



E-SLATE

American Academy of Underwater Sciences (AAUS)

EDITORIAL NOTE – September 2012

Welcome to the September E-Slate. This issue we announce our first Kevin Flanagan Travel Award winners. The 2012 AAUS Diving for Science Symposium is quickly approaching! We are currently sold out of banquet tickets. However there is still space at the symposium and some workshops. There may also be additional banquet tickets available at the registration desk the week of the symposium. We encourage you to participate in the online forum as well as submitting new publications to share with the membership. It is a great opportunity to highlight research from your home institution. In addition, we welcome news, announcements, job postings, and images of underwater work at aaus@disl.org. Please also note that our new website is live! As you submit information for the E-Slate, it will now also be posted on the new site. Current and past issues of the E-Slate are available at www.aaus.org.

NEWS/ANNOUNCEMENTS

2012 Kevin Flanagan Student Travel Awards

The 2012 award winners are **Kate Schoenrock** and **Anne Benolkin**. Kate is a PhD student at the University of Alabama, Birmingham where she also earned her master's degree in 2011. She has been diving for over 10 years, scientific diving for seven years. Prior to returning to higher education she worked as a dive technician and research assistant for the Pott's lab and a variety of biology graduate students at UC Santa Cruz. Currently her work focuses on physiological responses of Antarctic marine macroalgae to various environmental and biological stressors. Kate will be presenting some of her work at the 2012 symposium.

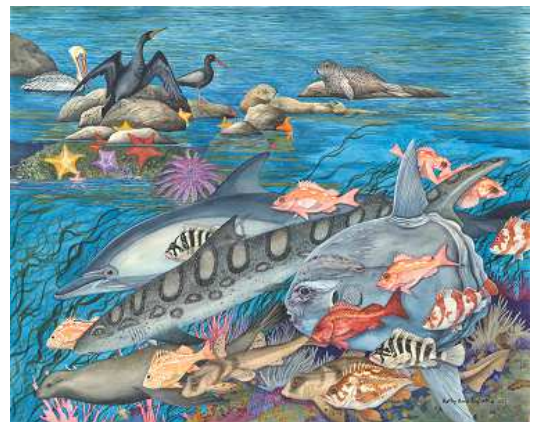
Anne is an undergraduate student completing her senior year at University of Alaska Southeast. She is currently working on a project with the Research Experience for Undergraduates program at the Shannon Point Marine Lab in Western Washington. She and her advisor, Dr. Paul Dinnel are looking at the devastation of the pinto abalone population and her research will focus on efforts geared towards restoration. She started diving at age 17 and in the fall of 2011 attended Florida International University as part of a national exchange program and began working for a PhD candidate who sponsored her AAUS certification under the direction of DSO Bob Weisman. Please read the article below highlighting Anne's summer experience at Shannon

Point Marine Center. The 2012 AAUS symposium will be Anne's first experience at a scientific meeting.

The Kevin Flanagan Student Travel Award is a competitive award developed to support the professional development of students engaged in diving science or the study of diving science. The award was created in memory of Kevin Flanagan (1970-2012), an AAUS board member (2009-2011) and diving safety officer (1998-2012). Donations to fund this award can be given at www.aausfoundation.org. Please indicate "K Flanagan Fund" on the donation page. We hope to make this our first permanently endowed fund by reaching \$60,000. AAUS will match all funds donated. Join us in our efforts to honor Kevin and provide students with much needed travel funds.

2012 AAUS Symposium

The 2012 AAUS Symposium will be held in Monterey, CA September 24-29, hosted by the Monterey Bay Aquarium, University of California Santa Cruz and Moss Landing Marine Laboratories. We are still taking registrations (<http://www.cvent.com/d/kcqlds>) for the symposium and some pre-symposium events however some of the workshops and the banquet are full. There are waitlists available on the registration site for these events and there may be additional banquet tickets available for purchase at the registration desk. If you are participating in a diving workshop, please do not forget to forward an LOR to aaus@disl.org and reserve your dive equipment needs at <http://www.sevensesasscuba.com/monterey/index.htm>. If you are registered for a recreational dive at Pt. Lobos, please note that you must also register with them and pay directly at www.pointlobos.org/diving.



