ISE Exploration Diver Level I

Disclaimer

This Manual is NOT meant for self-study but as an addition to the class held by a certified instructor from InnerSpace Explorers.

Reading this manual does NOT substitute this class or any part of it.

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ISE Exploration Diver Level I

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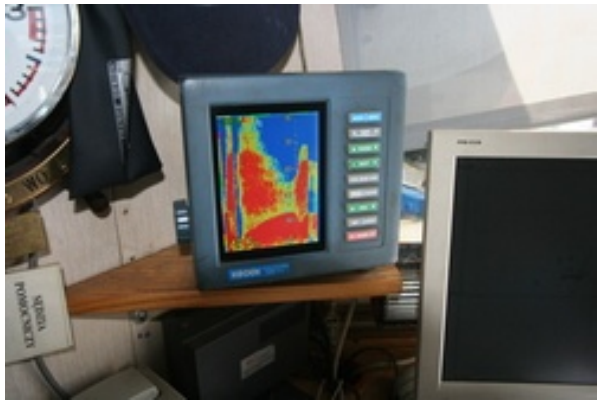
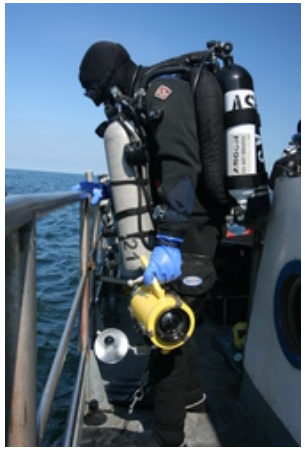
Introduction to InnerSpace Explorers

Mission Statement

Inner Space Explorers was founded to provide the highest quality training available, for all individuals sharing the common goal of underwater exploration and conservation.

The four main pillars of education, training, research and exploration builds the base line of all ISE training that greatly enhances the thrill, safety and ultimately the fun of 'Your Passion'.





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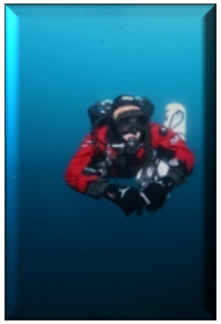
ISE Courses

Explorer 1
Explorer 2
Explorer 3



ISE Basics

Cave 1
Cave 2
Cave 3

Wreck 1
Wreck 2
Wreck 3

Workshops

Rebreather

Why ISE?

• Strict global standard and procedures of the organization
All instructors are to follow it so as to have standardized training and procedures, as this greatly removes inconsistency in within the organization.

• Re-qualification
This is to ensure divers and instructors do not jump back into the sport after long period of absenteeism hurting themselves, or greatly reducing the quality of diver training provided by ISE. Divers have to do an evaluation dive with the ISE instructor of that level of training.

• No 'back to back' or 'bundled' courses for divers.
Experiences have to be gained through personal dives before progression. Such divers enjoy advance training much more and have much better chances of excelling in the advance subject.

• Non smoking organization.
As the founders are active explorers, they know a healthy and fit diver will get the best out of the sport. We allow smokers to enter the foundation class, and give them the mindset that exploration brings more fun then smoking and help them quit.

Past, Present…

- ISE was founded by active explorers and educators
- ISE have increased the quality of diver training and education
- ISE is ready to set new standards to the topics of:

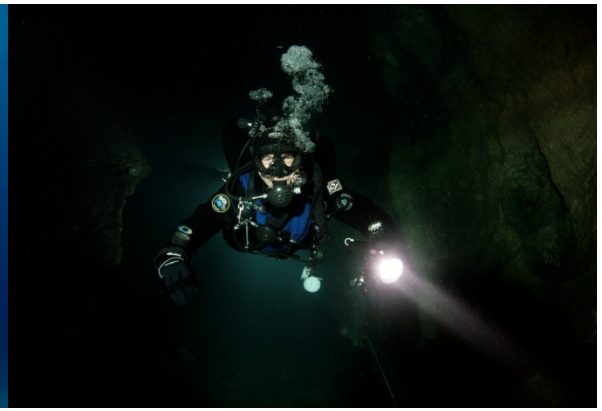
Education
Training
Research
Exploration

Diver training have often been focused on getting somebody to breathe underwater fast. By doing so, diver accidents occur at a significant rate. By redefining the four pillars of ISE, we provide a solution to these and significantly turned diving into a sport much enjoyed by all divers alike.

Future

- Develop programs that serve certified divers in their desire to get more out of the sport.
- Develop the highest set of standards in the industry.
- Develop an international base of dedicated instructors to serve divers around the world.
- Develop dive centers around the world to support explorers in their logistics and ability to explore the aquatic realm.





Introduction

- Why this course?
- Back to the basics?
- How is it going to benefit us?
- What to expect from the course?
- What are the minimum standards?
- How does ISE brings us to that level?

You are already a good diver, ISE wants to bring you up to the next level.

Index & Class Structure (sample)

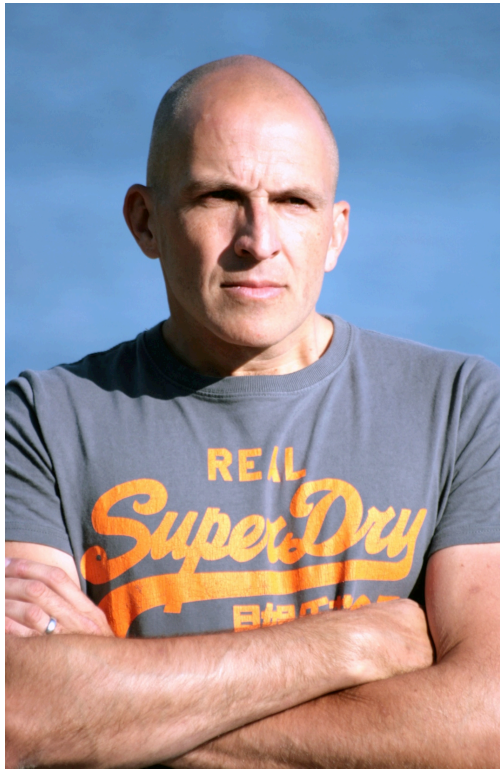
	Day 1	Day 2	Day 3	Day 4	Day 5
09:00	ISE Overview, Course Overview, Paperwork & Fees	**Diveplanning**	**Situational awareness**	**Deco**	Theory Review
10:00	**Physiology**				Ausblick Level 2
12:00	Lunchbreak	Lunchbreak	Lunchbeak	Lunchbreak	Lunchbreak
14:00	Equipment Review	Dryruns	Land- & Linework		Dive 5 (Experience)
16:00	"Breakdown Dive" Dive 1	Dive 2	Dive 3	Dive 4	Final discussion/ End of class
18:00	Video Debriefing	Video Debriefing	Video Debriefing	Video Debriefing	
20:00	Dinner	Dinner	Dinner	Dinner	

Message from the founder:

“You may ask what the heck? Why should I take this class and what is it all about? This class will show you
some facts, skills and items that in the end make your diving safer, more efficient and ultimately more fun.
The term “Exploration” is what you may have found a bit strange in the name of the class.

Well, what is Exploration? When a kid strolls through a ruin somewhere, the kid is exploring. If a Geologist wanders through a cave never seen before by human eyes, he is exploring it. If you swim through a popular reef you have never before been to, you explore it. Diving in general has a lot of potential for exploration.

Now we believe that there is a difference in how you do that. You may be able to breathe underwater and see because you have a mask, but that does not make you an explorer. An explorer is not only defined by the desire to cover new ground, but by the heart to preserve this ground, and make the knowledge gained
accessible for others, at least through a clear documentation.



Continued:

If you have poor trim, buoyancy and fin techniques for example, you stir up silt that covers anemones or corals that might damage it. Even in clear water, you may ruin your visibility at best. In a cave, a careless fin stroke will damage the pristine limestone formation, in which a geologist may be able to understand the history of millions of years of which nature developed.

Good skills are essential to exploration, the well prepared diver keen on diving new sites will also need some additional equipment to be prepared for the demands of the dive. Although this class can be done on a single tank, we will introduce you to the idea of doubles or at least two regulators on an H valve.

Murphy's law of what might happen, will happen gives an understanding that trouble is always around. The right equipment and skills needed to handle the situation can make a difference between a good dive, or the last dive. You will also be taught the spool – a simple tool that hold lines can be the most valuable piece of equipment ever, from sending up a surface marker, to measuring and surveying a site to doing search patterns – the possibilities are endless.."

Achim R. Schlöffel
President InnerSpace Explorers

Certification Policy

- Every level of ISE training has specific requirements that the student must meet before being awarded certification.
- These requirements include both academic knowledge as well as robust diving skills and techniques.
- The student must fulfill every skill and technique required for each step in the training before progression to the next step is possible.
- It is expected that the ISE student understands and accept the ISE Instructor obligation to deny certification if the training requirements have not been fulfilled.

Students pay for training but earn the certification.

Types of grading

- **Pass**
- **Fail**

Pass: Student have performed well in the required skills and shown positive attitude in training.

Fail: Student is required to consult the instructor again and remedy shortcomings.

There can only be a successful or a failed exploration

ISE Exploration Diver Level I

"I heard there is a resident Napoleon Wrasse somewhere at the first rock off the shore, I want to see it."

"The government wants to know where does water from the caves flow to in case of pollution. Shall our team volunteer to check it out?"

"Have you been to the deep wrecks of the HMS Repulse or the HMS Prince of Wales?"

What does exploration mean to you?

