

# Ecology & Evolutionary Biology

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## Letter from the Chair

By Mark Bertness



Greetings from EEB, where we have had a busy fall semester still living in the shadow of a construction site. The dust is starting to settle, the noise is subsiding and the wall of portable toilets has now been removed from around Walter Hall, so things are relatively rosy and we are getting back to some semblance of normal.

Things have changed since we were literally driven out of Walter Hall. We have a new Dean of Biology and Medicine, Ed Wing, who is a strong advocate for the importance of basic science; has an intense personal interest in

ecology and evolutionary biology; and coming in the door understands that EEB has different strengths, needs and priorities than other departments in the Division. We welcome his positive spirit, energy and leadership.

Annie Schmitt has taken the reigns of the Environmental Change Initiative and has moved her office to MacMillan Hall, where much of Brown's effort in environmental science is growing. Osvaldo Sala is back to being an ecosystem scientist and in casual dress.

Our curriculum is also getting a long needed facelift. This fall Erika Edwards taught a phylogenetics-flavored version of Plant Diversity, Dov Sax resurrected the Conservation Biology course (and over the next few semesters will be introducing a Climate Change and Invasive Species

freshman seminar), Kate Smith will be introducing a Conservation Medicine course, Casey Dunn will take over teaching Invertebrate Zoology, Jeremy Rich will be teaching Microbial Ecology, and Heather Leslie and I will be teaching a Coastal Ecology and Conservation Course. So, good things are happening for EEB undergraduates.

Some other good things to report: Congratulations to Steve Gatesy, who has been promoted with blushing great letters to Full Professor. Congratulations also to Steve Hamburg who has left Brown to become chief scientist for the Environmental Defense Fund at a time when and place where he can make a real difference. Good luck also to our newest parents, Dov Sax and Kate Smith. This, however, may just be a rumor, because to date the baby has not yet been seen.

## New to EEB in 2008!

### Emily Abbott:

Research assistant-  
Roberts Lab

### Henry Astley:

Graduate student from  
University of Cincinnati-  
Roberts Lab

### Lindsay Brin:

Graduate student from Boston  
University Marine Program  
-Rich Lab

**Jorn Cheney:** Graduate student  
from Lewis and Clarke  
College-Swartz Lab

### Megan Dawson:

Research assistant- Brainerd Lab

### Marie-Ines Drury:

Project assistant-Walter Hall

### Regan Early:

Postdoc,  
University of York UK- Sax Lab

### Laureano Gherardi:

Research Assistant- Sala Lab

### Nickolay Hristov:

Postdoc,  
Wake Forest University-  
Swartz Lab

### Kianosha Huffman:

Cyber-infrastructure architect-  
Brainerd Lab

**Robert Kambic:** Graduate student  
from Montana State University-  
Gatesy Lab

**Aleksandra Norton:** Lab manager-  
Tatar Lab

**Juliet Simpson:** Postdoc,  
University of California, Santa  
Barbara-Smith Lab

# In the Greenhouse



By Fred Jackson

Greenhouses, like all facilities, require maintenance, and we are currently in the midst of major upgrades. This facility has been greatly improved in the recent past, with glass and floor replacements, and repair of the top and side ventilation. Most greenhouses are at ground level, but our research areas are upstairs, with a classroom in the basement. If the floor leaks, it will ultimately drip down into the classroom and electrical components below. Experiments have been temporarily slowed to replace the floor face. For researchers who use greenhouses, such repairs can impose significant delays in

their experiments. In September we moved all plants and benches in three bays so that a new floor with walk pads could be laid down. Like most projects, once you start meddling with one thing it starts affecting other things. In this case, most of the legs and support members of the 16 moveable aluminum benches were rusted. We have slowly replaced bench parts and now have a new leak-proof floor. With the assistance of Peter Holden and Jim McLaughlin of Biomed Facilities we are currently planning future improvements. They will include updating our current control environmental systems – the

automatic opening and closing of vents and heating systems, temperature control monitoring, and possibly the addition of energy efficient and light control curtains. Other possible changes include adding a natural ventilation system to the third bay, which will use only the top and side ventilators for cooling. It will be useful for those native and invasive plant experiments that require natural cooling, vernalization and additional cold requirements. I will keep you posted on these exciting future improvements and new experiments in the spring newsletter.