2012 AAUS Symposium print by Kathy Johnston English

2014 AAUS Symposium

We are now accepting proposals from any organization interested in hosting the 2014 AAUS Diving for Science Symposium. Proposals are due no later than September 23, 2012. Please contact the AAUS office at aaus@disl.org for more information.

Organizational Member Highlight Shannon Point Marine Center

Student scientists Annie Thomson and Anne Benolkin are working to measure the survival and growth of 1,200 juvenile abalone raised in a hatchery by the Washington Department of Fish and Wildlife, and out-planted in Skagit County marine waters two to four years ago.



Both Thomson and Benolkin are participants in summer undergraduate research programs at Western Washington University's Shannon Point Marine Center in Anacortes.

In 1998, WDFW determined that abalone populations had fallen so low that this once abundant animal would disappear from Washington waters without intervention. Since male and female abalone individually spawn their sperm and eggs into the water, successful egg fertilization is difficult when remaining individuals are spaced too far apart. Last year, scientists found that abalone densities in some out-plant sites were sufficient for successful spawning, assuming continued good survival and growth.

"After surviving two to four years in the wild on their own, we are finding the juvenile out-planted abalone have, on average, tripled in size. It's exciting to see the abalone mature, but only time will tell if they will remain in densities high enough to spawn successfully" said Thomson. Thomson and Benolkin's work is part of a much larger collaboration among WWU's Shannon Point Marine Center, Puget Sound Restoration Fund, University of Washington and WDFW to eventually return numbers of this native gastropod to levels that will sustain recreational and tribal harvests.

"We are hoping to establish sites with densities greater than one abalone per six square meters (the minimum density required for successful egg fertilization). If we can

accomplish this at these sites and others, then, through natural reproduction, the total number of abalone should continue to increase" Benolkin said.

One success this project has already demonstrated is the ability of different organizations with limited resources to work together to accomplish a greater goal. Both Thomson and Benolkin are participants in the SPMC summer undergraduate research program. One of 11 students from around the nation participating in the program in 2012, Thomson, from Burien and a student in Oceanography from the University of Washington, is the recipient of a scientific diving summer internship co-supported by the Our World Underwater Scholarship Society, the American Academy of Underwater Sciences, and Shannon Point Marine Center. Benolkin, from Eagle River, Alaska, and a student from the University of Alaska Southeast, was awarded a National Science Foundation funded Research Experience for Undergraduates internship working with Shannon Point scientist Paul Dinnel.

The Shannon Point Marine Center's mission is to support and promote marine science academic programs at WWU, develop new information about local marine environments, train the next generation of marine scientists, and provide public education events.

Photos and more information about Thomson's internship are online. Information about the abalone restoration project can be found at the Puget Sound Restoration Fund website.

**Article courtesy of Western Today, a publication of Western Washington University. Editor's note: Anne Benolkin is one of the 2012 Kevin Flanagan Student Travel Award winners.*

UPCOMING EVENTS

National Diving Safety Officers Meeting 2012

Please submit any agenda items for the 2012 Diving Safety Officer's meeting to Cheryl Thacker (cthacker@ehs.ufl.edu) by September 15, 2012.

DAN Diving and Hyperbaric Medicine Course

The 72nd DAN Diving and Hyperbaric Medicine Course will be held October 06-13 at Divi Flamingo in Bonaire. The program is jointly sponsored by DAN and Wilderness Medical Society for continuing medical education credit. Contact DAN Education at 919-684-2948; 800-496-446-2671; cme@dan.org or visit: <http://www.diversalertnetwork.org/?a=events&eventNo=989>.

EUROTEK.2012

EUROTEK.2012, the bi-annual advanced and technical diving conference, will be held October 13-14 at the International Convention Centre, Birmingham, England.

Speakers include Dr. Petar Denoble, Dr. Andrew Fock, Jill Heinerth, Brian Kakuk, Evan Kovacs, Richard Lundgren, Michael Menduno, Pete Mesley, Dr. Simon Mitchell, Martin Robson, Dr. Arne Sieber and Rick Stanton. Presentations include: 'Rescue of an unconscious diver at depth (new UHMS Diving Committee guidelines),' 'Diving with living dinosaurs - Coelacanth,' 'Deep stops - deep trouble?,' 'Exploring Bahamian blue holes,' 'Operational safety,' '3D in deep ocean and caves' and 'Oxygen sensors.' A Rebreather Panel will discuss the consensus statements arising from Rebreather Forum 3.0 that AAUS co-organized. Tickets start at £42.60. For more information, visit www.amiando.com/eurotek2012.html or contact Rosemary E Lunn; roz@tumc.co.uk.

