E-SLATE

American Academy of Underwater Sciences (AAUS)

EDITOR'S NOTE – July 2009

Welcome to the July issue of the E-Slate. Please remember to vote for the AAUS Board of Directors Election. Balloting closes June 30. Also in this issue, the meeting notes from the NOAA Unit Diving Supervisor Conference and a report on the current use of Automated Emergency Defibrillators in scientific diving. Thank you for your submissions.

The E-Slate is a newsletter from and for the scientific dive community. We welcome news, announcements, job positions, new citations, and images with captions of underwater work. Please email submissions to aaus@disl.org. Current and past issues of the E-Slate are available at www.aaus.org.

NEWS/ANNOUNCEMENTS

AAUS Diving for Science Symposium 2010
The 2010 AAUS Diving for Science Symposium will be held March 25-27 in Waikiki, HI. Be sure to save the date. More information to follow.

A quick survey of AED use in Scientific Diving
Vallorie Hodges

Recently the Oregon Coast Aquarium purchased three Phillips AED's (Automated Emergency Defibrillator), including one waterproof unit. In an effort to get a quick view of how other scientific dive programs might be using these tools, the following survey was made of the AAUS membership (via the memberclicks website).

The question posed was: "Do you require an AED for diving operations?" In hindsight, several slightly different questions should have been asked, including; do you have AEDs available for all or some dive operations, and if so, how/when do you decide to bring one on these operations?

As responses came in to the question, this error was quickly recognized, and follow up questions were asked to clarify use.

There were a total of 64 responses, with the following results
Those that have AEDs:

- 3 Require them for all diving operations
- 33 Do not ***require*** AEDs for diving operations, but have available for:
  - all diving operations (9)
  - some offsite diving operations (24)
  - available at the dock – most diving within minutes of the dock (2)
  - onsite dives, but do not take them offsite (5)

Those that do not require them and/or do not have them for offsite dives:

- 10 Do not require and/or do not have them
- 13 Do not have/use but want them or plan to get them

A number of the comments that were made during this survey were also relevant to this discussion. Some members noted that AEDs might be inappropriate on some small vessels (e.g. inflatibles). Others pointed out that they did not have enough units for all diving operations, but did carry AEDs on their large Research Vessels and ships. Cost/budget was one reason cited for not having or requiring AEDs on all diving operations. A number of members also voiced strong opposition for any official move toward 'requiring' AEDs. One respondent stated, "our DCB feels that the regular cardiac screening of our divers, per AAUS standards, is sufficient risk management."

Some members commented that they encourage their divers to use them with larger groups, or more complicated or aggressive diving operations. Several suggested that older divers might warrant taking them along. Several respondents mentioned concerns with the rate of cardiac arrests in diving accidents reported to the Divers Alert Network.

This survey does indicate that there has been a move toward the provision or availability of AEDs for many scientific diving operations, and one might argue that it represents a standard of care. However, it should also be noted that there appears to be strong opinion among our membership that the use of these tools should continue to be at the discretion of the local dive program. It should also be noted that this was a quick, simple survey of our membership conducted on the memberclicks website, and only broad conclusions should be drawn from it. A more thorough and rigorous study would be required to identify the precise standard of care that is currently in practice.

UPCOMING EVENTS

AAUS BOD Voting - Closes June 30
Full members in good standing have until June 30th to vote in the 2009 Board of Directors election. Log into your individual

member record on the AAUS website (www.aaus.org), go to 'Community' on the left-hand tool bar, select 'Polls,' and select 'AAUS 2009 Election – Director's poll.

AMSA 2009 - Marine Connectivity

The Australian Marine Sciences Association Inc. (AMSA) 2009 International Conference will be held in Adelaide, South Australia July 5-9, 2009 at the Adelaide Convention Centre. The theme of the conference is 'Marine Connectivity.' This conference will provide a forum to discuss the state of the art for investigating marine connectivity, novel approaches and technical advances, and the meaning of connectivity in the oceans and coastal seas. For more information visit: www.amsaconference.com.au.

