



Edited by  
Peter Symes &  
Rosemary 'Roz' Lunn

POINT & CLICK  
ON BOLD LINKS



# Equipment *in the news*

## SD3

There are occasions when you need a suit that bridges the gap between a wetsuit and a drysuit. Enter stage left, son of Tauras, Waterproof's SD3.

Time to kill a popular myth that's perpetually repeated, "You're warmer if you have a trapped thin layer of water in your wetsuit." In reality, a warm wetsuit needs to fit snugly enough to eliminate water entrance, without restricting surface blood circulation.

It looks as though Waterproof might well have achieved Nirvana with the beautifully manufactured SD3. As you'd expect from Waterproof, plenty of attention has been given to the small details. The result is an anatomically designed 7mm semi-dry, dry enough to keep a diver warm in colder waters, whilst giving the diver that snug warm feeling of a decent wetsuit. Features include super-stretch neoprene seals, hard-core rubber knee guards, and a gas-proof shoulder dryzip complete with a zip cover. [waterproof.se](http://waterproof.se)



## iGills

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



## Pioneer

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

### Oceanic's Pioneer

## Get a grip

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



## a300

The new AERIS A300 is designed with a simple premise – using a dive computer doesn't have to be difficult. The A300 distinguishes itself with the use of NORM and TECH modes.

NORM mode is selected by default as an out-of-the-box solution that provides all the necessary settings and information for divers who just want to get in the water. When switched into TECH mode, the advanced features and fine-tuning become available that will satisfy any experienced diver.

### Aeris a300



# equipment



## Pico

The 'Pico' is the smallest Kowalski to date, weighting (with batteries).

This aluminum bodied torch has a decent burn time of up to 18 hours, with the 3 x 1.5V AAA batteries producing an impressive 6,000 Lux / 490 Lumens. It seems that Kowalski has produced a natty light that will be ideal for the entry-level diver and, as their diving progresses,

evolves to become a suitable redundant

torch. However, we can see the Pico also being popular with

more established divers because this dinky light (128cm long) has a decent depth rating (200m / 656ft) and will be easy to stash.

**Kowalski**



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in at a mere 223 grams

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**Kowalski**



## Alpha 9

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



## Ice

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

**Camaro.at**

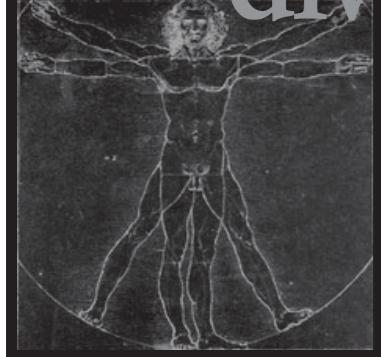
„If the sharks die,  
the oceans will die!“

Andrew Cobb, Ambassador Sharkproject South Afrika



**SHARKPROJECT**  
[www.sharkproject.org](http://www.sharkproject.org)





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

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

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

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

ty is a positive way to take responsibility for your health, bring focus and motivation to a fitness routine and improve your overall diving performance. Be concerned more with what's under your T-shirt than what is on it.

It was five years ago that I began to fitness for and

research diving discovered it primarily described the medical condition of divers. To create a distinction in early discussions, it was necessary to specify physical fitness for diving.

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

What does it mean to be physically

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

## Health profile of the diving community

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

## Training for diving performance and safety

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

USA. His practical research included studies

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

What follows is an overview of

such as measuring a diver's heart rate while putting on a wet-hot summer sun. discussions are helpful in understanding and emphasizing the importance of training to improve diving performance and safety.

