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DIVERS FOR THE ENVIRONMENT

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A GUIDE TO SOME OF THE WORLD'S DIVING DESTINATIONS DIVED AND EXPERIENCED BY EDA MEMBERS

NITROGEN NARCOSIS: ALSO TESTED ON DIVERS

FEATURE **PATRICK VAN HOESERLANDE** PHOTOGRAPHY **OLIVIER SIMOENS**

Walking with my briefcase in the empty hallway, I feel the nervousness creeping up on me. Despite the preparations and the laborious planning, I realize that I can do little if something should go wrong. Once we start, I have no possibility to make corrections. It's a one shot activity. A general briefing and dry-run are crucial. No wonder I'm nervous.

In 2004, I conducted an experiment to determine the effect of depth (in fact, pressure) on our ability to function as a diver. I don't have to tell you there is a narcotic effect of nitrogen. Every diving course worthy of the name, mentions nitrogen narcosis. And yet, many divers claim they have barely experienced this effect and thus wrongly assume that it doesn't affect them unless they dive really deep. Perhaps you belong to the group of divers who think it only starts at the depth of 30m? Why?

The effect is difficult to detect by oneself. Only a few will tell you that they are under influence after drinking one pint. And yet everybody is, because you don't possess your full intellectual capacity anymore. Asking your drinking buddies makes little sense because their reference is affected too. Only a comparative, 'before and after' test will uncover your reduced capacities. The same counts for the influence on high partial nitrogen pressure. No wonder this is also known as depth intoxication.

If a buddy team goes diving, then both divers are under the influence. A diver will therefore have great difficulties to perceive the effect of increased nitrogen pressure on his buddy's capability. And again, only a comparative test can clearly demonstrate the effect.

For my first experiment I used the caisson of the naval base of Zeebrugge (Belgium). This had the advantage that the experiment was supervised by a professional team that stayed unaffected. It also put fewer restrictions on the kind of tests I could design. If I could run it in my living room, then it could be done in the caisson. One drawback, however, manifested itself so strongly that I suspected that it heavily influenced the results. In a dry caisson, the test subjects can communicate with each other. The effect can be compared to that of a night at a bar. If you're a bit drunk, many situations and stories seem funny and provoke a lot of laughter. Unfortunately, if this happens during an experiment, the performance of the test subjects drops. So the results are more influenced by the funny communication than by the narcotic effect. Although this state of joyfullness is also sensed in a deep dive, due to the limited communication – try telling a joke under water – it doesn't affect the diver's ability to function.

A few months ago, diver-biologist Kiki Vleeschouwers came to me with a proposal that could eliminate this effect. She had ran through an intelligence test at 3m and 35m. The self-test suggested a clear difference in results. Unfortunately, the result of a pilot test with only 1 person can hardly be called a valid scientific experiment. Increasing the number of participants, would do just that. The idea of a wet experiment for nitrogen narcosis in the world's deepest pool was born.

Together with diver-psychologist Leentje Vervoort, we designed a test set-up whereby 2 groups of divers filled out equivalent intelligence tests at 2m and 35m. With Nemo 33, the world's deepest pool in our country, we had the luck to have easy access to deep, warm and relatively safe water, because in open water other uncontrollable factors such as darkness, dust, cold…would have an effect on the results. Notwithstanding, complicating the whole test and rendering it more dangerous.

It is still a long way from the idea to the implementation. Obtaining the 'go' from the pool owner went smoother than expected. Normally, for safety and hygienic reasons, the pool applies very strict rules. So everybody expected very little leeway from that side, but in the end almost everything we needed was admitted. Almost. The owner was reluctant to allow the use of Nitrox for the support divers and for me, the experiment-leader. Nevertheless, on the day we totaled 16 test divers, 7 support, 2 underwater photographers, 2 underwater cameramen and a camera crew at the surface. In addition to the photo cameras, video cameras, underwater lightning…all divers had their own lamp, a set of test sheets and a writing slate. A lot of material sponsored by ScubaService, a local dive shop, and the Flemish diving federation (Nelos), that is normally forbidden in this deep pool of crystal clear water.