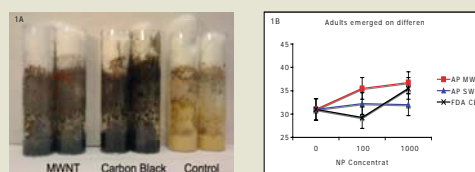
## The Mysterious BuckyBall Project *By David Rand*

Reach for your cell phone and order a pizza: you are relying on nanoparticles. Those shi-shi black plates at Café Nuovo: they

(C60), carbon black (CB ~printer toner), and various nanotubes (single walled, or multiwalled: SWNTs, MWNTs). Our hope was to evolve resistant strains and then use whole-genome tiled microarrays to map the loci that rendered flies resistant to NPs. Try as we might we could not kill fly larvae with food that was completely black with NPs (see Figure 1A, B). While this foiled our attempt at uncovering the genetics of

for you botanists). Interestingly, some NPs killed flies on contact (carbon black and single walled NPs – so stay clear of that printer toner). Other NPs slid off the flies' backs with no clear effect (C60, MWNTs, or 'washed' versions denoted W MWNT). In an effort to understand the functional consequences of contact with NPs, we filmed flies attempting to climb the wall of their test tubes after exposure to NPs. Not surprisingly, NPs interfered with locomotion, but did so in an aggregation-dependent way. Notably, NPs adhered to fly feet, which appear to have compromised the ability of these structures to grasp or adhere to the surface of the climbing vials. While NPs are really small (a nanometer is to a millimeter as a millimeter is to a kilometer), NPs often aggregate into arrays or clumps that are much bigger than a nanoparticle. When the scale of these clumps was on the order of 10's of micrometers, the NPs were quite toxic, but when the NPs were clumped, they were less toxic. The next steps are to take optical slices through whole flies and their spiracles to see if they are dying from NP inhalation. What is the meaning of all this? Flies are great for assessing the whole animal impact of NPs on survivorship and performance. A manuscript has been prepared and a grant proposal will be sent to NSF. This is what happens when colleagues from different departments have coffee together and decide to collaborate on something neither has done before.

are full of nanoparticles. Stain a cell culture with fluorescently labeled quantum dots: yessiree jimmydog, those are nanoparticles. So what happens to those nanoparticles when you toss them in the trash? They get into the environment and ... nobody knows. Nanoparticles (NPs) have been heralded as the next best thing for all kinds of technology from cancer treatments to lightweight tennis rackets. But there is growing concern that NPs may have negative impacts on the environment, and their fate and transport through ecosystems is of great concern. A broader question is: what are the evolutionary consequences of NPs in the environment? What happens when an evolutionary biologist and a materials scientist wind up on university committees together? Answer: unusual collaborations. With Prof. Bob Hurt in Engineering, and with the help of Bob's students Xinyuan Liu and Daniel Vinson and our master lab manager and fly wizard Dawn Abt, we attempted to do a selection experiment to evolve an NP-resistant strain of *Drosophila*. We exposed larval cultures of *D. melanogaster* to high levels of different NPs, such as buckyballs



NP resistance, this experiment revealed that flies sequestered NPs into distinct tissues in the adult after consuming NPs. This showed for the first time that NPs could cross the gut lining and suggested possible pathways for bioaccumulation by organisms in the environment. Nevertheless, there was no adverse effect of dietary intake of NPs. One of the major concerns for NPs is in respiratory health, and some fear that NPs are the next asbestos. Channeling youthful summers torturing frogs, insects and other living things, we (OK, I) dropped live adult flies into test tubes containing a dollop of different NPs, sealed the tubes and rotated the tubes in a test tube rotator to force the flies to breath NPs through their spiracles (insect equivalents of stomata

# News Update

**Scott Shumway's** (EEB 1991) book "A Naturalist's Guide to the Atlantic Seashore" was published as a Falcon Guide by Globe-Pequot Press in March of 2008. Scott is currently Professor of Biology at Wheaton College in Norton, MA.

