



# **SHOALS MARINE LABORATORY**

## **Handbook for Diving Safety**

**REVISED IN CONFORMANCE WITH THE GUIDELINES, PROCEDURES, AND STANDARDS OF  
THE AMERICAN ACADEMY OF UNDERWATER SCIENCES**

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## FOREWORD

Since 1951 the scientific diving community has endeavored to promote safe, effective diving through self-imposed diver training and education programs. Over the years, manuals for diving safety have been circulated between organizations, revised and modified for local implementation, and have resulted in an enviable safety record.

This document represents the minimal safety standards for scientific diving at the present day. As diving science progresses so shall this standard, and it is the responsibility of every member of the Academy to see that it always reflects state of the art, safe diving practice.

American Academy of Underwater Sciences

## ACKNOWLEDGEMENTS

The Academy thanks the numerous dedicated individual and organizational members for their contributions and editorial comments in the production of these standards.

Revision History	
April, 1987	
October, 1990	
May, 1994	
January, 1996	
March 1999	Added Sec 7.6.1 Nitrox Diving Guidelines. Revised Appendix 7 and 11.
January 2001	Revised Section 1.23.1 DSO Qualifications. Revised Section 5.31.4 Emergency Care Training. Revised Section 6 Medical Standards. Made Sec 7.6.1 Nitrox Diving Guidelines into Section 7. Added Section 8.0 Scientific Aquarium Diving. Moved Section 7.0 to Section 9.0 Other Diving Technologies.
April 2002	Removed Appendix 7 AAUS Checkout Dive and Training Evaluation. Revised Section 5.33.3. Revised Section 4.23.2.
August 2003	Section 1.27.3 Delete reference to Appendix 9 (checkout dive). Section 1.4 Remove word "waiver". Section 2.21 Change "supervisor" to "lead diver". Section 2.72.2.1 Remove reference to Appendix 13, and remove Appendix 13. Replace with "at www.aaus.org" after Incident Report. Section 3.28.3 Remove Appendix 10 (dive computers). Section 5.32 Training and 100-hour requirement, eliminate "beyond the DIT level". Section 5.32.1 Eliminate paragraph "Suggested topics include" and replace it with a list of topics for inclusion in the 100 hours. Some of these topics would be designated "R" (required). Section 4.0 Remove lead sentence "This section describes for diving". Alter the lead

sentence read as follows: "This section describes training for the non-diver applicant, previously not certified for diving, and equivalency for the certified diver."

Section 4.3 Delete this section.

Section 9 Update Required Decompression (9.10) and Mixed Gas Diving (9.60) to individual sections.

Appendices 9, 10, 11, and 12 Remove these and make available online as historic documents in the Virtual Office.

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Separated manual into two volumes. Volume 1 and the appendices are required for all manual and Volume 2 sections only apply when the referenced diving activity is being conducted. Volume 2 is where organizational specific information is contained.

October 2005

Section 11.70 Deleted section for rebreathers.

Section 12.00 Added new section for rebreathers.

March 2006

Section 13.00 Added new section for cave and cavern diving.

Section 11.5 and 11.6, revised definitions for Hookah and surfaced supplied diving.

April 2006

Section 5.30 Deleted emergency care training prerequisite.

Section 5.50 Added emergency care training requirements to Continuation of Certificate.

November 2006

Section 2.60 flying after diving rules updated to meet current DAN standards.

Section 3.20 dive computers reference changed to "appendix 8".

Section 3.60 air quality guidelines updated to meet current CGA standards.

Section 5.30 – added words "Transect Sampling" to item #9.

Appendix 1 – Updated one medical web link.

Appendix 2 - Added the abbreviation "DO" to the MD signature line.

Appendix 6 – new LOR template.

Updated and added Appendix 8 dive computer recommendations

Added Appendix 9 (criteria for entering diving statistics).

December 2009

Appendix 2 – Revised

December 2011

Section 6 – Revised after Medical Review Panel review

Appendix 1 - Revised

May 2013

Section 3.10- added "and serviced according to manufacturers' recommendations"

Section 9.1(c) (1)- added "omitted decompression"

Section 9.1(c) (7)- added "qualified" to DSO's designee

Section 9.30 (k)- replaced "mixed gas" with "decompression"

Section 4.0- removed specific requirements for Entry-Level Training. Adopted WRSTC/ISO standards by reference.

Section 5.0- merged requirements for Entry-Level Diver Training with Scientific Diver Training

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# CONTENTS

Section 1.00 GENERAL POLICY .....	7
1.10 Scientific Diving Standards .....	7
1.20 Operational Control .....	8
1.30 Consequence of Violation of Regulations by Scientific Divers .....	12
1.40 Consequences of Violation of Regulations by Organizational Members .....	12
1.50 Record Maintenance .....	12
Section 2.00 DIVING REGULATIONS FOR SCUBA (OPEN CIRCUIT, COMPRESSED AIR) .....	13
2.10 Introduction .....	13
2.20 Pre-Dive Procedures .....	13
2.30 Diving Procedures .....	14
2.40 Post-Dive Procedures .....	15
2.50 Emergency Procedures .....	15
2.60 Flying After Diving or Ascending to Altitude (Over 1000 feet) .....	15
2.70 Record Keeping Requirements .....	15
Section 3.00 DIVING EQUIPMENT .....	17
3.10 General Policy .....	17
3.20 Equipment .....	17
3.30 Auxiliary Equipment .....	18
3.40 Support Equipment .....	18
3.50 Equipment Maintenance .....	19
3.60 Air Quality Standards .....	19
Section 4.00 ENTRY-LEVEL TRAINING REQUIREMENTS .....	21
4.10 General Policy .....	21
4.20 References .....	21
Section 5.00 SCIENTIFIC DIVER CERTIFICATION .....	22
5.10 Prerequisites .....	22
5.20 Training .....	22
5.30 Examinations .....	25
5.40 Diver Permits/ Certifications .....	26
5.50 Depth Certifications .....	26
5.60 Continuation of Certificate .....	27
5.70 Revocation of Certification .....	27
5.80 Recertification .....	28
5.90 Waiver of Requirements/Temporary Diver .....	28
Section 6.00 MEDICAL STANDARDS .....	29

6.10 Medical Requirements .....	29
6.20 Frequency of Medical Evaluations .....	29
6.30 Information Provided Examining Physician.....	29
6.40 Content of Medical Evaluations.....	29
6.50 Conditions Which May Disqualify Candidates From Diving (Adapted from Bove, 1998).....	29
6.60 Laboratory Requirements for Diving Medical Evaluation and Intervals.....	30
6.70 Physician’s Written Report.....	31

**APPENDICES**

APPENDIX 1 DIVING MEDICAL EXAM OVERVIEW FOR THE EXAMINING PHYSICIAN .....	33
APPENDIX 2 AAUS MEDICAL EVALUATION OF FITNESS FOR SCUBA DIVING REPORT ....	35
APPENDIX 3 DIVING MEDICAL HISTORY FORM.....	37
APPENDIX 4 RECOMMENDED PHYSICIANS WITH EXPERTISE IN DIVING MEDICINE .....	40
APPENDIX 5 DEFINITION OF TERMS.....	41
APPENDIX 6 AAUS REQUEST FOR DIVING RECIPROCITY FORM VERIFICATION OF DIVER TRAINING AND EXPERIENCE .....	44
APPENDIX 7 DIVING EMERGENCY MANAGEMENT PROCEDURES.....	45
APPENDIX 8 DIVE COMPUTER GUIDELINES.....	46
APPENDIX 9 AAUS STATISTICS COLLECTION CRITERIA AND DEFINITIONS.....	47
APPENDIX 10 SHOALS MARINE LABORATORY MEDICAL RESPONSE PLAN .....	50
APPENDIX 11 SML DIVING OPERATIONS PLAN .....	51
APPENDIX 12 DIVER APPLICATION FORM.....	52
APPENDIX 13 OPERATIONAL PROCEDURES FOR DIVES BEYOND THE SCOPE OF SCIENTIFIC DIVING.....	55
APPENDIX 14 RELEASE / INDEMNIFICATION OF ALL CLAIMS AND COVENANT NOT TO SUE .....	56
APPENDIX 15 DIVER EQUIPMENT .....	58

# Volume 1

Sections 1.00 through 6.00

Required For All Organizational Members

## SECTION 1.00 GENERAL POLICY

### 1.10 Scientific Diving Standards

#### *Purpose*

The purpose of these Scientific Diving Standards is to ensure that all scientific diving is conducted in a manner that will maximize protection of scientific divers from accidental injury and/or illness, and to set forth standards for training and certification that will allow a working reciprocity between organizational members. Fulfillment of the purposes shall be consistent with the furtherance of research and safety.

This standard sets minimal standards for the establishment of the American Academy of Underwater Sciences (AAUS) recognized scientific diving programs, the organization for the conduct of these programs, and the basic regulations and procedures for safety in scientific diving operations. It also establishes a framework for reciprocity between AAUS organizational members that adhere to these minimum standards.

This standard was developed and written by AAUS by compiling the policies set forth in the diving manuals of several university, private, and governmental scientific diving programs. These programs share a common heritage with the scientific diving program at the Scripps Institution of Oceanography (SIO). Adherence to the SIO standards has proven both feasible and effective in protecting the health and safety of scientific divers since 1954.

In 1982, OSHA exempted scientific diving from commercial diving regulations (29CFR1910, Subpart T) under certain conditions that are outlined below. The final guidelines for the exemption became effective in 1985 (Federal Register, Vol. 50, No.6, p.1046). AAUS is recognized by OSHA as the scientific diving standard setting organization.

Additional standards that extend this document may be adopted by each organizational member, according to local procedure.

#### *Scientific Diving Definition*

Scientific diving is defined (29CFR1910.402) as diving performed solely as a necessary part of a scientific, research, or educational activity by employees whose sole purpose for diving is to perform scientific research tasks.

#### *Scientific Diving Exemption*

OSHA has granted an exemption for scientific diving from commercial diving regulations under the following guidelines (Appendix B to 29CFR1910 Subpart T):

- a) The Diving Control Board consists of a majority of active scientific divers and has autonomous and absolute authority over the scientific diving program's operation.
- b) The purpose of the project using scientific diving is the advancement of science; therefore, information and data resulting from the project are non-proprietary.
- c) The tasks of a scientific diver are those of an observer and data gatherer. Construction and trouble-shooting tasks traditionally associated with commercial diving are not included within scientific diving.
- d) Scientific divers, based on the nature of their activities, must use scientific expertise in studying the underwater environment and therefore, are scientists or scientists-in-training.

In addition, the scientific diving program shall contain at least the following elements (29CFR1910.401):

- a) Diving safety manual, which includes at a minimum: Procedures covering all diving operations specific to the program; including procedures for emergency care, recompression and evacuation, and the criteria for diver training and certification.
- b) Diving control (safety) board, with the majority of its members being active scientific divers, which shall at a minimum have the authority to: approve and monitor diving projects, review and revise the diving safety manual, assure compliance with the manual, certify the depths to which a diver has been trained, take disciplinary action for unsafe practices, and assure adherence to the buddy system (a diver is accompanied by and is in continuous contact with another diver in the water) for scuba diving.

#### *Review of Standards*

As part of each organizational member's annual report, any recommendations for modifications of these standards shall be submitted to the AAUS for consideration.

### **1.20 Operational Control**

#### *Organizational Member Auspices Defined*

For the purposes of these standards the auspices of the Shoals Marine Laboratory (SML) includes any scientific diving operation in which SML is connected because of ownership of any equipment used, locations selected, or relationship with the individual(s) concerned. This includes all cases involving the operations of employees of SML or employees of auxiliary organizations, where such employees are acting within the scope of their employment, and the operations of other persons who are engaged in scientific diving of SML or are diving as members of an organization recognized by SML.

It is SML's responsibility to adhere to the AAUS Standards for Scientific Diving Certification and Operation of Scientific Diving Programs. The administration of the local diving program will reside with SML's Diving Control Board (DCB).

The regulations herein shall be observed at all locations where scientific diving is conducted.

#### *SML's Scientific Diving Standards and Safety Manual*

SML shall develop and maintain a scientific diving safety manual that provides for the development and implementation of policies and procedures that will enable SML to meet requirements of local environments and conditions as well as to comply with the AAUS scientific diving standards.

#### *Diving Safety Officer*

The Diving Safety Officer (DSO) serves as a member of the Diving Control Board (DCB). This person should have broad technical and scientific expertise in research related diving.

#### *Qualifications:*



1. Shall be appointed by the responsible administrative officer or designee, with the advice and counsel of the Diving Control Board.
2. Shall be trained as a scientific diver.
3. Shall be a full member as defined by AAUS.
4. Shall be an active underwater instructor from an internationally recognized certifying agency.