DAN Instructor Trainer Workshops

Divers Alert Network (DAN) is offering a series of Instructor Trainer Workshops (ITW) and Trainer Updates throughout July in various cities across the US. DAN Trainers are able to offer both DAN Provider Courses and DAN Instructor Qualification Courses. The workshops are open to scuba diving instructor trainers who are also CPR Instructors. The ITW will cover Scuba Oxygen, Advanced Oxygen, Hazardous Marine Life Injuries, automated emergency defibrillators (AEDs), Neurological Assessment, Diving Emergency Management Provider (DEMP), both DAN Aquatics courses, and the new Dive Medicine for Divers Program (DMDP). DMDP covers topics such as fitness to dive, risk assessment and physical exam techniques. Combining it with DEMP and On-Site Neurological Assessment for Divers constitutes Dive Medicine for Divers Level 1. For more information, including a full list of dates and locations visit: http://www.dan.org/Events/Default.aspx.

Shoals Marine Lab Underwater Archaeology Course

Shoals Marine Laboratory (SML) is offering an Underwater Archaeology course (ARKEO 3002) August 10-17, 2009. This course will be held on Appledore Island, located six miles off the coast of Portsmouth, NH. The course will cover the development of maritime archaeology and the discipline of underwater archaeology. Students will participate in active fieldwork, including underwater exploration. Tuition includes room and board, activity fees, and round trip boat transportation between Portsmouth, NH and Appledore Island. This two-credit course is open to all college undergraduates. If space is available, non-matriculating students may audit with permission of the instructor. Those who wish to scuba dive must be active AAUS scientific divers. Training to become an AAUS scientific diver is also available at SML by participating in our four credit Underwater Research course (BIOSM 3650/ZOOL 730). For those without AAUS diving qualifications, snorkeling is a suitable way to participate. Financial aid is available and students are encouraged to apply. For more information visit: http://www.sml.cornell.edu.

ISOSD 2009

The 2nd International Symposium on Occupational Scientific Diving (ISOSD) of ESPD, held at Tvärminne Zoological Station, University of Helsinki, Finland October 6-8, 2009, is organized by the Finnish Scientific Diving Steering Association. Symposium organizers welcome oral presentations and posters on all fields of scientific diving and training (science, maritime archaeology, scientific engineering etc.). Special emphasis is on methods, techniques, and instrumentation in actual underwater fieldwork. In addition to scientific presentations, presentations of scientific diving methods, interesting projects etc, are encouraged. Presentations are not required to follow strict scientific guidelines, and may be in the form of image slideshows, video etc. Optional dives at sites of scientific and/or archaeological interest in northern Baltic Sea archipelago, and in a clear water limestone quarry will be offered. Information: http://luoto.tvarminne.helsinki.fi/ISOSD2009.html.

FUNDING/SCHOLARSHIPS

AAUS 2009 Student Scholarships

The application deadline for the 2009 AAUS graduate student scholarship awards is imminent (June 30th). Awards can support master or doctoral students who are using scientific diving as a principal research tool or studying diving science. For more information, visit: http://www.aaus.org/mc/page.do?sitePageId=64326&orgId=aaus.

MEETING NOTES

NOAA Unit Diving Supervisor Conference Report

Capt. Nathan T. Schwarck, M.S.

The National Oceanic and Atmospheric Administration (NOAA) Diving Program Unit Diving Supervisor Conference was held in Seattle Washington March 23-27. Participants included leadership level representatives from the National Marine Fisheries Service, National Ocean Service, Office of Marine and Aviation Operations, and the Office of Oceanic and Atmospheric Research Line Offices responsible for the 90+ NOAA diving units.

Recent changes to the NOAA diving program were discussed, challenges presented by them, and recommended actions needed to address them. For example, a total of 34 recommended corrective actions were identified in the incident review following a diving fatality (March 17th, 2008) in the NOAA Florida Keys National Marine Sanctuary. Many of the corrective actions were instituted within the last year, resulting in significant changes to diving operations. Several NOAA units have chosen to cease all diving operations until additional support can be acquired.