**Kate Smith** over the summer participated in two invited expert working groups on invasive species and wildlife trade. The first one was the Scientific Committee of the Diversitas Working Group, 'Health and Biodiversity'. The next group was the Secretariat of the Convention on Biological Diversity Expert Workshop 'Best Practices in Pre-import Risk Screening for Species of Live Animals in International Trade'. In addition she was recently invited to be the Associate Editor for the journal "EcoHealth". Her first-year seminar, Conservation Medicine, was approved for spring 2010. Kate and senior Gail Rosen were awarded a Spring Semester UTRA to prepare a publication that will quantify the scope, scale and implications of the illegal wildlife trade.

**Heather Leslie** will evaluate the success of marine ecosystem-based management (EBM) projects in the US, Mexico, and Western Pacific with support from the Packard Foundation. In collaboration with Lisa Campbell of Duke, she will investigate the social and institutional context in which marine ecosystem-based management occurs, and how to measure both social and ecological outcomes associated with marine EBM most effectively.

**Dan Riskin** won the Society for Experimental Biology's 3rd place talk prize (biomechanics section) for his talk in July: "Effects of body size on the wing kinematics of bats."

**Greg Sawicki** accepted a tenure track position in the Biomedical Engineering Dept. at N.C. State/UNC for the fall of 2009.

**Christine Janis** The second volume of "Tertiary Mammals of North America" (noted last time as "seriously in press") has now finally really appeared, so she is listing her various co-authored chapters on p.7 (current publications). The eighth edition of the textbook that she is a co-author with Harvey Pough and John Heiser, "Vertebrate Life", has also just come out.

Christine has just returned from Finland where she is setting up a collaboration with Mikael Fortelius and his group (University of Helsinki) who heads up the NOW (Neogene Old World Mammals) database. They will be incorporating the data on the North American mammals derived from her "Tertiary Mammals" volumes and hopefully will soon be able to look at patterns of paleofaunal and paleoclimatic change across the Northern Hemisphere. She was also awarded the Elizabeth LeDuc award for excellence in teaching in the life sciences.

**Rondi Butler** has left the Tatar Lab and is going to a new lab to resume research in toxicology (still at Brown). The lab has a new manager, **Alex Norton**. **Sara Naylor** has left the lab and is off to medical school at NYU.

**Erika Edwards** was an invited speaker at the Harvard University Plant Biology Initiative Annual Symposium, May 2008, and the International Organization of Succulent Plants Symposium at the Brazilian Botanical Congress, August 2008, in Natal, Brazil.

**Oswaldo Sala** was named a Correspondent Honorary Researcher for the National Research Council in Argentina. He also served as a member of the Global Agenda Council at the World Economic Forum; External Evaluation CREAM, Universidad Autónoma de Barcelona, Spain; Scientific Advisory Board, SARAS (South American Institute for Resilience and Sustainability Studies); Scientific Advisory Board, SCOPE Biofuels Project; and Advisor, National Science Foundation, Environmental Research and Education and Member, National Ecological Observatory Network, Global Change Experiment Steering Committee.

**Casey Dunn** was featured in Discovery Magazine, his article "You're more like a sponge than a comb jelly" was listed as one of the top 100 stories of 2008.

# Keryn Bromberg Gedan

## EEB Graduate Student

Flying into T.F. Green Airport, perhaps you've noticed some interesting ecological phenomena – the early arrival of fall foliage inland from the coast, changes in the Bay's color across the estuary, or the immensity of the Borderlands undeveloped corridor. I always stare at the tidal marshes. You can see a lot from the air – snaking tidal creeks, high marsh pools, and even plant zonation in some seasons. But most striking is the parallel pattern of the mosquito ditches, as if someone had dragged an oversized rake across the marsh.

Mosquito ditches are the most visible evidence of human impacts on New England salt marshes, and they have been a primary focus of my PhD research in Mark Bertness' lab, where I have been studying the ecological impacts of ditching, an important example of the broad array of human impacts on this critical ecosystem.