DEMA 2012

The Diving Equipment and Marketing Association will hold its annual show November 14-17 at the Sands Expo Center in Las Vegas, NV. Visit: <http://www.demashow.com>.

Gulf of Mexico Oil Spill & Ecosystem Science Conf.

January 21-23, 2013 – New Orleans, LA

The conference sponsors share a goal to improve society's ability to understand the Gulf of Mexico ecosystem, which includes humans, to ensure its long-term environmental health. This conference will engage and build a community of researchers working on all aspects of Gulf of Mexico ecosystem science and initiate dialogue with the users of that information. The conference will provide a forum through conference plenary and breakout sessions for the research community, state and federal agencies and other stakeholders interested in the Gulf of Mexico. For more information and registration information, visit www.gulfresearchinitiative.org.

NEW PUBLICATIONS

Black KD, Calder LA, Nickell TD, Sayer MDJ, Orr H, Brand T, Cook EJ, Magill SH, Katz T, Eden N, Jones KJ, Tsapakis M, Angel D. Chlorophyll, lipid profiles and bioturbation in sediments around a fish cage farm in the Gulf of Eilat, Israel. *Aquaculture*; 2012; 356-57: 317-27.

Sediment biogeochemical processes were measured on a transect of 4 stations FF 20W, 40W and 80W (number is metres from the fish farm, FF, to the west) at the Ardagh gilthead seabream *Sparus aurata* farm in the Gulf of Aqaba, a highly oligotrophic system renowned for its clear water and diverse corals. At each station samples were taken for analysis of macrofaunal community and benthic oxygen demand, together with depth profiles of CHN, porosity, chlorophyll a and fatty acids. The macrobenthos was dominated by the small marine snail *Nassarius sinusigerus*. In contrast to many fish farms in temperate waters, a large abundance of small, opportunist worms was

not observed near the fish farm although sulphide oxidising bacteria *Beggiatoa* spp. were observed. Oxygen demands ($108-154 \text{ mmol}\cdot\text{m}^{-2}\cdot\text{d}^{-1}$) near the farm were lower than those observed elsewhere despite the high water temperature (similar to 26°C). Bioturbation rates derived from chlorophyll profiles were low ($0.013-0.069 \text{ cm}^2\cdot\text{d}^{-1}$) compared to results from a farm in Scotland as a consequence of the much lower infaunal abundance. Porosity, organic carbon and carbon/nitrogen ratio profiles showed clear discrimination between the stations near the cages (FF and 20W) and those more distant. A multi-dimensional scaling plot of 31 sediment fatty acid concentrations from each of the 4 stations (averaged to 4 cm sediment depth) shows a trend in fatty acid composition that allows good discrimination between 80W, 40W and the two stations near the farm, which overlap. An increase in the proportion of bacterial fatty acids with distance from the farm indicates a change from profiles dominated by farm wastes (with a high proportion of fish feed derived mono-unsaturated fatty acids) near the farm to background conditions where the profiles are dominated by benthic biomass. The data presented are discussed by contrasting these with earlier studies in mesotrophic systems. The results indicate that the Pearson-Rosenberg paradigm of benthic succession may be altered owing to the dominance of the benthos by *N. sinusigerus* and low animal abundance and so benthic indicators of impact would have to be tailored for the characteristics of this environment. Sediment water content, organic carbon content, C/N ratios and fatty acids all showed trends with distance from the farm and could be considered as indicators, as could the density of *N. sinusigerus* and the presence of *Beggiatoa* sp. mats.

Buzzacott PL. The epidemiology of injury in scuba diving. *Med Sport Sci.* 2012; 58: 57-79. Epub 2012 Jul 18.

