

# Ambon

*Maluku's Magical Isle*

Text and photos by Don Silcock





Blenny on a sea-whip



Pair of Coleman shrimps on a fire urchin. PREVIOUS PAGE: Octopus in mid-water at the Twilight Zone

**Indonesia is a country that can constantly surprise and delight—usually when you are least expecting it! So it was, with my first experience of Ambon back in 2006, when I and a very sad and seasick party of Banda Island-bound divers found our way into the safety of its magnificent natural harbor. We had departed from Maumere in the south some five days earlier, and after two days diving around Alor and other sites along the Lesser Sunda Islands, we headed northeast for the mystical Bandas.**

September is a time of changeable weather on the Banda Sea. We encountered heavy seas that made our Pinisi-style liveaboard take on all the characteristics of a cork, as we pounded our way forward into the wind.

Pinisi boats are designed and built for the monsoonal trade winds to carry them along with the wind, not head-on into it. After two days and nights of constant pitching and rolling, we were offered a choice—at least two more days of the same punishment or 18 hours of easier seas by heading due north to Ambon.

The instinct to survive is a powerful one. The decision to abandon the trip to Banda Naira was unanimous, and the next day, we reached the safety of Ambon's harbor.



Porcupine fish watches warily



CLOCKWISE FROM LEFT:  
Anemone fish; Inside  
Hurikila Cave and superb  
sea fans at Pintu Kota on  
Ambon's South Coast

## Ambon

### THE SPICE TRADE

Now known as the province of Maluku, the remote Moluccas with its lush tropical climate and rich volcanic soil was where the exotic spices of cloves, mace and nutmeg first originated.

Today, these and other spices are a common supermarket commodity. But in the 15th century, they were so valuable that they were the driving force behind the Age of Exploration—a 200-year period when the major powers of Europe dispatched their sailing ships to find and control the fabled Spice Islands of the Far East.

Small quantities of spices from the Moluccas had first trickled into Europe via the so-called “overland route” through India and the Arabian Peninsula during the Middle Ages. Initially used by wealthy families to improve the taste of poorly preserved meat, over time, the spices were perceived to offer a degree of protection against the deadly plagues that periodically ravaged Europe, which further inflated their already exorbitant price!

Possibly the first really global commodity, control of the source of the spice supply was the key to enormous profits. The mission given to the ships' captains by their sponsors, was to find a sea route to the Spice Islands and break the Arab monopoly. In that process, Christopher Columbus discovered the New World of the Americas, Ferdinand Magellan's expedition circumnavigated the world for the first time, and Vasco Da Gama rounded the Cape of Good Hope at the tip of Africa and established the sea route to the Indian sub-continent.

In terms of their influence on the world economy today, the Moluccas are a mere shadow of their former glory, but are a fascinating place to visit for anyone with a sense of history. ■

as the Indonesian Army moved in to seize control and restore order.

It took well over two years before tempers cooled and order was fully restored, and by 2004, a strong recovery was underway, aided by significant investments into the area by the Indonesian government.

### Diving Ambon

Before the troubles, Ambon had an excellent reputation as a remote but first-rate dive location, and the Ambon Dive Center run by Carol Palmer and Sonny Tjandra, had built up a strong and loyal following.

Located about 30 minutes southeast of Ambon City, at a pleasant beach-side location near the village of Lathualat on the Letimar Peninsular, the dive center provided meals and accommodation as well as a base from which to explore the

### The Moluccas

Back in 2006, Ambon had just about returned to normal after the “troubles” of 2000 when heavy rioting broke out between the Christian and Muslim populations of the island.

Indonesia has the largest population of Muslims in the world, with some 86 per cent of its total population of almost 250 million following Islam. It also hosts the largest Hindu population outside of India, resident on the island of Bali, and a significant number of Christians on Ambon and in the surrounding Maluku province.

The Christians are a legacy from the 16th century when the Dutch made Ambon their center of operations in the Moluccas, as the area was called then, while they dominated and ran the incredibly lucrative spice trade.

Prior to independence, the Dutch colonial rulers introduced a policy called Transmigration, whereby workers from the densely populated main island of

Java were “encouraged” to work on plantations in Sumatra and other locations. Post-independence, the Suharto regime revived the policy as “transmigrasi” whereby whole families were given financial inducements to relocate from Java to areas such as Ambon and West Papua.

In Ambon, the transmigrasi migrants grew into a significant block of Muslims, who established their own village kampongs alongside Christian ones. The two religions coexisted reasonably peacefully until Christmas 1999, which coincided with the end of the Muslim holy month of Ramadan, when a combination of circumstances came together and were ignited by, of all things, a traffic accident between a Christian bus driver and a Muslim youth.

The subsequent riots and civil unrest escalated into what became known as “the troubles”, and resulted in the area being effectively closed to all foreigners,





LEFT TO RIGHT: Flamboyant cuttlefish; Purple *Rhinopias* at Rhino City; Pair of ornate ghost pipefish

30+ dive sites that Carol and Sonny had identified.

Unfortunately, the riots brought all that to a sad end, and the dive center had to close down in early 2000. When the troubles subsided in 2002, and the military restrictions on the area relaxed, it became possible to dive the area again, but only on the various liveaboard dive boats that work the area on their way to Raja Ampat.

Then in July 2005, expat Englishman Andy Shorten and

his partners took over the lease on the Ambon Dive Centre and reopened the operation as Maluku Divers.

It was Andy whom we contacted after arriving safely in Ambon and had recovered our appetite for the water again. The top of his list of potential dive sites was the Twilight Zone.

### The Twilight Zone

Christened by American dive explorers Burt Jones and Maureen Shimlock after a

chance exploration dive in 1994 while waiting to pick up incoming passengers for a trip on the liveaboard MV *Cehili*, the Twilight Zone is the area under and around the aviation jetty at the village of Laha near Ambon's airport.

The jetty was built to allow aviation fuel to be unloaded from tankers for the airport, but has become home to a fleet of fishing boats that work the rich waters around Ambon and southwards into the Banda

Sea.

The Twilight Zone really is a special place and probably the most appropriately named dive site I have ever had the pleasure of visiting—think Alfred Hitchcock meets the Lembeh Strait.

The black volcanic sand is covered in a dense mixture of organic and inorganic waste,

while above, the fishing boats moored alongside each other block out the sun, as their diesel generators create a steady but penetrating deep throbbing noise.

The inorganic debris is a mixture of car tires, filing cabinet drawers and other assorted flotsam and jetsam, which has been discarded over the years



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CLOCKWISE FROM FAR LEFT: Beautiful Seahorse; Above water at the Twilight Zone; Maluku Divers guest bungalows; The restaurant area at Maluku Divers



and created an underwater junkyard. The organic waste comes from fish carcasses, which are simply thrown over the side of the fishing boats after their crews have cleaned and filleted their catches for shipment to Bali.

The junkyard is now home to an amazing assortment of critters, fish and the most numerous moray eels I have personally ever seen in one location. The whole population is well fed from the fish carcasses.

We dived the Twilight Zone several times. I was so impressed that I arranged to spend four days with Maluku Divers

the following year when I went back to Ambon in transit to the Banda Islands. Operating as it did from the old Ambon Dive Center on the Letimar Peninsular meant regular crossings over the wide harbor to get to the Twilight Zone as well as other sites on the western side of the bay.

It has to be said that the dive center was really showing its age. Nonetheless, I very much enjoyed the diving and saw a really great selection of critters.

### The new Maluku Divers

Let's fast forward to 2011 and a chance encounter with Andy Shorten on Facebook, who regaled me with stories about all the new sites they have found now that Maluku Divers had migrated across the harbor—just down the shore from the Twilight Zone!

I just had to go back. So, in December I did just that, spending ten days diving both the old and the new sites and greatly enjoying the new resort, with its very nice restaurant, large dedicated camera preparation room and well-

appointed rooms.

The resort is run by Dutch expatriate Marcel Hagendijk and his crew of experienced Ambonese, who are, to his great credit, a well-balanced mixture of Muslim and Christians all very well versed in the basic requirement to get on well and ensure that the guests get to see what they came for.

### Critter dive sites

**Twilight Zone.** No discussion about diving Ambon can be complete without reference to this unique site and, in particular, the photographic opportunities here. The jetty can be thought of as the epicenter of about 100m of sloping sandy shoreline around a small sheltered bay, which offers protection for both the ships at anchor and the critters that inhabit the netherworld beneath the surface.

The thing that is really special about the Twilight Zone is that it is really two





Blue ribbon eel



sites—the mother of all muck sites most of the time, and then around midday, it transforms itself into a kind of unique and eerie wide-angle photography studio where you can practice all those techniques you've read about.