Mosquito ditches were mostly dug in the first half of the 20th century, many by legions of unemployed laborers in the Civilian Conservation Corps, although less intensive mosquito ditching continues today. I surveyed salt marshes using aerial photos and GIS and found mosquito ditches to be present in 95% of New England salt marshes, with ditches converting greater than 3% of the surface area of some sites to open water. These ditches stretch hundreds of miles in total and have considerably changed salt marsh hydrology. According to historical scientific accounts, the initial effects of ditching on salt marsh vegetation were significant, promoting high marsh species at the expense of low marsh species, with the exception of the ditch banks, where *Spartina alterniflora* thrives. In field surveys throughout New England, I have found that shifts in the plant community due to ditching have equilibrated

and are not undergoing further change. However, the altered hydrology of ditches continues to affect ecosystem processes. Net nitrogen mineralization is lower near ditches but, paradoxically, plant biomass production is higher. This is due to the flushing of ditch banks by the tides, which prevents a build-up of plant-stifling salts and sulfides in the peat.

Grid ditching is only one of a number of injuries endured by salt marshes in New England. Land reclamation has been another potent factor. Comparing salt marsh distributions from historical maps to modern GIS data, I found that nearly 40% of the salt marsh area in New



England has been converted, mostly for urban expansion and industrial port development. In Rhode Island, more than half of salt marshes were converted. In downtown Providence, the former Great Salt Cove marsh is now the circular basin next to the Providence Place mall – a great place to view Waterfire, but not waterfowl.

My research on past impacts in salt marshes led naturally to a curiosity and concern about today's human impacts and salt marsh preservation.



To my surprise, despite the enduring interest and significant resources being directed to salt marsh restoration, many of the approaches are untested. Some land managers, for example, favor plugging mosquito ditches and various ditch-plug restorations have been undertaken. Plugging all the mosquito ditches, however, requires nearly as large a disturbance as digging them initially caused. Additionally, ditch plugging floods the high marsh, imprudent considering the newer and more significant threat of rapid sea level rise. This is a questionable approach, and groups with conflicting interests in various ecosystem services, such as mosquito control, wildlife habitat and recreation, and storm protection, lobby for different restoration actions. There is clearly a need for more explicit evaluation of restorations, and I hope to address this pressing issue by building a framework to evaluate salt marsh restoration projects in terms of their costs and benefits on ecosystem services. So you see, all the mud I've dragged through Walter Hall all these years hasn't been for nothing!

# Cape Cod Marathon

## Jon Witman, EEB Professor



Marathon Relay. - On the last Sunday in October ten EEB runners, their significant others and Carol Casper got up well before dawn to drive over to Falmouth to run in the Cape Cod Marathon relay race. We fielded two relay teams “Walter Haul Volume 2” consisting of Andrew Clifford, Casey Dunn, Tommy Angelini, Andrew Altieri and Christine Holdredge; and “Slightly Faster than Evolution” with Emily Abbott, Regan Early, Erika Edwards, Jim Palardy and myself. Carol was one of our dedicated drivers, once again making sure that the runners got to their starting points along the course. Running the first leg, Casey and Emily got their teams off to a great start, appearing in the

fog at the first relay exchange point. Tommy hadn’t met Casey before, yet he needed to receive the baton from him, so Andrew C. said, “Just look for a Viking coming over the hill,” and that did the trick! The Cape Cod Marathon is known for the hills in the middle of the course; a race T-shirt has a profile of the course topography that looks like a roller coaster that we ran rather than rode. Everyone ran strong relay legs, no one dropped the baton, and it was exciting to be part of the overall event that encompassed 200 relay teams and 900 marathon runners. Erika and Casey handled the conflicts of parenthood while participating in the race by handing daughter Lucy off like a baton (well, sort of...). Andrew C. and Jim ran very fast final legs

to the finish line as the weather cleared into a spectacular autumn day. In the end, Walter Haul Volume 2 was Significantly Faster than Evolution, ( $p < 0.001$ ), but both teams finished in the top third. In addition to the EEB teams, MBL faculty in the Brown-MBL graduate program put together another relay team as they’ve done for years called “MBL Oldsters” consisting of Anne Gibling, Chris Neill, Neil Bettez, Ruth Yanai and Ken Foreman. Kudos to one of our Brown-MBL graduate students, Erica Lasek-Nesselquist who ran the entire marathon, not just one relay leg, in 3:20:39 - go Erica! Students in MBL’s Semester in Environmental Studies also ran in two relay teams. It was so much fun that we decided to make it an annual event.



