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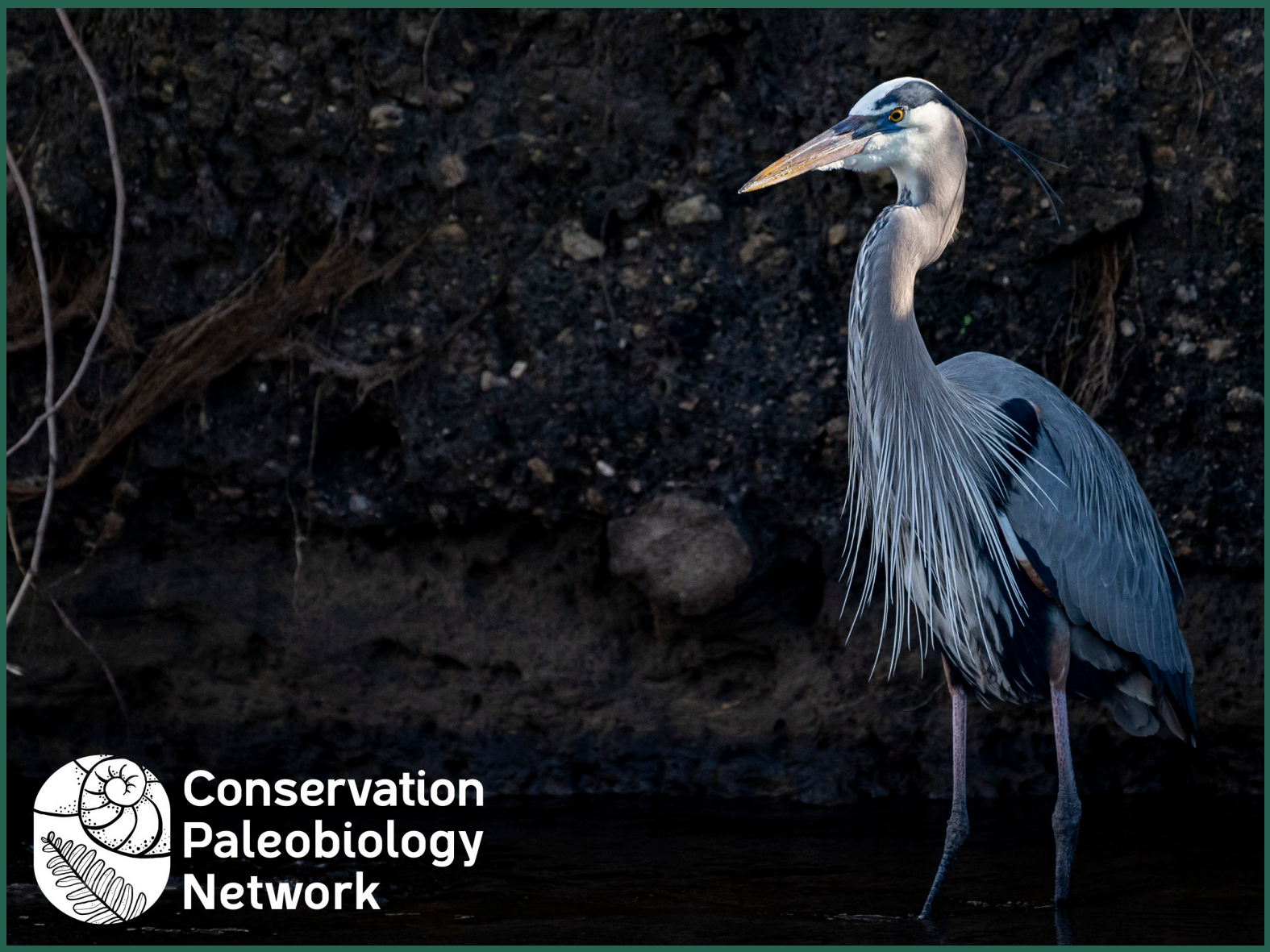

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Conservation Paleobiology Network

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THE IMPORTANCE OF PALEOECOLOGY IN EVERGLADES RESTORATION SCIENCE AND MANAGEMENT

— Keynote —

Aumen, Nicholas G., United States Geological Survey, USA; **Wingard, Georgiana L.**, United States Geological Survey, USA; **Bernhardt, Christopher**, United States Geological Survey, USA

Paleoecology studies provide pre-instrument data from the Everglades painting an informative picture of physical, biological, and ecological conditions prior to human intervention. Because Florida's development history is relatively recent, and because observational data span only the last half-century, managers rely on paleoecology data as the basis for important decisions regarding multi-decadal and expensive restoration. Effective restoration depends strongly on the establishment of restoration targets, especially pre-development vegetation and hydropatterns (flow, depth, timing, distribution). Coring data were instrumental in the reconstruction of paleo hydrologic and vegetation trends in the ARM Loxahatchee National Wildlife Refuge, helping managers understand the magnitude and causes of 20th century problems. Similarly, sediment cores from the Big Cypress National Preserve led managers to understand that the development of marl prairies in Everglades National Park – critical habitat for the endangered Cape Sable Seaside Sparrow – was a 20th century phenomenon resulting from past water management practices. Finally, paleoecological and modeling studies in Florida Bay and the Everglades for the $20B+ Comprehensive Everglades Restoration plan established freshwater flow targets now used by managers. Although restoration of historic freshwater flow is not feasible, knowledge about Everglades hydrology and ecology prior to human intervention plays a pivotal role in the design, selection, and construction of restoration projects. Paleoecological data, coupled with decadal-scale monitoring and other long-term studies, provide the long-term perspective necessary to understand decadal, to centennial, and to millennial time-scale processes. While these data are cost-effective to procure, a long-term commitment to funding these types of studies is essential to provide the scientific foundation for restoration.

