Author / speaker Rod McDonald launched his latest book about the Force Z wrecks at OZTek.2013 (lower left). John Garvin presented a "behind the curtains" story of James Cameron's successful "Deepsea Challenger" project (www.deepseachallenge.com). The filmmaker / explorer reached a depth of 10.9 km down in the Marianas Trench.(top right); A view of the 2013 OZTek Exhibtion (lower right)

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Tales of 'Daring Do'

— *And a Sobering Lesson from OZTek 2013*

Text by Rosemary E Lunn
Photos by Paul Morrall

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Although Facebook is a useful tool, it can never replace physical interaction with friends, colleagues and peers. Without a doubt there is a need for a regular gathering of the clans. Events like EUROTEK and OZTek serve a vital role drawing people in from all over the globe, bringing together briefly a good part of the technical diving village, and reinforcing the strong sense of community we share. We meet to discuss information, tell stories, share ideas, celebrate success, learn and laugh from our collective mistakes, and mingle with the top explorers, pioneers and exhibitors in our field.

Michael Menduno made a valid point when he suggested "these conferences may even be more important today when a preponderance of misinformation, in many cases perpetuated by self-proclaimed Internet experts (the online equivalent of TV's talking heads), seems to reign supreme."

OZTek.2013 dive conference and exhibition certainly successfully played its part by delivering accurate, relevant, educational and entertaining content. Over the course of two days (Saturday 16 and Sunday 17 March) over 50 talks were held at Sydney's Australian Technology Park, with delegates sorely tempted by four halls of concurrent talks—talks that covered so many aspects of diving, from technique, such as *Stick maps to virtual cave diving: Instruments and techniques for constructing maps, 3D images and even virtual cave models* by John Dalla-Zuanna, to exploration, such as *Bermuda's Deep Water Caves* in which Professor Tom Iliffe talked about how this project is employing sonar, ROV's and CCR divers to explore and document the island's extensive network of underwater passageways.

Safety was reviewed, as in *CCR Bailout: How much?* in which Ben Reymenants took a fresh look at every CCR diver's worst scenario. Is the current thinking of bailout gas volumes realistic, conservative or otherwise?

To getting au fait with the latest technology, as in *Mastering the Light* in which Kevin Deacon discussed a new genre—images shot using black light equipment.

With some amusing anecdotes along the way: *Carry on diving: The lighter side of diving*, with Martin Robson's entertaining view of the minor hiccups and diplomatic incidents that can only happen on a dive trip.

Dive safety and rescue

For once I got to sit and enjoy some of the talks. (When you are organising an event, you rarely get to enjoy this privilege). The talk at the very top of my personal wish list was *Rescue of an unconscious diver from depth: The new UHMS Diving Committee guidelines, their findings, and the arguments supporting them*, delivered by Associate Professor Simon J Mitchell.

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The UHMS—Undersea and Hyperbaric Medical Society at www.uhms.org—is an incredible source of information for diving and hyperbaric medicine physiology worldwide. Approximately three years ago, a number of members of the UHMS Diving Committee (Simon Mitchell, Mike Bennett, Nick Bird, David Doolette, Gene Hobbs, Ed Kay, Tom Neuman, Richard Vann, Richard Walker and Alan Wyatt) came together to discuss questions posed by the AAUS (American Academy of Underwater Science) and PADI. (PADI was revising its Rescue Diver manual at this point.)

There had also been much discussion by armchair forum divers on 'the question'. The great question posed—and no, it was not "what is the meaning of life, the universe and everything?"—was

Paul Haynes discussing 'Project Reclaim'

"what are the recommendations for rescuing a submerged unresponsive compressed gas diver?"

The team started looking into this and found that it was hard to find anything written in diving literature on rescuing an unconscious diver. A project was set up to develop definite guidelines, and three years later a paper was published.

Simon Mitchell's presentation (and the paper) covered a number of questions:

- If the regulator is out of the mouth, should it be replaced?
- If the diver is in the tonic (rigid) or clonic (grand mal) phase of a seizure, should the ascent be delayed until the clonic phase has passed?
- Are there any special considerations for rescuing CCR divers?
- What is a 'safe' ascent rate?
- If the rescuer has a decompression obligation, should they take the victim to the surface?
- If the regulator is in the mouth and the victim is breathing and has decompression obligations, does this change the ascent?
- Is it necessary to hold the victim's head in a particular position?
- Is it necessary to press on the victim's chest to ensure exhalation?
- Once you reach the surface, is it possible to assess breathing in the water?
- Can effective rescue breaths be delivered in the water?
- What is the likelihood of persistent circulation after respiratory arrest?
- Does the recent advocacy for 'compression-only resuscitation' suggest that in-water rescue breaths should not be administered to a non-breathing diver?
- What (if any) rules should guide the relative priority of in-water rescue breaths over accessing surface support where definitive CPR can be started?

Normally we (every day recreational and technical divers) would not get access to this paper for a few years, until it was made available to the Rubicon Foundation (www.rubicon-foundation.org). However, the UHMS has kindly given The Dive Forum (www.thediveforum.com) permission to upload the paper on their forum.

It should only be printed once you have downloaded it. This is because the UHMS wants to track the downloads of this paper, so please send everyone to this link: http://www.thediveforum.com/incidents-safety-information/1329-uhms-39-paper-unconscious-diver-recovery.html (You will need to register on The Dive Forum before you can download the paper.)

Once you have downloaded the paper, you will find a very useful flow diagram on page eight. It is a summary of the important recommendations and decision-making processes in the rescue of an unresponsive diver from depth. The authors have stated this chart should be considered along with the relevant comments made in the related sections of the paper.

This flow diagram was created so that it could be printed out and pinned to every diving club or dive centre notice board, laminated and put in with their first aid and oxygen kits, and included in every emergency action plan. It is an exceptionally useful rescue resource for all divers.

An excited OZTek audience waiting in anticipation to hear Simon Mitchell begin his presentation.

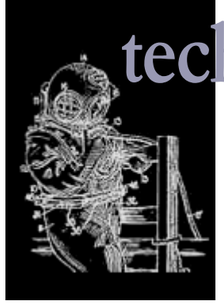
Safe exploration

Another presentation came from another diving doctor—this time Dr Richard 'Harry' Harris. Having briefly observed Harry Harris in action at Rebreather Forum 3, I was curious see more. He teamed up with fellow Wet Mule team member Craig Challen for a talk on extreme exploration entitled, *Beyond 200 metres*. The Wet Mules discussed the factors limiting safe exploration at these depths based on their experiences diving New Zealand's Pearse Resurgence.

The Pearse River Resurgence is located at the northern end of New Zealand's South Island, near Mount Arthur. It is Australasia's deepest underwater cave with 'summer' water temperatures of less than 7°C. Exploration has been going on here for a number of years, with various teams of experienced cave divers coming together to progress the cave at regular intervals. Back in 2007, a major leap forward was achieved by David Apperley and Rick Stanton MBE.

Over the years, expeditions had repeatedly pushed this cave system, and in 2011 during a nine hour dive, Craig Challen set a new record depth of 194 metres, with the cave continuing to 'go'. A year later, the Wet Mules team again comprising David Bardi, Craig Challen, John Dalla-Zuanna, Harry Harris, Ken Smith and Sandy Varin returned, armed with two objectives. They wanted to see if Pearse was connected with nearby Nettlebed Cave. With the assistance of Nelson's Speleological Group, dye tracing from the Spillway in Netttlebed confirmed a deep connection at >120 metres.

Another view over the OZTek exhibition



Attention then focused on pushing the cave once again. Four habitats were installed at 7, 16, 28 and 38 metres, gas was staged and build up dives commenced. Dave Bardi and Sandy Varin dived to 180 metres followed by seven hours in-water deco.

Richard Taylor received an OZTek Industry Recognition Award from AUP's Tony Davis

The next day, Harry Harris tied off to the end of Craig Challen's 2011 line in 194 metres, and proceeded to lay a further 70 metres of line in large passageway, tying off at 207 metres. He had a total run time of 10.5 hours in-water, in reasonable comfort, thanks to the habitats and surface supplied suit-heating systems.

Weather stopped play, with the final push dive being done by Craig Challen two days later. He tied off to the end of Harry Harris' line and scootered on a short distance only to discover another steep descent. Craig Challen made the final tie off at 221 metres and returned to the surface. His total runtime was 17 hours.

Jayne Jenkins, OWUSS Rolex Australasian Vice President, received an OZTek Industry Recognition Award

The passage way continues to go, and the technology is capable of going deeper. The obstacle to on-going exploration is human physiological limits.

Two short videos were played of the lines being tied off at depth—one of Harry Harris' dive, the other was Craig Challen's. What struck me was the soundtrack of the video, because of the grunting and coughing. These noises may not sound much to you, but it indicated a real and significant threat to both divers.

We are right on the edge of human physiology when we technical dive to these kinds of depths. (220 metres = 23 bar of pressure). Whilst the technology still functions, the body does not. Extreme pressure causes respiratory complications—in a nutshell, the gas is so dense that the body perceives it as an issue when breathing, and therefore starts coughing to deal with the problem. It can tragically lead to an inability to match ventilation with the demands of physical work at great depth - see reference 1 in footnote.

I sat there drinking in the tantalising crystal clear deep-water footage Craig Challen and Harry Harris had shot, showing a cave continuing to go, with my heart noticeably thudding. I have nothing but admiration for the Wet Mules; they quietly get on with remote exploration. To push the cave depth by another 27 metres is a significant achievement at these depths. However, I personally hope that this extreme project is put on hold until technology is able to catch up and support the body far more effectively and efficiently.

Gala hosts Michael Menduno and David Strike

REF. 1): MITCHELL SJ, CRONJE FJ, MEINTJES WAJ, BRITZ HC. FATAL RESPIRATORY FAILURE DURING A 'TECHNICAL' REBREATHER DIVE AT EXTREME PRESSURE. AVIATION, SPACE AND ENVIRONMENTAL MEDICINE 2007; VOLUME NUMBER (78) 2

Daring do

Time for a change of tempo and location. Enter stage left OZTek Speaker Paul Haynes. His delicious rip roaring yarn of 'daring do' had me giggling in my seat. It was entitled, *Operation Reclaim: The gripping story of the race by a combined British civilian and military expedition to recover the ship's bell from HMS Prince of Wales.*

Scuba Industry stalwart (and previous OZTek award winner) Terry Cummins, presented explorer Jill Heinerth with the OZTEk Media Award for her sustained work on 'We Are Water'

Simon Mitchell presented Pete Mesley with the OZTek Outstanding Achievement Award for "exceptional contributions to the growth and development of technical diving"

Very briefly in the early 2000s, during a British expedition to the Force Z wrecks, diver Gavin Haywood chanced upon *HMS Prince of Wales* ship's bell. It was protruding from the sand beneath the starboard gunwale at the forward end of the wreck. Haywood was instantly faced with a moral dilemma. He knew he was diving a protected site—'look, no touch'. However, the bell was in a visible place, and the wreck would inevitably be visited by divers who do not always respect British laws. What to do?