For a couple of hours around noon the bright Indonesian sun is overhead and sends beams of light down through the

gaps in between the moored fishing boats and around the jetty itself. This intense light seems to excite the large resident shoal of silversides, which normally hide away under the jetty. They stream around the pillars of the jetty and out underneath the fishing boats.

A similar thing seems to happen with the large colony of catfish, who also get a little agitated and start to do things out of character. This provides excellent wide-angle photo opportunities.

Then, there are the moray eels who come out of their daytime hideaways, seemingly disturbed by all the commotion and provide excellent foreground subjects for the creepy background. Add in all the other larger critters such as scorpionfish and stonefish, and one can understand why midday at the Twilight Zone is one of my favorite places—not just in Ambon, but in Indonesia. It's that special!

At night, the sight transforms again as the fish and critters active during the daytime settle down for the night in their hiding holes, and the nocturnal predators emerge. Extra care needs to be taken at night, as there are so many potentially stinging and poisonous things to kneel on such as stonefish, a profusion of scorpionfish—including lots of the Ambon variety—dozens of urchins around the junkyard area, and of course, the morays, which may be out foraging.

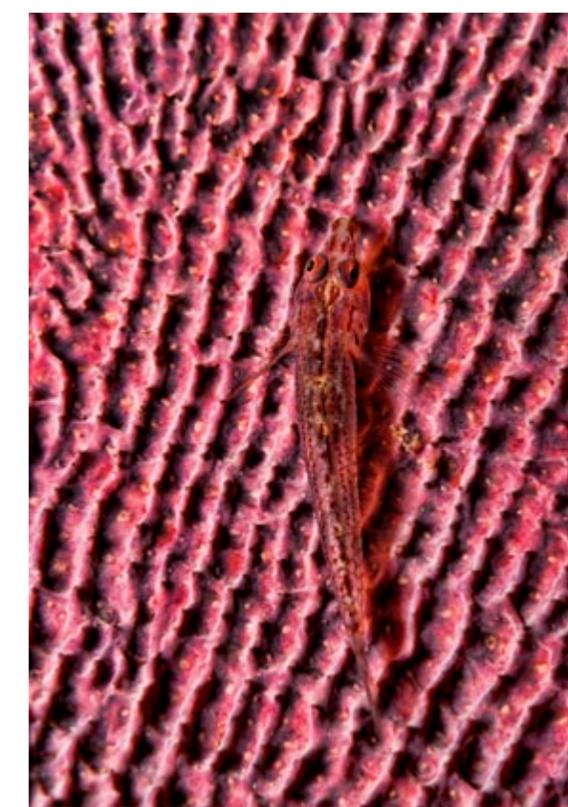
Sea whip crab (left); Leaf scorpionfish (bottom right); Cuttlefish in warning display (center)

**West side of Ambon Bay.** Maluku Divers have now identified a total of 18 sites on the west side, huge bay that forms Ambon's natural harbor, starting with Mimic Point in the north, near the newly identified "shipwreck", and ending in the

south at Bata Badiri. Many of the sites are named after the specific critters that are found there—such as Mandarin City on the edge of the Twilight Zone, or one of my other favorites—Rhino City. Dive master Marcel Hagendijk

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LEFT TO RIGHT: A tiny blenny blends in; Saron shrimp at Amahusu; Moray eel peers from its lair; Diminutive orangutan crab

and his team dive all these sites regularly and know the current status of what is there depending on the time of year, as water temperature directly impacts what critters are around, and will adjust the diving program around the specific things you want to see.

The area around the village of Laha, where Maluku Divers is located, is a particularly "target-rich" environment for critter spotters and photographers.

Besides the Twilight Zone itself and Mandarin City, there is Laha itself, which hosts a variety of things to see, and Rhino City, which has been known to have up to six resident *Rhinopias* scorpionfish at certain times of the year. It was down to "just" three when I was there!

**East side of Ambon Bay.** There are less sites on the east side of the bay, with a total of

seven identified and dived regularly, with Amahusu and the nearby Dark Blue Jetty being the most prolific.

Amahusu, with its resident colony of very photogenic Saron shrimps, was my personal favorite. These shrimps, which are rarely seen, make excellent photo subjects with their Captain America stars and stripes liveries!

The diving at all of the sites on both the west and east sides requires much the same diving discipline, as they are all located on the fairly steep slopes of the bay. So, care is needed with buoyancy skills to make sure you can hover above your subject matter. Plus, there are often strong currents running in the bay, which need to be heeded.

**The shipwreck**

I love critter diving as much as anybody,

but after several days of macro photography, I found myself gazing longingly at the wide-angle lenses in my camera bag. The quickest way to satisfy that urge in Ambon is a dive on the mysterious "shipwreck" located on the western side of the bay close to the state oil company Pertamina's main jetty.

Marked by a large but rather rusty buoy attached to the stern, which is in just 12m of water, the wreck is 100m in length and lies facing down the slope of the



harbor with its foredeck at 32m and the bow in over 40m. Very little was known about the wreck, but as with many things in Indonesia, there were no shortage of



Coral crab; Ornate ghost pipefish (far left); Beautiful paddle-flap scorpionfish at Rhino City (center)

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explore. One large exit hosts some very luxuriant gorgonian fans and sea whips, which can be showcased against the blue water from above.

Both Pintu Kota and Hurikila Cave are must-do dives and the minimum sites you should consider along the south coast. But, there are a total of ten other sites identified sites that are possible to dive

on a day boat.

## Afterthoughts

All in all, Ambon offers a terrific combination of probably the best critter diving anywhere in Indonesia, apart from the Lembeh Strait, together with an interesting shipwreck and some great coastal dive sites. Add in the excellent new Maluku Divers resort, plus the unique spice trade history, and it's easy to understand why it is so high on the "bucket list" of places to experience in the vast archipelago that is Indonesia. ■

*Don Silcock is a dive writer and underwater photographer based in Sidney, Australia. For more information, visit: [www.indopacificimages.com](http://www.indopacificimages.com)*

rumors and tales about it.

One such story was that the wreck is the remains of a Dutch cargo ship scuttled deliberately during WWII to prevent it from falling into Japanese hands, while another is that it was bombed and sunk by a single bomb dropped down its funnel by a (very good) mercenary pilot during civil strife in the 1950's.

Dive master Marcel Hagendijk is a wreck fanatic and conducted a series of penetration dives inside the shipwreck. He found a plaque in the engine room that identified the ship as the *Duke of Sparta*, built in 1940 at the William Gray shipyard in West Hatlepool in the north-east of England. Sold in 1951 to the Grimaldi brothers in Naples, the *Duke of Sparta* was renamed the *SS Aquilo*.

Marcel established that the ship was bombed in Ambon's harbor during Operation Haik—a clandestine Cold War CIA operation against Indonesian communist rebels in 1958.

The initial bombing did significant damage to



the *Aquilo*, but not enough to sink her. It was another month before she finally went down on May 27.

The shipwreck being located in the harbor meant that visibility was not that great and varied between 10-15m. But the wreck is still very much intact, and all its features are clearly identifiable. Soft and hard corals have grown abundantly on the wreck, making it a very nice alternative dive if you are a little crittered out.

## The south coast

Another good antidote to an excess of critter diving, and an excellent excuse to

dust off the wide-angle lenses, is a trip along the south coast to Pintu Kota and Hukurila Cave.

*Pintu Kota* means Gate of the City, in Bahasa Indonesia, and is located on a small headland about an hour's boat ride along the south coast from the entrance to Ambon's harbor. It gets its name from the several large archways that honeycomb the headland. The archways create an impression of large doorways that lead into a huge inner cathedral-like chamber.

Underwater, there is a very large archway at 17m that mirrors the ones above water. This archway and the healthy surrounding reef and clear blue water, combined

with the overall ambience created by the streams of sunlight penetrating down through the above water chambers, create a wonderful environment in which to use your widest wide-angle lens.

Hurikila Cave is further east along the coast from Pintu Kota and is another small honeycombed headland, which hosts a particularly interesting twisting chimney that is best entered from the top. The large passageways provide several interesting photo-opportunities with large sponges and archways against which to frame your model.

At the bottom, there are three exits to

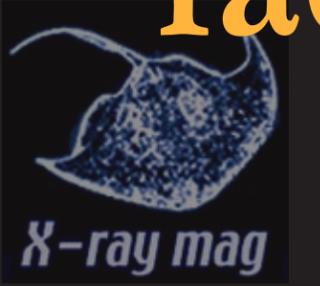


Inside Hurikila Cave on Ambon's South Coast



Stonefish

# fact file



## Indonesia



SOURCES: US CIA WORLD FACT BOOK, SCUBADOC.COM, E-MED.CO.UK

**History** In the early 17th century, the Dutch began to colonize Indonesia. During WWII, the islands were occupied by Japan. After Japan's surrender, Indonesia declared its independence, but four more years passed with intermittent negotiations, recurring hostilities, and U.N. mediation before the Netherlands let go of its colony. Home to the world's largest Muslim population, Indonesia is the world's largest archipelagic state. Its government faces several challenges including alleviating poverty, preventing terrorism, consolidating democracy after 40 years of authoritarianism, reforming the financial sector, eradicating corruption, halting human rights violations by the military and police, and controlling avian influenza. Indonesia reached a historic peace agreement with armed separatists in Aceh in 2005, which led to democratic elections in December 2006. In Papua, a low intensity separatist movement continues to confront Indonesia. Government: republic. Capital of Indonesia: Jakarta. Main city of Ambon: Ambon City.

