



Internal Audit Report

Scientific Scuba and Boating Safety Review

Report No. SC-20-13
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Table of Contents

I. EXECUTIVE SUMMARY	2
II. INTRODUCTION	
Purpose	3
Background	3
Scope	4
III. OBSERVATIONS REQUIRING MANAGEMENT CORECTIVE ACTION	
A. Out of date safety requirements.....	5
APPENDICES	
APPENDIX A – Summary of Work Performed and Results.....	10
APPENDIX B –Survey Results.....	12

I. EXECUTIVE SUMMARY

Audit and Management Advisory Services has completed a review of Scientific Scuba and Boating Safety. This review was included on the FY20 internal audit plan. Our audit was primarily focused on evaluating the system of internal controls in place to manage safety risks associated with scientific scuba and boating.

Generally we found that the Scientific Diving and Boating Safety Program had appropriate controls including logical oversight, appropriate training requirements, regular equipment inspections, and accurate record keeping. In addition to reviewing source documents to test for completeness and accuracy, we conducted a survey of 90 individuals to further ensure controls were working. Both the review of source documents and the survey seemed to indicate these controls were generally working as intended.

However, we did find some instances of scientific dives being recorded while participants were out of date on required safety items. The periodic safety requirements laid out in the UC Santa Cruz Dive Manual exist to reduce the inherent risks associated with diving. If individuals lapse on these requirements, there is a greater risk of harm occurring.

The following observations requiring management corrective action is identified below to address this control weakness:

A. Out-of-Date Safety Requirements

We found some instances of scientific dives being recorded while participants were out of date on required safety items. Specifically, we found that 8 of the 134 (~6%) divers we reviewed had recorded a scientific dive while they were out of date on at least one required safety item.

Agreement was reached with management on recommended actions to address risks identified in these areas. The observation and related management corrective actions are described in greater detail in section III.

II. INTRODUCTION

Purpose

The purpose of the audit was to evaluate the system of internal controls in place to manage safety risks associated with scientific scuba and boating. This audit was included on the campus FY20 Internal Audit Plan.

Background

UC Santa Cruz's Institute of Marine Sciences manages the "Diving and Boating Safety Program" out of the Long Marine Lab. The program supports scuba diving and scientific small boats used by UCSC classes, faculty, researchers, and staff. The Diving and Boating Safety Program provides training and oversight for scuba diving and boating at UC Santa Cruz. The Diving & Boating Safety Program is managed by the diving and boating safety officer and has one additional full time employee.

The Diving Control Board (DCB) is responsible for policy making and approving training programs for diving affiliated with the UC Santa Cruz Campus. The board is made up of various diving stakeholders including the diving safety officer, faculty researchers, staff, an undergraduate and a graduate student. On a day-to-day basis the diving safety officer is responsible for implementing the policy of the Diving Control Board.

In a similar fashion as with diving, the Scientific Boating Committee (SBC) is responsible for policy making and approving training programs for scientific boating affiliated with the UC Santa Cruz Campus. Also like the diving board, the SBC is comprised of various boating stakeholders, like faculty and staff, and the responsibility to implement the policy from the committee is the boating safety officer.

The primary relevant local policy found at UC Santa Cruz regarding scientific diving is the "Standards For Scientific Diving Certification & Operation Of Scientific Diving Programs," which is commonly simply referred to as the "Dive Manual." This local policy was developed locally to reflect the standards derived from the American Academy of Underwater Sciences (AAUS). The AAUS is an organization which has a primary mission of advancing and facilitating safe and productive scientific diving. In practice, the AAUS sets a common set of standards that member organizations, including the University of California, follow. The diving program also complies with standards set by the National Association of Underwater Instructors (NAUI) for training provided by the diving program.

UC Santa Cruz has also developed a formalized local policy on boating safety.