Haywood left the bell on the seabed, surfaced and rang the Receiver of Wreck (the U.K. Government Agency that overseas U.K. shipwrecks by satellite phone). Their reaction? The bell should remain with the ship.

Then the word went around that good money could be made for recovering the bell. A non-British private collector wanted it in his board room. The Ministry of Defense realised that this historical bell was in imminent danger of being claimed as 'a trophy'.

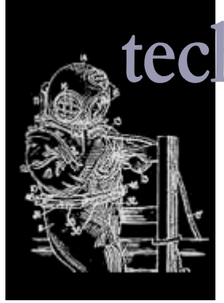
An urgent case for salvage was made by Lord Clifford, the Chair of the Force Z Survivors Association, who requested full U.K. Government support should be given to a U.K. civilian dive team preparing to recover and return the bell to the Royal Navy. This support turned into a full-scale military operation, following an initial conversation with the U.K. civilian dive team, that included Paul Haynes.

Haynes' story could have been taken straight out of any *Boys Own Manual*. It had everything in it. The danger, the toys, the failure, the boys, and the ticking clock. In cinematic terms think *Where Eagles Dare* meets Michael Caine's *Italian Job* featuring James Bond 007. I was enraptured. If you ever get the chance to listen to Haynes regale this story in the future, grab it for the sheer irreverent giggle factor of hearing how the bell came home in time for tea and medals.

Pioneering shark expert, photographer and cinematographer, Valerie Taylor received a standing ovation when she was given the OZTek Lifetime Achievement Award by Jayne Jenkins

Happiness to heartbreak

For me, one of the most significant moments of the conference was a rebreather accident analy-



Brian Kakuk waxing lyrical about scientifically significant underwater Bahamian caves.

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sis session. Billed as *Oxygen cell failure in rebreathers: Critical safety lessons from relevant cases*, this was a very rare and exceptional presentation and a key teaching moment for the 200 odd delegates crammed into the room. Thanks to the kind permission of the coroners, police and the families, two recent rebreather deaths were broadly analysed to help prevent future deaths.

The packed, standing-room-only audience listened to Drs Mitchell and Fock, as they lead a discussion on the fatalities, with supporting comments from rEvo CEO Paul Raymaekers. Data from both final dives was available because of the on-board Ambient Pressure Diving recorder, or black box.

It should be noted that the official cause of both deaths was not known at the time of this presentation, though a potential contributing factor in both fatalities appears to be a double O_2 sensor failure. Most rebreathers use three sensors and a voting logic algorithm. Both divers had sensors more than two years old in their units.

The session began with a very strong statement from Fock requesting that attendees do not post he-said/she-said facilitator opinions, as the coroner had not yet ruled on at least one incident, adding that there was "already too much misinformation online". Fock then dived into a presentation of the circumstances of both accidents.

The handset data of both dives was shown and evaluated, and the hushed audience was able to observe the PP02 readouts for all three cells throughout the dive. It was also noted that the divers had suppressed alarms given by the unit.

The doctors then asked the audience to consider what decision they personally would have made if they had seen the same data on a dive, and take time to step back and reflect on this. Fock and Mitchell neutrally observed that these divers believed at the time, that they were making reasonable and rational decisions both pre- and during the dives, even though they would probably agree that these decisions do not stand up well in the harsh cold light of day.

All too often we as divers discount such analysis when we are safely seated in our warm armchairs, because we feel that we would not make the same decisions. Yet, here are two divers, in quick succession, who have done exactly the same thing.

It was a sobering session, and we left the room older, wiser divers appreciating that data from accidents is not typically forthcoming, or even made available to the general diving community, because of litigious factors. Both cases and conclusions are currently being written up for publication, after the coroner's determination is released.

So what was the take home message from this talk? Be prepared to recognise, diagnose and deal with double sensor failures, because they WILL OCCUR with existing sensor technology.

The manufacturers present at this talk (APD, VR, Innerspace Systems, rEvo) recommended not using sensors older than 18 months because they are prone to failure. One advocated way of dealing with sensor replacement, which was promulgated at the session, is to replace your sensors one at a time in six-month intervals (to maximize the probability of independence between sensors).

My personal suggestion? We are all busy people with many good intentions. Give your rebreather manufac-

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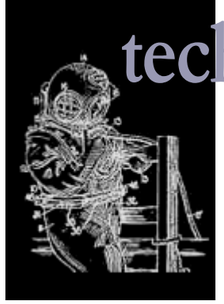
It seemed fitting that Liam Allen received the OZTek Technical Diver of the Year Award from the EUROTEK Technical Diver of the Year, Richard Lundgren



It was a bittersweet conference. Event organiser David Strike announced that he was retiring and this would be his last OZTek

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turer your credit card details, and ask them to automatically dispatch a new cell to you every six months.

As an aside, last year an international safety meeting was held about rebreathers called Rebreather Forum 3. A number of the presentations are now available online for free for you to download. Follow this link—www.rf30.org/presentation—and you will find a talk by Dr Arne Sieber on *O_2 Sensor Technology for Rebreathers*, Kevin Gurr on *Knowing Your Limits: CO_2 Sensors*, and Nigel Jones on *Redundant Oxygen Sensors: Theory and Heresy*. Click on 'Video Link' and you will hear the talk illustrated by supporting slides. In addition, there is also a PDF download available for both Arne's and Kevin's talks. Please pass this website onto anyone you know who is interested in or dives a rebreather.

Moving forward

There are times when I wish I could be cloned. During the run up to EUROTEK would be a good time to have 'extra Roz hands'. At OZTek my clone could have sat in on other presentations I wanted to watch. It didn't help the suffering much either when I caught up with delegates who had seen my second choice talks, because they raved about what a riveting presentation I had missed. As is always the case, I didn't get to hear everything, but I was certainly spoilt for choice thanks to OZTek organiser David Strike.

So I had been educated, inspired, and seen all the latest new toys in the exhibition. The only thing left was to celebrate success at the OZTek Gala Awards Dinner. This is held on Sunday night, at the conclusion of the conference at a wow of a venue in Cockle Bay Wharf. (Unfortunately, there is no way that Broad Street on a wet Sunday night in Birmingham could ever compete with Darling Harbour.) We enjoyed the view over pre-dinner drinks in the balmy dusk, whilst catching up with friends.

It was clear to everyone present that David Strike and Michael Menduno gleefully enjoyed being the joint Master of Ceremonies for the OZTek 2013 Awards. The evening was a very happy one, with much playful banter and laughter from the audience and those present on the stage.

The OZTek Award Winners were Liam Allen (Diver of the Conference), Jill Heinerth (Media Award), Jayne Jenkins (Industry Recognition Award), Pete Mesley (Industry Recognition Award), Liz Rogers (Image Award), Richard Taylor (Industry Recognition Award) and Valerie Taylor (Lifetime Achievement Award).

There was however a bittersweet moment, because it was the night that Strike announced his retirement from organising OZTek. Whilst most people can take a good guess at just how much work goes into making the magic happen, they never really see the whole of the trick. To consistently pull off a successful conference through these harsh economic times certainly does take experienced wizardry. No wonder Menduno presented Strike 'The Wizard of OZTek' Award.

I sincerely look forward to seeing OZTek continue to flourish in the future, whilst wishing David and Sylvia Strike a very happy retirement, and many thanks for all they have done to serve the recreational and technical diving industry. ■

The author acknowledges and wishes to thank Graeme Gourlay and Michael Menduno for their assistance with this article.

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The OZTek.2013 Speakers and MC's

'YankTek ahead'

TEKDiveUSA.2014

TEKDiveUSA LLC is excited to announce that they have retained The Underwater Marketing Company to help organise and promote TEKDiveUSA, a two-day advanced and technical diving conference and specialist exhibition, similar in approach to both EUROTEK and OZTek.

Randy Thornton, CEO of TEKDiveUSA LLC stated, "We decided to launch TEKDiveUSA after being inspired by some great experiences we've had at other events around the world. And after seeing just how popular Rebreather Forum 3 was last year, it seemed the obvious next step to take. It has been many years since we have had a technical diving conference in this country and it felt like the right time for the USA to have it's own home grown event.

"The prime focus of TEKDiveUSA is to educate and entertain. We want to help further the educational aspects of advanced and technical diving, while giving people who are out there doing exciting projects, a platform to share their story with others. This is the perfect opportunity to get the entire technical community engaged—regardless of agency affiliation or philosophy—together as one unified group. It will be great to see everyone sharing experiences, and be motivated by, and from each other. It's truly going to be an inspirational diving conference."

Randy Thornton

Rosemary E Lunn, Business Development Director of The Underwater Marketing Company stated, "I am delighted to say we have already got a number of top drawer speakers on board. Associate Professor Simon J Mitchell, (Head of Anaesthesiology at the University of Auckland), Richard Lundgren, (deep wreck explorer), The Phantom Cave Team and Dr Neal W Pollock (Research Director at DAN) have already said, 'Yes we'd love to come and talk, Roz.'

"We are currently drafting a really interesting lecture schedule covering everything from physiology, cave diving, imaging and wreck diving, through to equipment, rebreathers, safety and techniques.

"TEKDiveUSA will be held on Saturday 17 and Sunday 18 May 2014 in Florida, so scribble the date down and reserve that weekend now. We will be announcing the venue, website, sponsors and exhibitor details soon. However, we can confirm that TEKDiveUSA will be held every two years, and we will be considering a west coast venue for TEKDiveUSA.2016.

"One of the things I love about these big international advanced and technical diving conferences is the camaraderie, quality face time and exposure that you get with leading pioneers and explorers. It is a bit like being back stage at a top rock concert when you bump into the likes of Bill Stone, Richard Pyle, Rick Stanton or Evan Kovacs. The really cool thing is that because we are all divers, we love talking about diving and everyone is very friendly. I've seen delegates have some really in-depth conversations with the speakers on the stairs, at the bar or over breakfast."

