THE BAMFIELD MARINE SCIENCES CENTRE

WESTERN CANADIAN UNIVERSITIES MARINE SCIENCES SOCIETY

SCIENTIFIC DIVING SAFETY

v. February 2024

1. POLICY

The Western Canadian Marine Sciences Society (WCUMSS) recognizes the value of scientific diving as a tool for work and research in the marine environment. Bamfield Marine Sciences Centre (BMSC) shall maintain a diving safety program for appropriately trained individuals and ensure that all diving under WCUMSS auspices is conducted in a manner to minimize accidental injury, occupational illness, damage to property or endangerment of natural resources; and promote intelligent investigation of the underwater areas surrounding the BMSC. Scientific divers using the BMSC facilities are required to observe BMSC regulations. It is the intent of this guide to maximize diver safety.

All diving activities at the BMSC are undertaken on a strictly voluntary basis. It is the diver's responsibility to exercise judgment in deciding whether or not to dive. Divers must be aware that under certain circumstances they may not be eligible for workplace compensation for any diving related injury incurred.

2. INTRODUCTION

This guide shall act as a "Diving Safety Manual" in accordance with the Canadian Association for Underwater Sciences, CAUS, Standard of Practice (General Requirements 3.1.4); and additionally the "Safe Diving Procedures" as specified by WorkSafe BC, (OHS Regulation Part 24.17). This guide has been written solely for the use of individuals participating in scientific diving operations conducted under the auspices of WCUMSS.

Scientific diving is defined as "diving performed to collect specimens or data for scientific use under the auspices of an educational or research institute operating in accordance with the Canadian Association for Underwater Science- Standard of Practice for Scientific Diving". Note: Scientific diving does not include diving conducted for construction, including excavation, salvage, demolition, destruction, maintenance, repair or inspection of underwater structures, nor the collection of organisms for consumption or commercial use.

BMSC scientific diving activities are primarily governed by the Canadian Association for Underwater Science (CAUS) Standard of Practice for Scientific Diving as (exempted by the Canadian Standards Agency, CSA Standards Z275.2 and Z275.4) and additionally (where appropriate) the WorkSafe BC Occupational Health and Safety Regulations, Part 24: Diving (and Guideline 24.13-1 Evidence of competency for scientific divers). It is the responsibility of individual divers, to know and observe BMSC Diving Regulations and other relevant regulatory requirements, including the CAUS Standard of Practice. The BMSC Director and his/her designate (including the Diving Control Board and the Diving Safety Officer) may at anytime refuse an individual diver use of the BMSC diving equipment and facilities for failure to observe BMSC regulations.

3. SCOPE AND APPLICATION

> The purpose of this manual is to set forth the organization and conduct of the Bamfield Marine Sciences Centre Scientific Diving Program and to establish procedures for safety in diving operations. This manual covers BMSC requirements for snorkel and open circuit air SCUBA diving. Modes and forms of diving other than open circuit air SCUBA diving and snorkel diving require special authorization by the BMSC and must meet training, equipment and operational criteria in addition to those set down in this manual; this may include but is not limited to additional authorization and endorsement from the Diving Safety Officer, Dive Control Board, WorkSafe BC and CAUS. This Diving Safety Manual meets the requirements of the Canadian Association for Underwater Science Standard of Practice for Scientific Diving, and has been officially endorsed by the CAUS Standards and Procedures Committee. For more complete information see the CAUS Standard of Practice for Scientific Diving, v.May 2017.

The BMSC Diving Safety Program has been developed to ensure that all diving under the auspices of the WCUMSS is conducted in a manner that will protect divers from accidental injury and occupational illness. BMSC/WCUMSS auspices include: scientific diving by BMSC employees (occupational), university faculty, principle investigators, researchers, research assistants, volunteer divers, interns, registered students (undergraduate and graduate) as part of their research, occupation, training or instruction; and any scientific diving supported financially by the BMSC or utilizing BMSC equipment or facilities. It is not the intent of the BMSC to cover individuals engaged in diving for non-BMSC purposes, nor to provide training for such purposes.

The BMSC Diving Safety Program shares the objectives of the CAUS, which are:
1) To enhance health and safety in BMSC diving operations;
2) To facilitate use of diving in scientific study and research; and
3) To encourage reciprocity nationally and internationally in scientific diving programs.

3.1 Non-Scientific Diving at the BMSC

This Diving Safety Manual applies to Scientific Diving (see Section 2). It does not apply to commercial or industrial diving, such as diving performed as part of a commercial diving contract with the BMSC. Such contracts shall comply with the requirements of WorkSafe British Columbia Occupational Health and Safety Regulations (Part 24: Diving), other relevant regulation and any additional criteria established by the Diving Safety Officer. The use of the BMSC facilities for any other type of diving (such as SAR training, police diving or media diving) shall meet criteria as established by the Diving Safety Officer including compliance with governing federal and provincial regulation.

3.2 Sport/Recreational Diving

Sport diving is not permitted under WCUMSS auspices. However, divers are encouraged to engage in recreational/sport diving to maintain proficiency. Private boats may not load diving gear off the BMSC floats for recreational dives except with the expressed permission of the Diving Safety Officer or the Director.

3.3 BMSC Snorkel/Skin Diving

The BMSC requirements for undertaking snorkel/ skin diving under WCUMSS auspices are contained in Appendix XIII

4. DISCLAIMER

WCUMSS, the BMSC, its officers or appointees shall not be liable for any injury (fatal or otherwise) loss or damage sustained either directly or indirectly through the use of this manual, including injury, loss or damage resulting from negligence. All participants in diving activities (both surface support and divers) shall engage to do so on a voluntary basis and shall assume all risks, consequences and potential liability for his/her own actions.

5. THE CANADIAN ASSOCIATION FOR UNDERWATER SCIENCE (CAUS)

The Canadian Association for Underwater Science (CAUS) is a self-regulating body dedicated to safety in underwater research through the establishment and continual peer review of standards of practice for scientific diving. The Association provides a national forum for information exchange and policy making via a series of annual meetings, symposia and published proceedings.

The CAUS has experienced a number of successes since its inception in 1983. These include the written recognition by the Canadian Standards Association (CSA) of the standards equivalency between the CSA and the CAUS, and a growing ability to provide a strong voice for Canadian scientific diving.

A Standard of Practice for Scientific Diving has been developed as a uniform code of practice for scientific diving operations conducted by member organizations of the Canadian Association for Underwater Science.

5.1 CAUS Website

The Web Site for CAUS may be located at http://www.caus.ca/

5.2 CAUS Standard of Practice

The CAUS Standard of Practice is available for download and may be located directly at http://www.caus.ca/standard-of-practice/

5.3 CAUS Letter of Endorsement

6. GENERAL DIVING PROGRAM REQUIREMENTS

6.1 CAUS Membership

The BMSC shall at all times be a member in good standing with the Canadian Association for Underwater Science.

6.2 Diving Safety Manual

The Diving Safety Officer and Diving Safety Committee shall develop and maintain a Diving Safety Manual that mandates the development and implementation of policies and procedures that enable the BMSC to meet requirements of local environments and conditions as well as to comply with the requirements the CAUS Standard of Practice.

The diving safety manual must meet or exceed the CAUS Standard and contain as a minimum the following information:
i) Organization of the diving program including responsibility and accountability;
ii) Provisions for implementation of the manual;
iii) Diver qualification and competency;
iv) Medical requirements;
v) Equipment maintenance requirements;
vi) Approved gas purity and gas mixtures;
vii) Approved exposure tables and decompression schedules;
viii) Emergency and first aid requirements;
ix) Equipment inspection and maintenance requirements;
x) Record keeping requirements.

The BMSC Diving Safety Manual shall: conform to the policy established in the CAUS Standard, be approved by the Diving Safety Committee, and be endorsed by the Director (or designate) on official letterhead. The Diving Safety Manual is then to be forwarded to the Standards and Procedures Committee of the Canadian Association for Underwater Science.

A copy of the BMSC Diving Safety Manual shall be made available to all participants in

scientific diving activities under WCUMSS auspices.

6.3 Diving Safety Committee

The BMSC Scientific Diving Program must have a Diving Safety Committee, as per Section 7.3 of this manual

6.4 Diving Safety Officer

The BMSC Scientific Diving Program must have a Diving Safety Officer, as per Section 7.4 of this manual.

7. ORGANIZATION AND RESPONSIBILITY

7.1 Diving Safety Management Structure

The management structure outlined has been established to ensure that all BMSC diving activities are undertaken in a safe manner. It must be emphasized however, that ultimately, divers and dive team members, have a clear-cut individual responsibility for each other's and their own safety.

7.2 The Director

It is the responsibility of the Director of the BMSC to designate a suitable and competent Diving Safety Officer; and to appoint a Diving Safety Committee to act as a Diving Control Board and to be a member of the Committee.

7.3 Diving Safety Committee/ Diving Control Board

The Diving Control Board of BMSC shall comprise of Diving Safety Committee members. In accordance with the CAUS, Standard of Practice for Scientific Diving, the Board shall consist of a Diving Safety Officer and the Director, and such other representatives of the organization's diving program as shall be decided by the Director which shall:

1. Recommend procedures, policy and standards for diving operations to the Director and Diving Safety Officer,
2. Recommend the issue, reissue or revocation of diving authorization and certification
3. Act as a board of appeal, and
4. Act as a board of review with the authority to restrict, prohibit or suspend any diving operations, programs or practices it considers harmful, unwise or unsafe.

7.3.1 Current Membership

The BMSC shall at all times be a member in good standing with the Canadian Association for Underwater Science.

7.4 Diving Safety Officer

The Director shall appoint a Diving Safety Officer (DSO) to supervise and administer the BMSC diving program. The Diving Safety Officer shall be an experienced cold-water diver; and preferably be a currently certified, Open Water SCUBA Diving Instructor (with a nationally recognized diver-training agency), and must:
(a) Serve as a Diving Safety Committee member on the Diving Control Board;
(b) Act as the operational authority and administrator of the diving program;
(c) Oversee all aspects of the program such as:
    (i) dive project review and approval;
    (ii) equipment inventory and maintenance
    (iii) diver authorization and competency
    (iv) maintenance of diving records; and
    (v) dive policy development, compliance and enforcement.

It is the duty of the Diving Safety Officer to ensure, so far as is reasonably practical that all required statutes (including BMSC regulations; CAUS Standard of Practice for Scientific Diving as exempted by the Canadian Standards Agency, CSA Standards Z275.2 and Z275.4; WorkSafe BC Occupational Health and Safety Regulation, Part 24: Diving) are complied with. The Diving Safety Officer has the authority to restrict, prohibit or suspend any diving operations, programs or practices which he/she considers unwise, impractical, beyond the scope of BMSC diving capabilities or unsafe. The Diving Safety Officer shall report to the Director and to the Diving Control Board/ Diving Safety Committee.

8. OPERATIONS LEVEL DIVING ORGANIZATION

8.1 Organization and Responsibility of Personnel

Personnel involved with diving operations conducted under the auspices of the WCUMSS shall be responsible and accountable for the health and safety of those operations, in accordance with the following organizational plan.

8.2 Project Level: Scientific Project Leader/ Coordinator (Diving Project Director)

Each diving project shall have a Scientific Project Leader. Directors of research or study projects or programs, instructors of courses, field trips or like instructional components and persons in charge of any other scientific, research or educational undertaking any of which utilize SCUBA and/or snorkel diving are responsible for ensuring that all individuals engaging in diving in conjunction with their project are fully conversant with and comply with this manual. The

Scientific Project Leader need not be on-site while diving operations are undertaken and must defer to the views of the BMSC Diving Safety Officer, Diver-In-Charge and Diving Supervisor on matters connected with safety. The Scientific Project Leader may act as a Surface Safety Attendant (Diving Supervisor); however, to avoid any conflict of interests, generally they will not act as the Diver-In-Charge, except when expressed authorized to do so by the Diving Safety Officer. The Scientific Project Leader shall have the authority to restrict, prohibit or suspend diving operations under their charge. The Scientific Project Leader shall ensure that a Diver- In-Charge is appointed for each diving operation, and that the Diving Safety Officer approves this appointment. This Diver- In- Charge appointment decision may be deferred to the Diving Safety Officer.

8.3 On-site: Diver- In- Charge (Senior Diving Supervisor)

Each diving operation must be under the overall control of a designated on-site Diver-In-Charge (Senior Diving Supervisor), approved by the Diving Safety Officer. This individual must be present at the dive site or location and have the necessary experience and training in the conduct of the planned operation. The Diver- In- Charge is responsible for the overall coordination, supervision, and safety of the field diving operation within the scientific direction of the Scientific Project Leader. The Diver-In-Charge must ensure that all diving and related activity is conducted in a safe and healthy manner and conforms to the precepts of his/her training and to the regulations and requirements of the CAUS, BMSC and WorkSafe Bc. If he/she is unclear about any of the requirements he/she shall seek clarification from the BMSC Diving Safety Officer before commencement of diving operations. It is the responsibility of the Diver-In-Charge to ensure that a dive plan is constructed for each and every dive, that team members and support have received an operations plan brief and are clear as to the activities involved and their roles and responsibilities. He/she has the on-site authority to restrict, prohibit or suspend diving and related activity under his/her charge.

8.3.1 Emergency Deviation from this Manual (Diver- In- Charge)

The on-site Diver-in-Charge may deviate from the requirements of the CAUS Standard and the BMSC Diving Safety Manual to the extent necessary to prevent or minimize a situation that is likely to cause death, serious physical harm or major environmental damage. In such cases the diver in charge must:
(a) Notify the Scientific Project Leader and Diving Safety Officer as soon as possible after the onset of the emergency situation indicating the nature of the emergency and extent of the deviation from the prescribed standards; and
(b) Upon request from the diving officer, submit such information in writing.

8.4 “Top-side” Divers’ Tender: Surface Safety Attendant (Diving Supervisor)

The Surface Safety Attendant is part of the dive team and provides surface support for the diving operation. Each dive must be under the “top-side” (surface) control of a Surface Safety Attendant (Diving Supervisor). The Diver- In- Charge may also act as the Diving Supervisor or the two roles may be independent. Diving Supervisors act in accordance with BMS, CAUS and WCB regulations- if any uncertainties exist as to these requirements then clarification shall be obtained

from the Diving Safety Officer prior to commencing a surface supervisory role. During diving operations the Surface Safety Attendant (Diving Supervisor) must remain on the surface, in the dive area and monitor "top-side" hazards; and shall delegate the supervisory responsibilities to another Diving Supervisor, if required to enter the water. The Surface Safety Attendant has the authority to suspend diving operations under his/her control if conditions become unsafe (i.e. the authority to abort the dive if there is risk to the health and safety of the divers). At the completion of each day's diving activities the Diving Supervisor(s) must submit the "BMSC Dive Supervisors Log (Daily Project Log)", fully completed with accurate entries and filed with the BMSC Diving Safety Officer.

8.5 Dive Leader

Within a diving buddy pair one diver may be designated as a lead diver (the Dive Leader); when buddy groups consist of three members then one must act as the designated Dive Leader. The duties of the Dive Leader shall include being responsible, under the direction of the Diver–In-Charge for the underwater operational aspects of the dive.

8.6 Dive Team Members

Divers and immediate support personnel who are involved in a diving operation are considered members of the dive team(s) of that operation. As such team members have a duty and responsibility towards safety for themselves and each other. Divers are required to comply with this manual and any other relevant legislation. Divers must maintain a personnel dive logbook of a type approved by the Diving Safety Officer. Divers must ensure that all items of personal diving equipment are properly maintained, tested and approved by the Diving Safety Officer. Final authority and responsibility at the dive site shall rest with the dive team members. It is the dive team member's right, responsibility and duty to refuse to dive or engage in diving support activity if he/she:
(a) Feels unfit or in any other way unprepared for the activity;
(b) Judges that the conditions are unsafe or unfavourable; or
(c) Feels that the dive would violate the precepts of his/her training or the requirements set forth in the diving safety manual.

If a dive team member has a concern or is unsatisfied with any aspect of the operation, they should report their concerns to the Diving Officer, or if in the field to the Diver-In-Charge.

8.6.1 Emergency Deviation from this Manual (Dive Team Members)

In emergencies when danger to life exists or is probable, divers and dive team members may, at their own discretion, deviate from the requirements of this manual to the extent necessary to prevent or minimize the situation. The Diving Safety Officer and the Scientific Project Leader shall be notified as soon as possible after the onset of the incident indicating the nature of the emergency and extent of the deviation from the prescribed standards; and a written report of the incident shall be submitted to the Diving Safety Officer, explaining the circumstances and justifications for actions taken.

9. BMSC DIVING PROGRAM – ADMINISTRATIVE REQUIREMENTS

All personnel intending to use diving as a research tool under WCUMSS auspices must register with the Diving Safety Officer, at least one month prior to commencing diving activities (diving researchers are strongly advised to consult with the Diving Safety Officer before finalizing any other arrangements).

