



SHOALS MARINE LABORATORY
HANDBOOK FOR DIVING SAFETY

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

Last Revised: May 2007

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

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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. Formatted document for consistency. 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.

April 2006

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

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).

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SECTION 1.00 GENERAL POLICY

1.10 Scientific Diving Standards

1.11 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, education 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.

At the Shoals Marine Laboratory (SML), scientific diving is defined as all diving conducted as part of a SML course or a scientific research project. This includes diving by undergraduate students, graduate students, faculty, visiting researchers, and staff, as part of such educational and research activities.

1.12 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. All diving falling under this definition is also considered scientific diving under the definition used by SML.

1.13 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):

- 1.13.1 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.
- 1.13.2 The purpose of the project using scientific diving is the advancement of science; therefore, information and data resulting from the project are non-proprietary.
- 1.13.3 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 included within scientific diving.
- 1.13.4 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.
- 1.13.5 In addition, the scientific diving program shall contain at least the following elements (29CFR1910.401):
 - 1.13.5.1 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.
 - 1.13.5.2 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.

1.14 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

1.21 Organizational Member Auspices Defined

For the purposes of these standards the auspices of the organizational member includes any scientific diving operation in which an organizational member 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 the organizational member 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 the organizational member or are diving as members of an organization recognized by the AAUS organizational member.

It is the organizational member'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 the organizational member's Diving Control Board (DCB).

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

1.22 Organizational Member's Scientific Diving Standards and Safety Manual

Each organizational member shall develop and maintain a scientific diving safety manual that provides for the development and implementation of policies and procedures that will enable each organizational member to meet requirements of local environments and conditions as well as to comply with the AAUS scientific diving standards. The organizational member's scientific diving manual shall include, but not be limited to:

- 1.22.1 AAUS standards may be used as a set of minimal guidelines for the development of an organizational member's scientific diving safety manual. Volume 1, Sections 1.00 through 6.00 and the Appendices are required for all manuals. Volume 2, Sections 7.00 through 9.00 are required only when the organizational member conducts that diving activity. Organizational member specific sections are placed in Volume 2.
- 1.22.2 Emergency evacuation and medical treatment procedures.
- 1.22.3 Criteria for diver training and certification.
- 1.22.4 Standards written or adopted by reference for each diving mode utilized which include the following:
 - 1.22.4.1 Safety procedures for the diving operation.
 - 1.22.4.2 Responsibilities of the dive team members.
 - 1.22.4.3 Equipment use and maintenance procedures.
 - 1.22.4.4 Emergency procedures.

1.23 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.

1.23.1 Qualifications

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

1.23.2 Duties and Responsibilities

- 1.23.2.1 Shall be responsible, through the DCB, to the responsible administrative officer or designee, 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 of the membership organization, rests with the Diving Safety Officer.

1.23.2.2 May permit portions of this program to be carried out by a qualified delegate, although the Diving Safety Officer may not delegate responsibility for the safe conduct of the local diving program.

1.23.2.3 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.

1.23.2.4 Shall suspend diving operations considered to be unsafe or unwise.

1.23.3 The DSO is appointed by the Director, with the advice of the DCB. The DSO will be present at SML a minimum of once monthly throughout the SML operational season (May through August)

1.24 Diving Control Board

1.24.1 The Diving Control Board (DCB) shall consist of at least five members with a majority of members active scientific divers. Voting members shall include the Diving Safety Officer, and the SML Director, and should include other representatives of the SML diving program such as SML faculty, staff, physicians with experience in diving medicine, or visiting researchers. Members will be appointed by the Director of SML, who will also appoint one member to be chair of the Diving Control Board.

1.24.2 Has autonomous and absolute authority over the scientific diving program's operation.

1.24.3 Shall approve and monitor diving projects.

1.24.4 Shall review and revise the diving safety manual.

1.24.5 Shall assure compliance with the diving safety manual.

1.24.6 Shall certify the depths to which a diver has been trained.

1.24.7 Shall take disciplinary action for unsafe practices.

1.24.8 Shall assure adherence to the buddy system for scuba diving.

1.24.9 Shall act as the official representative of the membership organization in matters concerning the scientific diving program.

1.24.10 Shall act as a board of appeal to consider diver-related problems.

1.24.11 Shall recommend the issue, reissue, or the revocation of diving certifications.

1.24.12 Shall recommend changes in policy and amendments to AAUS and the membership organization's diving safety manual as the need arises.

1.24.13 Shall establish and/or approve training programs through which the applicants for certification can satisfy the requirements of the organizational member's diving safety manual.

1.24.14 Shall suspend diving programs that are considered to be unsafe or unwise.

1.24.15 Shall establish criteria for equipment selection and use.

1.24.16 Shall recommend new equipment or techniques.

1.24.17 Shall establish and/or approve facilities for the inspection and maintenance of diving and associated equipment.

1.24.18 Shall ensure that the organizational member's air station(s) meet air quality standards as described in Section 3.60.

1.24.19 Shall periodically review the Diving Safety Officer's performance and program.

1.24.20 Shall sit as a board of investigation to inquire into the nature and cause of diving accidents or violations of SML's diving safety manual.

1.25 Instructional personnel

1.25.1 Qualifications - All personnel involved in diving instruction under the auspices of the organizational member shall be qualified for the type of instruction being given.

1.25.2 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.

