DIVE TENDING GUIDE

For all your tender needs

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– 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

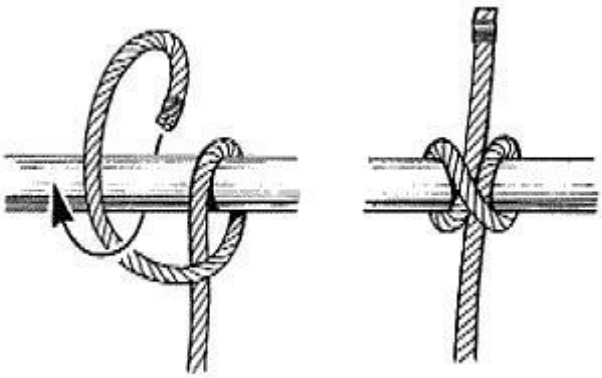
Repet. Group (RG)	Repetitive Factors (RF) for Surface Intervals (SI) in hr:min										
	0:15 → 0:29	0:30 → 0:59	1:00 → 1:29	1:30 → 1:59	2:00 → 2:59	3:00 → 3:59	4:00 → 5:59	6:00 → 8:59	9:00 →11:59	12:00 →14:59	15:00 →18:00
A	1.4	1.2	1.1	1.1	1.1	1.1	1.1	1.1	1.0	1.0	1.0
B	1.5	1.3	1.2	1.2	1.2	1.1	1.1	1.1	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

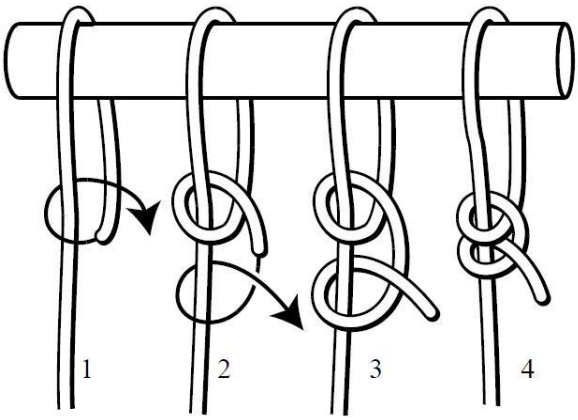
Depth (msw)	Allowable No-D Limits (min) for Repetitive Factors (RF)									
	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0
9	272	250	230	214	200	187	176	166	157	150
12	136	125	115	107	100	93	88	83	78	75
15	60	55	50	45	41	38	36	34	32	31
18	40	35	31	29	27	26	24	23	22	21
21	30	25	21	19	18	17	16	15	14	13
24	20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

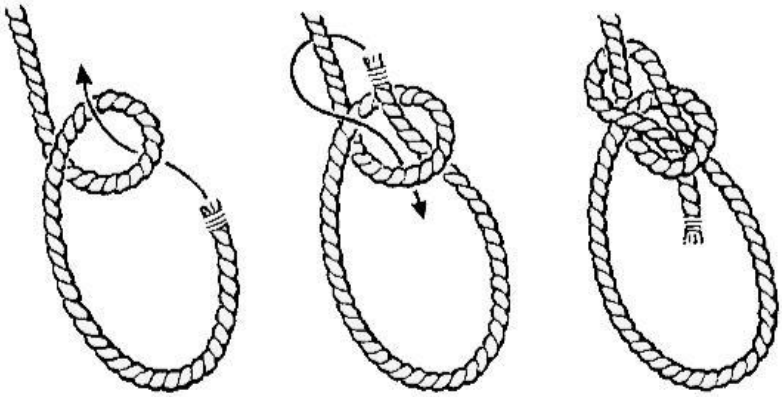
CLOVE HITCH



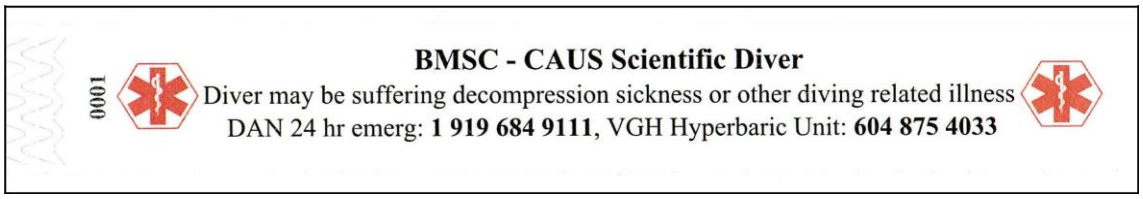
DOUBLE HALF HITCH



BOWLINE



APPENDIX IX – Diver Medical Alerts



WorkSafeBC 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			