Keywords: Everglades, Florida Bay, sediment cores

Aumen, N. G., G. Wingard, and C. Bernhardt, 2023. The importance of paleoecology in Everglades restoration science and management. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):56. https://doi.org/10.58782/flmnh.whwa9153

BRIDGING THE DIVIDE FROM PALEOECOLOGY TO NEOECOLOGY

— Keynote —

Bush, Mark B., Florida Institute of Technology, USA

As paleoecologists we often claim that our science is relevant to conservation, but relatively few management plans are steered by paleoecological insights. One of our common justifications that paleoecology should feature in conservation is to determine what is 'natural'. Intergenerational perceptions of naturalness are shaped by our experiences of ecosystems continuously and progressively influenced by human-induced stresses - the concept of shifting baselines. Those stresses have been present since the last ice-age in the tropical Andes, when fire regimes and megafaunal extinctions pre-dated the onset of the Holocene. Whereas human-induced ecological change is only evident for 200 years on the Galapagos Islands. But both instances are consistent that they show that low numbers of people, probably not even living in permanent settlements wrought lasting ecological changes and extinctions. Cascading effects of tortoise loss were seen on Galapagos vegetation that directly or indirectly led to extinctions among endemic plants. Making paleoecology relevant to conservation requires finding levels of taxonomic and temporal resolution that are relevant to land managers and providing concrete recommendations for restoration.

Keywords: paleoecology, neoecology, fossil pollen, Galapagos, Andes

Bush, M. B., 2023. Bridging the divide from paleoecology to neoecology. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):57. https://doi.org/10.58782/flmnh.zifq5560

CHARACTERIZING PAST COMMUNITIES TO BUILD FUTURE ONES: LESSONS FROM CARIBBEAN CONSERVATION PALEOBIOLOGY

— Keynote —

Kemp, Melissa E., The University of Texas at Austin, USA

The Caribbean is one of the most well-studied biodiversity hotspots, but the diversity of today's Caribbean is only a fraction of what once existed there, as natural and anthropogenic processes have contributed to extinction and extirpation across multiple taxonomic groups. Given this long-term history of environmental perturbations and human impacts, paleobiology is well-suited to inform ongoing conservation needs in the Caribbean, which continues to be impacted by habitat degradation, species introductions, and other global change phenomena. I show how fossil, archaeological, and ecological data elucidate patterns of biodiversity loss and resilience, with direct implications for conservation management. While conservation paleobiology has significant potential in the Caribbean, it also faces major challenges in implementation, in part due to colonial histories and practices of parachute science. I summarize how this colonial legacy perpetuates knowledge and resource gaps, and outline ways in which we can move toward an equitable conservation paleobiology. One path forward is through education and partnership with local communities. I highlight my program, NEET Young Innovators, a partnership between the University of Texas at Austin, the Negril Education Environment Trust, the University of the West Indies Mona, and the Jamaican Ministry of Education and Youth. The NEET Young Innovators program develops place-based, experiential curriculum and STEM camps for Jamaican students and teachers. Capitalizing on paleobiology's status as a "gateway science," we created and implemented a suite of conservation paleobiology lesson plans in a STEM camp designed to cultivate environmental stewardship and broaden awareness of Caribbean natural history and biodiversity among Jamaican youths. Through integrative research, reflection, and inclusive partnership, paleobiology can guide the conservation, management, and restoration of biodiversity in this critical ecosystem.

Keywords: Caribbean, reptiles, extinction, colonization, education

Kemp, M. E., 2023. Characterizing past communities to build future ones: Lessons from Caribbean conservation paleobiology. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):58. https://doi.org/10.58782/flmnh.usbk7399

CONSERVATION PALEOBIOLOGY AND THE STEWARDSHIP OF U.S. NATIONAL PARK SERVICE PALEONTOLOGICAL RESOURCES

— Keynote —

Santucci, Vincent L., National Park Service Paleontology Program, USA

Conservation biology, and the descendent discipline conservation paleobiology, are philosophically aligned with the mission of the National Park Service (NPS), including near time and deep time frameworks. As defined in the Organic Act of August 25, 1916, the purpose and mission of the NPS is "…to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations". This conservation mandate is broadly inclusive of grizzly bears, redwood trees, and dinosaur bones equally, throughout the 424 officially designated parks, monuments, and other areas managed by the NPS. Although conservation paleobiology is reported by some to be a new and integrated field of study, there are remarkable similarities to traditional and old school perspectives which embraced natural history more holistically during the nineteenth and early twentieth centuries. Notably, the written contributions by Charles Darwin, Aldo Leopold, and Edward Abbey synthesize observations at the global and landscape scales, promoting conservation advocacy of the natural world, past and present. U.S. National Park Service areas preserve some of Planet Earth's most globally significant natural resources, ecological systems, and biosphere reserves. Discoveries of fossil condors and mummified bats within caves of Grand Canyon National Park, the co-occurrence of human and megafaunal footprints preserved in Late Pleistocene strata at White Sands National Park, and pygmy mammoth remains on Channel Islands National Park, collectively demonstrate how valuable temporal and historical biological perspectives contribute to science, stewardship, and resources management in parks and beyond. The paleobiology community is cordially invited to join in the holistic study and conservation of the near time and deep time resources in the national parks.