All personnel involved in diving under WCUMSS auspices must submit a written proposal for approval by the Diving Safety Officer, and meet all criteria for obtaining qualification. Prior to commencing scientific diving activities or scientific diver training, the candidate must fulfill the following entry requirements:

(a) The applicant shall normally be at least eighteen years of age.
(b) Possess a nationally recognized SCUBA certification (such as PADI, ACUC, SSI, CMAS, BSAC, SDI, NAUI). At a minimum this should be at the Open Water level or equivalent; the Diving Safety Officer reserves the right to determine the suitability of the applicants certification level and has the right to request a level above the minimum (or request additional certifications), in keeping with the applicants planned diving activity.
(c) Have logged at least 20 dives and 10 hours in water or underwater, of which 12 dives shall be in the last year. At the Diving Safety Officer's discretion this entry level may be lowered in accordance with any additional criteria established (the absolute minimum in any instance for scientific diver training shall be the CAUS prescribed 5 open water dives with at least 2.5 hours underwater time).

(d) Have completed and submitted, to the Diving Safety Officer, the following items:
- (i) Diver Clearance Form – See Section 9.1
- (ii) Release and Waiver Form – See Section 9.2
- (iii) Proof of Diver Training and Experience – See Section 9.3
- (iv) Medical Approval From – See Section 9.4
- (v) Dive Project Approval Request Form – See Section 9.5
- (vi) Current CPR and First Aid Certification- See Section 9.6

Submission of these documents is part of the initial registration process, and does not automatically result in authorization to dive at the BMSC. Diver competency must first be established, according to Section 10.

9.1 Personnel Registration

Applicants must complete the Diver Clearance Form (found in Appendix IX, and on the BMSC website for download) and submit it to the Diving Safety Officer, prior to commencing research diving activities.

9.2 Release and Waiver

All individuals undertaking scientific diving under WCUMSS auspices shall execute a release holding the BMSC harmless for any claims which might arise in connections with SCUBA and snorkel diving (Appendix IX and on the BMSC website for download)).

9.3 Proof of Diver Training and Experience

Divers applying to enter into the BMSC Scientific Diving Program shall have, at minimum, an Open Water Diver certification card, or equivalent, from a nationally recognized diver training agency. As part of the application process, all prospective scientific divers shall submit, to the Diving Safety Officer, any original diver training certification cards, as well as their personal diving logbook(s). The Diving Safety Officer shall produce copies to keep within the diver's personal file. The Diving Safety Officer can request proof of additional experience in keeping with the applicant's proposed diving activity or establish criteria for additional experience

9.4 Diving Medical Examination and Approval

In keeping with the medical requirements of The Canadian Association for Underwater Science, every scientific diver shall "be declared medically fit to dive by a licensed physician knowledgeable in diving medicine and found to be free of any defect that would prohibit the type of diving in which they will engage". The medical evaluation shall meet the minimum requirements of the BMSC Scientific Diver Medical – For the use of student divers in training Only (Appendix XI) or other appropriate approved medical standard for diver fitness.

The type of diving medical required will vary according to the status of the applicant. In most instances scientific divers will require a WorkSafe BC occupational divers medical or recognized occupational diver's medical in compliance with provincial, federal, national or organizational regulation. Applicants are advised to consult with the BMSC Diving Safety Officer, and the Diving Office or Health and Safety Department of their home institution, to ascertain the appropriate medical to meet regulatory requirements.

Upon receipt of the Diving Medical History & Examination Form or equivalent form, a dated medical certificate for diving will be issued to the BMSC Diving Safety Officer and held on record in the diver's file.

9.4.1 Diving Medical Renewal

The required medical examination and certification shall be repeated every two years except if a shorter period is required. Additional medical examinations shall be given:

(a) After any major injury or illness or significant change in health or medication;
(b) At the request of the Diving Safety Officer or Diver-in-Charge
(c) At the discretion of the examining physician
(d) Annually once a diver is 40 yrs of age or older
(e) In accordance with any additional criteria set down in the diving safety manual.

9.4.2 Medical Records

The results of medical examinations and associated test results are to be maintained in the file of the examining physician in accordance with accepted medical practice. A statement must be forwarded to the Diving Safety Officer certifying medical fitness to dive and a copy of approval must be placed in the diver's file. As well as be kept at the dive site.

9.5 Project Description and Approval

Only divers involved in an approved scientific diving project may take part in the BMSC Scientific Diving Program. Prior to commencing research diving activities, divers are to complete in writing and submit to the Diving Safety Officer, a Dive Project Approval Request Form (Appendix IX), including details of the project, divers competency, proposed locations, and emergency plans. The Diving Safety Officer and/or Diving Control Board shall review the Dive Project Approval Request Form and determine approval.

9.5.1 Renewal (Project Description and Approval)

Divers shall submit a Dive Project Approval Request Form when requested by the Diving Safety Officer or Diving Control Board.

9.6 First Aid, CPR and emergency Oxygen provider Certification

Prior to commencing scientific diving activities, divers shall be required to have current recognized First Aid, CPR in Oxygen first aid for diving injuries certification acceptable to the Diving Safety Officer (this may include integrated Dive Accident Management certification and or First Aid/ CPR certification). Dive team members may be asked to demonstrate competency in first aid and CPR skills and undertake any additional training deemed necessary to refresh their skills.

9.6.1 Renewal (First Aid, CPR and Oxygen provider Certification)

All divers (and Dive tenders) are responsible for maintaining current First Aid, CPR and Oxygen provider certification, and for filing proof of certification with the Diving Safety Officer. Divers should also be able to show evidence of knowledge of standard first aid skills. First Aid, CPR and Oxygen provider certifications are generally valid for two-three years dependent on the certifying agency

10. SCIENTIFIC DIVER COMPETENCY REQUIREMENTS

Upon completion of the registration process, and prior to commencing scientific diving activities, divers must obtain diving authorization (and a BMSC diving program CAUS certification level) by demonstrating competency in the following areas:

1. Fitness and Watermanship
2. General Diving Skills
3. Diver Rescue and Dive Accident Management
4. Oxygen Administration Training
5. Scientific Diving Theory

The Diving Safety Officer will administer the evaluation processes, and determine if competency requirements have been met.

10.1 Fitness and Watermanship Evaluation

10.1.1 Competency Requirements- Fitness and Watermanship Evaluation

Prior to taking part in scientific diving activities the candidate will demonstrate fitness and watermanship proficiency. The criteria for this evaluation shall be established by the Diving Safety Officer in accordance with the CAUS Standard of Practice. This will include a rescue tow of 100 m with both participants fully geared with the appropriate thermal protection, and typically a 400m snorkel (using mask, fins and snorkel). However in addition to the 100m rescue tow the Diving Safety Officer may request the candidate to complete one of the following four tasks:.

(a) snorkel 400 m using mask, fins and snorkel;
(b)demonstrate a survival swim/float without any aids for not less than 20 minutes;
(c) swim 200 m without swim aids;
(d) conduct a head first surface dive to retrieve an object in 3 m of water.

Divers are responsible for staying physically fit for diving.

10.1.2 Renewal- Fitness and Watermanship Evaluation

Divers may be asked to demonstrate continued fitness and watermanship proficiency (such as following recovery from illness/injury or a period of diving inactivity).

10.2 General Diving Skills Evaluation

10.2.1 Competency Requirements- General Diving Skills Evaluation

Prior to participating in scientific diving activities the diver must demonstrate the ability to perform basic diving skills in an open water environment. A documented evaluation of a diver's competency is required. A performance evaluation shall include but is not limited to:

(a) pre-dive planning including emergency contingencies and evaluation procedures;
(b) local environment orientation and hazard assessment;
(c) dive planning procedures to be implemented to counter any known hazards;
(d) briefing procedures;
(e) appropriate dressing in and equipment assembly procedures;
(f) pre-dive safety check;
(g) appropriate entry techniques;
(h) maintenance of the buddy system;
(i) underwater navigation skills;
(j) diving skills circuit-may be conducted in a confined or open water setting and must include:

1. Proper weighting.
2. Proper descent/ascent techniques.
3. Proper buoyancy techniques.
4. Mask removal and replacement.
5. Regulator recovery and clearing.
6. Weight belt removal and replacement.
7. SCUBA unit removal and replacement
8. Options for out-of-air emergencies
9. Free flowing regulator
10. Dry suit over-inflation procedures
11. Appropriate exit techniques.
12. Appropriate dressing down and equipment disassembly procedures
13. Post dive debriefing
14. Dive log requirements

10.2.2 Renewal- General Diving Skills Evaluation

The criteria and schedule for an open water diving skills re-evaluation shall be established by the Diving Safety Officer. This may include a skills circuit and/or accompaniment (by the Diving Safety Officer or designate) on a scientific/research orientated dive, typically every one or years. At the Diving Safety Officer's discretion this may be integrated with diver rescue renewal.

10.3 Diver Rescue and Accident Management Evaluation

Divers shall be trained or undertake training in Diver Rescue & Accident Management before full Scientific Diver (CAUS Scientific Diver I) status is granted.

10.3.1 Competency Requirements- Diver Rescue and Accident Management Evaluation

The candidate must demonstrate proficiency in diver rescue and accident management procedures specific to location, mode, and condition of diving to be undertaken. A performance evaluation must include but is not limited to:

(a) site management and accident prevention;
(b) self rescue skills;
(c) diver rescue skills at surface;
(d) diver rescue skills underwater;
(e) missing diver procedures;
(f) recognition and treatment of diving related injuries;
(g) accident management and evacuation procedures;
(h) accident and incident reporting.

10.3.2 Renewal- Diver Rescue and Accident Management Evaluation

The criteria and schedule for Diver Rescue and Accident Management re-training/ re-assessment shall be established by the Diving Safety Officer. Typically this will occur at intervals of one or two years, depending on the diver's experience and previous training record. At the Diving Safety Officer's discretion this may be integrated with renewal of open water diving skills.

10.4 Oxygen Administration (for Divers) Evaluation

10.4.1 Competency Requirements- Oxygen Administration

The candidate must demonstrate proficiency in providing oxygen therapy to an injured diver. A performance evaluation must include but is not limited to knowledge of:

(a) flow rates;
(b) cylinder duration;
(c) physiology of oxygen therapy;
(d) equipment maintenance and operation.

10.4.2 Renewal- Oxygen Administration

Oxygen Therapy Administration is generally valid for 2-3 yrs from the date of training dependent on the issuing agency. Renewal shall typically be as a re-training session and/or competency evaluation every two years.

10.5 Scientific Diving Theory Knowledge Evaluation

10.5.1 Competency Requirements- Diving Theory Knowledge

Prior to taking part in scientific diving activities the candidate must demonstrate knowledge in, and understanding of, diving theory by completing a written exam with a mark of 75% or higher. Topics must include but are not limited to:

(a) diving physics;
(b) diving physiology and medical considerations;
(c) diver communication;
(d) underwater hazards;
(e) problems with contaminated air;
(f) DCIEM Diving Tables;
(g) the diving environment;
(h) diving equipment;
(i) problem management;
(j) legislation and standards;
(k) scientific diving techniques.

At the BMSC standard practice is for the exam to consist of two sections:
1) The standardized CAUS (or equivalent/reciprocal) Diving Theory Exam; and
2) The BMSC Written Diving Exam (based on BMSC diving standards and operating procedures).

10.6 Waiver of Specific Requirements

If an applicant for BMSC certification can show evidence of previous qualifying experience or training, he/she may be granted a waiver for specific requirements of training and experience. The requirements for a diving medical evaluation, written examination (a previous exam reciprocal/ equivalent to the CAUS exam may be acceptable to the Diving Safety Officer) and release and waiver shall not in any case be waived by the Diving Safety Officer. Under normal circumstances all experienced divers will be required to complete a check out dive with the Diving Safety Officer, typically demonstrating competency in open water diving skills and diver rescue.

11. BMSC AUTHORIZATION TO DIVE (SCIENTIFIC DIVER CATEGORIES)

The BMSC diving certification will authorize the holder to dive using SCUBA to the depth indicated on the BMSC divers list. Only individuals whose names are on this list are authorized to dive at the BMSC. If your name is removed from the list you are no longer authorized to dive at BMSC and will have to consult with the Diving Safety Officer in order to have your name reentered on the list.

11.1 Depth Limits

Divers are required to respect imposed graduated depth restrictions, typically: 40ft/12m; 60ft/18m; 80ft/24m; 100ft/30m; 120ft/36m; Other. The Diving Safety Officer will establish the conditions for authorization to a specified depth. Typically, 40ft/12m is the basic depth certification granted on initial qualification as a Scientific Diver-In-Training.

11.1.1 Authorization to Dive Deeper than 40 m. / 130 ft.

Authorization to dive to depths greater than 40 m. / 130 ft. shall not be given.

11.2 Scientific Diver-In-Training

This certification is a limited permit, authorizing diving in a training or on the job training (apprenticeship) capacity only. The Diver-In-Training must fulfill all basic entry requirements, and shall be undertaking training towards Scientific Diver I, with the following restrictions:
(a) must have successfully completed the General Diving Skills evaluation (see Section 10.2)
(b) must dive under the direct supervision of the Diving Safety Officer or specified designate.

11.2.1 Depth Restriction- Scientific Diver-In-Training

Divers-In-Training can dive to a maximum of 20 m or less as specified by the Diving Safety Officer (see Section 11.1) appropriate to their training and experience in no instance shall a Diver-In-Training be authorized to dive to deeper than 66ft/20m.
Diviers-In-Training must dive with Diving Safety Officer or Scientific Diver I or II. Diving must occur during daylight hours. Diving must not take place in hazardous conditions or environments, or include use of special modes and systems.

11.3 Scientific Diver I

This certification is a permit to do “working” scientific dives and signifies that a diver has completed the training required for the depth and conditions for which he/she is certified.

To achieve the Scientific Diver I rating, the diver must:

(a) Fulfill all basic entry requirements as outlined in previous sections (Section 9)
(b) Demonstrate competency as outlined in previous sections (Section 10)
(c) Accumulate a minimum 25 logged dives and 15 hours bottom time (with at least 15 of these dives accomplished as a Diver-In-Training) or have equivalent knowledge and experience acceptable to the Diving Safety Officer (typically including a minimum of 50 logged dives and 25 hours of bottom time).
the dives stipulated in 11.3 (c) must include:

c.1) The planning and execution of a minimum of 1 working dive to 20 m under the direct supervision of the Diving Safety Officer, and

c.2) The planning and execution of a minimum of 3 subsequent working dives to 20 m under the direct supervision of the Diving Safety Officer or a scientific Diver 1 with supervisory status.

11.3.1 Depth Restriction- Scientific Diver I

A Scientific Diver I can dive to a maximum depth of 20m or less as prescribed by the Diving Safety Officer (see Section 11.1) appropriate to their training and experience. In no instance shall a Scientific Diver I be authorized to dive deeper than 66ft/20m; unless undertaking training dives towards Scientific Diver II certification, accompanied by the Diving Safety Officer or specified designate.

11.4 Scientific Diver II

To achieve a Scientific Diver II rating, the diver must:
(a) hold the rating of CAUS Scientific Diver I (or equivalent);

(b) be registered for an approved project that requires diving between 20 m and 40 m;
(c) complete the Scientific Diver II exam with a minimum grade of 75% in the physics and physiology of deeper diving;
(d) plan and execute a minimum of 4 working dives to the anticipated depth (deeper than 20m and up to 40m) under the direct supervision of the Diving Officer or designate, or have documented equivalent knowledge and experience acceptable to the Diving Safety Officer;
(e) demonstrate proficiency in areas including but not limited to:

1) deep diving pre-dive planning including breathing gas consumption calculations
2) selection and use of redundant air systems
3) briefing procedures including narcosis awareness, gas and time monitoring, dive termination criteria
4) appropriate dressing in and equipment assembly procedures for deep extended dives
5) pre-dive and in-water safety checks
6) maintenance of the buddy system
7) ascent rates, safety stops, post dive activities.

11.4.1 Depth Restriction- Scientific Diver II

In no instance shall a Scientific Diver II be authorized to dive deeper than 40m/130ft.
A Scientific Diver II must dive with the Diving Safety Officer or another Scientific Diver II when diving deeper than 66ft/20m.

11.5 Temporary/Visiting Diver

This certification is a limited permit to dive at the BMSC that waives all other certification criteria in favour of a demonstration of required proficiency. The permit is to be used only on a temporary basis for personnel who do not normally and would not otherwise dive under the

auspices of the WCUMSS. Before being authorized to dive, temporary/visiting divers must provide evidence of certification, diving medical clearance, and experience. The temporary diving certification shall be valid only under the restrictions stipulated by the Diving Officer; typically a temporary diver is restricted to diving with the Diving Safety Officer or specified designate.

11.5.1 Depth Restriction- Temporary Diver

The Diving Safety Officer will determine the Temporary Diver's equivalent certification level, and will limit the diver to the maximum depth permitted for that certification level (or shallower).