1.26 Diving Coordinator

- 1.26.1 Qualifications - All personnel involved in diving instruction under the auspices of the organizational member shall be qualified for the type of instruction being given.
 - 1.26.1.1 The DC must be a qualified Scientific Diver (as described below) and Divemaster or Instructor certification for a nationally recognized agency. The DSO and DC may be the same person.
 - 1.26.1.2 The diving coordinator, an employee based at Appledore Island, is appointed by the Director of SML with the advice of the DCB and the DSO.
 - 1.26.1.3 When the DC is off-duty, the Director of SML, with the advice of the DSO, will appoint a qualified employee to be Acting Diving Coordinator. The Acting DC will have the same authority and responsibilities as the DC.
- 1.26.2 Authority- The DC has the authority to approve/disapprove dive plans and to qualify individuals to act as Radio Operators, based on criteria established by the DSO and DCB.
- 1.26.3 Responsibilities- The DC:
 - 1.26.3.1 Is responsible for all on-site supervision of diving activities and maintenance of SML air station and SML-owned scuba equipment, using criteria and procedures established by the DCB and DSO.
 - 1.26.3.2 Is responsible for record-keeping for the SML dive program, including dive-logs and SML-owned equipment maintenance logs, which shall be submitted to the SML Cornell office at the end of the season.
 - 1.26.3.3 Is responsible for approving/disapproving dive plans, and monitoring diver adherence to SML diving regulations.
 - 1.26.3.4 Is responsible for understanding and knowing how to implement the SML Dive Emergency Plan.
 - 1.26.3.5 Shall temporarily suspend diving operations that s/he considers to be unsafe or unwise; and make recommendations for permanent suspension to the DCB.

1.27 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. This should be the individual in charge of the scientific project or the most experienced diver. The Lead Diver shall be responsible for:

- 1.27.1 Coordination with other known activities in the vicinity that are likely to interfere with diving operations.
- 1.27.2 Ensuring all dive team members possess current certification and are qualified for the type of diving operation, have on file in the SML office the name, telephone number and relationship of person to be contacted in the event of an emergency, and are familiar with the SML diving emergency plan.
- 1.27.3 Planning dives in accordance with Section 2.20, and submitting dive plans to the DC.
- 1.27.4 Ensuring safety and emergency equipment is in working order and at the dive site, including a dive flag, emergency oxygen kit, first-aid kit and VHF radio (or 2-way radio).
- 1.27.5 Briefing dive team members on:
 - 1.27.5.1 Dive objectives.
 - 1.27.5.2 Unusual hazards or environmental conditions likely to affect the safety of the diving operation.
 - 1.27.5.3 Modifications to diving or emergency procedures necessitated by the specific diving operation.
- 1.27.6 Suspending diving operations if in their opinion conditions are not safe.
- 1.27.7 Reporting to the DC, and DCB any physical problems or adverse physiological effects including symptoms of pressure-related injuries.
- 1.27.8 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.

1.28 Reciprocity and Visiting Scientific Diver

- 1.28.1 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.
- 1.28.2 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.

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

1.28.4 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.

1.29 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 SML diving safety manual may be cause for the revocation or restriction of the diver's scientific diving certificate by action of the SML 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 organizational member'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 organizational member Diving Control Board, and other pertinent information deemed necessary.

1.50.1 Availability of Records:

1.50.1.1 Medical records shall be available to the attending physician of a diver or former diver when released in writing by the diver.

1.50.1.2 Records and documents required by this standard shall be retained by the organizational member for the following period:

1.50.1.2.1 Physician's written reports of medical examinations for dive team members - 5 years.

1.50.1.2.2 Diving safety manual - current document only.

1.50.1.2.3 Records of dive - 1 year, except 5 years where there has been an incident of pressure-related injury.

1.50.1.2.4 Pressure-related injury assessment - 5 years.

1.50.1.2.5 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 member's organizational scientific diving program unless they hold a current certification issued pursuant to the provisions of this standard.

2.20 Pre-Dive Procedures

2.21 Dive Plans (see Appendix 8)

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

2.21.1 Divers qualifications, and the type of certificate or certification held by each diver.

2.21.2 Emergency plan (Appendix 10) with the following information:

- Name, telephone number, and relationship of person to be contacted for each diver in the event of an emergency.
- Nearest operational decompression chamber via the Divers Alert Network
- Nearest accessible hospital.
- Available means of transport.

2.21.3 Approximate number of proposed dives.

2.21.4 Location(s) of proposed dives.

2.21.5 Estimated depth(s) and bottom time(s) anticipated.

2.21.6 Decompression status and repetitive dive plans, if required.

2.21.7 Proposed work, equipment, and boats to be employed.

2.21.8 Any hazardous conditions anticipated.

2.22 Pre-dive Safety Checks

2.21.1 Diver's Responsibility:

2.21.1.1 Scientific divers shall conduct a functional check of their diving equipment in the presence of the diving buddy or tender.

2.21.1.2 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 organizational member's diving safety manual.

2.21.1.3 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.

2.21.1.4 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.

2.21.1.5 Equipment Evaluations

2.21.1.6 Divers shall ensure that their equipment is in proper working order and that the equipment is suitable for the type of diving operation.

2.21.1.7 Each diver shall have the capability of achieving and maintaining positive buoyancy.

2.21.1.8 Site Evaluation - Environmental conditions at the site will be evaluated.

2.22 Requirement for boat/radio operator

2.22.1 Depending on Dive Location:

- Scientific divers diving outside the “Lee Area” of the Isles of Shoals, further than 200 ft from shore, or in an area with significant boat traffic are required to have a boat/radio operator in the dive boat (or on the dive platform) throughout the dive operation. (Shore divers must have a radio operator present at the shore dive site) The boat/radio operator must be approved by the DC, and will be responsible (instead of the Lead Diver) for pre-dive, post-dive and emergency communications with the SML office.
- The DSO and the DC have the authority, depending on diver experience and specific dive location, to waive this requirement.