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

## Getting started

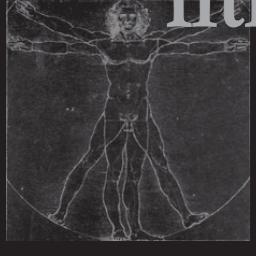
My surveys reveal that less than 30 percent of all divers exercise. For divers who are new to exercise, it is important to as much as possible be in good health, consider orthopedic conditions, maintain

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

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

# Are You Scuba Fit?





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

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

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

Ball Reach  
on Feet  
starting  
position



Ball Reach on  
Feet extended  
position



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

### Aerobic training zones

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

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

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

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

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

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

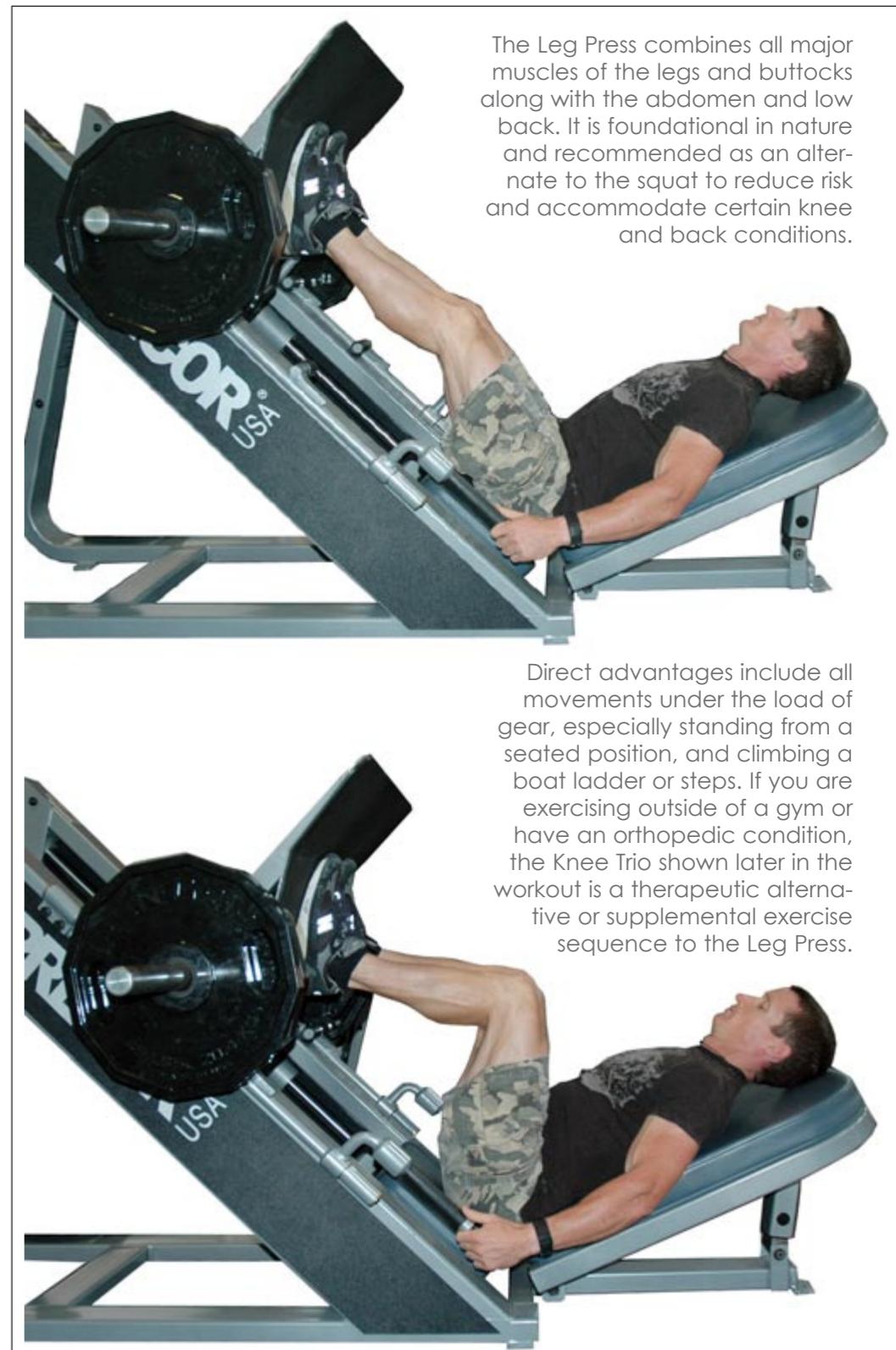
Using this example, while training in your 70 percent heart rate training zone, you will attempt to maintain a minimum pulse of 143 beats per minute. Your 80 percent heart rate training zone provides a maximum

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

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

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

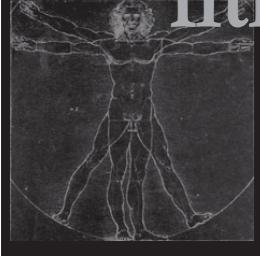
Notably, the 90 percent zone, while sometimes used for short periods to train for high levels of athletic performance, is not considered a healthful zone for recreational activity. However, of considerable importance is that exercising with consistency in the heart rate training zones of 70-80



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

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

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



## The “Basic Six” Exercises

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

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peutic alternative or supplemental exercise sequence to the Leg Press.

