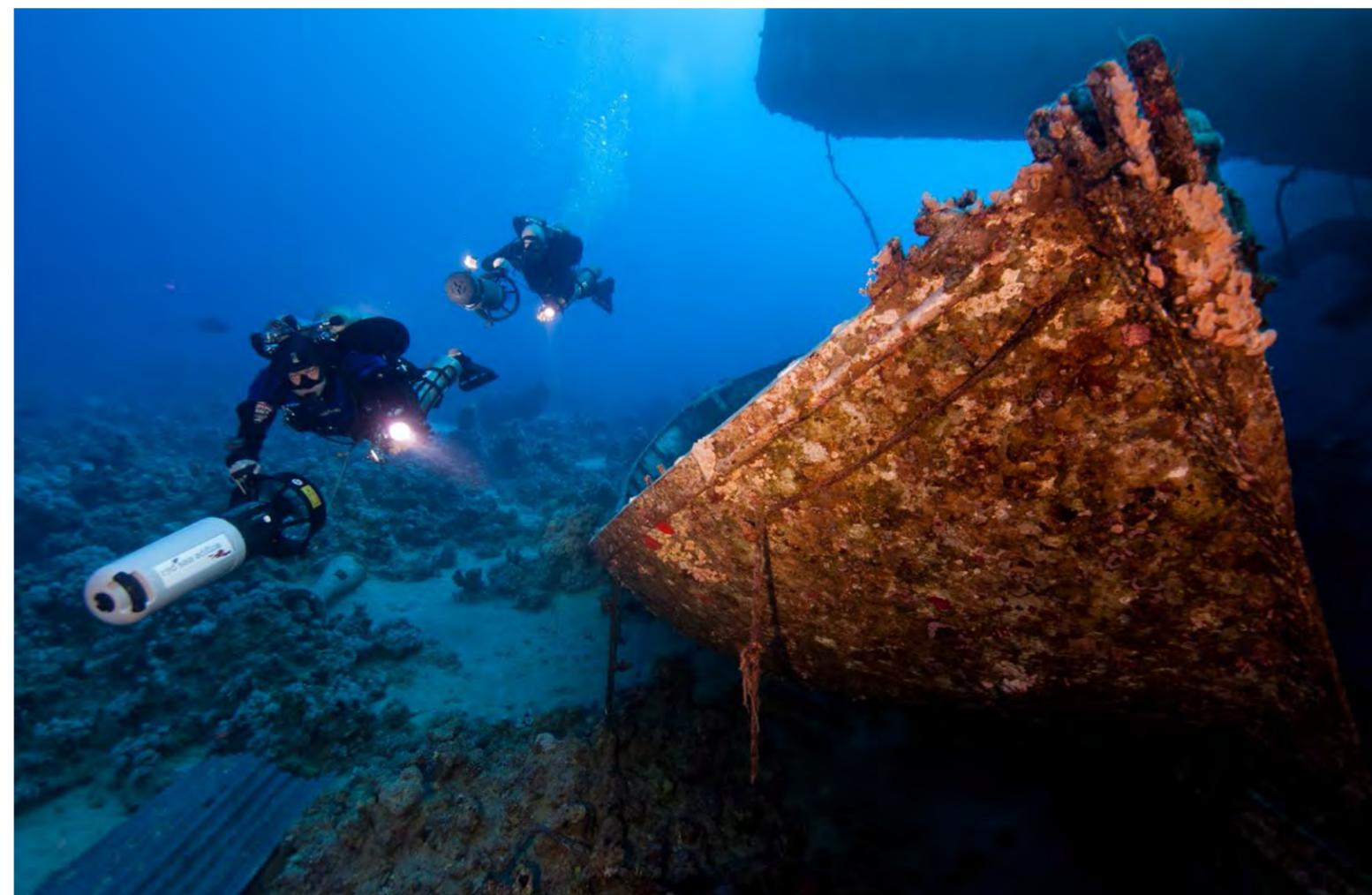
Lack of data creates uncertainty, which invariably leads to speculation. This is not useful when trying to determine lessons learned. Furthermore, the only person or people who really understood the decision-making process are no longer with us.

So, what prevents us from discussing non-fatal incidents when there are survivors and there isn't the same level of raw emotion as there is in a fatality?

I believe the following are all high up on the ladder of rea-

sons: emotion, fear, pride, the litigious nature of society, lack of structure or process to allow the other complimentary cultures to develop. Personal pride has been developed over time and the fear of its loss comes from the following linked factors:

- the majority of people don't like to discuss their personal failures,
- the majority of scuba training is delivered through positive reinforcement such that people are always told that they are great (even if they aren't), and
- there is significant personal investment in both terms of time and money, and people don't want to feel that that investment was wasted.



Divers on wreck of the MV Salem Express, Red Sea





opinion

Diver on SMS Karlsruhe wreck, Scapa Flow, UK (right); Diver at surface with delayed surface marker buoy (below); Divers on Freesia wreck, West Orkneys (bottom left)



difficult to define—even harder than the case of the nurse above.

Negative criticism

Unfortunately what sometimes occurs when incidents are published online in a public (non-anonymous) manner, is that they are dissected and criticised in terms of equipment configuration, training route or favoured training organisation, decompression profile, etc, in a negatively critical fashion rather than understand why the diver made the errors or decisions they did and address lessons that could be learned as a consequence.

This negative criticism appears to more vociferous if the 'incident'

diver in question doesn't conform to the respondents own 'norm', which ironically, could be a long way from best practice but they have 'always been done this way' and therefore must be right!

Fortunately over the last few years this attitude has started to be tempered but it is still prevalent in some quarters which reduces the opportunity to learn from others' mistakes.

In non-diving environments, punishment has legal or professional connotations, but in a recreational

activity, this could be personal or professional reputation and/or pride. This public criticism of detailed incidents is the "punishment" which needs to be managed with a just culture in sport diving. The matter is further complicated when instructors publicly talk about their incidents as this could be used against them in potential future cases where a dive did end up with fatal consequences.

Making diving safer

So how do we improve things to make diving safer? The first step is the normalisation of the reporting of incidents. An incident must not be seen as a failure, but rather it is an opportunity to learn. The stigmatisation of reporters must be recognised and reduced to give the confidence that others can report their incidents without fear of ridicule or negative criticism—people don't get up in the morning and decide

to make a string of mistakes that could (nearly) cost them their lives!

The reporting of mistakes and errors should be promoted throughout training, across the full range of diving from recreational through to advanced technical diving. This reporting shouldn't just be in the form of report forms to prevent litigation but to allow all to learn, and anonymous reporting systems outside of the organisation should be used if there is an issue with regards to stigmatisation.

Reporting should be considered the norm, not the exception and investment made to support such reporting systems as a consequence.

Secondly, the community needs to recognise that everyone's level of acceptable risk and specific configuration is unique (broadly) to them and will address feedback in that context. I have my views of what is acceptable or not, but

when I provide feedback on an incident and its causality, I couch it in terms of what that diver's likely knowledge, skill set, configuration and culture is, rather than my views.