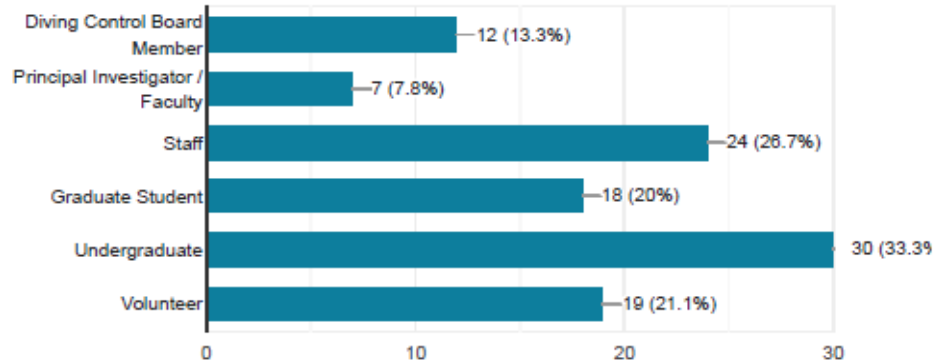
Scope

During the audit, we reviewed controls the University has in place to manage safety risks associated with scientific scuba and boating.

- We reviewed standards set forth by the AAUS, NAUI, and local policy included in the UC Santa Cruz Dive Manual.
- We interviewed the Diving and Boating Safety Officer and various other key players.
- We reviewed web resources provided to students, staff, faculty, and the public.
- We analyzed equipment inspections, medical approvals, and training dates, for a sample of 20 divers to verify completeness and accuracy.
- Reviewed the dive logs of the same 20 sampled divers, plus an additional 9 divers.
- We conducted a survey for individuals with an affiliation to the scientific diving program at the University. The survey had 90 responses from individuals with many different affiliations to the University:

What is your affiliation(s) to UC Santa Cruz dive program?

90 responses



III. OBSERVATIONS REQUIRING MANAGEMENT CORRECTIVE ACTION

A. Divers With Out-of-Date Safety Requirements		
We found some instances of scientific dives being recorded while participants were out of date on required safety items. Specifically, we found that 8 of the 134 (~6%) divers we reviewed had recorded a scientific dive while they were out of date on at least one required safety item.		
Risk Statement/Effect		
The periodic safety requirements laid out in the UC Santa Cruz Dive Manual exist to reduce the risk of injury or death to divers. If individuals lapse on these requirements, there will be a greater risk of harm occurring.		
Agreement		
A.1	The diving control officer will work with the Diving Control Board to develop and implement controls to reduce the likelihood of divers conducting scientific dives while out-of-date on required safety items.	Implementation Date
		December 1 st ,2020
		Responsible Manager
		Diving Safety Officer

A. Out of Date Safety Requirements

Generally we found that the Scientific Diving and Boating Safety Program had appropriate controls including logical oversight, appropriate training requirements, regular equipment inspections, and accurate record keeping. However, we did find some instances of scientific dives occurring while participants were out-of-date on at least one required safety item. Specifically, we found that 8 of the 134 (~6%) divers we reviewed had been involved in a scientific dive while they were out of date on at least one required safety item.

Oversight

The Scientific Diving and Boating Safety Program receives oversight from various sources and is generally appropriate:

- The Diving Control Board and the Scientific Boating Committee, which are both made up of various stakeholders from the UC Santa Cruz diving and boating community, is responsible for policy making, approving training programs, and providing general oversight over the programs.

- On a day-to-day basis the programs are overseen by a qualified diving and boating safety officer and one full time assistant safety officer.
- The Diving and Boating Safety Program falls under the Institute of Marine Science and Physical and Biological Sciences which also provide additional layers of oversight.
- Additionally, as a member of the American Academy of Underwater Sciences (AAUS), the diving program at UC Santa Cruz must comply with standards set by the AAUS.

Training

According to the Dive Manual, divers must undertake a number of trainings when first qualifying to conduct scientific dives as well as retake several trainings periodically in order to stay proficient. These required initial and reoccurring trainings are provided by the Diving Safety Program. These requirements are in line with AAUS standards and a survey conducted by Internal Audit found that stakeholders at the university generally thought they were appropriate.

New divers must successfully complete prerequisites, theoretical aspects, practical training, and examinations for a minimum cumulative time of 100 hours and a minimum of 12 open water dives. Some of the specific required training includes CPR training, first aid, and oxygen administration. These three specific training topics must be periodically retested in order to maintain proficiency.