11.6 Reciprocity: Reciprocal/ Equivalent Diver

The BMSC Diving Safety Officer shall establish reciprocity with other CAUS members and with institutions and associations involved in scientific diver training (such as the American Academy of Underwater Sciences). This will allow divers from one organization to dive under the auspices of another, with minimal inconvenience. Divers currently qualified under the auspices of one organization may gain equivalent status to dive at the BMSC, provided appropriate documentation (including a diver status report sheet and/or reciprocity request from the diving office) is submitted, and the candidate's level of experience and qualification is considered sufficient by the BMSC Diving Safety Officer. The BMSC has the right to approve or deny this request and may require at minimum a checkout dive with the Diving Safety Officer. A visiting diver may be asked to demonstrate their knowledge and skills for the planned diving operations; and can expect to perform a competency evaluation (open water diving skills and rescue), as considered appropriate by the Diving Safety Officer. If the request for reciprocity is denied, the BMSC should notify the diving office of the visiting diver with the reason for the denial. Divers granted reciprocal/ equivalent status are subject to the conditions and restrictions imposed by the Diving Safety Officer.

11.7 Diver In Charge (Senior Diving Supervisor)

To achieve a Diver-In-Charge rating, the diver shall:
1) Be a certified CAUS Scientific Diver I or II or equivalent.
2) Have a minimum of one year experience and 50 logged dives.
3) Have previous experience in the field of scientific diving specific to the depth, task and environment; acceptable to the BMSC Diving Safety Officer

11.8 Surface Safety Attendant (Diving Supervisor)

The Surface Safety Attendant shall attend the dive team at the dive site and must::
1) Possess a current, nationally recognized First Aid and CPR Certification;
2) Possess current certification in the provision of therapeutic oxygen
3) Have knowledge of the diving equipment, systems and procedures in the conduct of the planned operation;
3) Have knowledge of emergency accident management protocols and procedures.

Meet the boat operator requirements if acting as the boat tender/boat operator (Section 11.9).

11.9 Boat Operator

A boat operator /dive tender must:
1) be trained and/or experienced in boat handling; and
2) be competent as a boat operator in support of diving operations, specific to the boat used and type of operation (i.e. anchored or live-boating); to the satisfaction of the Diving Safety Officer.
3) Boat operator's must possess a minimum of a Canadian Coast Guard Pleasure Craft Operator Card (or equivalent)/ Small Vessel Operators Proficiency (SVOP) Certificate as appropriate to vessel/dive platform and a current Marine First aid certificate.
4) All boat operators/ dive tenders are responsible for maintaining current Vessel Operation and First Aid certification and for filing proof of certification with the Diving Safety Officer.
5) Boat Operator's must familiarize themselves with the BMSC Boat tenders Guide and must comply with the BMSC boating regulations (See BMSC Boat Policy).

11.10 Snorkel Diver

Snorkel Divers shall meet the requirements of Appendix XIII.

11.11 Denial of Diving Authorization

Even upon completion of certification requirements, any applicant who does not appear to possess the judgment necessary under diving conditions for the safety of the diver and dive team members (including his/her diving "buddy") may be denied certification by the Diving Safety Officer and or the Diving Control Board.

12. MAINTENANCE OF DIVING AUTHORIZATION

12.1 Term of Certificate

All diving certificates shall expire one year from the date of the last diving medical examination, or six months from the date of the last logged dive, or one year from the date of the last certification dive with the Diving Safety Officer, whichever comes first.

12.2 Diving Activity

Divers are expected to keep current in their diving skills by diving. During any 12 month period, each certified diver shall typically log a minimum of 12 dives. Normally, at least 6 dives shall be made in the preceding 6 months and at least one of those dives should be made to the depth of certification. If a diver does not dive for 2 months or more he/she should accomplish a work-up or training dive prior to resuming scientific diving activities. The Diving Safety Officer will assist in determining a schedule for work-up dives for divers who have not been diving for over two months. Failure to log dives to the depth of certification may be cause for revocation or

restriction of a certificate. Renewal of SCUBA depth certification shall proceed in a stepwise fashion through the shallower depth levels, in accordance with terms imposed by the Diving Safety Officer.

Example Schedule for Work-Up Dives for Various SCUBA Certification Depths After a Break from Active Diving

	MAXIMUM CERTIFICATION DEPTH	
TIME LAPSE	20 m / 65 ft	40 m / 130 ft
2 - 6 months	18 m / 60 ft	18 m / 60 ft 30 m / 100 ft 40 m / 130 ft
6 -12 months	12 m / 40 ft 18 m / 60 ft	12 m / 40 ft 18 m / 60 ft 30 m / 100 ft 40 m / 130 ft
Over 12 months	Dive Skills Session 12 m / 40 ft 18 m / 60 ft	Dive Skills Session 12 m / 40 ft 18 m / 60 ft 30 m / 100 ft 40 m / 130 ft

NOTE: Indicated depth represents one dive at that depth.

13. DENIAL OR REVOCATION OF DIVING AUTHORIZATION

13.1 Denial of Diving Authorization

Completion of all, or parts of, diving program entry requirements does not guarantee diving authorization, which may be denied, for cause, by the Diving Safety Officer and / or Diving Control Board.

13.2 Revocation of Authorization

A diving certification may be revoked or restricted for cause.

13.2.1 Violation of Diving Standard

Failure to comply with the requirements of the diving safety manual shall be cause for the

revocation or restriction of a diver's authorization to dive. The diver shall be informed of the reasons for revocation, and will be given an opportunity to present a case to the Diving Safety Officer and/or Diving Control Board.

14. RE-OBTAINING A DIVING AUTHORIZATION

14.1 Revoked Authorizations

If a diver's authorization certificate is revoked, he/she may be re-certified after complying with such conditions as the Diving Control Board or Diving Safety Officer may impose.

14.2 Expired Authorizations

If a diver's authorization certificate expires, he/she may be re-certified after complying with such conditions as the Diving Control Board or Diving Safety Officer may impose.

15. EQUIPMENT

15.1 General State of Equipment

All diving and snorkeling equipment must be of a standard, and in a state, acceptable to the Diving Safety Officer and Diving Control Board. Inspections and servicing must be done by an agency acceptable to the Diving Safety Officer or Diving Control Board.

15.2 Use of Diving Equipment

All diving equipment must be of approved design and condition. Diving and snorkeling equipment must be used and maintained in accordance with the manufacturer's recommendations. At no time shall equipment be used in modified form unless the modification has been specifically approved by, or by an agency acceptable to, the Diving Safety Officer or Diving Control Board.

15.3 Equipment Maintenance and Inspections

Inspections and servicing must be done by an agency acceptable to the Diving Safety Officer or Diving Control Board.

a) SCUBA Tanks - shall receive a visual inspection at least once a year ("Visual Plus" is recommended for aluminum SCUBA tanks and may be mandated by the Diving Safety Officer

for older Aluminum SCUBA tanks, in accordance with Luxfer and PSI guidelines). The visual inspection date must be affixed to the cylinder (an "Evidence of Inspection" sticker) and entered into the maintenance log. SCUBA tanks must be hydrostatically tested at least once every 5 years (in accordance with Canadian Transport Commission Regulations). The hydrostatic test date must be affixed to the cylinder (a testing station "stamp") and entered into the maintenance log.

Note: SCUBA cylinders should be cared for and stored in the manner recommended in CSA Standard Z 180.1-MB, Compressed Breathing Air and Systems.

b) Tank valves – shall be functionally tested at least once every 6 months or whenever a malfunction is suspected. Tank valves and burst disc assemblies shall be serviced according to manufacturers recommendations. It is recommended that burst disc assemblies be changed out every 5 years. Tank valve neck (pillar) 'o' rings should be changed out annually. Tank valve face 'o' rings should be inspected by the diver before assembling SCUBA equipment and shall be changed out whenever malfunction is suspected or signs of wear are apparent.

c) SCUBA Regulators - shall be serviced at least once every year.

d) Gauges (depth and pressure) - must have a functional check every 6 months or whenever a discrepancy is indicated. Suitable procedures for depth gauges may include any of the following: checking in water against a standard of known depth; checking in a container pressurized to a known standard; or any other suitable means approved by the manufacturer. When a discrepancy is indicated it shall be rectified without delay. If gauges and metering equipment are removed from service, such equipment shall be tagged as defective.

e) Buoyancy devices- shall receive a functional check every 6 months or whenever a malfunction is suspected.

15.4 Compressors and System Requirements

a) Compressor systems used to supply breathing air to a diver must meet the requirements of CSA Standard Z 180.1-M85, Compressed Breathing Air; and CSA Standard CAN/CSA-Z275.2-92, Occupational Safety Code for Diving Operations (see Section 15.4.1).

b) The Diving Safety Officer shall ensure that the air supplied by compressors for breathing gas media in BMSC diving operations must be tested at least annually to ensure that it meets the requirements of subsection (a).

c) All tanks, fixtures and fittings must meet the appropriate requirements of CSA Standard B51-M81, Code for the Construction and Inspection of Boilers and Pressure Vessels.

d) Compressor systems must be regularly maintained and serviced and the Diving Safety Officer shall enter this into the compressor log. The Diving Safety Officer shall ensure that the air station used to supply breathing air for BMSC diving operations is inspected annually.

15.4.1 Breathing Gas Purity

The Diving Safety Officer and Diver- In- Charge must ensure that all breathing air used in conjunction with a diving operation meets the minimum purity requirements as outlined in the CSA Z275.2-92 Occupational Safety Code for Diving Operations (with the exception of the water vapour standard, as permitted by WorkSafe BC regulations).

15.5 Equipment Requirements for SCUBA Diving

Each SCUBA diver must use all of the following equipment appropriate to the diving conditions and as specified by the Diving Safety Officer or Diver- In- Charge:
a) Open-circuit SCUBA, complete with demand (two stage) regulator and tank with quick-release harness/ Buoyancy Compensating Device (BCD);
b) Alternate air source (e.g. “octopus” or pony bottle with regulator),
c) Face mask;
d) Swimming fins;
e) Snorkel for surface swimming;
f) Weight belt with a quick release closure or weighting system with quick release;
g) Submersible pressure gauge for measuring remaining air in tank(s);
h) Exposure suit or protective clothing appropriate for the conditions of work and the temperature of the water;
i) Manually inflatable buoyancy device;
j) Elapsed-time indicator and depth gauge (or the equivalent);
k) A suitable knife
l) An underwater light when night diving
m) Each free swimming diver must carry an audible or visual locating device such as a whistle, flare, or strobe light.
n) Other equipment as may be required by the Diving Safety Officer or Diver- In- Charge.

Each SCUBA buddy team should have the following equipment;
o) Compass (at least one per buddy team);

15.5.1 Flotation Devices

All divers shall have adequate flotation gear on every dive. Typically, when using a dry suit an alternate buoyancy source (BCD) shall be worn when diving in a free swimming mode.

15.6 Digital Dive Computers

Diving computers must not be used in place of primary diving tables. Digital dive computers may be used by diver during diving operations provided:
(a) that the DCIEM dive tables are adhered to at all times;
(b) personnel using dive computers have thoroughly reviewed the manufacturer's manual and are familiar with the features and limitations of the computer.

15.7 Lifelines

When diving tethered on a lifeline, lifelines must:
(a) Be secured at the surface to a safe point of anchorage;
(b) Be tended at all times by a diver's tender;
(c) Be secured in a manner that will prevent loss of contact with the diver;
(d) Fit snugly around the diver's waist under all equipment (except exposure suite) or be securely fastened to the diver's safety harness, but not attached to the diver's weight belt;
(e) Be of sufficient length and free of knots and splices; and
(f) Have a breaking strength appropriate to the diving operation

15.8 Equipment Requirements for Snorkel Diving

Each snorkel diver shall use equipment appropriate to the conditions, as identified in Appendix XIII.

16. RECORD KEEPING

16.1 Daily Project Log (BMSC Dive Supervisors Log)

The Diving Supervisor shall keep a daily record of each dive; such record shall be separate from the Diver's Logbook and BMSC Personal Diving Log sheet. It is the responsibility of the Diver-In- Charge to ensure that the BMSC Dive Supervisors Log (Daily Project Log) sheet (Appendix V) is fully completed for each diving operation. This record must be filed with the Diving Safety Officer (for inspection) at the end of each day's diving. The Diving Safety Officer shall retain the daily records for a minimum period of 5 years.

16.2 Diver's Logbook

a) Each diver shall maintain a permanent personal logbook. Records should contain the following information (e.g. Appendix VI):
i) Diver's name;
ii) Date;
iii) Dives carried out, in chronological order;
iv) Diving mode and apparatus (if other than free swimming standard open circuit SCUBA);
v) Gas media breathed (if other than air);
vi) The time the diver left the surface and returned to the surface;
vii) Bottom time, the total dive time and any safety stops (deco stops);
viii) Maximum depth attained;
ix) Surface interval, if a repetitive dive;
x) Pressure group, if a repetitive dive;
xi) Air in/ Air out;
xii) Dive team signature(s) (Diver-In-Charge and/or Dive Supervisor);
xiii) Dive table and schedule used; and
xiv) Remarks, including purpose, location and any unusual incident or condition.

b) Divers shall keep all diving and diving -related certification cards with their logbooks, or have the Diving Safety Officer make an entry into their logbook verifying their scientific diving authorization (CAUS Scientific Diver status).

c) Divers shall have their current personal logbook at the BMSC dive locker and available for inspection.

d) Diver's shall log any medical recompressions and other exposures to a compressed air/mixed gas environment.

e) Divers are required to log all dives, including sport/recreational dives, even though such sport dives are not conducted under WCUMSS auspices

f) Divers shall retain their personal logbook for a minimum of five years after its completion.

16.3 Monthly Diving Logs (BMSC Personal Diving Log sheet)

Diver's must fill out BMSC Personal Diving Log forms (Appendix VIII) for each dive, in addition to the Diver's Logbook. Divers must submit monthly diving logs to the Diving Safety Officer. Failure to submit a monthly log may indicate there has been no diving activity.

16.4 Equipment Logs

Tanks, valves, regulators, gauges and buoyancy devices must have adequate service logs indicating the dates and results of servicing.

16.5 Training Records

The Diving Safety Officer is to maintain an individual training record for each diver including diving certifications, depth and specialty endorsements. The training record must be retained as part of the organization's diving records for at least 5 years.

16.6 Diving Project Description and Approval

All diving projects must be outlined on the Project Description and Approval Form (Appendix X) and submitted to the Diving Safety Officer for review before the beginning of any diving operations. All divers involved should have the appropriate depth and environmental certifications for the planned dives.

17. GENERAL OPERATING REGULATIONS

17.1 Diving Authorization Required

No person shall engage in diving under WCUMSS auspices unless he/she holds a valid certification/ diver status issued by the Diving Safety Officer pursuant to the provisions of this document, or is engaged in training as prescribed by this manual and the CAUS Standard of Practice.

17.1.1 Diver Category and Depth Limit

Diver categories and depth restrictions are covered in Section 11 of this manual. Diver's must consult with the Diving Safety Officer if they wish to be authorized to increase their depth certification.

17.2 General SCUBA Diving Procedures

The CAUS Standard of Practice specifies, "SCUBA diving may be performed in either a free-swimming or a tethered mode". Typically, BMSC scientific diving will be in a free-swimming mode. **All free swimming SCUBA divers shall employ the "buddy system"** and buddy groups shall be limited to a maximum of three persons; with three divers, one must be designated as the Dive Leader.

Buddy divers shall maintain effective two-way communication with each other at all times while in the water (visual and/or physical contact) and shall be in a position to render immediate assistance in case of need. Buddy divers should remain within 3-5 m of each other and must never exceed the limits of visual or physical contact. In accidental or unavoidable circumstance should they become separated, both shall execute a buddy separation procedure and then surface immediately (typically a 1minute search and then ascend). When the buddy system is employed in open water or in areas free of obstructions, where there is excessive surface current or other hazards, one of the divers should be attached to an identifiable float visually monitored from the surface. During dives of very low visibility, the divers should remain in physical contact and diving in three's should be avoided if at all possible.

Tethered diving shall only take place with the expressed permission of the Diving Safety Officer specific to the type of diving operation authorized. When SCUBA diving is accomplished in a tethered mode, the diver must be:
a) secured by a lifeline (see Section 15.7); and
b) tended by a diver's tender

Tethered SCUBA divers shall have effective two-way communication with the surface. A single tethered diver (i.e. not using the buddy system) must carry a bailout bottle (a fully redundant breathing supply); and a standby diver shall remain on the surface and be trained, equipped and

able to render immediate assistance (be able to enter the water within one minute). Typically, tethered diving shall not take place in conjunction with live-boating.

Note: WorkSafe BC diving regulations also allow for a single tethered diver to be tethered, with a minimum 10 mm (3/8 in) diameter synthetic line or equivalent, to an identifiable float located on the surface that is constantly visually monitored from a location that allows immediate assistance to be rendered in case of emergency. Under normal circumstances this mode of tethered diving shall not be used for scientific diving at the BMSC.