We are always learning, irrespective of our experience, skill set and knowledge. However, the ability to learn from others' mistakes can only happen when those mistakes (and their mitigations or strategies) are exposed in a manner which promotes honesty and prevents negative criticism; that is what a just culture is about. □

Gareth Lock is an accomplished technical diver based in the United Kingdom. Currently serving in the Royal Air Force, Lock is undertaking a part-time PhD examining the role of human factors in scuba diving incidents. For more information, visit the Cognitas Incident Research & Management website at: Cognitasresearch.wordpress.com

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New species of dolphin discovered near Australia

Scientists examining a taxonomically confused group of marine mammals have officially named a species new to science: the Australian humpback dolphin, *Sousa sahalensis*.

The process of describing a species new to science requires a systematic analysis of all species most closely related to the animal in question.

The humpback dolphins in particular have vexed researchers and taxonomists for decades until researchers from the Wildlife Conservation Society and a number of other institutions provided the most definitive results in late 2013.

The Australian humpback dolphin species joins the current assemblage of three other closely related species: the Atlantic humpback dol-

phin (*Sousa teuszii*), the Indo-Pacific humpback dolphin (*Sousa chinensis*), and the Indian Ocean humpback dolphin (*Sousa plumbea*).

Aside from slight differences in overall length, number of teeth and vertebrae, and geographic distribution, the Australian humpback dolphin differs in appearance from the other three humpback species. Its dorsal fin is lower and more wide-based than the dorsal fins of *Sousa teuszii* and *S. plumbea*, and its coloration is dark gray, as opposed to the distinctly white (often with a pink tinge) coloration of its closest humpback neighbor, *Sousa chinensis*. The Australian humpback dolphin also possesses a distinctive dark dorsal "cape." □ SOURCE: WCS.ORG



R.L. PITMAN PROVIDED VIA NEWSWISE

The Australian humpback dolphin (*Sousa sahalensis*) is a species of humpback dolphin and the fourth recognized humpback dolphin species chronologically

Humpback Fluke ID project needs your help

The Tongan Fluke Collective (TFC) aims to utilize photographers visiting the Kingdom of Tonga and photographing humpback whales during the breeding and calving season to compile a database of fluke shots for scientific purposes.

As a photographer who is visiting or has previously been to Tonga, you can assist by donating your whale fluke photos to the TFC.

All fluke shots will be credited to the photographer, but they will be sharing these with the scientific community and making them freely available to any researcher or organization that would not normally have access to such resources.

Step 1: Upload to dropbox and share the link with them at scott.portelli@gmail.com or send them your email address and they will add you to the shared dropbox folder <http://www.dropbox.com/TongaFlukeID>

If you are already collecting fluke shots from Tonga and have a website, flickr group or FB page where you are housing these, then simply send them the link and they can download from there.



Step 2: They upload your photos to their flickr group and credit the photographer. All EXIF data from the image will be captured so you don't have to do anything. □

Find out more at: www.facebook.com/groups/tonganflukecollective

Blue whales often cross shipping lanes

The endangered blue whale population has been slow to recover since they were protected in the 1960s. Scientists suggest that one reason may be ship strikes that injure or even kill whales.

To better understand where important whale habitat and shipping lanes overlap along the U.S. West Coast, scientists attached satellite tags to 171 whales off the coast of California during summer and early fall from 1993 to 2008.

The authors analyzed the whales' paths within 200 nautical miles of the coast, and based on their distribution identified areas of highest usage by the whales.

Travel distance and ranges of individual whales varied dramatically, but blue whales consistently used similar feeding grounds each year despite different ocean condi-

tions, like El Niño and La Niña. The two most heavily used areas were in the Gulf of the Farallones, off central California, and the western part of the Channel Islands in southern California.

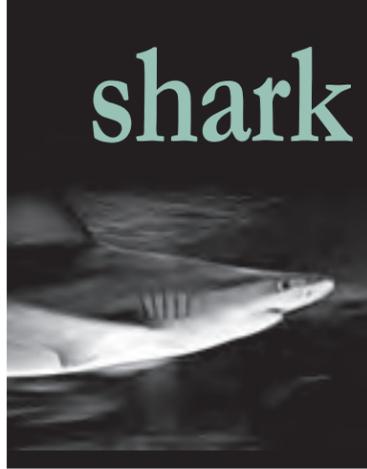
The timing of blue whale presence in U.S. waters is important information for managers trying to estimate the likelihood of human-whale interactions.

The authors report a high overlap between the areas heavily used by tagged blue whales and busy shipping lanes leading to major U.S. ports, and suggest possible modifications to ship routing aimed at reducing the likelihood of collisions with whales. □ SOURCE: PLOS ONE