A survey conducted by Internal Audit found that stakeholders at the university generally thought training requirements at UC Santa Cruz were appropriate. Specifically 89 of 90 total responses indicated that “the overall amount of training provided for those conducting scientific dives at UC Santa Cruz was sufficient.” This survey included individuals with differing affiliation with the university to include principal investigators, graduate students, undergraduate students, volunteers, staff, and diving control board members.

The training requirements at UC Santa Cruz are in line with the AAUS standards and the training events themselves are created to be in compliance with the National Association of Underwater Instructors (NAUI).

Equipment inspections

The Dive Manual describes the specific equipment maintenance and inspection requirements for diving. Specifically, all scientific divers must have their personal equipment inspected on an annual basis by the Diving Safety Program and also serviced by the diver themselves on whatever frequency the manufacturer recommends. Equipment included in this inspection include:

- Scuba regulators
- Gauges
- Buoyancy control devices
- Dry Suits
- Dive computers
- Full Face Masks
- Etc

Scuba cylinders are maintained by the Diving Safety Program and must be hydrostatically tested, have internal and external inspections on intervals not to exceed 12 months.

All equipment modification, repair, test, calibration, or maintenance service should be logged. In our sample, we found these logs were complete and dates matched between WebDiver and the source records.

Accuracy of Record Keeping

Records are kept for all scientific divers at UC Santa Cruz using the “WebDiver” web tool, and is backed up with physical documents (for things like physical approvals) and electronic records for other things like individual dive logs. WebDiver has an administration page that summarizes key information including the number of recent dives and periodic safety requirement due dates. We reviewed the accuracy of the information on this summary page by sampling 20 divers and reviewing source documents, specifically medical approval, equipment log, and annual review dates, to match against the information presented in the summary. We also reviewed the dive logs for these 20 divers plus an additional 9 divers. Our review found very few instances of dates being incorrect (and in these cases, they were off by only a single day) and therefore we believe the record keeping for the population as a whole is likely to be fairly accurate.

According to the Dive Manual, “Each authorized scientific diver shall log every dive made under the auspices of the UCSC program, and is encouraged to log all other dives. Dives should be logged into WebDiver at the earliest reasonable opportunity but no later than 1 month following the dive.” Among other things, the dive log should include things such as

- The date, time, and location of the dive
- The name of diving buddy
- Diving modes used.
- If the dive was a scientific dive or not

These dive logs are an especially important control as it provides an audit trail to ensure divers are getting their required number of dives annually and it shows what type of dives these individuals are performing. One potential challenge is that because this information is self-reported by the diver, there is little way to ensure the information is accurate, or that it is logged at all. One imperfect way to check the accuracy of the dive logs is to compare pairs of dive logs of individuals who listed each other as dive buddies. Dive buddies should have logs that match as they are conducting identical dives. In reviewing the dive logs of 29 divers, we found that these dive logs generally did match. However, we did find several instances of dive buddies listing dates that were 1 day apart.

We also confidentially surveyed divers about their logging practices. As this is self-reported, this should obviously be taken with some degree of skepticism. However the survey found that, of the 90 individuals surveyed:

- 81 (90%) reported that they logged all dives (or included a comment that indicated they reported all dives).
- 7 (7.8%) reported that they logged most of their dives, but not all.
- 2 (2.2%) reported that they did not do a good job logging all their dives.

The WebDiver tool also keeps a record of when specific required safety items are due to go out of date. These reoccurring items include:

- Medical Evaluations which must be completed every 2-5 years depending on one's age.
- Various training requirements such as first aid and CPR which must be recertified every two years.
- Annual equipment inspections by the Diving Safety Board.
- An annual safety review completed by the diver and validated by the diving officer.

We reviewed the source documents for medical evaluations, annual equipment inspections, and the annual safety review documents for 20 sampled divers to ensure WebDiver data matched the source documents. We did not find any instances of the dates in WebDiver being different than the source documents for these items.