2.22.2 Depending on Dive Conditions:

Conditions in the “Lee Area” can sometimes be rough or windy. It is the responsibility of the Lead Diver to evaluate these conditions prior to commencing the dive, and ensure the presence of a boat/radio operator if prudent.

2.22.3 By Decision of the DSO or DC:

The DSO and DC have the authority to require that a boat/radio operator be present on a dive operation.

2.30 Diving Procedures

2.31 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, immediately ascend to the surface to re-establish contact.

2.32 Refusal to Dive

2.32.1 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.

2.32.2 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.

2.33 Termination of the Dive

2.33.1 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.

2.33.2 The dive shall be terminated while there is still sufficient cylinder pressure (minimum of 500 psi) to permit the diver to safely reach the surface and return to the dive platform or boat.

2.33.3 Divers shall use ascent procedures recommended in AAUS Standards.

2.34 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 and the Diving Safety Officer explaining the circumstances and justifications.

2.40 Post-Dive Procedures

2.41 Post-Dive Safety Checks

2.41.1 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.

2.41.2 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 medical facility and recompression chamber if necessary.

2.41.3 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

Each organizational member 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

2.71 Personal Diving Log (Appendix 9)

Each certified scientific diver shall log every dive made under the auspices of the SML program, and is encouraged to log all other dives. Standard forms will be provided by the Shoals Marine Lab. Log sheets shall be submitted to the Diving Safety Officer to be placed in the diver's permanent file. Copies of these dive logs will be retained by the SML Cornell Office. Details of the submission procedures are left to the discretion of the Diving Safety Officer. The diving log shall be in a form specified by the organization and shall include at least the following:

- 2.71.1 Name of diver, buddy, and Lead Diver.
- 2.71.2 Date, time, and location.
- 2.71.3 Diving modes used.
- 2.71.4 General nature of diving activities.
- 2.71.5 Approximate surface and underwater conditions.
- 2.71.6 Maximum depths, bottom time, and surface interval time.
- 2.71.7 Diving tables or computers used.
- 2.71.8 Detailed report of any near or actual incidents.

2.72 Required Incident Reporting

All diving incidents requiring recompression treatment, or resulting in moderate or serious injury, or death shall be reported to the SML Diving Control Board and the AAUS. The report will specify the circumstance of the incident and the extent of any injuries or illnesses. The SML 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:

- 2.72.1 The Shoals Marine Laboratory Diving Control Board shall record and report occupational injuries and illnesses in accordance with requirements of the appropriate Labor Code section.
- 2.72.2 If pressure-related injuries are suspected, or if symptoms are evident, the following additional information shall be recorded and retained by SML, with the record of the dive, for a period of 5 years:
 - 2.72.2.1 Complete AAUS Incident Report at <http://www.aaus.org>.
 - 2.72.2.2 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.
 - 2.72.2.3 Shoals Marine Lab 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 Lab 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. 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 DC. 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

3.21 Regulators

- 3.21.1 Only those makes and models specifically approved by the Diving Safety Officer and the Diving Control Board shall be used.
- 3.21.2 Scuba regulators shall be inspected and tested prior to first use and every 12 months thereafter.
- 3.21.3 Regulators will consist of a primary second stage and an alternate air source (such as an octopus second stage or redundant air supply).

3.22 Breathing Masks and Helmets

Breathing masks and helmets shall have:

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

3.23 Scuba Cylinders

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

3.24 Backpacks

Backpacks without integrated flotation devices and weight systems shall have a quick release device designed to permit jettisoning with a single motion from either hand.

3.25 Gauges

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

3.26 Flotation Devices

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

3.27 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.

3.28 Determination of Decompression Status: Dive Tables, Dive Computers

- 3.28.1 A set of diving tables, approved by the Diving Control Board, must be available at the dive location.
- 3.28.2 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

3.31 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

3.41 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.

3.42 Diver's Flag

A diver's flag shall be displayed prominently whenever diving is conducted under circumstances where required or where water traffic is probable.

3.43 Compressor Systems – SML controlled

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

3.43.1 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.

3.43.2 Compressed air systems over 500 psig shall have slow-opening shut-off valves.

3.43.3 All air compressor intakes shall be located away from areas containing exhaust or other contaminants.

3.50 Equipment Maintenance

3.51 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:

3.51.1 Regulators

3.51.2 Submersible pressure gauges

3.51.3 Depth gauges

3.51.4 Scuba cylinders

3.51.5 Cylinder valves

3.51.6 Diving helmets

3.51.7 Submersible breathing masks

3.51.8 Compressors

3.51.9 Gas control panels

3.51.10 Air storage cylinders

3.51.11 Air filtration systems

3.51.12 Analytical instruments

3.51.13 Buoyancy control devices

3.51.13 Dry suits

3.52 Compressor Operation and Air Test Records

3.52.1 Gas analyses and air tests shall be performed on each organizational member-controlled breathing air compressor at regular intervals of no more than 100 hours of operation or 6 months, whichever occurs first. The

results of these tests shall be entered in a formal log and be maintained.

3.52.2 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 ³
Total Hydrocarbons as Methane	25 PPM/v
Water Vapor ppm	(2)
Objectionable Odors	None

SECTION 4.00 ENTRY-LEVEL TRAINING REQUIREMENTS

This section describes training for the non-diver applicant, previously not certified for diving, and equivalency for the certified diver.