Blue Whale, Southern California, 13 July 2014

shark tales



Aerial view of Malapascua Island in the Philippines

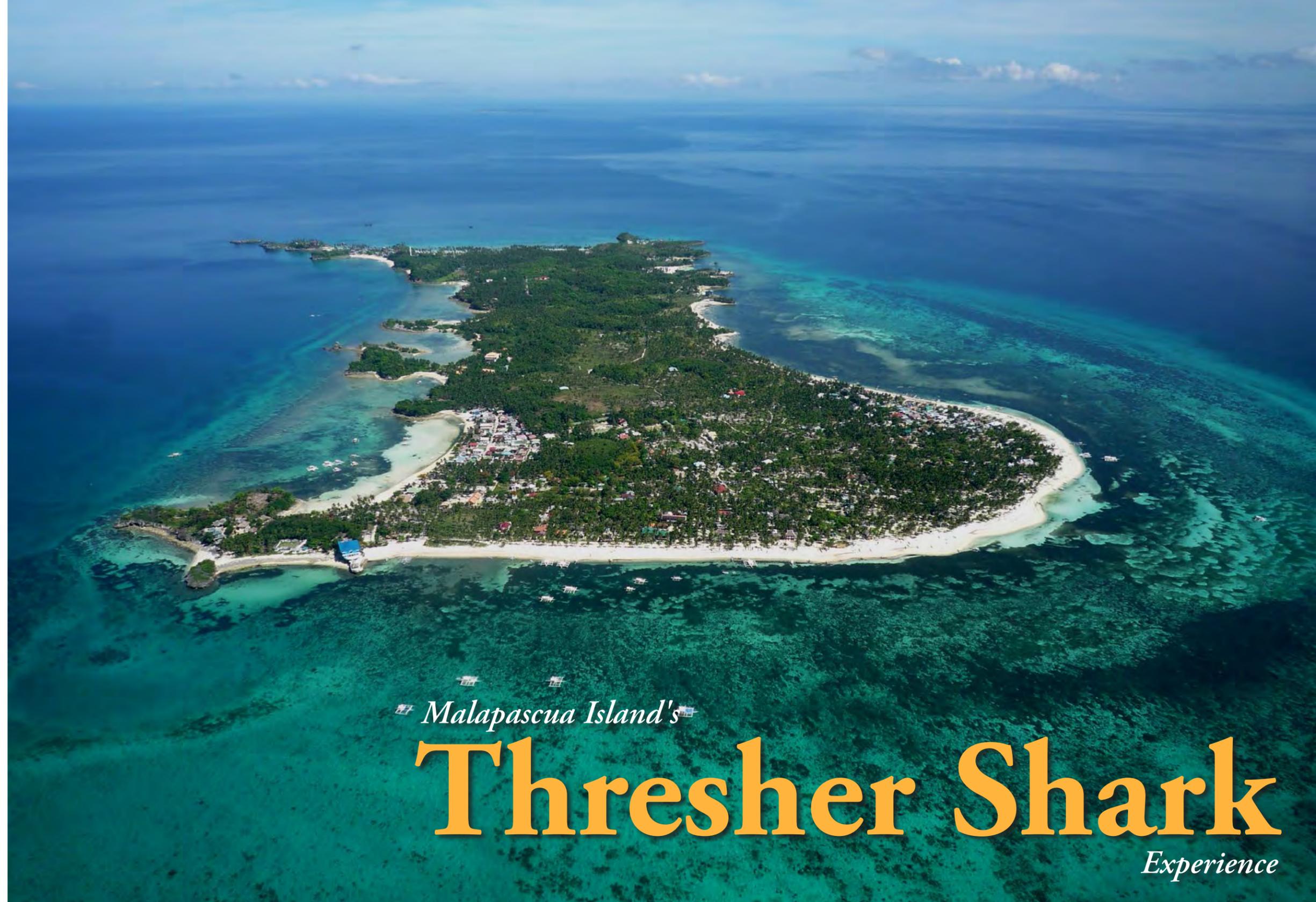
Text and photos by Kurt Amsler

The fox shark, also called the common thresher shark, lives usually at depths of over 200 meters and it is sighted only rarely. This is the main reason, we don't know very much about these animals, and there is very little good visual documentation showing thresher sharks up close on camera.

If there is a place where there is the greatest opportunity to meet the great pelagic thresher shark, it is the island Malapascua in the Philippines, about 7km east of Cebu. Here, at a depth of 20 to 25 meters, one can catch a glimpse of these elusive sharks on a plateau of a sunken island named Monad Shoal.

Attracted by several cleaning stations, the sharks come regularly before sunset for their early morning "toilette". They are cleaned by the small cleaner wrasse that clean the sharks' skin, gills and even inside their mouths of parasites, bacteria and food debris.

Due to this behavior, it also makes it necessary for observers to be there on time as well, because it is the only chance to see and approach this shark to photograph it.



Malapascua Island's

Thresher Shark

Experience

Photographing threshers

For a week now, I'd been getting up at 04:30 each morning in order to get some good shots of a thresher shark. On each dive at the Plateau I site, I saw some of them in the distance, but due to bad visi-

bility, pictures taken were blurred.

I wanted to get photographs in which the image of the animal was sharp and had good contrast, but this required that there be not more than two meters between shark and photographer—as

well as lots of luck! But patience and perseverance is a prerequisite for a wildlife photographer.

So now, I found myself again swimming confidently through the dim twilight to the edge of the plateau. Today, we'd try

a different spot, a place deeper and further away than the previous ones. Down there we would remain for 60 to 70 minutes, motionless and observing the blue-green horizon for the distinctive silhouette of the thresher shark.





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Thresher Sharks



Thresher shark with cleaner wrasse on mouth

We were located right on a steep wall dropping to over 200 meters below us. But instead of sharks appearing, just swells of very cold water arrived from the depths below. I wished I'd had a few more millimeters of neoprene on my body.

Already 50 minutes had passed, and thanks to nitrox 40/60, we were still good on bottom time. Around us, it was noticeably brighter now. I was still hopeful and set the camera to these

new light conditions—to be prepared just in case.

But now something seemed to be happening in the blue-green infinity—a dark shadow appeared, still hazy but slowly more and more clear. Suddenly a huge, approximately four-meter thresher swam right up to me!

Rushing adrenaline replaced, within seconds, the chill of the morning—certainly not for fear of the sharks, but

rather the pressure not make any mistakes, either technically or behaviorally, and risk losing this incredible chance. But the old routine came flowing back after a few seconds, and I followed all the action through the viewfinder of my camera.

The shark approached slowly but surely. Then suddenly, something strange happened. In less than three meters off camera, with its pectoral fins laterally turned, the shark stopped

shark tales



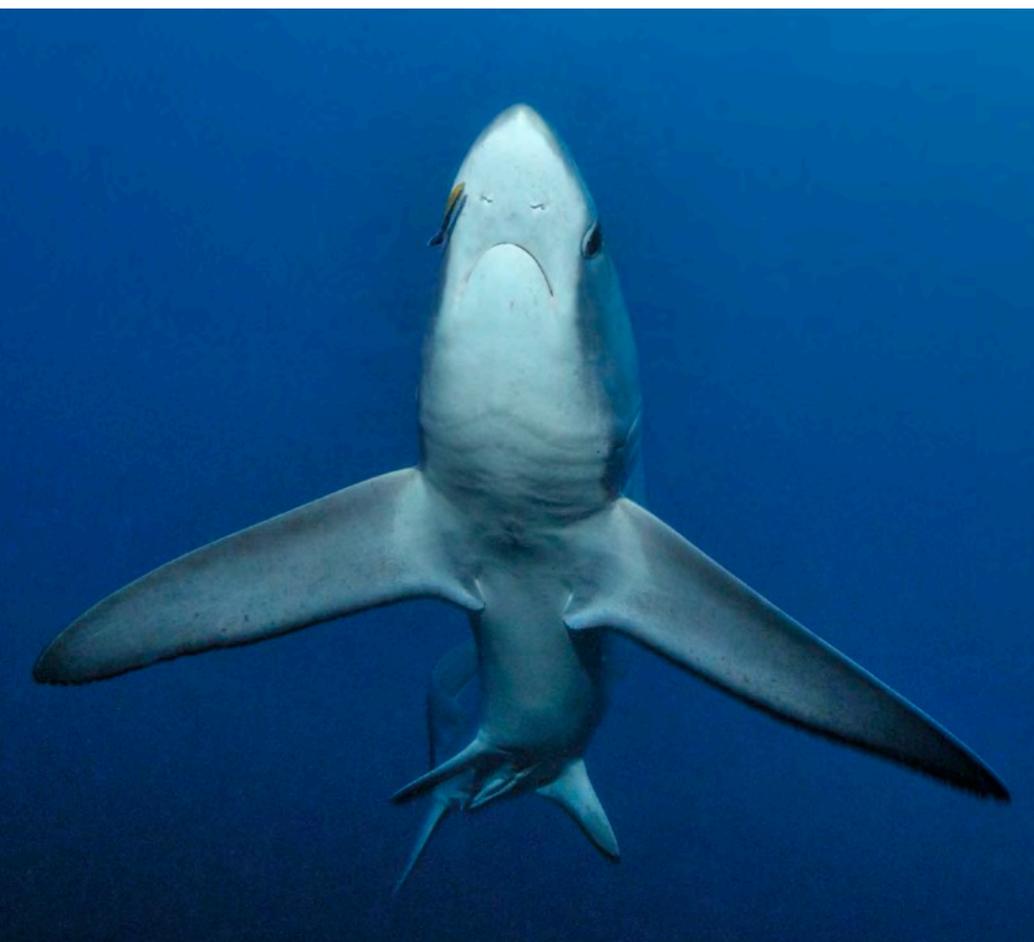
THIS PAGE: Scenes from early morning dives with thresher sharks at Monad Shoal off Malapascua Island in the Philippines

abruptly and remained almost motionless for a split second right in front of me—I pull the trigger!