Even though this conference is called TEKDiveUSA, it is not going to be America-centric.

JASON BROWN - BARDO CREATIVE

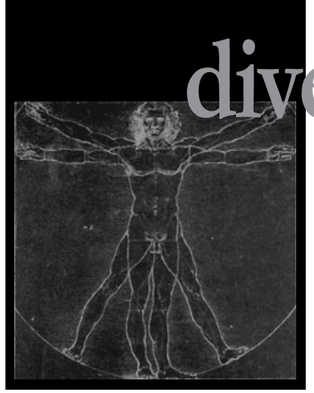
Associate Professor Simon J Mitchell, Head of Anaesthesiology at the University of Auckland

"We have been involved with diver education for many years. It is the foundation of everything we do," observed Randy Thornton. "By learning about our craft, we are able to push boundaries of exploration further in the safest manner possible. I look forward to opening the door and giving new divers who are curious about advanced and technical diving, a peek at this genre. You certainly don't need to be a hard core tekkie to come to TEKDiveUSA, just someone who wants to get more out of their personal diving.

"Even though this conference is called TEKDiveUSA, it is not going to be America-centric. We consider this to be an international event. After all, when you look at the major exploration teams around the world, they are comprised of people from many countries. Since we belong to a global community, we are confident the international diving community will feel most welcome! So please join us on Saturday 17 and Sunday 18 May 2014 in Florida for TEKDiveUSA." ■

JASON BROWN - BARDO CREATIVE

Rosemary 'Roz' E Lunn,



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

Fitness Programs *For Divers*

PETER SYMES

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

Fitness for diving is not one-size-fits-all. Just as important as the proper fit for a wetsuit, BC, fins and mask, it is essential for divers to find the best combination of exercise for good health, diving performance and other personal fitness goals.

The ideal fitness for diving program addresses the health of the individual diver, reduces the risks on human physiology associated with the stresses of the underwater environment, develops the strength, stamina and coordination for handling gear and improves performance for diving. All of this can *only* be accomplished with a balanced exercise program that incorporates aerobic exercise, good nutrition, strength training and flexibility.

Exercise is preparation for diving. Pushing the body through training adaptions of physical exertion to improve stamina, strength and endurance exceeding the physical demands of diving does not always feel good. But workouts on dry land are necessary so that divers can feel comfortable in the water.

Diving is *not* a workout, nor should divers think of it as such. If diving feels difficult for any reason in any condition, the diver needs to improve their fitness level. Further, the consensus among medical dive professionals is that the weight loss sometimes experienced when diving is not permanent weight loss, and the increased hunger following diving activities is typically not the result of a profound caloric expenditure because of diving.

Exercise can feel natural and be fun. While training is key for optimum performance, genetics also plays a role in predisposing divers to be 'good at' various physical activities. Participating in fitness activities in which the individual diver excels will bring greater success and enjoyment.

A wide range of fun and socially supportive group exercise classes such as Zumba, water aerobics, belly dancing and kick boxing are available to divers. Training with a partner or dive buddy is also a great way to stay motivated.

If fun equates to competitive sports, remember that divers who are athletes may need to change their exercise routine in preparation for diving. This can translate into adding weeks to a pre-competition training schedule but can be as simple as cross training.

Exercise methods and results may be different for men and women. Depending on individual goals and fitness level, women seem to benefit more from moderate exercise sessions every day, while men can produce results with high intensity and perhaps shorter duration workouts a few days each week.

CRITERIA FOR FITNESS FOR DIVING
Develops and maintains:
1. Cardio-respiratory fitness
2. Healthy body weight
3. Overall strength and endurance
4. Flexibility and range of motion

Exercise has some risk. Like any form of physical activity exercise, if not properly performed, may result in injury. Fortunately, the benefits of traditional exercise outweigh the risk.

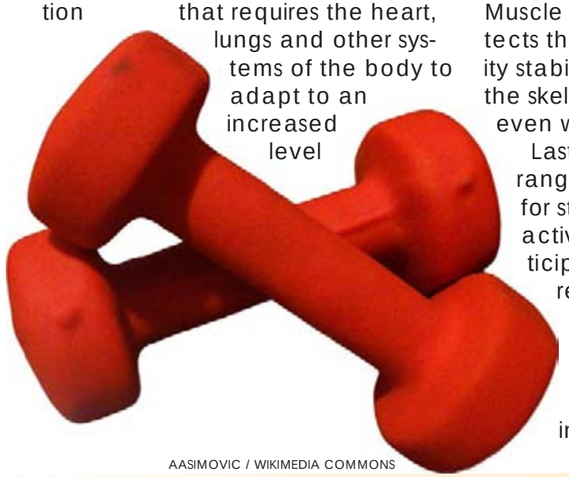
Some exercise programs are higher risk than others. The health and fitness of the individual diver is significant when selecting an exercise program. The type and intensity of exercise must be appropriate to the individual diver.

Remember: Exercise is not recommended for 24 hours before or after diving activity.

Criteria of fitness for diving

The greatest positive impact of exercise for divers begins with activities that maintain good health and reduce the risks associated with the underwater environment. This is best achieved by improving cardio-respiratory fitness (fitness of the heart and lungs) with aerobic exercise.

Aerobic exercise is performed by moving the large muscles of the body repeatedly and for a duration that requires the heart, lungs and other systems of the body to adapt to an increased level of functioning beyond that required of the body at rest and to prepare for a particular increased level of physical activity.



AASIMOVIC / WIKIMEDIA COMMONS

The next priority is maintaining a healthy body weight, which is primary in reducing the risks associated with poor health and diving. Being fit may include some aspect of weight loss. Weight loss done well always incorporates a balanced program of aerobic exercise, resistance training and just the right amount and type of nutrition.

Also important is overall body strength and increased levels of physical endurance. Placing demands on the body with resistance training maintains, prevents loss and/or adds muscle.

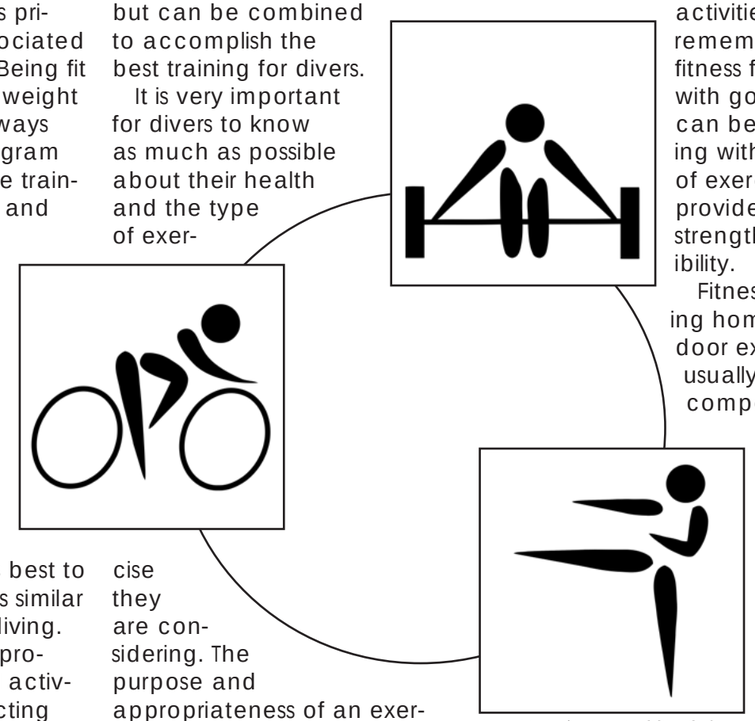
Resistance training comes in many forms both static and dynamic including variations of weight lifting and body weight movements. It is best to train muscles with movements similar to the way they are used in diving. Muscle moves, supports and protects the body throughout all activity stabilizing joints and protecting the skeleton. Muscle burns calories even when the body is resting.

Last but not least, flexibility and range of motion are important for strength when performing activities of daily living and participating in fitness, athletics and recreational activities such as diving. Flexibility and range of motion are maintained with stretching exercises and by strength training muscles in proper balance.

Exercise combinations

Divers will find a wide variety of exercise activities to choose from. Most of these activities singularly do not meet the criteria for fitness for diving but can be combined to accomplish the best training for divers.

It is very important for divers to know as much as possible about their health and the type of exercise they are considering. The purpose and appropriateness of an exercise program is defined by the needs, preferences, goals and best interests of the individual diver.