An individual who is authorized to dive under the auspices of the Shoals Marine Lab must be able to safely operate in an environment, which may include below freezing air temperatures, near freezing water temperatures, high currents, low to zero visibility, and rough seas. The transition for a diver with a basic SCUBA certification to one certified to dive at SML requires a specific training program to enable an individual to safely perform research activities within this challenging environment.

Candidate prerequisites are:

1. Age 18 years or older
2. Adult certification in basic SCUBA by a nationally recognized agency (NAUI, YMCA, PADI, SSI, etc.) or equivalency.
3. Successful completion of a diving medical examination (Appendix 1)
4. Successful completion of a swimming and SCUBA skill evaluation.

4.10 Evaluation

4.11 Medical Examination

The applicant for training shall be certified by a licensed physician to be medically qualified for diving before proceeding with the training as designated in Section 4.20 (Section 6.00 and Appendices 1 through 4).

4.12 Swimming Evaluation

Applicant shall successfully perform the following tests, or equivalent, in the presence of the Diving Safety Officer, or an examiner approved by the Diving Safety Officer.

- 4.12.1 Swim underwater without swim aids for a distance of 25 yards without surfacing.
- 4.12.2 Swim 400 yards in less than 12 minutes without swim aids.
- 4.12.3 Tread water for 10 minutes, or 2 minutes without the use of hands, without swim aids.
- 4.12.4 Without the use of swim aids, transport another person of equal size a distance of 25 yards in the water.

4.20 Scuba Training

4.21 Practical Training

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:

Enter water with full equipment.

- 4.21.1 Clear face mask.
- 4.21.2 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.
- 4.21.3 Demonstrate ability to alternate between snorkel and scuba while kicking.
- 4.21.4 Demonstrate understanding of underwater signs and signals.
- 4.21.5 Demonstrate simulated in-water mouth-to-mouth resuscitation.
- 4.21.6 Rescue and transport, as a diver, a passive simulated victim of an accident.
- 4.21.7 Demonstrate ability to remove and replace equipment while submerged.
- 4.21.8 Demonstrate watermanship ability, which is acceptable to the instructor.

4.22 Written Examination

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

- 4.22.1 Function, care, use, and maintenance of diving equipment.
- 4.22.2 Physics and physiology of diving.
- 4.22.3 Diving regulations and precautions.
- 4.22.4 Near-shore currents and waves.
- 4.22.5 Dangerous marine animals.
- 4.22.6 Emergency procedures, including buoyant ascent and ascent by air sharing.
- 4.22.7 Currently accepted decompression procedures.
- 4.22.8 Demonstrate the proper use of dive tables.
- 4.22.9 Underwater communications.
- 4.22.10 Aspects of freshwater and altitude diving.
- 4.22.11 Hazards of breath-hold diving and ascents.
- 4.22.12 Planning and supervision of diving operations.
- 4.22.13 Diving hazards.
- 4.22.14 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.

4.23 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:

- 4.23.1 Surface dive to a depth of 10 feet in open water without scuba.
- 4.23.2 Demonstrate proficiency in air sharing as both donor and receiver.
- 4.23.3 Enter and leave open water or surf, or leave and board a diving vessel, while wearing scuba gear.
- 4.23.4 Kick on the surface 400 yards while wearing scuba gear, but not breathing from the scuba unit.
- 4.23.5 Demonstrate judgment adequate for safe diving.
- 4.23.6 Demonstrate, where appropriate, the ability to maneuver efficiently in the environment, at and below the surface.
- 4.23.7 Complete a simulated emergency swimming ascent.
- 4.23.8 Demonstrate clearing of mask and regulator while submerged.
- 4.23.9 Demonstrate ability to achieve and maintain neutral buoyancy while submerged.
- 4.23.10 Demonstrate techniques of self-rescue and buddy rescue.
- 4.23.11 Navigate underwater.
- 4.23.12 Plan and execute a dive.
- 4.23.13 Successfully complete 5 open water dives 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.

SECTION 5.00 SCIENTIFIC DIVER CERTIFICATION

5.10 Certification Types

5.11 Scientific Diver Certification

This is a permit to dive, usable only while it is current and for the purpose intended.

5.12 Temporary Diver Permit

This permit constitutes a waiver of the requirements of Section 5.00 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 this section 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.

5.13 Scientific diver-in-training permit

5.13.1 Requirements:

5.13.1.1 possession of a nationally recognized diving certification

5.13.1.2 completion of the diver application (Appendix 10)

5.13.1.3 an evaluation by the DSO (or his/her designee) to verify that the diver possesses skills and knowledge adequate to qualify for a diver-in-training permit. At minimum, this evaluation will include an open water checkout dive and a written examination.

5.13.1.4 A statement from a licensed physician, based on an approved medical examination, attesting to the person's fitness for diving.

5.20 General Policy

AAUS 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 organizational member that subscribes to the practices of AAUS is eligible for a scientific diver certification.

5.30 Requirements For Scientific Diver Certification

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 organizational member scientific diving privileges. Minimum documentation and examinations required are as follows:

5.31 Prerequisites:

Application - Application for certification shall be made to the Diving Safety Officer on the form prescribed by the organizational member.

Medical approval. Each applicant for diver certification shall submit a statement from a licensed physician, based on an approved medical examination, attesting to the applicant's fitness for diving (Section 6.00 and Appendices 1 through 4).

Scientific Diver-In-Training Permit - This permit signifies that a diver has completed and been certified as at least an open water diver through an internationally recognized certifying agency or scientific diving program, and has the knowledge skills and experience to that gained by successful completion of training as specified in Section 4.00. Divers-In-Training must dive under the supervision of the DSO, DC, or a SML Scientific Diver as part of their training program. Divers-In-Training may not dive to depths greater than 45fsw.