#### *Duties and Responsibilities*

1. Shall be responsible, through the DCB, to the SML director, for the conduct of the scientific diving program of the membership organization. The routine operational authority for this program, including the conduct of training and certification, approval of dive plans, maintenance of diving records, and ensuring compliance with this standard and all relevant regulations SML, rests with the Diving Safety Officer.
2. May permit portions of this program to be carried out by the Diving Coordinator, although the Diving Safety Officer may not delegate responsibility for the safe conduct of the local diving program.
3. Shall be guided in the performance of the required duties by the advice of the DCB, but operational responsibility for the conduct of the local diving program will be retained by the Diving Safety Officer.
4. Shall suspend diving operations considered to be unsafe or unwise.

#### *Diving Control Board*

- The Diving Control Board (DCB) shall consist of a majority of active scientific divers. Voting members shall include the Diving Safety Officer, the SML director, the responsible administrative officer, or designee, and should include other representatives of the diving program such as qualified divers and members selected by procedures established by each organizational member. A chairperson and a secretary may be chosen from the membership of the board according to local procedure.
- Has autonomous and absolute authority over the scientific diving program's operation.
- Shall approve and monitor diving projects.
- Shall review and revise the diving safety manual.
- Shall assure compliance with the diving safety manual.
- Shall certify the depths to which a diver has been trained.
- Shall take disciplinary action for unsafe practices.
- Shall assure adherence to the buddy system for scuba diving.
- Shall act as the official representative of the Shoals Marine Laboratory in matters concerning the scientific diving program.
- Shall act as a board of appeal to consider diver-related problems.
- Shall recommend the issue, reissue, or the revocation of diving certifications.
- Shall recommend changes in policy and amendments to AAUS and SML's organization's diving safety manual as the need arises.

- Shall establish and/or approve training programs through which the applicants for certification can satisfy the requirements of SML's diving safety manual.
- Shall suspend diving programs that are considered to be unsafe or unwise.
- Shall establish criteria for equipment selection and use.
- Shall recommend new equipment or techniques.
- Shall establish and/or approve facilities for the inspection and maintenance of diving and associated equipment.
- Shall ensure that the Shoals Marine Laboratory's air station(s) meet air quality standards as described in Section 3.60.
- Shall periodically review the Diving Safety Officer's performance and program.
- Shall sit as a board of investigation to inquire into the nature and cause of diving accidents or violations of the Shoals Marine Laboratory's diving safety manual.

### *Instructional Personnel*

#### *Qualifications*

All personnel involved in diving instruction under the auspices of the Shoals Marine Laboratory shall be qualified for the type of instruction being given.

#### *Selection*

Instructional personnel will be selected by the responsible administrative officer, or designee, who will solicit the advice of the DCB in conducting preliminary screening of applicants for instructional positions.

### Diving Coordinator

#### *Authority*

The diving coordinator, an employee based at Appledore Island, and is appointed by the Director of SML with the advice of the DCB and the DSO.

The DC is the person in charge of diving operations in the absence of the DSO.

#### *Qualifications*

The DC must be a qualified Scientific Diver (as described below) and a certified Divemaster or Instructor from an internationally recognized agency. (The DSO and DC may be the same person.)

The Director of SML, with the advice of the DCB and the DSO, will appoint a qualified employee to be Acting Diving Coordinator when the DC is off duty. The Acting DC is responsible for diving operations while the DC is off duty. The DC will pre-approve all dive plans before departure.

#### *Responsibilities*

Is responsible for on-site supervision of diving activities

Is responsible for the approval of dive plans and to qualify individuals as Radio Operators, based on criteria established by the DSO and DCB.

Maintenance of SML air station and SML-owned scuba equipment, using criteria and procedures established by the DCB and DSO.

Is responsible for maintaining SML-owned equipment maintenance logs, which shall be submitted to the Dive Safety Officer at the end of the season.

### *Lead Diver*

For each dive, one individual shall be designated as the Lead Diver who shall be at the dive location during the diving operation. The Lead Diver shall be responsible for:

- Coordination with other known activities in the vicinity that are likely to interfere with diving operations.
- Ensuring all dive team members possess current certification and are qualified for the type of diving operation.
- Planning dives in accordance with Section 2.20
- Ensuring safety and emergency equipment is in working order and at the dive site.
- Briefing dive team members on:
  - a) Dive objectives.
  - b) Unusual hazards or environmental conditions likely to affect the safety of the diving operation.
  - c) Modifications to diving or emergency procedures necessitated by the specific diving operation.
- Suspending diving operations if in their opinion conditions are not safe.
- Maintaining pre-dive and post-dive contact (by VHF radio or 2-way radio) with the SML office regarding the status of the diving operation and requesting emergency help if needed.
- Reporting to the DC and DCB any physical problems or adverse physiological effects including symptoms of pressure-related injuries.

### *Reciprocity and Visiting Scientific Diver*

Two or more AAUS Organizational Members engaged jointly in diving activities, or engaged jointly in the use of diving resources, shall designate one of the participating Diving Control Boards to govern the joint dive project.

A Scientific Diver from one Organizational Member shall apply for permission to dive under the auspices of another Organizational Member by submitting to the Diving Safety Officer of the host Organizational Member a document containing all the information described in Appendix 6, signed by the Diving Safety Officer or Chairperson of the home Diving Control Board.

A visiting Scientific Diver may be asked to demonstrate their knowledge and skills for the planned dive.

If a host Organizational Member denies a visiting Scientific Diver permission to dive, the host Diving Control Board shall notify the visiting Scientific Diver and their Diving Control Board with an explanation of all reasons for the denial.

### *Waiver of Requirements*

The SML Diving Control Board may grant a waiver for specific requirements of training, examinations, depth certification, and minimum activity to maintain certification.

#### **1.30 Consequence of Violation of Regulations by Scientific Divers**

Failure to comply with the regulations of the Shoals Marine Laboratory's diving safety manual may be cause for the revocation or restriction of the diver's scientific diving certificate by action of the Shoals Marine Laboratory's Diving Control Board.

#### **1.40 Consequences of Violation of Regulations by Organizational Members**

Failure to comply with the regulations of this standard may be cause for the revocation or restriction of the Shoals Marine Laboratory's recognition by AAUS.

#### **1.50 Record Maintenance**

The Diving Safety Officer or designee shall maintain permanent records for each Scientific Diver certified. The file shall include evidence of certification level, log sheets, results of current physical examination, reports of disciplinary actions by the Shoals Marine Laboratory Diving Control Board, and other pertinent information deemed necessary.

#### *Availability of Records:*

- Medical records shall be available to the attending physician of a diver or former diver when released in writing by the diver.
  - Records and documents required by this standard shall be retained by the Shoals Marine Laboratory for the following period:
    1. Physician's written reports of medical examinations for dive team members - 5 years.
    2. Diving safety manual - current document only.
    3. Records of dive - 1 year, except 5 years where there has been an incident of pressure-related injury.
    4. Pressure-related injury assessment - 5 years.
    5. Equipment inspection and testing records - current entry or tag, or until equipment is withdrawn from service.

## **SECTION 2.00 DIVING REGULATIONS FOR SCUBA (OPEN CIRCUIT, COMPRESSED AIR)**

### **2.10 Introduction**

No person shall engage in scientific diving operations under the auspices of the Shoals Marine Laboratory's scientific diving program unless they hold a current certification issued pursuant to the provisions of this standard.

### **2.20 Pre-Dive Procedures**

#### *Dive Plans*

Dives should be planned around the competency of the least experienced diver. Before conducting any diving operations under the auspices of the Shoals Marine Laboratory, the lead diver for a proposed operation must formulate a dive plan that should include the following:

- Divers' qualifications, and the type of certificate or certification held by each diver.
- Emergency plan (Appendix 7) with the following information:
  1. Name, telephone number, and relationship of person to be contacted for each diver in the event of an emergency.
  2. Nearest operational decompression chamber.
  3. Nearest accessible hospital.
  4. Available means of transport.
- Approximate number of proposed dives.
- Location(s) of proposed dives.
- Estimated depth(s) and bottom time(s) anticipated.
- Decompression status and repetitive dive plans, if required.
- Proposed work, equipment, and boats to be employed.
- Any hazardous conditions anticipated.

#### *Pre-dive Safety Checks*

##### Diver's Responsibility:

1. Scientific divers shall conduct a functional check of their diving equipment in the presence of the diving buddy or tender.
2. It is the diver's responsibility and duty to refuse to dive if, in their judgment, conditions are unfavorable, or if they would be violating the precepts of their training, of this standard, or the Shoals Marine Laboratory's diving safety manual.
3. No dive team member shall be required to be exposed to hyperbaric conditions against their will, except when necessary to prevent or treat a pressure-related injury.
4. No dive team member shall be permitted to dive for the duration of any known condition, which is likely to adversely affect the safety and health of the diver or other dive members.

##### Equipment Evaluations:

1. Divers shall ensure that their equipment is in proper working order and that the equipment is suitable for the type of diving operation.
2. Each diver shall have the capability of achieving and maintaining positive buoyancy.

#### Site Evaluation

1. Environmental conditions at the site will be evaluated.

#### *Requirement for radio operator*

Every dive outing requires a radio operator that is approved by the DC. The radio operator is responsible for pre-dive, post-dive, and any emergency communications with the SML office.

#### *Shore or "Dive Platform dives"*

When diving from shore or the 'Dive Platform' an additional non-diving radio operator is not required. In these instances the lead diver may act as the radio operator for communicating with the SML office. If weather conditions are such that additional personnel are deemed necessary for safe dive operations a non-diving radio operator will be required by the DSO or DC.

#### *Vessel diving*

When diving from SML vessels a person/boat operator shall remain on the boat at all times to act as the radio operator, and to render assistance to the divers during the boat diving operations.

### **2.30 Diving Procedures**

#### *Solo Diving Prohibition*

All diving activities shall assure adherence to the buddy system for scuba diving. This buddy system is based upon mutual assistance, especially in the case of an emergency.

All divers are required to maintain constant visual contact with his/her diver buddy. If buddies lose visual contact, they must search the vicinity for 1 minute, and then, if contact has not been made, safely ascend to the surface to re-establish contact.

#### *Refusal to Dive*

The decision to dive is that of the diver. A diver may refuse to dive, without fear of penalty, whenever they feel it is unsafe for them to make the dive.

#### *Safety*

The ultimate responsibility for safety rests with the individual diver. It is the diver's responsibility and duty to refuse to dive if, in their judgment, conditions are unsafe or unfavorable, or if they would be violating the precepts of their training or the regulations in this standard.

#### *Termination of the Dive*

It is the responsibility of the diver to terminate the dive, without fear of penalty, whenever they

feel it is unsafe to continue the dive, unless it compromises the safety of another diver already in the water.

The dive shall be terminated while there is still sufficient cylinder pressure to permit the diver to safely reach the surface, including decompression time, or to safely reach an additional air source at the decompression station. At SML, all divers should be out of the water with no less than 500 psi in their tanks.

### *Emergencies and Deviations from Regulations*

Any diver may deviate from the requirements of this standard to the extent necessary to prevent or minimize a situation that is likely to cause death, serious physical harm, or major environmental damage. A written report of such actions must be submitted to the Diving Control Board explaining the circumstances and justifications.

## **2.40 Post-Dive Procedures**

### *Post-Dive Safety Checks*

After the completion of a dive, each diver shall report any physical problems, symptoms of decompression sickness, or equipment malfunctions to the DSO or DC.

When diving outside the no-decompression limits, the divers should remain awake for at least 1 hour after diving, and in the company of a dive team member who is prepared to transport them to a decompression chamber if necessary.

The lead diver or boat/radio operator shall use a VHF radio or 2-way radio to notify the SML office immediately after the divers have returned to the boat or dive float, and report on any need for assistance.

## **2.50 Emergency Procedures**

The Shoals Marine Laboratory will develop emergency procedures which follow the standards of care of the community and must include procedures for emergency care, recompression and evacuation for each dive location (Appendix 7).

## **2.60 Flying After Diving or Ascending to Altitude (Over 1000 feet)**

Following a Single No-Decompression Dive: Divers should have a minimum preflight surface interval of 12 hours.

Following Multiple Dives per Day or Multiple Days of Diving: Divers should have a minimum preflight surface interval of 18 hours.

Following Dives Requiring Decompression Stops: Divers should have a minimum preflight surface interval of 24 hours.

Before ascending to Altitude above (1000 feet) by Land Transport: Divers should follow the appropriate guideline for preflight surface intervals unless the decompression procedure used has accounted for the increase in elevation.