17.3 Diving Times

Diving is allowed at any time during daylight working hours (normally 0830 to 1630 Monday-Friday), or at other times pending the approval of the Diving Safety Officer.

18. GENERAL DIVE PROCEDURES

18.1 Planning of Diving Operation

a) A general plan of the diving operation shall be discussed in detail and accepted by the Diver-in-Charge, divers and any non-diving support personnel.

b) The plan of the diving operation shall include safety and health aspects of the following as appropriate to the conditions:
(i) Surface and underwater conditions and hazards;
(ii) Dive team assignments- Personnel assignments, task (work to be done) and purpose of the dive;
(iii) Diving equipment;
(iv) Breathing gas requirements and supply;
(v) Thermal protection;
(vi) Residual inert gas status of dive team members and repetitive dive groups;
(vii) Time limits and no-decompression limits
(viii) Dive profiles, including intended duration, maximum depth, surface intervals, contingency planning, altitude and post-dive surface intervals prior to travel by plane or on any roads exceeding 300m (1000ft) elevation.
(ix) Specific recall signals
(x) Emergency procedures including procedures that are to be followed in the event of an equipment or system malfunction.

c) A listing (including location, telephone numbers and radio frequencies, as appropriate) of locally operational recompression chambers, medical facilities and emergency evacuation agencies shall be available at the dive site (Appendix IV, Appendix III).

d) A procedure shall be established for the emergency evacuation of a diver in the event of an accident (Appendix II).

18.1.1 Air Requirements

No SCUBA diving shall be undertaken unless each diver carries a sufficient quantity of compressed air to complete the planned dive with an adequate reserve.

18.2 Emergency Services and Dive Accident Planning

The dive team (under the direction of the Diver- In- Charge) shall identify the location of the nearest emergency medical facility, emergency evacuation agencies and operational hyperbaric facility and shall make arrangements for emergency notification of and transportation to the facility in the event of an accident which warrants it.

If a diver shows signs of pressure related illness or requires therapeutic recompression, the dive team (under the direction of the Diver- In- Charge) must ensure that treatment is initiated immediately (including administering oxygen); and that the Canadian Coast Guard (or Joint Rescue Co-ordination Centre) and a physician knowledgeable in hyperbaric medicine (i.e. Vancouver General Hospital Hyperbaric Unit- on duty physician) is notified immediately. The Diving Safety Officer shall also be notified.

In case of emergency, divers and dive team members shall carry out appropriate first aid and emergency procedures in accordance with the precepts of their training.

18.3 Inspection of Equipment in Preparation for Diving

18.3.1 Diver-in-Charge

(a) Before commencing a diving operation, the Diver- In- Charge shall ensure that all diving systems and equipment used in connection with the diving operation are of an approved type and design and are in operating condition.

(b) The Diver- In- Charge shall ensure that air used in conjunction with the team's SCUBA diving activities meets CAUS minimum standards for air purity (see Section 15.4).

18.3.2 Dive Team Members (Pre-Dive Check)

Immediately before each dive, each diver shall be checked to ensure that he/she has all the required equipment (a "buddy check" overseen by the Dive Supervisor), and such equipment is properly fastened in place and all apparatus are functioning. Before decent, an equipment check shall be conducted in water.

18.4 Adherence to Planned Time/Depth Procedures

All scientific dives under WCUMSS auspices shall be planned and conducted in accordance with the No Decompression Limits of the DCIEM Diving Tables (see Section 19.3). All scientific dives under WCUMSS auspices in Barkley Sound shall be planned with the understanding that the diver will allow enough surface time for their R.F. to return to 1.0 prior to leaving the town of Bamfield by plane or vehicle due to the road elevation increasing the risk of decompression illness. The roads into and out of the BMSC have elevations exceeding 300 m (1000 ft); Port Alberni summit = 411m (1348 ft), Bamfield Main rd. ~370m (1214ft), Malahat Hwy 356 m (1168 ft). Except in the case of accident or unavoidable circumstances, a diver must not be permitted to remain at any depth longer than the maximum time planned for that depth during that dive nor shall the planned maximum depth be exceeded.

18.5 Termination of a Dive

A dive shall be terminated in accordance with the dive plan or when:
(a) The Diver- In- Charge requests termination;
(b) The Surface Safety Attendant (Dive Supervisor) requests termination;
(c) A diver requests termination;
(d) On receipt of a recall signal;
(e) A diver loses contact with (buddy separation) or fails to respond correctly to communications from a buddy team member;
(f) A diver fails to respond correctly to communications from the tender;
(g) A diver goes on diver-carried reserve breathing gas supply (the main air supply reaches a pre-determined pressure, or the diver goes on to the emergency air supply) or is low on air;
(h) A diver is aware of any sign of malfunction of gear
(i) At the onset of any signs or symptoms of physical or psychological diver distress;
(j) Any dive team member is aware of any unusual or unplanned situation that threatens the health or safety of any dive team member.
(k) In the event of excessive leakage to a dry suit

19. DIVE SITE REQUIREMENTS

The following lists personnel and equipment requirements that must always be present at the dive site for all diving activities through the BMSC:

19.1 Emergency Management System

19.1.1 Divers' First Aid Kit

a) Divers are to have at the dive site an approved first aid kit, appropriate to the location and nature of the diving operation, suitable for field use.

b) The Diver-in-Charge is to ensure, prior to commencing a diving operation, that the first aid kit is available and properly stocked with supplies, including those that may need to be added to a standard first aid kit, for diving-specific injuries or illnesses.

19.1.2 Emergency Oxygen Therapy Unit

a) Divers are to have available at the dive site an Oxygen Therapy Unit / Kit of sufficient capacity to treat divers until emergency medical facilities are reached or the arrival of emergency evacuation agencies with further oxygen supplies.

b) The Diver-in-Charge is to ensure, prior to commencing a diving operation, that the Oxygen Therapy Unit / Kit is available, is complete and in proper order, and the oxygen cylinder(s) has sufficient contents.

19.1.3 Emergency Communication System and Protocols

a) A means of providing effective voice communication with emergency assistance personnel must be available and on site while diving operations are in progress. Typically, at least one marine VHF radio shall be available; redundancy is also recommended (an additional VHF radio, and/or cellular telephone if operating in an area with cell phone coverage).

b) The Diver- In- Charge is to ensure, prior to commencing a diving operation, that voice communication devices are in good working order with sufficient battery life.

c) A listing of locally operational recompression chambers, medical facilities and emergency evacuation agencies shall be available on site, preferably included with the first aid kit or oxygen unit. This listing shall include locations, telephones numbers and radio frequencies, as appropriate.

19.1.4 Medical alert tag

A diver must wear a medical alert tag or bracelet stating the divers status and indicating the possibility of decompression sickness or other diving illness, for at least 24 hrs after completion of diving.

19.2 Entry/Egress Consideration

The Diver- In- Charge is to ensure, prior to commencing a diving operation that there is an appropriate means for entering and leaving the water, including the means for rescuing an incapacitated diver.

19.3 DCIEM Dive Tables

DCIEM (Defense and Civil Institute of Environmental Medicine) Air Diving Tables and procedures, or their equivalent, shall be followed during all diving operations- a copy of the

DCIEM tables shall be present at the dive site. Diving activity shall be restricted to diving within No Decompression Limits (NDL); the BMSC does not allow decompression diving. The BMSC recommends the use of safety stops (non-mandated stops on NDL dives to aid "off-gassing") especially on repetitive dives and dives deeper than 40ft/12m (typically, a safety stop of 3-5mins at between 20ft/6m and 10ft/3m).

19.4 BMSC Diving Safety Manual / Standard of Practice

A copy of this manual, including Protocols for Diving Emergencies, must be present at the dive site.

19.5 Identification and Signage at Dive Site

When diving operations are in progress, warning devices shall be displayed as follows:

(a) Buoys, flags, lights, lamps or other appropriate means to define the limits to be kept clear of by any equipment other than that connected with the diving operation;

(b) In navigable water, or under any circumstance in which marine traffic is probable, a diver's flag shall be prominently displayed (flown) on all dives. The Collision Regulations (International Regulations for Preventing Collisions at Sea) require all vessels engaged in diving operations to display the International Code Flag Alpha (a white and blue pennant). In the surrounding waters of Barkley Sound a red flag with a diagonal white stripe (the recognized Diver Down Flag) is also locally recognized.

19.6 Crew Requirements

19.6.1 Standby Diver(s) (Buddy Divers)

(a) A standby diver must be
(i) on the dive site and able to render assistance at all times when diving operations are in progress,
(ii) trained and equipped to operate at the depths and circumstances of the dive, and
(iii) able to enter the water in one minute.

(b) When the Diver- In- Charge can assure that the depth of the dive will not exceed 18m/60ft and no hazards are present, 2 divers in the water (a diving buddy pair) act as in-water standby for each other provided that
(i) divers are free swimming,
(ii) the no-decompression limit is not exceeded,
(iii) each diver has been trained to effectively rescue a diver in trouble and has demonstrated this ability,
(iv) the divers are in close proximity to each other at all times so as to be able to effect rescue, and

(v) the divers are in constant communication with each other (they maintain constant physical or visual contact with each other).

(c) In subsection (b) "no hazards are present" includes but is not limited to a dive made in good weather conditions, where there are no appreciable currents, where there is satisfactory underwater visibility, no possibility of entanglement with underwater objects, and good access and egress to and from the dive site.

19.6.2 Situations Requiring an Additional Standby Diver

An additional standby diver (remaining on the surface) must be present at the dive site during SCUBA diving operations as follows:
(1) Where there is a chance of diver entanglement or entrapment,
(2) Where there are special hazards,
(3) Where required by the Diving Control Board, Diving Safety Officer, or Diver- In- Charge.

For roles and responsibilities of the additional standby diver, refer to Section 9.6.1 and consult with the BMSC Diving Safety Officer. An additional standby diver must not dive or be required to dive except in the event of an emergency.

The additional standby diver should be equipped with a bail out bottle (redundant air source) and a standby diver's lifeline if appropriate for the diving conditions.

A Stand-by Diver must not dive or be required to dive except in the event of an emergency.

19.6.3 Surface Safety Attendant (Diving Supervisor)

A Surface Safety Attendant (Diving Supervisor) shall be present on the surface at the dive site during diving operations. For qualifications, roles and responsibilities of the Surface Safety Attendant see Sections 8.4, 11.8 and 11.9.

19.6.4 Diver- In- Charge (Senior Diving Supervisor)

A Diver- In- Charge (Senior Diving Supervisor) shall be appointed and present at the dive site during diving operations. For qualifications, roles and responsibilities of the Diver- In- Charge see Sections 8.4 and 11.8.

19.6.5 Minimum Crew Required

(a) A minimum crew of three must be present on each dive site: 2 divers (typically a diving buddy pair), and 1 Surface Safety Attendant (Diving Supervisor). One member of this team must be designated as the Diver- In- Charge (Senior Diving Supervisor).

(b) An additional standby diver may be required, as in the circumstances outlined in Section 19.6.2. When an addition standby diver is required then a minimum crew of four is required: 2 divers (a buddy pair), 1 additional standby diver (on the surface), and 1 Surface Safety Attendant

(Diving Supervisor). One member of this team must be designated as the Diver- In- Charge (Senior Diving Supervisor).

19.6.6 Additional Equipment

(a) In the interests of health and safety the Diving Safety Officer may mandate the use of any additional equipment for a diving operation (e.g. shotlines, reference lines, buoys, safety lines).

(b) One complete assembled ("ready to go") spare SCUBA set must be at the dive site if a risk of entrapment is present; and may be mandated by the Diver- In- Charge or Diving Safety Officer for other dives where known hazards or risks exist.

20. SCIENTIFIC DIVING TECHNIQUES

Scientific Project Leaders and Divers- In- Charge must ensure that divers who are to perform specialized scientific tasks underwater are properly instructed, trained and equipped to conduct these tasks in a safe manner. Specialized scientific divers training may include but not limited to:

(a) transects and quadrates;
(b) photography/video;
(c) specimen collecting;
(d) small object recovery (using lift bags);
(e) surveying and mapping.

Attention shall be given to the development of proficiency under the specific environmental conditions under which the diver is expected to work effectively.

21. AUTHORIZED DIVING MODES AND CIRCUMSTANCES REQUIRING SPECIAL APPROVAL

Only SCUBA diving and snorkel diving are currently authorized within the BMSC Scientific Diving Program.

21.1 SCUBA Diving

SCUBA diving activities, as approved under this manual, includes scientific diving activities in which:
a) Divers use Self-contained Underwater Breathing Apparatus in an open circuit mode.
b) Divers use (standard) air as the breathing gas.
c) Diving is typically accomplished in a free-swimming mode.
d) Diving is within DCIEM No Decompression Limits.
e) Divers may only utilize dive modes and equipment for which they have authorization.
f) Divers are authorized to dive in environments or conditions that are the same as, or similar to, those in which they were trained, and to which they are accustomed.

21.2 Snorkel Diving

Snorkel diving, as approved under this manual, includes activities as outlined in Appendix XIII

21.3 BMSC SCUBA Dives Requiring Special Approval

Dives under any of the following circumstances require expressed permission of the Diving Safety Officer:
a) Dives in excess of 18m/60ft.
b) Repetitive dives (DCIEM Repetitive Factor, RF >1).
c) Night dives.
d) Dives in adverse geological, environmental or weather conditions (e.g. current/surge diving).
e) Dives in or around caves, wrecks or overhead environments.
f) Dives outside the immediate BMSC area, as indicated by the boating boundary area on the BMSC sail plan.
g) Blue-water (no bottom) diving.
h) Diving in zero and very low visibility areas.
i) Use of non-standard or potentially dangerous SCUBA or scientific equipment, including full-face masks and voice communication devices.
j) Use of underwater power tools.
k) Snorkel dives following SCUBA diving.
l) Tethered dives.
m) Kelp bed diving
n) Dives where a known possible hazard exists, such as confined areas, or when there is a potential for entrapment or entanglement (e.g. diving in the vicinity of nets or cages).

Permission is not automatically granted and may be denied. Special approval dives may require training, certification, operating expertise and operational criteria beyond the general requirements of this manual. The Diving Safety Officer reserves the right to consult with the Diving Control Board, CAUS and/or WCB for any additional criteria and approval.

No surface supply diving operation shall be permitted.

21.4 Mixed Gas Diving:

21.4.1 Nitrox

Nitrox is recognized by CAUS as an acceptable breathing gas for diving. All divers wishing to use Nitrox up to 40% Oxygen must submit a written request to the DSO. This request must include the reason for wanting to use mixed gasses, and a description of the intended dive plan and gas mixes.

Prior to approval for mixed gas usage, the diver must demonstrate competency in Mixed gas diving by showing a current occupational mixed gas diver certification and by passing the CAUS Nitrox exam.

21.4.2 Other Gas Mixes

Divers wishing to use gas mixes other than Nitrox or at a greater Oxygen concentration than 40% must submit a written proposal to the DSO and demonstrate competency with a current, relevant mixed gas diving certification. BMSC may not be able to supply additional gases for mixing.

21.5 CAUS Recognized Special Dive Modes and Conditions

The CAUS recognizes a number of special conditions including:
(i) Diving under ice,
(ii) Altitude diving,
(iii) Deep diving,
(iv) Diving in zero visibility,
(v) Diving in contaminated water,
(vi) Night diving,
(vii) Diving in caves, shipwrecks, pipes, tunnels or other enclosed spaces,
(viii) Blue water diving (no bottom),
(ix) Decompression diving,
(x) Diving in currents;
And special diving modes including:
(i) Nitrox or other mixed gas diving (includes use of oxygen),
(ii) Saturation diving,
(iii) Habitats,
(iv) Bells (open and closed),
(v) Chamber diving,
(vi) Submersible vehicles (includes atmospheric diving systems),
(vii) Diver lock-out vehicles,
(viii) Rebreathing apparatus (closed and semi-closed circuit).

Typically, most of these activities are beyond the scope of the BMSC Scientific Diving Program. Personnel who have an operational need to utilize special diving modes and equipment are required to obtain written permission from the Diving Safety Officer and/or Diving Control Board. The request should be made in writing to the Diving Safety Officer describing the rationale and purpose of the proposed diving. The Diving Safety Officer and/ or Diving Control Board will take into consideration safety, statutory regulation and practicality in reviewing the request. It is the responsibility of the Diving Safety Officer to consult acceptable authorities and texts in considering the application and reviewing operation criteria; and to ascertain whether approval is also required from other authorities (e.g. CAUS, WorkSafe BC). In all cases, the special modes and equipment listed above require additional training, certification, operating expertise and operational criteria beyond the general requirements already stated in this manual.

22. INCIDENT AND ACCIDENT REPORTS

22.1 Duties of the Diver-in-Charge

The Diver- In- Charge must notify the Scientific Project Leader and the Diving Safety Officer as soon as possible after the occurrence of any accident or incident involving the health and safety of diving personnel. A written report of the accident or incident must be completed and submitted to the Diving Safety Officer within 48 hours of the occurrence.