Emergency Care Training: The trainee must provide proof of training in the following:

Adult CPR (must be current)

Emergency oxygen administration (must be current)

First aid for diving accidents (must be current)

5.32 Theoretical and Practical Training

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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.

5.32.1 Required Topics (include, but not limited to):

- Diving Emergency Care Training
- Cardiopulmonary Resuscitation (CPR)

- Standard or Basic First Aid
 - Recognition of DCS and AGE
 - Accident Management
 - Field Neurological Exam
 - Oxygen Administration
- 5.32.2 Dive Rescue
- 5.32.3 Dive Physics
- 5.32.4 Dive Physiology
- 5.32.5 Dive Environments
- 5.32.6 Decompression Theory and its Application
- 5.32.7 AAUS Scientific Diving Regulations and History
- Scientific Dive Planning
 - Coordination with other Agencies
 - Appropriate Governmental Regulations
- 5.32.8 Scientific Method
- 5.32.9 Data Gathering Techniques (Only items specific to area of study are 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
- 5.32.10 HazMat Training
- HP Cylinders
 - Chemical Hygiene, Laboratory Safety (Use Of Chemicals)
- 5.33 Suggested Topics (include, but not limited to):
- 5.33.1 Specific Dive Modes (methods of gas delivery)
- Open Circuit
 - Hooka
 - Surface Supplied diving
- 5.33.2 Small Boat Operation
- 5.33.3 Rebreathers
- Closed
 - Semi-closed
- 5.33.4 Specialized Breathing Gas
- Nitrox
 - Mixed Gas
- 5.33.6 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

5.33.7 Specialized Diving Equipment

- Full face mask
- Dry Suit
- Communications

5.34 Practical training must include a checkout dive, with evaluation of the skills listed in Section 4.20 (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.

5.35 Examinations

5.35.1 Written examination

- General exam required for scientific diver certification.
- Examination covering the suggested topics at the DSO's discretion.

5.35.2 Examination of equipment.

- Personal diving equipment
- Task specific equipment

5.40 Depth Certifications

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

5.41 Depth Certifications and Progression to Next Depth Level

A certified diver diving under the auspices of the organizational member 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.

- Certification to 45 Foot Depth - Initial permit level, approved upon the successful completion of training listed in Section 4.00 and 5.30.
- 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 31 and 60 feet, for a minimum total time of 4 hours.
- 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.

5.50 Continuation of Certificate

5.51 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. Divers certified to 150 feet or

deeper may satisfy these requirements with dives to 130 feet or over. Failure to meet these requirements may be cause for revocation or restriction of certification.

5.52 Re-qualification of Depth Certificate

Once the initial certification requirements of Section 5.30 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.

5.53 Medical Examination

All certified scientific divers shall pass a medical examination at the intervals specified in Section 6.10. After each major illness or injury, as described in Section 6.10, a certified scientific diver shall receive clearance to return to diving from a physician before resuming diving activities.

5.54 Diving Emergency Care Training, diver must be current to national standards in the following:

- Cardiopulmonary Resuscitation (CPR)
- Standard or Basic First Aid
- Recognition of DCS and AGE
- Accident Management
- Field Neurological Exam
- Oxygen Administration

5.60 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. 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.

5.70 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.

SECTION 6.00 MEDICAL STANDARDS

6.10 Medical Requirements

6.11 General

- 6.11.1 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.
- 6.11.2 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.
- 6.11.3 The diver should be free of any chronic disabling disease and be free of any conditions contained in the list of conditions for which restrictions from diving are generally recommended. (Appendix 1)

6.12 Frequency of Medical Evaluations

Medical evaluation shall be completed:

- 6.12.1 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 member organization has obtained the results of that examination, and those results have been reviewed and found satisfactory by the member organization.
- 6.12.2 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.
- 6.12.3 Clearance to return to diving must be obtained from a physician following any major injury or illness, or any condition requiring hospital care. If the injury or illness is pressure related, then the clearance to return to diving must come from a physician trained in diving medicine.

6.13 Information Provided Examining Physician

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

6.14 Content of Medical Evaluations

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

- 6.14.1 Applicant agreement for release of medical information to the Diving Safety Officer and the DCB (Appendix 2).
- 6.14.2 Medical history (Appendix 3).
- 6.14.3 Diving physical examination (Required tests listed below and in Appendix 2).

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

- 6.15.1 Abnormalities of the tympanic membrane, such as perforation, presence of a monomeric membrane, or inability to auto inflate the middle ears.
- 6.15.2 Vertigo including Meniere's Disease.
- 6.15.3 Stapedectomy or middle ear reconstructive surgery.
- 6.15.4 Recent ocular surgery.
- 6.15.5 Psychiatric disorders including claustrophobia, suicidal ideation, psychosis, anxiety states, untreated depression.
- 6.15.6 Substance abuse, including alcohol.
- 6.15.7 Episodic loss of consciousness.
- 6.15.8 History of seizure.
- 6.15.9 History of stroke or a fixed neurological deficit.
- 6.15.10 Recurring neurologic disorders, including transient ischemic attacks.
- 6.15.11 History of intracranial aneurysm, other vascular malformation or intracranial hemorrhage.
- 6.15.12 History of neurological decompression illness with residual deficit.
- 6.15.13 Head injury with sequelae.
- 6.15.14 Hematologic disorders including coagulopathies.
- 6.15.15 Evidence of coronary artery disease or high risk for coronary artery disease.
- 6.15.16 Atrial septal defects.
- 6.15.17 Significant valvular heart disease - isolated mitral valve prolapse is not disqualifying.