Keywords: fossil, paleontology, National Park Service, conservation, stewardship

Santucci, V. L., 2023. Conservation paleobiology and the stewardship of U.S. National Park Service paleontological resources. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):59. https://doi.org/10.58782/flmnh.dtxe7925

GEOLOGICAL PERSPECTIVES ON THE DEGRADATION AND RESTORATION OF CORAL REEFS

— Keynote —

Toth, Lauren T., United States Geological Survey, St. Petersburg Coastal and Marine Science Center, USA

The growth and maintenance of coral-reef structures built over 1000s of years serve as the foundation for the myriad ecosystem services reefs provide to society. Predicting how reef building will change in the future is, therefore, critical to designing effective coral-reef management strategies; however, it is challenging to accurately forecast the long-term process of reef accretion based on short-term ecological studies alone. Geological records, particularly those from sensitive, marginal reef environments such as the subtropical reef system of south Florida, are essential for projecting changes in reef accretion, and for optimizing strategies for coral-reef management. Using a combination of millennial-scale reconstructions of reef accretion and paleoecology from reef cores, and contemporary carbonate budget modeling, I evaluated the past, present, and a possible future of coral-reef development in south Florida. I will show that climate has been the primary control on the rate and extent of regional reef development and, by 3000 years ago, reef accretion was negligible throughout the region. This confined the ecosystem to an unstable equilibrium in which a veneer of living coral was the only barrier to catastrophic reef erosion. In recent decades, climate and other anthropogenic disturbances have pushed many reefs into a novel state characterized by a loss of reef-building corals that is unprecedented in the geological record. These changes have unbalanced Florida's carbonate budgets, leading to increases in reef-framework erosion. I will show that there is hope for ongoing coral restoration efforts to revive reef growth on a local scale to levels comparable to long-term natural baselines; however, the central role of climate in both the millennial-scale declines in reef building and the modern decline in coral populations suggests that the efficacy of these local efforts will be limited without global-scale action to mitigate anthropogenic climate change.

Keywords: coral reef, reef accretion, climate, restoration, species turnover

Toth, L. T., 2023. Geological perspectives on the degradation and restoration of coral reefs. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):60. https://doi.org/10.58782/flmnh.oxzv5621

UNDERSTANDING PALEOCLIMATE THROUGH SOUTHERN CALIFORNIA'S PACKRAT MIDDENS

Austin, Elizabeth L., Middlebury College, USA; **Mychajliw, Alexis M.**, Middlebury College, USA

Documenting how ecosystems responded to climate change in the past can inform models for the future relevant to conservation decision-making. Packrat middens, or giant nests consisting of gathered plant material made by rodents of the genus *Neotoma*, represent one of the best data sources for understanding how plant communities change over time. These nests can be preserved for thousands of years, spanning episodes of glacial-interglacial variation, such as the Pleistocene-Holocene transition, or more recent fluctuations, such as the Little Ice Age and Medieval Warm Period. We used the USGS-NOAA paleoclimate open-access database to develop spatiotemporal reconstructions of plant species in Southern California, incorporating more than 242 individual middens with a total of 193 available radiocarbon dates spanning around 44,493 years cal BP. As a result, 374 plant species were identified within the SoCal middens, with Joshua Tree (*Yucca brevifolia*), Joint Pine (*Ephedra* species), and California Juniper (*Juniperus californica*) being the most abundant. We then applied these data to reconstruct past vegetation communities and contextualize a recently discovered asphaltic midden recovered from the La Brea Tar Pits (Los Angeles, California). The La Brea midden represents both the oldest and most coastal midden in our dataset in California and contains vegetation spanning Marine Isotope Stages 2-3. Ultimately, this research allows us to paint a picture of changing vegetation over time as a baseline for palaeoecological food web studies and can be compared with present day packrat nests found in this urban biodiversity hotspot. These data will be curated through the Conservation Paleobiology Network's urban vegetation working group (based in Los Angeles, California) and made available for use by conservation and management projects throughout the region. With this information, CPN can implement habitat restoration projects in SoCal.

Keywords: *Neotoma*, paleoclimate, SoCal, La Brea Tar Pits, vegetation

Austin, E. L. and A. M. Mychajliw, 2023. Understanding paleoclimate through southern California's packrat middens. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):61. https://doi.org/10.58782/flmnh.dhkb7794

MOBILIZING PALEOBIOLOGY TO SUPPORT CONSERVATION IN THE BAHAMAS

The Bahamas Lost Ecosystems Conservation Paleobiology Working Group

The Bahamas sit at the intersection of multiple global change issues emblematic of contemporary Anthropocene conservation challenges. However, the region also has a long and dynamic biocultural history characterized by multiple human migration events associated with species extirpations, extinctions, invasions, and biogeographic rearrangements. This dynamic history informs present day species and ecosystem diversity, as well as societal perceptions of biodiversity conservation. Here, we introduce an interdisciplinary working group focused on the mobilization of paleobiology data and models in support of contemporary conservation agendas and outreach in The Bahamas. Our aims are aligned with global biodiversity goals but are scaled to regional needs. They include: (1) Identify the temporal and spatial scale of human drivers of loss beginning with initial human settlement (ca. AD 700) and through more contemporary time periods; (2) Using these baselines of taxa through time, consider both species-specific conservation and broader ecosystem restoration possibilities; (3) Employ paleobiological data in new modeling and computational approaches to reconstruct ecosystem functions through time and across space to explore possible avenues for "rewilding"; and (4) Ensure equitable benefits of research and conservation implementation. Within the context of these aims, we also discuss both the challenges and great promise of forming a "conservation paleobiology working group" across people with diverse backgrounds and engagement with conservation.