22.2 Scope of Report

Accidents and incidents warranting reporting are:
(a) Death;
(b) Injury, including squeezes, laceration and fractures;
(c) Convulsions or serious impairment of consciousness during or after a dive;
(d) Decompression illness (DCI)/ Decompression sickness (DCS);
(e) Lung over-pressurization including arterial gas embolism, pneumothorax, subcutaneous emphysema or mediastinal emphysema;
(f) Any serious illness or injury which results from a diving operation;
(g) Any serious mishap (entrapment, entanglement, etc.), even though the dive team member escapes actual injury, or any series of incidents prior to, during or after a diving operation which make approved procedures or equipment suspect; and
(h) Any serious mishap or series of incidents which threaten the integrity of the environment or the general health and safety of personnel.

22.3 Content of Report

The facts must be established with care and recorded as soon after the accident or incident as possible. The report must include the following information:
(a) The place, date and time of the accident or incident;
(b) The duties of persons involved, including any injured;
(c) A detailed description of the accident or incident including the dive profile (as appropriate) and all relevant details, however remote;
(d) A statement of the sequence of events which preceded the accident or incident;
(e) Identification of any unsafe conditions, acts or procedures which contributed in any manner to the accident or incident; and
(f) Any further comments including (as appropriate) any corrective actions which might prevent similar accidents or incidents.

22.4 Disposition of Records

Copies of the report shall be kept on file by the member organization for a period of 5 years. The Diving Safety Officer must forward a copy of the report to the President of CAUS and to WorkSafe BC if a worker is involved.

22.5 Equipment

In the event of a diving accident all equipment related to the incident must be isolated for subsequent investigation. The BMSC reserves the right to take temporary possession of any equipment needed for subsequent investigation.

APPENDIX I

A CAUTIONARY NOTE

The Barkley Sound region, and the Bamfield Marine Sciences area in particular, contain many interesting and unique subtidal environments. The geographical features that combine to produce these unique habitats can also combine to create conditions that can be hazardous to unaware divers.

Rapid, sometimes unpredictable, and sometimes violent weather changes are common, particularly in winter. Storms some distance offshore, or onshore winds can generate rapid increases in wave height or swells causing surge and strong currents. Depending on local topography, these effects can cause problems for divers in depths exceeding 20 m, as well as in the shallower surge zones. Additionally, transit conditions to and from dive sites in a heavily laden boat can become hazardous.

The Barkley Sound region is sparsely populated and dive sites some distance from the BMSC can be in areas with little boat traffic and no potential on-shore assistance. Furthermore, transportation to a recompression chamber will take at least several hours. Consequently, diving activities are restricted to areas close to the BMSC and decompression diving is not allowed. Diving activities outside of these geographical areas may be given special approval, but generally require special equipment, such as additional radios, or training. It is the responsibility of the researcher to provide such additional equipment.

Because of potentially rough water conditions, diving activities are permitted only from boats that have good stability characteristics and reserve floatation such as Boston Whalers and some inflatable boats. Other craft should be used for diving activities only with the expressed approval of the Boat and Diving Coordinator, and then only in sheltered areas.

Divers are encouraged to be cautious, and should be aware that under certain weather conditions, boats should not be taken outside Bamfield or Grappler Inlets. Weather conditions periodically render diving in even the most sheltered areas dangerous. Divers should be aware of this and should be prepared to abort or cancel dives if conditions are threatening.

Dense fogs, particularly in mid-summer, are common and divers and their boat tenders should plan accordingly. Navigation in a small, open boat laden with ferrous metals using a diver's compass can be an uncertain procedure, at best. Appropriate bearings and shoreline landmarks should be noted for the return trip from all dive sites.

Finally, during fishing season, small boat traffic may be effectively impossible in areas where fishing boats operate. Boat tenders and divers must take special care to avoid nets and fishing craft. During some fishing periods, various dive sites will be effectively inaccessible. Divers should check with the Diving Safety Officer or other appropriate BMSC staff and be aware of these and other potential problems.

APPENDIX II

BMSC Diving Accident Procedures

If you suspect a diver is suffering from Decompression Illness (air embolism or decompression sickness)/ compressed gas injury you should do the following:
Step 1: Conduct Primary Survey- Airway Breathing Circulation. Administer assisted ventilation (rescue breaths) or CPR if required. Keep airway open and prevent aspiration of vomitus.

Step 2: Notify Canadian Coast Guard on VHF Ch 16, use a MAYDAY (life threatening) or PAN PAN (urgent) call.

****Inform them you have a diving accident****

Request immediate assistance from Bamfield Coast Guard and inform them a hyperbaric medicine specialist (Vancouver General Hospital Hyperbaric Unit on-duty physician) must be contacted immediately. Ask them to notify Bamfield Red Cross Outpost Hospital and BMSC Diving Safety Officer.
Step 3: Administer Oxygen and place injured diver in appropriate position:

- Unconscious & breathing= recovery position (on side)
- Unconscious & non-breathing= supine (on back)- administer breaths or CPR as appropriate
- Conscious & breathing= preferably in recovery position (on side)

Do not remove Oxygen except to clear patient's airway
Step 4: Protect injured diver from excessive heat, cold, wetness or noxious fumes
Step 5: Await Coast Guard instructions

Note: If unable to make radio contact carry out the above first aid and transport injured diver to Bamfield Coast Guard Station, Bamfield Red Cross Outpost Hospital or BMSC as soon as possible.

The following information should be gathered as soon as practical:

- Name and Age of injured diver
- Max depth attained
- Bottom time and total dive time
- Circumstances leading to accident

The injured diver's equipment should be isolated and turned over to the Diving Safety Officer for investigation.

APPENDIX III

USEFUL CONTACTS

Canadian Coast Guard Distress & Calling	VHF 16
Bamfield Coast Guard Station	250-728-3322
Canadian Coast Guard Non-emergency	VHF 22A
Bamfield Marine Sciences Centre	VHF 09 Ph: 250-728-3301
Joint Rescue Coordination Centre	1-800-567-5111
Bamfield Red Cross Outpost Hospital	VHF 82 Ph: 250-728-3312
BC Ambulance 911	Remote Loc 1-800-461-9911
Vancouver General Hospital (VGH)	604-875-4111
VGH Hyperbaric Unit	604-875-4033
VGH Emergency Medical Secretary	604-875-4700
Hyperbaric specialist (24hrs)	604-325-8111 or 8011
Fleet Diving Unit	250-363-2379
Port Alberni General Hospital	250-723-2135
Diver's Alert Network (DAN) 24hr emergency	919-684-8111 or 4326 (collect)

APPENDIX IV

LIST OF RECOMPRESSION CHAMBERS

BRITISH COLUMBIA

****Vancouver General Hospital** (604) 875-4111**
VGH Hyperbaric Unit (604) 875-4033
VGH Emergency Medical Secretary (604) 875-4700
Vancouver

Fleet Diving Unit (250) 363-2379
Esquimalt (Victoria)

Can-Dive Marine Services Ltd. (604) 984-9131
Vancouver (604) 988-3029

WASHINGTON

****Virginia Mason Medical Center**(206) 624-1144**
Hyperbaric Dept. (206) 583-6543
24 hr Emergency line (206) 583-6433
Seattle

Diver's Institute of Technology (206) 783-5542 or 5543
Seattle (206) 784-7982

St. Joseph's Medical Centre
Hyperbaric Medical Service (253) 426-6630
24 hr Emergency line (253) 426-6630
Tacoma

USAF Regional Hospital (509) 247-5406
Fairchild AFB Spokane (after 4:30 p.m.) (509) 247-5661

US Naval Torpedo Station (206) 396-2522/ (360) 396-2522
Keyport (206) 296-5153

Institute of Applied Physiology and Medicine (206) 442-7330
Seattle (206) 784- 7982

OREGON

****Providence Hospital** (503) 230-6061**
Portland

ALASKA

Bartlett Memorial Hospital	(907) 586-2611
Juneau	(907) 586-1895
Ketchikan General Hospital	(907) 225-5171
Ketchikan	(907) 225-5144
Marteck International	(907) 277-2478
Anchorage	(907) 243-2529

Additional Assistance

•Diver's Alert Network (DAN) 24hr emergency 919-684-8111 or 4326 (collect)

****NOTE**: THESE ARE PRIMARY SITES OF MEDICAL TREATMENT FOR DECOMPRESSION ILLNESS.**

PLEASE ENSURE THAT DIRECTORY ASSISTANCE IS CONTACTED FOR CURRENT PHONE NUMBER(S) BEFORE DIVING OPERATIONS COMMENCE.

APPENDIX V

BMSC Dive Roster (Daily Project Log)

Date:	Tables Used:	Vessel:	Dive Location(s):
Senior Diving Supervisor/ Diver-in-Charge:			Boat tender, Surface Safety Attendent/Diver:
Divers:			Other Persons involved (state duties):
Scientific Project Leader/Account:			
Type of Dive (please circle): Research Collection Training Other (state nature)			

Notes: successful or not, observations, environmental conditions, type of breathing gas used if other than SCUBA Air, Any change in equipment or needs.
Particulars of any Equipment faults, Incidents, Dive related illness or injury, Any other Medical Problems and or Emergency;
Action taken (continue on separate sheet as necessary and attach)

Details of Dive #1

Dive Plan and verification of Predive Briefing_____ and Buddy check_____:

Planned Depth_____ Planned Total Dive Time _____

Diver's Name	Left Surface	Arrived Surface	Max Depth (ft / m)	Bottom Time (in min.)	Deco (min @ ft)	Total Dive Time (Incl. Deco.)	SI prior to dive (If Repetitive)	Air In (PSI / Bar)	Air Out (PSI / Bar)

Diving Supervisors: Signature..... Print.....

Details of Dive #2

Dive Plan and verification of Predive Briefing_____ and Buddy check_____:

Planned Depth_____ Planned Total Dive Time _____

Diver's Name	Left Surface	Arrived Surface	Max Depth (ft / m)	Bottom Time (in min.)	Deco (min @ ft)	Total Dive Time (Incl. Deco.)	SI prior to dive (If Repetitive)	Air In (PSI / Bar)	Air Out (PSI / Bar)

Diving Supervisors: Signature..... Print.....

Coast Guard / Distress & Calling VHF 16
Bamfield Marine Sciences Centre VHF 09
Coast Guard Non-Emergency VHF 22A
Bamfield Red Cross Outpost Hospital VHF 82

BC Ambulance 911 or Remote Loc	1 800 461 9911
Red Cross Outpost Hospital	250 728 3312
Port Alberni General Hospital	250 723 2135
Vancouver Hyperbaric Unit	604 875 4033
24 hr Hyperbaric Specialist Dr. Lepawsky	604 325 8111 or 604 325 8011

APPENDIX VI

Sample Diver's Personal Logbook Page

Record of Dive

Project:					**Date:**				**Tables Used:**		
Location:					**Site/Vessel:**						
Diver-In-Charge (Senior Supervisor) **:					**Surface Safety Attendant (Dive Supervisor)**:**						
Dive Buddy/ Buddies & Dive Leader (DL):					**Scientific Project Leader/Co-ordinator:**						
Weather:					**Air Temp:**				**Sea Temp:**		
Tide:		**Sea Height:**			**Current:**				**UW Visibility:**		
Dive N°	**Left Surface**	**Max. Depth (ft/m)**	**Bottom Time**	**Deco-Safe Stops**	**Arrive Surface**	**Total Dive Time**	**Pressure Grp. (*) In**	**Out**	**Air In**	**Out**	**SI prior to dive (*if repetitive)**

Diver's Signature:…….. **Verification Signature(s):…….

Verification by Dive Officer (Signature/Date):…….. Accumulated UW Time:……..……...

Remarks/Observations

(Nature of dive, purpose, team members, specialist equipment used, additional personnel and an account of activities carried out can be noted. Details of incidents, dive related illness or injury, or any factor relevant to health and safety. Mode of diving if other than standard SCUBA, and breathing gas media if other than air must be recorded).

APPENDIX VII

Sample Scientific Diver Personal Dive Log

Divers Name:

BMSC Scientific Diver Personal Dive Log

Date & Dive #	Left Surface @	Arrived Surface @	Max Depth (ft/m)	Bottom Time (min.)	Deco Stop (min @ ft)	Total Dive Time (incl. Deco)	Surface Interval prior to dive if repetetive	Air In/ Air Out	Dive Leader & Buddy	Dive Tender & Project Leader	Purpose of Dive Training, Research, Collection, Other-specify	Comments: Location, Vessel, Environmental conditio Breathing gas if other than air, Any chan to equipment, Was Specialist equipment
											T R C	
#											O	
											T R C	
#											O	
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Accumulated Underwater Time in Minutes: ____________

Additional Remarks/Observations:

APPENDIX VIII

Sample Diver Waiver- NOT FOR USE- current waivers can be found on the BMSC Website and are available from the BMSC DSO

BAMFIELD
MARINE
SCIENCES
CENTRE

Scientific SCUBA Diver Liability Waiver

In consideration of WCUMSS permitting me to use its diving equipment and facilities, I _____, on behalf of myself, my executors, administrators, heirs and assigns, do hereby release and discharge WCUMSS, the Universities, their employees and agents from all claims and demands that, my executors, administrators, heirs and assigns may have for any injury, including that resulting in death, however caused, sustained by me or suffered by me while using the said diving equipment and facilities including - but without limiting the generality of the foregoing - injury sustained by me by reason of negligence of WCUMSS, the Universities, their employees and agents. I hereby confirm the I have been provided with an opportunity to read the WCUMSS regulations relating to diving, and recognize that it is my responsibility to maintain safety in my diving activities.

Signature: _____

Date: _____

APPENDIX IX

Sample Only -NOT FOR USE- current forms can be found on the BMSC Website and are available from the BMSC DSO

Scientific SCUBA Diver Clearance Form

APPLICANT

Name: Last- First-

Mail address: street/city

Country/postal/zip

Phone and fax numbers: Phone- Fax-

Email:

Height: Weight:

Sex: Age:

BMSC Status: Staff Researcher Student Other?

Emergency Contact:

Relationship:

Phone:

Mail address: street/city

Country/postal/zip

Diving Experience

Certifying Organization: Number Date

Highest diving certification held: Number Date

Date of last dive:

Dives within last 12 months: Total number of dives:

Number of ocean dives: Number of coldwater dives:

Approx. Number or dives at 0-30 feet: 30-60 feet:

60-100feet: Deeper than 100 feet:

Geographical location of most diving:

List any First Aid, Life Saving or Diving Specialty courses that you have successfully completed:

The above accurately summarizes my diving experience

Signature: Date:

APPENDIX X

Sample Project Proposal Form -NOT FOR USE- current Forms can be found on the BMSC Website and are available from the BMSC DSO

Bamfield Marine Sciences Centre Diving Project Proposal

BMSC scientific diving activities are primarily governed by the Canadian Association for Underwater Science (CAUS) Standard of Practice for Scientific Diving as (exempted by the Canadian Standards Agency, CSA Standards Z275.2 and Z275.4) and additionally (where appropriate) the WCB Occupational Health and Safety Regulations, Part 24: Diving (and Guideline 24.13-1 Evidence of competency for scientific divers). It is the responsibility of individual divers, to know and observe BMSC Diving Regulations and other relevant regulatory requirements, including the CAUS Standard of Practice. The BMSC Director and his/her designate (including the Diving Control Board and the Diving Safety Officer) may at anytime refuse an individual diver use of the BMSC diving equipment and facilities for failure to observe BMSC regulations.

(Please print legibly)

Principle Investigator (s)_____

Commencement Date: _____ Finishing Date:_____

Purpose of diving activity:_____
_____
_____
_____

The plan of the diving operation shall include safety and health aspects of the following as appropriate to the conditions:

Dive sites (indicate on chart) list Lats and Longs:_____
_____

# of Dives: _____
Maximum Depth:_____

Dive Team Assignments and Divers:_____
_____
_____
_____
_____
_____

Will the project involve: Y/N If 'Yes' how many?

- Dives deeper than 40 ft? _____ _____
- Dives deeper than 60 ft? _____ _____
- Repetitive dives? _____ _____
- Diving in confined spaces? _____ _____
- Diving in overhead environments _____ _____
- Diving at altitude _____ _____
  -If yes Altitude corrections_____

Expected surface and underwater conditions and hazards:_____

Diving equipment and scientific tools:_____

Breathing gas requirements :_____

Thermal protection/exposure suit:_____

Dive profiles:_____

DCIEM (Defense and Civil Institute of Environmental Medicine) Air Diving Tables and procedures, or their equivalent, shall be followed during all diving operations- a copy of the DCIEM tables shall be present at the dive site. Diving activity shall be restricted to diving within No Decompression Limits (NDL); the BMSC does not allow decompression diving. The BMSC recommends the use of safety stops (non-mandated stops on NDL dives to aid "off-gassing") especially on repetitive dives and dives deeper than 40ft/12m (typically, a safety stop of 3-5mins at between 20ft/6m and 10ft/3m).