## **2.70 Record Keeping Requirements**

### *Personal Diving Log*

Shoals Marine Lab utilizes an AAUS online diving log form. All SML divers are required to log their dives in a timely fashion on the system, using their personal log in information. Copies of each diver's logs will be accessible by the DSO and the DCB upon request, and each diver is

responsible for obtaining a copy of their own log. The following information will be included for each dive:

- Name of diver and buddy.
- Date, time, and location.
- Diving modes used.
- General nature of diving activities.
- Approximate surface and underwater conditions.
- Maximum depths, bottom time, and surface interval time.
- Diving tables or computers used.
- Detailed report of any near or actual incidents.

### *Required Incident Reporting*

All diving incidents requiring recompression treatment, or resulting in moderate or serious injury, or death shall be reported to the Shoals Marine Laboratory's Diving Control Board and the AAUS. The Shoals Marine Laboratory's regular procedures for incident reporting, including those required by the AAUS, shall be followed. The report will specify the circumstances of the incident and the extent of any injuries or illnesses.

Additional information must meet the following reporting requirements:

- Shoals Marine Laboratory shall record and report occupational injuries and illnesses in accordance with requirements of the appropriate Labor Code section.
- If pressure-related injuries are suspected, or if symptoms are evident, the following additional information shall be recorded and retained by the Shoals Marine Laboratory, with the record of the dive, for a period of 5 years:
  1. Complete AAUS Incident Report at <http://www.aaus.org>.
  2. Written descriptive report to include:
    - Name, address, phone numbers of the principal parties involved.
    - Summary of experience of divers involved.
    - Location, description of dive site, and description of conditions that led up to incident.
    - Description of symptoms, including depth and time of onset.
    - Description and results of treatment.
    - Disposition of case.
    - Recommendations to avoid repetition of incident.

Shoals Marine Laboratory shall investigate and document any incident of pressure-related injury and prepare a report that is to be forwarded to AAUS during the annual reporting cycle. This report must first be reviewed and released by the Shoals Marine Laboratory's Diving Control Board.



## SECTION 3.00 DIVING EQUIPMENT

### 3.10 General Policy

All equipment shall meet standards as determined by the Diving Safety Officer, the Diving Coordinator, and the Diving Control Board. All equipment shall be regularly examined by the person using them and serviced according to manufacturer recommendations. Equipment that is subjected to extreme usage under adverse conditions should require more frequent testing and maintenance.

Divers are responsible for required inspection and maintenance of their scuba equipment, and for supplying copies of inspection/maintenance/certification records to the DSO. The SML diving program only verifies that it has received copies of required inspections/maintenance, it does not perform or take responsibility for such inspections/maintenance.

### 3.20 Equipment

#### *Regulators*

- Only those makes and models specifically approved by the Diving Safety Officer and the Diving Control Board shall be used. The DCB has the right to disallow the use of equipment on a case by case basis.
- Scuba regulators shall be inspected and tested prior to first use and every 12 months thereafter, or according to the manufacturer's specifications if longer.
- Regulators will consist of a primary second stage and an alternate air source (such as an octopus second stage or redundant air supply).

#### *Breathing Masks and Helmets*

Breathing masks and helmets shall have:

- A non-return valve at the attachment point between helmet or mask and hose, which shall close readily and positively.
- An exhaust valve.
- A minimum ventilation rate capable of maintaining the diver at the depth to which they are diving.

#### *Scuba Cylinders*

- Scuba cylinders shall be designed, constructed, and maintained in accordance with the applicable provisions of the Unfired Pressure Vessel Safety Orders.
- Scuba cylinders must be hydrostatically tested in accordance with DOT standards.
- Scuba cylinders must have an internal and external inspection at intervals not to exceed 12 months.
- Scuba cylinder valves shall be functionally tested at intervals not to exceed 12 months.

#### *Gauges*

- Gauges shall be inspected and tested before first use and every 12 months thereafter.

## Flotation Devices

- Each diver shall have the capability of achieving and maintaining positive buoyancy.
- Personal flotation systems, buoyancy compensators, dry suits, or other variable volume buoyancy compensation devices shall be equipped with an exhaust valve.
- These devices shall be functionally inspected and tested at intervals not to exceed 12 months.

### *Timing Devices, Depth, and Pressure Gauges*

- Both members of the buddy team must have an underwater timing device, an approved depth indicator, and a submersible pressure gauge.

### Determination of Decompression Status: Dive Tables, Dive Computers

- A set of NAUI diving tables must be available at the dive location.
- Dive computers may be utilized in place of diving tables, and must be approved by the Diving Control Board. AAUS recommendations on dive computers are located in Appendix 8.

## **3.30 Auxiliary Equipment**

### *Hand held underwater power tools*

- Electrical tools and equipment used underwater shall be specifically approved for this purpose.
- Electrical tools and equipment supplied with power from the surface shall be de-energized before being placed into or retrieved from the water.
- Hand held power tools shall not be supplied with power from the dive location until requested by the diver.

## **3.40 Support Equipment**

### *First aid supplies*

- A first aid kit and emergency oxygen shall be available at the dive site for all dives. Visiting Researchers must: (1) provide their own first aid and emergency oxygen kits and ensure they are properly maintained and inspected; or (2) make prior arrangements for use of SML equipment.

### *Diver's Flag*

A diver's flag shall be displayed prominently whenever diving is conducted at Shoals Marine Lab.

### *Compressor Systems – SML controlled*

The following will be considered in design and location of compressor systems:

- Low-pressure compressors used to supply air to the diver if equipped with a volume tank shall have a check valve on the inlet side, a relief valve, and a drain valve.
- Compressed air systems over 500 psig shall have slow-opening shut-off valves.
- All air compressor intakes shall be located away from areas containing exhaust or other contaminants.

### 3.50 Equipment Maintenance

#### *Record Keeping*

Each equipment modification, repair, test, calibration, or maintenance service shall be logged, including the date and nature of work performed, serial number of the item, and the name of the person performing the work for the following equipment, if applicable:

- Regulators
- Submersible pressure gauges
- Depth gauges
- Scuba cylinders
- Cylinder valves
- Diving helmets
- Submersible breathing masks
- Compressors
- Gas control panels
- Air storage cylinders
- Air filtration systems
- Analytical instruments
- Buoyancy control devices
- Dry suits

#### *Compressor Operation and Air Test Records*

Gas analyses and air tests shall be performed on each SML-controlled breathing air compressor at beginning of each dive season (May-September). The results of these tests shall be entered in a formal log and be maintained.

A log shall be maintained showing operation, repair, overhaul, filter maintenance, and temperature adjustment for each compressor.

### 3.60 Air Quality Standards

Breathing air for scuba shall meet the following specifications as set forth by the Compressed Gas Association (CGA Pamphlet G-7.1).

CGA Grade E	
Component	Maximum
Oxygen	20 - 22%/v
Carbon Monoxide	10 PPM/v
Carbon Dioxide	1000 PPM/v
Condensed Hydrocarbons	5 mg/m <sup>3</sup>
Total Hydrocarbons as Methane	25 PPM/v
Water Vapor ppm	(2)
Objectionable Odors	None

For breathing air used in conjunction with self-contained breathing apparatus in extreme cold where moisture can condense and freeze, causing the breathing apparatus to malfunction, a dew

point not to exceed -50°F (63 pm v/v) or 10 degrees lower than the coldest temperature expected in the area is required.

## SECTION 4.00 ENTRY-LEVEL TRAINING REQUIREMENTS

### 4.10 General Policy

Shoals Marine Laboratory does not conduct entry level diver training, but ensures that all Scientific divers in training have the minimum entry-level diving standards referenced below. Training and certification as an entry-level diver is a prerequisite to AAUS Scientific Diver Training. In lieu of writing/promulgating AAUS specific standards for entry-level divers, AAUS references here the standards for entry-level diver training as defined by the WRSTC and/or ISO. AAUS programs who wish to train entry-level divers may do so using one of the following options:

- a) under the auspices and standards of an internationally recognized diver training agency.
- b) under the auspices of AAUS using the minimum guidelines presented by the most current version of the RSTC/WRSTC and/or ISO entry-level diver standards.

### 4.20 References

“Minimum Course Content for Open Water Diver Certification”- World Recreational Scuba Training Council (WRSTC), [www.wrstc.com](http://www.wrstc.com). The minimum standard at Shoals Marine Laboratory includes: Successfully completing 5 open water dives (1 may be a snorkel) for a minimum total time of 3 hours, of which 1-1/2 hours cumulative bottom time must be on scuba. No more than 3 training dives shall be made in any 1 day.

“Safety related minimum requirements for the training of recreational scuba divers -- Part 2: Level 2 -- Autonomous diver”. ISO 24801-2:2007- International Organization for Standardization (ISO)- [www.iso.org](http://www.iso.org).

## SECTION 5.00 SCIENTIFIC DIVER CERTIFICATION

### 5.10 Prerequisites

#### *Administrative*

The applicant/candidate must complete all administrative and legal documentation required by the Shoals Marine Laboratory.

#### *Diver Certification*

The applicant/candidate must, at minimum, show documented proof of entry-level diver certification from an internationally recognized training agency. As an alternative, AAUS OMs who wish to train and certify entry-level divers under AAUS auspices may do so under the guidelines presented in Section 4.0.

#### *Medical Examination*

The applicant/candidate must be medically qualified for diving as described in Section 6.0 of the AAUS Standards for Scientific Diving. Please note that all appropriate medical exams in Appendix 2 must be conducted.

#### *Swimming/Watermanship Evaluation*

The applicant/candidate must demonstrate the following in the presence of the Diving Safety Officer, instructor, or other approved examiner. All tests are to be performed without swim aids, however, where exposure protection is needed, the applicant must be appropriately weighted to provide for neutral buoyancy.

- a) Snorkel 900 yards/meters in open water in less than 18 minutes.
- b) Transport a passive person of equal size a distance of 25 yards/meters in open water
- c) Demonstrate a surface dive and recovery, fin push or BC towing, and leg cramp release
- d) Demonstrate how to lift a passive person out of the water and onto the dive float/platform, with the help of an additional person.

### 5.20 Training

The diver must complete theoretical aspects and practical training for a minimum cumulative time of 100 hours. Theoretical aspects shall include principles and activities appropriate to the intended area of scientific study.

#### *Theoretical Training/ Knowledge Development*

Required Topics:

1. Diving Emergency Care Training
  - Cardiopulmonary Resuscitation (CPR)
  - Standard or Basic First Aid
  - Recognition of DCS and AGE
  - Accident Management

- Field Neurological Exam
  - Oxygen Administration
2. Dive Rescue
  3. Dive Physics
  4. Dive Physiology
  5. Dive Environments
  6. Decompression Theory and its Application
  7. AAUS Scientific Diving Regulations and History
    - Scientific Dive Planning
    - Coordination with other Agencies
    - Appropriate Governmental Regulations
  8. Scientific Method
  9. Data Gathering Techniques (Only Items specific to area of study required)
    - Transect Sampling (Quadrating)
    - Transecting
    - Mapping
    - Coring
    - Photography
    - Tagging
    - Collecting
    - Animal Handling
    - Archaeology
    - Common Biota
    - Organism Identification
    - Behavior
    - Ecology
    - Site Selection, Location, and Re-location
    - Specialized Equipment for data gathering
    - HazMat Training
    - HP Cylinders
    - Chemical Hygiene, Laboratory Safety (Use Of Chemicals)

Suggested Topics:

10. Specific Dive Modes (methods of gas delivery)
  - Open Circuit

- Hooka
  - Surface Supplied diving
11. Small Boat Operation
  12. Rebreathers
    - Closed
    - Semi-closed
  13. Specialized Breathing Gas
    - Nitrox
    - Mixed Gas
  14. Specialized Environments and Conditions
    - Blue Water Diving,
    - Ice and Polar Diving (Cold Water Diving)
    - Zero Visibility Diving
    - Polluted Water Diving
    - Saturation Diving
    - Decompression Diving
    - Overhead Environments
    - Aquarium Diving
    - Night Diving
    - Kelp Diving
    - Strong Current Diving (Live-boating)
    - Potential Entanglement
  15. Specialized Diving Equipment
    - Full face mask
    - Dry Suit
    - Communications

### *Practical Training/Skill Development*

#### Confined Water Evaluation

At the completion of training, the trainee must satisfy the Diving Safety Officer or the instructor of their ability to perform the following, as a minimum, in a pool or in sheltered water:

- a) Enter water with full equipment.
- b) Clear face mask.
- c) Demonstrate air sharing, including both buddy breathing and the use of alternate air source, as both donor and recipient, with and without a face mask.
- d) Demonstrate ability to alternate between snorkel and scuba while kicking.