# 2008 Fall Seminars

Brown Bag seminars usually catch up on research and work in progress within EEB, and the more formal colloquium series features speakers from outside the University.

## Brown Bag Seminars

- SEPT 12** **David Rand**, Professor. The mysterious buckyball project: Fruitflies on nanoparticles.
- SEPT 19** **Keryn Bromberg Gedan**, Graduate Student. Climate change signals in the intertidal: rocky shore and salt marsh communities.
- SEPT 26** **Juliet Simpson**, Postdoctoral Research Associate. Effects of multiple anthropogenic stressors on the spread of invasive species: climate change, urbanization and water hyacinth.
- OCT 3** **Dov Sax**, Assistant Professor. Expecting invasions: Implications for species extinctions.
- OCT 10** **Henry Astley**, Graduate Student. Arboreal habitat structure affects the performance and modes of locomotion of corn snakes (*Elaphe guttata*).
- OCT 24** **Paul Dayton**, Visiting Professor. Bottoms beneath the ice: benthic ecology at McMurdo Sound, Antarctica.
- OCT 31** **Dan Weinreich**, Assistant Professor. Pleiotropy, epistasis, microbial adaptation and R.A. Fisher.
- NOV 7** **Andrew Clifford**, Graduate Student. Fossils, function, and phylogeny: How new fossils, experimental morphology, and shifting topologies alter inference.
- NOV 14** **Matt Heard**, Graduate Student. A decade of change in the strandline plant communities of Narragansett Bay.
- NOV 21** **Dan Riskin**, Postdoctoral Research Associate. Biomechanical implications of roosting sites for bats.
- DEC 5** **Lara Reichmann**, Graduate Student. From dry to wet years all at once in the Chihuahuan Desert.

## Monday Colloquia

- SEPT 8** **Todd Oakley**, University of California, Santa Barbara. Let there be light! Evolutionary origins of photoreception in animals.
- SEPT 15** **Steve Vollmer**, Marine Science Center, Northeastern University. Emerging marine diseases: A case study of white band disease of threatened staghorn coral.
- SEPT 22** **Peter and Rosemary Grant**, Princeton University. Evolution of Darwin's finches.
- OCT 6** **Bethany Jenkins**, University of Rhode Island. Elucidating controls on marine nitrogen cycling using gene-based methods.
- NOV 3** **Colleen Cavanaugh**, Harvard University. Deep-sea chemosynthetic symbioses: diversity, comparative genomics, and biogeography.
- NOV 17** **Kevin Padian**, University of California, Berkeley. Darwin, Dover and intelligent design.
- NOV 24** **Lars Hedin**, Princeton University. Emergence of terrestrial nutrient cycles: intelligent design by Darwinian process?
- DEC 1** **Adam Summers**, University of California, Irvine/National Science Foundation. Learning new tricks from old fishes- biomaterials and the skeletons of sharks.