Diving computers must not be used in place of primary diving tables. Digital dive computers may be used by diver during diving operations provided: that the DCIEM dive tables are adhered to at all times

Outline possible risks and how you plan to minimize risks: _____

Will Boats be used as a dive platform? Will you need the use of BMSC boats? List required/desired vessel. Will you be using a non BMSC boat? List type of vessel. List Principle boat operator and operator's certification.

Emergency procedures including procedures that are to be followed in the event of an equipment or system malfunction:

Notes:

Signature: Date:

Approval of Project (Staff use only)

University Program Coordinator
(student projects only)

Research Coordinator
as member of BMSC Diving Safety
committee/diving control board

Diving and Safety Officer

BMSC Director

APPENDIX XI

Sample BMSC Student - Scientific Diver-in-training Medical Form Only -NOT FOR USE- current forms will be provided to student D-I-Ts and diving physicians by the BMSC DSO

SCUBA Diver Medical Examination Form

All applicants wishing to undertake SCUBA Diving are required to submit a completed medical form signed by their physician. Please arrange for an appointment for a medical examination with your physician and present this form at that time.

Part I Diver Medical History (to be completed by applicant)

Name: Last- First-

Mail address: street/city

Country/postal/zip

Phone and fax numbers: Phone- Fax-

Date of Birth:

Height: Weight:

Sex: Age:

Eye Color: Hair Color:

University Supervisor:

Please check all that apply:

- ☐ Persistent headaches
- ☐ Persistent coughs
- ☐ Severe/frequent colds
- ☐ Dizziness or fainting
- ☐ Emotional problems
- ☐ Alcoholic beverages
- ☐ High blood pressure
- ☐ Hospitalized
- ☐ Allergies to drugs
- ☐ Regular medication
- ☐ Chest pains
- ☐ Heart trouble
- ☐ Claustrophobia
- ☐ Tuberculosis
- ☐ Operation
- ☐ Epilepsy
- ☐ Glasses/contacts
- ☐ Sinus trouble
- ☐ Ear trouble
- ☐ Hay Fever
- ☐ Asthma
- ☐ Serious injury
- ☐ Motion sickness
- ☐ Pneumothorax
- ☐ Dentures
- ☐ Smoking
- ☐ Pregnant
- ☐ Diabetes
- ☐ Tranquilizers

If you checked any of the above, please explain:

Any serious injury, accident, or illness not mentioned above, explain:

Date of last chest x-ray:

Result:

Emergency Contact: Last- First-

Relationship:

Mail address: street/city

Country/postal/zip

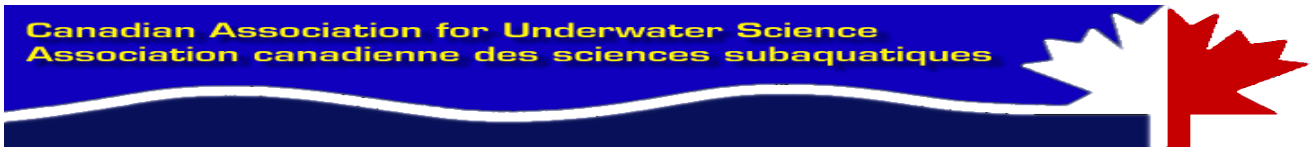
Phone:

Applicant's Signature: Date:

Appendix XII

Sample BMSC/CAUS Reciprocity Form-NOT FOR USE_ BMSC DSO will provide a divers status summary/LOR upon request

bmsc BAMFIELD MARINE SCIENCES CENTRE



BMSC
CAUS Request for Diver Reciprocity

Diver:_____Date:
_____

Institutional Member:_____

This letter verifies that the above person has met the training and pre-requisites as indicated below,
as described in both the CAUS *Standard for Scientific Diving Safety* and the *Bamfield Marine Sciences Centre scientific diving policy and safety manual* and has demonstrated competency in the indicated areas.

Diving Status:
☐ Expired/ Inactive ☐ Diver-In-Training ☐ Scientific 1 ☐ Scientific 2

Depth Restriction:
40ft/12m 60ft/18m 80ft/24m 100ft/30m 120ft/36m Other-
_____

Supervising Status: Inactive Active-60ft/18m Active-_____

Required training/qualifications:

Item	Date	Expiry	Comments
BMSC Waiver signed and Policy read	_____	_____	_____
BMSC Diver Clearance Form Completed	_____	_____	_____
First Aid Certification and Agency	_____	_____	_____

Oxygen Administration and agency (2 yr)	_____	_____	_____
CAUS Diving Theory Exam	_____	_____	_____
BMSC Scientific Diving Written Exam	_____	_____	_____
Equipment Service (1 yr)	_____	_____	_____
Last Diving Skills Evaluation (1 yr)	_____	_____	_____
Diver Rescue and Accident Management (1yr)	_____	_____	_____
Boat check-out and conducted by	_____	_____	_____
No. of dives in last 12 months	_____	_____	_____
Swimming/ Watermanship	_____	_____	_____

Dive experience: Please list the number of dives in the following modes/environments:

Environment		**Equipment /Modes**	
Deep (>66 ft/20m)	_____	Full-Face Mask	_____
Current	_____	Enriched Air/Mixed gas	_____
Swell	_____	Drysuit	_____
Blue Water	_____	Weight integrated	_____
Cold (>10 C)	_____	Tank	_____
Ice/overhead	_____		
Boat dives	_____		
Night dives	_____		

Comments/ special endorsements/ restrictions:

Diving and Safety Officer: Siobhan Gray _____
Date:_____ diving@bms.bc.ca v. 250 728 3301 x 222 f. 250 728 3452

Western Canadian Universities Marine Sciences Society

University of ALBERTA Edmonton, Alberta | University of BRITISH COLUMBIA Vancouver, British Columbia | University of CALGARY Calgary, Alberta | SIMON FRASER University Burnaby, British Columbia | University of VICTORIA Victoria, British Columbia

Appendix XIII
BMSC Snorkel/ Skin Diving Policy Guide

Policy: The intent of this Guide is to maximize snorkel/ skin diver safety. WCUMSS, the BMSC, its officers or appointees shall not be liable for any injury (fatal or otherwise) loss or damage sustained either directly or indirectly through the use of this Guide, including injury, loss or damage resulting from negligence.
All participants in snorkel/ skin diving activities (both surface support and snorkel/ skin divers) do so on a voluntary basis and shall assume all risks, consequences and potential liability for his/her own actions.

Candidates must complete:

1. Applicant portion of medical form completed by snorkel/ skin diver.
2. Waiver, clearance and project proposal forms completed by the applicant.
3. Current First Aid and CPR certification required by the surface safety attendant (boat tender or shore watch). If two snorkel/ skin divers have these certificates the surface safety attendant is not required to.

Required Equipment:

 Personal equipment must be supplied by each individual Snorkel/ skin diver.
 Exposure suit and fins must be used.
 The snorkel/ skin diver must be able to maintain buoyancy at the surface with minimal effort. If
weights are used then the weighting system must be capable of quick release and the snorkel/
skin diver must be positively buoyant when at the surface. Flotation jackets are recommended.
 BMSC will provide a dive flag to be displayed at all times snorkeling is going on, including when
snorkel/ skin diving takes place from shore.
 BMSC will provide a safety kit (including a first aid kit) to be taken along on all dives.

Snorkel/Skin Diving Protocol:

 Must have a surface safety attendant on the boat (boat tender), or shore (shore watch).
 Minimum team size of three people: two snorkel/ skin divers and a surface safety attendant.
 All snorkel/ skin diving in Bamfield and Grappler Inlets should be from shore and avoid areas of
boat traffic.
 Snorkel/ skin diver should stay within 15 metres/ 50 feet of dive flag and surface safety attendant.

 Snorkel/ skin divers should adhere to the buddy system. On the surface divers should remain
within 5 metres/ 15 feet of their buddy. When making surface dives and swimming underwater
divers should adopt “one-up”, “one-down” (buddies alternate).
 Applicants requiring training in snorkel/ skin diving techniques and/or applicants with weak
swimming abilities should make this apparent to the Scientific Diving Coordinator.
 Hyperventilation prior to breath hold diving is a dangerous practice and is not permitted.

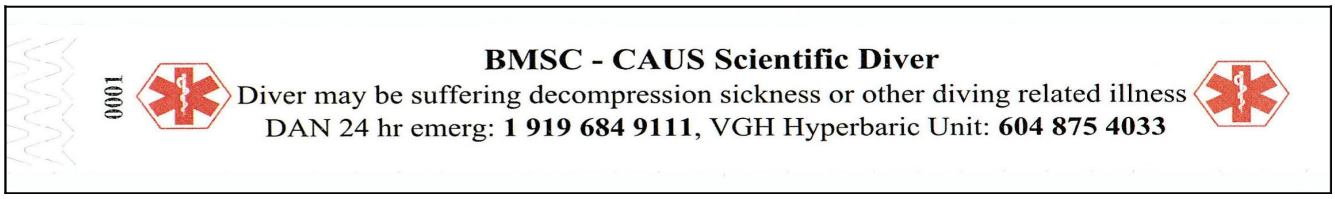
Special Approval may be needed:

The following dives require the expressed prior approval from the Scientific Diving Coordinator (this list is not designed to be exhaustive and it is the diver’s responsibility to consult the Scientific Diving Coordinator should it be unclear as to whether an activity is cause for concern):

 Snorkel/ skin dives that do not adhere to this policy guide.
 After hours dives.
 Snorkel/ skin diving between sunset and sunrise.
 Dives along the shoreline and foreshore of BMSC property.
 Hazardous conditions.
 Exposed areas.
 Currents and waves.
 Confined areas and inside caverns.
 Risk of entanglement.
 Increased boat traffic.
 Adverse weather conditions.
 Outside of BMSC boundary area indicated on sail plans.
 Boat diving in the inlets.
 Snorkel/ skin diving following dives breathing compressed gas (SCUBA dives).
 Breath hold dives deeper than 5m/ 15 feet.

APPENDIX XIV

Diver Medical Alert Bracelet



WorkSafe BC Regulation Part 24: Diving, Fishing and Other Marine Operations

24.24 Medical alert tag

A diver must wear a medical alert tag or bracelet stating the diver's status and indicating the possibility of decompression sickness or other illness, for at least 24 hours after completion of diving.

Phone Numbers Included:

DAN 24 hr emerg: 1 919 684 9111

When you call the DAN Emergency Hotline:

- Your call will be answered by a live person. Give that person a brief description of your emergency, and your call will be routed to the resource best qualified to assist you.
- DAN's medical staff may make an immediate recommendation or request to call you back after making arrangements with any number of DAN's resources.
- If a call-back is necessary, please wait by the phone while arrangements are made. The resources may take 30 minutes or more to coordinate, as several pieces and calls may be required.

VGH Hyperbaric Unit: 604 875 4033

When you call the VGH (Vancouver General Hospital) Hyperbaric Unit:

- Monday-Friday 0800-1600 your call will be answered by a live person.
- After hours, Saturday-Sunday and holidays, the call will go to the answering machine. The message will direct you to call the VGH switch board (604 875 4111) and request the hyperbaric physician on call be paged.

APPENDIX XV

Dive Tending Guide

Contents

– A Cautionary Note

The Barkley Sound region, and the Bamfield Marine Sciences Center area in particular, contain many interesting and unique subtidal environments. The geographical features that combine to produce these unique habitats can also combine to create conditions that can be hazardous to unaware divers.

Rapid, sometimes unpredictable, and sometimes violent weather changes are common, particularly in winter. Storms some distance offshore, or onshore winds can generate rapid increases in wave height or swells causing surge and strong currents. Depending on local topography, these effects can cause problems for divers in depths exceeding 20 m, as well as in the shallower surge zones. Additionally, transit conditions to and from dive sites in a heavily laden boat can become hazardous.

The Barkley Sound region is sparsely populated and dive sites some distance from the BMSC can be in areas with little boat traffic and no potential on-shore assistance. Current estimates for transportation to a recompression chamber is approximately 3-4.5 hours; Consequently, diving activities are restricted to areas close to the BMSC and decompression diving is not allowed. Diving activities outside of these geographical areas may be given special approval, but generally require special equipment, such as additional radios, or training. It is the responsibility of the researcher or diving group to provide such additional equipment.

Because of potentially rough water conditions, diving activities are permitted only from boats that have good stability characteristics and reserve floatation such as Boston Whalers and some inflatable boats. Other craft should be used for diving activities only with the expressed approval of the Diving and Safety officer, and then only in sheltered areas.

Divers are encouraged to be cautious, and should be aware that under certain weather conditions, boats should not be taken outside Bamfield or Grappler Inlets. Weather conditions periodically render diving in even the most sheltered areas dangerous. Divers should be aware of this and should be prepared to abort or cancel dives if conditions are threatening.

Dense fogs, particularly in mid-summer, are common and divers and their boat tenders should plan accordingly. Navigation in a small, open boat laden with ferrous metals using a diver's compass can be an uncertain procedure, at best. Appropriate bearings and shoreline landmarks should be noted for the return trip from all dive sites. Finally, during fishing season, small boat traffic may be effectively impossible in areas where fishing boats operate. Boat tenders and divers must take special care to avoid nets and fishing craft. During some fishing periods, various dive sites will be effectively inaccessible. Divers should check with the Diving Safety Officer or other appropriate BMSC staff and be aware of these and other potential problems. The DFO website posts commercial fishery notices that affect the Barkley Sound region (area 23).

DFO fishery notices link (you will have to create a login):

http://www-ops2.pac.dfo-mpo.gc.ca/xnet/xIndex.cfm?pg=welcome&lang=en&targetPage=content/fns /index

1 OVERVIEW

BMSC Dive Tenders Must read the following document; conduct a dive tender checkout aboard a BMSC or researcher's dive vessel with the DSO. They also must submit / fill out / keep up to date the appropriate dive tender paper work prior to any dive tending. Please see the DSO with any questions and to access your tender file. Call: ext. 222 or email: diving@mail.bamfieldmsc.com

2 LIVE BOATING GUIDELINES

2-1 Purpose:

This summary is intended to provide basic instruction for boat operators when working in support of dive operations. Standard dive tending practices are included as well as specific instructions for safe operations when manoeuvring vessels in close proximity to divers in the water.

2-2 Definition:

Live Boating – maintaining a mobile vessel in support of dive operations. This method of dive tending is preferred in instances where anchoring is difficult, under conditions with high currents, when the dive plan makes it likely that divers will move away from the initial dive location, and in locations where divers may need to be shielded from other vessel traffic.

2-3 Operator Qualifications:

Live Boating requires exceptional boat handling skills and situational awareness. Qualified operators must demonstrate good close quarters manoeuvring skills and be able to communicate and navigate effectively. Previous dive experience is highly recommended for dive tending boat operators. Novice operators should work in the company of more experienced personnel until the necessary skills have been developed. Operators must hold a current SVOPC and are obligated to

have a copy of their certificate on person at all times when operating BMSC vessels. Dive Tenders/Surface Safety Attendants must have current Dive Accident Management training including Oxygen provider certification. Operators must (at minimum annually) conduct dive accident scenarios with the DSO and dive team that include put are not limited to: patient removal from the water, first aid, O2 administration and emergency services contact. Operators must demonstrate confidence and understanding in all aspects of emergency response and care as out lined in this document and by the DSO. All Dive tenders need to be approved by BMSC DSO.

2-4 Dockside:

1. Verify that all required and recommended equipment is on board before getting underway (see Pre-Dive Checklist), including Emergency O2 kit and phone numbers for DAN and local recompression chambers. Fill out sail plan.

2. Ensure that all members of the dive team have proper documentation as appropriate including: collection permits, dive project plan, dive status paperwork, logbooks, boating permits, etc.

3. Evaluate sea and weather conditions. Are conditions appropriate for boating/diving?

4. Review dive plan with all participants. Make sure everyone understands the plan before leaving the dock. This includes dive emergency procedure, lost buddy procedure, diver recall signal (series of three bangs metal on metal below the waters surface or series of 3 short engine revs in neutral, repeated 3 times – repeat sequence if there is no diver response), and expected maximum time, depth and distance/direction of travel.

5. Have dive roster and dive slate available for boat driver/dive tender to keep track of dive data. Keep track of dive data.

6. Stow gear securely and monitor equipment while in transit. Keep deck as clear as possible.

2-5 On Station (Dive Site):

1. Scan area for potential hazards such as boat traffic, or dangerous animals. Note the rate of drift or other signs of strong current.

2. Evaluate sea state/weather conditions. Are local conditions likely to change during the period of dives?

3. **Put up the dive flag**.

4. Call shore contact via VHF radio (and cell phone if one has been brought aboard as additional communication device) to confirm operational status and ability to communicate.