- e) Demonstrate understanding of underwater signs and signals.
- f) Demonstrate simulated in-water mouth-to-mouth resuscitation.
- g) Rescue and transport, as a diver, a passive simulated victim of an accident.
- h) Demonstrate ability to remove and replace equipment while submerged.
- i) Demonstrate watermanship ability, which is acceptable to the instructor.

### *Open Water Evaluation*

The trainee must satisfy an instructor, approved by the Diving Safety Officer, of their ability to perform at least the following in open water:

- a) Surface dive to a depth of 10 feet in open water without scuba.
- b) Demonstrate proficiency in air sharing as both donor and receiver.
- c) Enter and leave open water or surf, or leave and board a diving vessel, while wearing scuba gear.
- d) Kick on the surface 400 yards while wearing scuba gear, but not breathing from the scuba unit.
- e) Demonstrate judgment adequate for safe diving.
- f) Demonstrate, where appropriate, the ability to maneuver efficiently in the environment, at and below the surface.
- g) Complete a simulated emergency swimming ascent.
- h) Demonstrate clearing of mask and regulator while submerged.
- i) Demonstrate ability to achieve and maintain neutral buoyancy while submerged.
- j) Demonstrate techniques of self-rescue and buddy rescue.
- k) Navigate underwater.
- l) Plan and execute a dive.

### Checkout Dive/ Additional Experience

Practical training must include an Open Water checkout dive(s), with evaluation of the skills listed in Open Water Evaluation, with the DSO or qualified delegate followed by at least 11 ocean or open water dives in a variety of dive sites and diving conditions, for a cumulative bottom time of 6 hours. Dives following the checkout dive must be supervised by a certified Scientific Diver with experience in the type of diving planned, with the knowledge and permission of the DSO.

## **5.30 Examinations**

### *Written Exams*

Before completing training, the trainee must pass a written examination that demonstrates knowledge of at least the following:

1. Function, care, use, and maintenance of diving equipment.
2. Physics and physiology of diving.
3. Diving regulations and precautions.
4. Near-shore currents and waves.

5. Dangerous marine animals.
6. Emergency procedures, including buoyant ascent and ascent by air sharing.
7. Currently accepted decompression procedures.
8. Demonstrate the proper use of dive tables.
9. Underwater communications.
10. Aspects of freshwater and altitude diving.
11. Hazards of breath-hold diving and ascents.
12. Planning and supervision of diving operations.
13. Diving hazards.
14. Cause, symptoms, treatment, and prevention of the following: near drowning, air embolism, carbon dioxide excess, squeezes, oxygen poisoning, nitrogen narcosis, exhaustion and panic, respiratory fatigue, motion sickness, decompression sickness, hypothermia, and hypoxia/anoxia.
15. Suggested topics (from Sec. 5.20) at the DSO's discretion.

### *Equipment*

The trainee will be subject to examination/review of:

1. Personal diving equipment
2. Task specific equipment

### **5.40 Diver Permits/ Certifications**

SML requires that no person shall engage in scientific diving unless that person is authorized by an organizational member pursuant to the provisions of this standard. Only a person diving under the auspices of the SML that subscribes to the practices of SML is eligible for a scientific diver certification.

#### *Scientific Diver-In-Training Permit*

This is a permit to dive, usable only while it is current and for the purpose intended. This permit signifies that a diver has completed and been certified as at least an entry level diver through an internationally recognized certifying agency or scientific diving program, and has the knowledge skills and experience necessary to continue training as a scientific diver under supervision, as approved by the DSO.

#### *Scientific Diver Certification*

This permit signifies a diver has completed all requirements in Section 5.0 and is authorized by the Shoals Marine Lab to engage in scientific diving without supervision, as approved by the DSO. Submission of documents and participation in aptitude examinations does not automatically result in certification. The applicant must convince the Diving Safety Officer and members of the DCB that they are sufficiently skilled and proficient to be certified. This skill will be acknowledged by the signature of the Diving Safety Officer. Any applicant who does not possess the necessary judgment, under diving conditions, for the safety of the diver and their partner, may be denied Shoals Marine Laboratory scientific diving privileges.

### **5.50 Depth Certifications**

#### *General Policy*

Diving is not permitted beyond a depth of 100 feet at SML, except with special permission of the DCB.

#### *Depth Certifications and Progression to Next Depth Level*

A certified diver diving under the auspices of the Shoals Marine Laboratory may progress to the next depth level after successfully completing the required dives for the next level. Under these circumstances the diver may exceed their depth limit. Dives shall be planned and executed under close supervision of a diver certified to this depth, with the knowledge and permission of the DSO.

- a) Certification to 45 Foot Depth - Initial permit level, approved upon the successful completion of training listed in Section 4.00 and 5.00. Note that the normal initial certification for most AAUS institutions is 30 fsw, therefore subsequent verification of training letters or letters of reciprocity will reflect a 30 fsw depth certification.
- b) Certification to 60 Foot Depth - A diver holding a 45 foot certificate may be certified to a depth of 60 feet after successfully completing, under supervision, 12 logged training dives to depths between 45 and 60 feet, for a minimum total time of 4 hours. A diver achieving this depth certification will require at least 24 dives total.
- c) Certification to 100 Foot Depth - A diver holding a 60 foot certificate may be certified to a depth of 100 feet after successfully completing, 4 dives to depths between 61 and 100 feet. The diver shall also demonstrate proficiency in the use of the appropriate Dive Tables.

## **5.60 Continuation of Certificate**

### *Minimum Activity to Maintain Certification*

During any 12-month period, each certified scientific diver must log a minimum of 12 dives. At least one dive must be logged near the maximum depth of the diver's certification during each 6-month period.

### *Re-qualification of Depth Certificate*

Once the initial certification requirements of Section 5.00 are met, divers whose depth certification has lapsed due to lack of activity may be re-qualified by procedures adopted by the organization's DCB.

### *Medical Examination*

All certified scientific divers shall pass a medical examination at the intervals specified in Section 6.0. After each major illness or injury, as described in Section 6.0, a certified scientific diver shall receive clearance to return to diving from a physician before resuming diving activities. Annually, divers will be required to complete a new copy of Appendix 3, to note any changes in their medical status.

### *Emergency Care Training*

The scientific diver must provide proof of training in the following:

1. Adult CPR (must be current).
2. Emergency oxygen administration (must be current)
3. First aid for diving accidents (must be current)

## **5.70 Revocation of Certification**

A diving certificate may be revoked or restricted for cause by the Diving Safety Officer or the DCB. Violations of regulations set forth in this standard, or other governmental subdivisions not in conflict with this standard, may be considered cause. The Diving Safety Officer shall inform the diver in writing of the reason(s) for revocation. The diver will be given the opportunity to present their case in writing

for reconsideration and/or re-certification. All such written statements and requests, as identified in this section, are formal documents, which will become part of the diver's file.

### **5.80 Recertification**

If a diver's certificate expires or is revoked, they may be re-certified after complying with such conditions as the Diving Safety Officer or the DCB may impose. The diver shall be given an opportunity to present their case to the DCB before conditions for re-certification are stipulated.

### **5.90 Waiver of Requirements/Temporary Diver**

A temporary diver permit constitutes a waiver of the requirements of Section 5.0 and is issued only following a demonstration of the required proficiency in diving. It is valid only for a limited time, as determined by the Diving Safety Officer. This permit is not to be construed as a mechanism to circumvent existing standards set forth in this standard.

Requirements of Section 5.0 may be waived by the Diving Safety Officer if the person in question has demonstrated proficiency in diving and can contribute measurably to a planned dive. A statement of the temporary diver's qualifications shall be submitted to the Diving Safety Officer as a part of the dive plan. Temporary permits shall be restricted to the planned diving operation and shall comply with all other policies, regulations, and standards of this standard, including medical requirements.

## SECTION 6.00 MEDICAL STANDARDS

### 6.10 Medical Requirements

#### *General*

- The SML diving safety officer shall determine that divers have passed a current diving physical examination and have been declared by the examining physician to be fit to engage in diving activities as may be limited or restricted in the medical evaluation report.
- All medical evaluations required by this standard shall be performed by, or under the direction of, a licensed physician of the applicant-diver's choice, preferably one trained in diving/undersea medicine.
- The diver should be free of any chronic disabling disease and any conditions contained in the list of conditions for which restrictions from diving are generally recommended. (Appendix 1)

### 6.20 Frequency of Medical Evaluations

#### *Medical evaluation shall be completed:*

- Before a diver may begin diving, unless an equivalent initial medical evaluation has been given within the preceding 5 years (3 years if over the age of 40, 2 years if over the age of 60), the Shoals Marine Laboratory has obtained the results of that examination, and those results have been reviewed and found satisfactory by the member organization.
- Thereafter, at 5 year intervals up to age 40, every 3 years after the age of 40, and every 2 years after the age of 60.
- Clearance to return to diving must be obtained from a physician following any major injury or illness, or any condition requiring hospital care or chronic medication. If the injury or illness is pressure related, then the clearance to return to diving must come from a physician trained in diving medicine

### 6.30 Information Provided Examining Physician

The Shoals Marine Laboratory shall provide a copy of the medical evaluation requirements of this standard to the examining physician. (Appendices 1, 2, and 3).

### 6.40 Content of Medical Evaluations

Medical examinations conducted initially and at the intervals specified in Section 6.10 shall consist of the following:

1. Applicant agreement for release of medical information to the Diving Safety Officer and the DCB (Appendix 2).
2. Medical history (Appendix 3).
3. Diving physical examination (Required tests listed below and in Appendix 2).
4. Divers shall complete the medical history form (questionnaire) each year they are involved in the program. This information will be kept confidential.

### 6.50 Conditions Which May Disqualify Candidates From Diving (Adapted from Bove, 1998)

- a) Abnormalities of the tympanic membrane, such as perforation, presence of a monomeric membrane, or inability to auto inflate the middle ears.
- b) Hearing loss; Vertigo including Meniere's Disease.
- c) Stapedectomy or middle ear reconstructive surgery.
- d) Recent ocular surgery.

- e) Psychiatric disorders including claustrophobia, suicidal ideation, psychosis, anxiety states, depression.
- f) Substance abuse, including alcohol.
- g) Episodic loss of consciousness.
- h) History of seizure.
- i) History of stroke or a fixed neurological deficit.
- j) Recurring neurologic disorders, including transient ischemic attacks.
- k) History of intracranial aneurysm, other vascular malformation or intracranial hemorrhage.
- l) History of neurological decompression illness with residual deficit.
- m) Head injury.
- n) Hematologic disorders including coagulopathies.
- o) Risk factors or evidence of coronary artery disease.
- p) Atrial septal defects.
- q) Significant valvular heart disease - isolated mitral valve prolapse is not disqualifying.
- r) Significant cardiac rhythm or conduction abnormalities.
- s) Implanted cardiac pacemakers and cardiac defibrillators (ICD).
- t) Inadequate exercise tolerance.
- u) Hypertension.
- v) History of pneumothorax.
- w) Asthma.
- x) Chronic pulmonary disease, including radiographic evidence of pulmonary blebs, bullae or cysts.
- y) Diabetes mellitus.
- z) Pregnancy.

## **6.60 Laboratory Requirements for Diving Medical Evaluation and Intervals**

*Initial examination under age 40:*

1. Medical History
2. Complete Physical Exam, emphasis on neurological and otological components
3. Chest X-ray
4. Spirometry
5. Hematocrit or Hemoglobin
6. Urinalysis
7. Any further tests deemed necessary by the physician.

*Periodic re-examination under age 40 (every 5 years):*

1. Medical History
2. Complete Physical Exam, emphasis on neurological and otological components
3. Hematocrit or Hemoglobin
4. Urinalysis
5. Any further tests deemed necessary by the physician

*First exam over age 40:*

1. Medical History
2. Complete Physical Exam, emphasis on neurological and otological components
3. Assessment of coronary artery disease using Multiple-Risk-Factor Assessment (age, lipid profile, blood pressure, diabetic screening, smoker)
4. Resting EKG
1. Chest X-ray

2. Spirometry
3. Urinalysis
4. Hematocrit or Hemoglobin
5. Any further tests deemed necessary by the physician

\* Exercise stress testing may be indicated based on risk factor assessment.

*Periodic re-examination over age 40 (every 3 years); over age 60 (every 2 years):*

1. Medical History
2. Complete Physical Exam, emphasis on neurological and otological components
3. Detailed assessment of coronary artery disease risk factors using Multiple-Risk-Factor Assessment (age, family history, lipid profile, blood pressure, diabetic screening, smoking history). Further cardiac screening may be indicated based on risk factor assessment.
4. Resting EKG
5. Urinalysis
6. Any further tests deemed necessary by the physician

### **6.70 Physician's Written Report**

After any medical examination relating to the individual's fitness to dive, the Shoals Marine Laboratory shall obtain a written report prepared by the examining physician that shall contain the examining physician's opinion of the individual's fitness to dive, including any recommended restrictions or limitations. This report will be reviewed by the DCB.

