Mastering Proper Trim

“There is a basic rule I always teach my students: Where the head is pointing, the backside will follow. It usually triggers a series of chuckles and smirks, but the truth is that if we are not trim in the water column, we will struggle during the entire dive. Trim is the diver’s angle through the water in terms of alignment with the direction of motion. For most of our dive, we want to be in what ‘s called neutral trim, a horizontal position parallel to the direction of travel. When we control our trim, we reduce our swimming effort, as we reduce the surface area the diver presents to the water. Consequently, we consume less gas, efficiently use our energy throughout the dive, and become less tired. Being able to keep trim on the dive will significantly benefit our buoyancy control and our breathing patterns.

To achieve trim, we need to balance the gear we are wearing, considering our exposure suit, the position of our cylinder or cylinders, and the distribution of weights. These items adequately adapted to our body should facilitate our dive, not create additional effort and struggle.

Working on the trim is a big part of becoming a good and comfortable scuba diver.”

Cristina Zenato, Cave Explorer, Advanced Cave Diving Instructor, Sidewinder Rebreather Instructor, Member of the Women Divers Hall Of Fame, Explorers Club Fellow

While mastery of breathing and buoyancy control is the ability of a diver to achieve and hold a specific position in the water column, trim defines the angle of the body in the water, in either static or propulsion mode. Have you ever spotted a Seahorse? It's vertical trim in the water is typically the opposite of what a diver's trim should be. In fact, in theory, a diver's trim could be identified as neutral, positive (slanting upward) or negative (slanting downward). However, in practice, and apart from constraints imposed by overhead environments, keeping the trim as neutral as possible throughout the dive and avoiding slanting upward or downward, is the true skill to master.

If you think of a diver as a helicopter taking off, flying at various altitudes before landing, a diver's body line should remain horizontal at all times, knees and ankles bent ninety degrees in order to keep the fins above the body level and parallel to the bottom, just like a helicopter's blades rotating parallel to the ground. Laying face down as if on a virtual platform, the diver's hands, arms, chest, hips and upper legs are all at the same level and no part of his or her equipment should dangle below the line of the body. Beyond being environmentally friendly, the less resistance a diver creates passing through the water and staying aligned with the direction of motion, the better the hydrodynamics, the less the swimming effort and subsequent gas usage, and the safer the dive.

Many factors can offset a diver's horizontal axis. However, apart from the body tension required in shoulders, core and gluteal muscles, holding a horizontal posture should not be too much of an effort provided all weight components and gas distribution don't alter the diver's center of gravity.

As Greek mathematician and physicist Archimede once observed, *"Equal weights at equal distances are in equilibrium and equal weights at unequal distances are not in equilibrium but incline towards the weight which is at the greater distance."* Achieving proper trim is largely a matter of weight positioning. In the case of a diver, the weight components are cylinders (and all related equipment: valves, regulators, backplates), ballast weights and potentially fins. Whether you're diving a single, or doubles, there is a limit

to the adjustments that can be made to the cylinders' position relative to the body be they back or side mounted, independent of the type of cylinder. Also for safety reasons, divers need to be able to reach their valves in case a valve shutdown is required.

However, the distribution of a diver's ballast weights is a major contributing factor to their trim, and something that they can act on. Once a diver has determined the amount of ballast weights required, wrapping a metaphorical anvil around the waist on a heavy, ill-fitting weight belt is arguably not the smartest nor the safest strategy. The effect is the one of an unbalanced seesaw that can force a diver into a vertical position that many divers with poor skills tend to experience before surfacing, usually with back pain. Instead they need the right amount of weight, positioned and secured in the right place. Securing one's ballast weights in the proper location not only guarantees that none of the weights will be dropped accidentally but it avoids having them shifting in a dissymmetric way that would make the diver roll sideways.

Fins can also have a major impact on a diver's trim; traveling considerations should not be the main concern when choosing their dry weight. Beyond obvious requirements such as an appropriate foot pocket size and a blade surface matching the diver's leg power, the dry weight and salt water buoyancy weight can vary tremendously from one model to another and from one size to another. Selecting the appropriate size and weight of fins makes the use of ankle weights unnecessary and prevents the knees from dropping under the horizontal axis.

Provided the weight is distributed properly enabling the diver to position themselves face down, gas distribution is the second major factor to consider when tuning a diver's trim. The action of inflating or deflating a wing (or buoyancy compensator device), a drysuit, or ensuring the right amount of gas flows through a rebreathers diver's counter lungs during the dive, are done to maintain buoyancy and comfort. However, where the gas flows, the diver goes.

Provided the design and sizing of such equipment is appropriate, finding the balance between the center of gravity and the center of buoyancy is the skill to master. Wings and buoyancy compensator devices come in different designs which have different gas distribution characteristics. For example, gas spreads more easily in a donut-shaped wing bladder compared to a horseshoe design. To be in equilibrium underwater, the centre of buoyancy must be directly above the centre of gravity. Any variation requires exertion on the part of the diver to maintain a hydrodynamic position. This can increase gas consumption when static in the water compared to the propulsion phase where the speed makes up for a positive or negative trim.

Drysuits tend to be disregarded by many divers who find them hard to manage, and only see them as providing thermal comfort. However the amount of gas required to provide thermal protection, while avoiding squeezes or vasoconstriction, plays an active role in a diver's trim and should allow for slight trim adjustments. This is accomplished through the efficient distribution of gas within the suit, which can only be achieved in horizontal or neutral trim position.

Once a diver has performed a buoyancy check, a trim check will enhance their underwater experience. It only takes a few minutes for one to maintain proper body tension, remain still in shallow waters, deflate his drysuit, look forward, find neutral buoyancy by inflating the wing and adopt a normal breathing pattern to find out whether they shift forward, backwards or sideways. This check is not about a diver's ability to perform but a verification of proper weight distribution together with the alignment of centers of buoyancy and gravity.

Trim mastery together with breathing and buoyancy control represent two of the fundamentals of safe and advanced diving. Any deviation can create numerous hazards and jeopardizes the diver and the team's safety, and the environment—loss of buoyancy and breathing control, along with the seesaw depth profile created by being out of trim can negatively impact team awareness and ability to communicate

effectively, impact the environment, create depth and gas management issues, and even result in less than optimal decompression. Once entropy has turned into equilibrium, the resulting balance and order enable the diver to focus on their surroundings and the team rather than themselves, perform tasks, and move on to the next level of their 'House of Cards'.

About the Author

Audrey Cudel is a cave explorer and technical diving instructor specializing in sidemount and cave diving training in Europe and Mexico.

She is also renowned in the industry for her underwater photography portraying deep technical divers and cave divers. Her work has appeared in various magazines such as *Wetnotes, Octopus, Plongeur International, Perfect Diver, Times of Malta*, and SDI/TDI and DAN (Divers Alert Network) publications.