But we hadn't got that far yet. First we had to design the tests. Dexterity tests are difficult to organize underwater, therefore we chose testing intelligence. As we were not 'intelligent' enough to design objective tests ourselves, we contacted the association for people with high IQ, Mensa, for inspiration. Mensa proposed to use their tests for this experiment and offered their assistance in the analysis of the results. This opened the possibility of discovering the most affected parts of the brain. In the Mensa test, the subject must determine the fifth symbol that flows logically out of a row of 4 given ones. In our setup, the divers had 7 minutes to give as many correct answers as possible.

We added a specially designed memory test in the form of imaginary fish. For this memory test, divers were given the time to study imaginary fish. After the wet time, they had to recall the characteristics of the two fish. This test corresponds to seeing an unknown fish and then to try to identify it after the dive with the aid of a fish book.

To make sure that only depth would come into play, we had to mix the different test sheets so that the 16 sets would be comparable. After that, we had to find a good mix of divers. On our limited call for guinea pigs, we got nearly 60 responses. Much more than we had hoped for, because the candidates had to pay for their participation. Thanks to the many candidates, we had the luxury to be able to select the team members. After much discussion, we decided to limit ourselves into two distinct groups: 'instructors' with lots of diving experience and novice divers who barely touched 30m. We also made for a good mix of men and women. The opportunity to include two older divers, gave our experiment an extra flavour.

So on that particular Friday evening at 7.30, the completed team was ready. After the general briefing followed a dry-run in which everything was rehearsed. This made it possible to implement some minor adjustments and to discuss the set-up in detail. No superfluous luxury, because it would be virtually impossible underwater to influence the procedure. Not only is communication underwater about unforeseen circumstances, the risk was that I would also be under the influence of nitrogen. You can compare it to a contest at the bar in which the referee drinks as much as the contestants.

After the mandatory local safety briefing, we started our compulsory period of acclimatization. The photographers and camera crew were already in stand-by to capture everything. Then we got the go-ahead and the experiment could begin.

I descended together with the team responsible for the right ambient light at 35m. Unfortunately, it took almost 5 minutes before the first test divers took up positions next to me. My first minute of deco time appeared already on my dive computer and the first 7 minutes hadn't yet started. In an attempt to limit my deco time, normally only 'no deco dives' are allowed, I decided to change the protocol by leaving the bottom after giving the start signal and to return in due time to give the stop signal.

Although late, the first group session went smoothly, but due to the early arrival of the second group, the deepest metre of the pool quickly became crowded and the shaft turned into a huge jacuzzi. In this mixture of divers and bubbles, it wasn't easy to distinguish who was who, but the dive leaders were capable enough so that the transition created no problems. After giving the 'go' to the second group, I ascended and gave (earlier than agreed during the dry run), the bag for collecting the tablets to the support divers.

After a few minutes of enjoying the jacuzzi, I noticed that someone was prematurely breaking away from the test. Apparently there was some misunderstanding. Lucky, I directly took notice of the time because I realized that there was little I could do. After wrapping it up, my diving computer informed me of the 25 minutes of decompression time that lay before me.

At 5m, I could only reflect on what went wrong and how we could adjust the test results. Both problems would find a solution after the dive. However, it was already clear to me that part of the problem was due to the influence of the nitrogen at depth. I felt confident that this would probably not have happened at 3m. Once more, it demonstrated that at depth, a simple execution doesn't exist. The experiment was therefore, in my mind, already a success.

After the smooth but not trouble-free one hour test dive, the team was debriefed while enjoying spaghetti. As the evening turned into night and the memory tests were completed, the team exchanged experiences and personal thoughts. Diving logs were filled in and the test team was disbanded.

Now, we had to process the test results. This showed that there was a statistically 'significant' difference between the performance at 2 and at 35 metres. Significant means that the differences have not 'coincidentally' occurred in our experiment, but that it was very likely that they would also be present in 'a real dive'.

Because the dive team was made up by both men and women and both experienced (instructors) and novice divers, we could also consider the factors that were influencing or had an influence on the results. The number of completed questions was significantly smaller at 33m (average of 12 questions) than at 2m (17 questions). These results confirmed that at greater depth, nitrogen narcosis reduces our speed of thinking. The difference in the number of completed questions between 33m and 2m was equally greater for men and women, and for novice divers and instructors. At 2m an average of 10 questions was correctly answered against an average of only 6 at 35m. At depth, a diver thinks less 'precisely'. Again, the difference in correct answers was equally great for men and women. Furthermore, it was found that experience did not protect divers against the effects of the nitrogen.