# New Publications



- Armas, C., F.I. Pugnaire & **O. E. Sala**. 2008. Patch structure dynamics and mechanisms of cyclical succession in a Patagonian steppe (Argentina). *Journal of Arid Environments* 72:1552-1561.
- Beeck BK, **M.D. Bertness**, et al. 2008. Potential for sudden shifts in transient systems: Distinguishing between local and landscape-scale processes. *Ecosystems* 11:1133-1141.
- Bergland, A.O.**, A. Genissel, S. V. Nuzhdin, & **M. Tatar**. 2008. Quantitative trait loci affecting phenotypic plasticity and the allometric relationship of ovariole number and thorax length in *Drosophila melanogaster*. *Genetics* 180:567-582.
- Bertness, M.D.** & B.R. Silliman. 2008. Consumer control of salt marshes driven by human disturbance. *Conservation Biology* 22:618-623.
- Butterworth, C.A. & **E.J. Edwards**. 2008. Investigating *Pereskia* and the earliest divergences in Cactaceae. *Haseltonia* 14:46-53.
- Crain, CM; L.K. Albertson & **M.D. Bertness**, Secondary succession dynamics in estuarine marshes across landscape-scale salinity gradients. *Ecology* 89:2889-2899.
- Daleo P, **M.D. Bertness**, et al. 2008. Mycorrhizal fungi determine salt-marsh plant zonation depending on nutrient supply. *Journal of Ecology* 96:431-437.
- Flatt, T., R. Yamamoto, M. Tatar**, et al. 2008. Hormonal regulation of the humoral innate immune response in *Drosophila melanogaster*. *Journal of Experimental Biology*. 211:2712-2724.
- Flatt, T., E. Villa-Cuesta, J. Cumbers, M. Tatar**, et al. 2008. *Drosophila* germ-line modulation of insulin signaling and lifespan. *PNAS* 105:6368-6373.
- Flombaum, P. & **O. E. Sala**. 2008. Higher effect of plant species diversity on productivity in natural than artificial ecosystems. *PNAS* 105:6087-6090.
- Harper, C.J.**, et al. 2008. Morphology of the melon and its tendinous connections to the facial muscles in bottlenose dolphins (*Tursiops truncatus*). *Journal of Morphology* 269:820-839.
- Hilley, G.E. & **S. Porder**. 2008. A framework for predicting global silicate weathering and CO<sub>2</sub> drawdown rates over geologic time-scales. *PNAS* 105:16855-16859.
- Iriarte-Díaz, J. & **S.M. Swartz**. 2008. Kinematics of slow turn maneuvering in the fruit bat *Cynopterus brachyotis*. *Journal of Experimental Biology* 211:3478-3489.
- Janis, C. M.**, G.F. Gunnell & M.Uhen, eds. 2008. *Evolution of Tertiary mammals of North America. Vol. 2: small mammals, edentates, & marine mammals*. Cambridge University Press, Cambridge, UK. 760 pp. Christine is also first author of the Introduction, pp. 1-6 (with G. F. Gunnell & M. Uhen); Nontherian mammals, pp. 7-18 (with A. Weil); Glires, pp. 263-292 (with M. R. Dawson & L.J. Flynn); and Addendum to Volume 1, pp. 645-693 (with R. Hulbert & M. Muhlbacher).
- Keefe, D.F., T.M. O'Brien, **D.B. Baier, S.M. Gatesy, E.L. Brainerd** & D.H. Laidlaw. 2008. Exploratory visualization of animal kinematics using instantaneous helical axes. *Eurographics/ IEEE-VGTC Symposium on Visualization* 27(3):1-8.
- Knies J.L.**, et al. 2008. Compensatory evolution in RNA secondary structures increases substitution rate variation among sites. *Molecular Biology & Evolution* 25:1778-1787.
- Lutzy, R. M. & **D. H. Morse**. 2008. Effects of leg loss on male crab spiders *Misumena vatia*. *Animal Behaviour* 76:1519-1527.
- Matthews, K.A., A.G. Grotoli, W.F. McDonough & **J.E. Palardy**. 2008. Upwelling, species and depth effects on coral skeletal cadmium to calcium ratios (Cd/Ca). *Geochimica et Cosmochimica Acta*. 72:4537-4550.
- Melillo, J.M. & **O.E. Sala**. 2008. Ecosystem services. Pp. 75-115 in E. Chivian & A. Bernstein, eds. *Sustaining life: how human health depends on biodiversity*. Oxford University Press: Oxford.
- Meyerson, L. A., **O. E. Sala** et al. 2008. Sustainable allocation of biodiversity to improve human health and well-being. Pp. 83-98 in O. E. Sala, et al., eds. *Biodiversity change and human health: from ecosystem services to spread of disease*. Island Press: Washington, D.C.