I prayed to all the gods of the Philippines that the shark would not back off and disappear, never to return again. Fortunately, this was not the case. Then, almost from a still stop, the shark suddenly shot past me, over me and turned 180 degrees around, only to disappear to whence he had come.

During the whole shark encounter, I wasn't breathing at all—and for good reason—but now I had to rinse out my lungs with such vigor that all the fishes, and I guess also all the sharks, in the area escaped in a panik. But by now I didn't care—I had the "Thresher" in my box! Tomorrow I could sleep longer. □

For more information, please visit Kurt Amsler's website at: www.photosub.com



THRESHER SHARK FACTS

CLASSIFICATION:

Kingdom: Animalia
Phylum: Chordata
Class: Chondrichthyes
Subclass: Elasmobranchii
Superorder: Selachimorpha
Order: Lamniformes
Family: Alopiidae
Genus: *Alopias*

GENERAL DESCRIPTION

The thresher shark is of the order Lamniformes (or mackerel sharks) with a tail fin that has a greatly elongated upper lobe. They are very strong swimmers that can vault completely out of the water. Threshers have a countershaded body—dark blue-gray above and white underneath. The thresher shark has small jaws, but can use its tail to corral and even kill fish. The first dorsal fin is much,

much bigger than the second; the pectoral fins are curved. Like other mackerel sharks, it has an anal fin, five gill slits, two dorsal fins, no fin spines, a mouth behind the eyes and no nictitating eyelids. It is mostly nocturnal (active at night).

SIZE: 16.5-20 ft (5-6m) long

HABITAT AND DISTRIBUTION: The common thresher shark swims from the surface to a depth of about 1,150ft (350m). It lives in open tropical and temperate waters, including the eastern and western Atlantic, the central Pacific and the Indo-west Pacific.

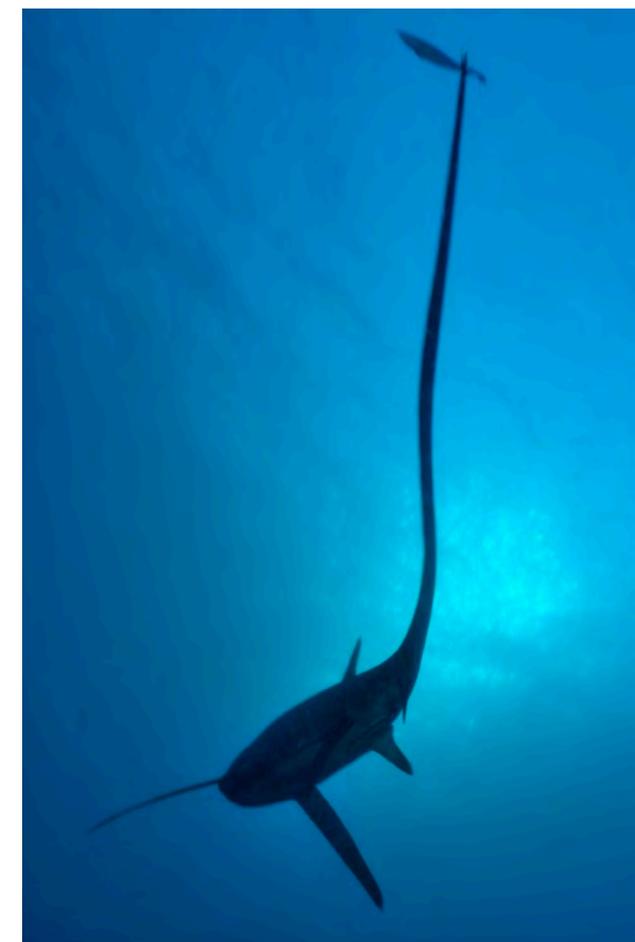
TEETH AND DIET: The thresher shark eats squid and fish, corraling them with its elongated tail, stunning them with slaps from it, and catching

them with its very sharp (but small) teeth.

SPEED AND SWIMMING: They are very strong swimmers and can even leap out of the water.

REPRODUCTION: Threshers reproduce via aplacental viviparity; the eggs hatch inside the female. The developing embryos are ovophagous; they will eat smaller, weaker siblings while in the womb. Mature females (at least 10ft or 3m long) have litters of 4-6 pups, bearing live young. These pups are 3.5-5ft (1.1-1.5m) long at birth.

POPULATIONS: Threshers are decreasing in numbers because of overfishing; they are hunted for their meat and fins. □ SOURCE: WIKIPEDIA



Edited by Ila France Porcher

THIS PAGE:
Demonstrators
opposing the
shark cull in
Australia

Three hundred one scientists criticise Australian shark cull

Text by Ila France Porcher
Photos by Tanya Izzard

Scientists from 20 Australian Universities and international institutions made a joint submission to the Western Australia Environmental Protection Authority, rejecting the scientific grounds for continuing the proposed three-year programme to cull sharks.

The programme was launched after an unusual number of fatal shark bites—seven between August 2010 and November 2013. Western Australia's premier, Colin Barnett, responded by ordering that baited hooks be strung from floating drums near recreational and beach areas, and that any great white, tiger shark, or bull shark caught be shot if it exceeded three metres in length.

Barnett was photographed clutching a large shark hook as the programme began, vowing that he had an "overriding responsibility to protect the people of Western Australia."

Amid great controversy and crowds, which flocked to the beaches to protest the killing, drum lines trailing the huge baited hooks were set up, and more than 170 sharks were fished. Those over three metres were shot, and the rest "released," yet it is unlikely that many survived the brutal treatment.

Further, not one great white shark, the species responsible for most incidents, was caught.

Drum lines and discord

The intense public outrage reflects the growing public concern about the plight of sharks, even in the country in which most fatal shark bites occur.

Yet in spite of the anger of the very surfers and swimmers that the slaughter was designed to protect, and the growing pool of scientific evidence that the presence of baited hooks has no effect on the activities of sharks, except to attract them closer to shore, the government intends to continue the programme for three more years.

Professor Jessica Meeuwig from the University of Western Australia, was the coordinating scientist for the submission. She explains:

"Given the lack of demonstrated safety benefits of drum lines, the uncertainties around the impacts of a cull on threatened and ecologically important marine

wildlife, and the ecosystems they inhabit, and given the availability of immediately applicable, proven, non-lethal alternatives, we don't need to resort to a 1960s-style lethal response to achieve safety outcomes.

To have over 300 researchers, including some of the world's top shark specialists and marine ecologists, all strongly agreeing that there is no scientific basis for the lethal drum-line programme, tells you how unjustified the government's proposal is. If the EPA and the Federal Minister for the Environment are using science for decisions, the drum-line proposal should not be approved."

Dr Christopher Neff from the University of Sydney stated: "There is no evidence that drum lines alone reduce shark bites. The Western Australia EPA now faces a question of science versus politics with global implications, because it is considering establishing a new international norm that would allow for the killing of protected white sharks."

The drum lines are ineffective and indiscriminate, the scientists affirm, with

78 percent of the sharks captured not considered 'threatening' to humans. Yet, scientifically supported, non-lethal alternatives such as the South African 'Shark Spotter' and Brazil's 'Tag and Remove' programmes were not assessed as viable options for Western Australia. Evidence from hook-based programs in Hawaii and Queensland that have been shown to be ineffective in reducing shark attacks on humans were ignored.