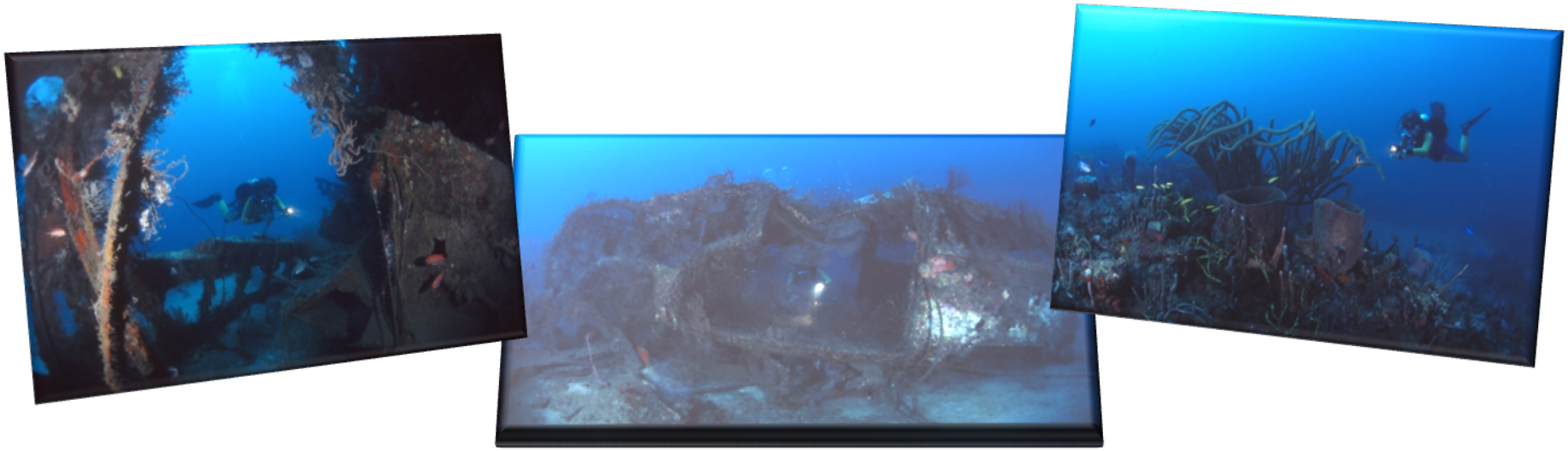
- Curiosity
- Purpose
- Excitement
- Research
- Share

ISE Exploration Diver Level I

HOW DO WE BUILD

THE EXPERTICE OF AN EXPLORATION

GRADE DIVER?



By primarily receiving the right education!

By selecting the specific equipment to support our dives!

We have to dive to gain experiences, and once we have a concrete foundational support…

We inherit the qualities through constant practice!

Additional Equipment for Level 1

Additional Equipment for Exploration Diver Level I

> Stagetank
> Stage Regulator
> Reel
> Liftbag
> Drysuit
> Argonsystem

Additional Equipment for Exploration Diver Level I

Stagetank

Stagetanks are tanks that we use to carry additional gas either for deco or as bottomgas. There are 3 major sizes that we use as stages:

40 cft (5.1 Liters)
7 Liters
80 cft (11.2 Liters)

Stages are ALWAYS aluminium tanks to make sure they sit neutral in the water and do not affect the trim of the diver. Marking is essential and must not be compromised.

Additional Equipment for Exploration Diver Level I

Stage Regulator

need to be „swifel-style“ with a 100 cm hose that is stowed under the rubberband when not in use. No clips on the regs. The second stage should be around the middle of the tank to be protected when not in use and not in the way when handling the valve.

The SPG is on a short hose and attached behind the first stage with bungee or caveline. It is easy to read and in a safe position

Additional Equipment for Exploration Diver Level I

Reel

about 400 feet are a good all around solution. As a rule of thumb we recommend at least 1.5 times the amount of line that You plan as maximum depth. (Expl: 40 meters max depth = 60 meters of line.)
So diving deeper sometimes call for a reel to set the bag.

Additionaly the reel will be part of every dive to make sure you are solid in using a reel as a guideline.

Additional Equipment for Exploration Diver Level I

Liftbag

is an addition to the surface marker you already know. Now we introduce the liftbag, that you will use for extended decotimes. The bag is stored in the storage bag in the backplate.

Additional Equipment for Exploration Diver Level I

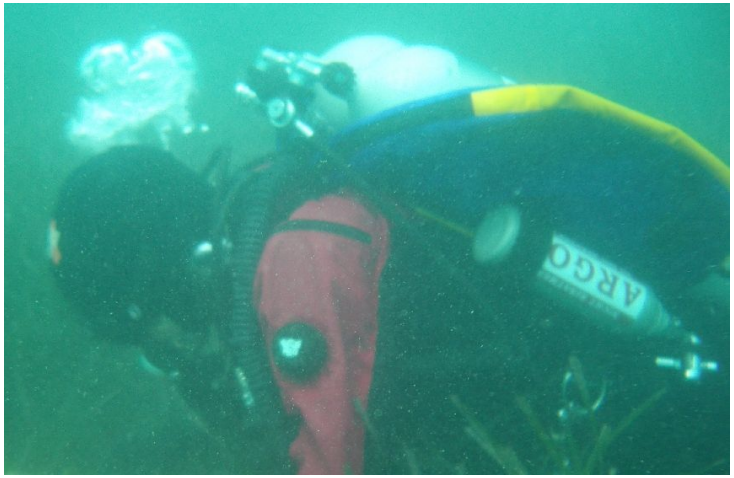
Drysuit

This can fill a book. The suit needs to fit perfectly, needs to be of a non compressible material (Trilam) with soft boots (ankle movement). Your Instructor will show you the key elements and point you in the right direction if you need a suit. Please refere to the BoE manual as well.

Additional Equipment for Exploration Diver Level I

Argonsystem

Suit Inflation cant be done with backgas when it contains helium. Therefore you need an extra bottle with gas to inflate your drysuit. This can either be a 6cft (0.8 Liter) tank that is mounted on the backplate or a 14cft low pressure tank that is mounted on the left side of the backtanks (only for very dep dives or cave dives) A simple first stage with only one outlet and a OPV and a reduced intermidiate pressure of around 6 bar is used to feed the gas to a 22“ hose that conects to the suit.



Gas Properties

Gas Properties

The ISE Standard Gases

Standard Gas	Operational Depth	Max depth
Nitrox 32%	0-30 Meter	33 Meter (1.4)
Triox 30/30	0-36 Meter	36 Meter (1.4)
Triox 21/35	**30-45 Meter**	**56 Meter (1.4)**
Trimix 18/45	**45-60 Meter**	**67 Meter (1.4)**
Trimix 15/60	60-75 Meter	83 Meter (1.4)
Trimix 10/80	75-90 Meter	130 Meter (1.4)
Trimix 21/35	Deco 57 Meter up	57 Meter (1.4)
Triox 35/25	Deco 36 Meter up	36 Meter (1.6)
Nitrox 50%	**Deco 21 Meter up**	**21 Meter (1.6)**
Oxygen	Deco 6 Meter up	6 Meter (1.6)

Gas Properties

Oxygen

Oxygen is not only the gas that makes life possible on this planet it is also a very agressive substance that can be hazourdous for our health if not handled with care and caution.

Oxygen is contained in our surounding air with a volume of 20.8%. In Diving we often use gases with a higher oxygen percentage or even pure Oxygen for Decompression. On the other hand we sometime use gases with a lowered Oxygen content that bring along different hazzards like Hypoxia.

If we expose ourselfs to Oxygen doses with a too high partial preasure or we overstay the timelimits we risk serious injuries and / or death. This chapter will help You to unerstand the physiology of Oxygen and how to deal with it in a safe way.

PO2	Effect
1.6 bar	max PO2 in rest (deco)
1.4 bar	Max PO2 in rec diving
0.8-1.2 Bar	Bottom PO2 in technical diving
0.5 bar	Oxygen Tracking beginns
0.21 Bar	**NORMOX**
0.16 Bar	Hypoxia starts
0.10 Bar	Deadly Zone

Gas Properties

Helium

Helium is a inertgas that is mined from natural resources and not (as many people believe) taken from the few molecules that we have in the surounding air.
Helium is a very light gas with smaller molecules than nitrogen. Also inert, it can replace the nitrogen in the breathing mix.
The main difference in diving helium instead of nitrogen is the dramatically reduced narcosis. (Narcotic potential of gases are measured by there ability to conect with lipids. This is simulated by a test using olive oil instead. Helium has a much lower ability to conect to the Oil than Nitrogen (and Oxygen)). Due to its smaller size, the Heliummolecules saturate our body 2.65 times faster than Nitrogen.
Despite common believe they also desaturate in that speed and therfore have NO dissadvantages compared to Nitrogen. As there are in fact physicaly less molecules in a comparable volume, Helium offers an advantage compared to N2 regarding Decompression.
One point to handle with care is that bubbles form faster than with N2 so that the diver needs to be very carefull regarding his ascent speed.

Hypothermia is another issue to be watched as Helium offers no thermal isulation and cant be used as an inflation gas for the drysuit.