The epidemiology of injury associated with recreational scuba diving is reviewed. A search of electronic databases and reference lists identified pertinent research. Barotrauma, decompression sickness and drowning-related injuries were the most common morbidities associated with recreational scuba diving. The prevalence of incidents ranged from 7 to 35 injuries per 10,000 divers and from 5 to 152 injuries per 100,000 dives. Recreational scuba diving fatalities account for 0.013% of all-cause mortality aged ≥ 15 years. Drowning was the most common cause of death. Among treated injuries, recovery was complete in the majority of cases. Dive injuries were associated with diver-specific factors such as insufficient training and preexisting medical conditions. Environmental factors included air temperature and flying after diving. Diver-specific factors included loss of buoyancy control, rapid ascent and repetitive deep diving. The most common event to precede drowning was running out of gas (compressed air). Though diving injuries are relatively rare prospective,

Longitudinal studies are needed to quantify the effects of known risk factors and, indeed, asymptomatic injuries (e.g. brain lesions). Dive injury health economics data also remains wanting. Meanwhile, health promotion initiatives should continue to reinforce adherence to established safe diving practices such as observing depth/time limits, safety stops and conservative ascent rates. However, there is an obvious lack of evaluated diving safety interventions.

Duraković Z, Duraković MM, Skavić J, Gojanović MD. Unexpected sudden death due to recreational swimming and diving in men in Croatia in a 14-year period. Coll Antropol. 2012; 36(2): 641-5.

The article deals with 17 sudden deaths which occurred during recreational swimming and diving in men in Croatia in a 14-year period: from January 1, 1998 to December 31, 2011. The sample is taken out from the total number of 61 sudden deaths in men during or immediately after sport or recreational exercise. Included are also sudden deaths of 8 foreigners spending holidays at the Croatian Adriatic Coast. In all of them forensic medicine autopsy was done. Thirteen males from Croatia died during recreational swimming. Three of them were aged 15-29 yrs: one had signs of hypertrophic cardiomyopathy, the second suffered from chronic myopericarditis with left ventricular aneurysm, and the third had cardiomegaly and blood alcohol level of 1.7 per thousand. Five were aged 30-64 yrs: four of them have suffered from coronary atherosclerosis and left ventricular hypertrophy of 15-18-18-22 mm, and one with left ventricular hypertrophy drowned suddenly, probably because of malignant ventricular arrhythmia. The fifth suffered stroke and drowned. Five elderly men, aged 65-85 yrs, have suffered from coronary atherosclerosis, myocardial fibrosis or myocardial scars, and three of them had left ventricular hypertrophy of 19 mm. Four males died during recreational diving. One aged 26yrs drowned, at autopsy he had left ventricular hypertrophy of 17 mm. Three males were middle-aged: two had coronary atherosclerosis, two of them had a severe degree of coronary atherosclerosis and one had coronary atherosclerosis of medium degree but with myocardial fibrosis and left ventricular hypertrophy of 18 mm. Seven male foreigners died, five of them during swimming: two aged 30-64 and two aged 65-85. They all have had coronary atherosclerosis: one of them had an acute myocardial infarction of the posterior wall, and one hypertrophic cardiomyopathy as well. One middle-aged and one elderly man died during diving, and both had an acute myocardial infarction of the posterior wall. One elderly foreign woman died during swimming, she had coronary atherosclerosis and a myocardial scar. In Croatia, death rate during both swimming and diving in men aged 15-29 years amounted to 0.63/1,000.000 ($p=1.0000$); in those aged 30-64 it reached 0.56/1,000.000 ($p=0.3698$), and in those aged 65-85 it was 1.41/1,000.000 ($p=0.1849$). The death rate during swimming in men aged 15-29

amounted to 1.47/1,000.000 ($p=0.9864$), in men aged 30-64 it reached 0.35/1,000.000 ($p=0.2245$), and in those aged 65-85 it was 1.41/1,000.000 (the difference is significant, $p=0.0472$). The death rate during diving in men aged 15-29 was 0.16/1,000.000, and in men aged 30-64 the observed rate was 0.21/1,000.000 ($p=1.0000$).

Ivkovic D, Markovic M, Todorovic BS, Balestra C, Marroni A, Zarkovic M. Effect of a single pool dive on pulmonary function in asthmatic and non-asthmatic divers. Diving Hyperb Med. 2012; 42(2): 72-7.