- 6.15.18 Significant cardiac rhythm or conduction abnormalities.
 - 6.15.19 Implanted cardiac pacemakers and cardiac defibrillators (ICD).
 - 6.15.20 Inadequate exercise tolerance.
 - 6.15.21 Severe hypertension.
 - 6.15.22 History of spontaneous or traumatic pneumothorax.
 - 6.15.23 Asthma.
 - 6.15.24 Chronic pulmonary disease, including radiographic evidence of pulmonary blebs, bullae or cysts.
 - 6.15.25 Diabetes mellitus.
- Pregnancy.
- 6.16 Laboratory Requirements for Diving Medical Evaluation and Intervals.
- 6.16.1 Initial examination under age 40:
- Medical History
 - Complete Physical Exam, emphasis on neurological and otological components
 - Chest X-ray
 - Spirometry
 - Hematocrit or Hemoglobin
 - Urinalysis
 - Any further tests deemed necessary by the physician.
- 6.16.2 Periodic re-examination under age 40 (every 5 years):
- Medical History
 - Complete Physical Exam, emphasis on neurological and otological components
 - Hematocrit or Hemoglobin
 - Urinalysis
 - Any further tests deemed necessary by the physician
- 6.16.3 Initial exam over age 40:
- Medical History
 - Complete Physical Exam, emphasis on neurological and otological components
 - Assessment of coronary artery disease using Multiple-Risk-Factor Assessment¹ (age, lipid profile, blood pressure, diabetic screening, smoker)
 - Resting EKG
 - Chest X-ray
 - Spirometry
 - Urinalysis
 - Hematocrit or Hemoglobin
 - Any further tests deemed necessary by the physician
 - Exercise stress testing may be indicated based on risk factor assessment.²
- 6.16.4 Periodic re-examination over age 40 (every 3 years); over age 60 (every 2 years):
- Medical History
 - Complete Physical Exam, emphasis on neurological and otological components * Assessment of coronary artery disease using Multiple-Risk-Factor Assessment¹ (age, lipid profile, blood pressure, diabetic screening, smoker)
 - Resting EKG
 - Urinalysis
 - Hematocrit or Hemoglobin
 - Any further tests deemed necessary by the physician

* Exercise stress testing may be indicated based on risk factor assessment.²

¹ “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>

6.17 Physician's Written Report

- 6.17.1 After any medical examination relating to the individual's fitness to dive, the organizational member 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 will be reviewed by the DCB.
- 6.17.2 The organizational member shall make a copy of the physician's written report available to the individual

Appendices

Appendix 1 through 16

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 disease³. [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]
23. Asthma⁴. [42 - 44]

³ "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>

24. Chronic pulmonary disease, including radiographic evidence of pulmonary blebs, bullae, or cysts. [45,46]
25. Diabetes mellitus. [46 - 47]
26. Pregnancy. [56]

³ “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>

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>
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- 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.

⁴ “Are Asthmatics Fit to Dive? “ Elliott DH, ed. 1996 Undersea and Hyperbaric Medical Society, Kensington, MD.

APPENDIX 2
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 neurological and otological components
- _____ Chest X-Ray
- _____ Spirometry
- _____ Hematocrit or Hemoglobin
- _____ Urinalysis
- _____ Any further tests deemed necessary by the physician

Additional testing for first over age 40

- _____ Resting EKG
- _____ Assessment of coronary artery disease using Multiple-Risk-Factor Assessment⁵
(age, lipid profile, blood pressure, diabetic screening, smoker)
Note: Exercise stress testing may be indicated based on risk factor assessment⁶

[] Re-examination

**(Every 5 years under age 40,
first exam over age 40,
every 3 years over age 40,
every 2 years over age 60)**

- _____ Medical History
- _____ Complete Physical Exam, with emphasis on neurological and otological components
- _____ Hematocrit or Hemoglobin
- _____ Urinalysis
- _____ Any further tests deemed necessary by the physician

Additional testing for over age 40

- _____ Resting EKG
- _____ Assessment of coronary artery disease using Multiple-Risk-Factor Assessment⁵
(age, lipid profile, blood pressure, diabetic screening, smoker)
Note: Exercise stress testing may be indicated based on risk factor assessment⁶

RECOMMENDATION:

- [] APPROVAL. I find no medical condition(s) that I consider incompatible with diving.
- [] RESTRICTED ACTIVITY APPROVAL. The applicant may dive in certain circumstances as described in REMARKS.
- [] FURTHER TESTING REQUIRED. I have encountered a potential contraindication to diving. Additional medical tests must be performed before a final assessment can be made. See REMARKS.
- [] REJECT. This applicant has medical condition(s), which, in my opinion, clearly would constitute unacceptable hazards to health and safety in diving

⁵ "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>

⁶ 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>

REMARKS:

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

Name (Print or Type)

Address

Telephone Number

My familiarity with applicant is:

____ With this exam only

____ Regular Physician for ____ years

____ Other (describe) _____

My familiarity with diving medicine is:

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, REU Program or Visiting Researcher) (Mo/Day/Yr)

TO THE APPLICANT:

Scuba diving makes considerable demands on you, both physically and mentally. Diving with certain medical conditions may be asking for trouble not only for yourself, but also to anyone coming to your aid if you get into difficulty in the water. Therefore, it is prudent to meet certain medical and physical requirements before beginning a diving or training program.

Your answers to the questions are as important in determining your fitness as your physical examination. Obviously, you should give accurate information or the medical screening procedure becomes useless.

This form shall be kept confidential. 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 and s/he must then indicate, in writing, that you have done so and that no health hazard exists.