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

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

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

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

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

## Knee Trio: Bun Wrapper, Wall Sit with Ball Squeeze.

The Bun Wrapper is a combination of leg raises throughout the full complement of hip rotation, which targets the medial muscles of the gluteus and provides weight bearing



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

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

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



Ball Reach  
on Knees  
starting  
position



Ball Reach  
on Knees  
extended  
position

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

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

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

## Interval Training

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



Wall Sit side view



Wall Sit front view



Bun Wrapper start position



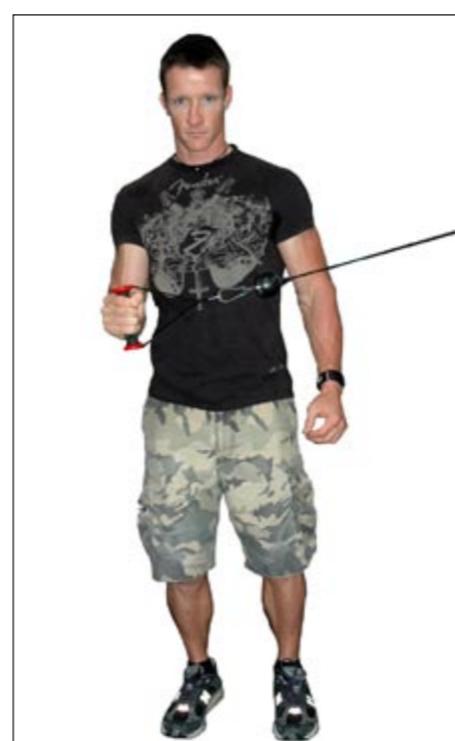
Bun Wrapper extended back position



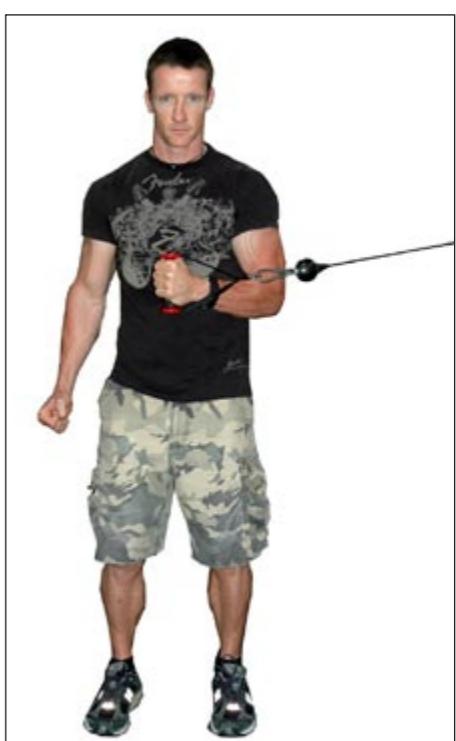
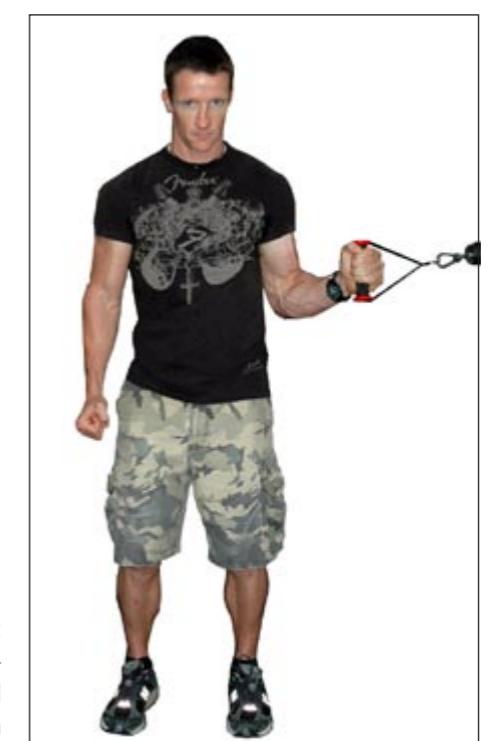
Bun Wrapper side position