Overall we believe the record keeping within WebDiver for the population as a whole is likely to be fairly accurate based on our sample analysis.

Lapsed Safety Items

We found some instances of scientific dives being recorded while participants were out-of-date on at least one required safety item. As indicated in previous section regarding "Accuracy of Record Keeping," we believe the information populated in WebDiver as a whole is likely to be fairly accurate. Therefore using the information contained within the population as a whole, we compared the dates in which particular safety items were due to be repeated against the date the records were pulled and the date in which the last scientific dive occurred for the particular diver. Overall we found that 8 of the 134 (~6%) divers we reviewed had recorded a scientific dive while they were out of date on at least one required safety item.

In total, the diving safety officer was tracking 134 divers with a current affiliation with the University as of our data request on April 14th 2020. For each of these divers, WebDiver tracks a great deal of information including tracking reoccurring requirements that must be kept up to date, and previous dives, etc. The administrative summary page in particular is useful as it includes a listing of all divers along with when particular reoccurring requirements are set to expire such as training requirements (such as First Aid, CPR, and O²). Diver Alert Network (DAN) insurance, and an annual review and equipment inspection by the Diving Safety Program. During our review of this administrative summary page we found a total of 13 divers who had taken a dive while one of these requirements was out of date. The table below shows examples of the 13 divers that had taken a dive while one of these requirements was out of date:

	First Aid Exp	CPR Exp	O2 Exp	DAN Exp	Annual Review Exp	Equipment Inspect	Last Dive	Last Scientific Dive
Diver 1	2/28/2020	2/28/2020	2/28/2020	4/30/2020	5/1/2020	4/9/2020	4/8/2020	4/8/2020
Diver 2	3/21/2021	3/21/2021	3/30/2020	5/31/2019	5/1/2019	6/23/2019	5/4/2019	11/27/2018
Diver 3	2/22/2020	2/22/2020	6/14/2020	3/31/2021	5/1/2020	12/31/2019	2/11/2020	2/11/2020
Diver 4	6/27/2021	6/27/2021	6/27/2021	6/30/2020	5/1/2020	10/24/2019	2/1/2020	4/5/2017
Diver 5	5/24/2020	5/24/2020	5/24/2020	2/28/2019	5/1/2019	2/19/2020	5/4/2019	5/4/2019
Diver 6	11/3/2019	11/3/2019	3/30/2020	2/28/2020	5/1/2020	2/15/2020	12/9/2019	11/13/2019
Diver 7	5/26/2020	4/6/2020	7/30/2020	8/31/2019	5/1/2020	7/26/2020	12/6/2019	9/13/2019
Diver 8	4/19/2020	4/19/2020	4/19/2020	5/31/2020	5/1/2020	7/27/2019	10/3/2019	10/3/2019
Diver 9	1/26/2020	1/26/2020	1/26/2020	1/31/2020	5/1/2018	1/1/2020	6/21/2019	6/21/2019
Diver 10	5/23/2019	5/23/2019	5/23/2019	11/30/2019	5/1/2020	6/10/2015	6/1/2017	11/19/2014
Diver 11	9/13/2019	9/13/2019	3/10/2018	3/31/2018	5/1/2018	10/5/2018	6/10/2019	10/18/2016
Diver 12	2/28/2021	2/28/2021	2/28/2021	5/31/2019	5/1/2020	2/27/2020	8/27/2019	10/4/2018
Diver 13	3/28/2021	3/28/2021	3/28/2021	9/30/2020	5/1/2020	8/20/2016	5/8/2019	8/17/2018

*As of April 14th 2020

Legend
Item expired during dive
Item expired during scientific dive

In the table above, five divers had taken a recreational dive since one of the items had lapsed. Divers are encouraged to log all dives, even if they are recreational. Because recreational dives have a different set of standards than scientific dives, recreational dives that occurred while lapsed on safety requirements are of less concern than scientific dives.