- Meyerson, F. A. B., **O. E. Sala** et al. 2008. Human health, biodiversity and ecosystem services: the intertwined challenging future. Pp. 281-285 in **O. E. Sala**, et. al., eds. *Biodiversity change and human health: from ecosystem services to spread of disease*. Island Press: Washington, D.C.
- Montooth K.L. & **D.M. Rand**. 2008. The spectrum of mitochondrial mutation differs across species. *PLoS Biol.* 6(8):e213.
- Morse, D. H.** 2008. Defecation behavior of adult female crab spiders *Misumena vatia*. *Journal of Arachnology* 36:612-614.
- Nyffeler, R., U. Eggli, **M.O. Ogburn** & **E.J. Edwards**. 2008. Variations on a theme: repeated evolution of succulent life forms in the Portulacaceae. *Haseltonia* 14: 26-36.
- Palardy, J.E.**, L.J. Rodrigues & A.G. Grotoli. 2008. The importance of zooplankton to daily metabolic carbon requirements of healthy and bleached corals at two depths. *Journal of Experimental Marine Biology and Ecology* 367:180-188.
- Palmqvist, P., J. A. Perez Claros, **C. M. Janis**, & D. R. Gröcke. 2008. Tracing the ecophysiology of ungulates and predator-prey relationships in an early Pleistocene large mammal community. *Palaeogeography, Palaeoclimatology, Palaeoecology* 266:95-111.
- Pough, F.H., **C.M. Janis** & J.B. Heiser. 2008. *Vertebrate life*, 8th ed. Benjamin Cummings: NJ.
- Schmidt, P.S., **D.M. Rand** et al. 2008. Ecological genetics in the North Atlantic: environmental gradients and adaptation at specific loci. *Ecology* 89:S91-S107.
- Riskin, D. K., S. M. Swartz** et al. 2008. Quantifying the complexity of bat wing kinematics. *Journal of Theoretical Biology* 254:604-615.
- Roberts, T.J.** & M. Gabaldon. 2008. Interpreting muscle function from EMG: lessons learned from direct measurements of muscle force. *Integrative and Comparative Biology* 48:312-320.
- Sala, N.M.; **M.D. Bertness** & B.R. Silliman. The dynamics of bottom-up and top-down control in a New England salt marsh. *Oikos*: 11:1050-1056 .
- Sala, O. E.**, L. A. Meyerson & C. Parmesan, eds. 2008. *Biodiversity change and human health: from ecosystem services to spread of disease*. Island Press: Washington, DC.
- Sala, O.E.**, L.A. Meyerson & C. Parmesan. 2008. Changes in biodiversity and their consequences for human health. Pp. 1-12 in O. E. Sala, L. A. Meyerson, & C. Parmesan, eds. *Biodiversity change and human health: from ecosystem services to spread of disease*. Island Press: Washington, D.C.
- Sax D.F.** & S.D. Gaines. 2008. Species invasions and extinction: The future of native biodiversity on islands. *PNAS* 105(Suppl):11490-11497.
- Seckel, L. & **C.M. Janis**. 2008. Convergences in scapula morphology among small cursorial mammals: an osteological correlate for locomotory specialization. *Journal of Mammalian Evolution* 15:261-279.
- Smith, K.F.**, M.D. Behrens, L. Max & P.Daszak. 2008. U.S. ports drowning in fish: scope, implications and win-win regulation of freshwater and marine imports. *Conservation Letters* 1:103-109.
- Smith, K.F.** 2008. *Wildlife Extinction and Conservation*. In M. Benton, ed. *The seventy great mysteries of the natural world*. Thames and Hudson: UK.
- Smith, K.F.** 2008. U.S. regulation of live animal trade. *Trade & Biological Resources News Digest* 3:6-7.
- Ward B. B., **J. J. Rich**, et al. 2008. Organic carbon, and not copper, controls denitrification in oxygen minimum zones of the ocean. *Deep Sea Research, Part I* 55:1672-1683.
- Witman, J.D.**, et al. 2008. The relation between productivity and species diversity in temperate-arctic marine ecosystems. *Ecology* 89:S66-S80.



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Can we contact you for further information about your activities in Biology?     yes     no