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



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



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

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

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

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

Your goal is to complete four full intervals of both resistance

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

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

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

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

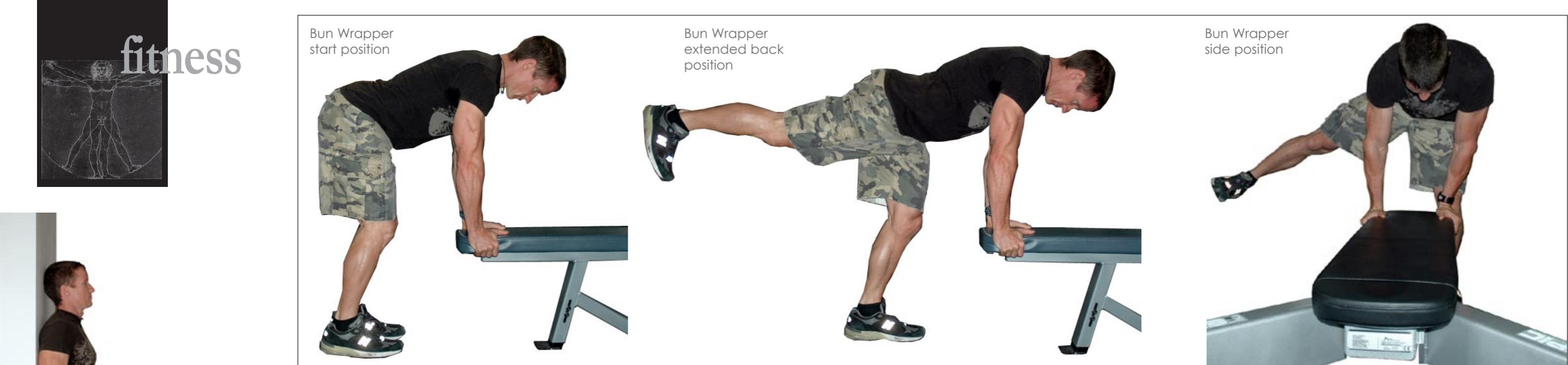
Gretchen M. Ashton is registered with the National Board of Fitness Examiners. An advanced diver, International Sports Sciences Association Elite Trainer, and world champion athlete, Ashton developed the ScubaFit® program and the comprehensive

*FitDiver®* program, which includes the first mobile app for scuba diver fitness. Ashton is the co-author of the PADI ScubaFit Diver Distinctive Specialty course and is an Expert Speaker for Los Angeles County's Advanced Diver and Underwater Instructor Certifications in California, USA. She is the Health and Fitness Editor of California Diver Magazine, has been published in Divers Alert Network, Alert Diver - United States and Asia-