Should your answers indicate a condition that might make diving hazardous, you will be asked to review the matter with your physician. In such instances, his/her 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 s/he is concerned only with your well-being and safety. Please respect the advice and the intent of this medical history form.

Have you ever had or do you presently have any of the following?	Yes	No	Comments
1. Trouble with your ears, including ruptured eardrum, difficulty clearing your ears, or surgery.			
2. Trouble with dizziness.			
3. Eye surgery.			
4. Depression, anxiety, claustrophobia, etc.			
5. Substance abuse, including alcohol.			
6. Loss of consciousness.			
7. Epilepsy or other seizures, convulsions or fits.			
8. Stroke or a fixed neurological deficit.			
9. Recurring neurologic disorders, including transient ischemic attacks.			
10. Aneurysms or bleeding in the brain.			
11. Decompression sickness or embolism.			
12. Head injury			
13. Disorders of the blood, or easy bleeding.			
14. Heart disease, diabetes, high cholesterol			
15. Anatomical heart abnormalities including patent foramen ovale, valve problems, etc.			
16. Heart rhythm problems.			
17. Need for a pacemaker			
18. Difficulty with exercise.			
19. High blood pressure			
20. Collapsed lung			
21. Asthma.			
22. Other lung disease.			
23. Diabetes mellitus.			
24. Pregnancy			

25. Surgery. If yes explain below			
26. Hospitalizations. If yes explain below			
27. Do you take any medications? If yes list below			
28. Do you have any allergies to medications, foods, environmental? If yes explain below			
29. Do you smoke?			
30. Do you drink alcoholic beverages?			
31. Is there a family history of high cholesterol?			
32. Is there a family history of heart disease or stroke?			
33. Is there a family history of diabetes?			
34. Is there a family history of asthma?			

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

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

Signature

Date

APPENDIX 4
RECOMMENDED PHYSICIANS WITH EXPERTISE IN DIVING MEDICINE

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

1. Dr. Thomas Chayka
Old Post Road
York, ME 03809
207-363-5321

2. Dr. Craig Hersh
Pulmonary Medicine
Mass General Hospital
617-726-1721

3. Dr. Stephen Rowe
Catholic Medical Center
Hyperbaric Medical Service
603-626-2301

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.

fN₂ - Fraction of nitrogen in a gas mixture, expressed as either a decimal or percentage, by volume.

fO₂ - Fraction of oxygen in a gas mixture, expressed as either a decimal or percentage, by volume.

FFW - Feet or freshwater, or equivalent static head.

FSW - Feet of seawater, or equivalent static head.

Hookah Diving - A type of shallow water surface-supplied diving where there is no voice communication with the surface.

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 - 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_2 - 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 - A diving mode in which the diver in the water is supplied from the dive location with compressed gas for breathing.

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 RECIPROCITY 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 as established by the Shoals Marine Laboratory's 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 Shoals Marine Laboratory (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 Shoals Marine Laboratory

Diving Safety Officer:

_____ (Signature) _____ (Date)
 Rebecca Toppin, Shoals Marine Laboratory DSO 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 Coast Guard 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 DAN (Divers Alert Network) or 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 Shoals Marine Lab (see next page).
7. Complete and submit Incident Report Form (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 Shoals Marine Lab

US Coast Guard- Portsmouth	603-436-4414 marine radio, channel 16
Divers Alert Net work (DAN)	919-684-8111
Portsmouth Regional Hospital	603-436-5110
Hyperbaric Chamber, Catholic Medical Center 100 McGregor Street Manchester, NH Dr. Stephen Rowe (Medical Director)	603-626-2301
York Hospital	207-363-4321
Dr. Thomas Chayka	207-363-5321
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:

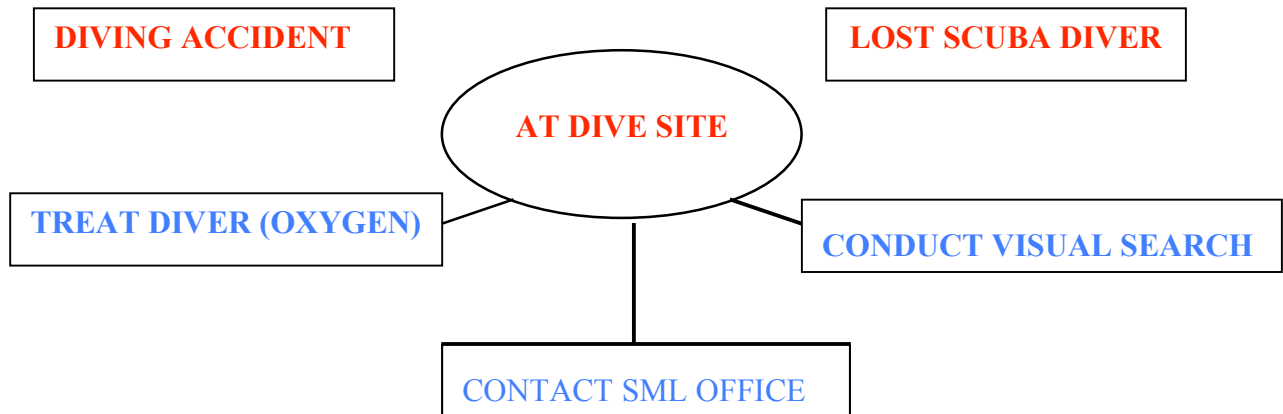
- Hyperbaric: Decompression Sickness, AGE, or other barotrauma requiring recompression therapy.
- Barotrauma: Barotrauma requiring medical attention from a physician or medical facility, but not requiring recompression therapy.
- Injury: Any non-barotrauma injury occurring during a dive that requires 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:

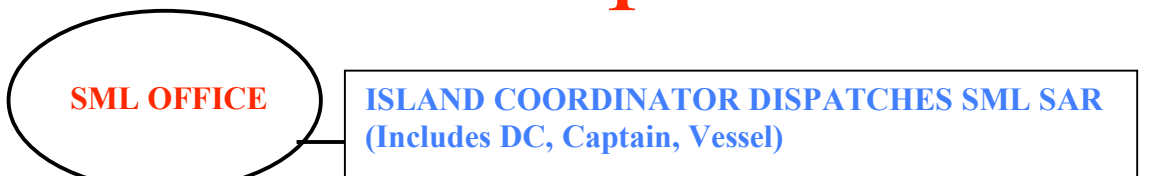
- Minor: Injuries that the OM considers being minor in nature. Examples of this classification of incident would include, but not be limited to:
 - Mask squeeze that produced discoloration of the eyes.
 - Lacerations requiring medical attention but not involving moderate or severe bleeding.
 - Other injuries that would not be expected to produce long term adverse effects on the diver's health or diving status.

- 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 OM 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.

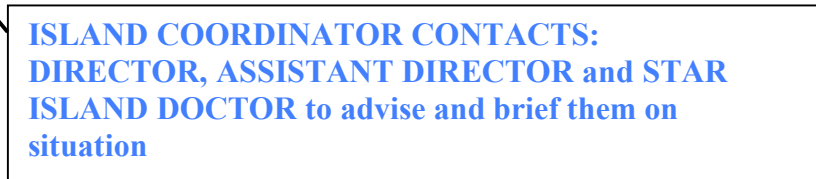
APPENDIX 10
SML SCUBA DIVING EMERGENCY PLAN



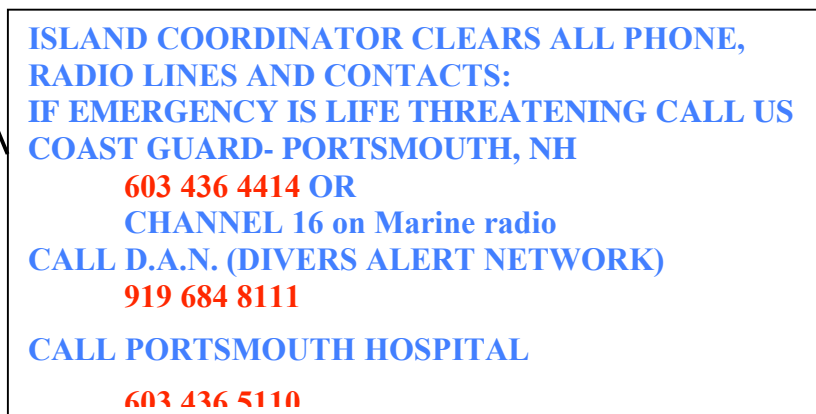
1



2



3



COMMUNICATIONS OPTIONS:

DIVING OFFICER: 508 454 3571
JMK CELL PHONE: 603 498 2554
ROSS HANSEN: 603 834 0644
603 430 5220
MARINE RADIO

DOCUMENTS NEEDED:

DIVER'S MEDICAL FORMS
DIVER'S STATUS
DIVE PROFILE
US COAST GUARD FORM

TRANSPORT OPTIONS to PORTSMOUTH HOSPITAL:

Standard protocol for all diving accidents is to medevac directly to the hospital Emergency Room at Portsmouth Regional Hospital, 333 Borthwick Ave.

- **US COAST GUARD VESSEL**
- **SHOALS MARINE LAB VESSEL**
- **US COAST GUARD HELICOPTER**
- **STAR ISLAND VESSEL**

INSTRUCTIONS FOR PATIENTS'S "ESCORT":

Escort should be trained to handle dive emergencies.

- **Maintain100% OXYGEN with full face mask**
- **Keep patient.....RECLINED and comfortable.**
(For air travel—advise pilot that low level flight is required for dive accident patients)
- **ContactD.A.N at 919 684 8111 for ER consultation with a dive medicine physician and to establish chamber location.**
- **ContactSML at 603 964 9011 to update the island as to patient's status. Collect SML belongings.**

BACK AT THE DIVE ACCIDENT SITE

Secure the scene: ALL SCUBA equipment should be left as it was at the time of the accident, and put in a secure location. Note anything unusual—zero air, blown hose, ruptured BC, etc.

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 13
DIVER APPLICATION FORM
SHOALS MARINE LABORATORY**

NAME: _____
(Please type or print)

SML COURSES OR RESEARCH PROGRAMS IN WHICH YOU ARE PARTICIPATING:

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: **Shoals Marine Laboratory, G-14 Stimson Hall, Cornell University, Ithaca, New York 14853.**

(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.

Applicant Signature

Date

Witness Name (print or type)

Witness Signature

APPENDIX 14

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 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.

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 (i.e. a fouled or bent propeller, etc.) and the lead determines that these repairs are within the capability of the dive team (in terms of diver qualification, available air, 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 15
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 16 DIVER EQUIPMENT

REQUIRED ITEMS for Diving at SML

1. FULL WETSUIT FOR COLD WATER DIVING at least 1/4 inch (6mm) thick. 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 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.)

OPTIONAL 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. Cold water vest
- d. Catch bag and/or dive bag
- e. Extra fin, mask straps, O-rings
- f. Aqua socks or equivalent
- g. Camera
- h. Dry suits are acceptable with proper training and experience (at least 20 dives); they must be equipped with an exhaust valve.
- i. Over-the-counter ear drops to prevent ear infections!