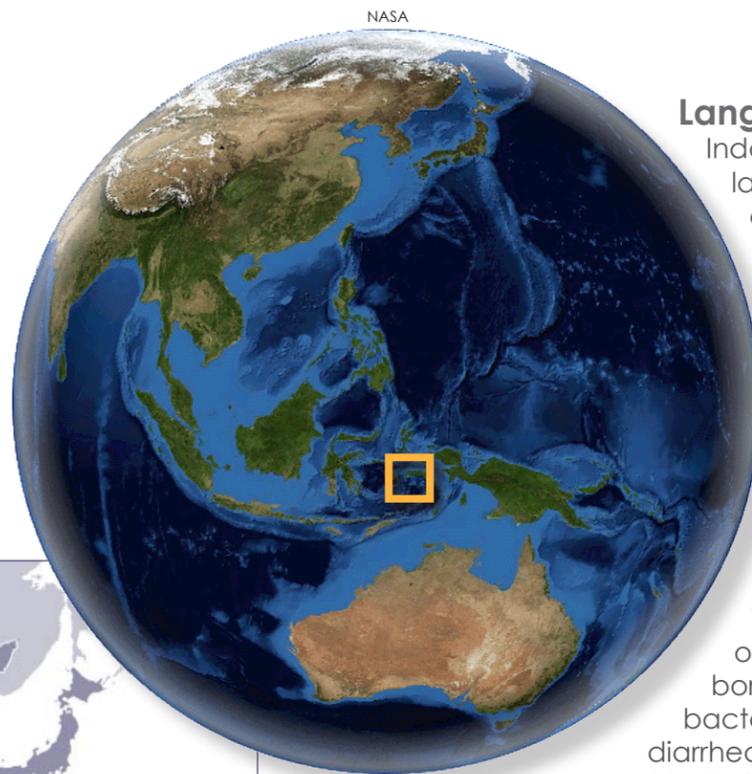
**Geography** Indonesia is located in Southeastern Asia. It is an archipelago between the Indian Ocean and the Pacific Ocean, which consists of 17,508 islands, of which 6,000

are inhabited and the country is approximately three times the size of Texas. Indonesia straddles the equator and has a strategic location along major sea lanes from the Indian Ocean to the Pacific Ocean. The terrain is mostly coastal lowlands with interior mountains on the larger islands. The lowest point is the Indian Ocean at 0m, and the highest point is Puncak Jaya at 5,030m.

**Climate** Tropical, hot and humid. Temperatures range from a high of 31°C (88°F) to 25°C (78°F) low. Highlands are cooler and drier. Lowlands along the coast are pleasantly drier than the main tourist areas in the south. Monsoons: the dry season takes place April through November, and the wet season, December through March. Natural hazards include occasional floods, severe droughts, tsunamis, earthquakes, volcanoes and forest fires.

**Economy** Indonesia is a vast polyglot nation, which grew an estimated 6.1% and 6.4% in 2010 and 2011, respectively. The government made economic advances under the first administration of President Yudhoyono

RIGHT: Location of Ambon on global map  
BELOW: Location of Ambon on map of Indonesia  
BOTTOM RIGHT: "Deep Throat"



Indonesia's credit rating to investment grade in December 2011. Indonesia still struggles with poverty and unemployment, inadequate infrastructure, corruption, a complex regulatory environment, and unequal resource distribution among regions. The government in 2012

(2004-09), introducing significant reforms in the financial sector, including tax and customs reforms, the use of Treasury bills, and capital market development and supervision. During the global financial crisis, Indonesia outperformed its regional neighbors and joined China and India as the only G20 members posting growth in 2009. The government has promoted fiscally conservative policies, resulting in a debt-to-GDP ratio of less than 25%, a small current account surplus, a fiscal deficit below 2%, and historically low rates of inflation. Fitch and Moody's upgraded

faces the ongoing challenge of improving Indonesia's insufficient infrastructure to remove impediments to economic growth, labor unrest over wages, and reducing its fuel subsidy program in the face of rising oil prices.

**Population** 248,216,193 (July 2011 est.) Ethnic groups: Javanese 45%, Sundanese 14%, Madurese 7.5%, coastal Malays 7.5%, other ethnic groups 26%. Religions: Muslim 88%, Protestant 5%, Roman Catholic 3%, Hindu 2%, Buddhist 1%, other religions 1% (1998) Internet users: 16 million

**Language** Bahasa Indonesia is the official language and is a modified form of Malay. Other languages spoken: English, Dutch, local dialects (Javanese is the most common)

**Health** Be prepared and get your shots before you go to Indonesia. There is a high degree of risk for food or water-borne diseases including bacterial and protozoal diarrhea, hepatitis A and E, and typhoid fever. There is also a risk for vectorborne diseases in some locations. These diseases include dengue fever, malaria and chikungunya. Bird flu, or highly pathogenic H5N1 avian influenza, has been identified among birds in Indonesia. It poses a very low risk, but check with your doctor before you go.

**Environmental Issues** Deforestation, sewage, industrial water pollution, urban air pollution, forest fire smoke and haze

**Visa** Travelers from most Western countries do not need a visa and are automatically given a 30 day stay permit upon arrival. Passports must be valid for at least six months upon arrival in Indonesia. Indonesian immigration is very strict. No work is permitted while visiting on a tourist visa.

**Indonesian Law** Very hard on drug offenders; the death penalty is regularly applied on narcotics couriers.

**Driver's License** A valid international driving license is required. Rental car insurance is

highly recommended. Drive carefully. Traffic rules are not followed as well as in the West. Accidents are frequent.

**Currency** Indonesian Rupiah (IDR). Exchange rate: 1EUR=10,002 IDR; 1USD=9132IDR; 1GBP=14537IDR; 1AUD=9,500IDR; 1SGD=7,316IDR. Credit cards are accepted by most higher end resorts and businesses. Payment in U.S. dollars and traveller's checks is widely accepted.

### Decompression Chambers

**Ambon.** Rumah Sakit Angkatan Laut (RSAL) Halong, Ambon Tel. 62-911-52152  
**Bali.** Sanglah General Hospital, USUP Sanglah Denpasar, Jl. Diponegoro, Denpasar 80114 Bali Tel. 62-361-227911 [www.sanglahbalihospital.com](http://www.sanglahbalihospital.com)  
**Jakarta.** Rumah Sakit Angkatan Laut (Navy Hospital) Mintoharjo in Jl. Bendungan Hilir No.17, Central Jakarta. Tel. 021-5703081

### Web sites

Indonesia Tourism  
[www.indonesia-tourism.com](http://www.indonesia-tourism.com)  
Maluku Divers [Divingmaluku.com](http://Divingmaluku.com)



—ed. Our features editor, Robert Osborne, interviewed freediving champion Stig Åvall Severinsen for an insightful look into the man and the philosophy that underlies his success as well as forms the basis of his recent book, *Breatheology*—the Art of Conscious Breathing.

Text by Robert Osborne  
Images courtesy of Stig Åvall Severinsen

**Freediving is easy. All you have to do, according to freediver extraordinaire, Stig Severinsen, is “learn to hold your breath as long as you can”. Simple.**

But it becomes a little more complicated when you set out to turn what most of us do when we're fooling around at the bottom of the pool into an almost mystic disci-

pline, which has allowed Severinsen to break long-standing records and win world championships. So, how does Severinsen manage all that? Well, in the words of the Bard, “There's the rub”. Severinsen accomplished this by transforming a sport into a personal philosophy.

Severinsen discovered he could use meditation to decrease his physical need for oxygen, a kind of mind over body approach. And once he'd perfected that, he began to see the potential for his methods beyond the world of freediving—it could inform an entire philosophical approach to life. “For me, breath holding work is ‘walking the talk’ of human potential. It's more of a metaphor for what's possible in life.”

And where did this obsession with what he calls “underwater meditation” begin? Where it begins for most of us, sinking to the bottom of his family's backyard pool when he was barely able to walk—and holding his breath.