The remaining eight divers (~6% of all divers reviewed) had recorded a scientific dive while out of date on at least one reoccurring safety requirement. There could be multiple reasons for divers being out of date:

- The divers may have completed the required item, but it had not yet been updated into WebDiver.
- The information in WebDiver could be inaccurate. However, it should be repeated that we found fairly good data accuracy during our review of WebDiver.
- The diver may have recorded a scientific dive, when they actually completed a non-scientific dive.
- The diver may not have yet completed the requirement as required.

The periodic safety requirements laid out in the Dive Manual exist to reduce the inherent risks associated with diving. If individuals lapse on these requirements, there is a greater risk of harm to these individuals. This risk is especially high if the fourth item listed above is the cause of the lapse. In order to reduce this risk the diving control officer should work with the Diving Control Board to develop and implement controls to reduce the likelihood of divers conducting scientific dives while out-of-date on required safety items.

APPENDIX A – SUMMARY OF WORK PERFORMED AND RESULTS

Preliminary Analysis	
Work Performed	Results
Review key guidance and criteria associated with diving and boating safety.	The primary relevant local policy found at UC Santa Cruz regarding scientific diving is the “STANDARDS FOR SCIENTIFIC DIVING CERTIFICATION & OPERATION OF SCIENTIFIC DIVING PROGRAMS,” which is commonly simply referred to as the “Dive Manual.” This local policy was developed locally to reflect the standards derived from the American Academy of Underwater Sciences (AAUS). The AAUS is an organization which has a primary mission of advancing and facilitating safe and productive scientific diving. In practice, the AAUS sets a common set of standards that member organizations, including the University of California, follow. The diving program also complies with standards set by the National Association of Underwater Instructors (NAUI) for training provided by the diving program.
Review databases associated with diving and boating safety.	Records are kept for all scientific divers at UC Santa Cruz using the “WebDiver” web tool, and is backed up with physical documents (for things like physical approvals) and electronic records for other things like individual dive logs.

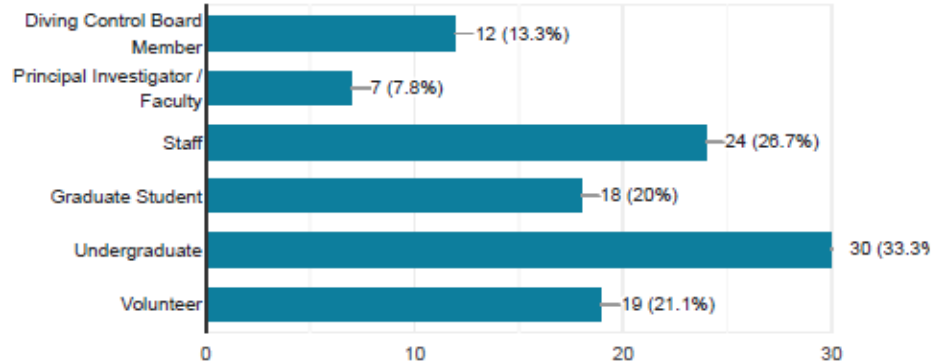
Fieldwork	
Work Performed	Results
Ensure individuals conducting scientific diving have been trained and certified in accordance with UCSC and AAUS requirements.	I reviewed WebDiver records to conclude that all active divers had taken mandatory training required by UCSC. UCSC Training is in compliance with AAUS requirements.
Ensure individuals are up-to-date on mandatory safety requirements.	<p>Eight divers (~6% of all divers reviewed) had taken a scientific dive while out-of-date on at least one reoccurring safety requirement. There could be multiple reasons for divers being out-of-date:</p> <ul style="list-style-type: none"> • The divers may have completed the required item, but it had not yet been updated into WebDiver. • The information in WebDiver could be inaccurate. However, it should be repeated that we found fairly good data accuracy during our review of WebDiver. • The diver may not have yet completed the requirement as required.

