

Scuba Fitness:

Aerobic Exercise:

Training Tools for Scuba Divers

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The Tin Woodsman from the Wizard of Oz would not make a good scuba diver. Although, it would be great if scuba divers were able to as easily get a new heart. While it requires more than a little bit of oil to perform aerobic exercise well, divers with enough metal to participate consistently will benefit from these training tools, which help prevent rust, corrosion, and the need for repair or replacement of valuable parts.



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AEROBIC EXERCISE = CARDIORESPIRATORY

Understanding the importance of cardiorespiratory fitness for scuba diving begins with an understanding of the changes that take place within the body in an underwater environment.

- Most divers experience a shift in breathing patterns from dry to wet.
- Upon entering the water breathing capacity is reduced by 10%.

- Diving equipment affects breathing and is a major stressor.
- On land at sea level the limiting factor of how much work can be performed is the cardiorespiratory system, while at depth underwater the limiting factor is primarily the respiratory system.
- Donning equipment increases heart rate.
- Most divers are over-weighted causing fatigue.

- Cold temperatures increase the energy costs associated with oxygen utilization throughout the body.
- Respiratory limitations of divers at depth may require increased respiratory rates.
- Younger, slimmer, or more aerobically fit divers are at less risk of decompression sickness (produce fewer bubbles) compared with older, fatter, or poorly fit divers.



IF THAT WASN'T ENOUGH, based on a review of reported medical conditions by scuba divers, heart disease, cardiovascular illness and high blood pressure are the most prevalent health concerns in the scuba diving community. **Cardiorespiratory fitness is achieved through aerobic exercise.** The lack of aerobic exercise or physical inactivity is one of the major risk factors for heart disease. The good news is that aerobic exercise helps to prevent heart disease, high blood pressure, high cholesterol, and may help repair the damage from smoking.

Aerobic exercise is a necessary fitness component for scuba divers. Positive results are apparent within weeks and are usually noticed when activities of daily living become easier to perform. However, the benefits of aerobic exercise diminish dramatically in as little as two weeks of inactivity. The best results are achieved when aerobic exercise is performed consistently as part of a healthy lifestyle. Research demonstrates that divers who maintain a good level of cardiorespiratory fitness reduce the risks associated with scuba diving and improve overall diving performance.

Generally speaking, the purpose of cardiorespiratory fitness is to maintain and/or improve the efficiency of the heart, lungs and vascular system.

This is accomplished through aerobic exercise which is any activity that utilizes oxygen. Greater oxygen demand is created through exercise by moving primarily the large muscles of the body repeatedly and rhythmically at a particular intensity beyond the usual activity of rest or relaxation. Repeated and regular aerobic exercise causes permanent favorable changes in health and performance, strengthens the heart, improves the ability of the body to transport and utilize oxygen and waste products such as carbon dioxide, and is also beneficial for weight loss. Examples of aerobic exercise are walking, jogging, running, swimming, rowing, cycling, jumping rope, aerobics classes, and dancing. Aerobic exercise may be performed outdoors almost anywhere. Fitness centers and home gyms provide equipment such as treadmills, stair climbers, ellipticals and exercise bikes.

GETTING STARTED

Aerobic exercise can be as simple as going for a walk. Begin gradually in both time and frequency. To get started, select an activity or a combination of activities and make a commitment to participate a minimum of two to four times a week for 20 to 60 minutes the first two weeks. Work up to three, four, five or more days per week depending on recovery, goals and the duration of workouts. Additional exercise in the form of resistance training is recommended for a balanced exercise program. To aid in weight loss, perform aerobic exercise for 20 to 40 minutes immediately following 20 to 40 minutes of resistance training.

IMPORTANT REMINDER

Exercise and strenuous physical activity are to be avoided within 24 hours before and after scuba diving. It is important to see a physician for a complete physical examination before beginning any exercise program. For divers, an annual physical examination is a responsibility associated with participating in the sport.

Aerobic Training Tools

Aerobic training tools assist divers in determining current fitness level, establishing the intensity of workouts, establishing goals and tracking training. Tools may be applied individually or combined to provide more detailed information and different training perspectives. One of the easiest tools for measuring exercise intensity is the talk test; exercise as hard as possible while still able to speak words clearly or carry on a conversation. Other training tools include the Karvonen Formula, a training heart-rate calculation, VO_2 testing, which defines fitness by oxygen uptake and utilization, METS, a metabolic unit of energy, with one MET being equal to the energy expended while the body is at rest, and the BORG Scale for Rating Perceived Exertion, a subjective measure of how challenging exercise feels. Divers may also utilize heart rate monitors to measure heart rate during exercise and provide target heart rate training zones. Pedometers record the number of steps and/or distance walked. The daily goal for pedometer use is recommended at 10,000 steps. Heart rate monitors and pedometers are found at most sporting goods stores.