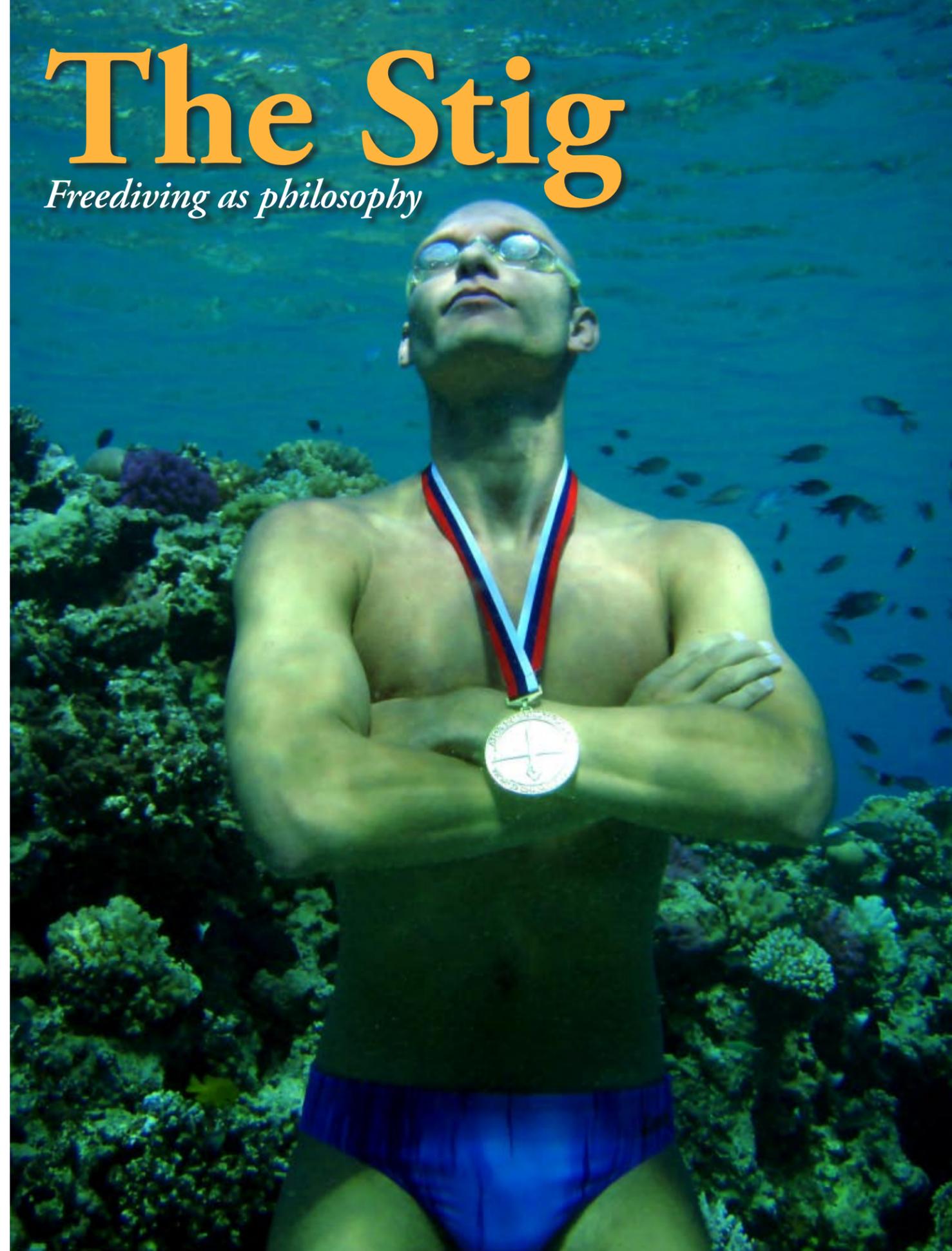
### History

Severinsen was born in Aalborg, Denmark, in 1973. Family lore has it that his connection to the sea began literally in the womb—“I was conceived on a boat,” he laughed. Regardless of whether that anecdote is family fact or revisionist history, Severinsen said he has always had a love of the sea and has always felt quite at home underwater.

By the time he'd turned six, he was competing as a swimmer at school. From the age of nine he was a champion, winning Danish National Championships four years

# The Stig

*Freediving as philosophy*





sounded a deep inner note in Severinsen's psyche. Breath-holding dives not only became a challenge to him physically—for the driven young man—it “became a way of getting away from myself”. In order to become really accomplished at the sport, he would learn to “relate more to my heartbeat than my brain functions”.

from this ancient practice onto the elegant challenge of freediving. The results were impressive.

**Championships**

Between 2000 and 2007, he won no fewer than four freediving world championships: a gold medal in Switzerland in 2005, gold in Egypt in 2006 and a double gold in Slovenia in 2007.

He also set several world records—among them, a freedive in 2007 to 186 meters without using a set of fins to propel himself. That same year, he set another record by swimming 225 meters distance on one breath.

More recently, he wrote himself into the 2010 Guinness Book of World Records by being the first person to swim 72 meters under the ice without the use of an exposure suit. In 2012, he broke another

er record by becoming the first human being to hold his breath for 22 minutes.

Anyway you measure it, Severinsen's combination of yogic breathing and freediving has been enormously successful.

Interestingly, despite being a freediving world champion, Severinsen said he still suffers the same anxieties as any kid holding his breath at the bottom of the pool. “Of course, I still feel that burning desire to head for the surface, but I've trained myself to let the diving response kick in.” His belief that feeling fear is inescapable but controlling that fear is quite achievable has become a personal doctrine and a metaphor for life.

**Paying it forward**

In 2010, Severinsen began to look for another “mountain” to conquer. Given



ing all of his time with his head underwater. In the midst of all that activity, he somehow found the time to complete a master's degree in biology and then added a Ph.D. in medicine for good measure.

It goes without saying that most people would look at what Severinsen had accomplished by the age of 27 and think that it was already an impressive career. But it was only the begin-

**Meditation**

Initially unaware it was even happening, freediving for Severinsen became a form of meditation. He trained himself to slip into a state in which his brainwaves were operating on the alpha level instead of on the more active beta level. Essentially, Severinsen said he was learning to mimic the “mammalian dive reflex”, which whales and sea lions use instinctively. By dropping himself into that alpha state, he lowered his entire body metabolism—thus using less energy and less air. More than anything, Severinsen credits the ability to achieve this state of mind to his phenomenal success as a freediver: “It's more important to go into this state for long or deep dives than to have huge capacity in your lungs.”

And just how was Severinsen able to descend into this alpha state while floating in the ocean inhaling massive quantities of air while preparing for what many might describe as nothing less than a horrifically deep dive? Well, in the late 90's, Severinsen had started to study yoga. And yoga became his secret weapon. He transposed the breathing and meditation techniques he learned

in a row. By 1993, his powerful obsession with the water progressed to a different venue. Now at university, Severinsen began playing underwater rugby, ultimately becoming part of the Danish National Team. A few years later, while studying at the University of Barcelona, he joined the Spanish National Underwater Hockey Team.

But clearly Severinsen wasn't spend-

ning of Severinsen's aquatic vocation. As it turns out, his early accomplishments would be a pale shadow of what would come next.

In the year 2000, Severinsen discovered the challenging world of competitive freediving. On top of the physical challenges of the sport and the adrenaline rush it offered, the challenge of controlling the most basic of impulses—breath—





they could accomplish parallel feats in their own personal venues.

### The book

Ultimately, Severinsen's approach to transcending mental limitations was put together in a book. Originally published in Denmark, *Breatheology—the Art of Conscious Breathing* explains his belief that any one of us can do what he's done: create a link between the mind and body through proper breathing and drive the self to achieve much more than we ever thought possible. The book was a best-seller and went on to be published in English, Chinese, Spanish and Russian; Arabic and Portuguese versions are in the works.

The philosophy also has a website: [Breatheology.com](http://Breatheology.com). And Severinsen has recently created a brand new online platform called Breatheology Academy, which gives people

instant 24-hour access to training via video exercises.

Certainly, the whole idea seems to have caught fire. Severinsen is on the go virtually 12 months of the year, hopping around the globe, giving talks and running workshops on Breatheology. In a single week he'll fly between Spain and Hong Kong and the United States—all to promote his concept. His ultimate goal—to have the book translated into as many languages as possible and to have as many people as he can benefit from what he believes is a powerful life tool. Breatheology has taken over his life.