Physiology

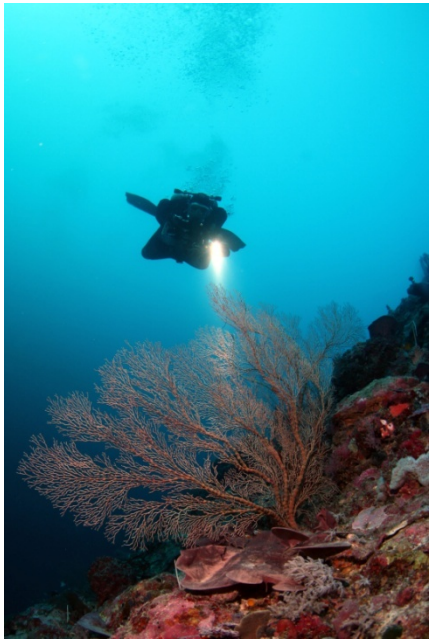
Physiology

Hypoxia

Symptoms:

Dizziness – Nausea - Reduced judgment - Blueness (cyanosis) -

Reduced muscular control – Unconsciousness – Euphoria - Light tingling sensation - Visual disturbance - Loss of coordination – Fatigue - Weakness



0.21 bar – Surface exposure
0.18 bar - ability to work hard is reduced
0.16 bar – hypoxia : first syptoms occur
0.12 bar – Sypmtos get serious
0.10 bar – Unconsciousness
< 0.10 bar - Death

Physiology

Hyperoxia

CNS Symptoms:

Vision, *ANY* disturbance including *tunnel vision* etc
Ears, *ANY* changes in normal hearing function
Nausea, severity may vary and be intermittent
Twitching, classically manifested in facial muscles
Irritability, personality shifts, anxiety, confusion etc
Dizziness, vertigo, disorientation

Pulmonary Symptoms:

Dry cough
Breast pain /irritation
Shortness of breath
Reduction of the Vital capacity

> 2.0 bar Convulsions, drowning, death
2.0 bar - Elevated CNS oxygen toxicity danger
1.6 bar – Max. exposure during decompression
1.4 bar – Max. exposure during recreational diving
1.2 bar – Max. exposure during technical diving
0.5 bar -Threshold for pulmonary oxygen toxicity (theoretical)
0.21 bar - Normoxic oxygen level

Physiology

Variation of O_2 tolerance

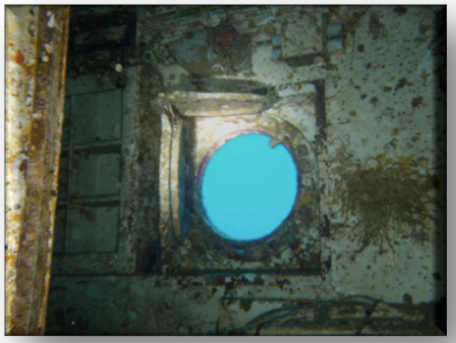
"The variation of tolerance between individuals, the variation of tolerance of each individual, the impairment of tolerance with work and underwater exposure, all make diving pure oxygen below 25 feet (7.6 meters) of sea water a hazardous gamble." - Donald, 1944

The obove statement by Henneth Mc Donald basicly says it all. In fact all the number we use to measure Oxygen exposure and as well the limits we set are theoretical and can vary not only from Inividual to individual but also from day to day on the same individual.
This is affected by serveral factors, some within our influence some not.
Factors are age, fitness level, hydration, enviroment, stress, mixture of gas and many more.

Physiology

The CNS% Clock

Dr. Bill Hamilton defined that at a PO2 greater than 0.5 bar the oxygen tracking beginns. The following table shows the maximum exposure times for the given PO2s.



PO2 in Bar	Max exposure time in min.
1.6	45
1.5	120
1.4	150
1.3	180
1.2	210
1.1	240
1.0	300

Note: The accumulated CNS halvens every 90min.

Tip:

For a rough guess You can estimate:

(Bottomtime + Decotime) : 2 = CNS%

Example:

20 min @45 min + 20min of deco : 2
➔ 20% CNS

Physiology

The OTU (Oxygen Toxicity Unit) Table

Dr. Bill Hamilton defined that 1 bar of Oxygen for 1 Minute is 1OTU.
The following table indicates the maximum dose one can tolerate.

Multi day exposure	Daily dose limit	Total operational limit
1	800	850
2	700	1400
3	620	1860
4	525	2100
5	460	2300
6	380	2520
7	350	2660
8	330	2800
9	310	2970

Note: The accumulated OTUs reset after 24 hrs.

Tip:

For a rough guess You can estimate:

(Bt-time + half of Decotime) x 1.5 = Total OTUs

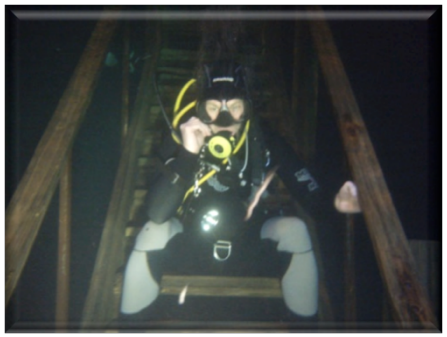
Example:

20 min @45 min + 10min of deco x 1.5
➔ 45 OTUs

Dive Planning

Please note that the dive planning section is built around the classical backmounted configuration and is different for Sidemount and MCCR diving. If You take the class in one of these configurations – please refer to the ISE Sidemount or MCCR Manual.

Dive Planning



END

Stands for Equivalent Narcotic Depth. Although the term is frequently used in Nitrox Diving this is wrong as Nitrox has no narcotic benefit. Therefore the term makes only sense in Helium based Diving where a clear benefit compared to air can be archived.

Sample Calculation 1:

Let´s consider a dive to 40 Meters using 21/35.

While in Air the Nitrogen percentage is 79, in 21/35 it is 44%.
The Oxygen can be left aside as it is 21% in both mixtures.

40 Meter –> 5 Bar x .65 = 3.25 Bar of Nitrogen

Result: On a dive to 40 Meters with 21/35 a diver expiriences the same narcosis as on an airdive to 22.5 Meters.

Sample Calculation 2:

Let´s consider a dive to 60 Meters using 18/45.

While in Air the Nitrogen percentage is 79, in 18/45 it is 37%.
The Oxygen is 18% instead of 21%

Here the comparison is that of the sum of narcotic gases:

60 Meter –> 7 Bar x .55 = 3.85 Bar

Result: On a dive to 60 Meters with 18/45 a diver expiriences the same narcosis as on an air dive to 28.5 Meters.

Dive Planning

EAD

Stands for Equivalent Air Depth. The term is frequently used in Nitrox Diving and describes the amount of Nitrogen Your Body takes on a dive with nitrox compared to a dive on air at a equivalent depth.

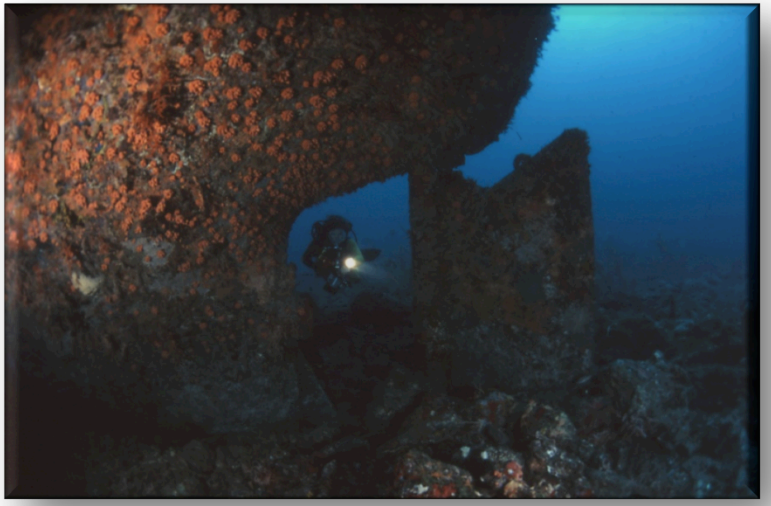
Sample Calculation 1:

Let´s consider a dive to 30 Meters using 32% Nitrox

While in Air the Nitrogen percentage is 79, in Nitrox 32 it is 68%.

30 Meter –> 4 Bar x .68 = 2.72 Bar of Nitrogen

As we want to compare to air -> 2.72 Bar of Nitrogen : .79 = 3.44 Bar
Result: On a dive to 30 Meters with Nitrox 32 a diver loads as much Nitrogen as on a air dive to 24 Meters.
Therfore his No Deco Limit is the same as for air @24 meters -> 30 Minutes!!



Dive Planning

CNS%

As we learned before we need to make sure we do not get too much Oxygen over the course of the dive to avoid symptoms of Oxygen toxicity. Carefull planning well within the limits helps to avoid problems.

Sample:
40 Meters for 30 min with 21/35, +deco of 25 min on 50% Nitrox

-> 5 bar x .21 bar o2 = 1.05 Bar O2 => 1.1 Bar for 240 min = 100%
=> 1.1 Bar for 30 min = 12.5%

-> 2 bar x .5 bar O2 = 1.0 Bar O2 => 1.0 bar for 300 min = 100%
=> 1.0 bar for 25 min = 9%

Total CNS after Dive is ca 21.5%

Please note: Estimate Result: 30 (Bt)+25 (Dt) = 55:2 = 27%

Dive Planning

OTU

As we learned before we need to make sure we do not get too much Oxygen over the course of the dive to avoid symptoms of Oxygen toxicity. Carefull planning well within the limits helps to avoid problems

Sample:
40 Meters for 30 min with 21/35, +deco of 25 min on 50% Nitrox

-> 5 bar x .21 bar o2 = 1.05 Bar O2 => 1 Bar for 1 min 1 OTU => 31.5 OTUs

-> 2 bar x .5 bar O2 = 1.0 Bar O2 => 25 OTUs

Total OTUs after Dive is ca. 57

Please note: Estimate Result: 30+13=43x1.5=65 OTUs

Dive Planning

PO2 & PN2 -> MOD

The max PO2 we do not want to exeed have ben discussed previously. On top of that we do not want to expose ourselfs to a higher narcosislevel than we would expirience at 30 meters on air.