Keywords: The Bahamas, Anthropocene, archaeology, paleontology, conservation

The Bahamas Lost Ecosystems Conservation Paleobiology Working Group, 2023. Mobilizing paleobiology to support conservation in The Bahamas. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):62. https://doi.org/10.58782/flmnh.sbmq1125

IMPLICATIONS OF IMMIGRANT ARRIVAL TIMES DURING THE PALEOCENE-EOCENE THERMAL MAXIMUM FOR MAMMAL BIOGEOGRAPHIC RESPONSE TO MODERN CLIMATE CHANGE

Bloch, Jonathan I., Florida Museum of Natural History, University of Florida, USA; **Morse, Paul E.**, Department of Cell & Developmental Biology, University of Colorado School of Medicine, USA; **Vitek, Natasha S.**, Department of Ecology & Evolution, Stony Brook University, USA; **Boyer, Doug M.**, Department of Evolutionary Anthropology, Duke University, USA; **Korasidis, Vera A.**, School of Geography, Earth & Atmospheric Sciences, University of Melbourne, Australia; **Wing, Scott L.**, Department of Paleobiology, National Museum of Natural History, Smithsonian Institution, USA

Abilities of taxa to track suitable habitat under climate change is a concern in conservation biology. Projections that assume suitable habitat is limited to currently occupied biomes can produce underestimates of species viability. The geological record is a valuable source of data to test assumptions about habitat tracking because it archives past episodes of climate change. The Paleocene-Eocene Thermal Maximum (PETM) ~56 million years ago was an interval of rapid carbon release (millennial scale) and global warming (~5 C) that caused large geographic range shifts in Earth's biota. Large, stratigraphically controlled fossil collections spanning the PETM in the Bighorn Basin, Wyoming, document first occurrence data for immigrant mammals and plants, providing evidence of geographic range shifts as well as changes in climate, flora and vegetation. If mammals tracked specific habitats, their intercontinental dispersal would imply continuity of biomes across Holarctica. In that case, intercontinental mammal and plant immigrants should appear concurrently. Instead, mammalian immigrants crossed high latitude belts of warm, temperate forest, then appeared in the Bighorn Basin during the warmest part of the PETM when plant fossils suggest a dry tropical forest. Warm temperate Eurasian plants are rare during the body of the PETM, but become abundant during the recovery, as climate became wetter. Floral change during the PETM recovery is not concurrent with change in mammalian community structure. Distinct patterns of mammalian and plant turnover suggest that mammals did not strictly track plant-defined habitats. Species may be capable of more flexible responses to rapid climate change than current models predict. Efforts that support movement and provide multi-latitudinal networks of protected areas should be prioritized as a viable means to help conserve some species in the face of climate change.

Keywords: mammals, plants, biogeography, climate, PETM

Bloch, J. I., P. E. Morse, N. S. Vitek, D. M. Boyer, V. A. Korasidis, and S. L. Wing, 2023. Implications of immigrant arrival times during the Paleocene-Eocene thermal maximum for mammal biogeographic response to modern climate change. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):63. https://doi.org/10.58782/flmnh.pyuj3341

ENVIRONMENTAL CONTROLS ON PREDATOR AND PREY BODY SIZE IN THE NORTHERN GULF OF MEXICO

Calderaro, Luke A., Colgate University, USA; **Harnik, Paul G.**, Colgate University, USA; **Rillo, Marina C.**, University of Oldenburg, Germany

The Mississippi River delivers vast quantities of nutrient-rich freshwater to the northern Gulf of Mexico, fueling primary productivity in the coastal zone. Aerobic decomposition of these phytoplankton blooms has resulted in one of the most extensive dead zones on Earth. In contrast, primary productivity and hypoxia are more limited in the northeastern Gulf, where coastal environments are fed by smaller watersheds. How do environmental factors such as primary productivity, oxygen availability, and sea surface temperature shape coastal food webs? Here, we investigate environmental correlates of predator and prey body size in benthic mollusks using Holocene death assemblages. Results of linear mixed effects models indicate that bivalve size and the frequency of drilling predation are both influenced by dissolved oxygen concentrations; bivalve size increases and drilling frequency decreases with declining oxygen levels. Sea surface temperature is positively associated with predator and prey size, whereas net primary productivity has little effect on the size of predators or prey. Predator-to-prey size ratios were not significantly associated with any of the environmental factors considered. Larger bivalves found in oxygen-limited areas may be due to decreased predation pressure, resulting in greater prey longevity. Warmer waters with sufficient dissolved oxygen may also provide suitable growth conditions to increase the size of bivalves and predatory gastropods. Holocene death assemblages can be used to test long-standing hypotheses regarding environmental controls on predator-prey body size distributions through geologic time and provide baselines for assessing the ongoing effects of anthropogenic eutrophication and warming on coastal food webs.