WHAT DID WE LEARN FROM ALL OF THIS?

FEATURE **LEENTJE VERVOORT** PHOTOGRAPHY **PETER VAN BRAGHT**

Scientific experiments, analyzing statistical data and drawing meaningful conclusions is my profession. I have a PhD degree in psychology and investigate how people process information that comes from their environment. When I learned about Hoesy (Patrick) and Kiki's plan to carry out an experiment on depth intoxication, I immediately offered my collaboration. I would statistically verify that with the differences in performance, we would find that our experiment was 'significant'.

On the first co-ordination meeting I assisted in, it occurred to me that Hoesy and Kiki handled things very professionally. What Hoesy called 'mixing things up so only depth would have an influence on the results', is called 'randomization', an essential feature of sound scientifc research. The use of the Mensa test ensured that we definitely knew what we were measuring, namely the different aspects of intelligence (counting, three-dimensional thinking, etc.).

As a new diver (1*) with barely 30 dives logged, I look with full admiration to my buddies who always seem to know exactly what kind of fish we saw because of some observed detail. All this while I can barely remember that we have seen fish…I figured the present experiment would provide a nice opportunity to test this 'fish memory ability'. So I designed 2 non-existing fish (one for every test depth), of which the divers had to recognize 7 distinct characteristics (number, head, tailfin, dorsal fin, ventral fin, colour and skin pattern). In memory research, this is called "The Magical Number Seven, Plus or Minus Two". This is because people can, on average, put 7 (+ or – 2, so 5 to 9) elements of information in their working memory. So, it should be easy to remember the 7 characteristics…

With a power-analysis that determines how many people you need to find a significant difference in performance between two different situations, I figured that with the already planned 16 participants we would have enough to demonstrate that depth intoxication affects the test results. Unlike the 'normal' life of a scientist, where it's always difficult to find sufficient guinea pigs for research, for this experiment it was no problem getting the participants. Because there were both men and women in the test groups, both experienced (instructors) and less experienced (2* and 3*) divers, we could also investigate whether these characteristics would influence the results.

From articles on nitrogen narcosis, one can find out that not only our intellectual capabilities can be influenced, but that it can also lead to euphoria, exaggerated self-confidence, recklessness, fear…So I wondered what the effect of depth would be on the number of questions on the intelligence test that the divers would fill out: at depth, would they think less quickly and answer fewer questions? Or would they fill out more from an increased reckless and excessive self-confidence?

The number of completed questions was significantly fewer at 35m (12 questions) than at 2m (17 questions). The difference in the number of completed questions between 35m and 2m was equally more for men as for women, and for novice divers as for instructors. This supports the thesis that depth intoxication makes us think less quickly.

By comparing the number of faulty answers, we could find out if a diver at depth also thinks less 'precisely'. Wim Proest of Mensa gave me the corrected copies of the intelligence tests. He told me that someone who has 24 (of 33) questions correct, has a 50% chance to succeed in the full version of the Mensa test. That none of the divers scored this highly was no real surprise given the particular circumstances in which the tests were completed. After all, as Hoesy stated, 'the capabilities of a diver starts to deteriorate from the moment we put our head underwater'. That two divers (no, I'm not saying who because anonymity is very important in scientific research) scored 20 out of 33 questions at 2m, indicating that there were quite a few clever people amongst our test divers. The highest score at 35m was 12.

Not only the highest scores, but also the average scores differed significantly between the two depths. At 2m on average, 10 questions were answered correctly. At 35m on average, only 6. The difference in correct answers between 35 and 2m was equal for men and women. Furthermore, it seemed that experience is not a protection against the effects of depth intoxication.

After the dive, (but before the spaghetti) the fish memory of the divers was put to the test. On a response form, they had to identify what they remembered of the fish that they had seen for approximately 1 minute at 2m and 35m. The results revealed that memorizing the characteristics of a previously unknown fish was a lot harder than expected. On average, the divers remembered only 2 characteristics of the '2m fish', and only 3 of the '33m fish'. In other words, for both depths, the divers remembered less than half a fish. Neither gender, nor experience made any difference. Needless to say that from now on I have less confidence in the 'fish memory' of my diving buddies.