5. Assist divers donning gear as required. Be prepared to hand equipment over the side once divers are in the water.

6. If diving operations are conducted in high traffic areas or transit lanes perform a securité call on VHF channels 16 and 06. (see Appendix I)

***Before deploying divers:**

7. Make sure engine is idling in neutral – confirm by stating “neutral”, or “all stop”.

8. Deploy divers as far away from the engine as possible. Be certain the boat is not in a position to drift over divers.

Note: In areas of strong wind and/or current, the vessel should be positioned up current from the drop location. All divers need to enter the water as a unit when given the OK to avoid getting separated at the surface. Deploy divers up current from the target so they do not have to swim against the current before descending. Have divers enter the water on the up current side of the boat to keep the boat from drifting over them.

9. Once divers are clear of the boat, floating at the surface, and have given the surface OK signal (one hand on top of head) it is safe to engage the engine and move a short distance (8m) away. Note your current position by GPS or by taking line-ups to points on shore.

***During dive:**

10. Mark time on dive roster slate when divers begin descent.

Note: Dive tending requires singular focus. Do not attempt any other sampling or instrument deployments that could distract the operator or make recovering divers difficult.

11. Keep the boat down weather (wind and/or current) from the drop location if possible. The sun should be behind you for best visibility, and the wind should be in your face.

12. **Keep bubbles in sight at all times.**

Note**:** Wind chop, glare and kelp canopies can make this difficult, so it is important to minimize distractions and stay focused on the divers. It may be preferable to position the boat parallel to the diver's bubbles if they are moving with a current. When the dive team is transecting under dense kelp, a rendezvous strategy may be employed allowing the boat to parallel the divers while transiting just offshore from the kelp line. Closed circuit diving (no bubbles) requires a different strategy. Consult with your DSO for specific diver/surface communication procedures. Tenders should be aware that currents affect bubble drift and therefore the bubbles do not necessarily indicate that divers are directly below.

13. Monitor VHF radio and continue to scan for hazards.

14. Keep any approaching vessels at least 30m away from divers. It may be appropriate to issue a 'Securité" (seh-curitay) warning on VHF Ch. 16 (see Appendix I) to inform other boaters of your activity. You may also use the VHF radio to hail specific vessels on approach. Sound the danger/doubt signal (five short horn blasts/loud whistle blasts) if necessary and/or use hand gestures to divert an approaching vessel.

15. Diver Recall – if a situation arises that requires a recall, employ the previously discussed plan.

Note: If you lose track of diver bubbles during the course of a dive it is important to maintain your current position (or course and speed if transecting) and continue scanning. Enlist assistance from other crewmembers and stay calm. Take note of the time relative to expected dive duration and consider recalling divers. If planned dive duration has been exceeded and multiple recall attempts are unsuccessful it may be necessary to summon aid by radio (or cell phone). Continue scanning until divers are located. Divers should carry safety sausage, or other float and a sound-making device in case they can't see the boat when they come up. A safety sausage or float on a line that reaches the surface can help the boat operator keep track of the divers if they are drifting with a current during their safety stop or throughout a drift dive if no obstructions are present.

BOX 1: MISSING DIVER RECOMMENDATIONS

(See also 3-1 Lost Diver/Divers)

1. Deploy BMSC' anchored buoy (in a pinch anchor & life jacket or attach something to the kelp) or select the MOB. (man over-board) button on the GPS at the last known location or the start point of the dive.

2. Note current direction when diver was last seen. Drop a highly visible floating object with submerged portion attached to help note current direction and speed.

3. Recall other divers.

4. Note time: Start of dive & present time; depth of water. Attempt to determine when air supply should be depleted. Account for and question dive partner noting anything unusual about the dive.

5. Briefly search for the diver and their bubbles within the dive area and down current while also looking towards the shore and/or any other area the diver may have sought refuge.

6. Call appropriate EMS - Coast Guard (Ch 16 VHF) have them notify BMSC (Ch 09 VHF), 911 or other local EMS.

7. If unable to locate the missing diver, return to last known position. Prepare dive teams at marker buoy and await instructions from EMS.

***Recovering divers:**

1. Record time of surfacing. Look for OK signal from divers and verify that all team members are present. Signal the divers to let them know you see them.

Note: Divers should swim together as a group to get away from obstacles (kelp, lines, buoys, rocks or the shore line).

2. Approach divers by heading into the wind or current. Approach slowly, using only enough speed to maintain steerage (control of the boat's heading) and keep divers up current relative to the vessel.

Do not allow the boat to be blown/drift over divers at the surface!

3. Shift to neutral at least one boat length from divers and allow the boat to drift to within easy swimming distance. Call out "neutral".

Note: In some cases, it may be helpful to use a floating line trailing 6m to15m off the boat for divers to grab onto. Short tag lines (with end clips) secured to the rail are also helpful for tethering inflated BCs.

4. Assist with equipment recovery as needed including weight belts and BCs.

5. Verify physical condition of all participants and monitor thereafter for symptoms of decompression illness (DCI).

6. Take down dive flag.

7. Call shore contact.

8. Call Securité “Dive operations ended” on VHF 16 and 06 as necessary.

9. Stow gear for transit.

2-6 Upon Returning Dockside:

1. Rinse all equipment with fresh water before returning to storage.

2. Report any lost or damaged equipment to the appropriate staff member.

3. Close out the Sail Plan, complete the BMSC dive roster and have diving supervisor sign. Fill tender log and remind divers to complete BMSC scientific dive logs and file appropriately.

4. Remind divers to don ‘diver alert tags’ for following 24 hours.

3 DIVE ACCIDENT PROCEDURES

3-1 Lost Diver/Divers:

If a diver/divers do not surface after their planned dive time has expired, follow these steps (see also BOX 1):

1. Watch for bubbles

2. Diver recall: bang 3 times metal on metal under the water’s surface (e.g. pole of dive flag on boat hull, SCUBA tank, etc.), wait a few minutes. Rev engine three times in neutral repeat three times.

***If no response i.e.: divers are missing**

3. Drop anchored buoy (in a pinch anchor & life jacket or attach something to the kelp) or select the MOB. (man-over-board) button on the GPS at the last known location or the start point of the dive.

4. Note current direction when diver was last seen. Drop a highly visible floating object with submerged portion attached to help note current direction and speed.

5. Continue to recall other divers.

6. Note time: Start of dive & present time; depth of water. Attempt to determine when air supply should be depleted. Account for and question dive partner noting anything unusual about the dive.

7. Briefly search for the diver and their bubbles within the dive area and down current while also looking towards the shore and/or any other area the diver may have sought refuge.

8. Call “MAYDAY” on CH 16 VHF. (see Appendix III)

9. If unable to locate the missing diver, return to last known position. Prepare rescue/safety dive teams at marker buoy and await instructions from EMS.

3-2 Seriously Injured Diver/Decompression Sickness:

1. Call for help on CH 16 VHF (see Appendix III)

2. Get the divers into the boat.

3. Keep divers’ gear grouped individually; do not adjust gear in any way or place with other equipment/gear.

4. Remove mask/hood

5. Assess Airway Breathing and Circulation

6. Provide rescue breathing/CPR as needed

7. Make sure there is no open flame, spark or grease present.

8. Administer Oxygen 100% at 15L/minute – note time

9. Get a history of the incident if possible (Depth, Time, sudden ascent, gear failure)

10. Reassess ABC's every 5 minutes

11. Keep the diver comfortably warm

12. If trained, take a set of vital/neurological signs every 15 minutes (see neuro exam sheet in O2 kit)

Note: Where one diver is injured, you should carefully watch their buddy for any signs of developing DCI.

BOX 2: POSSIBLE DCI

The symptoms of decompression illness can be misleading, especially in a cold-water environment. If you have any doubt, treat as though an injury is present and watch the diver carefully for any change in condition.

- Place diver in position of comfort
- Make sure there is no open flame spark or grease present.
- Administer Oxygen at 100%, 15L/minute flow
- If trained, take a set of vital signs (Pulse, breathing rate and quality)
- If needed, alert the joint rescue coordination center (CCG, BMSC) on VHF Channel 16 that you have a possible diving emergency.
- Ask the diver (and take notes on) the history of their dive (depth, time, sudden ascent or descent, gear failure).
- Ask about the symptoms: position of any pain or discomfort, the quality of the pain, whether it radiates up an arm or leg, how bad it is, whether there is any numbness or tingling. Also take into account any history outside of diving that might be contributing to their condition (dehydration, hangover, physical exhaustion etc.).
- Carefully monitor the diver for any changes, keep them warm and comfortable.

Note: Any time oxygen is used the DSO must be notified as soon as possible.

APPENDIX I – Securité Call Script

***Any Dive Operation being conducted in traffic lanes or high traffic areas must radio a securité on both VHF channels 16 and 06**

Before divers have entered the water:

"Securité Securité Securité

All stations all stations all stations

This is the Bamfield Marine Sciences Centre _____
Vessel name

We will be conducting dive operations at: _____,
State location- use gazetted name
i.e. in the mouth of Bamfield Inlet,
E shore Nanat Islet, Trevor Channel

From/For: _____.
State duration. Use 24 hr clock i.e.: 1325-1525, / 1,3,2,5 to 1,5,3,5
Or length of time i.e.: for the next two hours

Please observe 30m exclusion from dive vessel and dive flag Alpha.

For any vessel traffic concerns please contact BMSC

_____
Vessel name

on VHF Channel 16 or 09

Standing by on VHF Channel 16 and 09."

***All Dive Operations to standby on VHF Channel 16 and 09**

After all divers have exited the water:

"Securité Securité Securité

All stations all stations all stations

This is the Bamfield marine Sciences Centre _____
Vessel name

Dive operations at _____,
State location- use gazetted name
i.e.: in the mouth of Bamfield
Inlet. E shore Nanat Islet,
Trevor Channel

Have been completed – Securité broadcast now cancelled

_____ out".
Vessel name

APPENDIX II – Radio Distress Calls

The **Canadian Coast Guard provides 24 Hr monitoring on VHF Channel 16** (156.8 MHz) and on MF 2182 kHz.

These channels are used for distress and emergency calling only.

In a **life-threatening distress situation;**
Select **VHF Channel 16** and say:

"MAYDAY, MAYDAY, MAYDAY

This is the Bamfield Marine Sciences Centre _____ (x2)
Vessel name

We are located at: _____,
State location- use gazetted name i.e.:
In the mouth of Bamfield
Inlet, E shore Nanat Islet,
Trevor Channel

We are: _____
State the nature of the emergency i.e. - we are taking on water; have a man overboard; etc.

There are_____ people on board
State # of people on board
Including yourself

We require immediate assistance

Over"

Wait 30 seconds for a response;
Repeat message until you receive and answer.

If there is **no immediate danger to life or property;**
Repeat **"PAN PAN, PAN PAN, PAN PAN"** on **VHF Channel 16**
Give the information listed above.
Listen for a response;
And repeat message until you receive an answer.

***Non-emergency communication with CCG is to be conducted on VHF Channel 22A**

APPENDIX III – Dive Accident Procedures

If you suspect a diver is suffering from Decompression Illness (air embolism or decompression sickness)/compressed gas injury you should do the following:

Step 1: Notify Canadian Coast Guard on VHF Ch 16:

"Prince Rupert Coast Guard Radio, Prince Rupert Coast guard Radio, Prince Rupert Coast guard Radio"

This is the Bamfield Marine Sciences Centre _____ (x2)
Vessel name

We are located at: _____,
State location- use gazetted name i.e.:
In the mouth of Bamfield Inlet,
E shore Nanat Islet, Trevor Channel

We have a diving emergency involving _____ divers
Total # of divers (whether they appear injured or not)

We are bringing / have brought the patient(s) aboard and are beginning first aid and oxygen administration

Patient may require emergency airlift and hyperbaric treatment,

Over"

Be prepared to be directed to a private channel by the Coast Guard responders. Channel 83A is a common private channel used by CCG for emergencies.

Step 2: Conduct Primary Survey- Airway Breathing Circulation. Administer assisted ventilation (rescue breaths) or CPR if required. Keep airway open and prevent aspiration of vomitus.

Step 3: Open diver O2 case make sure there is no open flame, spark or grease present prior to turning on O2 unit. Administer Oxygen and place injured diver in appropriate position:

- Unconscious & breathing = recovery position (on side)
- Unconscious & non-breathing = supine (on back)
- Administer breaths or CPR as appropriate
- Conscious & breathing= preferably in recovery position (on side)

Do not remove Oxygen except to clear patient's airway

Keep track of timing during the emergency.

Note the time when:

- O2 administration begins
- Any changes in patient condition occur (good and bad)

Step 4: Protect injured diver from excessive heat, cold, wetness or noxious fumes

Step 5: Await Coast Guard instructions

Note: If unable to make radio contact carry out the above first aid and transport injured diver to Bamfield Coast Guard Station, Bamfield Health Centre - VIHA or BMSC as soon as possible.

Step 6: The following information should be gathered as soon as practical:

- Name and Age of injured diver
- Max depth attained
- Bottom time and total dive time
- Circumstances leading to accident
- Pertinent medical history

Note: The injured diver's equipment including their dive computer should be isolated and not altered in any way before turning it over to emergency response team.

Prepare for Coast Guard Transport:

- Bring in any lines that are in the water
- Bring in / Remove boarding ladder from side of vessel
- Clear deck to maximize room for medics
- Have patient's computer ready to hand over to medics with patient
- Have patient's scuba equipment as-is: regulator with gauges and BCD still on tank- in same condition as when patient surfaced- ready to hand over.

APPENDIX IV – Dive Accident Response Times

The Barkley Sound region is sparsely populated and dive sites some distance from the BMSC can be in areas with little boat traffic and no potential on-shore assistance. Current estimates for transportation from the dives sites furthest from BMSC to a recompression chamber is approximately 3-4.5 hours.
The following scenario includes a breakdown of the 3-4.5 hour response time from the time of a dive emergency call to patient's arrival at Vancouver General Hospital (VGH) – the nearest recompression chamber.

A call has been made over VHF Radio 16 to the Canadian Coast Guard from the Broken Group Islands requesting assistance for a diving emergency. Assuming Bamfield CCG are on base at the time of the call:

5-10 minutes:	**CCG prepare, depart from base, and call for a B.C. Ambulance helicopter.**
15-20 minutes:	Transit time for CCG lifeboat to reach the middle of Coaster Channel in the Broken Group
10-15 minutes:	Packaging and transfer of patient to CCG lifeboat
15-20 minutes:	CCG lifeboat to Bamfield Harbour from Broken Group
5-10 minutes:	Transfer of patient from lifeboat to the Bamfield Health Centre
60 minutes:	Transfer of patient between medical service teams, transporting to Bamfield Airstrip (48.8206, -125.1193) and loading patient into helicopter.
40 minutes:	Travel in Helicopter from Bamfield to VGH

Note:

Helicopter deployment will differ based on availability, weather conditions, timing, and level of care required. Helicopter travel time to the Bamfield airstrip in East Bamfield is approximately 1 hour. Bamfield CCG may transport patients directly to Port Alberni for hand off to the helicopter, adding another 1.5 hours to the 3 hour timeline.

