E-SLATE

American Academy of Underwater Sciences (AAUS)

EDITOR'S NOTE – September 2009

Welcome to the September issue of the E-Slate. Be sure to check out the new publications section this month. Several of the publications are from the Proceedings of the 1st International Workshop in Research in Shallow Marine and Fresh Water Systems and cover a wide range of scientific diving methods.

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

Explosion of Lawrence Factor Test Cylinder

In May 2009 AAUS Organizational Member (OM) North Carolina Aquarium, Roanoke Island experienced an explosion of a Lawrence Factor test cylinder (kit #193665) while conducting an air test of their breathing air compressor. The test cylinder in this kit is a thin walled aluminum cylinder rated at 600 psi and does not require hydrostatic testing due to the low pressures to which the cylinder is designed to be exposed. It is fitted with a preset release/bleed valve and cylinder burst disc. Gas is circulated through the test cylinder for three minutes at 2500 psi to obtain the gas sample sent to Lawrence Factor for analysis. When working properly, the release valve maintains pressure in the cylinder at 80 to 90 psi with fill the pressure set at 2500 psi.

Over the past seven years the OM Diving Safety Officer (DSO) had conducted over 30 previous air tests without incident with this type of sampling equipment, always conducting the test according to the instructions provided by Lawrence Factor. In this instance the same sampling procedures were followed.

The OM's fill station is equipped with a blast chamber and remote filling controls. During the sampling process, the cylinder was placed in the blast chamber and the fill rate was adjusted per Lawrence Factor instructions. The DSO did not hear gas bleeding from the cylinder and opened the blast door to confirm gas was being released; it was not. The blast door was closed and the DSO was in the process of shutting down the fill whip when the explosion occurred. There were no injuries associated with this incident.

The preliminary findings indicate the bleed valve failed, and that the cylinder had two burst discs installed instead of a single burst disc, allowing pressure to increase to the point of cylinder failure. Discussions between the DSO and Lawrence Factor find that the company currently does not track the exact cylinder used during an air test after the sample has been removed for analysis, providing no trail as to where this cylinder had been prior to this incident. The company representative stated that after the sample gas is removed the sampling equipment is recycled to other customers.

Ruptured Lawrence Factor test cylinder

This article was approved and submitted by AAUS OM North Carolina Aquarium, Roanoke Island.
Author credit: Steve Sellers and Patrick Murphy

UPCOMING EVENTS

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.

AAUS Fall BOD Meeting

The Fall Board of Directors meeting will be held in conjunction with the DEMA meeting in Orlando, FL. It will be on Thursday, November 5, 2009, from 1000-1800, at the Metropolitan Hotel in Orlando.

AAUS Diving for Science Symposium 2010

The 2010 AAUS Diving for Science Symposium will be held March 25-27 in Waikiki, HI. The Ala Moana Hotel has been secured for the symposium. When making a reservation mention AAUS for the reduced rate of $119. This rate is available March 22-29. If hotel rates decrease before the symposium, the AAUS rate will also decrease. However, if the hotel rate increases, the AAUS fee is locked in at $119. All symposium meetings including the DSO meeting and business meeting will be held at the hotel. The banquet will be at the Waikiki Aquarium (http://www.waquarium.org). Schedule of workshops will be posted ASAP. Call 1-808-955-4811 or visit http://www.alamoanahotelhonolulu.com/ for reservations.

EQUIPMENT WARNING

Closed-Circuit Rebreathers and Hydraulic Tools

Recent testing of Ambient Pressure Diving's Vision Electronics (used in the Inspiration, Evolution and Evolution + closed-circuit rebreathers), while operating underwater hydraulic tools (handheld hydraulic breakers) has demonstrated that water jets from tool use can activate switches on the handsets. This could lead to alterations in the closed-circuit rebreather's user defined programming.

A report will be issued but DSOs using closed-circuit rebreathers and hydraulic tools in their program should take appropriate precautions in the interim.