<p>Ensure diver certification records are accurate.</p>	<p>Our review found very few instances of dates being incorrect (and in these cases, they were off by only a single day) and therefore we believe the record keeping for the population as a whole is likely to be fairly accurate.</p>
<p>Ensure pre-dive plans are completed prior to when they occur.</p>	<p>I found that pre-dive plans generally were created for dives that I reviewed.</p>
<p>Ensure dives are logged after they occur.</p>	<p>Dive logs are an especially important control as it provides an audit trail to ensure divers are getting their required number of dives annually and it shows what type of dives these individuals are performing. One potential challenge is that because this information is self-reported by the diver, there is little way to ensure the information is accurate, or that it is logged at all. One imperfect way to check the accuracy of the dive logs is to compare pairs of dive logs of individuals who listed each other as dive buddies. Dive buddies should have logs that match as they are conducting identical dives. In reviewing the dive logs of 29 divers, we found that these dive logs generally did match. However, we did find several instances of dive buddies listing dates that were 1 day apart.</p> <p>Of the 90 individuals surveyed: 81 (90%) reported that they logged all dives, 7 (7.8%) reported that they logged most of their dives, but not all, and only 2 (2.2%) reported that they did not do a good job logging all their dives.</p>
<p>Ensure boater operation logs are properly completed.</p>	<p>I reviewed boater operation logs and found they appeared to be properly completed.</p>

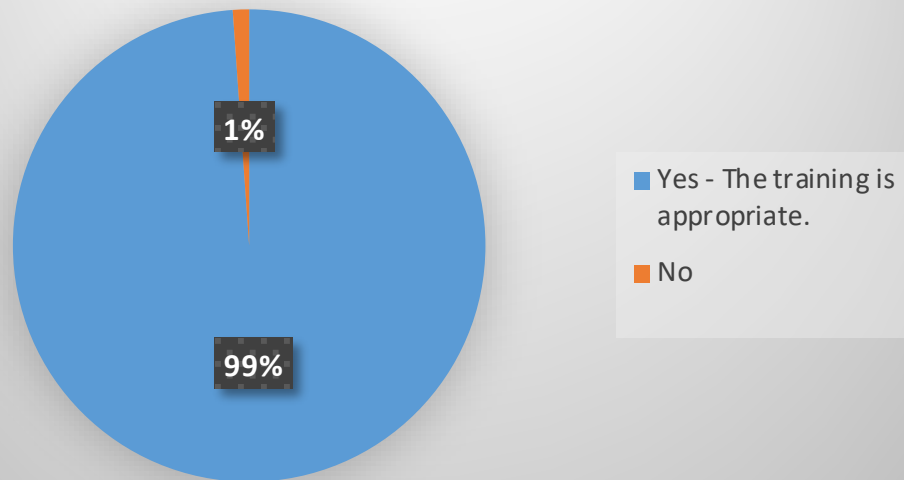
APPENDIX B – DIVER SURVEY RESULTS

What is your affiliation(s) to UC Santa Cruz dive program?

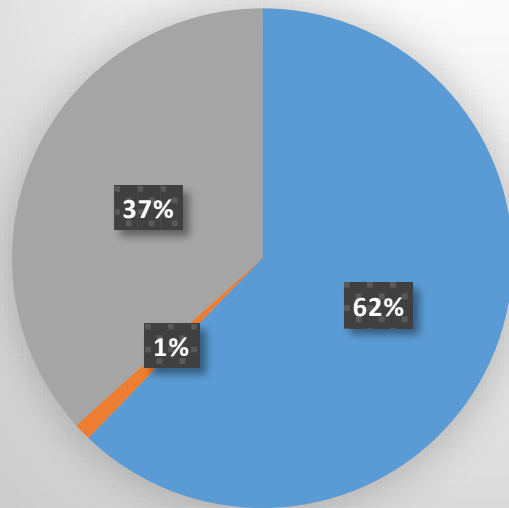
90 responses



Do you believe the overall amount of training provided for those conducting scientific dives at UC Santa Cruz is sufficient?