A recommended action requiring the development of a formalized training and certification program for NOAA 'science' and 'equivalent' divers is of specific interest to AAUS and those organizational Members conducting reciprocity dives with NOAA. Although NOAA has addressed this recommendation in part by adopting the AAUS standards for NOAA 'science' dives, NOAA's current interpretation of what can be classified as a science dive is very limited.

The recent review of the dive program yielded additional requirements including 1) the implementation of a dive unit inspection program; 2) the need to update the functionality of the NOAA diver database; 3) the requirement to develop a means for topside supervisors to communicate with divers when diving deeper than 100 ft; and 4) the necessity to ensure that automated external defibrillators are on all appropriately sized boats supporting dive operations. The NOAA dive center staff are working to implement these changes.

NOAA has decided to abandon the idea of pursuing new federal regulations and to instead devote efforts towards requesting alternate standards from the Secretary of Labor for specific regulations that most hinder NOAA's ability to accomplish its mission. If granted, this would allow the NOAA dive program to again use nitrox, dive to 130 ft without an on-site chamber, use manually-triggered ventilators for oxygen delivery, and to eliminate the need for an independent gas source for buoyancy compensator inflation, to list a few. In April of this year, a policy decision was made to once again allow training or proficiency dives under the OSHA scientific exemption instead of adhering to OSHA commercial standards.

Dave Dinsmore, the NOAA Dive Program Manager concluded his Day 1 presentation at the conference by stating, "… Additional changes are coming and we might as well face the fact that the old NOAA Diving Program as we knew it is gone forever. However, I'm convinced that once all the dust settles, we will be a stronger, safer program than we've ever been in the past. Please don't give up…..I haven't."

The AAUS Board of Directors is working with NOAA and additional stakeholders to determine the value of revisiting the terms of the 'scientific diving' exemption from OSHA regulation. Unlike the new federal regulations NOAA was pursuing, the alternate standards currently requested by NOAA would only apply (if granted) to the NOAA dive program, and not to the larger scientific diving community as a whole.

Please refer to the AAUS website for more information on the NOAA Unit Diving Supervisor's Conference, subsequent discussions pertaining to the alternate standards, and the value of proposing new scientific diving federal regulations.

EQUIPMENT RECALL

Poseidon Diving Wings Recalled

The US Consumer Product Safety Commission (CPSC), in cooperation with Poseidon, announced a voluntary recall of Besea W50 Diving Wings with Poseidon Inner Bladders. Consumers should stop using recalled products immediately unless otherwise instructed. The inner bladder located inside the diving wing can break, causing the wing to fail to operate as a floating/buoyancy device. This poses a drowning hazard to divers. Poseidon has received 15 reports of inner bladders breaking. No injuries have been reported. The recall involves the Poseidon inner bladders with batch number 5445 sold with the Poseidon Besea W50 wings. The inner bladder is located inside the outer cover of the wing. The batch number and 'Poseidon' are molded on a tab located between the 'legs' of the inner bladder. These units were sold at Poseidon dealers nationwide from September 2007 through June 2008 for about $366.

Consumers who have wings that contain the recalled inner bladders should stop using the wing immediately and contact Poseidon for a free replacement. For additional information, contact Poseidon toll-free at 877-673-4366 (weekdays 0800-1700 central time) or email info@poseidoncentral.com

For additional information, visit:
http://www.cpsc.gov/cpscpub/prerel/prhtml09/09251.html.

NEW PUBLICATIONS

Di Franco A, Milazzo M, Baiata P, Tomasello A, Chemello R. Scuba diver behaviour and its effects on the biota of a Mediterranean marine protected area. ICES J Mar Sci, doi:10.1093/icesjms/fsp058.