Dr Fred Whoriskey from Dalhousie University (Canada) and Executive Director of the global Ocean Tracking Network (OTN) that includes over 400 scientists from 15 countries, said:

"The OTN has protested the cull because it makes the oceans less safe. The cull undermines white shark research programs that provide the fundamental understanding of the behaviour of these animals that is key to guiding ocean-safety strategies."

Skewing the evidence

The experts are also concerned that potential impacts on protected and



TANYA IZZARD

TANYA IZZARD

Edited by Ila France Porcher

threatened species are poorly evaluated, and ignore uncertainty, population biology, and the best available, peer-reviewed estimates of population size. Instead, the government is relying on its own internal estimates.

University of Queensland Principal Research Fellow Jennifer Ovenden challenged the science of the Western Australian Government submission. The government accepted the results of her two-year, peer-reviewed study identifying separate white shark populations on the east and west coasts, but ignored the estimated numbers of animals in her study.

She stated, "I think it's unprofessional because they are making inferences from inappropriate data sources using computer models. I think it would have been prudent to include our mature individual estimates in at least one computer model."

Negative impacts

Negative impacts on the wider marine ecosystem and World Heritage Areas were dismissed with little justification, ignoring existing scientific knowledge on the role that sharks play in maintaining ecosystem health.

Professor Mike Heithaus from Florida International University said, "More than 15 years of research on the ecological importance of tiger sharks in Western Australian waters has shown that these animals—espe-



TANYA IZARD

cially the large individuals targeted by the cull—play a critical role in the major seagrass ecosystems that provide immense benefits to people in Western Australia. The loss of tiger sharks could destabilize the system and negatively impact ocean health and economic benefits."

Prof Bob Costanza, an internationally respected ecological economist from the Australian National University said:

"Marine ecosystems provide a range of valuable services to humanity. Removing apex predators from these systems can have unintended ecological and economic costs that far outweigh any real or perceived benefits."

Noting the important role that Australia plays in global leadership for the oceans, Dr Elliott Norse, Founder and Chief Scien-

tist of the Marine Conservation Institute (USA) asked:

"How can a country be a leader when it comes to saving whales in Antarctica, but kill threatened sharks in Western Australia? It is a step backwards at a time when a growing list of countries is moving to protect larger areas of our oceans, in part to protect these mobile large predators, as has recently occurred in the United States with President Obama's announcement of a greatly expanded Pacific Remote Islands Marine National Monument."

The scientific consensus from 301 experts categorically condemns the ineffective and dangerous policy of killing sharks in Western Australia. □

SOURCE: PRESS RELEASE BY DR CHRISTOPHER L. NEFF, PROF. JESSICA MEEUWIG

An Oceanic Time Bomb

Text by Ila France Porcher

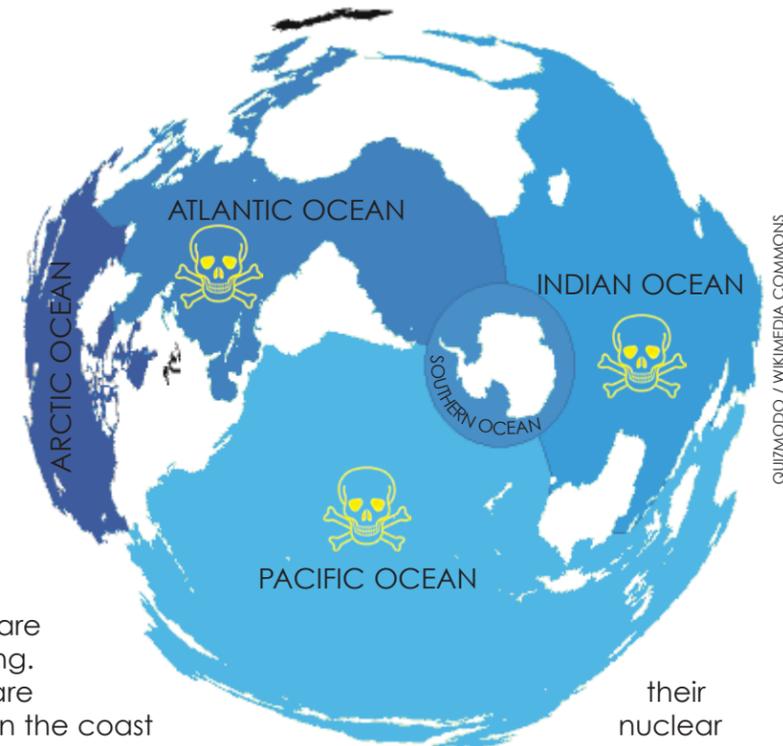
Governments and industries around the globe have been using the oceans to dispose of the hazardous and toxic wastes that became a problem on land. With an out-of-sight, out-of-mind attitude, the most hazardous and toxic constituents ever created have been dumped off shore rather than recycled, or elementalized into benign elements. This has been done globally, often secretly, often carelessly, often without keeping records, so that now, the actual locations of the dump sites are in most cases unknown.

This massive hazardous waste disposal has been going on for centuries, but it has dramatically increased in volume and toxicity in recent decades. Since the Second World War, radioactive

waste has been added to the toxic pile, and in many cases these barrels are already leaking. Such barrels are washing up on the coast of Somalia, and are known to lie off San Francisco and in the English Channel as well as other locations. Adding to the problem are pipes in Sellafield, United Kingdom, and La Hague, France, which simply carry radioactive waste from nuclear plants directly into the ocean; nuclear submarines that have been accidentally lost still lie on the floor of the north Atlantic Ocean,

their nuclear reactors still in place.

War munitions have also been dumped in unexpected quantities in oceans around the world, most of them off the coasts of the United States and Europe. The quantities in many cases involve hundreds of thousands of tons of toxic chemicals. Some of these were accurately recorded, but many were not.



QUIZMODO / WIKIMEDIA COMMONS



Tiger shark (file photo)

ILA FRANCE PORCHER

shark tales

Edited by Ila France Porcher

THIS PAGE:
Gray reef sharks (file photos)

For the locations of known sites see: **Chemical Weapon Munitions Dumped at Sea** (videolink).

Secret and under-reported

While the more dramatic pollution accidents, such as Fukushima, gain attention in the media, some experts feel that it is the secret and under-reported disposal of radioactive waste and other toxins that is more dangerous, and now threaten the oceans' capacity to adequately dilute it.

Yet, this aspect of oceanic pollution is under-reported, and difficult to research, in spite of

growing concern about marine health. All life originated in the oceans, and water forms the basis of life. The system through which water circulates by evaporating from the oceans, falling as rain, running into rivers, and flowing back to the oceans, is the key life-supporting system of our planet, and the oceans furnish about 80 percent of the oxygen in our atmosphere.

Threatened species

The oceanic ecosystems fringing the land, where the sun penetrates to the seafloor

and supports the rich communities we visit by diving, are particularly threatened. Those shallow waters along the shores and on the continental shelves, are home to a high fraction of oceanic life, and it is in these regions that many shark species have established nurseries, or pupping grounds. They, along with countless other species that depend on the shallows for part of their life-span, are most threatened by possible future leaks. Heavy concentrations of hazardous waste roll into the shore in waves, concentrate along the

shorelines, and poison them.