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



Gretchen M. Ashton



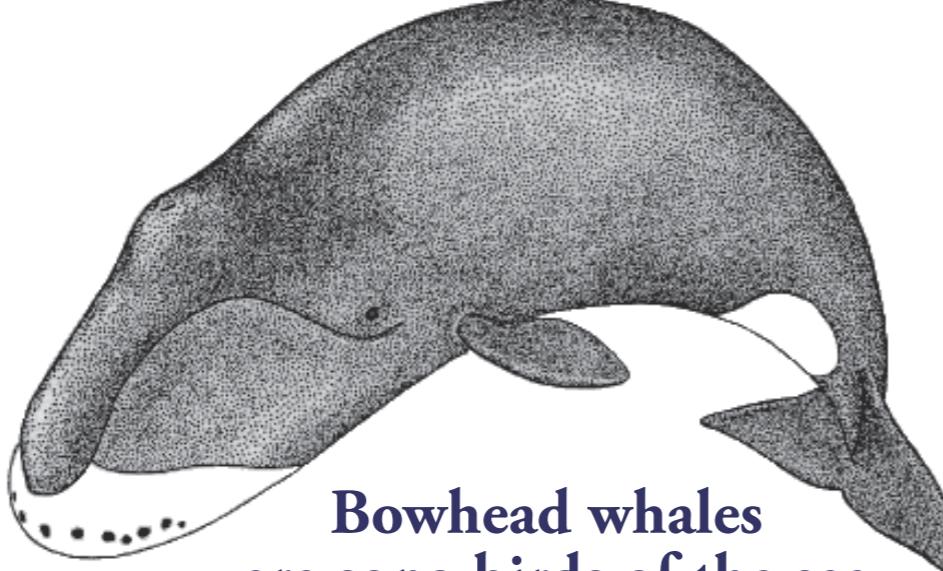
# marine mammals



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

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

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



DAVID G. STANTON / NOAA

## Bowhead whales are song birds of the sea

catalog of tunes to that

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

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

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

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

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

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

■ SOURCE: WILDLIFEEXTRA.COM

## Forty blue whales spotted off California coast

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



DAN SHAPIRO / NOAA

gist Eddie Kisfaludy spotted the whales and recorded the event.

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

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

Learn more... visit us at [OceanicWorldwide.com](http://OceanicWorldwide.com) for the full story.

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## Dolphins Are Good At Math

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

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

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

Leighton and colleagues Paul White and student

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

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

It is theorized that after this, the dolphin has to subtract the echoes from each other, making sure the echo of the second pulse is first multiplied by three. Thus, by addition, the dolphin's process makes the fish visible

to sonar, and by subtraction, the fish is made invisible, so the dolphin can confirm the fish is a real target. ■  
SOURCE: DISCOVERY NEWS



TOLOMEA / CREATIVE COMMONS

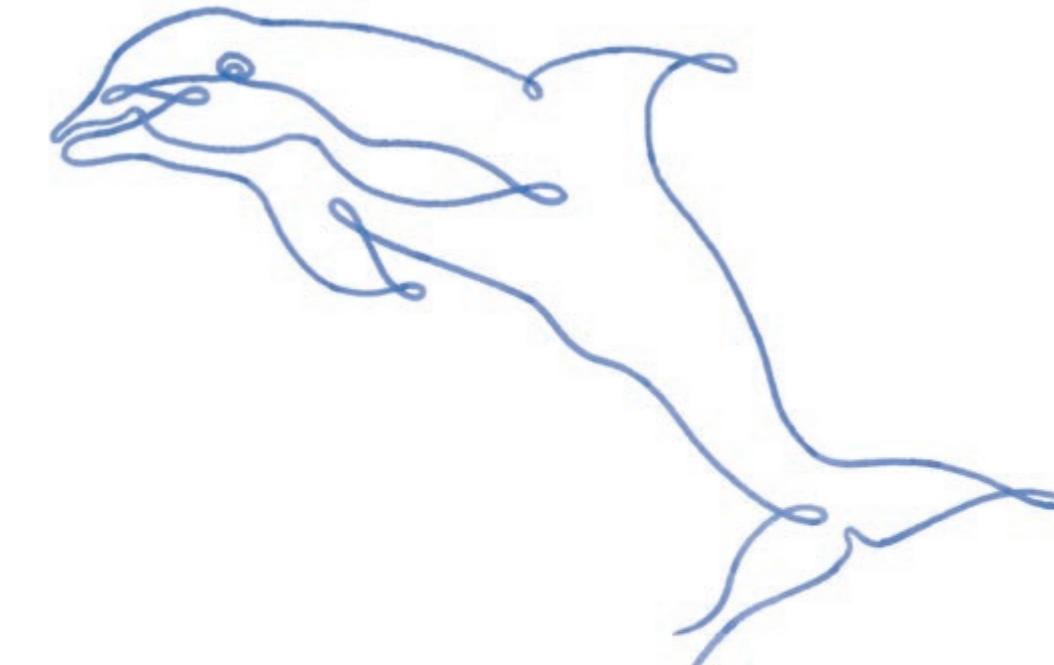
## Whale Poop Power

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

Blue whales feed on krill, tiny crustaceans floating in the seas, and the orange hue of their prey colors fecal plumes the animals deposit in the oceans. Considered by marine biologists to be the precursors of the their

the aquatic world chugging along. Playing an enormous role in nutrient and carbon cycles, their huge skat deposits, which can be as large as an adult whale, result in an increase in plankton, fish and thereby, whales, says Joe Roman, a conservation biologist at the U.S. University of Vermont.