PARUTAKUPIU / WIKIMEDIA COMMONS

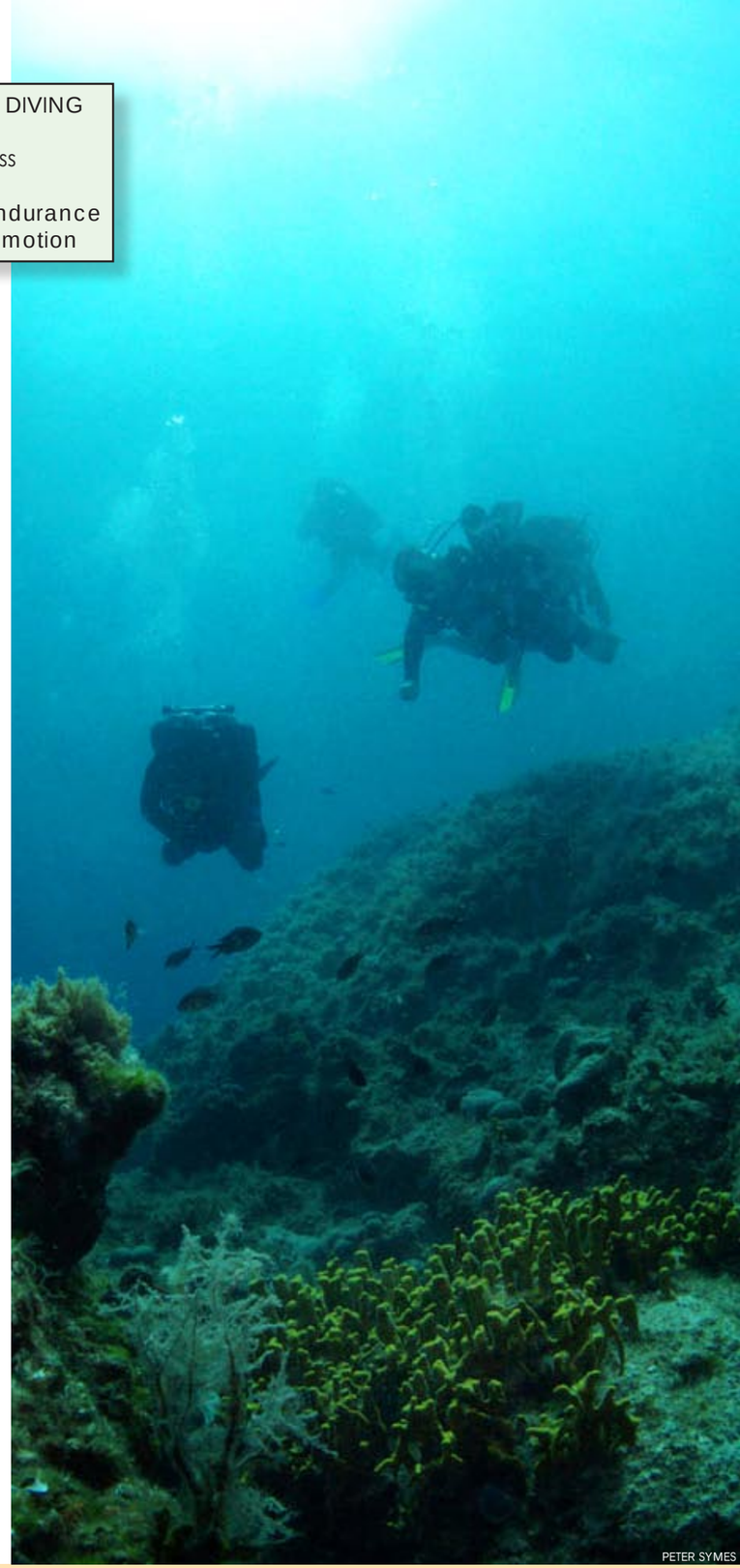
Divers may encounter both dive and fitness professionals who sell themselves as the one-and-only-best instructor or recommend a specific exercise method as the 'answer for everything'. This be-all-and-end-all approach is a red flag. There are a number of successful ways to learn to dive, many forms of exercise to choose from, and numerous qualified instructors that can contribute to the skill, safety, health and fitness of the individual diver.

When divers are researching and selecting diving and exercise activities it is important to remember the criteria for fitness for diving. Along with good nutrition, divers can best prepare for diving with a combination of exercise methods that provide aerobic exercise, strength training and flexibility.

Fitness facilities (including home gyms and outdoor exercise circuits) usually offer all of the components of fitness for diving under one roof (or sky). A diver can participate in aerobic dance classes and indoor cycling sessions, utilize cardio machines including treadmills, bikes, rowers, and ellipticals, develop strength with free weights, benches, cables and resistance equipment, and if they wish, benefit from the supervision of both exercise and nutrition professionals.

For divers wishing to exercise outdoors, there are endless options from hiking to road cycling, swimming, running, walking, stroller strides, and boot camp style programs in parks and on beaches.

While traditional exercise pro-



PETER SYMES

PETER SYMES

grams are deemed the safest and remain the mainstay of a sound fitness for diving plan, other physical activities in which divers are known to participate include yoga, crossfit and kettlebells. Each of these interests must be combined with other forms of exercise for a balanced and safe exercise program and to meet the criteria for fitness for diving.

Yoga with its various body postures primarily meets the criteria of stretching for diving. Yoga does not replace cardio exercise or strength training for diving and (along with good nutrition) must be supplemented with both. The practice of yoga includes breathing techniques and spiritual meditation based in ancient Indian philosophy.

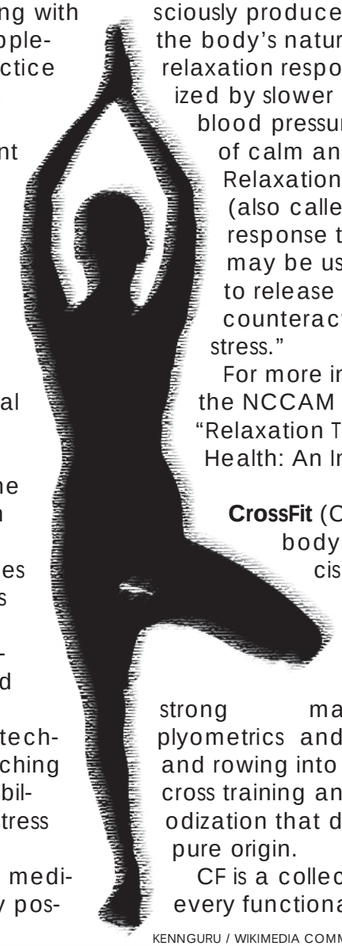
Research on the benefits and risks associated with yoga vary widely because of the many forms, teaching styles and intensities of yoga. A good source for the science of yoga is the National Center of Complementary and Alternative Medicine (NCCAM), an agency of the National Institutes of Health (NIH).

The NCCAM also describes other relaxation techniques such as "progressive relaxation, guided imagery, biofeedback, self-hypnosis and deep breathing exercises". Divers can combine these techniques with traditional stretching exercises for improved flexibility, breathing control and stress reduction.

Other options for spiritual meditation, breathing and body postures that improve flexibility include those body postures described for praise and worship in the Bible and Tai Chi. Tai Chi originated in China as a martial art with focus on body awareness and breathing and is described as moving meditation.

According to NCCAM, "The goal is similar in all: to consciously produce the body's natural relaxation response, characterized by slower breathing, lower blood pressure, and a feeling of calm and well-being. Relaxation techniques (also called relaxation response techniques) may be used by some to release tension and to counteract the ill effects of stress."

For more information see the NCCAM fact sheets on "Relaxation Techniques for Health: An Introduction".



KENNGURU / WIKIMEDIA COMMONS

CrossFit (CF) combines body weight exercises, gymnastics, Olympic weightlifting, calisthenics, power lifting, strong man movements, plyometrics and some running and rowing into a hybrid of cross training and a form of periodization that deviates from its pure origin.

CF is a collection of nearly every functional exercise in the fitness portfolio combined with bursts of high intensity, momentum and varying duration. The fitness achieved with CF happens the same way it does with any of its individual components if they were performed at the same fast pace and high intensity. Divers who participate in CF may or may not be in better physical condition than divers who participate in more conservative forms of exercise.

The 70% and 80% training heart rates are the most effective in preparing the body for diving. Typically, CF works the individual above these heart rate ranges, and the body begins to adapt to the exercise method itself. Depending on the selected activities, the short 20-minute brackets of exercise utilized by CF may not produce the same results as aerobic exercise maintained for a sufficient length of time to complete all of the adaptations of the body to prepare for diving.

The weight loss from CF has to do with energy expenditure. Generally speaking, the harder an individual exercises (at any form of exercise) the more calories burned and the likelihood that more fat is burned. However, ideally fat reduction is accomplished with aerobic exercise as oxygen is necessary to metabolize fat as fuel. Intense exercise can become anaerobic (lack of oxygen) and therefore not as efficient for fat loss.

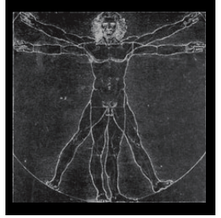
Research discounting CF is abundant, while research supporting CF is limited. Some units of the U.S. Army embraced CF for military preparedness, while the U.S. Navy Center for Personal and Professional Development advised caution because of the high incidence and severity of injuries with CF. The Navy also stating CF is not in line with their 'core values' because of the exercises named after women.

While some say CF changes lives, i.e. helping participants go from being unfit to healthy, CF crosses all boundaries of proper form and safe use of equipment. For most, it is considered too high risk versus the benefits of exercise.

Fitness professionals have known long before CF came along that

Crewmembers at sea aboard *USS Nimitz* doing calisthenics inside hangar bay

U.S. NAVY PHOTO BY PHOTOGRAPHER'S MATE 3RD CLASS ELIZABETH THOMPSON



exercise improves health. The results achieved with CF can be achieved with a wide variety of proven exercise methods including sophisticated applications of periodization and cross training in a more efficient and safe manner.

CF participants are more likely to have sustained serious injury to internal organs, life threatening break down of muscle fibers—called Exertional Rhabdomyolysis (ER)—and injury to joints.

ER can be experienced when participants are not well adapted to a fitness activity, from military type training or long-distance events such as marathons. Some individuals are more susceptible to ER than others.

Instructors must know their client well. Divers who choose CF are best served by instructors with a broad fitness education over and above a CF certification. That being said, some divers love CF and participate regularly without injury.

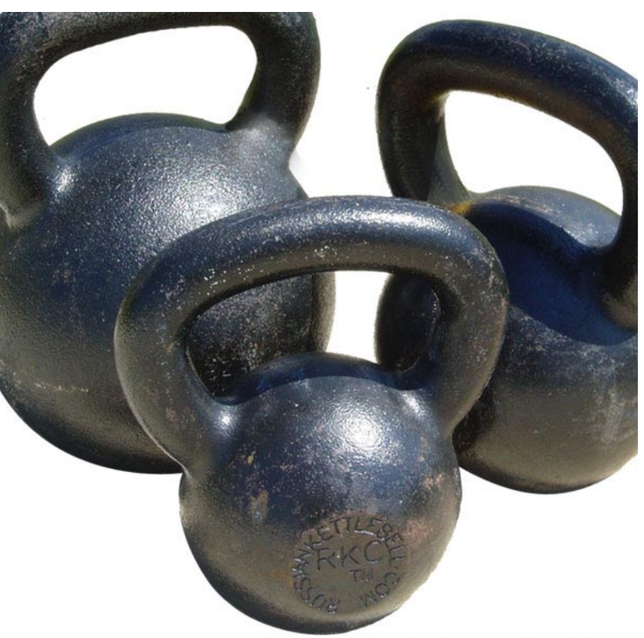
Kettlebells (KB) Although KB have been around as long as dumbbells, they seem to be growing in popularity. Recent studies reported in the *Strength and Conditioning Research Journal* sought to "determine whether performing continuous two-handed KB swings would create an energy cost capable of improving cardiorespiratory fitness" and the "effects of weightlifting vs. kettlebell training on vertical jump, strength and body composition".