As we use standard gases we do not need to figure out if the gas is correct for every dive again. The following table gives You an idea of why we do what we do.

Standard Gas	Depthrange	Max PO2/END
Nitrox 32%	0-30 Meter	1.28 / 30
Triox 30/30	0-36 Meter	1.38/22
Trimix 21/35	30-45 Meter	1.2/25
Trimix 18/45	45-60 Meter	1.26/28
Trimix 15/60	60-75 Meter	1.27/24
Trimix 10/80	75-90 Meter	1.0/10
Trimix 21/35	Deco 57 Meter up	1.4/33
Triox 35/25	Deco 36 Meter up	1.6/24
Nitrox 50%	Deco 21 Meter up	1.6/21
Oxygen	Deco 6 Meter up	1.6/6

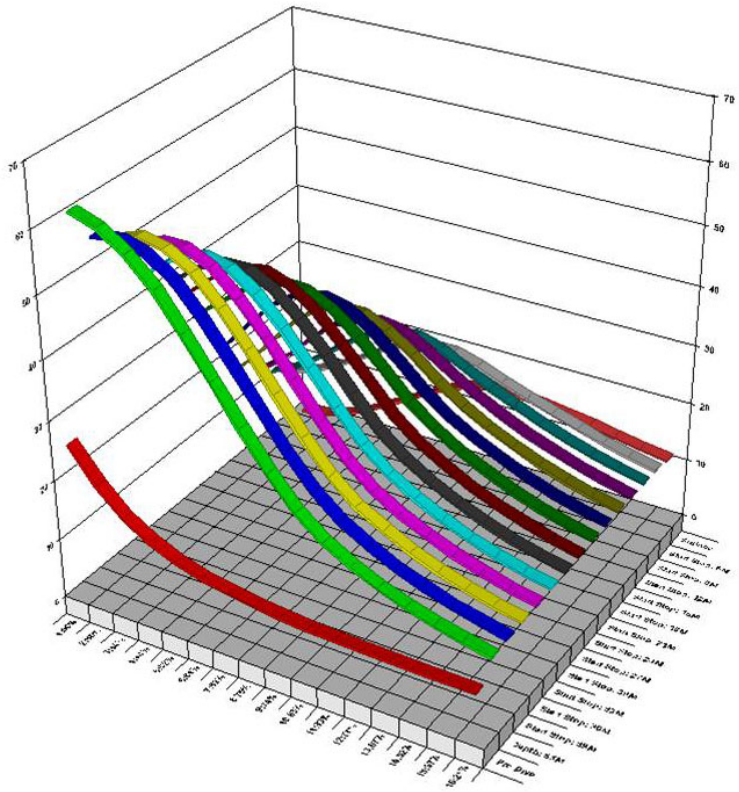
Dive Planning

Average Depth – Profiling the dive

The classical question for any diveplanning is: **How deep do I go for how long?**
Unfortunately this cannot realy be answered in advance. So the question needs to be:
How long have I been on what depth?

The answer to this is somewhere between the moment You touch the water and the moment You give thumbs up and start Your ascent. What numbers You come up with is up to Your analysis of the dive, the amount of conservatism You want to add and Your ability to picture what you did.

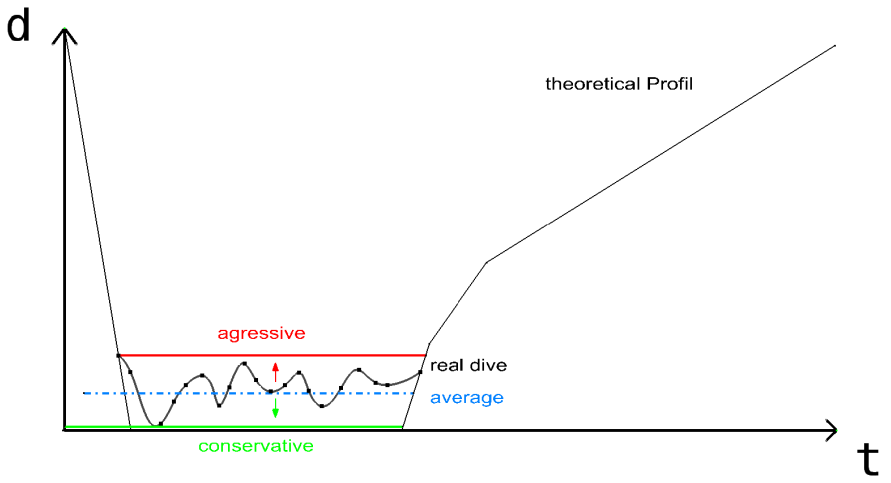
We call this „***profiling the dive***."



Profiling the Dive

Choose Your conservatism

As stated before, the Bottomtime can be set anywhere between the start of You descent and the start of ascent. While most tables are based on this method, some of the programs available on the market use the pure Bottomtime, beginning wit the reach of traget depth and the start of the ascent. The truth lies somewhere in between and can differ



The same statement can be given for the depth. While one could simple count the estimated bottomtime on the maximum depth reached , whilst someone else may choose an average between any point of the descent an the max depth.. Up the level of conservatism You want to use.
Regarding to various factors such as Bodyshape, fitness, temperatur, taskload, a.s.o.

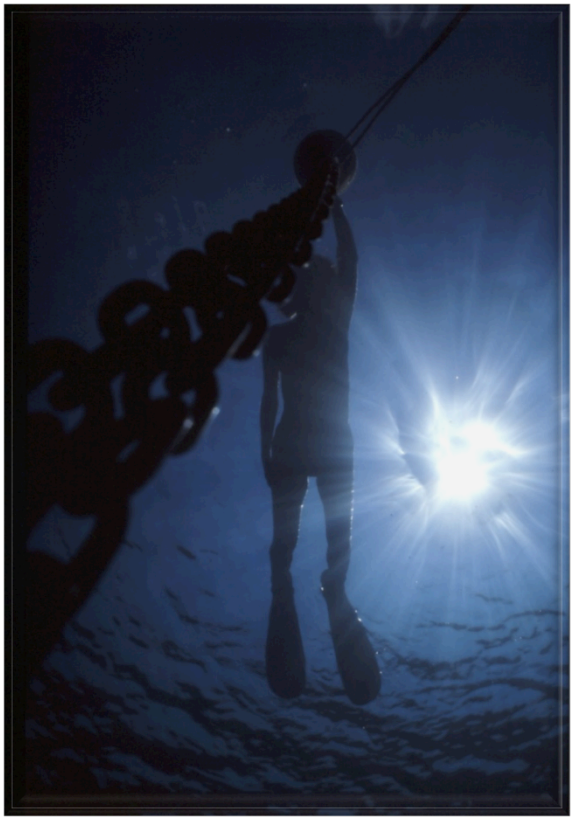
Situational Awareness

Create Awareness on the Situation

Although this may seem logic in the first place it is not something that is given to the diver naturally. In fact, the more demanding the dive becomes, may it be trough more and advanced equipment or may it be through the tasks of the dive itself, the higher the chance is, that the diver is not able to focus on all matters at once.

A big part of situational awareness is to visualize the dive before and play mentaly with the tasks and problems that may arise and have a solution and a tactic ready.

Situational awareness means to be able to adapt to the situation coming up on You – may it be enviromental issues, marine live, partners or changes in the plan.



- **Gasmanagement**

  Please note that the Gaspmanagement section is built around the classical backmounted configuration and is different for Sidemount and MCCR diving. If You take the class in one of these configurations – please refer to the ISE Sidemount or MCCR Manual.

Gasmanagement

Gasmanagement for technical dives is simple:

„You need enough gas to get Yourself and your OOG Partner up to the next breathable gas while following proper ascent procedures.“

Lets look at it on a practical example:

You and Your partner plan a dive to 45 Meters using D12 with 21/35 and 50% Nitrox as a Decogas in a 7L Tank.

HOW LONG DOES IT TAKE YOU TO GO TO 21 METERS?
(here the OOG can go on his own stage – ONE FAILURE ONLY!!)

1 Min @ 45 to solve the issue (deploy long hose and start up)

2 Min up to 33 Meters (9m/min to 75% of max depth)

4 Min up to 21 Meters (3m/min to first deco stop / gasswitch)

---

7 Min total

Gasmanagement

HOW MUCH GAS DO YOU NEED FOR THAT?

Estemating a RMV of 20 Liters / min and the fact that both of have stress and therfore breath more we can assume a total 80 Liters / min for both of You (we estimate 60 L/ min on rec Dives with NO DECO)

Att.!! This value may vary due to depth, equipment, enviroment and can be significantly more!!! – so plan accordingly!!

7 Min at an average between 45 and 21 (45+21 /2 = 33 Meters) using 80 Liters / min =>

7 x 4,3 x 80 = 2408 Liters of Gas

As You use a D12 this has to be divided by 24 => 2408 / 24 = 100

This means that You need to call the dive with a min of 100 Bars left in You D12 to have sufficient backup!

Estimate a round 15 Liters RMV on a relaxed dive this means that with the left 2400 (4800-2400) You can stay 29 min at 45 Meters. – More that enough!! (2400 / 5.5 / 15 = 29)

Gasmanagement

WHAT HAPPENS IF I LOOSE MY DECOGAS?