The barrels of hazardous, toxic, and radioactive waste lying off shore constitute a ticking time bomb. Government and industry did not know what to do with such hazardous compounds when they created them, and now the effect on oceanic life as a result of their irresponsible practice is not known. But, they are in our water system, and when this bomb goes off, it may well bring about the planet's worst progressive extinction cascade so far.

Clean-up technology exists, unused

Yet, the technology required to locate, retrieve, and clean up these sites is available! It has been found by industry and government, but the willpower necessary to address the problem will not arise

as long as the public remains unaware of the full extent of the problem, and fails to demand action. Information regarding local areas needs to be brought to the attention of the appropriate authorities, so that the necessary processes can be set in motion to finally clean the mess up. □

Ila France Porcher, author of The Shark Sessions, is an ethologist who focused on the study of reef sharks after she moved to Tahiti in 1995. Her observations, which are the first of their kind, have yielded valuable details about their lives, including their reproductive cycle, social biology, population structure, daily behaviour patterns, roaming tendencies and cognitive abilities. Her next book, On the Ethology of Reef Sharks, will soon be released.



ALBERT KOK / WIKIMEDIA COMMONS



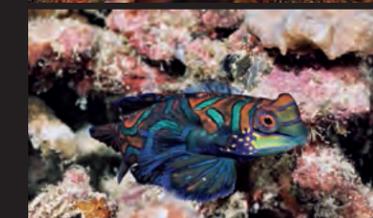
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The Philippine's
Malapascua Island

Text and photos by Andy Murch

— *Where Thresher Sharks Roam*



Enchanting Malapascua—the view from the private beach at Tepanee Resort



PREVIOUS PAGE: Thresher shark at Monad Shoal; Diver and soft corals at Gato Island (above)

As picture perfect as Malapascua is, in a nation of 7,107 palm tree fringed islands, 2.5km long Malapascua wouldn't be on anyone's radar were it not for the thresher sharks that treat the island like a spa. Each morning as the sun peeks over the mountains on distant Cebu, Pelagic threshers rise from the depths to be cleaned by reef fish along a deep ledge known as Monad Shoal.

When my plane touched down in Cebu City in the central Philippines, the ground had barely stopped shaking from a catastrophic earthquake that rocked

Bohol and Cebu causing severe property damage and loss of life. From the media reports that I saw en route, I was expecting total chaos, but Filipinos are used to the occasional quake and no one that I met seemed particularly phased by the tremor that registered 7.2 on the Richter scale. When I reached Malapascua Island, there were no signs at all of earthquake damage, and before long, I completely forgot about the possibility of more violent tectonic shifts.

Monad Shoal

At 6:00am, a dozen Filipino dive boats form a ragged line along the edge of the drop off. I sit quietly in the dawn glow, waiting for the sun to rise high enough to begin the first dive of the day.

The key to close encounters at Monad



Tigertail seahorse



Shoal is to dive (and shoot) without artificial lights or camera strobes. Threshers have extremely sensitive eyes that are designed for hunting prey in the half-light. Understandably, they do not respond well to flash photography and will bolt at the first sign of a bright light.

Around 6:30am, I join the ranks of bleary-eyed divers slipping below the waves, and descend through clear water to a steep sandy slope at 80ft/24m. When my eyes finally adjust, I see that the lower edge of the slope takes a sharp downturn and plummets past a series of deeper ledges into liquid night. To my right, a coral spur (covered in cleaner fish) juts out from the slope but it is devoid of sharks so we swim on.

As we approach the next cleaning station, Tata—my eagle-eyed divemaster from Thresher Shark Divers (TSD)—gives me a 'halt' signal the points insistently along the slope. Straining my eyes in that direction, I drop to the sand and try to look small and nonthreatening.

When the first thresher materializes, there is nothing obviously predatorial about its demeanor. As it snakes past me, the 3m long animal seems confident and nervous in equal measures; an accomplished deepwater hunter forced out of its comfort zone by the need to rid itself of parasites.

Thresher sharks spend much of their lives in the open ocean hunting schooling fish. Over time, they accumulate copepods, sea leaches and various other parasitic organisms that irritate their skin, especially around their vulnerable gill openings and on the trailing edges of their fins. Cleaning stations like the ones at Monad Shoal are a critical part of their

Malapascua



THIS PAGE: Thresher sharks at Monad Shoal

Thresher Shark Divers' banca—a thin, wooden-hulled boat with bamboo outriggers





Gato Island gate house and protective cliffs (left); Brooks urchin shrimp (above)



Thresher shark at Monad Shoal

daily hygiene regimen.

I continue to hunker down as the thresher approaches the cleaner fish. On its third pass, the shark stalls a few meters in front of me and drops its tail. It's a clear signal to the cleaners to begin work. Right on cue, a variety of bannerfish, angels and various other parasite eating teliosts swim towards the shark and get busy. The thresher remains motionless for half a minute and then sinks out of view.

Back on board TSD's roomy banka (a thin, wooden-hulled boat with bamboo outriggers), I relive the encounter and wish that I could slip back in for a second dive. But by 8am, the tropical sun burns down through the water column, and the threshers retreat to the safety of the deep.

Gato Island

In the afternoon, manta rays visit the cleaning stations at Monad Shoal, but I will have to skip that encounter this time around because our banka is headed to Gato Island. The locals say that divers

come to Malapascua to see thresher sharks but they leave remembering Gato.

Gato Island is so small that you could easily swim around it on a single dive but no one does because there is simply too much to take in. The island is shaped vaguely like a pyramid and undercut from erosion along the waterline. A small guard's shack clings to its coral foundations but there is no guard in residence.

Tata explains that ownership of the island is being disputed by two different provinces. With little government funding available, the dive shops on Malapascua pay the guard's salaries but they can't police Gato until the dispute is over. In the mean time, the island is under constant siege by illegal dynamite fishermen.

A large cavern runs completely through the island forming a colourful swim-through and a quiet resting place for whitetip reef sharks and whitepotted bamboo sharks. Shimmering bullseyes and silversides swim in dizzying circles in



Coral garden at Gato Island



LEFT TO RIGHT: Hermit crab with adornments; Coleman shrimp; Porcelain crab

gloomy recesses in the rock and large anemone-toting hermit crabs drag their elaborately adorned shells across the cave floor like society women showing off their outrageous hats.

The shark cave is clearly the headline act at Gato Island but the macro life on the surrounding reef slopes will keep you busy for days. Tata swims along the sand flipping over one heart urchin after another. Each holds a different surprise. On one, a pair of brooks urchin shrimps wave me in for a potential manicure. On another, two coleman shrimps do their best to blend with a purple fire urchin's spines and on a third, a bold little zebra crab tiptoes over its prickly host in search of scraps. After a second great dive through the cavern I am completely sold on Gato Island and make a mental

note to come back here before I leave.

Bad Easter

An hour later, I am back on Malapascua enjoying the sunset from the comfort of the beach bar at Tepanee Beach Resort. The staff—like everyone I meet on the island—are charming and polite but refreshingly relaxed and quick to giggle amongst themselves at the slightest provocation. I could get very comfortable on this slip of land but the first Europeans here felt rather differently.