NEW PUBLICATIONS

Buzzacott P, Rosenberg M, Pokora T. Western Australian recreational scuba diving fatalities, 1992 to 2005. Aust NZ J Public Health. 2009; 33(3): 212-4.

OBJECTIVE: To investigate recreational scuba diving fatalities within Western Australia (WA) between 1992 and 2005. METHODS: Coroners reports for 24 diving fatalities were reviewed to determine anthropometry, certification status and breaches of safe practices for each. RESULTS: Certification status was known for 20 divers and of these six (30%) were uncertified. Certified divers breached significantly fewer safe diving practices than uncertified divers ($p<0.01$). Existing regulatory mechanisms require training certification only for dives made from commercial dive boats, yet the number of deaths involving shore dives or private craft (n=15) were triple the number diving from commercial boats (n=5). CONCLUSION: Uncertified divers are less regulated and breach more safe practices than certified divers. Implications: We recommend changes to existing regulations governing dives made from shore and private craft in WA, requiring that all divers be certified.

Currie DR, Sorokin SJ. Evaluating the effects of reserve closure on algae, invertebrate and fish assemblages at a temperate South Australian marine reserve. J Mar Biol Assoc UK. 2009; 89: 651-61.

Differences in the reef biota between the Point Labatt Marine Reserve and adjacent unprotected reference areas were examined following an 18-year period of protection from fishing. Quantitative measures of fish, invertebrates and algae were obtained by divers at 16 depth-stratified locations inside and outside the reserve, and the significance of differences examined using a combination of univariate (ANOVA) and multivariate (MDS) analyses. Strong depth-related differences in the composition and abundance of algae and invertebrates were observed, both inside and outside the reserve. These community differences were most pronounced in shallow near-shore waters (<10 m depth), and were largely due to variations in the abundance of a small group of species with widespread distributions. Spatial patterns in fish were not closely related to depth, and it appears that trophic linkages between fish and the underlying algal and invertebrate assemblages at Point Labatt are either weak or occur at spatial scales larger than that covered in this study. No significant reserve-related differences were detected in the abundance, diversity or community structures of algae, invertebrates and fish examined in this study. In many cases this is because the biological attributes measured were highly variable in space, and required more intensive sampling regimes to improve statistical precision. This study emphasizes the need for more robust survey designs and their timely implementation in marine conservation planning processes.

Esposito A, Giordano G, Anzidei M. Diving in Panarea volcanic (Aeolian Islands, Italy): methodology and results. Freiberg Online Geol. 2009; 22: 67-70.

A submarine gas eruption started in November 2002 offshore of Panarea volcano (Aeolian Islands, Italy). We planned a scuba diving campaign using a high resolution Marine Digital Terrain Model to study the exhalation centres and the geological, morphological and structural features and to clarify the relationships between gas vents distribution, submarine volcanological structures of this submerged area. We drew the first geological and structural maps of the seafloor surrounding the exhalative area and establish the role of NE- and NW- trending fractures as the main pathways for the 2002 gas exhalation.
Link: http://www.geo.tu-freiberg.de/fog/FOG_Vol_22.pdf.

Gempp E, Blatteau JE. Risk factors and treatment outcome in scuba divers with spinal cord decompression sickness. J Crit Care. 2009 Aug 12. [Epub ahead of print]