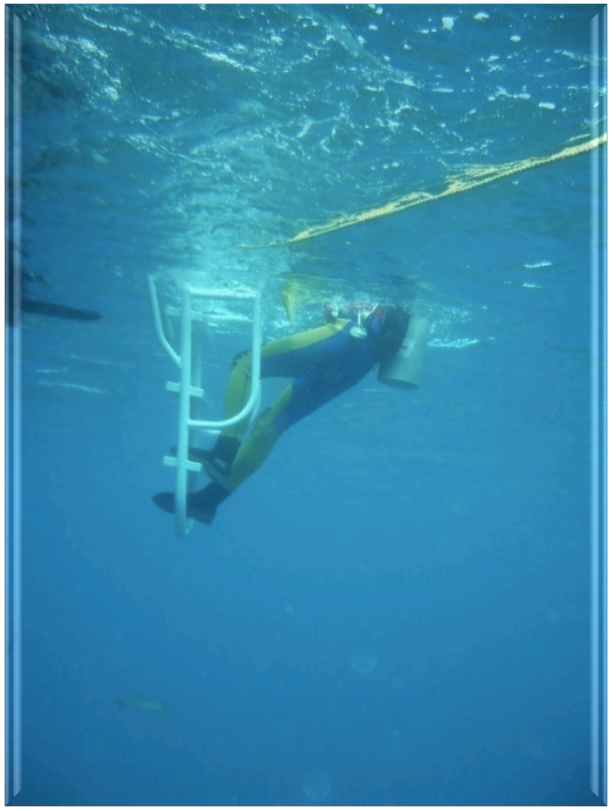
Not much! You double Your deco and do it on the backgas.
The backgasreserve You need for that is covered by the minimum gas we just calculated:

29 Min @ 45 Meters give You 29 Min of Deco.
Double this gives You 58 Min of deco.

At an avarage of 10 Meters (21 – 0) using 15 Liter of gas You need now:

2 bar x 15 x 58 = 1740 Liters

This proofs that minimum gas covers the loss of decogas as well.

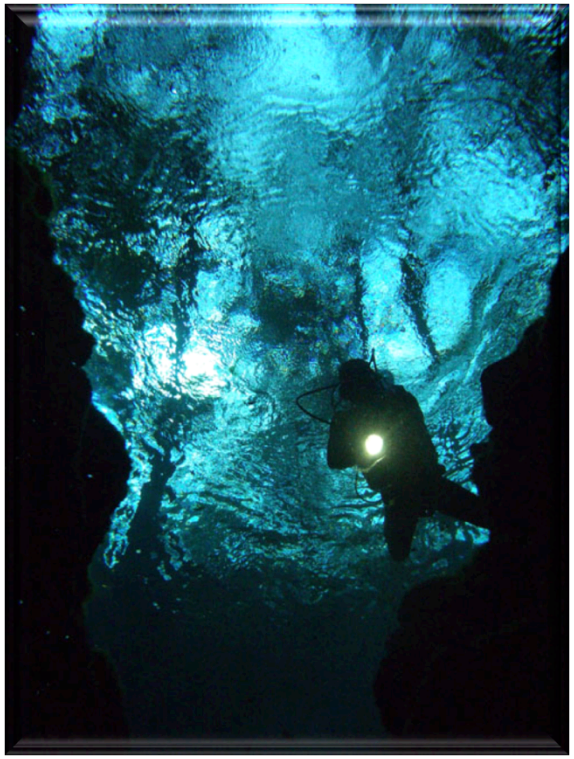


Gasmanagement

Rule of Thirds and Dissimilar Tanks

The rule of thirds is a phrase that comes from cavediving and stands for: one 3rd IN, one 3rd OUT and one 3rd RESERVE. This is hard to apply on openwater diving and it does not work in Cavediving as everyboday will crearly notice who read the previous chapter carefully. So whenever the term comes up it is to be seen more as a synonym for proper gasplanning than as a guidline of how to.

Dissimlar Tanks are a topic that arises frequently and should be taken into consideration. As we plan in Liters and than divide by the the Volume of the tanks every diver gets the right preassure for his set of tanks. (See „Minimum Gas“)



Decompression

Please note that the decompression section is built around the classical backmounted configuration and is different for Sidemount and MCCR diving. If You take the class in one of these configurations – please refer to the ISE Sidemount or MCCR Manual.

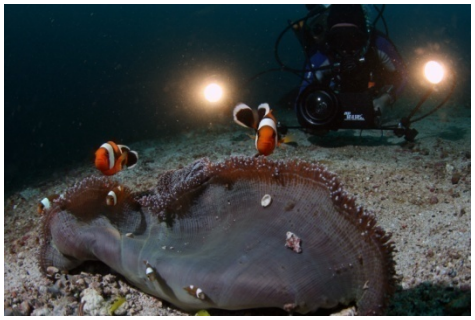
Decompression

Theorie of Decompression

This is a very complex topic and every organisation or agency developed ist very own way of approching this and communicating it to its customers and students. ISE believes that the sientific aroach is not the best and that a practical approach is what serves the diver best. The diver neither needs to be a doctor nor a needs a master in physics. The diver needs to understand what happens in his body and how to handle this situations.

Why this intro?
There are manuals out there that look so professional and sientific but in the end most users do not understand what it is all about. On the other hand there are very rudimentary plans out there that bring the „aha- effect“ on the students face and get all the mystery out of the topic. In the end, if the instrutor is able to bring the knowlegde to the student in clear and understandable words, the diver will be able to plan his dives safe and will avoid trouble.

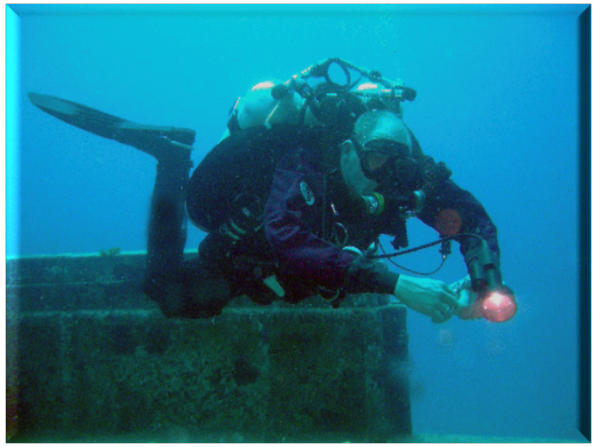
The ISE approach is very practical and avoids a too sientific way of explaining things. We hope You appreciate this and ask Your instructor i You want a more sientific explanation for certain things.



Decompression

Theorie of Decompression

Generally speaking one can say that decompression is the way of accomplishing two needs: Get back to the surface as fast as possible and dont get bubbles to from in Your system. The Solution for these two needs are very contrary. Whilst a fast ascent would serve the first, avoiding any ascent and therfore preassure reduction would be best for the second. The way to go lies somewhere in between…



Decompression

Theorie of Decompression

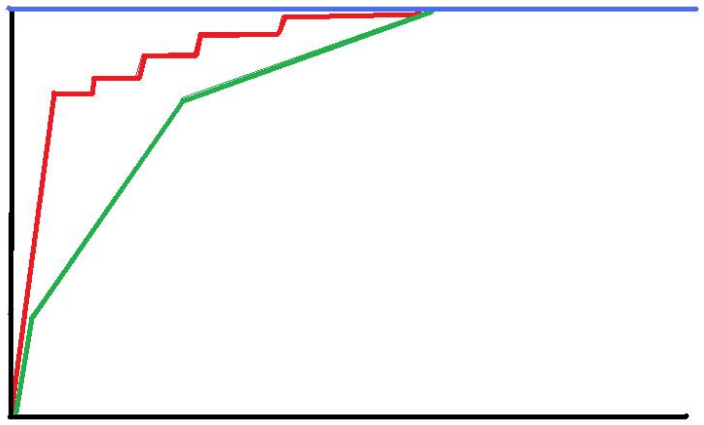
The historic approach was to go as far in the water column as possible in a defined speed. Reaching the so clalled Deco-Ceiling (the maximum preassure differnce between his tissues and his lungs that can be tolerated bevor bubbles start to form) the diver has to wait for a certain amount of time to allow the preasure difference to reduce before he can go to the next stop.

That way, the diver places himself on the limit with little to no space for bailout and always at the risk of bubbles forming because of diver error or any other issue that overrides the „rule“.
Almost no clerarance of any tissues till the reach of teh first stop. With all deco to be done in the shallow part of the ascent.

Decompression

Theorie of Decompression

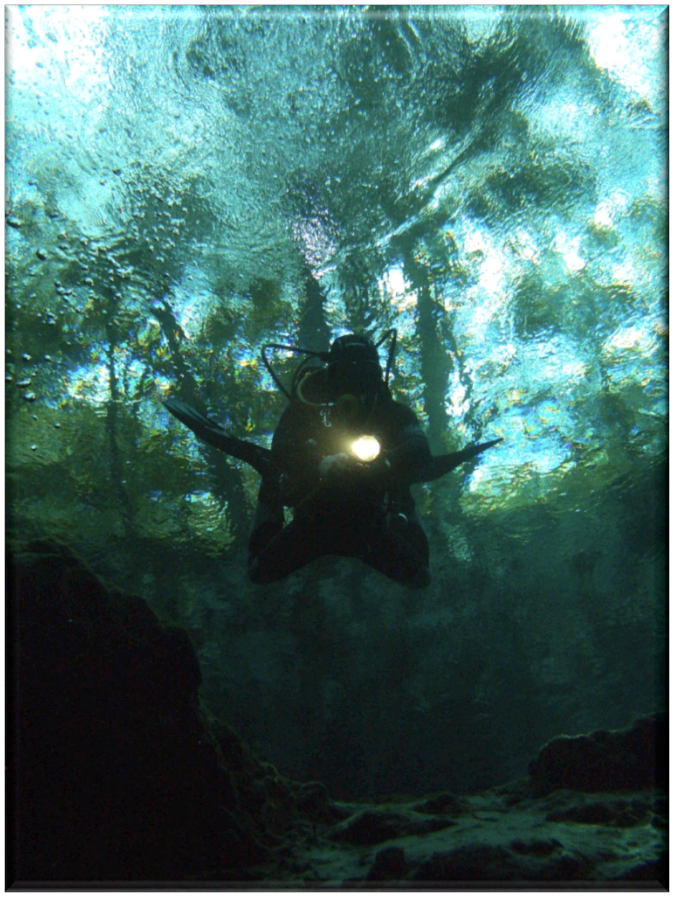
Today we accept the fact that Deco starts the moment that the preassure in our lungs gets below the the preassure in our tissues. Depending on depth and exposure time this is roughly at ¾ of our max. depth in decodiving and ½ of the max depth in recreational diving. Whilst the speed of ascent to that point is not significant we still want to keep it controlled and do not go faster than 10 meter / min. From there the diver slows down to 3 meter / min by doing 40/20 stopps (40 sec stay followed by a 20 sec ascent to the next stop 3 meters shallower).That way, the pressure difference between the tissues and the lungs that is minor at that stage can equalize and be „rebuild“ during the 20 sec ascent. This goes till the first real decostop is reached. Basicly the fast tissues are very much cleared by this procedure and the diver is in a much better state than with the old procedure. The „real“ decostops follow common rules and slow the ascent further down to also clear the slow tissues and pay for the fact that the presure diffenrece gets bigger the closer we get to the surface.