The studies revealed that the KB workouts show some cardio, strength and weight loss benefits. Yet, the treadmill and traditional weightlifting produced a slightly lower heart rate (more conducive to training for diving), "significantly higher oxygen consumption and calorie expenditure" and "significantly greater strength and performance gains".

The first and only biomechanical study assessed spinal loading during various KB exercises. "The KB swing (regardless of style of swing or snatch) appears to create a hip-hinge squat movement pattern together with patterns of rapid muscle activation-relaxation cycles that elicit considerable magnitudes of load on the spine," stated researchers. "This type of exercise results in unique compression and shear load ratios in the lumbar spine which may explain why it causes discomfort in the lower backs of people who otherwise tolerate very heavy loads."

As with yoga and CF, KB needs to be supplemented with one or more of the exercise criteria for diving. Aerobic exercise in the heart rate training zones recommended for divers and good nutrition should be added to all three of these activities.

Yoga also needs to be supplemented with strength training. CF and KB provide strength training, but also need flexibility to create a balanced exercise program for diving. Further, CF and KB are typically forms of strength training with higher risk of injury than traditional resistance training and according to research may not produce better results.



GIRYAGIRL / WIKIMEDIA COMMONS

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Exercise programming for diving is as unique as the individual diver. The health profile of the diving community, an understanding of the stresses of the underwater environment on human physiology, and sound research provide divers with a great deal of information. Using this information, divers can participate in a wide variety of safe, fun and effective forms of exercise to become and stay fit for diving.

Just as each piece of dive gear has its purpose and must fit properly for successful and enjoyable diving, each component of a balanced exercise program is essential for fitness for diving, and the type of exercise performed must be a good fit for each individual diver. ■

Gretchen M. Ashton is registered with the National Board of Fitness Examiners. An advanced diver, International Sports Sciences Association Elite Trainer, and world champion athlete, Ashton developed the ScubaFit® program and the comprehensive FitDiver® program, which includes the first mobile app for scuba diver fitness. Ashton is the co-author of the PADI ScubaFit Diver Distinctive Specialty course. For more information, visit: ***Scubafit.com***

marine mammals

Edited by Kelly LaClaire

Baleen filters differently that previously supposed

U.S. scientist Professor Alexander Werth recently published a study in the *Journal of Experimental Biology* investigating how bowhead and humpback whales capture prey using baleen.

He found that, in flowing water, the fringed edges of the baleen of filter-feeding whales actually tangle together to form a food-trapping net and do not remain motionless as previously thought.

"People presumed that baleen was simply a static material, but my work showed that it is a highly dynamic material whose porosity (empty space between the baleen) depends on the force and flow rate of the water moving through the whale's mouth," said Werth from Hampden-Sydney College, Virginia.

"When I began testing plates of baleen in my circulating flow tank, I found that the fringes moved dramatically and became tangled together."

To understand more about feeding behavior, the biologist studied the unique structure of baleen material. Whales have 300 baleen plates inside their mouths that are composed of keratin—the same protein that makes hair and fingernails in humans.

Werth placed sample plates from both bowhead and humpback whales in a purpose-built flow tank to test how they behaved in conditions similar to the wild, and despite their different feeding styles, he found that the bowheads' and humpbacks' baleens performed in almost identical ways.

His experiments revealed that both the flow speed of the water and angle of the baleen had a significant effect on their food trapping effectiveness. Further testing proved that, at the normal swimming rates of both types of whales, the fringe on a single plate swayed and tousled to catch prey as effectively as possible. But at faster speeds the hairs simply streamed through the water and filter efficiency was lost.

"When I did these experiments," Werth told BBC Nature, "I found that the multitude of fringes from all the plates got all tangled up and greatly decreased porosity (empty space), making it like a very finely meshed plankton net to catch very small planktonic creatures.

"This is an important finding because it shows how complicated the story of whale feeding truly is. There is so much that we have yet to learn about the biology of these huge creatures." ■ SOURCE: BBC

DAVID MONNIAUX / WIKIMEDIA COMMONS

Baleen plate

New study sheds light on pilot whale strandings, but questions still remain

It has been the prevailing theory among researchers that the mass strandings of pilot whales was linked to familial connections. Scientists believe that pilot whales (the most common species involved in large strandings) live in pods consisting of members who are all descendants of the same maternal ancestor.

For this reason, it was thought that if just one whale was to become beached due to sickness or disorientation, the extended family would rush to the aid and attempt to "save" the confused whale.

If this older hypothesis is correct, then all the whales involved in the beaching would have to be related.

New evidence presented by conservation geneticist Professor Scott Baker in the *Journal of Heredity* suggests this is not the case.

"It has been assumed that when you have a pod of 100 or 150 pilot whales strand that they were part of a single matrilineal social group and our results suggest that is not the case," said Baker.

Baker said mass strandings, which can involve more than 150 whales, are now assumed to be natural events and not always caused by human activity, such as sonar and ship noise—although these things are known to cause beaching from time to time.

"The mass stranding of pilot whales and probably sperm whales and some of the other species has been documented for hundreds of years all the way back to Aristotle," said Baker.

"In general, without human assistance, these large mass strandings are almost always fatal. The curious thing is whales appear to mass strand intentionally, and even after humans re-float them, they will often return to the beach."

Baker and his colleagues studied 490 pilot whales involved in 12 strandings around Tasmania and New Zealand. By analysing mitochondrial DNA, which is inherited through the maternal line, the researchers revealed the stranding groups were descended from more than one ancestral mother.

"You'd expect to have a cluster of individuals that were of close relatives supporting a central individual that might be the matriarch. We just didn't see that," said Baker. "Mothers and calves were very often widely separated on the beach," he added. "And in some cases we had dependent calves dead on the beach, and no mother that matched those calves dead on the beach."

According to the researchers, these findings do not call the theory that pods members come from the same maternal ancestor but it does suggest that unrelated groups of pilot whales are coming together at some stage, possibly to mate or feed.

Just why the whales beach themselves remains a mystery. "It is an enigma," said Baker. "This is the word we've decided best describes it." ■

SOURCE: ABC NEWS


BAHNFREND / WIKIMEDIA COMMONS

Stranded pilot whales


FILE PHOTO: ERIC CHENG

Pod of sperm whales

Sperm whales adopt deformed dolphin

Nature continues to surprise us, as does the propensity for animals to take in injured or lost members of another species.

Behavioral ecologists Alexander Wilson and Jens Krause of the Leibniz-Institute of Freshwater Ecology and Inland Fisheries in Berlin have discovered a group of the sperm whales in the Azores that seem to have taken in an adult bottlenose dolphin with a spinal malformation.

The researchers were 15 to 20 kilometers off the island of Pico in the Azores when they came upon a small group of sperm whales that included several calves and an adult male bottlenose dolphin with a mal-formed spine that twists into an "S" shape near its tail. Over the next eight days, they watched, as the dolphin swam with, rubbed and nuzzled the cetaceans. And surprisingly, the whales seemed fine with it; at times even reciprocated the dolphin's affections.

"It really looked like they had accepted the dolphin for whatever reason," said Wilson. "They were being very sociable."

Dolphins are usually the most social among the ocean-dwelling mammals, and they've been spotted foraging and interacting with a wide variety of other sea life, including many whales. On the other hand, sperm whales are shy deep-water hunters who travel great distances and have never been reported being so gregarious with another species.

The puzzle here is why these sperm whales have accepted the dolphin into their pod. "Sometimes some individuals can be picked on," Wilson said. "It might be that this individual dolphin didn't fit in, so to speak, with its original group." Another theory is that the spinal defect prohibited the mammal from staying with its pod.

The fact that large sperm whales swim far more slowly and always leave a member near the surface with the calves while other adults dive for food could be making it far easier for the dolphin to keep pace with them.

Very few predators can be found in Azorean waters, so the scientists doubt that it was using the whales for protection. It could be that the spinal malformation could have put the dolphin at a serious disadvantage among its own kind—possibly it had a very low social ranking and had been exiled.

Whatever the reason, the show of cross-species solidarity and acceptance is nothing short of remarkable. ■

SOURCE: SCIENCE NOW

Edited by
Kelly LaClaire

Best anti-whaling season yet for Sea Shepherd – Lawsuits still flying

The Sea Shepherd fleet came to port in Australia claiming its biggest victory of Japan to date.

Captain Peter Hammarstedt of the *Bob Barker*, one of the groups central vessels, said it had been the most successful and most dangerous campaign of the nine they have carried thus far, with Japanese whalers only able to haul in 75 animals—the lowest kill total ever. This is far short of their intended harvest of 1,000 minke and fin whales.

"It's been a long campaign. It's certainly been the most dangerous," he told the Melbourne press. "Never before have the Japanese whalers been as brazen, as reckless, as violent as they have been this year."

In addition, lawyers for the environmental group have started legal proceedings, claiming the Japanese fleet repeatedly rammed the anti-whaling boats during refueling operations.

Japan's Institute for Cetacean Research has responded with its own recriminations, saying Sea Shepherd was to blame for the collision and was deliberately targeting its vessel, the *Nisshin Maru*.

BIELLA "GABRIELLA" COLEMAN / WIKIMEDIA COMMONS

It is the second time Sea Shepherd has attempted to have Japanese whalers prosecuted. But a win in court will not be easy, especially after a recent defeat from the 9th U.S. Circuit Court of Appeals, who publicly denigrated Sea Shepherd founder Paul Watson for his group's militant like tactics in disrupting the annual Japanese whale hunt in the treacherous waters of Antarctica.

The court's leading judge said: "You don't need a peg leg or an eye patch. When you ram ships; hurl glass containers of acid; drag metal-reinforced ropes in the water to damage propellers and rudders; launch smoke bombs and flares with hooks; and point high-powered lasers at other ships, you are, without a doubt, a pirate, no matter how high-minded you believe your purpose to be."

But Watson seemed unconcerned and unphased by the ruling in a recent interview with Canadian news media. "Well, I might play the part of pirate for the media if that helps," Watson said. "Seriously though, come on, there is no parrot on my shoulder. No wooden leg. I have always acted for one reason and that is to protect whales from human predators like Japanese whalers.