PURPOSE: This study was designed to determine the recompression strategy and the potential risk factors associated with the development of severe diving-related spinal cord decompression sickness (DCS). METHODS: Sixty-three injured recreational divers (52 men and 11 women; 46±12 years) presenting with symptoms of spinal involvement were retrospectively included. Diving information, symptom latency after dive completion, and time interval between symptom onset and hyperbaric treatment were studied. The severity of spinal cord DCS was rated numerically for both the acute event and one month later. Initial recompression treatment at 2.8 atmosphere absolute (ATA) with 100% oxygen breathing or deeper recompression at four atmospheres absolute with nitrogen-oxygen or helium-oxygen breathing mixture was also noted. RESULTS: Twenty-one divers (33%) had incomplete resolution after one month. The clinical severity at presentation was the only independent predictor of poor outcome (odd ratio, 2.68; $p<0.033$). Time to treatment did not influence the recovery with a similar median delay (three hours) between the divers with or without long-term sequelae. Choice of recompression procedure was not also a determinant factor for treatment outcome. CONCLUSION: The initial clinical course before treatment is a major prognostic factor of spinal cord DCS. Delay to recompression less than three hours and use of deep treatment tables did not improve outcome in DCS divers.

Guaraldi P, Serra M, Barletta G, Pierangeli G, Terlizzi R, Calandra-Buonaura G, Cialoni D, Cortelli P. Cardiovascular changes during maximal breath-holding in elite divers. Clin Auton Res. 2009 Aug 5. [Epub ahead of print]

During maximal breath-holding six healthy elite breath-hold divers, after an initial "easy-going" phase in which cardiovascular changes resembled the so-called "diving response", exhibited a sudden and severe rise in blood pressure during the "struggle" phase of the maneuver. These changes may represent the first tangible expression of a defense reaction, which overrides the classic diving reflex, aiming to reduce the hypoxic damage and to break the apnea before the loss of consciousness.

Hall-Spencer JM, Rodolfo-Metalpa R. Using scientific diving to investigate the long-term effects of ocean acidification at CO_2 vents. Freiberg Online Geol. 2009; 22: 72-6.

We are using scuba to document ecosystem responses to long-term ocean acidification at volcanic CO_2 vents. There are 30% reductions in biodiversity at average pH 7.8-7.9 (minimum pH 7.4), compared with areas with normal pH (8.1-8.2). Some groups (seagrasses and many algae) are tolerant of the increased CO_2 levels but others (corals, sea urchins and calcified algae) are removed from the ecosystem. Transplant experiments show dissolution of calcareous organisms and our study demonstrates, for the first time, what happens to coastal marine ecosystems when key groups of species are killed due to rising CO_2 levels. Link to article: http://www.geo.tu-freiberg.de/fog/FOG_Vol_22.pdf.

Hall-Spencer J, Munn C, Hiscock K. Scientific divers quantify first known outbreaks of cold-water coral disease. Freiberg Online Geol. 2009; 22: 42-8.

Coral diseases are widely reported in the tropics but the first incidence of cold-water coral disease was not noted until 2002 when divers recorded an outbreak at 10-28 m depth off Lundy in a NE Atlantic marine protected area. The seafan *Eunicella verrucosa* exhibited coenchyme necrosis and subsequent diving surveys of >600 colonies at 13 sites since revealed that disease outbreaks were widespread in SW England to depths of 50 m from 2003-2008, possibly caused by infection by *Vibrio* bacteria at high temperatures. Link to article: http://www.geo.tu-freiberg.de/fog/FOG_Vol_22.pdf.

Hart AM, Fabrisa FP, Brown J, Murphy D. Digital video surveys of abalone (*Haliotis* sp.) stocks by commercial fishers in Western Australia. Fisheries Res. 2008; 93(3): 305-14.

An evaluation of a digital video survey programme (DVI surveys) to provide cost-effective stock assessment information for Haliotid (abalone) fisheries was undertaken. Cost effectiveness was achieved by using commercial abalone industry divers to collect abundance and length–frequency data from remote locations using a custom designed video survey unit. Production of training DVD/video, training regimes, and a comprehensive suite of experimental tests on two abalone species (*Haliotis laevigata*; *Haliotis roei*) were utilized to achieve this outcome. Estimates of density and size-frequency of the populations of interest were achieved (0.5-1.0 m^2 for *H.laevigata*; 6-18 m^2 for *H. roei*), and appeared reasonable in comparison with existing studies. Although results were not be used as a basis for management decisions due to their preliminary nature, they provided evidence of the potential usefulness of the method for detecting change at the population level. Importantly, the DVI surveys performed favorably against a traditional area-based survey technique, providing the same level of precision in abundance estimation of recruited *H. laevigata* (greenlip abalone), for 40% of the sampling effort and costs. Overall, this work has expanded the role of DVI surveys as applied to fish and fish habitat assessment, however the abundance and size estimates generated by DVI surveys need to be primarily considered as relative indices, useful for detecting trends over time, provided that the selectivity and sampling issues have appropriately considered.