APPENDIX V – Useful Contacts

Canadian Coast Guard Distress & Calling	**VHF 16**	
Canadian Coast Guard Non-emergency	VHF 22A	
Joint Rescue Coordination Centre		**1 800 567-5111**
Bamfield Marine Sciences Centre	VHF 09	250 728-3301
Bamfield Volunteer First Responders		911
Remote Location Ambulance		1 800 461-9911
Vancouver General Hospital (VGH)		604 875-4111
VGH Hyperbaric Unit		604 875-4033
VGH Emergency Medical Unit		**604 875-4995**
West Coast General Hospital (Port Alberni)		250 731-1370
Diver's Alert Network (DAN) 24hr emergency		**919-684-9111**
		(call collect)

APPENDIX VI- Dive Tender Log

NAME:_______________________ **CERT**:____________ **1st AID EXP**:___________

Date: _________ Vessel: _____________ Vessel Type:_____________

Destination: ______________________________ BMSC Vessel / Other Vessel (circle one)

Time Depart:______ Time Return:______ Total Hours: __________

Dive Mode/Purpose:_________________________________ # Of Divers:________

Anchored / Live (circle one) Reboarding Method:________________________

Notes:

Date: _________ Vessel: _____________ Vessel Type:_____________

Destination: __________________________ BMSC Vessel / Other Vessel (circle one)

Time Depart:______ Time Return:______ Total Hours: __________

Dive Mode/Purpose:_________________________________ # Of Divers:________

Anchored / Live (circle one) Reboarding Method:________________________

Notes:

Date: _________ Vessel: _____________ Vessel Type:_____________

Destination: ___________________________ BMSC Vessel / Other Vessel (circle one)

Time Depart:______ Time Return:______ Total Hours: __________

Dive Mode/Purpose:_________________________________ # Of Divers:________

Anchored / Live (circle one) Reboarding Method:________________________

Notes:

Total Accumulated Hours: (LIVE) ___________ (TOTAL) ___________

APPENDIX VII – DCIEM Tables

TABLE 1S: SHORT STANDARD AIR DECOMPRESSION (FEET)

Depth (fsw)	No-Decompression Bottom Times (min)				Decompression Required Bottom Times (min)			
20	30 A 60 B 90 C 120 D	150 E 180 F 240 G 300 H	360 I 420 J 480 K 600 L	720 M ∞				
30	30 A 45 B 60 C 90 D	100 E 120 F 150 G 180 H	190 I 210 J 240 K 270 L	300 M	330 N 360 O	400	420	450
40	22 A 30 B 40 C	60 D 70 E 80 F	90 G 120 H 130 I	150 J	160 K 170 L	180 M 190	200	215
50	18 A 25 B	30 C 40 D	50 E 60 F	75 G	85 H 95 I	105 J 115 K	124 L	132 M
60	14 A 20 B	25 C 30 D	40 E	50 F	60 G	70 H 80 I	85 J	92 K
Decompression Time in minutes at			10 fsw		5	10	15	20
70	12 A 15 B	20 C	25 D	35 E	40 F	50 G	63 I	66 J
80	10 A 13 B	15 C	20 D	25 E	29 F	35 G	48 H	52 I
90	9 A	12 B	15 C	20 D	23 E	27 F	35 G	43 I
100	7 A	10 B	12 C	15 D	18 D	21 E	29 G	36 H
110		6 A	10 B	12 C	15 D	18 E	22 F	30 H
120		6 A	8 B	10 C	12 D	15 E	19 F	25 G
130			5 A	8 B	10 C	13 D	16 F	21 G
140			5 A	7 B	9 C	11 D	14 F	18 G
150			4 A	6 B	8 C	10 D	12 E	15 F
Decompression Time in minutes at			20 fsw		-	-	5	10
			10 fsw		5	10	10	10

TABLE 4: REPETITIVE DIVING (FEET)

A. REPETITIVE FACTORS/SURFACE INTERVALS TABLE

Repet. Group (RG)	Repetitive Factors (RF) for Surface Intervals (SI) in hr:min										
	0:15 → 0:29	0:30 → 0:59	1:00 → 1:29	1:30 → 1:59	2:00 → 2:59	3:00 → 3:59	4:00 → 5:59	6:00 → 8:59	9:00 → 11:59	12:00 → 14:59	15:00 → 18:00
A	1.4	1.2	1.1	1.1	1.1	1.1	1.1	1.1	1.0	1.0	1.0
B	1.5	1.3	1.2	1.2	1.2	1.1	1.1	1.1	1.1	1.0	1.0
C	1.6	1.4	1.3	1.2	1.2	1.2	1.1	1.1	1.1	1.0	1.0
D	1.8	1.5	1.4	1.3	1.3	1.2	1.2	1.1	1.1	1.0	1.0
E	1.9	1.6	1.5	1.4	1.3	1.3	1.2	1.2	1.1	1.1	1.0
F	2.0	1.7	1.6	1.5	1.4	1.3	1.3	1.2	1.1	1.1	1.0
G	-	1.9	1.7	1.6	1.5	1.4	1.3	1.2	1.1	1.1	1.0
H	-	-	1.9	1.7	1.6	1.5	1.4	1.3	1.1	1.1	1.1
I	-	-	2.0	1.8	1.7	1.5	1.4	1.3	1.1	1.1	1.1
J	-	-	-	1.9	1.8	1.6	1.5	1.3	1.2	1.1	1.1
K	-	-	-	2.0	1.9	1.7	1.5	1.3	1.2	1.1	1.1
L	-	-	-	-	2.0	1.7	1.6	1.4	1.2	1.1	1.1
M	-	-	-	-	-	1.8	1.6	1.4	1.2	1.1	1.1
N	-	-	-	-	-	1.9	1.7	1.4	1.2	1.1	1.1
O	-	-	-	-	-	2.0	1.7	1.4	1.2	1.1	1.1

B. NO-DECOMPRESSION REPETITIVE DIVING TABLE

Depth (fsw)	Allowable No-D Limits (min) for Repetitive Factors (RF)									
	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0
30	272	250	230	214	200	187	176	166	157	150
40	136	125	115	107	100	93	88	83	78	75
50	60	55	50	45	41	38	36	34	32	31
60	40	35	31	29	27	26	24	23	22	21
70	30	25	21	19	18	17	16	15	14	13
80	20	18	16	15	14	13	12	12	11	11
90	16	14	12	11	11	10	9	9	8	8
100	13	11	10	9	9	8	8	7	7	7
110	10	9	8	8	7	7	6	6	6	6
120	8	7	7	6	6	6	5	5	5	5
130	7	6	6	5	5	5	4	4	4	4
140	6	5	5	5	4	4	4	3	3	3
150	5	5	4	4	4	3	3	3	3	3

TABLE 1S: SHORT STANDARD AIR DECOMPRESSION (METRES)

Depth (msw)	No-Decompression Bottom Times (min)				Decompression Required Bottom Times (min)			
6	30 A 60 B 90 C 120 D	150 E 180 F 240 G 300 H	360 I 420 J 480 K 600 L	720 M ∞				
9	30 A 45 B 60 C 90 D	100 E 120 F 150 G 180 H	190 I 210 J 240 K 270 L	300 M	330 N 360 O	400	420	480
12	22 A 30 B 40 C	60 D 70 E 80 F	90 G 120 H 130 I	150 J	160 K 170 L 180 M	200	210	220
15	18 A 25 B	30 C 40 D	50 E 60 F	75 G	90 H 100 I	110 J 120 K	128 L	137 M
18	14 A 20 B	25 C 30 D	40 E	50 F	60 G	70 H 80 I	88 J	95 K
Decompression Time in minutes at			3 msw		5	10	15	20
21	12 A 15 B	20 C	25 D	35 E	40 F	53 H	65 I	68 J
24	10 A 13 B	15 C	20 D	25 E	30 F	37 G	50 H	54 I
27	9 A	12 B	15 C	20 D	24 E	28 F	35 G	44 I
30	7 A	10 B	12 C	15 D	18 D	22 F	30 G	37 H
33		6 A	10 B	12 C	15 D	18 E	24 G	31 H
36		6 A	8 B	10 C	12 D	15 E	19 F	25 G
39			5 A	8 B	10 C	13 D	17 F	21 G
42			5 A	7 B	9 C	12 D	14 F	18 G
45			4 A	7 B	8 C	10 D	13 F	16 G
Decompression Time in minutes at			6 msw		-	-	5	10
			3 msw		5	10	10	10

TABLE 4: REPETITIVE DIVING (METRES)

A. REPETITIVE FACTORS/SURFACE INTERVALS TABLE

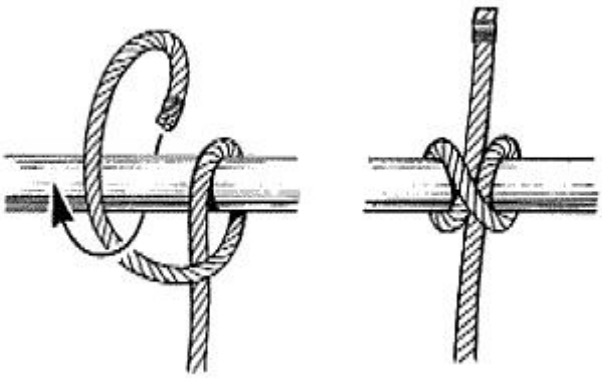
Repet. Group (RG)	Repetitive Factors (RF) for Surface Intervals (SI) in hr:min										
	0:15 → 0:29	0:30 → 0:59	1:00 → 1:29	1:30 → 1:59	2:00 → 2:59	3:00 → 3:59	4:00 → 5:59	6:00 → 8:59	9:00 → 11:59	12:00 → 14:59	15:00 → 18:00
A	1.4	1.2	1.1	1.1	1.1	1.1	1.1	1.1	1.0	1.0	1.0
B	1.5	1.3	1.2	1.2	1.2	1.1	1.1	1.1	1.1	1.0	1.0
C	1.6	1.4	1.3	1.2	1.2	1.2	1.1	1.1	1.1	1.0	1.0
D	1.8	1.5	1.4	1.3	1.3	1.2	1.2	1.1	1.1	1.0	1.0
E	1.9	1.6	1.5	1.4	1.3	1.3	1.2	1.2	1.1	1.1	1.0
F	2.0	1.7	1.6	1.5	1.4	1.3	1.3	1.2	1.1	1.1	1.0
G	-	1.9	1.7	1.6	1.5	1.4	1.3	1.2	1.1	1.1	1.0
H	-	-	1.9	1.7	1.6	1.5	1.4	1.3	1.1	1.1	1.1
I	-	-	2.0	1.8	1.7	1.5	1.4	1.3	1.1	1.1	1.1
J	-	-	-	1.9	1.8	1.6	1.5	1.3	1.2	1.1	1.1
K	-	-	-	2.0	1.9	1.7	1.5	1.3	1.2	1.1	1.1
L	-	-	-	-	2.0	1.7	1.6	1.4	1.2	1.1	1.1
M	-	-	-	-	-	1.8	1.6	1.4	1.2	1.1	1.1
N	-	-	-	-	-	1.9	1.7	1.4	1.2	1.1	1.1
O	-	-	-	-	-	2.0	1.7	1.4	1.2	1.1	1.1

B. NO-DECOMPRESSION REPETITIVE DIVING TABLE

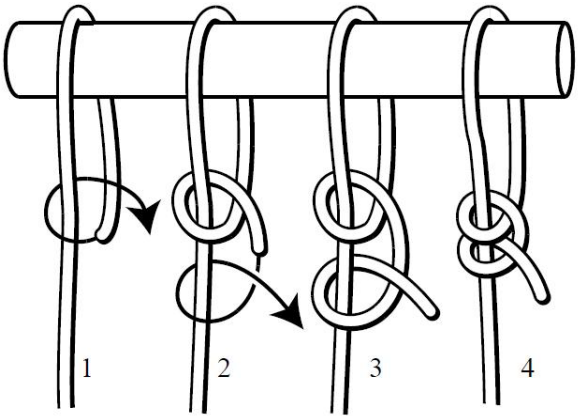
Depth (msw)	Allowable No-D Limits (min) for Repetitive Factors (RF)									
	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0
9	272	250	230	214	200	187	176	166	157	150
12	136	125	115	107	100	93	88	83	78	75
15	60	55	50	45	41	38	36	34	32	31
18	40	35	31	29	27	26	24	23	22	21
21	30	25	21	19	18	17	16	15	14	13
24	20	18	16	15	14	13	12	12	11	11
27	16	14	12	11	11	10	9	9	8	8
30	13	11	10	9	9	8	8	7	7	7
33	10	9	8	8	7	7	6	6	6	6
36	8	7	7	6	6	6	5	5	5	5
39	7	6	6	5	5	5	4	4	4	4
42	6	5	5	5	4	4	4	3	3	3
45	5	5	4	4	4	3	3	3	3	3

APPENDIX VIII – Useful Knots

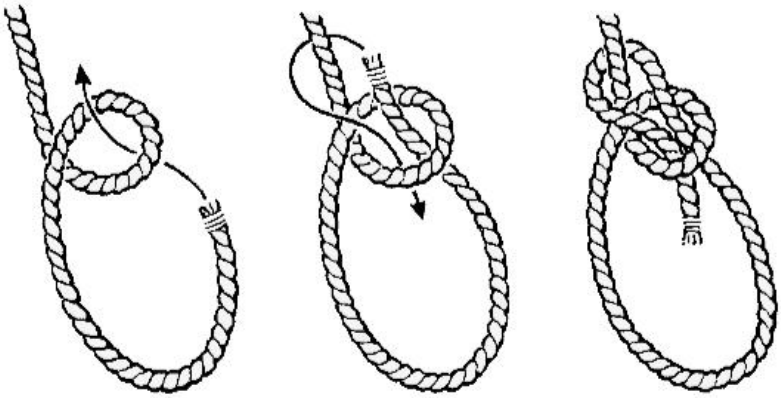
CLOVE HITCH



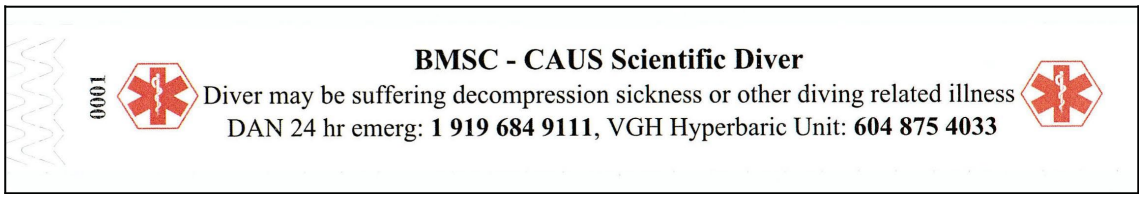
DOUBLE HALF HITCH



BOWLINE



APPENDIX IX – Diver Medical Alerts



WorkSafe BC Regulation Part 24: Diving, Fishing and Other Marine Operations

> *24.24 Medical alert tag - A diver must wear a medical alert tag or bracelet stating the diver's status and indicating the possibility of decompression sickness or other illness, for at least 24 hours after completion of diving.*

Phone Numbers Included:

DAN 24 hr emergency: 1 919 684 9111

When you call the DAN Emergency Hotline:

- Your call will be answered by a live person. Give that person a brief description of your emergency, and your call will be routed to the resource best qualified to assist you.
- DAN's medical staff may make an immediate recommendation or request to call you back after making arrangements with any number of DAN's resources.
- If a call-back is necessary, please wait by the phone while arrangements are made. The resources may take 30 minutes or more to coordinate, as several pieces and calls may be required.

VGH Hyperbaric Unit: 604 875 4033

When you call the VGH (Vancouver General Hospital) Hyperbaric Unit:

- Monday-Friday 0800-1600 your call will be answered by a live person.
- After hours, Saturday-Sunday and holidays, the call will go to the answering machine. The message will direct you to call the VGH switch board (604 875 4111) and request the hyperbaric physician on call be paged.

APPENDIX X – Line Pull Signals

Special training required

Excerpt from the U.S. Navy Diving Manual:

A line-pull signal consists of one or a series of sharp, distinct pulls on the umbilical that are strong enough to be felt by the diver. All slack must be taken out of the umbilical before the signal is given.

Acknowledgment of signals consists of replying with the same signal. If a signal is not properly returned by the diver, the signal is sent again. A continued absence of confirmation is assumed to mean one of three things: the line has become fouled, there is too much slack in the line, or the diver is in trouble. If communications are lost, the Diving Supervisor must be notified immediately and steps taken to identify the problem. This situation is treated as an emergency.

Two line-pull signals are not answered by repeating the line pull. They are from diver to tender, “haul me up” and “haul me up immediately.” Acknowledgment consists of initiation of the action. A third signal, “come up”, signaled from the tender to diver, is not acknowledged until the diver is ready to leave the bottom. If the diver cannot respond to the order, the diver must communicate the reason via the voice intercom system or through the line-pull signal meaning “I understand,” followed (if necessary) by an appropriate emergency signal.

Table 8-2. *Line-Pull Signals.*

From Tender to Diver		Searching Signals (Without Circling Line)	
1 Pull	“Are you all right?” When diver is descending, one pull means “Stop.”	7 Pulls	“Go on (or off) searching signals.”
2 Pulls	“Going Down.” During ascent, two pulls mean “You have come up too far; go back down until we stop you.”	1 Pull	“Stop and search where you are.”
3 Pulls	“Stand by to come up.”	2 Pulls	“Move directly away from the tender if given slack; move toward the tender if strain is taken on the life line.”
4 Pulls	“Come up.”	3 Pulls	“Face your umbilical, take a strain, move right.”
2-1 Pulls	“I understand” or “Talk to me.”	4 Pulls	“Face your umbilical, take a strain, move left.”
3-2 Pulls	“Ventilate.”		
4-3 Pulls	“Circulate.”		
From Diver to Tender		**Searching Signals (With Circling Line)**	
1 Pull	“I am all right.” When descending, one pull means “Stop” or “I am on the bottom.”	7 Pulls	“Go on (or off) searching signals.”
2 Pulls	“Lower” or “Give me slack.”	1 Pull	“Stop and search where you are.”
3 Pulls	“Take up my slack.”	2 Pulls	“Move away from the weight.”
4 Pulls	“Haul me up.”	3 Pulls	“Face the weight and go right.”
2-1 Pulls	“I understand” or “Talk to me.”	4 Pulls	“Face the weight and go left.”
3-2 Pulls	“More air.”		
4-3 Pulls	“Less air.”		
Special Signals From the Diver		**Emergency Signals From the Diver**	
1-2-3 Pulls	“Send me a square mark.”	2-2-2 Pulls	“I am fouled and need the assistance of another diver.”
5 Pulls	“Send me a line.”	3-3-3 Pulls	“I am fouled but can clear myself.”
2-1-2 Pulls	“Send me a slate.”	4-4-4 Pulls	“Haul me up immediately.”
ALL EMERGENCY SIGNALS SHALL BE ANSWERED AS GIVEN EXCEPT 4-4-4			