Keywords: body size, primary productivity, live-dead, eutrophication, mollusk

Calderaro, L. A., P. G. Harnik, and M. C. Rillo, 2023. Environmental controls on predator and prey body size in the northern Gulf of Mexico. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):64. https://doi.org/10.58782/flmnh.ynof4861

SHELL MICROSTRUCTURE AS AN INDICATOR OF CHANGING ENVIRONMENTAL CONDITIONS IN COASTAL OCEANS

Carskaddan, Jane S., Colgate University, USA; **Harnik, Paul G.**, Colgate University, USA; **Metzler, Rebecca A.**, Colgate University, USA

Ocean ecosystems are undergoing pronounced changes in temperature and chemistry. Biomineralizing animals, such as mollusks, that produce calcium carbonate shells can be sensitive to these changes, and this may be reflected in the microstructure of their shells. Shell microstructure potentially offers conservation paleobiologists an additional tool for assessing spatiotemporal changes in environmental conditions resulting from human activities. Previous work suggests that environmental factors, such as temperature and pH, can affect how mollusks build their shells. Certain mollusks continuously lay down tablets of nacre on the interior of their shells, and the thickness of these tablets may reflect the temperature of the environment in which the organism lived. We have been investigating spatial and temporal variation in tablet thickness in two groups of marine mollusks. Our first case study focuses on a variety of present-day abalone species along a temperature gradient. Data were collected from individuals raised in aquaculture at controlled temperatures, as well as wild-grown individuals from different latitudes in the Pacific Ocean. Our second case study focuses on the marine bivalve *Nucula proxima* from the northern Gulf of Mexico. Live and dead *Nucula proxima* specimens were collected from 20 meters water depth offshore Louisiana and Alabama; radiocarbon analyses indicate that these specimens represent both present-day and pre-Industrial populations. Our preliminary results show: 1) little variation in tablet thickness among abalone grown in aquaculture at different temperatures, suggesting that fine scale variation in temperature has little effect on abalone microstructure; and 2) an increase in tablet thickness during the past 250 years for *N. proxima* offshore Louisiana, but little change in *N. proxima* microstructure in coastal Alabama over past centuries.

Keywords: biomineralization, environmental variation, mollusk, nacre, live-dead

Carskaddan, J. S., P. G. Harnik, and R. A. Metzler, 2023. Shell microstructure as an indicator of changing environmental conditions in coastal oceans. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):65. https://doi.org/10.58782/flmnh.oxbu6164

INTEGRATING PALEO, HISTORICAL, ARCHEOLOGICAL, AND TRADITIONAL ECOLOGICAL KNOWLEDGE DATA INTO CARIBBEAN CORAL REEF MANAGEMENT

Cramer, Katie L., Arizona State University, USA; **McClenachan, Loren**, University of Victoria, Canada; **Alvarez-Filip, Lorenzo**, Universidad Nacional Autónoma de México, México; **Carilli, Jessica**, United States Navy, USA; **Cope, Jason**, NOAA Fisheries, USA; **Graham, Rachel**, MarAliance, Panama; **Martínez, Ilse**, University of Victoria, Canada; **McField, Melanie**, Healthy Reefs for Healthy People Initiative, USA; **Nowlis, Josh**, Bridge Environment, USA; **Pérez Jiménez, Juan Carlos**, El Colegio de la Frontera Sur, México; **Rubio-Cisneros, Nadia**, Mar Sustentable Ciencia y Conservación, A.C, México; **Tewfik, Alexander**, consultant, Canada; **Vardi, Tali**, NOAA/Coral Restoration Consortium, USA; **Whaley, Zachary B.**, Arizona State University, USA

Studies using paleoecological and historical data can inform coral reef management by providing accurate ecological baselines and by pinpointing the timing, magnitude, and drivers of ecosystem declines. However, these studies have rarely been incorporated into policy and management frameworks. This working group brings together paleontologists, historical ecologists, ecologists, fisheries scientists, and conservation practitioners to develop pathways for incorporating long-term ecological data into decision-making to advance the sustainable management of reef ecosystems. Our group is focusing on Caribbean coral reefs, a geography with an abundance of historical ecological data and a track record of collaboration between reef scientists and managers. This spirit of collaboration is enhanced by the immediacy of conservation needs for reef ecosystems in this region. We are focusing on the application of long-term data to two pressing management issues for Caribbean coral reefs, which together address the most urgent local human drivers of ecosystem change - fishing and land-based pollution. In this talk, I will outline our working group's aims and progress to date.