The Shoals Marine Laboratory shall make a copy of the physician's written report available to the individual.

# Appendices

Appendix 1 through 15



## APPENDIX 1

### DIVING MEDICAL EXAM OVERVIEW FOR THE EXAMINING PHYSICIAN

*TO THE EXAMINING PHYSICIAN:*

This person, \_\_\_\_\_, requires a medical examination to assess his/her fitness for certification as a Scientific Diver for the Shoals Marine Laboratory. His /her answers on the Diving Medical History Form (attached), may indicate potential health or safety risks as noted. Your evaluation is requested on the attached scuba Diving Fitness Medical Evaluation Report. If you have questions about diving medicine, you may wish to consult one of the references on the attached list or consult a physician with expertise in diving medicine. Please contact me if you have any questions or concerns about diving medicine or the Shoals Marine Laboratory standards.

Thank you for your assistance.

Becca Toppin, Diving Safety Officer

Shoals Marine Laboratory

(508) 454-3571

Scuba and other modes of compressed-gas diving can be strenuous and hazardous. A special risk is present if the middle ear, sinuses, or lung segments do not readily equalize air pressure changes. The most common cause of distress is eustachian insufficiency. Most fatalities involve deficiencies in prudence, judgment, emotional stability, or physical fitness. Please consult the following list of conditions that usually restrict candidates from diving.

(Adapted from Bove, 1998: bracketed numbers are pages in Bove)

#### *CONDITIONS WHICH MAY DISQUALIFY CANDIDATES FROM DIVING*

1. Abnormalities of the tympanic membrane, such as perforation, presence of a monomeric membrane, or inability to autoinflate the middle ears. [5, 7, 8, 9]
2. Vertigo including Meniere's Disease. [13]
3. Stapedectomy or middle ear reconstructive surgery. [11]
4. Recent ocular surgery. [15, 18, 19]
5. Psychiatric disorders including claustrophobia, suicidal ideation, psychosis, anxiety states, untreated depression. [20 - 23]
6. Substance abuse, including alcohol. [24 - 25]
7. Episodic loss of consciousness. [1, 26, 27]
8. History of seizure. [27, 28]
9. History of stroke or a fixed neurological deficit. [29, 30]
10. Recurring neurologic disorders, including transient ischemic attacks. [29, 30]
11. History of intracranial aneurysm, other vascular malformation or intracranial hemorrhage. [31]
12. History of neurological decompression illness with residual deficit. [29, 30]
13. Head injury with sequelae. [26, 27]
14. Hematologic disorders including coagulopathies. [41, 42]
15. Evidence of coronary artery disease or high risk for coronary artery disease<sup>1</sup>. [33 - 35]
16. Atrial septal defects. [39]
17. Significant valvular heart disease - isolated mitral valve prolapse is not disqualifying. [38]
18. Significant cardiac rhythm or conduction abnormalities. [36 - 37]
19. Implanted cardiac pacemakers and cardiac defibrillators (ICD). [39, 40]
20. Inadequate exercise tolerance. [34]
21. Severe hypertension. [35]
22. History of spontaneous or traumatic pneumothorax. [45]

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<sup>1</sup> "Assessment of Cardiovascular Risk by Use of Multiple-Risk-Factor Assessment Equations." Grundy et. al. 1999. AHA/ACC Scientific Statement. <http://www.acc.org/clinical/consensus/risk/risk1999.pdf>

23. Asthma<sup>2</sup>. [42 - 44]
24. Chronic pulmonary disease, including radiographic evidence of pulmonary blebs, bullae, or cysts. [45,46]
25. Diabetes mellitus. [46 - 47]
26. Pregnancy. [56]

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*SELECTED REFERENCES IN DIVING MEDICINE*

Most of these are available from Best Publishing Company, P.O. Box 30100, Flagstaff, AZ 86003-0100, the Divers Alert Network (DAN) or the Undersea and Hyperbaric Medical Association (UHMS), Bethesda, MD.

- ACC/AHA Guidelines for Exercise Testing. A report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Committee on Exercise Testing). Gibbons RJ, et al. 1997. Journal of the American College of Cardiology. 30:260-311.  
<http://www.acc.org/clinical/guidelines/exercise/exercise.pdf>
- Alert Diver Magazine; Articles on diving medicine  
<http://www.diversalertnetwork.org/medical/articles/index.asp>
- “Are Asthmatics Fit to Dive?” Elliott DH, ed. 1996 Undersea and Hyperbaric Medical Society, Kensington, MD.
- “Assessment of Cardiovascular Risk by Use of Multiple-Risk-Factor Assessment Equations.” Grundy et. al. 1999. AHA/ACC Scientific Statement. <http://www.acc.org/clinical/consensus/risk/risk1999.pdf>
- DIVING MEDICINE, Third Edition, 1997. A. Bove and J. Davis. W.B. Saunders Company, Philadelphia
- DIVING AND SUBAQUATIC MEDICINE, Third Edition, 1994. C. Edmonds, C. Lowery and J. Pennefather. Butterworth-Heinemann Ltd. Oxford
- MEDICAL EXAMINATION OF SPORT SCUBA DIVERS, 1998. Alfred Bove, M.D., Ph.D. (ed.). Medical Seminars, Inc. San Antonio, TX
- NOAA DIVING MANUAL, NOAA. Superintendent of Documents, U.S. Government Printing Office, Washington, D.C.
- U.S. NAVY DIVING MANUAL. Superintendent of Documents, U.S. Government Printing Office, Washington, D.C.

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<sup>2</sup> “Are Asthmatics Fit to Dive?” Elliott DH, ed. 1996 Undersea and Hyperbaric Medical Society, Kensington, MD.

**APPENDIX 2**  
**AAUS MEDICAL EVALUATION OF FITNESS FOR SCUBA DIVING REPORT**

\_\_\_\_\_  
Name of Applicant (Print or Type)

\_\_\_\_\_  
Date (Mo/Day/Year)

To The PHYSICIAN:

This person is an applicant for training or is presently certified to engage in diving with self-contained underwater breathing apparatus (scuba). This is an activity that puts unusual stress on the individual in several ways. Your opinion on the applicant's medical fitness is requested. Scuba diving requires heavy exertion. The diver must be free of cardiovascular and respiratory disease. An absolute requirement is the ability of the lungs, middle ear and sinuses to equalize pressure. Any condition that risks the loss of consciousness should disqualify the applicant.

**TESTS:** Please initial that the following tests were completed.

**[ ] Initial Examination**

- \_\_\_\_\_ Medical History
- \_\_\_\_\_ Complete Physical Exam with emphasis on
- \_\_\_\_\_ Chest X-Ray
- \_\_\_\_\_ Spirometry
- \_\_\_\_\_ Hematocrit or Hemoglobin
- \_\_\_\_\_ Urinalysis
- \_\_\_\_\_ Any further tests deemed necessary by the

**[ ] Re-examination**

- \_\_\_\_\_ Medical History
- \_\_\_\_\_ Complete Physical Exam, with emphasis on
- \_\_\_\_\_ Hematocrit or Hemoglobin
- \_\_\_\_\_ Urinalysis
- \_\_\_\_\_ Any further tests deemed necessary by the

**Additional testing for first over age 40**

- \_\_\_\_\_ Resting EKG
- \_\_\_\_\_ Assessment of coronary artery disease using  
(age, lipid profile, blood pressure, diabetic screening,

**Additional testing for over age 40**

- \_\_\_\_\_ Resting EKG
- \_\_\_\_\_ Assessment of coronary artery disease using  
(age, lipid profile, blood pressure, diabetic screening,

**RECOMMENDATION:**

[ ] APPROVAL. I find no medical condition(s) that I consider incompatible with diving.

[ ] REJECT. This applicant has medical condition(s), which, in my opinion, clearly would constitute unacceptable hazards to health and safety in diving

**REMARKS:**

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

<sup>3</sup> "Assessment of Cardiovascular Risk by Use of Multiple-Risk-Factor Assessment Equations." Grundy et. al. 1999. AHA/ACC Scientific Statement. <http://www.acc.org/clinical/consensus/risk/risk1999.pdf>

<sup>6</sup> Gibbons RJ, et al. ACC/AHA Guidelines for Exercise Testing. A report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Committee on Exercise Testing). Journal of the American College of Cardiology. 30:260-311, 1997. <http://www.acc.org/clinical/guidelines/exercise/exercise.pdf>

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**PHYSICIAN'S STATEMENT:**

I have evaluated the above-mentioned individual according to the American Academy of Underwater Sciences medical standards for scientific diving (Section 6.00), and find no conditions that may be disqualifying. I have discussed with the patient any medical condition(s) that would not disqualify him/her from diving but which may seriously compromise subsequent health. The patient understands the nature of the hazards and the risks involved in diving with these conditions.

\_\_\_\_\_ M.D./D.O.  
Date Signature

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Name (Print or Type)

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Address

---

Telephone Number

My familiarity with applicant is:

- \_\_\_\_ With this exam only
- \_\_\_\_ Regular Physician for \_\_\_\_ years
- \_\_\_\_ Other (describe) \_\_\_\_\_

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My familiarity with diving medicine is:

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***APPLICANT'S RELEASE OF MEDICAL INFORMATION FORM***

I authorize the release of this information and all medical information subsequently acquired in association with my diving to the Shoals Marine Laboratory's Diving Safety Officer and Diving Control Board or their designee at (place) \_\_\_\_\_ on (date) \_\_\_\_\_.

Signature of Applicant \_\_\_\_\_

### APPENDIX 3 DIVING MEDICAL HISTORY FORM

(To Be Completed By Applicant-Diver)

Name \_\_\_\_\_ Sex \_\_\_\_ Age \_\_\_\_ Wt. \_\_\_\_ Ht. \_\_\_\_

Reason for Diving \_\_\_\_\_ Date \_\_\_\_/\_\_\_\_/\_\_\_\_  
(SML Course, Internship Program, Staff, or Visiting Researcher) (Mo/Day/Yr)

**TO THE APPLICANT:**

Scuba diving places considerable physical and mental demands on the diver. Certain medical and physical requirements must be met before beginning a diving or training program. Your accurate answers to the questions are more important, in many instances, in determining your fitness to dive than what the physician may see, hear or feel as part of the diving medical certification procedure.

This form shall be kept confidential by the examining physician. If you believe any question amounts to invasion of your privacy, you may elect to omit an answer, provided that you shall subsequently discuss that matter with your own physician who must then indicate, in writing, that you have done so and that no health hazard exists.

Should your answers indicate a condition, which might make diving hazardous, you will be asked to review the matter with your physician. In such instances, their written authorization will be required in order for further consideration to be given to your application. If your physician concludes that diving would involve undue risk for you, remember that they are concerned only with your well-being and safety.

	Yes	No	Please indicate whether or not the following apply to you	Comments
1			Convulsions, seizures, or epilepsy	
2			Fainting spells or dizziness	
3			Been addicted to drugs	
4			Diabetes	
5			Motion sickness or sea/air sickness	
6			Claustrophobia	
7			Mental disorder or nervous breakdown	
8			Are you pregnant?	
9			Do you suffer from menstrual problems?	
10			Anxiety spells or hyperventilation	
11			Frequent sour stomachs, nervous stomachs or vomiting spells	
12			Had a major operation	
13			Presently being treated by a physician	
14			Taking any medication regularly (even non-prescription)	
15			Been rejected or restricted from sports	
16			Headaches (frequent and severe)	
17			Wear dental plates	
18			Wear glasses or contact lenses	
19			Bleeding disorders	
20			Alcoholism	
21			Any problems related to diving	
22			Nervous tension or emotional problems	

	Yes	No	Please indicate whether or not the following apply to you	Comments
23			Take tranquilizers	
24			Perforated ear drums	
25			Hay fever	
26			Frequent sinus trouble, frequent drainage from the nose, post-nasal drip, or stuffy nose	
27			Frequent earaches	
28			Drainage from the ears	
29			Difficulty with your ears in airplanes or on mountains	
30			Ear surgery	
31			Ringing in your ears	
32			Frequent dizzy spells	
33			Hearing problems	
34			Trouble equalizing pressure in your ears	
35			Asthma	
36			Wheezing attacks	
37			Cough (chronic or recurrent)	
38			Frequently raise sputum	
39			Pleurisy	
40			Collapsed lung (pneumothorax)	
41			Lung cysts	
42			Pneumonia	
43			Tuberculosis	
44			Shortness of breath	
45			Lung problem or abnormality	
46			Spit blood	
47			Breathing difficulty after eating particular foods, after exposure to particular pollens or animals	
48			Are you subject to bronchitis	
49			Subcutaneous emphysema (air under the skin)	
50			Air embolism after diving	
51			Decompression sickness	
52			Rheumatic fever	
53			Scarlet fever	
54			Heart murmur	
55			Large heart	
56			High blood pressure	
57			Angina (heart pains or pressure in the chest)	
58			Heart attack	

	Yes	No	Please indicate whether or not the following apply to you	Comments
59			Low blood pressure	
60			Recurrent or persistent swelling of the legs	
61			Pounding, rapid heartbeat or palpitations	
62			Easily fatigued or short of breath	
63			Abnormal EKG	
64			Joint problems, dislocations or arthritis	
65			Back trouble or back injuries	
66			Ruptured or slipped disk	
67			Limiting physical handicaps	
68			Muscle cramps	
69			Varicose veins	
70			Amputations	
71			Head injury causing unconsciousness	
72			Paralysis	
73			Have you ever had an adverse reaction to medication?	
74			Do you smoke?	
75			Have you ever had any other medical problems not listed? If so, please list or describe below;	
76			Is there a family history of high cholesterol?	
77			Is there a family history of heart disease or stroke?	
78			Is there a family history of diabetes?	
79			Is there a family history of asthma?	
80			Date of last tetanus shot? Vaccination dates?	