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



cinema of dreams



[www.seacam.com](http://www.seacam.com)

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

Text by Gareth Lock  
Photos courtesy of Gareth Lock

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

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

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

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



# Safety Culture *Diving in the Zone*

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

Everyone makes mistakes, even

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

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

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

The following is a series of actual incidents that have ended

with fatalities.

- Entering the water with O<sub>2</sub> turned off on a rebreather; the diver died shortly afterwards.
- Switching to 50% when at

# feature

## Safety Culture

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

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

being breathed at 3.2 ppO<sub>2</sub>; the diver had a seizure and died very shortly afterwards.

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



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

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

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

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

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

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

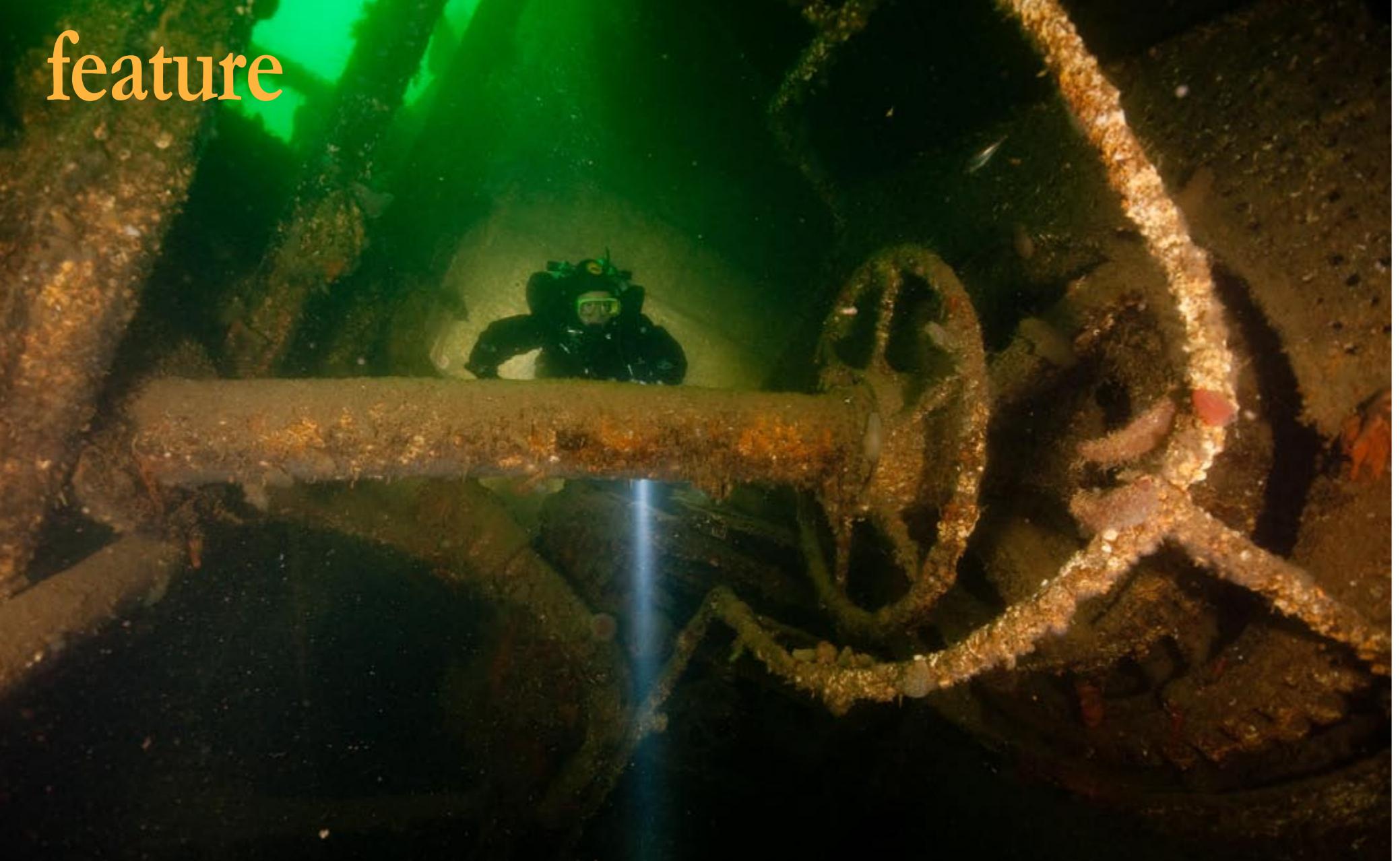
Providing an environment where divers, instructors and those involved in management of diving and diver training operations can report honest mistakes and