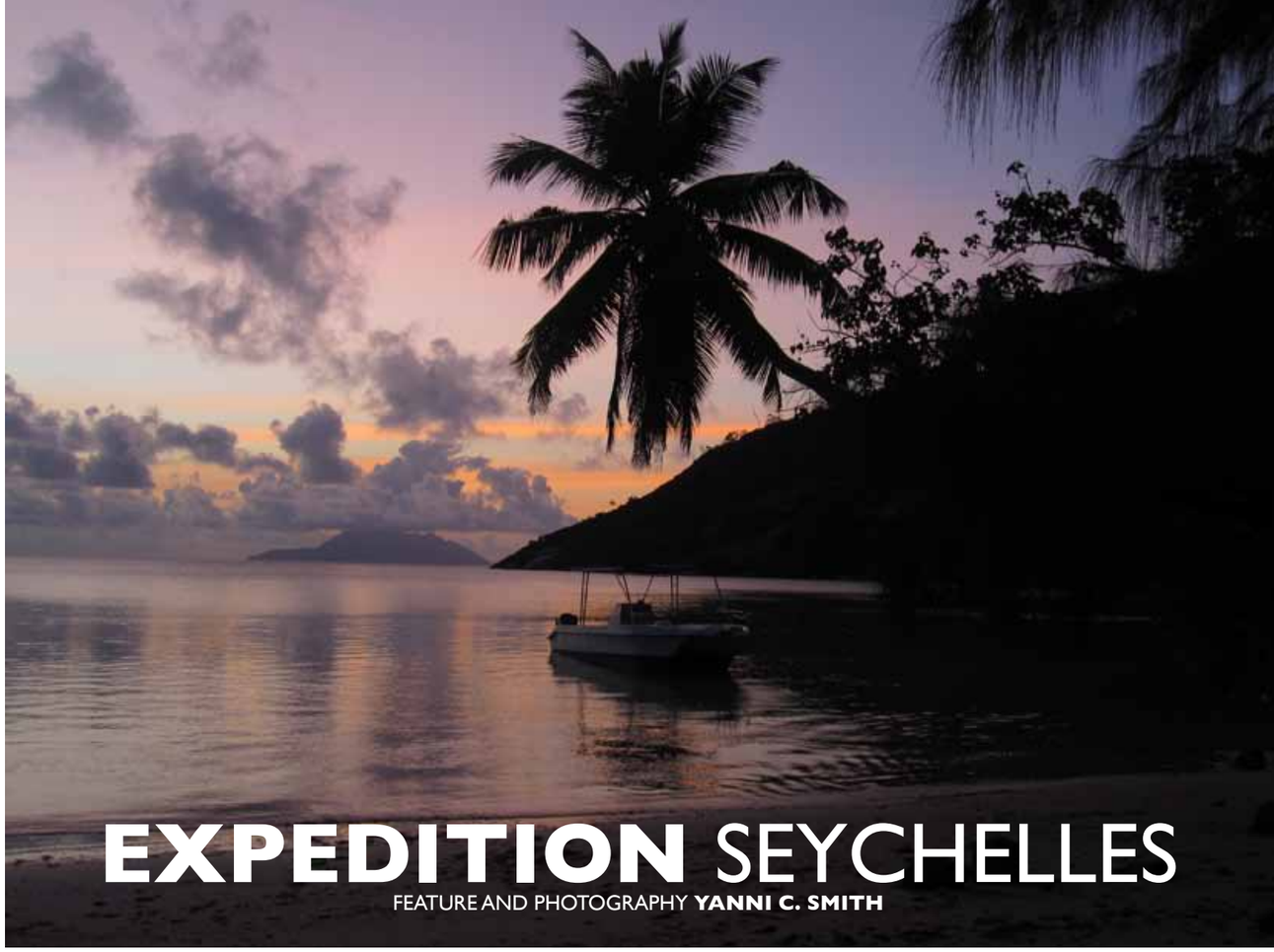
So dear reader, what have we learned today?

1. Depth makes us think slower and makes us more prone to mistakes;
2. Neither experience, nor gender protects us from these effects. Depth has the same negative consequences for novice divers as for instructors, and for women as for men!
3. Never trust the fish memory of your buddy.