Please explain any "yes" answers to the above questions.

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I certify that the above answers and information represent an accurate and complete description of my medical history.

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Signature

Date

**APPENDIX 4**  
**RECOMMENDED PHYSICIANS WITH EXPERTISE IN DIVING MEDICINE**

List of local DAN-recommended Medical Doctors that have training and expertise in diving or undersea medicine:

1. Mark Lombardo  
603-224-6691  
Concord Hospital  
Concord, NH
  
2. George Vraney / Richard Kahn  
207-784-5489  
Central Maine Pulmonary  
Auburn, ME
  
3. Nicholas Vandemoer  
508-775-7026  
Hyannis ENT, Cape Cod Medical and Surgical Center  
Hyannis, MA
  
4. Stephen Cummings  
401-736-4646  
Kent Hospital  
Warwick, RI



## APPENDIX 5 DEFINITION OF TERMS

*Air sharing* - Sharing of an air supply between divers.

*ATA(s)* - “Atmospheres Absolute”, Total pressure exerted on an object, by a gas or mixture of gases, at a specific depth or elevation, including normal atmospheric pressure.

*Breath-hold Diving* - A diving mode in which the diver uses no self-contained or surface-supplied air or oxygen supply.

*Buddy Breathing* - Sharing of a single air source between divers.

*Buddy Diver* - Second member of the dive team.

*Buddy System* - Two comparably equipped scuba divers in the water in constant communication.

*Buoyant Ascent* - An ascent made using some form of positive buoyancy.

*Burst Pressure* - Pressure at which a pressure containment device would fail structurally.

*Certified Diver* - A diver who holds a recognized valid certification from an organizational member or internationally recognized certifying agency.

*Controlled Ascent* - Any one of several kinds of ascents including normal, swimming, and air sharing ascents where the diver(s) maintain control so a pause or stop can be made during the ascent.

*Cylinder* - A pressure vessel for the storage of gases.

*Decompression Chamber* - A pressure vessel for human occupancy. Also called a hyperbaric chamber or decompression chamber.

*Decompression Sickness* - A condition with a variety of symptoms, which may result from gas, and bubbles in the tissues of divers after pressure reduction.

*Dive* - A descent into the water, an underwater diving activity utilizing compressed gas, an ascent, and return to the surface.

*Dive Computer* - A microprocessor based device which computes a diver’s theoretical decompression status, in real time, by using pressure (depth) and time as input to a decompression model, or set of decompression tables, programmed into the device.

*Dive Location* - A surface or vessel from which a diving operation is conducted.

*Dive Site* - Physical location of a diver during a dive.

*Dive Table* - A profile or set of profiles of depth-time relationships for ascent rates and breathing mixtures to be followed after a specific depth-time exposure or exposures.

*Diver* - An individual in the water who uses apparatus, including snorkel, which supplies breathing gas at ambient pressure.

*Diver-In-Training* - An individual gaining experience and training in additional diving activities under the supervision of a dive team member experienced in those activities.

*Diver-Carried Reserve Breathing Gas* - A diver-carried independent supply of air or mixed gas (as appropriate) sufficient under standard operating conditions to allow the diver to reach the surface, or another source of breathing gas, or to be reached by another diver.

*Diving Mode* - A type of diving required specific equipment, procedures, and techniques, for example, snorkel, scuba, surface-supplied air, or mixed gas.

*Diving Control Board (DCB)* - Group of individuals who act as the official representative of the membership organization in matters concerning the scientific diving program (Section 1.24).

*Diving Safety Officer (DSO)* - Individual responsible for the safe conduct of the scientific diving program of the membership organization (Section 1.20).

*EAD* - Equivalent Air Depth (see below).

*Emergency Ascent* - An ascent made under emergency conditions where the diver exceeds the normal ascent rate.

*Enriched Air (EANx)* - A name for a breathing mixture of air and oxygen when the percent of oxygen exceeds 21%. This term is considered synonymous with the term “nitrox” (Section 7.00).

*Equivalent Air Depth (EAD)* - Depth at which air will have the same nitrogen partial pressure as the nitrox mixture being used. This number, expressed in units of feet seawater or saltwater, will always be less than the actual depth for any enriched air mixture.

$fN_2$  - Fraction of nitrogen in a gas mixture, expressed as either a decimal or percentage, by volume.

$fO_2$  - Fraction of oxygen in a gas mixture, expressed as either a decimal or percentage, by volume.

*FFW* – Feet of freshwater, or equivalent static head.

*FSW* - Feet of seawater, or equivalent static head.

*Hookah* - While similar to Surface Supplied in that the breathing gas is supplied from the surface by means of a pressurized hose, the supply hose does not require a strength member, pneumofathometer hose, or communication line. Hookah equipment may be as simple as a long hose attached to a standard scuba cylinder supplying a standard scuba second stage. The diver is responsible for the monitoring his/her own depth, time, and diving profile.

*Hyperbaric Chamber* - See decompression chamber.

*Hyperbaric Conditions* - Pressure conditions in excess of normal atmospheric pressure at the dive location.

*Lead Diver* - Certified scientific diver with experience and training to conduct the diving operation.

*Maximum Working Pressure* - Maximum pressure to which a pressure vessel may be exposed under standard operating conditions.

*Organizational Member* - An organization which is a current member of the AAUS, and which has a program, which adheres to the standards of the AAUS as, set forth in the AAUS Standards for Scientific Diving Certification and Operation of Scientific Diving Programs.

*Mixed Gas* - MG

*Mixed-Gas Diving* - A diving mode in which the diver is supplied in the water with a breathing gas other than air.

*MOD* - Maximum Operating Depth, usually determined as the depth at which the  $pO_2$  for a given gas mixture reaches a predetermined maximum.

*MSW* - Meters of seawater or equivalent static head.

*Nitrox* - Any gas mixture comprised predominately of nitrogen and oxygen, most frequently containing between 21% and 40% oxygen. Also be referred to as Enriched Air Nitrox, abbreviated EAN.

*NOAA Diving Manual* - Refers to the *NOAA Diving Manual, Diving for Science and Technology*, 2001 edition. National Oceanic and Atmospheric Administration, Office of Undersea Research, US Department of Commerce.

*No-Decompression limits* - Depth-time limits of the “no-decompression limits and repetitive dive group designations table for no-decompression air dives” of the U.S. Navy Diving Manual or equivalent limits.

*Normal Ascent* - An ascent made with an adequate air supply at a rate of 60 feet per minute or less.

*Oxygen Clean* - All combustible contaminants have been removed.

*Oxygen Compatible* - A gas delivery system that has components (o-rings, valve seats, diaphragms, etc.) that are compatible with oxygen at a stated pressure and temperature.

*Oxygen Service* - A gas delivery system that is both oxygen clean and oxygen compatible.

*Oxygen Toxicity Unit* - OTU

*Oxygen Toxicity* - Any adverse reaction of the central nervous system (“acute” or “CNS” oxygen toxicity) or lungs (“chronic”, “whole-body”, or “pulmonary” oxygen toxicity) brought on by exposure to an increased (above atmospheric levels) partial pressure of oxygen.

*Pressure-Related Injury* - An injury resulting from pressure disequilibrium within the body as the result of hyperbaric exposure. Examples include: decompression sickness, pneumothorax, mediastinal emphysema, air embolism, subcutaneous emphysema, or ruptured eardrum.

*Pressure Vessel* - See cylinder.

$pN_2$  - Inspired partial pressure of nitrogen, usually expressed in units of atmospheres absolute.

*pO<sub>2</sub>* - Inspired partial pressure of oxygen, usually expressed in units of atmospheres absolute.

*Psi* - Unit of pressure, “pounds per square inch.

*Psig* - Unit of pressure, “pounds per square inch gauge.

*Recompression Chamber* - see decompression chamber.

*Scientific Diving* - Scientific diving is defined (29CFR1910.402) as diving performed solely as a necessary part of a scientific, research, or educational activity by employees whose sole purpose for diving is to perform scientific research tasks.

*Scuba Diving* - A diving mode independent of surface supply in which the diver uses open circuit self-contained underwater breathing apparatus.

*Standby Diver* - A diver at the dive location capable of rendering assistance to a diver in the water.

*Surface Supplied Diving* - Surface Supplied: Dives where the breathing gas is supplied from the surface by means of a pressurized umbilical hose. The umbilical generally consists of a gas supply hose, strength member, pneumofathometer hose, and communication line. The umbilical supplies a helmet or full-face mask. The diver may rely on the tender at the surface to keep up with the divers’ depth, time and diving profile.

*Swimming Ascent* - An ascent, which can be done under normal or emergency conditions accomplished by simply swimming to the surface.

*Umbilical* - Composite hose bundle between a dive location and a diver or bell, or between a diver and a bell, which supplies a diver or bell with breathing gas, communications, power, or heat, as appropriate to the diving mode or conditions, and includes a safety line between the diver and the dive location.

*Working Pressure* - Normal pressure at which the system is designed to operate.

**APPENDIX 6**  
**AAUS REQUEST FOR DIVING RECIPROCIY FORM VERIFICATION OF DIVER TRAINING AND EXPERIENCE**

Diver: \_\_\_\_\_

Date: \_\_\_\_\_

This letter serves to verify that the above listed person has met the training and pre-requisites as indicated below, and has completed all requirements necessary to be certified as a (*Scientific Diver / Diver in Training*) as established by the (*Shoals Marine Laboratory*) Diving Safety Manual, and has demonstrated competency in the indicated areas. Shoals Marine Laboratory is an AAUS OM and meets or exceeds all AAUS training requirements.

**The following is a brief summary of this diver's personnel file regarding dive status at**

\_\_\_\_\_  
 (Date)

\_\_\_\_\_ Original diving authorization  
 \_\_\_\_\_ Written scientific diving examination  
 \_\_\_\_\_ Last diving medical examination      Medical examination expiration date \_\_\_\_\_  
 \_\_\_\_\_ Most recent checkout dive  
 \_\_\_\_\_ Scuba regulator/equipment service/test  
 \_\_\_\_\_ CPR training (Agency) \_\_\_\_\_      CPR Exp. \_\_\_\_\_  
 \_\_\_\_\_ Oxygen administration (Agency) \_\_\_\_\_      O2 Exp. \_\_\_\_\_  
 \_\_\_\_\_ First aid for diving \_\_\_\_\_      F.A. Exp. \_\_\_\_\_  
 \_\_\_\_\_ Date of last dive \_\_\_\_\_ Depth \_\_\_\_\_  
 Number of dives completed within previous 12 months? \_\_\_\_\_      Depth Certification \_\_\_\_\_ fsw  
 Total number of career dives? \_\_\_\_\_

Any restrictions? (Y/N) \_\_\_\_\_ if yes, explain:

Please indicate any pertinent specialty certifications or training:

Emergency Information:

Name: \_\_\_\_\_ Relationship: \_\_\_\_\_  
 Telephone: \_\_\_\_\_ (work) \_\_\_\_\_ (home)  
 Address: \_\_\_\_\_

This is to verify that the above individual is currently a certified scientific diver at \_\_\_\_\_

Diving Safety Officer:

\_\_\_\_\_  
 (Signature) \_\_\_\_\_ (Date)  
 Rebecca Toppin, Shoals Marine Laboratory Dive Safety Officer      508-454-3571, becca.toppin@unh.edu

## APPENDIX 7 DIVING EMERGENCY MANAGEMENT PROCEDURES

### Introduction

A diving accident victim could be any person who has been breathing air underwater regardless of depth. It is essential that emergency procedures are pre-planned and that medical treatment is initiated as soon as possible. It is the responsibility of each AAUS organizational member to develop procedures for diving emergencies including evacuation and medical treatment for each dive location.