As for freediving, Severinsen simply no longer has the time to compete on the world championship circuit. What training time he does have he devotes to working on achieving still greater underwater breath-holding world records. It seems that having shown thousands of people how to transcend their limitations, he's run into one of his own—time. ■

*Features editor Robert Osborne is an internationally published dive writer, television producer and reporter based in Toronto, Canada.*

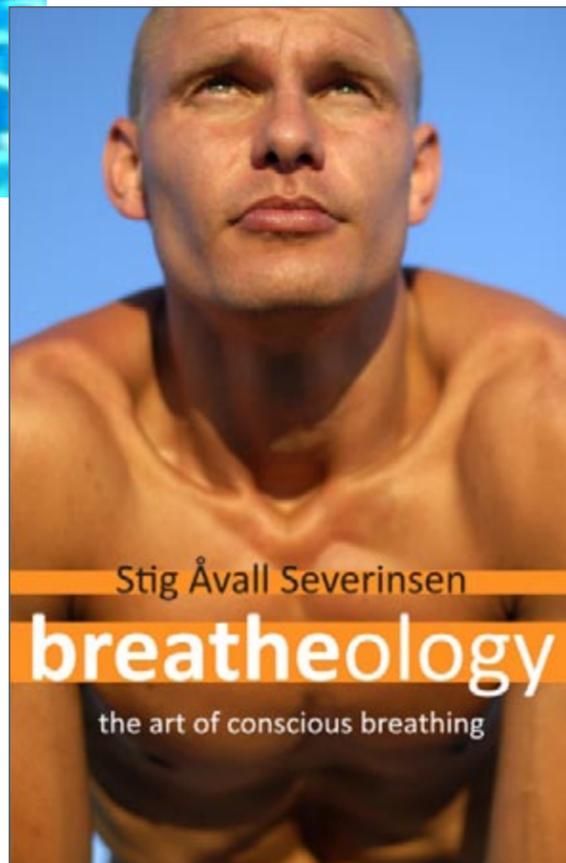
what he had learned about his own ability to use his mind to master his body and accomplish pretty much any goal he set out for himself, Severinsen saw no reason why others could not benefit from the same approach. So, he set out to share some of the knowledge he'd gained.

First, he began to work with elite athletes from around the world including the likes of cyclist Alberto Contador and Olympic gold medalist Martin Kirketerp—not to mention the Danish National Freediving Team and soccer star William Kvist. Severinsen said, when it comes to elite athletes, "Their physical and anatomical differences are not that different." So, what does make the difference between a champion and an also-ran? Severinsen suggested that one needs to

tap into some kind of extraordinary ability.

Amazingly, "For people who manage superhuman efforts, it's the way they've trained their minds." And with that, we are returned to exactly what Severinsen specializes in—using breathing and meditation to train your mind to go beyond where you believe it can go.

He started with athletes, but soon his client base expanded to include everyone from CEO's to people with physical disabilities. In each case, Severinsen applied the same wisdom. He worked to teach them how they could transcend their physical limitations with their minds. In the same way he had pushed his mind and body to achieve near superhuman efforts underwater, he showed them how





# No Limits

—New medical technologies for apnea diving

Text and images courtesy of Andrey Bizyukin, Mikhail Artamonov, Igor Erenburg, and Damir Musin.

**“What is the hypoxia? It is a deficit of oxygen in the lungs, blood and tissues. Each of us feels hypoxia from time to time, even if we do not realize it.”**  
**What is the limit of human capability? How long can a person swim without breathing, and to which depths can a diver reach in one breath? This question has troubled generations of athletes, apnea divers and scientists as well.**

The dream of the “Blue Abyss” is embodied in the depth records of some of the most famous divers—Jacques Mayol, Francisco Ferreira and Umberto Pelizzari—who have destroyed so many myths and even scientific theories about the limited capacity of humans as overland beings.

It was a hard road of study—to develop the infinite possibilities, which are sleeping somewhere deep inside of us. The representation of the features of the human body and the

ability of the body to adapt to unusual, new and extremely harsh conditions—excessive pressure, hypoxia and biophysical changes on all levels, from the cellular level to the whole organism were changed with each new achievement.

Now, we have more and more people coming to the discipline of freediving. New names of champions are appearing. The records for apnea diving depths have shifted from 137 meters to 154 meters and deeper, while the records for breath hold for the last five years have remained unchanged until just recently, when the record for breath hold reached 7 minutes 35 seconds in a static position and 8 minutes in

exact dynamics.

The time has come for new scientific and medical technologies in the training of “human dolphins”. In Russia, new research is being done in one of Moscow’s medical clinics, on human physiology in hypoxic conditions. Here, a method of “interval hypoxic training” has been used. It’s based on an alternation of hypoxic breathing gas with oxygen at reduced concentrations (from 14% to 9%) and normal air (21% oxygen).

One participant described the scene: “Tables with soft chairs, devices worn on fingers, and masks on faces with corrugated hoses. It seemed that sitting motionless in a chair and

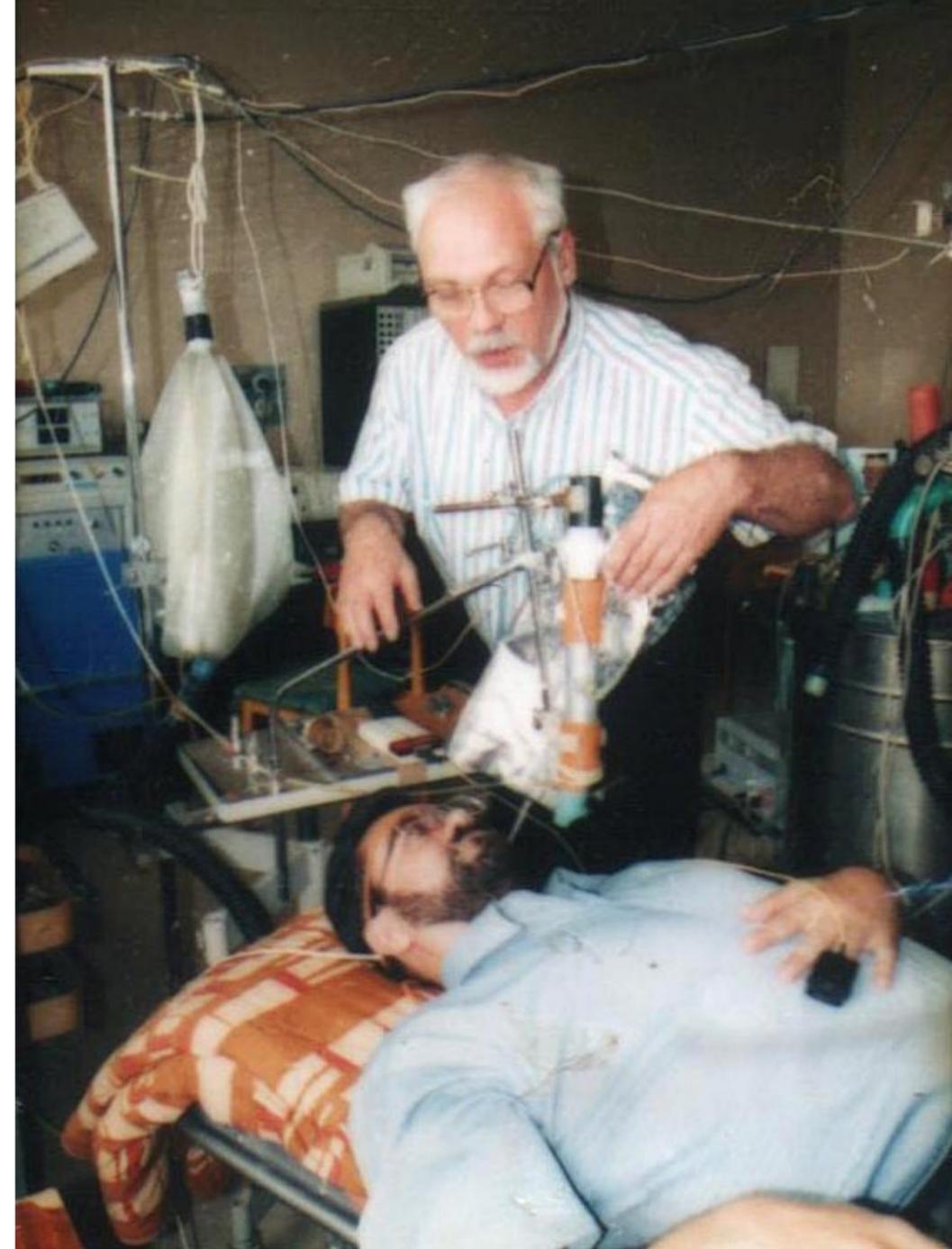
breathing through the mask, even on a low oxygen mixture that was not very serious, was challenging. Divers would more likely prefer to do something more extreme—for example, lift some dumbbells or spin a bike—to at least blend in with the background of normal patients in the clinic.”

In particular, apnea divers, are used to more “extreme” training regimes. In this experiment, the oxygen concentration was reduced to eight percent, which corresponds to the partial pressure of oxygen at 7,000 meters above sea level. For participants, the lack of oxygen began to feel much larger.