KARVONEN FORMULA - TRAINING HEART RATE CALCULATION

TO MAXIMIZE THE BENEFITS OF TRAINING IT IS IMPORTANT TO ESTABLISH HEART RATE TRAINING ZONES. These training zones are based on individual maximum heart rate, which is the highest number of times the heart can contract in one minute. Working within 60% to 80% of maximum heart rate is most beneficial for overall health. *The 70% to 80% heart rate training zones improve the ability of the body to take in and distribute adequate amounts of oxygen to working muscles during physical activity and relate well to scuba diving.* One of the most respected fitness standards for calculating training heart rate zones is the Karvonen Formula.

Upon waking in the morning, before getting out of bed, place two fingers under the back corner of the jaw (on the carotid artery) and count the number of heart beats for one minute. This pulse is the Resting Heart Rate (RHR). Use it to perform the Karvonen calculation. An example of a 45 year-old diver with a RHR of 68, looks like this: $220 - (\text{AGE}) 45 = 175$; $175 - (\text{RHR}) 68 = 107$; $107 \times 70\% = 75$; $75 + (\text{RHR}) 68 = 143$ (THR). Using this example, training in the 70% heart rate training zone, divers will attempt to maintain a minimum pulse of 143 beats per minute. The 80% heart rate training zone provides a maximum pulse of 154 beats per minute. However, beginners may work at 60% intensity until these higher percentages can be performed while still able to carry on a conversation (the talk test).

VO_2 Aerobic Capacity and Oxygen Utilization

VO_2 testing is usually performed in a human performance laboratory and provides both cardiovascular fitness and metabolic feedback that may be helpful for divers who have reached a plateau in their fitness endeavors, new divers who would like to measure improvement or are interested in training more efficiently, and for divers who are also athletes. Oxygen utilization is measured in milliliters of oxygen per kilogram of body weight per minute (ml/kg/min). The more oxygen a diver can uptake and utilize the greater the aerobic capacity and the better the cardiorespiratory fitness of the diver. Lower cardiorespiratory fitness can be improved by participating in lower intensity exercise. The higher the cardiorespiratory fitness level, more increased exercise intensity is required for improvement.

- An oxygen uptake score of less than or equal to 30 ml/kg/min indicates a low level of fitness.
- An oxygen uptake score of 30-to-50 ml/kg/min indicates a moderate level of fitness.
- An oxygen uptake score of 50-to-90 ml/kg/min indicates a high level of fitness.

METS


A MET is a metabolic equivalent for the energy expenditure of a particular physical activity. One MET is equivalent to sedentary activity such as sitting on a couch reading a book. Any physical activity beyond resting is more than one MET of energy expenditure. For example, walking 3.0 miles per hour at a moderate pace on a level firm surface is 3.3 METs, which is slightly more than light-intensity physical activity. Moderate-intensity physical activity is performed between three and six times the intensity of rest and vigorous-intensity physical activity is performed at six or more times the intensity of rest.

The Compendium of Physical Activities includes several descriptions of METs for diving activities. Notice that recreational scuba diving is considered to exert approximately seven times the energy a diver would expend at rest; the low end of the vigorous-intensity category. Most diving activities are considered moderate-intensity. Diving activities requiring more energy equate to the need for higher levels of cardiorespiratory fitness and overall physical fitness including strength.

- Skindiving, fast 16
- Skindiving, SCUBA Diving, General 7.0
- Skindiving, moderate 12.5
- Snorkeling 5.0

Borg Rating of Perceived Exertion (RPE)

The Borg Rating of Perceived Exertion (RPE) is a way of measuring the intensity of physical activity. When using the RPE method of measuring exercise intensity, divers determine how hard exercise feels based on all of the physical sensations experienced during exercise. This includes heart rate, breathing, sweating, and muscle fatigue.

It is generally agreed that perceived exertion ratings between 12 and 14 on the Borg Scale indicate physical activity is being performed at a moderate level of intensity. On the RPE scale, activity ranges from 6 to 20, 6 means "no effort at all" and 20 means "maximal effort." Select the number that best matches the intensity of the sensations of exercise. The goal is to train in a moderate-intensity range of 12 to 14 on the RPE scale. 

- 6 No exertion at all
- 7
- Extremely light (7-5)
- 8
- 9 Very light
- 10
- 11 Light
- 12
- 13 Somewhat hard
- 14
- 15 Hard (heavy)
- 16
- 17 Very hard
- 18
- 19 Extremely hard
- 20 Maximal exertion

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