Deco-Calculation

The question now is obviously how we figure the total deco time and how we spreat it over the stops.
To get the overall decotime a table can be used or a program. Both methodes have the dissatvantage of displaying the stops as well and usually in a way we do not want them. For this reason the ***ISE DecoRuler*** gives only one total number of total deco time and leaves You with the possibility to spread the stops Your way.

Before we discuss how to spread the stops we would like to introduce You to another method to estimate your decotime that works very well in the Level 1 Range: Ratio Deco

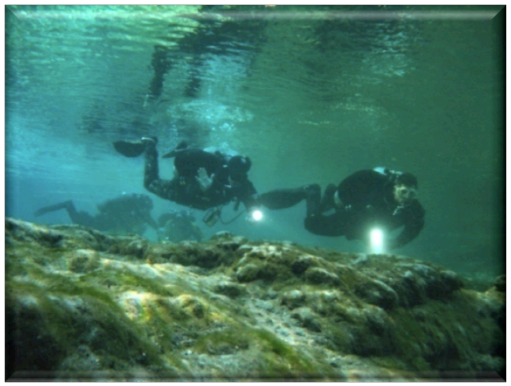


Ratio Deco

Ratio Deco is based on the fact that for every gas combination on every depth there is a fixed ratio between Bottomtime and Decotime. We use this fact.

Ready? – ok – here´s the rules:

Gases: 21/35 on the Bottom and 50% Nitrox for Deco from 21 Meters up.
- Setpoint for the Ratio is 45 Meters
- The Ratio is 1:1
- For every 3 Meters plus / minus off the setpoint – the deco changes plus / minus 5 minutes
- Overall decotime is spread 50/50 between the 21-9 Meter segment and the 6/3 Meter Segment


Ratio Deco – how to spread the stops

We do this step by step to help You understand the process.

Our example is a dive for 35 Minutes @ 42 Meters.

We are 3 meters shallow of our setpoint so we have 5 min less deco.
Our overall deco is therfore 30 minutes that we spread 15 minutes on 21-9 and 15 minutes to 6 and 3.

We ascent with 10 meters / minute to 75% of 42 Meters = 30 Meters.

Step 1 – spread time linear:

30			1
27			1
24			1
21	3		
18	3		
15	3		
12	3		
9	3		
6	7		
3	8		

Ratio Deco – how to spread the stops

- We do 40/20 stops from 30 to 21 Meters slowing our ascent to 3 Meters / minute.

- The rule for the Gasswitch is: Minimum 3 Minutes or the „linear“ Time. In our example 3 Minutes in fact is the linear time.

-On 18, we loose the effect of the O2-window and speed up the gradient to go up to 15. We do a short stop of 1 minutes. The 2 minutes from the linear time we keep in mind

- 15 meters – we slow down and do a 2 minute stop and keep 1 minute

- 12 meters – we slowly get into longer stops and put the 1 minute from the 15 Stop on top to stay 4 minutes

- 9 meters. We add the 2 from 18 and do a 5 minute stop.

- 6 meters we stay slithly longer than on 9 and shift the one minute to 3 meters.

The result is the same amount of decotime than before but in a nice shaped curve.

Step 2 – create curve:

30		**1**	
27		**1**	
24		**1**	
21	3	**3**	
18	3	**1**	2 on memory
15	3	**2**	1 on memory
12	3	**4**	Use the 1 from 15
9	3	**5**	Use the 2 from 18
6	7	**6**	1 goes on 3m
3	8	**9**	

ISE minimum Deco for technical Dives

ISE technical minimum Deco

This describes a procedure to handle ascents on dives with a linear Deco time of less than 3 Minutes.
Remember that the “linear deco time” is the time you get per stop when you spread the time evenly over a certain deco segment. Stops that hold a gas switch must be 3 min at least or the linear stop time. Usually the next shallower stop is significantly shorter (max. ratio between stops should not exceed 1:3) The time You gain from this shorter stop is then moved to the shallowest stop of this segment the remaining stops get spread out so you create a curve getting more flat every stop.
In case a total deco time is so short that the linear time is 2 minutes, this concept does not work obviously.

We will discuss this on an example:
20 min @ 45 meters ➔ 20 minutes total deco.
10 minutes between 21 & 9 metes
10 minutes on 6 & 3 meters
Linear Time is 2 Minutes.

Result see Table on the right

21	**2**	**3**	**1 min more as 3 min min**
18	2	**1**	**1 min goes on 21m**
15	2	**1**	**1 min goes on 9m**
12	2	**2**	**ok**
9	2	**3**	**Receives 1 min from 15m**
6	5	**4**	**1 on 3**
3	5	**6**	**1 from 6**

ISE minimum Deco for technical Dives - continued

This is not perfect anymore regarding the curve but still acceptable. If the time gets shorter the curve is not doable anymore as the next example shows:
10 min @ 45 meters ➔ 10 minutes total deco.
5 minutes between 21 & 9 metes
5 minutes on 6 & 3 meters
Linear Time is 1 Minutes.

This results in the “ISE Minimum Deco for technical dives” as to be seen here:

21	**1**	**3**
18	1	**1**
15	1	**1**
12	1	**1**
9	1	**1**
6	2	**2**
3	3	**3**

Decompression

Decompression Sickness

Decompression Sickness (DCS) ist divided into 3 Categories:

I – No CNS related Sypmtoms. Sypmtoms are Jointpain, Skinrash, Weakness, etc

II – CNS related Symptoms. Paralysation, Coordination Problems, Unconcouness, Death

(III) DCS affection the inner ear causing vertigo (vestebiular hit)

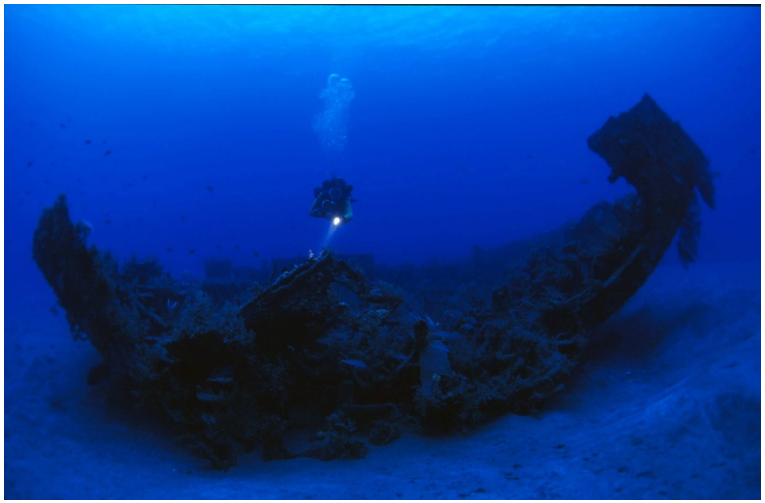
Decompression

I – No CNS related Sypmtoms

The definition of „type1“ is that there are no CNS effects. This is because we talk about symptoms created by the slower tissues like bones and fat that do not interact with nerves or bloodvessels directly and therefore cause pain or irritation but no effects on the CNS side.
It is important to understand that the slower and therfore type-1 related tissues usually get cleared in the later and shallower part of the deco.

Syptoms are:

- Weakness
- Jointpain
- Skinrash
- „Flu“ Symptoms
- T.b.c.



Decompression

II – CNS related Symptoms

The definition of „type2“ is that there are CNS effects. This is because we talk about symptoms created by the faster tissues like blood, muscles, etc that do interact with nerves or bloodvessels directly and therfore lead to issues with the CNS
It is important to understand that the faster and therfore Type-2 related tissues usually get cleared in the early and deeper part of the deco.

Syptoms are:
- Fatigue
- loss of feeling / sense
- Paralyzation
- Death
-T.b.c.

Decompression

III) DCS affection the inner ear causing vertigo (vestebiular hit)

The Definition of „Type3“ is sometimes used for this special case. There is no „rule“ when and how this occures. Although it seems that it is more likely to happen with a high He-content it was also confirmed on recreational divers on no deco dives with air.

The diver usually expirience a heavy vertigo that shows up within 45 min after the dive. This is caused by a small bubble in the inner ear that affect the balance.

Danger is given tru dehydration and the victim should get O2 and chamber treatment asap.