Keywords: coral reef conservation, fisheries ecology, land-based pollution, reef water quality, integrated coastal watershed management

Cramer, K. L., L. McClenachan, L. Alvarez-Filip, J. Carilli, J. Cope, R. Graham, I. Martínez, M. McField, J. Nowlis, J. C. Pérez Jiménez, N. Rubio-Cisneros, A. Tewfik, T. Vardi, and Z. Whaley, 2023. Integrating paleo, historical, archeological, and traditional ecological knowledge data into Caribbean coral reef management. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):66. https://doi.org/10.58782/flmnh.kkvf4776

CORAL GEOCHEMICAL RECORDS TRACK MILLENNIAL-SCALE ECOSYSTEM CHANGE AND RESILIENCE IN THE TROPICAL EASTERN PACIFIC

Cybulski, Jonathan D., Smithsonian Tropical Research Institute, Republic of Panamá; Max Planck Institute for Chemistry, Otto Hahn Institute, Germany; Graduate School of Oceanography, University of Rhode Island, Rhode Island, USA; **Duprey, Nicolas**, Max Planck Institute for Chemistry, Otto Hahn Institute, Germany; Connolly, Sean, Smithsonian Tropical Research Institute, Republic of Panamá; **Foreman, Alan**, Max Planck Institute for Chemistry, Otto Hahn Institute, Germany; **Dillon, Erin**, Smithsonian Tropical Research Institute, Republic of Panamá; **Vonhof, Hubert**, Max Planck Institute for Chemistry, Otto Hahn Institute, Germany; **Martinez-Garcia, Alfredo**, Max Planck Institute for Chemistry, Otto Hahn Institute, Germany; **De Gracia, Brigida**, Smithsonian Tropical Research Institute, Republic of Panamá; **O'Dea, Aaron**, Smithsonian Tropical Research Institute, Republic of Panamá

Along the coastal Tropical Eastern Pacific (TEP), regions of strong seasonal upwelling bring cold, nutrient-rich waters, controlling ecological conditions and sustaining millions of people through large-scale fisheries. The TEP is also important for the regulation of global climate and is affected by large-scale environmental processes such as ENSO. How the nutrient dynamics of this region will respond to climate change and what the implications will be for coastal ecology remains unknown. Environmental records are needed that capture intra and inter-decadal variation and extend over millennia where these biotic and abiotic processes interact. Here, we develop a new sampling approach and construct two coral skeleton records (n = >600) from reef matrix cores that extend six millennia, from the upwelling Gulf of Panamá and the non-upwelling Gulf of Chiriquí. We ask what effects millennial-scale climate patterns have on upwelling in the region, and how the magnitude of upwelled nutrients influences ecological productivity and even human habitation. We combined multiple proxies using climatic (carbonate δ18O), nutrient (skeletal-organic matrix δ15N), diagenetic (taphonomic scoring), ecological (benthic community composition), and temporal (U-Th dates) data. Using Generalised Additive Models to assess variability, we find strong divergences in the nutrient (δ15N; range >5 ‰) records between Gulfs, while δ18O (range ~2‰) is more stable. The greatest variation in δ15N values occurs during times of high reef accretion whereas δ18O is constant, suggesting that nutrients, not temperature, are driving reef productivity. Taphonomic, taxonomic, and age data reveal periodic shifts and collapses of coral communities that differ between Gulfs. We end by drawing connections between these ecological shifts to the episodic human habitation documented during the late-Holocene and hypothesize what this may mean for ecosystem resilience and environmental management under future climate.

Keywords: nutrients, Tropical Eastern Pacific, ecosystem resilience, climate change, geochemistry

Cybulski, J. D., N. Duprey, A. Foreman, E. Dillon, H. Vonhof, A. Martinez-Garcia, B. De Gracia, and A. O'Dea, 2023. Coral geochemical records track millennial-scale ecosystem change and resilience in the Tropical Eastern Pacific. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):67. https://doi.org/10.58782/flmnh.gitr2523

DETECTING GENUINE VERSUS PSEUDO-ABSENCE IN THE FOSSIL RECORD: APPLICATIONS OF OCCUPANCY MODELLING FOR CONSERVATION PALAEOBIOLOGY

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Palaeontological data provide a unique avenue to evaluate the impact of climatic, habitat and ecosystem change over longer temporal scales than typically examined in ecology and conservation, contributing critical data on extinction dynamics that can help contextualize the current biodiversity crisis. However, the fossil record is biased by a variety of factors. In particular, the issue of data absence causes a genuine concern when attempting to discern spatial patterns. Does the lack of a fossil occurrence indicate genuine absence or imperfect detection (i.e., pseudo-absence)? Failing to quantify, discern and mitigate both the main drivers and impacts of data absence will have major implications for any attempt to reconstruct past diversity dynamics, limiting the applicability of paleontological data for addressing questions pertaining to present-day biodiversity. Occupancy modelling, a technique commonly applied in the fields of ecology and conservation, provides a novel way to evaluate the impact of both spatial and temporal biases on the fossil record. By distinguishing between true (taxon genuinely absent) and false (taxon present, but not observed) absences, occupancy modelling produces independent and simultaneous probability estimates for both occupancy and detection. Here, we show how paleontological occurrences can be adapted for use alongside relevant modern and paleo covariate data in both single season models run using the R package 'unmarked' and dynamic occupancy models using a Bayesian framework. We additionally test the impact of varying spatial scale, as well as uneven numbers of repeated site visits, on model outcomes, and provide recommendations for conservation paleobiologists intending to run these models. Finally, we outline additional benefits of applying occupancy modelling within conservation paleobiology.