### General Procedures

Depending on and according to the nature of the diving accident:

1. Make appropriate contact with victim or rescue as required.
2. Establish (A)irway, (B)reathing, (C)irculation as required.
3. Stabilize the victim
3. Administer 100% oxygen, if appropriate (in cases of Decompression Illness, or Near Drowning).
4. Call local Emergency Medical System (EMS) for transport to nearest medical treatment facility. Explain the circumstances of the dive incident to the evacuation teams, medics and physicians.  
Do not assume that they understand why 100% oxygen may be required for the diving accident victim or that recompression treatment may be necessary.
5. Call appropriate Diving Accident Coordinator for contact with diving physician and decompression chamber. etc.
6. Notify DSO or designee according to the Emergency Action Plan of the organizational member.
7. Complete and submit Incident Report Form ([www.aaus.org](http://www.aaus.org)) to the DCB of the organization and the AAUS (Section 2.70 Required Incident Reporting).

### List of Emergency Contact Numbers Appropriate For Dive Location

List of Emergency Contact Numbers Appropriate for Shoals Marine Lab

US Coast Guard- Portsmouth	603-436-4414 marine radio, channel 16
Divers Alert Network (DAN) Contact DAN for diving specific medical advice and nearest viable chamber, if needed	919-684-8111
Portsmouth Regional Hospital (nearest hospital)	603-436-5110
Becca Toppin (Diving Safety Officer)	508-454-3571

## **APPENDIX 8**

### **DIVE COMPUTER GUIDELINES**

1. Only those makes and models of dive computers specifically approved by the Diving Control Board may be used.
2. Any diver desiring the approval to use a dive computer as a means of determining decompression status must apply to the Diving Control Board, complete an appropriate practical training session and pass a written examination.
3. Each diver relying on a dive computer to plan dives and indicate or determine decompression status must have his/her own unit.
4. On any given dive, both divers in the buddy pair must follow the most conservative dive computer.
5. If the dive computer fails at any time during the dive, the dive must be terminated and appropriate surfacing procedures should be initiated immediately.
6. A diver should not dive for 18 hours before activating a dive computer to use it to control their diving.
7. Once the dive computer is in use, it must not be switched off until it indicates complete out gassing has occurred or 18 hours have elapsed, whichever comes-first.
8. When using a dive computer, non-emergency ascents are to be at a rate specified for the make and model of dive computer being used.
10. Whenever practical, divers using a dive computer should make a stop between 10 and 30 feet for 5 minutes, especially for dives below 60 fsw.
11. Multiple deep dives require special consideration.

## APPENDIX 9 AAUS STATISTICS COLLECTION CRITERIA AND DEFINITIONS

### COLLECTION CRITERIA:

The "Dive Time in Minutes", "The Number of Dives Logged", and the "Number of Divers Logging Dives" will be collected for the following categories.

- Dive Classification
- Breathing Gas
- Diving Mode
- Decompression Planning and Calculation Method
- Depth Ranges
- Specialized Environments
- Incident Types

Dive Time in Minutes is defined as the surface to surface time including any safety or required decompression stops.

A Dive is defined as a descent into water, an underwater diving activity utilizing compressed gas, an ascent/return to the surface, and a surface interval of greater than 10 minutes.

Dives will not be differentiated as openwater or confined water dives. But openwater and confined water dives will be logged and submitted for AAUS statistics classified as either scientific or training/proficiency.

A "Diver Logging a Dive" is defined as a person who is diving under the auspices of your scientific diving organization. Dives logged by divers from another AAUS Organization will be reported with the divers home organization. Only a diver who has actually logged a dive during the reporting period is counted under this category.

Incident(s) occurring during the collection cycle. Only incidents occurring during, or resulting from, a dive where the diver is breathing a compressed gas will be submitted to AAUS.

### DEFINITIONS:

#### Dive Classification:

- Scientific Dives: Dives that meet the scientific diving exemption as defined in 29 CFR 1910.402. Diving tasks traditionally associated with a specific scientific discipline are considered a scientific dive. Construction and trouble-shooting tasks traditionally associated with commercial diving are not considered a scientific dive.
- Training and Proficiency Dives: Dives performed as part of a scientific diver training program, or dives performed in maintenance of a scientific diving certification/authorization.

#### Breathing Gas:

- Air: Dives where the bottom gas used for the dive is air.
- Nitrox: Dives where the bottom gas used for the dive is a combination of nitrogen and oxygen other than air.
- Mixed Gas: Dives where the bottom gas used for the dive is a combination of oxygen, nitrogen, and helium (or other "exotic" gas), or any other breathing gas combination not classified as air or nitrox.

### Diving Mode:

- Open Circuit Scuba: Dives where the breathing gas is inhaled from a self contained underwater breathing apparatus and all of the exhaled gas leaves the breathing loop.
- Surface Supplied: Dives where the breathing gas is supplied from the surface by means of a pressurized umbilical hose. The umbilical generally consists of a gas supply hose, strength member, pneumofathometer hose, and communication line. The umbilical supplies a helmet or full-face mask. The diver may rely on the tender at the surface to keep up with the divers' depth, time and diving profile.
- Hookah: While similar to Surface Supplied in that the breathing gas is supplied from the surface by means of a pressurized hose, the supply hose does not require a strength member, pneumofathometer hose, or communication line. Hookah equipment may be as simple as a long hose attached to a standard scuba cylinder supplying a standard scuba second stage. The diver is responsible for the monitoring his/her own depth, time, and diving profile.
- Rebreathers: Dives where the breathing gas is repeatedly recycled in the breathing loop. The breathing loop may be fully closed or semi-closed. Note: A rebreather dive ending in an open circuit bailout is still logged as a rebreather dive.

### Decompression Planning and Calculation Method:

- Dive Tables
- Dive Computer
- PC Based Decompression Software

### Depth Ranges:

Depth ranges for sorting logged dives are 0-30, 31-60, 61-100, 101-130, 131-150, 151-190, and 191->. Depths are in feet seawater. A dive is logged to the maximum depth reached during the dive. Note: Only "The Number of Dives Logged" and "The Number of Divers Logging Dives" will be collected for this category.

### Specialized Environments:

- Required Decompression: Any dive where the diver exceeds the no-decompression limit of the decompression planning method being employed.
- Overhead Environments: Any dive where the diver does not have direct access to the surface due to a physical obstruction.
- Blue Water Diving: Openwater diving where the bottom is generally greater than 200 feet deep and requiring the use of multiple-tethered diving techniques.
- Ice and Polar Diving: Any dive conducted under ice or in polar conditions. Note: An Ice Dive would also be classified as an Overhead Environment dive.
- Saturation Diving: Excursion dives conducted as part of a saturation mission are to be logged by "classification", "mode", "gas", etc. The "surface" for these excursions is defined as leaving and surfacing within the Habitat. Time spent within the Habitat or chamber shall not be logged by AAUS.
- Aquarium: An aquarium is a shallow, confined body of water, which is operated by or under the control of an institution and is used for the purposes of specimen exhibit, education, husbandry, or research. (Not a swimming pool)



### Incident Types:

- Hyperbaric: Decompression Sickness, AGE, or other barotrauma requiring recompression therapy.
- Barotrauma: Barotrauma requiring medical attention from a physician or medical facility, but not requiring recompression therapy.
- Injury: Any non-barotrauma injury occurring during a dive that requires medical attention from a physician or medical facility.
- Illness: Any illness requiring medical attention that can be attributed to diving.
- Near Drowning/ Hypoxia: An incident where a person asphyxiates to the minimum point of unconsciousness during a dive involving a compressed gas. But the person recovers.
- Hyperoxic/Oxygen Toxicity: An incident that can be attributed to the diver being exposed to too high a partial pressure of oxygen.
- Hypercapnea: An incident that can be attributed to the diver being exposed to an excess of carbon dioxide.
- Fatality: Any death accruing during a dive or resulting from the diving exposure.
- Other: An incident that does not fit one of the listed incident types

### Incident Classification Rating Scale:

- Minor: Injuries that the OM considers being minor in nature. Examples of this classification of incident would include, but not be limited to:
  - Mask squeeze that produced discoloration of the eyes.
  - Lacerations requiring medical attention but not involving moderate or severe bleeding.
  - Other injuries that would not be expected to produce long term adverse effects on the diver's health or diving status.
  - ear infections, minor ear squeezes, and seasickness
- Moderate: Injuries that the OM considers being moderate in nature. Examples of this classification would include, but not be limited to:
  - DCS symptoms that resolved with the administration of oxygen, hyperbaric treatment given as a precaution.
  - DCS symptoms resolved with the first hyperbaric treatment.
  - Broken bones.
  - Torn ligaments or cartilage.
  - Concussion.
  - Ear barotrauma requiring surgical repair.
- Serious: Injuries that the Shoals Marine Laboratory considers being serious in nature. Examples of this classification would include, but not be limited to:
  - Arterial Gas Embolism.
  - DCS symptoms requiring multiple hyperbaric treatment.
  - Near drowning.
  - Oxygen Toxicity
  - Hypercapnea.
  - Spinal injuries.
  - Heart attack.
  - Fatality.

## APPENDIX 10 SHOALS MARINE LABORATORY MEDICAL RESPONSE PLAN

### Diving Accident (DCS, AE)

- Alert All Island (call office and/or all on job-coms):
  - Dispatch *Designated Cell Phone*, O<sub>2</sub> bottles, and AED to Dive site
  - Call Becca (508-454-357) and Mike (603-897-5893)
- Call DAN with *Designated Cell Phone*: 919-684-9111
  - DAN consultation of patient's condition/treatment
- Call Coast Guard with *Designated Cell Phone*: 603-436-4414
  - Fine-tune evacuation (include personal documents, medical forms from island)
- Lead Diver locks patient's tank and regulator in the Appledore Store for post-dive investigation

### Non-diving Accident

- First responder alerts All Island (call office and/or all on job-coms)
  - Dispatch *Designated Cell Phone* and Senior Medical personal (Val, Mike)
- First responder provides appropriate first aid until staff arrives
- First responder remains in contact with staff until staff arrive
- Staff evaluation; if necessary:
  - Call Star Island medical personnel: 603-817-6716
  - Call Coast Guard: 603-436-4414
  - If necessary, evacuation via SML vessel or Coast Guard (include personal documents, medical forms from island)

### Missing Person

- Diver/snorkeler
  - Alert All Island
    - Dispatch *Designated Cell Phone* to Dive Float/site
    - If off vessel, initiate man-overboard procedures
  - Call Coast Guard
  - Patrol shoreline with inflatables
  - Patrol shoreline on foot
- Non-diver
  - Alert All Island
  - Identify last known sighting
  - Hail and search all buildings
  - Hail and search all trails
  - Walk shoreline
  - Patrol shoreline with inflatables

**APPENDIX 11  
SML DIVING OPERATIONS PLAN**

*To be filled out by the Lead Diver*

**Dive Operation Date** \_\_\_\_\_ **Estimated Start Time** \_\_\_\_\_ **Number of Divers** \_\_\_\_\_

**Dive Location** \_\_\_\_\_

**Purpose of Dive** \_\_\_\_\_

**No. of Dives Planned** \_\_\_\_\_ **No. of Tanks Needed** \_\_\_\_\_ **Dive Boat** \_\_\_\_\_

**Depth(s) and bottom time(s) anticipated** \_\_\_\_\_

**Decompression status of divers at start of operation** \_\_\_\_\_ (attach repetitive dive plan, if required by decompression status of any diver)

**List any hazardous conditions anticipated:**

**Will any special equipment be used? If yes, describe:**

**Name of Boat/Radio Operator:** \_\_\_\_\_

(boat/radio operator required for course dives or dives outside of the “Lee Area”)

**Diver Information:** in the table below, list the names of all divers, certification type (DIT= Diver in Training; SD= Scientific Diver), and current certification depth. Attach additional list if necessary.

