

Alessandro Marroni and Menno Gaastra

Diving is defined as an underwater activity during which a person breathes from a source of compressed gas. In this chapter it also includes breath-hold diving in which the person stays underwater for the duration of the breath-hold time and then returns to the surface for a further breath. The definition does not include diving by head-first entry into water.

---

### 164.1 Summary

In this section many aspects of diving and their specific problems are discussed, starting from the basic physiology and physics and diving techniques. About 50 % of the reported diving fatalities is due to drowning. Most diving-related drownings occur in recreational divers. A combination of measures will lower the number of diving-related drowning deaths. These measures will become more effective when they can be based on the systematic investigation of each diving-related drowning incident and on protocolised autopsies performed on the victims. Other important aspects are appropriate fitness for diving and proper dive training that include risk awareness and rescue and resuscitation skills. A second group of divers with a high fatality rate are fishermen in Low-Income Countries (LIC). Most of these fatalities occur outside the reach of the international diving, safety and health communities.

A complete list of the recommendations that may help to lower the number of diving fatalities is provided. This list was derived and edited for this chapter, from

---

A. Marroni (✉)  
Divers Alert Network, Continental Europe Office,  
Contrada Padune, 11 Roseto degli Abruzzi, 64026, Italy  
e-mail: [amarroni@daneurope.org](mailto:amarroni@daneurope.org)

M. Gaastra  
Oosterwal Centre,  
Comeniusstraat 3, 1817 MS Alkmaar, The Netherlands  
e-mail: [m.gaastra@centrum-oosterwal.nl](mailto:m.gaastra@centrum-oosterwal.nl)

the consensus recommendations which were established during the World Congress on Drowning in Amsterdam in 2002. This part of the book addresses only some of the aspects that are mentioned in these recommendations.

---

## 164.2 Recommendations

- Self-regulation within the worldwide recreational diving industry continues to be the practical route to reduce the number of drowning during diving. At the same time, there is a need to counter a perception that there is a conflict between commercial interests and safety.
- Training agencies, such as the Professional Association of Diving Instructors (PADI), SCUBA Schools International (SSI), the National Association of Underwater Instructors (NAUI) and *Confédération Mondiale des Activités Subaquatiques* (CMAS), should comply with international quality assurance and control procedures and encourage independent monitoring of diving incidents and fatalities. This will assure the effective and safe use of existing and new procedures.
- Subsistence fishermen, who are predominantly in the poor countries around the world, use equipment that is minimal and their training, regulations and medical support appear to be zero. To improve diving-fishermen safety and reduce drowning there is a need to collect data on accidents and drowning among representative samples of diving fishermen around the world.
- The collection of diver morbidity and mortality data and the associated contributory factors for each incident is a necessary first step in reducing drowning incidents among divers. Also needed are the denominator data that will allow the calculation of risk.
- Greater stringency is needed in the assessment of the physical, mental and medical fitness of all who choose to dive. A single assessment of fitness for diving at the beginning of diver training should not be considered valid throughout the rest of the life of a diver. Re-assessments are recommended at intervals that may diminish with advancing years and re-assessment may also be needed after illness or injury. To give a medical opinion on the fitness of a diver, the doctor should have knowledge of the unique hazards faced by the diver. The medical assessment should be conducted by a doctor acknowledged as competent in this field. It is recommended that the training of diving doctors, both for the medical examination of divers and also for the treatment of medical emergencies in diving, complies with guidance such as that published by the European Diving Technology Committee (EDTC) and the European Committee for Hyperbaric Medicine (ECHM). Periodical revision is also important. The mental, physical and medical standards of fitness in each category of diving should be harmonised internationally.
- Greater emphasis should be placed at all levels of training on the causation of diving and prevention of in-water fatalities. Training of rescuers should include the procedures for recovery of the victim from the water into a boat and transfer

of the patient from the deck of a boat to a helicopter or some other emergency transport vehicle. Policy of training children as young as 8 years old to dive should emphasise the immaturity of mental outlook that many young persons may have when an emergency occurs. Programs of refresher training should be established to maximise practical re-learning and updating of basic emergency skills. This is needed particularly after equipment has been modified. After some 3 to 5 years without regular diving, the individual should be subject to a formal re-assessment of competence before re-entering the water.

- Emergency procedures should be consistent with a variety of equipment in a variety of configurations. Self-rescue and buddy-rescue procedures should be compatible with the equipment used and the environmental conditions.
- Hand signals and basic procedures used in diving emergencies, whether at depth or on the surface, should be standardised and promoted through rescue and diving agencies throughout the world.
- Rescuers must be aware that the treatment of drowning in a diver might be complicated by other medical conditions such as carbon monoxide poisoning, envenomation and omitted decompression arising from that same dive.
- National and international standards of medical care should be written for all medical emergencies in diving.
- Drowning is mostly a diagnosis of exclusion and often is a presumptive diagnosis based on purely circumstantial evidence. All diving-related deaths should be thoroughly investigated, including a complete autopsy, evaluation of the equipment and a review of the circumstances surrounding the fatality by knowledgeable investigators with appropriate training and experience. The post-mortem examination of a drowned diver should be conducted by a pathologist who is knowledgeable about diving or who is advised by a doctor who is knowledgeable about diving.