Keywords: occupancy modelling, occurrence, data absence, fossil record bias, methods

Dean, C. D. and P. D. Mannion, 2023. Detecting genuine versus pseudo-absence in the fossil record: Applications of occupancy modelling for conservation palaeobiology. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):68. https://doi.org/10.58782/flmnh.bflu9472

COYOTES REVEAL BASELINE NITROGEN DECLINE ACROSS END-PLEISTOCENE ECOSYSTEM COLLAPSE

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The end Pleistocene was a time of ecological turmoil, coincident with environmental change, extinctions, and anthropogenic impacts on the landscape. As one of the few persisting predators from the Pleistocene, La Brea's exceptional record of coyotes (*Canis latrans*) provides a unique opportunity to clarify how a recently documented ecosystem state-shift impacted survivors. Through a multiproxy analysis of Rancho La Brea coyotes from the past 50,000 years to present, we analyzed over 100 individuals for radiocarbon chronologies, stable isotopes, dental microwear, and morphology to assess the consequences of megafaunal extirpation on these predators. Most notably, coyotes demonstrate a significant decline in $\delta^{15}N$ bone collagen values immediately after the extirpation of megafauna. While this decline is suggestive of a change in diet from more to less meat, stable isotopes of amino acids from a subset of samples instead provide evidence of a baseline shift in nitrogen—indicating large scale changes in the availability of nutritional resources. While coyotes do not demonstrate notable changes in diet across the extirpation boundary, as inferred from stable carbon isotopes in tooth enamel and dental microwear texture analysis, significant shifts in stable oxygen isotopes in $\delta^{18}O$ enamel and $\delta^{13}C$ bone collagen indicate more nuanced changes in potential prey-resources. Coyotes also demonstrate a linear decline in body size that begins prior to the local extirpation of megafauna (~20,000 years ago) and may be in response to competition with larger canids, the decline in large prey, and/or concurrent increases in aridity during this interval. A dramatic increase in scavenging of forested prey (e.g., deer) during the past century stands out as significantly distinct from the dietary niches occupied over the past 50,000 years—implying dramatic impacts of human behavior on coyotes, a recent shift in their ecological role, and the highly adaptable nature of these carnivores.

Keywords: Carnivora, diet, ecology, paleoecology, Rancho La Brea, stable isotopes

DeSantis, L., J. Meachen, J. Miller, R. Dunn, E. Lindsey, M. Pardi, J. Southon, W. Binder, J. Cohen, F. R. O'Keefe, E. Muller, A. Petherick, E. Hall, S. Johnson, B. Fuller, A. Farrell, and G. Takeuchi, 2023. Coyotes reveal baseline nitrogen decline across end-Pleistocene ecosystem collapse. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):69. https://doi.org/10.58782/flmnh.qfpe6016

PALEOECOLOGY OF THE PLIO-PLEISTOCENE OF QUEENSLAND: ECOLOGICAL SHIFTS EVIDENCED FROM FAUNA AT THE DARLING DOWNS

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The continent of Australia is currently warming approximately thirty-five percent faster than the rest of the globe, with the warmest year on record coinciding with the most extreme bush fires. While effects of ongoing climate change are apparent over the past century, Australia has experienced pronounced aridification since the Miocene/Pliocene, transitioning from tropical forests to more open habitats. To better contextualize on-going climate change, we assess the ecology and paleobiology of mammalian faunas in Australia from the Pliocene to the Present in the Darling Downs region of Queensland Australia. Via the analysis of stable isotopes from tooth enamel and dental microwear texture analysis of the chewing surfaces of teeth, we clarify the ecology and paleobiology of medium to large marsupials from the Pliocene Chinchilla Sands and Pleistocene Eastern Darling Downs faunas. By comparing these ancient marsupial mammal communities to extant marsupial mammals that inhabit these regions today, we further demonstrate that the most dramatic changes between past ecosystems are clearly between those of the Present and the Plio-Pleistocene—indicated that the Darling Downs region of today is disparate as compared to the past. Most notably, *Macropus giganteus* consumes vegetation that is ~5.6‰ higher in δ13C values today than during the past, indicating feeding in a significantly more open landscape. The Pliocene and Pleistocene of the Darling Downs are instead dominated by mixed-feeding and browsing taxa, with several taxa exhibiting diets disparate from modern analogues (e.g., an abundance of C4 browsers). Collectively, these deep-time temporal comparisons are a clear example of how ecological communities observed today do not represent the full range of ecological niches occupied in the past and highlight the dramatic climate-departures experienced today.

Keywords: Cenozoic, mammal, stable isotopes, dental microwear, paleobiology

DeSantis, L. R., G. Price, J. Louys, 2023. Paleoecology of the Plio-Pleistocene of Queensland: Ecological shifts evidenced from fauna at the Darling Downs. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):70. https://doi.org/10.58782/flmnh.xztv9346

INTEGRATING INFORMATION FROM THE PAST INTO OYSTER MANAGEMENT

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In the United States, the eastern oyster (*Crassostrea virginica*) is an economically, culturally, and ecologically important oyster species that ranges from Maine to Texas. Eastern oyster populations are managed by a variety of federal, state, and local governments as well as non-governmental organizations. In addition, the long history of oyster harvesting and coastal land use change in the United States, and asynchronous fluctuations in abundance across the species range due to diverse pressures (e.g., hydrological changes, pollution, disease, overharvesting), combined with often scarce historical monitoring records documenting the timing and magnitude of the changes, have challenged oyster applied professionals for well over a century. The Oysters Past Working Group (OPWG) brings together academic researchers (paleoecologists, archaeologists, and historical ecologists) and applied professionals, representing federal, state, and local government and non-governmental organizations tasked with conserving, managing, and/or restoring oyster populations and habitat. The primary goals of the OPWG are to: 1) identify priority research directions for academic researchers by evaluating the information needs among applied professionals and the types of information from the past that may be able to address them; 2) create a guidance document on best practices for applying information from the past to oyster management; and 3) build trust and commitment to promote longer-lasting and sustained collaboration between academic researchers and applied professionals.