INTRODUCTION: The aim of this study was to evaluate the effect of a single, shallow, swimming pool scuba dive on pulmonary function in divers with asthma as compared to controls. Opinions concerning the risks of diving with asthma are still contradictory and inconclusive in the diving community. **METHODS:** Baseline pulmonary function tests (PFTs) were performed on a group of 22 divers with asthma and on a control group of 15 healthy divers. The same PFTs were repeated within 10 minutes after a single pool dive, at 5 metres' depth for 10 minutes. PFTs were measured using a portable Jaeger SpiroPro™ device. Student's paired t-tests and linear mixed effects model comparisons and interactions within the groups were used in the data analysis. **RESULTS:** Divers with asthma initially presented significantly lower values of FEV1/FVC%* ($p<0.01$), FEF25* ($p<0.01$), FEF50* ($p<0.001$), FEF75* ($p<0.01$) and FEF25-75* ($p<0.001$) compared to controls. There were significant reductions in FEV1 ($p<0.01$), FEV1/FVC% ($p<0.05$), FEF50* ($p<0.01$), FEF75* ($p<0.05$) and FEF25-75* ($p<0.001$) in the asthma group after the dive as compared to the control group. PEF was initially lower, although not significantly, in the asthma group and did not change significantly after the dive in either group ($p>0.05$). **CONCLUSIONS:** A single, shallow, pool scuba dive to 5 metres' depth may impair function of small airways in asthmatic divers. More studies are necessary to estimate the risks when divers with asthma practise scuba diving. PFT results should be analysed after replicated dives in deeper pools and controlled open-water conditions

Miller M, Graham M. Environmental evidence that seasonal hypoxia enhances survival and success of jellyfish polyps in the northern Gulf of Mexico. J Exper Mar Biol Ecol. 2012; 432-433: 113-20.

Seasonal blooms of the scyphozoan jellyfish *Aurelia* sp. in the northern Gulf of Mexico broadly overlap with summer-fall hypoxia of the Louisiana-Texas shelf. It has been suggested previously that increased cultural eutrophication and hypoxia promote outbreaks of jellyfish by favoring the medusa stage of scyphozoans, since hypoxia affects their prey more than the jellyfish themselves. However, little information exists on what role hypoxia plays on the benthic polyp (scyphistoma) stage of the scyphozoan life-history. Understanding hypoxic effects on scyphozoan

benthic stages is especially important in the northern Gulf of Mexico, since settlement and growth rates of its sessile benthic community are high and space is limited. Therefore, we used a combination of laboratory and field experiments to investigate the effect of low dissolved oxygen (DO) concentrations on the survival and growth of the polyps of the moon jellyfish *Aurelia* sp. and whether the general sessile community was relatively impacted by low DO to reduce spatial competition for hard substrate (i.e. if low DO might create transient openings in the sessile community for polyp settlement). We conducted a set of laboratory experiments that revealed low DO had a positive effect on planulae settlement. Greatest planulae settlement rates occurred under lowest DO concentrations ($1.3 \text{ mg}\cdot\text{L}^{-1}$), indicating that reduced DO promotes settlement, perhaps as a signal of physiological stress on planula swimming. In a second set of experiments, survival of scyphistomae decreased only marginally under prolonged (56 days) hypoxic conditions. Numerical growth due to asexual budding remained positive under prolonged hypoxia but at a rate significantly lower than the normoxic treatment. A third set of laboratory experiments showed that naturally seeded sessile community coverage was significantly reduced under similar levels of hypoxia when compared to normoxia. A field experiment placing polyp-seeded plates at different depths and oxygen concentrations off south-central Louisiana during seasonal hypoxia showed that polyps had higher survivorship in deeper, lower oxygen waters when compared to higher oxygen surface waters. Our data indicate that tolerance to the physiological stresses of hypoxia in the scyphozoan polyp stage and the reduction of sessile competition and predation in hypoxic areas may make these areas particularly vulnerable to jellyfish blooms.

Moshara K, Lobel P. Acoustic signals of two toadfishes from Belize: *Sanopus astrifer* and *Batrachoides gilberti* (Batrachoididae). *Environ Biol Fish.* 2012; 94:623-38.