In these very low oxygen conditions, a normal person starts to feel that really not enough air is going in. Breathing becomes deeper and more frequent. The pulse rate and intensity at which the heart has to work is increased a great deal. The person starts to suffocate. To survive this challenging situation, it is necessary to switch on the protective reaction of the body.

## Stillness

The main and most important thing to accomplish is maximum relaxation, reduction of respiratory function and heartbeat. Concentration of consciousness can achieve a state of almost complete stillness, in which one



stops thinking and “time” stands still, tapping into one of our internal resources.

Breathing a hypoxic mixture does not feel like the state a diver experiences right before a dive, when he or she breaths in and out intensively (hyperventilation), and a feeling of euphoria comes—filling the body with what yogis call “breathing prana” or life force—and it feels like one could stay under water for ages.

While the participants breathed the hypoxic mixture, they felt

some slight intoxication, dizziness and weakness. One participant said, “I often fell asleep or dreamt ‘under the mask’ while sitting up.”

It seemed inevitable that the breakdown mechanism worked out by divers in the process of training for dives in the water would occur. This is when the mind begins to save “emotions”, and the awareness of what is happening here and now is perceived from a side view, an impartial view of just what is happening to you. In





terms of martial arts, specifically the philosophy of Karate, this condition is called *Mitsu no kokoro*—when the human mind is like the surface of a “sleeping lake” and is a desirable goal of adept martial artists, automatically achieved by breathing oxygen-depleted air.

At the clinic, doctors constantly monitored oxygenated hemoglobin in the blood as well as the heart rate of each participant. With several training sessions, the frequency of the heart rate fell to 30 beats per minute, which meant that the

bodies of the participants adapted and responded adequately to hypoxia.

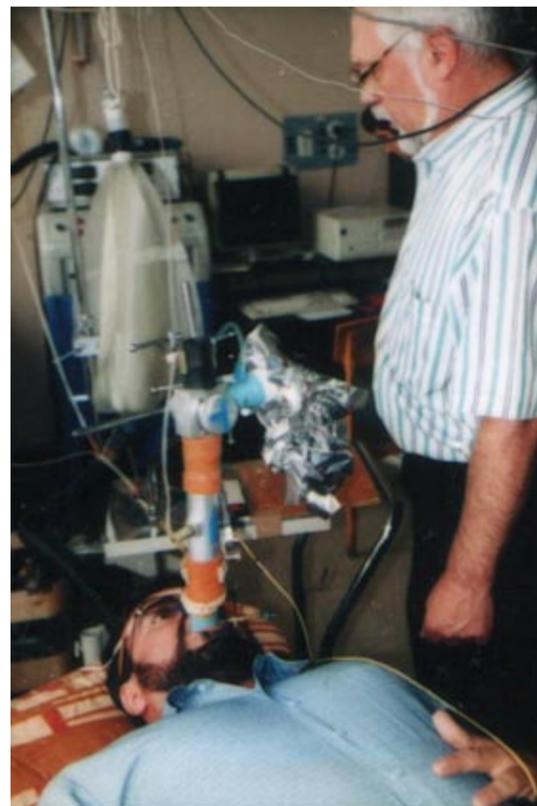
### Methodology

The research methodology of this experiment consisted of 10-30 sessions; each session consisted of 5-10 cycles, with durations of two to 15 minutes. If hypoxia is not too strong, it activates the body's internal reserves, and slow adaptation occurs. “Answers” to the body's stress had become a more appropriate and sustainable.

There is going to be improving pulmonary ventilation, a decrease in the frequency and an increase in the depth of breathing, improving lung diffusion capacity, enhancing the effectiveness of external respiration, and an increase in oxygen capacity, improving the antioxidant properties of the blood, increasing the heart rate and cardiac output, volume, while the increase in the number of red blood cells is reduced. Blood flow to organs and secondary systems and increases in primary systems (such as brain and heart) increases the activity of anaerobic enzymes.

### Conclusions

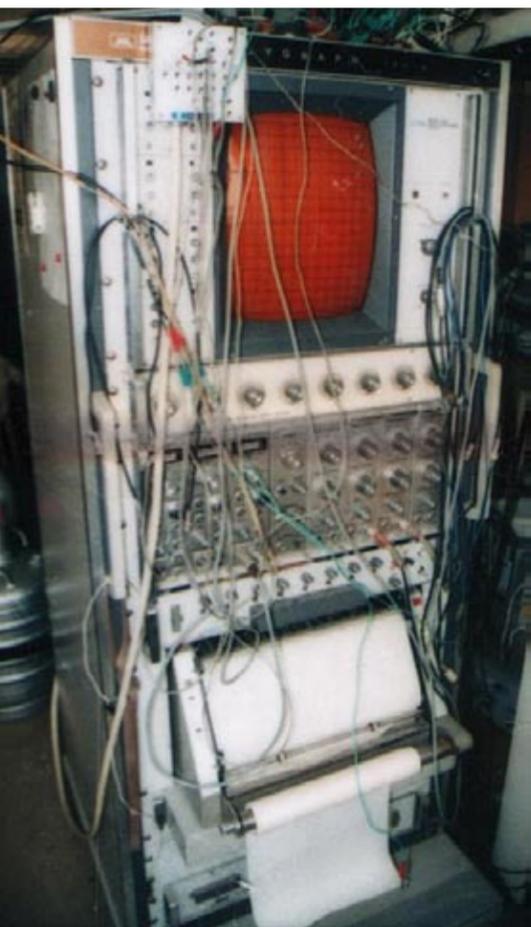
The tangible result of the experiment was the increase of breath-holding time, without prior pulmonary ventilation, to 4-4.5



minutes, which was previously achieved only after prior intensive hyperventilation for 1-2 minutes.

During the workout in the pool, participants in the experiment at the clinic were able to overcome the time of 5 minutes 30 seconds in static apnea. It was pointed out that it was a very quick and easy entry; Participating divers were in good shape despite the long absence of training at sea. If they did the same hypoxia training from the first day, they could easily reach depths of 30-35 meters. Whereas, it usually took three to four days of intense training in order to reach these depths.

Today, hypoxic training is used widely in clinical medicine and sport. And the results of the successful experiment at the Moscow clinic once again allows us to recommend the method of interval hypoxic training as one of the most effective ways to improve the adaptability of the human body. ■



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## New study reaching back thousands of years may disprove long standing theory about bowhead whales

Until recently, it was the wide-spread belief among the scientific community that bowhead whale populations existing on opposite sides of the Arctic were unable to intermingle and were therefore genetically unrelated. After all, how could two distinct groups of whales separated by miles and miles of impenetrable ice sheets be able to interact?

But scientists from the American Museum of Natural History, the Wildlife Conservation Society and other organizations have published the most comprehensive broad-range genetic analysis of the bowhead whale ever conducted and may have debunked that theory all together.

Using hundreds of DNA samples collected from whales over the past 20 years as well as ancient genetic samples (some over one thousand years old) showed that whale populations in both regions were related, and thus individual whales must be able to make the journey.

Just how does a team of researchers go about gathering DNA samples from whales that lived thousands of years ago? Good question.

Apparently, researchers tracked down archaeological sites and now-abandoned settlements of indigenous Arctic

hunters known as the Thule people (the likely ancestors of the Inuit) and collected genetic samples from centuries-old specimens—extracted from old vessels, toys and housing material made from bowhead baleen—still preserved due to the extreme cold of the icy climate.

The new study attempts to shed light on the impacts of sea ice on this threatened but now recovering species. “Our study represents the first genetic analysis of bowheads across their entire range,” said Elizabeth Alter, the study’s lead author and professor at City University of New York. “The study also illustrates the value of ancient DNA in answering questions about the impact of changing climate and human exploitation on genetic diversity in bowhead whales.”

Specifically, the study was aimed at examining DNA from all bowhead populations that are believed to exist for the purpose of gauging “gene flow” between those groups, i.e. whether or not these separate populations intermingle sexually and mate with individuals from other groups.

“The assumption that Arctic sea ice has separated bowhead whale populations over the past several thousand years is contradicted by the genetic analysis, which indicates that significant

migration between Atlantic and Pacific populations has recently taken place,” said Dr Howard Rosenbaum, Director of WCS’s Ocean Giants Program and senior author on the study. “The finding reveals much about the abilities of bowheads to find navigable routes through sea ice and helps illuminate hidden connections between populations.”

Achieving lengths of 65 feet and weighing up to 100 tons, the bowhead gets its name from its enormous arched head, which it can use to break through ice up to two feet thick in order to breathe. The whales may also be among the most long-lived mammal species on the planet. A few years ago, aboriginal whalers in Alaska landed a whale that had a harpoon point embedded in its blubber. When the metal tip was dated, it was discovered to have been manufactured in the 1890’s.