The effects of diving activity in different Mediterranean subtidal habitats are scarcely known. This study evaluates diver behaviour (for example time spent in each habitat), use (contacts made with the substrate) and immediate effects of diver contact on benthic species in a marine protected area (MPA) in Sicily. Over a two-year period, intentions of 105 divers were observed within seven subtidal habitats: algae on horizontal substrate, algae on vertical substrate, *Posidonia oceanica*, encrusted walls, caves, sand and pebbles. Divers selected a habitat in proportion to its availability along the scuba trail. On average, each diver made 2.52 contacts every seven minutes, and no differences were detected among the levels of diver scuba certification. The highest rates of total and unintentional contacts were recorded on caves and encrusted walls, and the slow growing species *Eunicella singularis* and *Astroides calycularis* were the most frequently injured by divers. Most of the contacts were concentrated in the first minutes of the dives. The identification of diving effects in different habitats will enable management strategies to specifically control this

impact at a habitat scale, for example restricting the start of the dive to low vulnerability habitats would reduce damage to benthic organisms, allowing sustainable use of MPAs.

Gole Y, Rossi P, Fontanari P, Gavarry O, Boussuges A. Arterial compliance in divers exposed to repeated hyperoxia using rebreather equipment. Aviat Space Environ Med. 2009; 80(5): 482-4.

BACKGROUND: Acute hyperoxic exposure is known to modify cardiovascular parameters like a decrease in cardiac output, arterial vasoconstriction, and autonomic nervous system changes. We hypothesized that repeated hyperbaric hyperoxic exposures, as experienced by military oxygen divers, lead to long-term arterial alterations. METHODS: Arterial blood pressure measurements and pulse wave velocity (PWV) recordings were performed during basal conditions in 15 elite military oxygen divers, and compared to 15 non-diver controls. The two groups were matched appropriately for physical characteristics (age: 35±5 yr, weight: 77±8 kg, height: 177±6 cm, body mass index: 24.6±2.0 $kg \cdot m^{-2}$), and aerobic capacity ($VO_{2\,max}$: 52±7 $mL \cdot min^{-1} \cdot kg^{-1}$). RESULTS: No significant difference was found in systolic blood pressure (120±11 mmHg), diastolic blood pressure (70±8 mmHg), or pulse pressure (50±7 mmHg). Furthermore, there was no significant difference in the carotid-femoral PWV (6.7±0.9 $m \cdot s^{-1}$), the carotid-radial PWV (8.7±1.7 $m \cdot s^{-1}$), or the carotid-pedal PWV (8.1±1.1 $m \cdot s^{-1}$) between divers and controls. CONCLUSION: No difference in arterial compliance was observed in physically well-trained military oxygen divers in comparison with matched controls.

Hobbs M, Kneller W. Effect of nitrogen narcosis on free recall and recognition memory in open water. Undersea Hyperb Med. 2009; 36(2): 73-81.

RATIONALE: Previous research has demonstrated that nitrogen narcosis causes decrements in memory performance but the precise aspect of memory impaired is not clear in the literature. OBJECTIVE: The present research investigated the effect of narcosis on free recall and recognition memory by applying signal detection theory (SDT) to the analysis of the recognition data. METHODS: Using a repeated measures design, the free recall and recognition memory of 20 divers was tested in four learning-recall conditions: shallow-shallow (SS), deep-deep (DD), shallow-deep (SD) and deep-shallow (DS). The data was collected in the ocean off Dahab, Egypt with shallow water representing a depth of 0-10 m (33 ft) and deep water 37-40 m (121-131 ft). The presence of narcosis was independently indexed with subjective ratings. RESULTS: In comparison to the SS condition there was a clear impairment of free recall in the DD and DS conditions, but not the SD condition. Recognition memory remained unaffected by narcosis. CONCLUSIONS: It was concluded narcosis-induced memory decrements cannot be explained as simply an impairment of input into long term memory or of self-guided search and it is suggested instead that narcosis acts to reduce the level of processing/encoding of information.

Hunter WR, Sayer MDJ. The comparative effects of habitat complexity on faunal assemblages of northern temperate artificial and natural reefs. ICES J Mar Sci. 2009; 66: [advance online].