The name Malapascua was coined by Spanish sailors that spent a long and lonely Christmas holed up on the island. Desperately homesick, the seamen called the Island "Mala Pascua" which literally means "Bad Easter". Had the aqualung



Whitespotted bamboo shark at Gato Island



Location of Malapascua Island on map of the Philippines (right); Location of the Philippines on regional map of Asia (above)

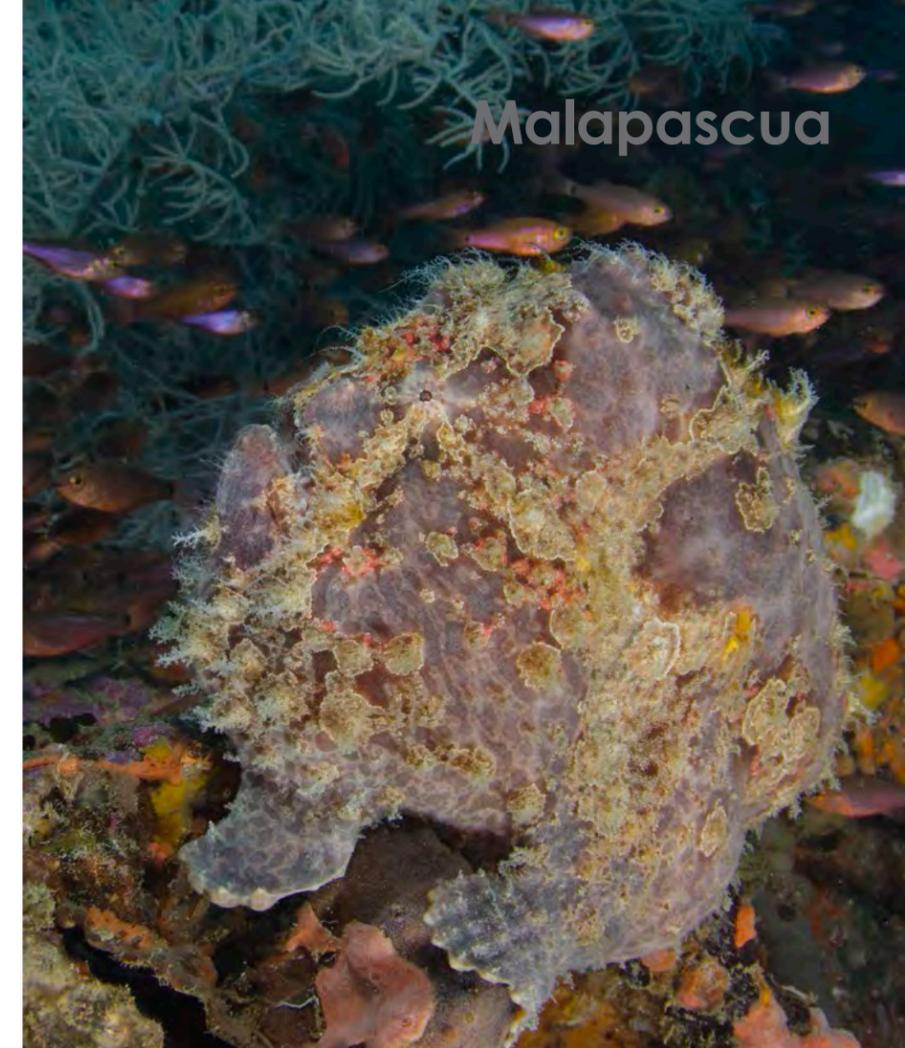




Diver at *Dona Marilyn* wreck



Diver with broadclub cuttlefish (above) and giant frogfish (top right) at *Dona Marilyn* wreck



Malapascua

been invented back then, the island might have been named Bella Pascua! The next morning I join the other shark divers on a deep ledge to watch the threshers slip in and out of visibility. TSD runs a dawn trip to Monad Shoal virtually every day of the year (barring earthquakes and super-typhoons). Sightings hover around 98 percent—an incredible success rate when you consider that there is virtually nowhere else in the world that threshers can be reliably encountered.

Now and then, they even see a few bigeye threshers—a species with extremely large eyes that is usually found in much deeper water.

***Dona Marilyn* Wreck**

Another deep site not far from Malapascua is the wreck of the *Dona Marilyn*—an inter-island ferry that fell victim to Typhoon Unsang in 1988.

After 25 years underwater, not a lot of the wreck is visible under the sheer weight of coral festooning its decks and superstructure. Giant frogfish and broadclub cuttlefish are some of the easily recognizable residents but keen-eyed divers may also stumble upon a variety of nudibranchs, ornate ghost pipefish and the universally popular pygmy seahorses.

Chocolate Island

Later in the week—after our daily dawn thresher encounter—we head to Chocolate Island. I ask three separate divemasters how the island got its name and get three humorous and utterly implausible responses. When we finally submerge, all becomes clear.

The algae and corals that grow in the shallows around Chocolate Island range from dark brown to olive drab. Although healthy, it is not the most



Denise's pygmy seahorse



TOP LEFT TO RIGHT: Ornate ghost pipefish at *Dona Marilyn* wreck; Blue-ringed octopus and mating mandarinfish at night at Lighthouse Reef

visually appealing site, but Tata assures me that it's a macro wonderland, and after one dive, I couldn't agree more.

Within a few minutes, I manage to spot dozens of different nudibranchs grazing on the algae and more cleaner shrimp varieties than I have ever seen before.

Macho mandarinfish

With my brain firmly set on macro-mode, I decide to sign up for a night dive to Lighthouse Reef. The seabed here is completely covered by a meter-thick blanket of acropora coral—an excellent habitat for mandarinfish.

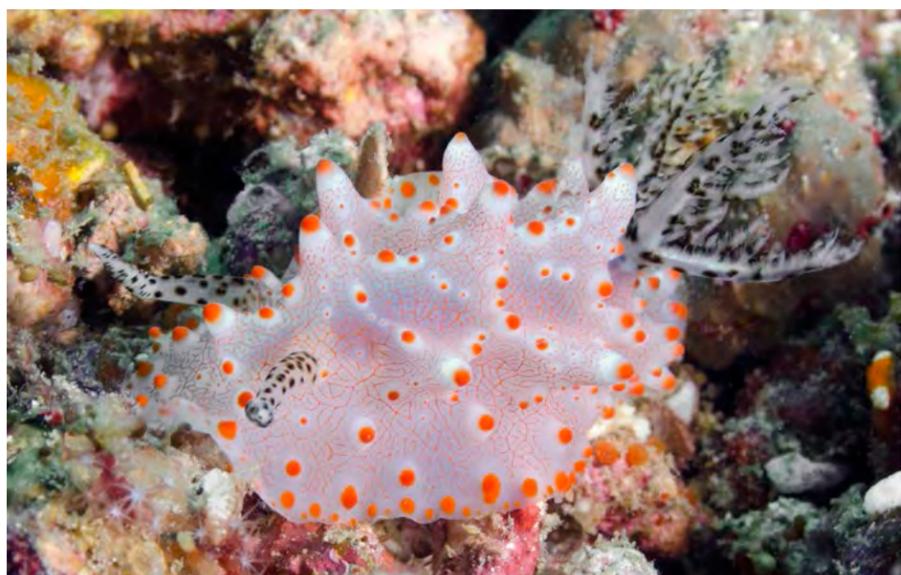
Not just beautiful, mandarinfish also make great study subjects for anyone interested in fish behavior. All year long, mandarins indulge in elaborate mating rituals, ballet-like courting displays and dramatic climaxes in which the male and much smaller female throw caution to the wind and swim far above the reef. Then, quivering in what looks like ecstasy, they release a tiny cloud of sperm

and eggs into the night. As if coming to their senses, the happy couple then dart back into the safety of the acropora.