"It does seem to raise the ire of some people," he continued. "Well, OK, lots of people actually, but what can I say—somebody has to act to stop the bloody whale slaughter." ■

SOURCE: BBC NEWS, ASIA ONE, C-NEWS CANADA

The members of the International Court of Justice

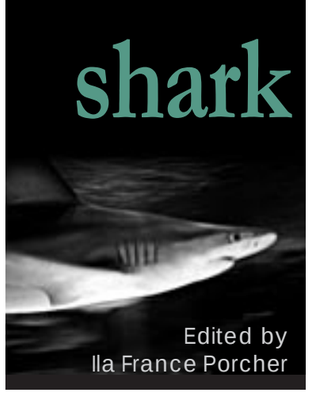
Australia takes Japan to court

Australia's case against Japanese Antarctic whaling to be heard at the International Court of Justice in the Hague.

Australia took Japan to court, alleging "Japan's continued pursuit" of a large-scale whaling hunt, which Japan calls scientific research, put the nation in breach of international conventions and its obligation to preserve marine mammals and their environment.

Japan's annual whale hunt has long drawn worldwide criticism, but Tokyo defends the practice saying that eating whale is a culinary tradition. Commercial whaling has been banned for 25 years, but Japan catches about 1,000 whales annually in what it terms a scientific research program.

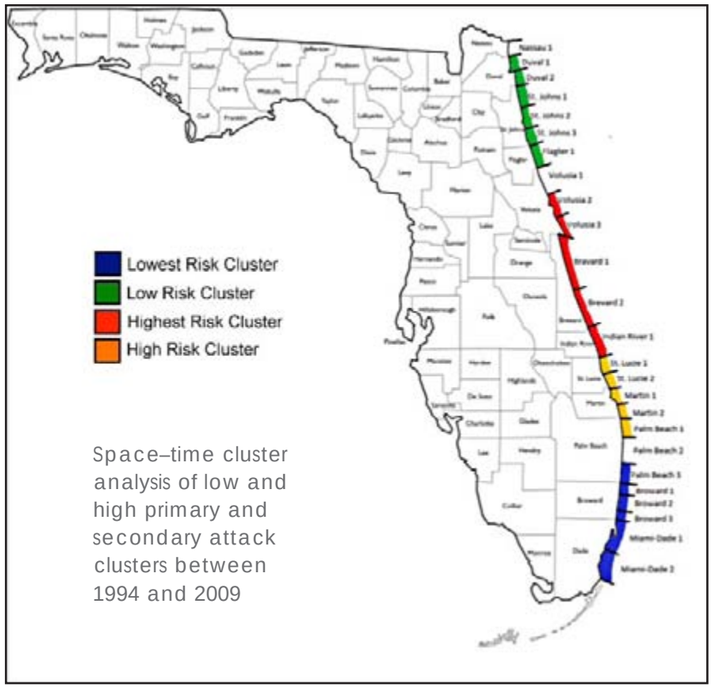
Australia, along with other critics, calls Japan's activities commercial whaling in another guise and has asked the U.N. court to halt a Japanese whale research program, which includes hunting in Antarctica using a special permit. ■



Where and why sharks attack

Text by Ila France Porcher

The reasons for shark attacks and the question of when and where they might occur has always been the subject of intense scientific interest in the effort to make seaside recreation as safe as possible.



Space–time cluster analysis of low and high primary and secondary attack clusters between 1994 and 2009

Now, Erich K. Ritter of the Shark Research Institute, and Raid Amin, Peter Kennedy, and Laura Cossette of the University of West Florida, have approached the problem in a new way and have discovered that there are definite high and low risk zones involved. They have localized several such areas along the coastlines of Florida and California, where more than two thirds of all shark attacks take place in the United States, examining the regions where attacks rarely happen as well as those already known to be dangerous. This has resulted in a more comprehensive understanding of shark attack patterns along these shores.

The researchers used data from the Shark Research Institutes's Global Shark Attack File and the records of attendance at beaches to determine the ratio of shark attacks to the number of people using the water. They used the modern cluster analysis software SaTScan™ to find the relative risk of being bitten by a shark, termed the "shark attack rate", which was not possible before this tool was available.

This new method revealed regions with significantly higher or lower sharks attack rates than would have been predicted by examining just the numbers of shark bites. Though they varied over time, the clusters were clearly defined and remained in place year after year.

Application

On the eastern coast of Florida, for example, 345 shark attacks were recorded between 1994 and 2009, and of these, 210 incidents involved surfers, and 114 involved swimming and bathing. The remainder did not fit the criteria and were excluded. No attacks on divers were mentioned. The SaTScan™ analysis revealed two high risk zones, and two that are low risk areas.

Applying the same method to the Californian coastline resulted in similar clearly defined clusters being identified. Since 90 percent of the attacks on that coastline are due to the great white shark, the shark attack clusters seemed to be linked to the nearby presence of colonies of seals and sea lions where great whites congregate to hunt for food. The coastal region between San Mateo and Del Norte is one such region. The presence of the pinniped colonies continuously attracts the great seal predators to the area, some of which likely circle closer to the shores and come into contact with humans.

On the other hand, the low risk regions occurring south of Santa Barbara and Conception Point, where the low attack rate has remained stable over many years, were associated with regions dominated by female white sharks migrating to a shark nursery in the area to give birth.

Noting that many of the attacks were by smaller sharks, the researchers postulated that they might be due to very young ones hunting fishes along the sea floor and into shallow waters where people were swimming and surfing. They could also have been driven inshore by cannibalistic adults, though such speculation is yet to be proven. Little is known about the social patterns of the species.

As Ritter explained, "It is the constellation of factors that determine the likelihood of an incident—be aware of those and the chances are greatly reduced."

From innovation to insight

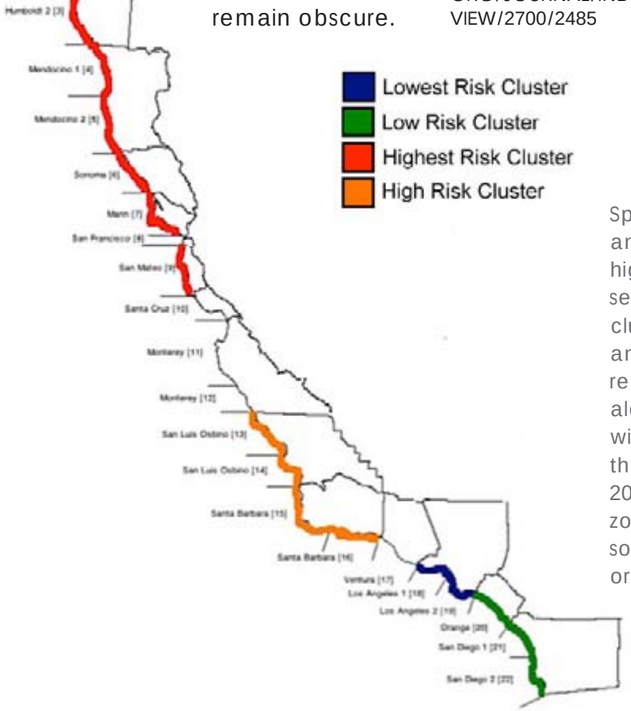
SaTScan™ was initially developed by Martin Kulldorf for the purpose of analysing

outbreaks of diseases to see whether they are random or not, and to evaluate them geographically and over time. The software can also be applied in other fields of research, but this is the first instance of it being used to generate information about the likelihood of being bitten by a shark.

Sharks travel widely under the influence of a variety of factors that include food sources, reproductive cycle, migratory patterns, and more that are unknown. So the reasons behind such clusters remain obscure.

But now that the shark attack rates for these coastlines have been established, beach goers looking for the safest places to swim and surf have definite information on which to base their decision at last. ■

SOURCES:
R. AMIN, E. RITTER, AND P. KENNEDY. A GEOSPATIAL ANALYSIS OF SHARK ATTACK RATES FOR THE EAST COAST OF FLORIDA: 1994–2009. MARINE AND FRESHWATER BEHAVIOUR AND PHYSIOLOGY. WWW.TANDFONLINE.COM/DOI/ABS/10.1080/10236244.2012.715742
R. AMIN, E. RITTER, AND L. COSSETTE. A GEOSPATIAL ANALYSIS OF SHARK ATTACK RATES FOR THE COAST OF CALIFORNIA : 1994 - 2010. JOURNAL OF ENVIRONMENT AND ECOLOGY. WWW.MACROTHINK.ORG/JOURNAL/INDEX.PHP/JEE/ARTICLE/VIEW/2700/2485



Space-time cluster analysis of low and high primary and secondary attack clusters between 1994 and 2010. The highest region of risk was along the north coast with higher risk during the years 2003 to 2010, while a lesser risk zone occurred farther south, as shown in orange

Great white sharks as scavengers

Great white sharks love whale blubber more than seals and gorge on it whenever they can, a new study finds.

University of Miami scientists Dr Neil Hammerschlag and Austin Gallagher, in collaboration with Chris Fallows of Apex Expeditions, South Africa, observed the feeding activity around four dead whales that appeared in the False Bay region during a period of ten years. They concluded that such bountiful sources of energy-rich blubber may be a significant food source for the great sharks.

A whale carcass trails a rich scent flow for miles, which continuously attracts sharks to the feast. The sounds made by feeding sharks carry a long distance too, and will rouse the curiosity of any other sharks within range. The resulting gathering presents an opportunity for researchers to document the behaviour of white sharks feeding together over long periods of time. The researchers were able to watch up to forty sharks scavenging on one whale over the course of one day.

No aggression

Yet though these apex predators are usually solitary creatures, and large individuals were often attracted to eat, no wild feeding frenzy ever occurred. There were no signs of aggression, and the great white sharks left no inter-animal space between them.

However, a size hierarchy was identified in which the largest sharks took charge of the parts of the carcass where the blubber was richest, so that the smaller ones had to feed on the less fatty parts. Those who could not gain a place among those devouring the carcass, such as the juveniles, were left snapping up the crumbs which, it seems were sizeable.

The sharks tore into the carcass as only great white sharks can do, taking huge bites, tasting them, spitting them out, and biting again, displaying unexpected fussiness as they picked over their meal, searching for the best titbits. One was filmed tearing a fetus from the huge cadaver.

The researchers observed that the sharks often fed on the flukes first but could offer no explanation since the flukes contain comparatively little fat.

By attracting many large white sharks together to scavenge, we suspect that the appearance of a whale carcass can play a role in shaping the behaviors, movements, and the ecosystem impacts of white sharks.

While the sharks were occupied with the whale blubber, pressure was taken off their usual prey, the local seals, who were freer to roam in search of their own food. Thus, the feeding event affected the ecology of the rest of the food chain.