Several north temperate marine species were recorded on subtidal hard-substratum reef sites selected to produce a gradient of structural complexity. The study employed an established scuba-based census method, the belt transect. The three types of reef examined, with a measured gradient of increasing structural complexity, were natural rocky reef, artificial reef constructed of solid concrete blocks, and artificial reef made of concrete blocks with voids. Surveys were undertaken monthly over a calendar year using randomly placed fixed rope transects. For a number of conspicuous species of fish and invertebrates, significant differences were found between the levels of habitat complexity and abundance. Overall abundance for many of the species examined was 2–3 times higher on the complex artificial habitats than on simple artificial or natural reef habitats. The enhanced habitat availability produced by the increased structural complexity delivered through specifically designed artificial reefs may have the potential to augment faunal abundance while promoting species diversity.

Katsenelson K, Arieli R, Arieli Y, Abramovich A, Feinsod M, Tal D. Hyperbaric oxygen pretreatment according to the gas micronuclei denucleation hypothesis reduces neurologic deficit in decompression sickness in rats. J Appl Physiol. 2009 [Epub ahead of print].

During sudden or too rapid decompression, gas is released within supersaturated tissues in the form of bubbles, the cause of decompression sickness (DCS). It is widely accepted that these bubbles originate in the tissue from preexisting gas micronuclei. Pretreatment with hyperbaric oxygen (HBO) has been hypothesized to shrink the gas micronuclei, thus reducing the number of emerging bubbles. The effectiveness of a new HBO pretreatment protocol on neurological outcome was studied in rats. This protocol was found to carry the least danger of oxygen toxicity. Somatosensory evoked potentials (SSEPs) were chosen to serve as a measure of neurologic damage. SSEPs in rats given HBO pretreatment before a dive were compared with SSEPs from rats not given HBO pretreatment and SSEPs from non-dived rats. The incidence of abnormal SSEPs in the animals subjected to decompression without pretreatment (1013 kPa for 32 min followed by decompression) was 78%. In the pretreatment group (HBO at 304 kPa for 20 min followed by exposure to 1013 kPa for 33 min and decompression) this was

significantly reduced to 44%. These results call for further study of the pretreatment protocol in higher animals.

Liow MH, Chong SJ, Kang WL. A tale of three divers: recompression therapy for divers with severe Type II decompression sickness with neurological deficits. Singapore Med J. 2009; 50(5): e173-5.

Decompression sickness (DCS) is manifested in a myriad of symptoms, and can affect any part of the body. It is attributed to the formation of inert gas bubbles in the blood and tissues. Following a diving incident, the pathogenesis of DCS is a result of mechanical obstruction caused by the inert gas bubbles and the body's immunological response to the bubbles. Neurological DCS may present with unusual sensory/motor symptoms that may lead to paralysis. This report describes three divers who suffered severe neurological Type II DCS and underwent recompression therapy at the Naval Hyperbaric Centre in 2007.

Prediletto R, Fornai E, Catapano G, Carli C, Garbella E, Passera M, Cialoni D, Bedini R, L'Abbate A. Time course of carbon monoxide transfer factor after breath-hold diving. Undersea Hyperb Med. 2009; 36(2): 93-101.

Breath-hold divers may experience haemoptysis during diving. Central pooling of blood as well as compression of pulmonary gas content can damage the integrity of the blood-gas barrier, resulting in alveolar hemorrhage. The single-breath carbon monoxide test (DL_{CO}) was used to investigate the blood-gas barrier following diving. The study population consisted of 30 divers recruited from a training course. DL_{CO} levels were measured before diving and at 2, 10 and 25 min after the last of a series of four dives to depths of 10, 15, 20 and 30 m. When compared to pre-diving values, DL_{CO} values increased significantly at 2 min following diving in all subjects except one. Thereafter values progressively decreased toward baseline at 10 and 25 min in all subjects but one, while in four divers DL_{CO} values decreased below baseline. The early but transient increase in DL_{CO} levels shortly after diving supports the persistence of capillary pooling of red blood cells following emersion. Persistence at 25 min of high DL_{CO} values in one subject could be attributed by lung CT to extravasation of blood into the alveoli. Early or late DL_{CO} values >10% below baseline values suggest the presence of pulmonary edema. The relatively high prevalence of DL_{CO} alterations found suggests caution on the safety of breath-hold diving activities.