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

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

However, calling it a Safety Culture

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

## The Just Culture aspect

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

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

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

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

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

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

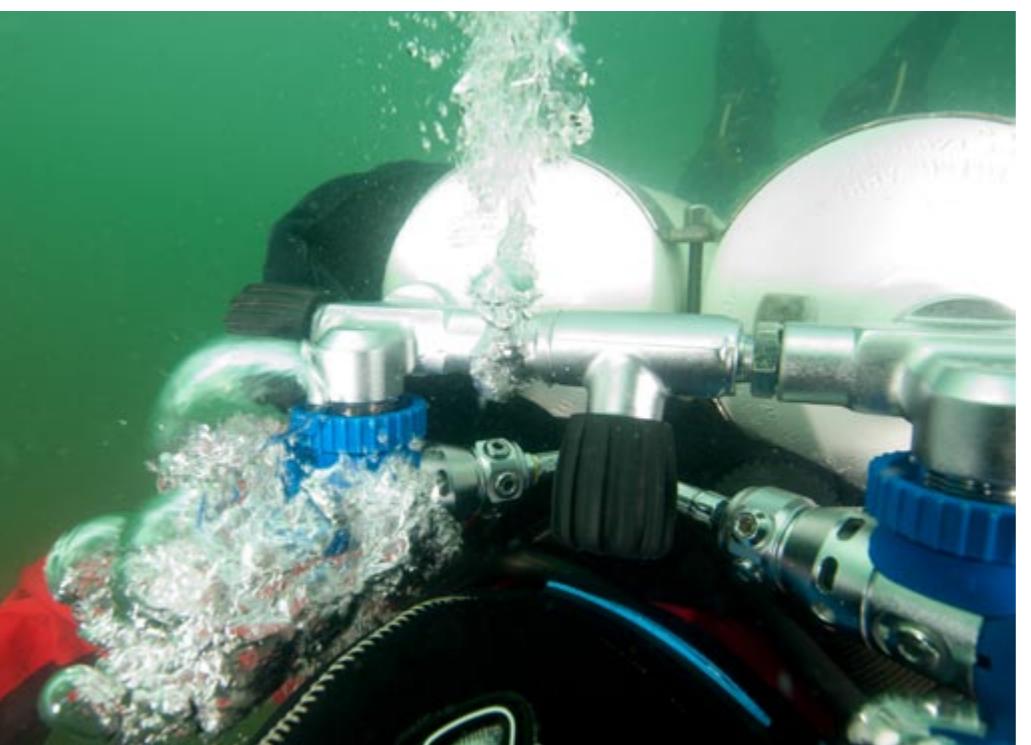
## Responsibility... personal responsibility

Looking at the tabloids, one could argue that

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

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

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



## CULTURES

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

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

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

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

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

equipment—and safety will be reduced as a consequence.

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

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

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

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

fatal episodes.

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

Diving is a fun activity, but these bad

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



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

### What YOU can do to help the wider diving community

In the United Kingdom, there are a

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

DISMS allows a search to be conducted against the live public

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

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

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

I have been quoted many times as being able to provide numbers on why incidents occur. However, until people start submitting reports in

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

An experienced advanced trimix diver and instructor who had been using a KISS rebreather for a while had made a habit of turning his rebreather unit off when on the bench while taking off his kit—because he had left the unit on several times in the past only to return and find an empty O<sub>2</sub> bottle. This practice gradually backtracked, evolving from turning the valves off while de-kitting on the bench, to turning off the O<sub>2</sub> while walking to the bench, to turning it off already when he was getting out of the water, as his gear was being lifted onto the back of the boat after his dive.