No waste

Carcasses in nature are never wasted, and scavengers are well known among terrestrial animals. But it is uncommon for marine researchers to come across the spectacle of marine life feeding on large carcasses.

The researchers found that at least in this region off South Africa, great white sharks are the dominant feeders on dead baleen whales and suggest that in spite of the rarity of coming across a whale carcass, shark populations may actually rely on such finds to supplement their usual diet of seals.

Hammerschlag said, "By attracting many large white sharks together to scavenge, we suspect that the appearance of a whale carcass can play a role in shaping the behaviors, movements, and the ecosystem impacts of white sharks. These patterns may shed some light into the ecology of this often studied—yet still highly enigmatic—marine predator."

Their study entitled, *White sharks (*Carcharodon carcharias*) scavenging on whales and its potential role in further shaping the ecology of an apex predator*, was published in *Plos One*. ■

Wobbegongs of Raja Ampat

— Celebrating West Papuan Carpet Sharks

Text and photos by Andrea and Antonella Ferrari, courtesy of ANIMA MUNDI: Adventures in Wildlife Photography, Animamundimag.com

Beautifully adapted to an ambush predator existence, wobbegongs rely on their exquisitely cryptic coloration to avoid detection and catch their prey by surprise.

Wobbegongs—also commonly known as carpet sharks due to their velvety and highly ornamented livery—are currently grouped into three genera and eleven species. All are found in the Western Indo-Pacific, mostly in shallow Australian and Indonesian waters. Their common name derives from the Australian aboriginal language meaning "shaggy beard", referring to the flaps and tassels growing around their wide mouths.

The specimens featured in these pages were all photographed during several separate dives in the Raja Ampat area (an archipelago of four large islands and several islets located in front of the Vogelskop Peninsula) and are easily identified as tasselled wobbegongs, *Eucrossorhinos dasypogon*, a species frequently observed in West Papuan waters where it reaches a maximum size of 1.3 meters. The largest species of carpet shark, the spotted wobbegong, *Orectolobus maculatus*, is found in Western Australia and grows up to an imposing 3.2 meters.

Only one—clearly identified in the caption of the image—is a very rare and apparently still undescribed species which we photographed in Bali.

Most carpet sharks are rather small, but in fact they belong to the same order—the *Orectolobiformes*—of the whale shark, *Rynchodon typus*, the biggest living fish in the world.

The wobbegong's muscular body is wide and flat, finely patterned in yellowish and pale blue spots, with bands and rosettes neatly arranged on a tan background. Wobbegongs are a true wonder of nature to behold, as they lie immobile in ambush on large table corals—a far cry from the popular image of the shark as a torpedo-like, steel-grey, sleek predator patrolling the blue void of the open ocean.

Their incredibly wide, highly compressed head and mouth profile is broken by an array of dermal flaps and tassels. Their small, beady and slightly malevolent eyes are cleverly hidden in a confusing maze of reticulations. Their broad, paddle-like pectoral fins are widely spread out, and their dark, ribbon-like tails are curved at a sharp angle.

Spotted wobbegongs are almost impossible to detect in the

In ambush position, a wobbegong lies in wait for prey under an overhang

Diver with wobbegong, commonly known as a carpet shark

Wobbegongs are masters of camouflage

layered, highly structured environment of West Papuan coral reefs—despite sitting out in the open and in full sunlight most of the time, as if brashly defying divers and prey alike to find them. Their apparently peaceful, even torpid attitude—as it usually happens in nature—can be mortally deceptive, however, as when needed, they will unexpectedly explode into action and strike with lighting speed at fish passing within reach of their cavernous mouths, usually gulping prey down in a matter of seconds.

Diving with wobbegongs

Territorial and sedentary, carpet sharks make wonderful and obliging subjects—careful divers moving slowly and cautiously can actually approach them within inches—but one must never forget that these sharks are perfectly adapted and highly evolved sit-and-wait ambush predators after all, gifted with an exceptionally big mouth displaying a formidable array of sharp teeth including a set of frontal snake-like curved fangs to get a better grip on

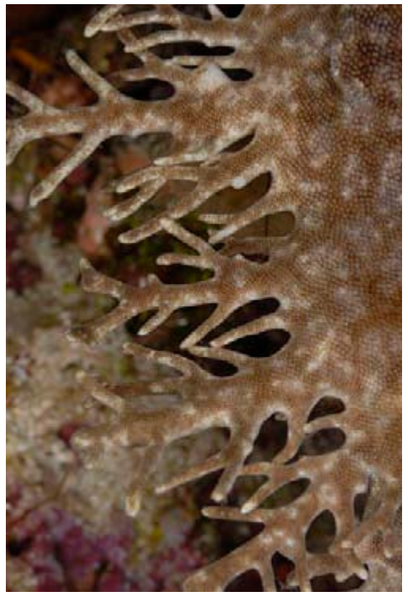
Wobbegongs

their slippery prey and a supple, muscular, highly flexible body. Wobbegongs can easily bend over and bite their own tail, so don't pull it.

Reluctant to move if not unduly disturbed and relying on their spectacular camouflage to avoid detection instead, wobbegongs are also well known to inflict serious bites on waders and snorkellers who step on them in coastal waters.

As most ambush predators (one only has to think of several arboreal snakes to remark the striking similarities), wobbegongs not only have fearsome front fangs but also show a worrying tendency to hold tight with pitbull-like tenacity once they have bitten, so one has to be very careful in dealing with them as camera subjects.

Divers also have to remember, as with most other large fish, never to block their escape route when one is found in a cave or under an overhang. However



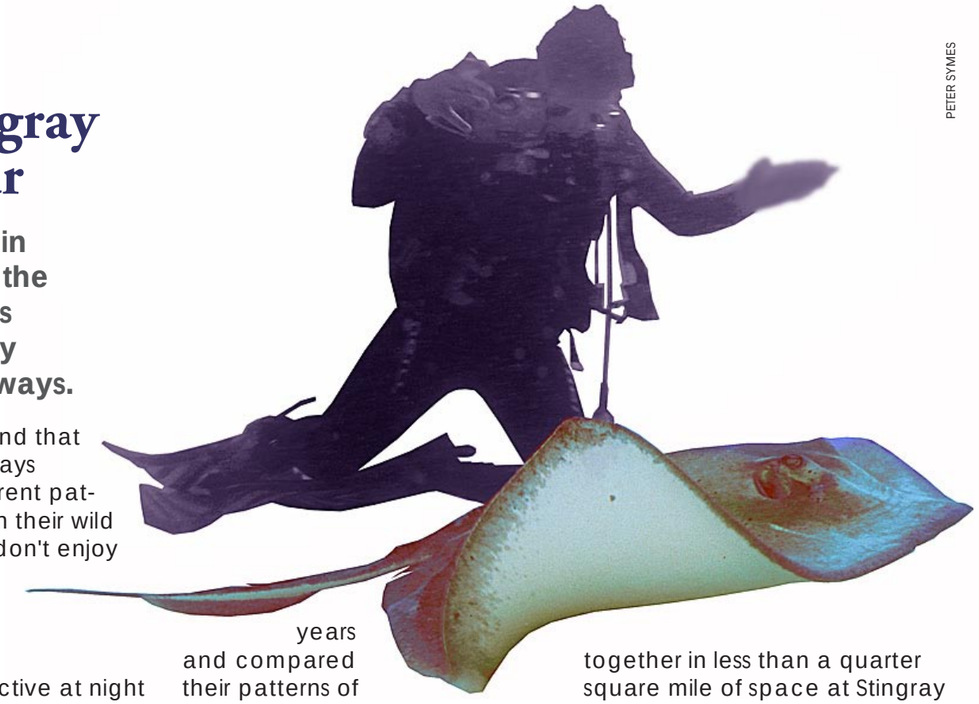
Close-up of carpet shark tassels

small, a shark intent on leaving its lair in a hurry will not hesitate to thrash violently and strike blindly at anything obstructing its way.

Regularly sighted on the colorful, overwhelmingly rich coral reefs of Indonesia's easternmost province, the tasselled wobbegongs of West Papua are a source of endless wonder and amazement to divers. Stunning examples of the science of camouflage in its most evolved form, superbly adapted to their sun-dappled shallow water habitat, they lie still on flat table corals like some exquisite work of abstract art, the weird and wonderful creation of an underwater interior decorator gone slightly mad. Wobbegongs are marvelous icons of nature's whimsy and a wildlife photographer's dream. ■

Tourists alter stingray behaviour

Stingrays living in Stingray City in the Cayman Islands have profoundly changed their ways.



PETER SYMES

The researchers found that Stingray City's stingrays show distinctly different patterns of activity than their wild counterparts, who don't enjoy daily feedings or close human contact.

Wild stingrays are active at night and solitary; they forage through the night over large distances to find food, and rarely cross paths with other stingrays. To see if Stingray City's fed stingrays stray from this behavior, Mark Corcoran—lead author of the study who did the research as part of his graduate work at NSU—and the research team tagged and monitored both wild and fed stingrays over the course of two years and compared their patterns of movement.

They found that fed stingrays swapped their normal nighttime foraging for daytime feeding, and in contrast to their wild counterparts, began to rest at night. They also didn't mind rubbing shoulders with their neighbors. At least 164 stingrays abandoned the species' normal solitary behavior, crowding together in less than a quarter square mile of space at Stingray City.

They even formed schools and fed together. The fed stingrays mated and became pregnant year-round, instead of during a specific mating season, and also showed signs of unusual aggression, biting each other more frequently than their wild counterparts. ■

Sharks and manta rays win protection

CITES restrict cross-border trade in the oceanic whitetip, the porbeagle, three types of hammerheads and the manta ray.

The agreement, which must still be formally approved by the CITES plenary session, delighted conservationists who warn that Asia's voracious appetite for shark fins is causing their population to plunge. Manta rays are killed for their gill plates, which are used in Chinese medicine. Shark supporters have been attempting to get Cites to protect these species since 1994. But there has long been strong opposition to the move from China and Japan who also tried to block the proposals, which were pushed by countries including Brazil, Colombia and the United States.

Regulation, not ban

While the vote to upgrade these shark species to Appendix 2 does not ban the trade, it regulates it. Both exporting and importing countries must issue licences. If a nation takes too many of these species, they can be hit with sanctions on the range of animal and plant products that are governed by CITES. ■

A team of divers working well together

One for all or all for one?

What are the differences between the self-sufficiency and team diving approaches to technical diving?