We are planning a follow-up experiment where we want to investigate the effect of Nitrox on depth intoxication.

MEMBERS OF THE EXPERIMENTAL DIVE TEAM (*in alphabetical order*)
Benoy Carry – Buytynck Nanou – Cockx Ann – De Loose Nick – De Wit Joeri – Devos Tom – Engels Hans – Hans Theo – Janssen Rudi – Lambrechts Tom – Limpens Jacques – Michiels Harry – Simons Olivier – Smets Peter – Steeno Patrick - Steeno Kristof – Van Bragt Peter – Van den Berghe Jozef – Van den Bleeken Jose – Van Dessel Tine – Van Deuren Walter – van Doorn Roy – Van Hoeserlande Patrick – Van Hooghten Niki – Van Poucke Frederik – Vanderaspoilden Tine – Verhoeven Dora – Vervoort Leentje – Vleeschouwers Kiki

USEFUL WEBSITES:
Nemo 33 – **www.nemo33.com**
Flemish Diving Federation – **www.nelos.be**
Dive Shop Scuba Service – **www.scubaservice.be**
Personal Site – **www.webdiver.be**



EXPEDITION SEYCHELLES

FEATURE AND PHOTOGRAPHY **YANNI C. SMITH**

During June 2012, I participated in an expedition in the Seychelles that was organised by Global Vision International (GVI), who provide support and services to international charities, non-profit and governmental agencies, through volunteering opportunities, internship programs, training and direct funding: **http://www.gvi.co.uk/expeditions/africa/seychelles/marine-conservation-expedition-seychelles/home**

The aims and objectives of the project include learning about and conducting coral reef research, surveys and samplings as well as observations of the marine environment in Seychelles. The marine data that is continually collected is used to show the health of the coral reefs in the Seychelles. This research is part of an ongoing monitoring program that provides a record of the magnitude and frequency of severe bleaching events in the South Indian Ocean and the subsequent recovery or degradation of the reef. In the wider context, this research can benefit in the understanding of global climate change in marine environments around the world.

Before arriving in the Seychelles, each volunteer is assigned to a group of Fish (1&2), Corals or Invertebrates. For each group, there is a list of species for that volunteer to focus on learning so that they can survey them underwater.

Group 2 fish were assigned to volunteers who were staying for a longer time than Group 1 fish and therefore had to learn an extra set of fish species to Group 1. We were also given a guide for the expedition but I don't think that anything can really explain the life that you have on base camp apart from actually experiencing it yourself.

When we got to base, we were given a full schedule for the first week with lectures and study sessions to make sure we all knew our fish or coral species. They gave us plenty of time to learn our given species, so when it came to the exams it really wasn't so difficult. We also had to identify the various species underwater correctly three times in a row. Once we passed the exams and in-water identification, we were then qualified to conduct surveys.

The divemasters showed us how to conduct the surveys on land first, just to give us a feel for what we were doing before heading underwater in pairs (usually a Group 1 fish and a Group 2 fish) to try it out. There were different kinds of surveys to conduct; depending on what group you were assigned.

As I was assigned to Fish Group 1, I had to learn to conduct two types of surveys: a stationary point count, and a 50m-belt survey. Before entering the water to do the survey, the skipper of the boat has to first tell you the "centre point" for the survey site, whether you are doing a deep or shallow survey and what your depth ranges are. Once you know this information and whether you are left, right or centre of the centre point, you head down to conduct two surveys. We were either assigned two point counts or a point count and a belt survey.

For a point count, we found a spot within our assigned point of the survey site and laid down the tape measure (attached to a two pound weight) for 7 metres. The length of the tape was a reference for the radius of a circle that we had to count the fish. We then had to hover in the middle of this circle for six minutes and counted our assigned fish that entered the "circle". On the seventh minute, we had to swim around within the circle and look within and under crevices to make sure we didn't miss any fish.

All the data was recorded on our dive slates.

To conduct the 50m-belt, we selected a spot within our given site and laid down the weight for the tape measure. The Group 2 diver then swims in a straight line, parallel to shore, and counts their assigned fish, while the Group 1 diver lays down the tape below them.

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