Diver's Name (list lead diver first)	Cert. Type		Cert. Depth		
	DIT	SD	30'	60'	100'

Lead Diver Signature \_\_\_\_\_ Date: \_\_\_\_\_

**Approval by Dive Coordinator**

Dive Coordinator Signature \_\_\_\_\_ Date: \_\_\_\_\_

**APPENDIX 12  
DIVER APPLICATION FORM  
SHOALS MARINE LABORATORY**

**NAME:** \_\_\_\_\_  
(Please type or print)

**SML COURSES OR RESEARCH PROGRAMS IN WHICH YOU ARE PARTICIPATING:**

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**PLEASE READ:**

All students, staff, volunteers, faculty and visiting investigators planning to SCUBA dive at the Shoals Marine Laboratory are required to complete this form. In addition, **at least one month prior to your arrival on Appledore**, SML must receive:

(1) *SML Diving Medical Evaluation* and *Medical History* forms from a medical evaluation completed within the 12 months prior to your arrival at SML.

(2) Signed and witnessed *Release/Indemnification of all Claims and Covenant Not to Sue* form.

(3) Documentation that your diving equipment has been maintained and tested as required by the *Diver Equipment* form.

All divers must supply their own scuba equipment (see *Diver Equipment* form).

All divers must complete and pass an open-water Check-Out dive with the SML Diving Safety Officer or designee. [If you have been a SML diver, what was the date (mth, yr) of your check-out dive?  
\_\_\_\_\_ ]

**PLEASE COMPLETE:**

(1) **DIVER TRAINING:** Level of certification, name of certifying organization, date and location. List this information in this space AND attach a photocopy of your dive certificate or card.

(2) **EXPERIENCE:** Please give a summary of your diving experience during the past twelve months. Include location, depth and purpose of dive. (If you are currently a certified scientific diver with any

agency such as AAUS, NOAA, WHOI, or UNH, do not complete this or the following section. Instead, document certification and experience by submitting the appropriate reciprocity forms.)

(3) **ADDITIONAL TRAINING and INFORMATION NEEDED FROM DIVER:** Have you taken any CPR, first aid, emergency oxygen, or life-saving courses? If yes, list names and dates AND provide a photocopy of your CERTIFICATION CARD(s). If you have a DIVE COMPUTER that you will be using, please indicate make and model below (see SML manual, appendix 8). Please also provide the make and model of your REGULATOR.

(4) **INSURANCE:** To participate in the SML diving program, you must have health insurance that provides diving-accident coverage. Check your personal health and accident insurance to see if you have coverage for diving accidents, pay specific attention to any "exception clauses". D.A.N. (Diver Alert Network) provides affordable and easily obtained insurance for dive accidents and medical emergencies. For more information, call 1 800 446-2671.

**NOTE:** Shoals Marine Laboratory employees engaged in working dives, instruction and/or supervision of student divers are additionally covered by Worker's Compensation Insurance. Check with the SML Cornell Office if you are unsure of your status.

\_\_\_\_\_ I have coverage in case of a diving accident.

Company: \_\_\_\_\_

Policy No. \_\_\_\_\_

\_\_\_\_\_ I do not have coverage at this time but will provide the company name and policy number(s) to the Cornell Office (607) 255-3717, to complete my requirements before arriving on Appledore. I understand that I will not be able to dive until this information is provided.

(5) **MEDICAL:** You and your physician must complete the SML Diving Medical Forms. Your physical must be current (within twelve months before your arrival at the Lab). These forms must be submitted to the Cornell Office at least 1 month before your arrival on island. ***Please make a copy of the completed forms for yourself and bring them with you to Appledore.*** Return the completed original forms to: **Rebecca Toppin, SML Diving Safety Officer, 21 Michela Way, Nottingham, NH 03290.**

(6) **DIVER RESPONSIBILITIES AND CERTIFICATIONS:** *Please initial each item to verify you have read and understood it.*

I understand that the basic responsibility, while diving, rests with the individual, and that in requesting SCUBA diving privileges at the Shoals Marine Laboratory, I will be responsible for and insure that:

\_\_\_(1) I am in good physical condition and physically prepared for the rigorous diving conditions at the Isles of Shoals.

\_\_\_(2) I am at the level of diving proficiency required for basic certification and am certified by a nationally recognized diver training organization.

\_\_\_(3) My equipment is in safe operating condition and maintained according to the requirements of the *Shoals Marine Laboratory Scientific Diving Standards.*

\_\_\_(4) I do not violate the dictates of my diver training.

Additionally, I certify that:

\_\_\_(5) I have read, understood, and agree to follow the *Shoals Marine Laboratory Scientific Diving Standards.*

\_\_\_(6) I understand that all SCUBA diving at the Shoals Marine Laboratory is voluntary.

\_\_\_(7) I have sufficient health and accident insurance coverage for any injury incurred while diving.

\_\_\_(8) To the best of my knowledge, the information in this Diver Application is correct.

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Applicant Signature

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Date

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Witness Name (print or type)

---

Witness Signature

## **APPENDIX 13**

### **OPERATIONAL PROCEDURES FOR DIVES BEYOND THE SCOPE OF SCIENTIFIC DIVING**

#### **Definition**

As defined in Part 1910 of the Occupational Safety and Health Standards, Subpart T – Commercial Diving Operations, Appendix B Guidelines for Scientific Diving #3: The tasks of a scientific diver are those of an observer and data gatherer. Construction and trouble shooting tasks traditionally associated with commercial diving are not within the scope of scientific diving.

#### **Scope**

Any dive, which involved tasks that extend beyond the definition of scientific diving as described in the previous paragraph shall be conducted under the applicable regulations of the commercial diving standards. This includes, but is not limited to, activities such as: underwater structure construction or repair, mooring replacement, underwater rigging for and about heavy objects, underwater cutting, burning, welding, cleaning or demolition, etc.

#### **Procedures**

Faculty and staff who anticipate that such non-scientific dives will be required must submit a request to the DCB for permission to conduct these diving operations.

The request must include the following:

- Overall project plan and objectives
- Date, location, and time of dive(s)
- Dive profile and tasks to be performed
- Equipment to be used
- Names and qualifications of the divers involved
- Identification of support vessels including size, capabilities and names of boat operators
- Emergency plan of action
- Appropriate insurance and liability release documents

The DCB will review the dive plan with respect to the requirements of the Commercial Diving Operations Regulations. Once the dive plan has been approved, the DSO or his/her designee will monitor the operation to ensure compliance with Commercial Diving Operations Regulations particularly Sections 1910.423 (c) and 1910.424 (b-2).

#### **Emergency repairs**

If during scientific or training dive operations a situation occurs where underwater repairs to a vessel or structure are immediately required to maintain the safety of on-board personnel or the integrity of the vessel (i.e. a fouled or bent propeller, etc.) and the lead diver determines that these repairs are within the capability of the dive team (in terms of diver qualification, available air, and bottom time without decompression), then he/she is authorized to conduct dive operations to make the necessary repairs. A written report of the incident shall be forwarded to the DSO.

## APPENDIX 14

### RELEASE / INDEMNIFICATION OF ALL CLAIMS AND COVENANT NOT TO SUE

**NOTICE:** This is a legally binding agreement. By signing this agreement you give up your right to bring a court action to recover compensation or obtain any other remedy for any injury to yourself, your property, or your death, however caused arising out of your participation in your course at Shoals Marine Laboratory.

#### INITIAL EACH ITEM TO VERIFY YOU HAVE READ AND UNDERSTOOD IT

#### ACKNOWLEDGMENT OF RISK

\_\_\_\_\_ I hereby acknowledge and agree that the sport of SCUBA diving has inherent risks. I have full knowledge of the nature and the extent of all the risks associated with SCUBA diving, including but not limited to:

- (1) Drowning
- (2) Decompression illness - including DCS and lung over-pressure syndromes
- (3) Marine animal attacks
- (4) Failure of equipment
- (5) Bad air
- (6) Injuries resulting from contact with underwater objects and/or the sea bottom
- (7) Temperature extremes
- (8) Boats, boat motors and propellers, docks, wharves, and diving platforms
- (9) Hyperbaric treatment may not be readily available

\_\_\_\_\_ I further acknowledge that the above list is not inclusive of all possible risks associated with the sport of SCUBA in and around the Isles of Shoals and that the above list in no way limits the extent or reach of this release and covenant not to sue.

#### RELEASE / INDEMNIFICATION

\_\_\_\_\_ In consideration of my enrollment in a Shoals Marine Laboratory course or courses, I, the undersigned diver, hereby do agree on behalf of myself, heirs, representatives, executors, administrators and assigns, to release University of New Hampshire, Cornell University and the Shoals Marine Laboratory, their officers, agents, and employees (herein collectively referred to as the Universities) from any cause of action, claims, demands of any nature whatsoever, including but not limited to a claim of negligence, which I, my heirs, representatives, executors, administrators and assigns may now have, or have in the future against the Universities on account of personal injury, property damage, death or accident of any kind, arising out of or in any way related to my participation in my Shoals Marine Laboratory course, whether that participation is supervised or unsupervised, howsoever the injury or damage is caused, including but not limited to the negligence of the Universities.

(continued on next page)



\_\_\_\_\_ In consideration of my enrollment, I, the undersigned participant, agree to indemnify and Hold Harmless, University of New Hampshire, Cornell University, its officers, agents, and employees from any and all causes of action demands, losses, costs of any nature whatsoever arising out of or in any way relating to my participation in a Shoals Marine Laboratory course.

\_\_\_\_\_ I hereby certify that I have full knowledge of the nature and the extent of the risks inherent in diving at the Lab, and that I am voluntarily assuming the risks. I understand that I will be solely responsible for any loss or damage (including death) that I sustain while participating in my course or courses and that by this agreement I am relieving the Universities of any and all liability for such loss, damage or death.

\_\_\_\_\_ I further certify that I am in good health and that I have no physical limitations, which would preclude my safe participation. I further certify that I hold a valid SCUBA certification, and that my equipment is in safe operating condition.

\_\_\_\_\_ I further certify that my date of birth is \_\_\_\_\_ (month/day/year) and that my present age is \_\_\_\_\_, and that I am therefore of lawful age (18 years or older) and otherwise legally competent to sign this agreement. I further understand that the terms of this agreement are legally binding and I certify that I am carefully signing this agreement, after carefully reading the same, of my own free will.

WITNESS WHEREOF, this instrument is duly executed at: \_\_\_\_\_

this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

\_\_\_\_\_

Diver's Signature

\_\_\_\_\_

Diver's Name Printed Clearly

\_\_\_\_\_

Witness' Signature

\_\_\_\_\_

Witness' Name Printed Clearly

## **APPENDIX 15 DIVER EQUIPMENT**

### REQUIRED ITEMS for Diving at SML

1. FULL WETSUIT FOR COLD WATER DIVING at least 1/4 inch (6mm) thick (or drysuit, if trained). This should include: “farmer-john” bottoms; jacket with either attached or separate hood; booties; and mitts or gloves. (Note: A 3/16 inch (5mm) wetsuit augmented with a vest with attached hood is a less preferred, but acceptable alternative. Anything less than 5mm will not be sufficient.)
2. MASK, SNORKEL and HEEL STRAP FINS
3. Weight BELT and WEIGHTS (SML provides). IF, diver provides their own weight belt – please bring only those with metal buckles (no plastic please).
4. Aluminum or steel TANK (SML provides).
5. BUOYANCY COMPENSATOR VEST (BC), equipped with a power inflator and exhaust valve, is required for all divers, including those using dry suits. Maintenance requirement: Must have been functionally inspected within the past 12 months.
6. REGULATOR equipped with second stage, pressure gauge, power inflator and an octopus rig or safe second. Provide make and model number on your Diver Application/Maintenance requirement: This equipment must have undergone inspection and needed maintenance within the previous 12 months.
7. DEPTH GAUGE and dive water or bottom timer (dive computers are permitted, please provide make and model on your Diver Application!) Maintenance requirement: Must have been inspected within the previous 12 months.
8. DIVE KNIFE
9. COMPASS
10. Maintenance Records for Diving Equipment: A copy of the written record, including the date and nature of work performed, serial number of the item, and the name of the person performing the work. You must provide such records for all required equipment inspections/maintenance included in this list. (Note: If you are using rental equipment, you must get a letter from the dive shop indicating the dates of equipment inspections/maintenance and certifying that the equipment has been appropriately serviced.)

### RECOMMENDED ITEMS for Diving at SML:

- a. Dive light and batteries for optional night dive
- b. Extra sweats (etc.) for pre and post dive wear
- c. Large bath or beach towel for the dive site (separate from your shower towel)
- d. Extra fin, mask straps, O-rings
- e. Old running shoes, sneakers of any kind to wear to/from the dive site

f. Dry suits are acceptable with proper training and experience (at least 20 dives); they must be equipped with an exhaust valve.

#### OPTIONAL ITEMS

- a. Digital camera (with charger, cables, etc.)
- b. Catch bag and/or dive bag