Tata swims directly to a nondescript patch of coral where half a dozen mandarinfish are going about the serious business of courting, fighting and mating.

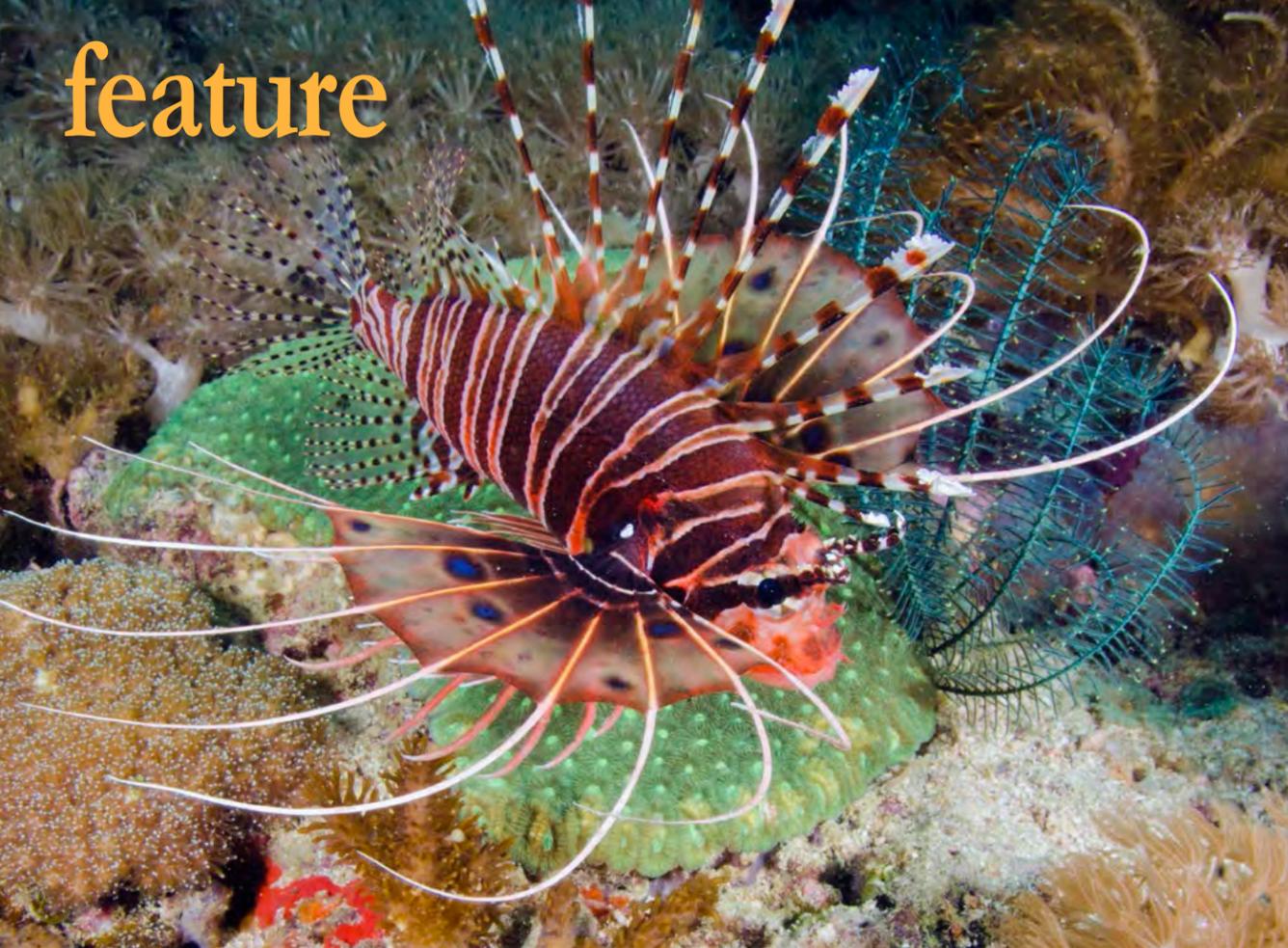
As we look on, two rival males size each other up and then crash head long into each other and bite down on one another's gill regions. Locked together in this way, the macho mandarins spin in circles until one gains supremacy over the other and chases the inferior suitor away. The winner then struts towards a patiently waiting female like a barroom brawler that has just 'taken out the trash'. Apparently impressed by the show of bravado, the tiny female stays put while her alpha male swims erratically around her.

I am utterly entranced by the mandarins, but Tata drags me off to shoot a colony of tigertail seahorses a few short kicks away. Although



THIS PAGE: Assorted nudibranchs at Chocolate Island





Malapascua



TOP LEFT TO RIGHT: Spotfin lionfish, tigertail seahorses and big-fin reef squid at Lighthouse Reef; Banded pipefish (left)



barely 10cm tall, they look enormous compared to the 6mm Denise's pygmy seahorses that I photographed earlier in the week.

Nearby, a sinister looking spiny devilfish, claws its way across

a sand patch to a coral head inhabited by three different species of lionfish and two blue-ringed octopuses. Above the reef a male bigfin reef squid flashes orange then blue and purple.

There is clearly too much going on here for me to absorb in just one dive so I add Lighthouse Reef to the rapidly expanding list of sites that I need to revisit.

Super-typhoon Haiyan

By the end of the week my must-dive-again list includes virtually every site that we've been to. I clearly have to come back, but shortly after I get home, the headlines are filled with stories about super-typhoon Haiyan.

From the aerial images, it looks as though Cebu Island has been flattened by a giant steamroller. The death toll is almost incomprehensible. For the next few days, I wait patiently for news from Malapascua. The island was directly in the path of the storm and I wonder if it has been wiped off the map forever.

Then the first reports finally

come in: most of the locals are safe and the resilient Malapascuans have begun to rebuild their homes. Amazingly, Tata and the other dive masters from TSD are already back in the water analyzing the effects of the enormous waves that accompanied the storm. Like many buildings on the island, their shop sustained some serious damage but not enough to keep them closed for very long.

Reports from underwater are just as promising. As sometimes happens after a big storm, a few things have been moved around, but right now the marine life close to shore is actually better than it was before Haiyan, and because of its depth, the thresher shark dive at Monad Shoal

was completely unaffected. So by the time I get back to Malapascua next year, it looks like I will be able to tick off all those must-

dive-again sites from my list and then hopefully add a few more. □

Andy Murch is a photojournalist and outspoken conservationist specializing in images of sharks and rays. Bigfishexpeditions.com



Spiny devilfish (above) and mandarinfish courting (left) at Lighthouse Reef