■

## Killer Court Case – Round Three

*The third round of the fight to free the orca ‘Morgan’ from captivity set to begin on 1 November 2012.*

If you are unfamiliar with the ongoing fight over what to do with the juvenile killer whale, let me fill you in on the details.

On 23 June 2010, a young female orca was found alone and starving in shallow water of the Wadden Sea, off the Dutch coast. The exhausted cetacean was brought to a dolphinarium—a cetacean theme park—at Harderwijk, The Netherlands, and given the name ‘Morgan’. The company vowed they would care for her until she regained her strength to be released.

After a short time in recovery, the dolphinarium determined Morgan would be better off in captivity than in the wild and mentioned other marine mammal parks as possible destinations for Morgan. They soon made plans to send the young whale to an entertainment facility called Loro Parque in Tenerife—one of the Canary Islands off the north-west coast of Africa.

“The theme park is the best option for her because that is where she can live in a group and that is the best we can offer her,” said Niels van Elk, a vet who has been working at the dolphinarium for 13 years. “We as humans should not pretend that we can replace the chal-

lenges and the satisfaction that a group of killer whales can give. It is an artificial environment, it’s a different life but it’s a good life all the same.”

Not everyone agreed, and it was at this stage that a group of concerned Dutch animal welfare and conservation NGO’s founded the Orca Coalition.

According to law, rescued cetaceans should only be kept in captivity if it is not in the mammal’s best interest to be released. Orca coalition and several cetacean experts working with the group believe that the dolphinarium’s assessment of Morgan’s future was incorrect based on their own findings and started court proceedings.

Two important hearings followed. During the first, held on 3 August 2011, a judge ruled that the responsible parties had neglected obligations on the issue and should do additional research to investigate the possibilities to rehabilitate the orca and set her free. The scheduled transport of Morgan to Tenerife was temporarily blocked.

However, two weeks after the second hearing, which took place on 7 November 2011, the judge announced in her ruling that the dolphinarium was allowed to move Morgan to Loro Parque, and she was transported to the island later that month.

Now, the third round of court proceedings are about to come before the Dutch courts, and the judges must decide whether Morgan’s continued captivity is in her best interest or in the best interest of the Dolphinarium Harderwijk and Loro Parque. To do so, they will need to obtain an unbiased evaluation of Morgan’s health as well as weigh the evidence presented by the Dutch veterinarians who first cared for Morgan and the conflicting data given by the Orca Coalition.

At stake is not only the future life of the young killer whale but also a new legal precedent if Morgan is set free. ■ SOURCE: BBC NATURE, SEATTLE PI



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# marine mammals

## Young beluga imitates human speech tones

The internet is buzzing right now with headlines claiming: "SCIENTISTS FIND WHALE CAN SPEAK LIKE HUMANS!" and "EXPERTS SAY BELUGA LEARNED ENGLISH!" But before you run off and tell all your friends and neighbors about the amazing white whale that can talk, let's take a closer look at what researchers actually are saying.

In late October, a paper entitled, *Spontaneous human speech mimicry by a cetacean*, published in the journal *Current Biology*, researchers from the National Marine Mammal Foundation, the University of California San Diego and the U.S. Navy Marine Mammal Program describe a young beluga, named NO-C, who apparently had a short-lived ability for vocalizations that sounded, not like human speech itself—as so many internet stories are saying—but similar speech tones used by humans when speaking.

Confused? Yeah, so was I. But here is what happened according to the research paper:

### A whale named NO-C

In 1977, as part of a program to study whether or not cetaceans and other marine mammals could perform underwater reconnaissance missions or perhaps disable mines, the U.S. Navy captured several beluga whales in Canada's Hudson Bay and brought them to California. The smallest of the pack was nicknamed "no-see-um" or "NO-C" for short.

Several years later, staff mem-



FILE PHOTO: ANDREY BIZYUKIN

bers started noticing that unusual sounds were coming from around the vicinity of the dolphin and whale enclosure—almost, they said, as if two people were conversing in the distance just out of range of understanding. They realized that the "voices" they were hearing must be coming from NO-C when one day a diver came to the surface outside the white whale's enclosure and asked his colleagues, "Who told me to get out of the tank?" When pressed about what he heard, the diver said he thought he heard the word "Out" repeated several times.

Scientists began recording NO-C's speech-like sounds in air and underwater and soon saw that the rhythm and frequencies and tones of vocalizations were all similar to those of human speech, but several octaves lower than NO-C's usual clicks and whistles.

The lead author of the paper, Dr Sam Ridgway of the National Marine Mammal Foundation, is convinced the juvenile beluga was deliberately imitating the speech tone of humans. "Our observations suggest that the whale had to modify its vocal mechanics in order to make the speech-like sounds," he said. "Such obvious effort suggests motivation for contact."

The researchers encouraged NO-C to keep up the vocalizations by giving him rewards, allowing the team to examine him more closely.

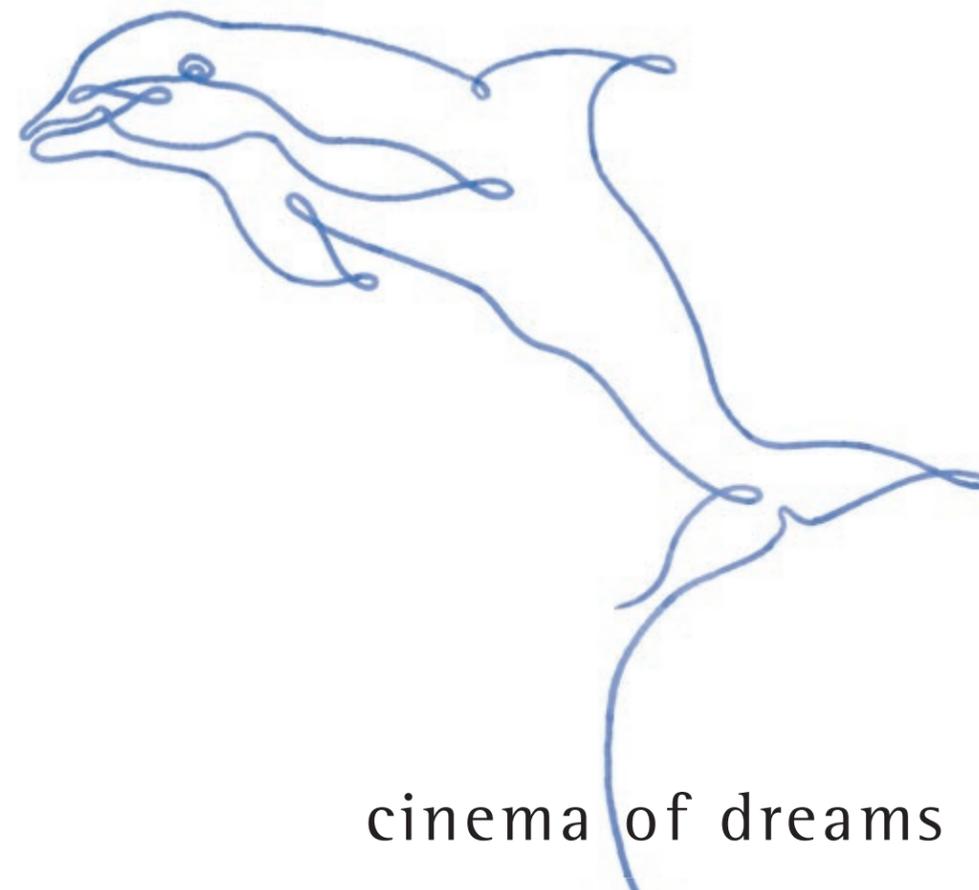
### Speaking the beluga way

In general, whales make sounds via their nasal tract (not in the larynx as humans do) so the team decided to use catheters inserted into NO-C's nasal cavity. By doing so, they were able to determine that the beluga had to vary the pressure in his nasal tract while making several other muscular adjustments, as well as inflate a special sac in his blowhole—not the easiest of tricks.

One such recording of NO-C has been posted on several internet sites, and you can listen to it yourself. Just don't expect to hear a whale chatting about the weather, or even anything that remotely sounds like a person talking, as the screaming web headlines might have you believing.

But if you close your eyes and listen carefully, you should be able to hear how the tone and pitch of the sounds could be confused with distant chatter, almost as if a group of children were all talking at once. And as a diver, you will probably appreciate how those same sounds could be confused with someone speaking underwater. ■

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# turtle tales



Edited by  
Bonnie McKenna

## Sea turtle nests increase

A record number of sea turtle nests have been recorded along the beaches of Volusia and Flagler County, Florida, USA, this summer. More than 1,480 nests have been counted and officials say more than 50,000 eggs have been hatched.

Hundreds of those hatchlings have been reported as disoriented before finding their way to the sea. Open lighting from homes and businesses seem to be the cause. This summer the counties had about 185 open lighting cases as it tries to enforce the ordinance requiring that lights be shielded from shin-



STEVE JURVETSON / CREATIVE COMMONS

ing onto the nesting beaches. Volusia County is working with property owners to resolve lighting problems.