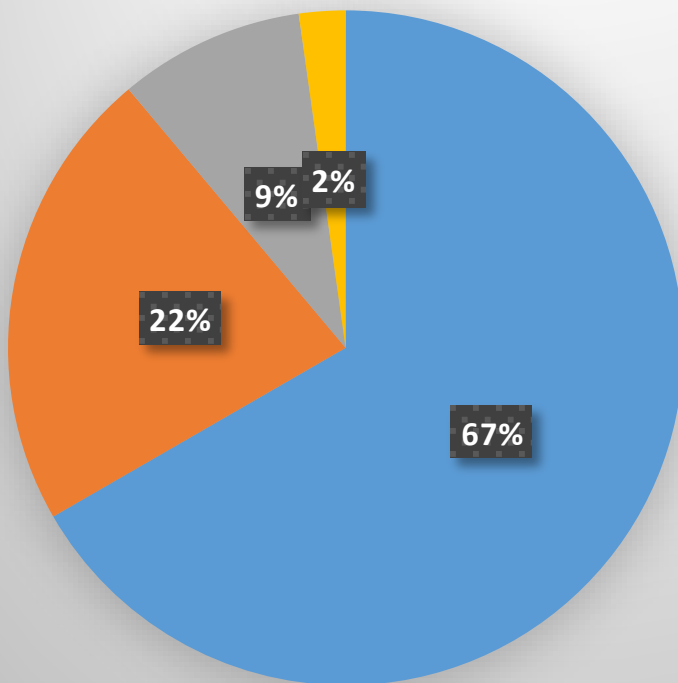


Do you believe the process in selecting Lead Divers at UC Santa Cruz is appropriate?



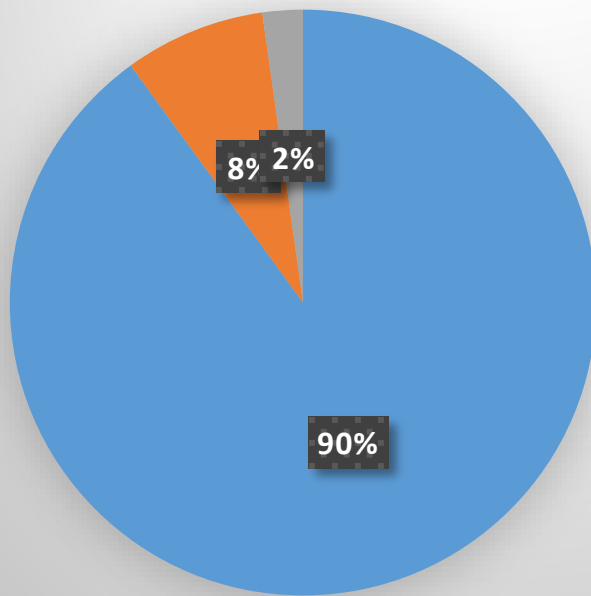
- Yes. The process is appropriate.
- No. The process is not strict enough
- I have no basis to know one way or another.

Presently, field classes involving diving must be supervised by a qualified Divemaster. Do you believe this requirement is appropriate?



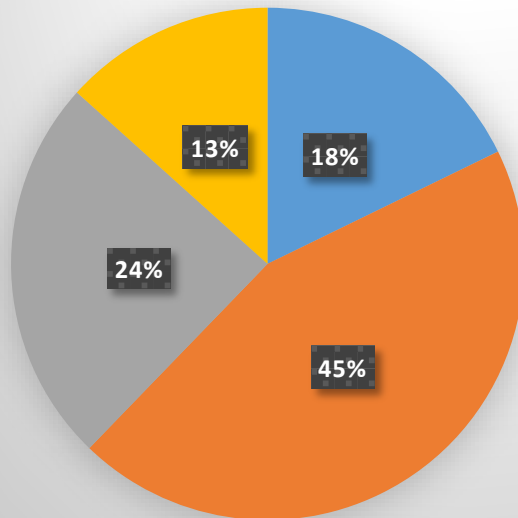
- Yes. This is the appropriate qualification for a field class involving diving.
- No. The requirement is too strict.
- I have no basis to know one way or another.
- No. The requirement is not strict enough.

Do you log your dives in WebDiver after diving?



- I log all my dives.
- I log most of my dives, but not all of them.
- I do not do a great job at logging my dives. (paraphrased response)

Generally, when do you log your dives in WebDiver after diving?



- I log my dives the day of the dive.
- I log my dives weekly.
- I log my dives monthly.
- Less than Monthly