The "boatwhistle" calls of *Sanopus astrifer* and *Batrachoides gilberti*, two toadfish species from Belize, are described for the first time. These descriptions add to the small number of toadfish species sounds known to date (6 out of 79 species). Both Belize toadfishes produced multiple notes per call, unlike most other toadfish species which produce a single-note call (with the exception of *Opsanus beta*). *S. astrifer* produced significantly more notes per call than *B. gilberti* ($p < 0.05$), and was recorded producing up to seven notes, the highest number of notes per call of any toadfish species reported. Differences in the boatwhistle call between all species with available data are reviewed and it is hypothesized that phylogenetic relationships, morphology of the swimbladder, and evolutionary processes are factors that potentially influenced these differences.

Noren SR, Kendall T, Cuccurullo V, Williams TM. The dive response redefined: underwater behavior influences cardiac variability in freely diving dolphins. *J Exp Biol.* 2012; 215(Pt 16): 2735-41.

A hallmark of the dive response, bradycardia, promotes the conservation of onboard oxygen stores and enables marine mammals to submerge for prolonged periods. A paradox exists when marine mammals are foraging underwater because activity should promote an elevation in heart rate (f_H) to support increased metabolic demands. To assess the effect of the interaction between the diving response and underwater activity on f_H , we integrated interbeat f_H with behavioral observations of adult bottlenose dolphins diving and swimming along the coast of the Bahamas. As expected for the dive response, f_H while resting during submergence ($40 \pm 6 \text{ beats}\cdot\text{min}^{-1}$) was significantly lower than f_H while resting at the water surface ($105 \pm 8 \text{ beats}\cdot\text{min}^{-1}$). The maximum recorded f_H ($f_{H,\text{max}}$) was $128 \pm 7 \text{ beats}\cdot\text{min}^{-1}$, and occurred during post-dive surface intervals. During submergence, the level of bradycardia was modified by activity. Behaviors such as simple head bobbing at depth increased f_H by 40% from submerged resting levels. Higher heart rates were observed for horizontal swimming at depth. Indeed, the dolphins operated at 37-58% of their $f_{H,\text{max}}$ while active at depth and approached 57-79% of their $f_{H,\text{max}}$ during anticipatory tachycardia as the animals glided to the surface. f_H was significantly correlated with stroke frequency (range=0-2.5 strokes $\cdot\text{s}^{-1}$, $r=0.88$, $n=25$ dives) and calculated swim speed (range=0-5.4 $\text{m}\cdot\text{s}^{-1}$, $r=0.88$, $n=25$ dives). We find that rather than a static reflex, the dive response is modulated by behavior and exercise in a predictable manner.

Oliver S, Lobel P. Direct mate choice for simultaneous acoustic and visual courtship displays in the damselfish, *Dascyllus albisella* (Pomacentridae). *Environ Biol Fish.* DOI 10.1007/s10641-012-0028-z

Acoustic signals are well established as key components of mate selection in terrestrial species, but not in aquatic species. It has long been known that damselfish (Pomacentridae) use a combined visual and acoustic display in their courtship. This study examined several male qualities including individual size, courtship vigor, territory size and complexity, as well as components of the acoustic call including dominant frequency, pulse characteristics and repetition rate. The objective was to determine which male traits were correlated with mating success. Observations made over ten reproductive cycles revealed that female mate choices were not random and that male mating success was correlated with courtship rate (a simultaneous visual and acoustic cue) and the number of neighboring females, but not with male morphological traits, territory quality, or acoustic call structure. These results suggest that females choose mates based on a condition-dependent trait (courtship

rate) that advertises quality of paternal care, which supports good parent models of sexual selection, thereby demonstrating the importance of the combined acoustic/visual display for sexual selection in fishes

Yang TK, Seo HM, Lee CS. Non-traumatic spinal epidural haematoma after breath-hold diving. Br J Neurosurg. 2012 Jul 17. [Epub ahead of print]

We report a case of non-traumatic spinal epidural haematoma in a female vocational diver after breath-hold diving. Sudden and repetitive atmospheric changes along diving may cause venous engorgement of the valveless spinal epidural veins. We suggest that repetitive barotrauma was the cause of the spinal epidural haematoma in this patient.

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.

American Academy of Underwater Sciences
101 Bienville Boulevard, Dauphin Island, AL 36528
Tel 251 591 3775 Fax 251-861-7540
aaus@disl.org www.aaus.org

Editor: Heather Fletcher - aaus@disl.org
Editorial Board: Neal Pollock, Michael Dardeau,
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