Decompression

Factors for DCS

DCS is caused and affected by the following factors:

- Age
- Fat
- Fitness
- Dehydration
- workload
- PFO
- Profile
- wrong gas
- Cold

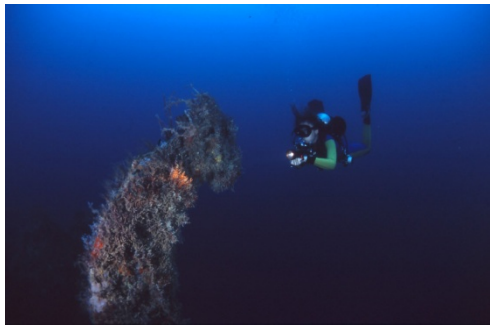
Decompression

Loss of Decogas

Loss of decogas will result in extended Decompression. The question is always what rule to apply and what to do in practical diving,

The Rule is simple and safe.
Double the stops that You have not the right gas for and use the deeper gas. In Level 1, using only 50% Nitrox as a deco gas, that means that You do the double deco on bottomgas. To be sure You have enough gas for that amount of deco You apply the minimum gas rule. In deeper diving, using more deco gases the rules get a bit more complex

In the real world You will have – hopefully – a buddy next to You who has decogas. What You can do now, instead of staying alone and let the partner deco away with his gas, is to share the gas (no buddybreathing!! But share 50/50) and extend the stops by 50% (decotime times 1.5)



Failures & Critical Skills

Please note that Critical Skills section is built around the classical backmounted configuration and is different for Sidemount and MCCR diving. If You take the class in one of these configurations – please refer to the ISE Sidemount or MCCR Manual.

Failures & „critical skills”

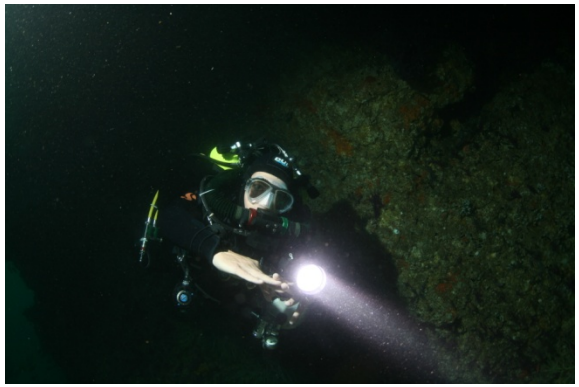
Loss of Gas

Loss of gas can be some small bubbles or a terrible, sudden noise – in any case your life-support is draining and You need to react immediately.

The problem solution is based on the likelihood of the problem, in 99% of all cases the loss will be from the right first stage as it is the working one

* Close right post DO NOT CHENGE REGULATORS and listen
* if it does not stop – reopen and close left post simultaneously
* purge backup and listen
* if is does not stop, reopen and close Isolator simultaneously.
* be aware that the loss will not stop – check SPG, breath from draining tank and call dive

THIS WHOLE SZENARIO SHOULD NOT TAKE MORE THAN 30 SECONDS



Failures & „critical skills”

OOG

One Diver is out of gas. Immediate action is needed – keep in mind that you do not only have to donate gas but also attention and decisions.

* OOG Diver signals OOG
* Donator makes eye contact, deploys longhose – Mouthpiece pointing to receiver
* donator retrieves Backup
* Donator makes body contact (left hand on right arm of receiver
* Donator asks OK
* Donator frees lightcord and deploys full hose length – make sure Reg is not pulled from receiver
* KEEP EYE CONTACT
* route Hose – depending on where Receiver is (left or right)
* Exit – donator in the back touch contact on receivers elbow.

Failures & „critical skills“

Loss of mask

Can happen: fin in face – cracked frame or glass, currrent, marine life. etc

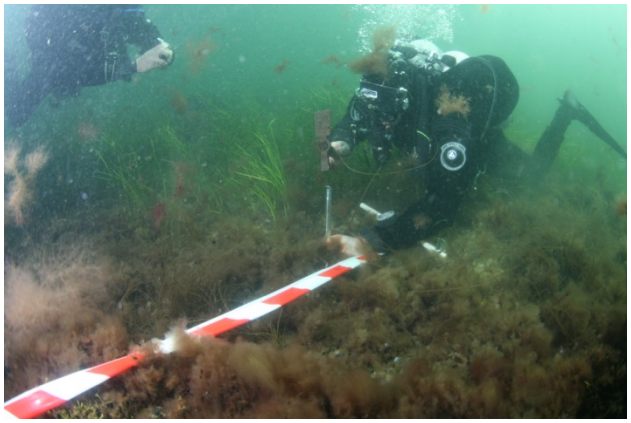
* Signal team
* Stop – control breathing and buoyancy
* get Backup mask from right pocket
* put on and take doubleender back in pocket
* Signal team ok

Failures & "critical skills"

Entanglement

Happens if reel is handled incorrect, high current, other teams, bad vis…

* STOP!!
* Signal Team
* do NOT turn or move
* Think and try to free Yourself – keep bottom time, deco and gas in mind
* if you cant - and Your team cant – cut:
* hold the end that leads to exit
* cut before and after you – maintain contact with the line end and fix it somewhere
* call dive – make sure team is on the line complete and exit



Failures & „critical skills“

Lost Line or broken line (gap)

Due to loss of light, bad skills, loss of visibility

* STOP – every move can bring you further away from the line
* get backup spool out and fix where you are
* go in the direction of where you think the line is.
* if not successful, depending on environment either go back and try other direction or search in circle
* when line is found – make connection and exit.

Failures & “critical skills“

Loss of light

Happens more or less for sure once in a while

* stop and signal buddy if You can
* deploy backup light, switch on and clip off
* signal team
* store primary
* call the dive

Training Dives

Dive 1: (Breakdown – max. 6 meter / Nitrox 32)

- Pre-Dive Sequence
- Bubble check

- Multiple failures on the team, while laying line, building maximum stress.

•Short debreifing by the instructor
•Videdebriefing & Discussion

Dive II: (Skills – max. 6 meter / Nitrox 32)

- Pre-Dive Sequence
- Bubble check

- Skill-work (one by one) on the skills from dive one (OOG / OOM / Line / a.s.o)
- Stagehandling procedures
- Liftbag shooting with reel in team

•Short debreifing by the instructor
•Videdebriefing & Discussion

Dive III: (Skills – max. 20 meter / Nitrox 32)

- Pre-Dive Sequence
- Bubble check

- Skill-work (one by one) on the skills from dive one (OOG / OOM / Line / a.s.o)
- Ascents with failures (failing bag, failing regulator, OOG, OOM
- Blue-water stops
- Gas switching

•Short debreifing by the instructor
•Videdebriefing & Discussion

Dive IV: (Skills – max. 30 meter / Nitrox 32)

- Pre-Dive Sequence
- Bubble check

- Skills at the bootom (light survey, etc)
- Failure at Bottom
- Blue water Ascents with failures (failing regulator, OOG, OOM
- Gas switch
- Blue-water stops

•Short debreifing by the instructor
•Videdebriefing & Discussion

Dive V: (Experience – max. 50 meter / TMX 21/35 + 50%)

- Pre-Dive Sequence
- Bubble check

- Experience Dive to a real target
- Survey

•Short debreifing by the instructor
•Videdebriefing & Discussion

Final Words

Conservation & Environmental Protection

ISE with its "Explorer Mindset" and the strong believe that all of us have to share the responsibility for our environment and the duty to preserve the natural resources for future generations is happy to introduce our members and students to Brad Robertson from Ondine Escape.
An Australian native with a long history in diving industry and experience all around the world, Brad settles in Mallorca were he runs Ondine Escape and organizes conservation project and works tireless on the building of a community to preserve Mallorca's aquatic habitats.

In the following Brad talks a bit about conservation and offers some inside views.
Brad is an active explorer, environmentalist and a fond member of InnerSpace Explorers.

Introduction

Conservation and Improving of local marine ecosystems.
As divers we have the ability to enjoy many different and exciting ecosystems, but simply looking and enjoying is not enough these days. Gone are the days when Jacques Cousteau dived into the Mediterranean and was amazed by the variety of life, the majority of marine life in the Mediterranean has now disappeared due to overfishing, human development and pollution. This sad fact is not restricted to the Mediterranean, it is a world wide problem. Hence understanding, protecting and even improving local marine ecosystems should be on the top of every divers To Do list.

Who is responsible.
Ultimately YOU are responsible for the health of our Sea´s and Ocean´s.
As a diver, as a consumer and as a human being with a conscience. As a diver you receive many pleasures from enjoying time underwater such as photography, encounters with majestic whales and impressive sharks. Imagine the pleasures you would enjoy if you were involved in preserving and improving your local marine ecosystems. Don't wait for governments to do anything. It is up to us, the worldwide diving community to get involved and make a difference.

Why is it so important.
Preserving our local marine ecosystems is beneficial to local communities both economically and socially. Healthy marine environments managed in a sustainable and practical way generate millions of dollars around the world annually. In fact, should you get to the stage of working with your local government, showing them the benefits of conservation in a financial sense may just be the key to get them involved. Show them the money! Socially and culturally the sea has been a huge influence in many parts of the world, a healthy sea. Allowing our sea´s and oceans to die a not so slow death is adding to the decline of centuries old sustainable cultural practices and limiting the social enjoyment of the sea. A dirty, unhealthy sea is not inviting for anyone.

Understanding local Ecosystems – sience base

Any conservation project needs to be science based, dreams don't work alone.
We need to have dreams and ideas to begin this process of global marine conservation; we need dreams and ideas at a local level with international attention that inspire more people to take more initiatives. These dreams and ideas must have a scientific base to them otherwise they lack the clarity and direction they require as well as lacking real beneficial objectives.