Howle LE, Weber PW, Vann RD, Campbell MC. Marginal decompression sickness events: their relation to decompression and use in DCS models. J Appl Physiol. 2009 Aug 20. [Epub ahead of print]

We consider the nature and utility of marginal decompression sickness (DCS) events in fitting probabilistic decompression models to experimental dive trial data. Previous works have assigned various fractional weights to marginal DCS events so that they contributed to probabilistic model parameter optimization, but less so than did full DCS events. By including fractional weight for marginal DCS events, the model's predictions are more conservative. We explore whether marginal DCS events are correlated with exposure to decompression or are randomly occurring events. Three null models are developed and compared to a known decompression model that is tuned on dive trial data containing only marginal DCS and non-DCS events. We further investigate the technique by which marginal DCS events were previously included in parameter optimization, explore the effects of fractional weighting of marginal DCS events on model optimization, and explore the rigor of combining data containing both full and marginal DCS events for probabilistic DCS model optimization. We find that, although marginal DCS events are related to exposure to decompression, empirical dive data containing marginal and full DCS events are not combinable under a single DCS model. Further, we find analytically that the optimal weight for a marginal DCS event is 0. Thus, marginal DCS should be counted as no-DCS events when optimizing probabilistic DCS models with binomial likelihood functions. Specifically, our study finds that including marginal DCS events in model optimization to make the dive profiles more conservative is counterproductive and worsens the model's fit to the full DCS data.

Kuklinski, P. Diving and ecological studies in a challenging environment. Freiberg Online Geol. 2009; 22: 12-9.

The Arctic is renowned for its extreme environment. Not only is the Arctic extremely cold, but also there is a high degree of disturbance caused for instance by icebergs and strong winds. Due to these extreme conditions the acquisition of scientific data, especially in the shallow subtidal zone is very challenging. In this short account I present methods for obtaining biological samples and environmental data in the European Arctic with the use of scuba diving. Examples of ecological studies conducted by Institute of Oceanology are provided.

Sieber A, L'abbate A, Passera M, Garbella E, Benassi A, Bedini R. Underwater study of arterial blood pressure in breath-hold divers. J Appl Physiol. 2009 Aug 20. [Epub ahead of print]

Knowledge regarding arterial blood pressure (ABP) values during breath-hold diving is scanty. It derives from a few reports of measurements performed at the water's surface, showing slight or no increase in ABP, and from a single study of two simulated deep breath-hold dives in a hyperbaric chamber. Simulated dives showed an increase in ABP to values considered life threatening by standard clinical criteria. For the first time, using a novel non-invasive subaqueous sphygmomanometer, we successfully measured arterial blood pressure in ten healthy elite breath-hold divers at 10 mfw (meter of fresh water) depth. ABP was measured in dry conditions, at the surface (head out immersion) and twice at 10 mfw depth. Underwater measurements of ABP were obtained in all subjects. Each measurement lasted 50-60 s and was accomplished without any complications or diver discomfort. In the 10 subjects as a whole, mean ABP values were 124/93 mmHg at surface and 123/94 mmHg at 10 mfw depth. No significant statistical differences were found when comparing blood pressure measurements at water surface to breath-hold diving conditions at 10 mfw depth. No systolic blood pressure values higher than 140 mmHg or diastolic values higher than 115 mmHg were recorded. These findings differ strikingly from previous alarming results obtained in simulated dives.

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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