Grants from the Sea Turtle Conservancy, which administers the BP grant program, funded by

the sale of crude oil recovered at the site of the Gulf of Mexico oil spill has paid for improvement in lighting retrofits at facilities along the beaches most frequently visited by nesting sea turtles. ■

## Green turtle hatchlings crawl to sea

It was reported that 75 green sea turtles crawled to the sea

at Senggigi beach in Lombok, Indonesia.

As the hatchlings reached the sea, tourists kept their cameras on to capture the event.

The management of the Sheraton hotel in Senggigi said the green sea turtles were

hatched at the hotel's turtle conservation center.

The hotel buys eggs from locals and incubates them. The hatchlings stay at the center for three months before being sent to the sea.

"In 15 years, we have released more than nine million turtles to their habitat," said Sheraton sales director Jelantik Suharta. ■



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## Rescued Leatherback sea turtle released off Cape Cod

A seven-foot long, 655-pound leatherback sea turtle found stranded near Cape Cod, Massachusetts, USA, was released back into the wild after being treated for dehydration, trauma and shock.

The turtle was found near death. Experts said it was underweight, lethargic and a large portion of its left front flipper was missing. New England Aquarium officials say it might have been entangled in a vertical line of a lobster pot or boat mooring.

Veterinarians treated the turtle with drugs to stabilize its blood values and oxygen levels. As the turtle regained strength, it was released, with a tracking device, a couple of miles off the coast.

"He dove deep right away and did not re-surface within sight of the boat," aquarium spokesman Tony LaCasse said. "That is normal behavior for healthy leatherbacks. A couple of early hits came in off his satellite tag indicating that he was moving." ■

## Rare white sea turtles found in Florida

The unusual coloration of the two turtle hatchlings is known as leucistic, or lack of pigment. Mike Walsh with the University of Florida's College of Veterinary Medicine says such animals have some pigment in their skin or eyes

—unlike albinos. Leucistic animals are uncommon in the wild, and they can become easy targets for prey since they lack the natural coloring to help them blend into their surroundings. ■

## Earthquake in San Salvador destroys 45,000 sea turtle eggs

The director for the El Salvador Zoological Foundation said the 7.4-magnitude undersea quake sent at least three waves approximately 30 feet high up the beach and destroyed thousands of nests and just-hatched sea turtles. The waves also washed up on 150 people collecting eggs in

order to protect them in special pens hundreds of feet up on the beach. The waves injured three people. Last year, the zoological foundation successfully hatched and released 70,000 turtles from four species of endangered sea turtles. ■



CHRISTOPHER BARTLETT

## Lawsuit launched to save whales, sea turtles and sharks from California's gillnets

Conservation groups filed a notice of intent to sue the U.S. federal government under the Endangered Species Act for authorizing California's drift gillnet fishery.

Most gillnets have been banned in California, but the fishery targeting swordfish and thresher shark continues to operate. Nets stretch a mile or more and are set to 'soak' overnight and catch and drown marine animals indiscriminately. On average, more than 130 protected whales, dolphins, seals and sea lions as well as thousands of sharks and non-targeted fish are caught and discarded each year. Government observers documented the lethal take of two sperm whales in 2010 and estimates 16 sperm whales were injured or killed in the fishery that year.

"Deadly fishing nets are risk-

ing the future of large whales and sea turtles," said Catherine Kilduff of the Center of Biological Diversity. "Gillnets entangle everything in the sea, wasting sea life that is precious to the balance of our oceans. It is time to retire gillnets. They should belong to the past."

The notice of intent to sue the national Fisheries Service also seeks new analysis of the gillnet fishery's impact on sea turtles. This includes leatherback sea turtles in the Pacific, whose status has been upgraded

from threatened to endangered because their population has declined by 80 percent over the last decade. ■



CHRISTOPHER BARTLETT

## California designated the Leatherback as the state reptile

In a strong affirmation of the U.S. state of California's commitment to the environment, the endangered Pacific leatherback sea turtle has been chosen as the state reptile.

Per the new state law, 15 October 2013 will be the beginning of California's annual Leatherback Conservation Day. Schools will be encouraged to teach students about this endangered sea turtle species that travels an incredible 6,000 mile journey from Indonesia to California to feed on jellyfish.

By designating the leatherback, California has established itself as a national leader in promoting

conservation of Pacific leatherbacks.

More than 16,000 square miles of California coastal waters were designated as critical habitat for leatherbacks earlier this year. The new law encourages state and federal agencies to build cooperative relationships with island nations where the Pacific leatherback turtles return to nest.

Pacific leatherbacks are on the brink of extinction and public awareness is the key to saving these ancient marine reptiles. ■



PROJETO TAMAR BRAZIL/MARINE PHOTOBANK

# shark tales



Matthew Oliver with OTIS underwater device



## Underwater robot to track tagged sharks

In a bid to better understand migration patterns of sand tiger sharks, researchers from the University of Delaware (UD) and Delaware State University (DSU) are utilizing an underwater robot to track the shark movements.

Resembling a yellow torpedo, the Oceanographic Telemetry Identification Sensor (OTIS) is a remote-controlled underwater device normally used for testing water conditions. Scientists have outfitted the device with acoustic receivers to recognize signals transmitted by previously tagged sharks, as they traverse their coastal habitat. "This is the first time that a glider has found tagged sharks and reported their location in real

time," said Matthew Oliver, assistant professor of oceanography in UD's College of Earth, Ocean, and Environment.

OTIS will be tracking sharks with a trio of different tags. The first is an acoustic transmitter that "pings" receivers while passing by a set of 70 devices situated around Delaware Bay. DSU maintains these receivers and has successfully tagged more than 500 sharks since 2006. Another feature is the pop-off satellite archival tag. The team is utilizing 34 of these tags, which store data on the sharks' journeys for up to a year before being automatically released for retrieval.

Newest is the larger VEMCO mobile transceiver (VMT), which receives and transmits information to specify its location and listen for the pings of other marine animals outfitted with acoustic tags. The VMT tag "will tell us not only where it is, but who it's with", said Oliver. "It's like a social network for sharks."

Oliver and students from both

universities spent the summer catching sand tiger sharks and surgically inserting the transmitters.

OTIS will play a big part, helping researchers find out which water conditions sharks prefer to swim in during their migrations as well as gathering information on water temperature, quality, clarity and oxygen levels. University teams plan to map these habitats, cross-referencing shark data with satellite and remotely sensed environmental conditions to create a comprehensive picture of shark habitats. The team hopes the data will provide scientists with a better understanding as to why these sharks head to certain places.

Sand tiger sharks are the largest commonly occurring shark in Delaware's bay and coastal regions. Generally slow-moving and placid, these apex predators play a crucial role in the region's ecological balance. In 1997, sand tigers were listed as a 'species of concern' by the National Marine Fisheries Service.

The next goal is to direct the glider to remain near the sharks, as OTIS can last up to four weeks without recharging. "We have at least another two weeks of battery," Oliver said. "We'll see how it develops." ■



FILE PHOTO: SCOTT BENNETT

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## Bull shark has strongest bite

Relative to body size, bull sharks bite harder than their larger relatives.

Research has revealed that bull sharks bite with almost 6,000N, a force that is greater than what is required to kill and eat prey. In a study published in the journal *Zoology*, Maria Habegger from Tampa's University of South Florida, along with colleagues in the United States and Germany, examined bite forces produced by 13 shark species and their close relatives, ranging from 1m-long rat-fish to the great white shark.

"We expect strong bite force values in the larger sharks that occupy top positions in the food chain, for example, the great hammerhead, great white shark, tigers and bull sharks," said Habegger. "These species usually prey upon large prey items such as dolphins, turtles and other sharks, so high bite forces are expected due to the mechanical demands of this type of prey."

"The study shows that pound per pound, bull sharks have the largest bite force value among all studied sharks," said the biologist. "Bull sharks can bite harder than a great white shark and great hammerhead."

The study raises an intriguing question: Why do bull sharks

require such a powerful bite?

It may be advantageous for young bull sharks, allowing them to eat more diverse prey earlier in their lives. Smaller bull sharks bite harder than expected for their size, but larger individuals do not.

"From our knowledge there is no need of such massive values to break fish skin or even to puncture bone," Habegger added. It is believed that a strong bite is particularly useful for hunting in murky waters that bull sharks inhabit. "In a lower visibility environment catching prey may be more difficult than in open water. So, once you get a prey between your jaws, securing it is crucial to not lose your meal," she added. However, it is possible that the huge bite forces are simply an artifact of the large size these top predators attain. ■



FILE PHOTO: SCOTT BENNETT