On the day in question, he was waiting in que behind another diver to get out of the water at the pick-up point. He presumed that the diver in front of him would be out of the water in a couple of minutes. At this point, he turned off his O<sub>2</sub>. Unfortunately, the boat had to circle around again in order to pick up the diver in front of him.

He was, however, still breathing off the loop. Once he finally got picked up, the pO<sub>2</sub> was a little low!! He felt rather unwell standing on the lift, looked down at the handset and noticed that the partial pressure of O<sub>2</sub> had

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

sensation is caused by CO<sub>2</sub>, which was still being removed by his rebreather canister. So essentially, he was depleting his oxygen without noticing it.]

If this had been reported as just, "A diver switched off his O<sub>2</sub> in the water",

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

## It's your attitude!

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

only a part of the wider 'Culture'. While articles like this one can highlight what a Just Culture is to the diving

community, it really takes the organisations of the dive world to actively promote it at the top level, so that it cascades down to the instructor trainer staff, the instructors, and ultimately, the divers themselves.

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

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

## Safety Culture

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

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

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

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

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

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**WATER PROOF SWEDEN**



# turtle tales



Edited by  
Bonnie McKenna

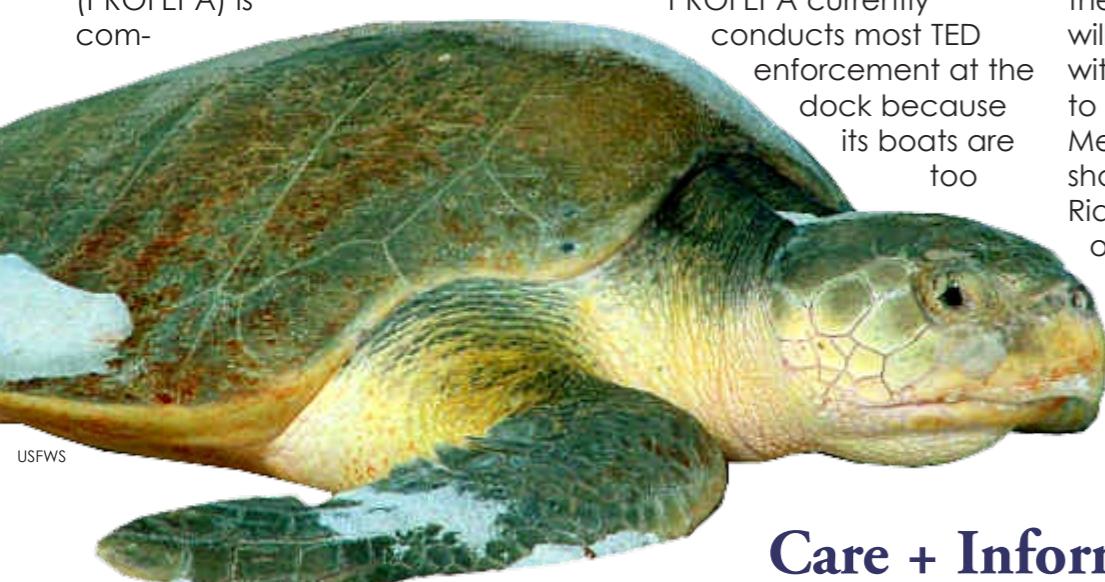
## National Fish and Wildlife Foundation donates boat to Mexico's fishery authorities

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

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

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

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



## Care + Information = Results

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

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

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

Since rehabilitation started, the turtles' weights have

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

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

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## The Philippines go after sea turtle restaurants

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

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

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

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

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



JAN SMITH / FLICKR / CC BY 2.0

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## Sea turtle migration answered by scientists

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

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

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

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

rector at the National Science Foundation.

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

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



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

## Turtle meat vendors caught

The police in Galle, India, busted a lucrative trade in turtle meat.

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



## Pacific leatherback turtles hurt by jellyfish hunt

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

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

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

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

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

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



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