Sureda A, Ferrer MD, Batle JM, Tauler P, Tur JA, Pons A. Scuba diving increases erythrocyte and plasma antioxidant defenses and spares NO without oxidative damage. Med Sci Sports Exerc. 2009; 41(6): 1271-6.

PURPOSE: The aim of the present work was to study the effects of a single scuba diving immersion to high depth on erythrocyte and plasma antioxidant defenses, on erythrocyte cellular damage, and on nitric oxide (NO) production. METHODS: Seven male preprofessional divers performed an immersion at a depth of 40 m for a total time of 25 min. Blood samples were obtained before the diving session after overnight fasting, immediately after diving, and 3 h after the diving session was finished. Erythrocytes and plasma fractions were purified. RESULTS: No significant differences were found in circulating erythrocytes, bilirubin, and hemoglobin concentration attributed to diving. Hematocrit levels were reduced after diving because of the reduction of erythrocyte size that was maintained after 3 h of recovery at the surface. Leukocyte counts significantly increased at recovery (38±4%). In erythrocytes, glutathione peroxidase activity significantly increased (18±4%) at recovery. A rise in plasma catalase activity (38±6%) immediately occurred after diving, returning to basal values after recovery. Plasma superoxide dismutase activity significantly increased (58±7%) during recovery. Markers of oxidative damage in both erythrocytes and plasma such as malondialdehyde and protein carbonyl derivates remained unchanged after diving. Nitrite levels significantly rose in plasma and erythrocytes (85±8% and 52±6%, respectively) at recovery. CONCLUSION: Scuba diving session induced an antioxidant response in plasma and erythrocytes without the appearance of cellular damage and an increase in NO, which can be related with its vasodilator role.

Vann RD, Denoble PJ, Howle LE, Weber PW, Freiberger JJ, Pieper CF. Resolution and severity in decompression illness. Aviat Space Environ Med. 2009; 80(5): 466-71.

We review the terminology of decompression illness (DCI), investigations of residual symptoms of decompression sickness (DCS), and application of survival analysis for investigating DCI severity and resolution. The Type 1 and Type 2 DCS classifications were introduced in 1960 for compressed air workers and adapted for diving and altitude exposure with modifications based on clinical judgment concerning severity and therapy. In practice, these proved ambiguous, leading to recommendations that manifestations, not cases, be classified. A subsequent approach assigned individual scores to manifestations and correlated total case scores with the presence of residual symptoms after therapy. The next step used logistic regression to find the statistical association of manifestations to residual symptoms at a single point in time. Survival analysis, a common statistical method in clinical trials and longitudinal epidemiological studies, is a logical extension of logistic regression. The method applies to a continuum of resolution times, allows for time varying information, can manage cases lost to follow-up (censored), and has potential for investigating questions such as optimal therapy and DCI severity. There are operational implications as well. Appropriate definitions of mild and serious manifestations are essential for computing probabilistic decompression procedures where severity determines the DCS probability that is acceptable.

Application of survival analysis to DCI data would require more specific case information than is commonly recorded.

Wheen LC, Williams MP. Post-mortems in recreational scuba diver deaths: the utility of radiology. J Forensic Leg Med. 2009; 16(5): 273-6.

Post-mortem radiology and autopsy findings in a series of six diving-related deaths are presented. The cases had different causes of death but essentially similar radiological findings. We propose that the so-called classical radiological features of cerebral arterial gas embolism more likely represent 'off-gassing' (gas coming out of solution into intra-vascular spaces due to pressure changes). As such, we suggest that post-mortem radiology, when accompanying a competent autopsy examination, be limited to the chest, whereby it may be useful in the demonstration of pneumothoraces which might not be demonstrated at autopsy, thereby providing supporting evidence for barotrauma in the context of appropriate clinical and autopsy findings.

The mission of the American Academy of Underwater Sciences is to facilitate the development of safe and productive scientific divers through education, research, advocacy, and the advancement of standards for scientific diving practices, certifications, & operations.

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