Text by Mark Powell
Photos by Gareth Lock and Chris Sterritt

One of the most contentious issues amongst technical divers is the difference between the self-sufficiency and team diving approaches to diving. Like a number of other issues in technical diving, it seems to polarise opinions, often along agency boundaries. This often leads to exaggerated positions that can take on a similarity to religious fundamentalism.

The self-sufficiency mindset is where the diver is fully self-sufficient and approaches the dive with the view that they can perform the dive on their own and would be fully able to complete the dive without a buddy. The approach is summed up by the mindset that if you can't do the dive on your own then you should not be doing the dive at all.

The other approach is team diving where strong team work and cooperation are the focus of the dive, and you plan to dive with a team of divers, and the team works as a well coordinated whole.

These two approaches seem to have a very different emphasis, and many divers think that they are contradictory. That is, you have to decide whether you have a self-sufficient approach or a team-based approach and that it is a choice of one or the other. Both approaches have their extremists who will go to great lengths to explain why their approach is right and the other approach is wrong.

In some areas, technical diving in the United Kingdom has evolved into a culture of solo diving where many experienced technical divers dive solo. All equipment choices are made on the basis that you will be diving alone or that your buddy will be of no use. Gas planning is based on the principle that it is impossible or unlikely that your buddy will be any use in an emergency and so all procedures are based on individual action.

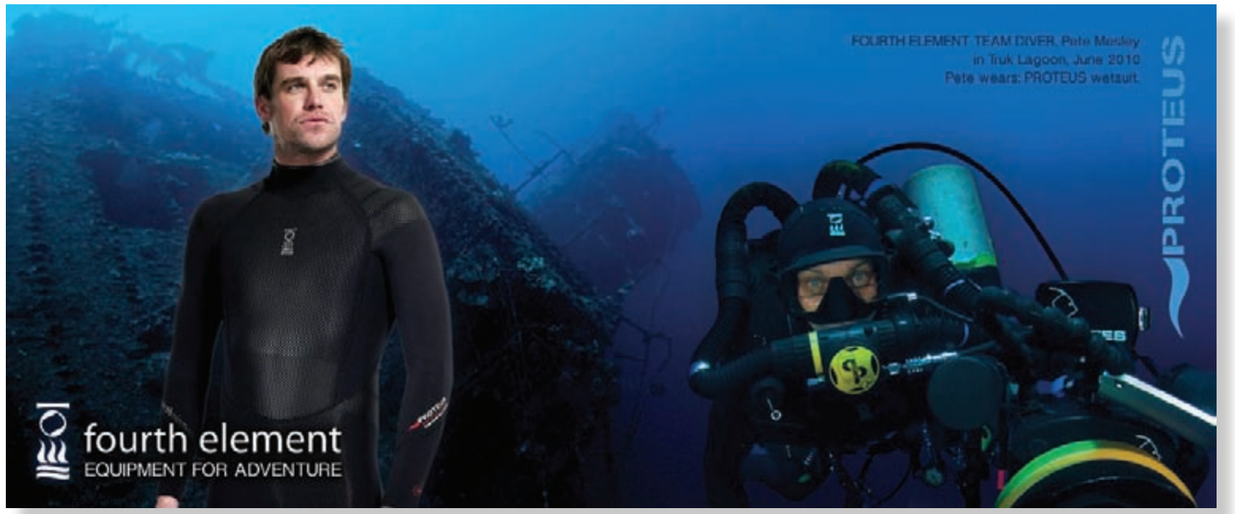
The team diving approach also has its extremists who focus on teamwork as the primary goal and consider self-sufficiency to be a sign of weak teamwork. These divers will only dive with divers who follow the exact same team procedures.

In reality, these two extreme positions are not very realistic, and when taken to extreme, counteract the very point of the principles. This can cause significant problems, as the advocates of self-sufficiency can refuse to see some of the benefits of team diving, whereas the advocates of team diving refuse to see any benefit in self-sufficiency.

Self-sufficiency vs solo diving

In particular, the principle of self-sufficiency does not mean the same thing as solo diving. For example, pioneering technical diving instructor Kevin Gurr says, "Assume all dives are solo dives; do not get into the water if you feel you can't do it without someone else to rely on." This is a clear endorsement of the self-sufficient approach, and many people have taken this to be a recommendation for diving solo. However, Gurr then goes on to say, "This does not mean you should not dive in a team;

You may have to finish a dive without your buddy



you should. Be prepared to be separated and to have to look after yourself." Similarly, those who advocate team diving do not mean that you should not be able to deal with situations on your own or need to rely on your team.

Two sides of a coin

So despite initial impressions, the self-sufficient and team diving approaches are not as contradictory as they might at first seem. In fact, they are just two sides of the same coin.

The best technical divers obviously have to have good individual skills. Building on your own level of buoyancy control, familiarity with kit and ability to deal with difficult situations are fundamental for anyone wanting to progress in technical diving. No diver who has thought about this question for more then a millisecond would ever suggest anything less.

Team sports such as football, rugby or cricket are a perfect example of the team approach, but players still ensure that they work on their individual skills. Players with weak individual skills would never make it into the team in the first place.

Diving with someone who is not self-sufficient is not team diving. If one of the team cannot deal with an emergency situation, then they are going to weaken the overall team rather than strengthen it. This means that self-sufficiency is clearly a prerequisite for team diving.

The self-sufficiency extremists however go further than this. They claim that all divers should be self-sufficient because you can never rely on a buddy to provide any assistance in an emergency. They will often cite examples of where an individual buddy has not been able or willing to provide assistance in an emergency, and from this conclude that no buddy will ever be able to provide assistance. Furthermore, they argue that a poor buddy might cause an incident that would not have happened had you been on your own. As such, their argument is that it's better to be completely solo and never have a buddy than to have a poor buddy.

In some ways, this argument has some merits in recreational diving, as there are a whole range of abilities. Inexperienced or out-of-practice divers can certainly fit this description, and many instructors and dive guides will tell you that they feel safer on their own. Certain recreational training agencies even support the concept of solo diving in the recreational area and provide training courses on self-sufficiency and solo diving.

However, this argument breaks down for technical diving. At this level, any divers undertaking these types of dives require a higher level of skill and abilities. Divers who are unable to help their buddy are clearly operating at the limits of their own ability and so do not have enough self-sufficiency to undertake that dive, whether they are alone or with a buddy.

Self-sufficiency in a team environment

The best approach then is to aim for self-sufficiency within a team environment. Each diver should have enough capacity to resolve any problems they may have and have enough spare capacity to be able to offer assistance to the other members of their team. If their buddies also have enough capacity to resolve their own problems and have enough spare capacity to be able to offer assistance to the other divers, then you have a very strong team.

The strongest teams usually consist of experienced individual

It is essential to be self-sufficient

Some agencies allow solo diving for recreational diving

divers with good self-sufficiency and self-awareness skills that have practiced working together in a team. Training and practice are essential in order for team diving to work successfully. Each member of the team should have similar views, so they are following the same general approach.

In addition, good teamwork only comes with practice. You can see this with national sports teams. Each player is amongst the best player in the country yet, unless they train together as a team, they will not be able to perform well as an effective team.

When team diving is carried out by experienced, trained divers then it is a very safe way of diving. In the case of a problem, you have more options available to help out; more gas available, more chance of spotting the problem and more ideas on how to solve it.

In the case of an incident, one member of the team can be initiating a rescue while the other sends up a delayed SMB and another provides a visual reference to ensure the rest of the team can maintain depth.

It is when problems occur that the benefits of diving in a team become apparent.

Of course, this is very easy to say. Of course, this raises the question that if self-sufficiency within a team environment is the goal, how come it is not that common? The reason for this is that it's not easy to develop these two aspects.

Time and effort

The time and effort required to master your own skills to the point where you are truly self-sufficient and then the additional time and effort required to maintain those skills is more than most people can commit to. We all have jobs, families, other hobbies and commitments, which are all competing for our time.

It is entirely feasible to be a recreational diver and just dive a few times a year on holiday or

A buddy can be very useful in an emergency

You need to invest time and effort to develop your skills

on a couple of dive club trips. However, this is not the case for technical diving. If you are involved in decompression diving, trimix or rebreathers, then it is essential to ensure that you put in sufficient practice to build up and maintain your skills.

Some people may take to diving more easily than others, but no one is born with all the skills and knowledge they need to become a technical diver. There are some people that may have more innate cricketing skills than others, but if you want to play for one of the premiership teams, you will need to put in a huge amount of practice in order to refine your skills and reach the level required. Once you have reached that level, you then need to put in even more effort to maintain those skills.

The development of a strong team also requires time and effort. If it is difficult to ensure that a single person can dedicate the time and effort, it is even more difficult to gather a group or team to practice together.

The individual commitments of each team member and the logistics of getting them together can be difficult. However, the same principle applies. If you want to become a true technical diver, then it requires a certain commitment in terms of time and effort. Irrespective of how good a cricket player is and how much time they spend working on their individual skills, they spend more time in team training.

Strong individual divers in a strong team is the safest option

Alternative approaches

It is because developing strong self-sufficiency skills and teamwork require such a commitment that alternative approaches have sprung up. If individual divers and their buddies do not have the individual or team skills required, they take alternative approaches to try to overcome these problems.

Teamwork is made more prescriptive, so that it removes the emphasis on the individual diver. Alternatively, teamwork is ignored all together and divers adopt a solo diving mentality. Each of these approaches might seem easier in the short term and more appealing to those who cannot commit the time and effort to develop their individual and team skills, but it is a poor solution to the problem.

In the case of emergencies, the lack of personal skills and self-sufficiency can cause problems for you and any buddies you are loosely teamed up with. Equally, the lack of team skills may cause confusion and often makes the situation worse. So even though those alternatives might seem more attractive in the short term, and maybe acceptable for the majority of divers where nothing goes wrong, they are a poor long term solution, as they can fall apart in times of emergency.

There is no getting away from the fact that for technical diving there is a need to invest time and effort in developing your personal skills and your team skills to a higher level than is normally required for recreational diving. Playing cricket in the park with our kids, or in a pub team is great fun. In this environment you will sometimes find very good players, but the level of play is nowhere near the same level as in the Premier League. As technical divers, we should use Premier League cricket as our model, rather than a game in the park or the occasional pub team game. ■

For more information on any aspect of technical diving contact Mark Powell at ***www.dive-tech.co.uk***