Importance of local experienced marine biologists.
The most important people you could possibly involve in any size marine research and conservation project are experienced local marine biologists, these people are imperative! You can be the best diver in the world with the best intentions in the world but without local knowledge and professional attitudes you will achieve very little in comparison. Contact your local aquarium, local department of fisheries, local marine research facility and let them know what you have planned. If you don't get the response you were after, then try again, you will eventually find someone who is interested in your project. With a scientific base and objectives with the best possible outcomes you will be building a base for success.

Utilizing and connecting with local authorities and scientific research centers.
Accumulated and shared knowledge is the way forward, starting from scratch in many circumstances is time consuming and counter productive, hence, connecting with your local scientific bodies is a must to succeed at studying and conserving local marine ecosystems. Most aquariums have a conservation department, most scientific institutes have a website and contact form, the hard work is gaining respect and having people open themselves and their knowledge to you. This does take a little time. If you have the drive and the stamina it will happen.

Merging science and the rest of us.
This is the key to large scale success, we need to bridge the gap between science and the community, we need to make science fun, interesting and most of all available to the masses. Involving volunteer divers in your projects will get people like you and me right in amongst the scientists as they work. Beginning the process of a larger understanding of science, which really is just understanding nature in detail.

Establish a solid team

Each individual role needs to be filled with the most capable professional available.
Like every great team, we need individuals to fulfill certain roles, each of these roles need to function on an individual basis and on a team basis.
If you are the one with the ideas but lack experience in building a team then that is the first person you need to find, the team builder and leader. Whoever leads your projects needs a great ability to find the right people for the job.

Importance of good leadership and a functioning team
Once your team has been established you will need to ensure it runs like the well oiled machine it is, this can only be done with great leadership, motivation and genuine interest in each individuals role as well as the larger objectives of the project. If you are genuinely interested in the subject you will surprise yourself with your ability to lead!!!

Communication within the team
Open & clear communication will allow your team to evolve, work more productively and be creative with ideas. Being able to communicate in a way that is not offensive and allows people to clearly express themselves is a great place to start.

Finding Objectives

<u>What are you wanting to achieve</u>

This is something that should be clear from the beginning, particularly when you are starting out with local projects. Beginning with a project that has a foreseeable end and foreseeable success is a great way to build your foundations. Having achievable goals ensures your success which in turn will increase your credibility and chances of success in the future.

As discussed above, talking to local scientists will give you a clear idea of what needs addressing in your local area. Dive centers are also a good source of local information.

<u>How are you going to do it</u>

Now you have your objectives you will need a plan of action. If you have successfully built a solid team then delegation of respective jobs is the most productive way to get moving. Each individual has their part to play, hence allowing them to create their own plan means their own understanding of their role and the experience they have should produce a solid plan. When you have all the different aspects done you will collaborate all the plans to make your final proposal. Its pretty simple really. Breaking the whole project up into different sections allows individual input into a team production.

Don’t expect anything but hard work

Gaining respect
This will come in time if you truly believe in what you are doing, if you do it in a positive way, if you do it in a professional way and if you really get your teeth stuck into it. You may need to create a project yourself, obviously with a scientific base but with the majority of work done by YOU. This will show commitment, interest and if done well will also show your level of professionalism.

Start small
Don’t bite off more than you can chew! As we mentioned earlier, having a first project that will succeed is crucial for your longevity and the health of your local marine ecosystems. Little by little is the key!

Involve as many established organizations as possible
Unless you have a limitless supply of money then you are going to need to be creative in your marketing and publicity. Involving established and respected companies and organizations will, if done correctly, benefit your projects with both public awareness and sponsorship. It will also accelerate the building of your reputation, which is another crucial aspect for successful projects in the future.

Looking for Sponsorship

Finalize your proposal
Once your proposal is complete ask a few people you know to have a look over it, make comments and suggestions. Brainstorming at this stage is still a productive way forward. Should there be any small alterations, make them and then prepare to write an accompanying letter to possible sponsors.

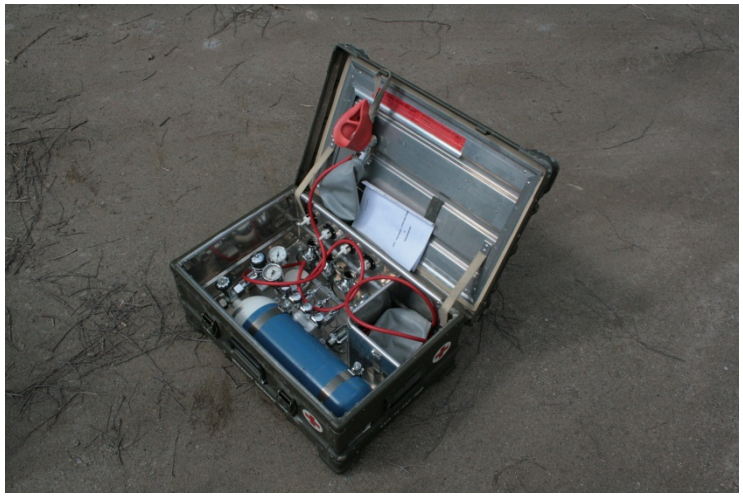
Utilize the contacts you already have
You would be surprised at who may take up an opportunity to sponsor a marine research or conservation project, particularly if you live in an area where there is very little being done. People like to feel good about themselves, give them the opportunity to join you. It will benefit them directly.

Expand your horizons
Think outside the box, if you are looking for a sponsor try to create a link between them and what you are doing, a natural and obvious link will do the trick.

Never give up
When you believe in something it will happen. The combination of hard work, determination and belief will lead to success of your projects. If you feel like giving up, think again! If thinking again should fail then contact me… Brad@OndineEscape.com or Brad@asociacionondine.org. I am just like you, a diver that cares and doesn't mind a little hard work.

Emergency Oxygen – A MUST

It is barely understandable how divers can spend thousands for training and gear but fail to understand that the - compared to the rest of their gear – cheap Oxygen Set may safe their live or the live of fellow divers.
Divers Emergency Oxygen can be the classical set up like from Wenoll or a budget solution using ex commercial stuff like seen on the pictures.
No matter what, the importance is to create the awareness amongst divers that having their own Emergency Oxygen Kit on the dive site without having to rely on others in case of ..

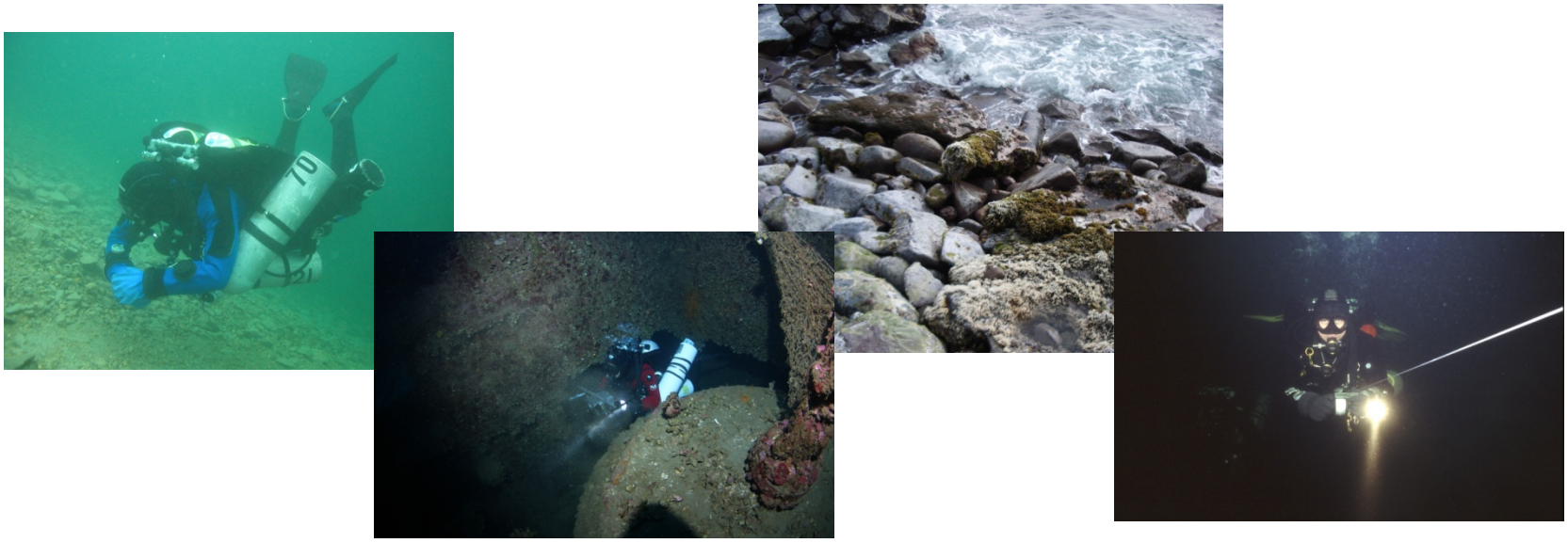


Thank You!

We would like to thank you greatly for all your time and commitment to enroll in this course, and are sure this course have greatly benefited your diving career by enhancing you aquatic fun.

Please remember to fill up the ISE instructor QA forms.

ISE is dedicated to promote intense and solid dive training around the world. Help us spread the system and please show your support for our projects and development. Thank You!



Credits

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Primary author:
Achim R. Schlöffel

Photo credits:
Jan-Lars Hanz
Helen Tsopouropoulou
Stephanie Meier
Achim Schlöffel
Norbert Eder
Wilke Reints

ISE contact information:
Website: www.is-expl.com
Email: hq@is-expl.com