Keywords: co-production research, *Crassostrea virginica*, research-implementation gap, resource management

Dietl, G. P. and S. R. Durham, 2023. Integrating information from the past into oyster management. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):71. https://doi.org/10.58782/flmnh.gmei9892

COPRODUCTION IN CONSERVATION PALEOBIOLOGY: LESSONS LEARNED FROM THE HISTORICAL OYSTER BODY SIZE PROJECT

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Over the past decade, many conservation biology researchers and practitioners have turned to knowledge co-production, which prioritizes collaboration between academic and non-academic partners, to increase the impact of science in conservation practice and policy. Co-production promises to produce context-specific knowledge that better aligns with conservation practitioners' needs and concerns. Here, we argue that the conservation paleobiology community could similarly build collective capacity to engage more effectively in shared "learning spaces" where actionable knowledge is produced. We draw from our experiences with the Historical Oyster Body Size project and lessons learned from other fields to identify key attributes of actionable geohistorical knowledge and the meaningful co-production processes that produced it. Familiarity with these concepts will benefit conservation paleobiologists who aspire to help develop longer lasting, fairer, and more equitable solutions to complex conservation problems presented by a changing world.

Keywords: actionable science, engagement, knowlege-action gap, translational paleoecology

Dietl, G. P., S. R. Durham, C. Clark, and R. Prado, 2023. Coproduction in conservation paleobiology: Lessons learned from the historical oyster body size project. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):72. https://doi.org/10.58782/flmnh.vpbf5634

RECONSTRUCTING MILLENNIAL-SCALE VARIABILITY IN REEF SHARK COMMUNITIES ACROSS THE ISTHMUS OF PANAMA

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Shark populations have declined over the last half century, but the patterns of change vary across space. Long-term records of shark abundance are limited, making it challenging to determine how local environmental conditions influence pre-exploitation shark baselines and their susceptibility to human impacts. We use shark scales (dermal denticles) preserved in coral reef sediments to reconstruct shark communities during the mid-Holocene and today across the Isthmus of Panama. We interpret these data alongside records of primary productivity, habitat, and fish abundance to explore energy flow to higher trophic levels on each coast. The Tropical Eastern Pacific is a productive system driven by seasonal upwelling with a long history of shark exploitation. The Caribbean coast, on the other hand, is oligotrophic and environmentally stable, with lower rates of harvesting. We find that denticle accumulation rates, a proxy for shark abundance, are an order of magnitude greater in Pacific Panama (Gulf of Panama) than in Caribbean Panama (Bocas del Toro). Primary productivity and fish abundance are also higher in Pacific Panama, helping to support these large predator populations. Denticle accumulation rates declined by 71% since the mid-Holocene in Caribbean Panama, including a selective loss of pelagic sharks. In contrast, modern denticle accumulation rates in Pacific Panama are comparable to their range of variability during the mid-Holocene, and the composition of denticle assemblages remained similar through time—suggesting that sharks in the Gulf of Panama have persisted despite intensive fishing. We postulate that the region's high productivity might underlie its high shark abundance and apparent resilience by increasing available resources for predators. Our findings shed light on the role of energy in shaping natural variability in shark baselines and recovery potential. They also highlight the importance of incorporating oceanographic context into shark management.

Keywords: coral reef, Holocene, productivity, resilience, shark dermal denticle

Dillon, E., D. McCauley, B. De Gracia, J. Cybulski, and A. O'Dea, 2023. Reconstructing millennial-scale variability in reef shark communities across the Isthmus of Panama. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):73. https://doi.org/10.58782/flmnh.qkui8894

WHAT IS CONSERVATION PALEOBIOLOGY? TRACKING 20 YEARS OF RESEARCH AND DEVELOPMENT

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Conservation paleobiology has coalesced over the last two decades since its formal coining, united by the goal of applying geohistorical records to inform the conservation, management, and restoration of biodiversity and ecosystem services. Yet, the field is still attempting to form an identity distinct from its academic roots. Here, we ask a deceptively simple question: What is conservation paleobiology? To track its development as a field, we synthesize complementary perspectives from a survey of the scientific community that is familiar with conservation paleobiology and a systematic literature review of publications that use the term. We present an overview of conservation paleobiology's research scope and compare survey participants' perceptions of what it is and what it should be as a field. We find that conservation paleobiologists use a variety of geohistorical data in their work, although research is typified by near-time records of marine molluscs and terrestrial mammals collected over local to regional spatial scales. Our results also confirm the field's broad disciplinary basis: survey participants indicated that conservation paleobiology can incorporate information from a wide range of disciplines spanning conservation biology, ecology, historical ecology, paleontology, and archaeology. Finally, we show that conservation paleobiologists have yet to reach a consensus on how applied the field should be in practice. The survey revealed that many participants thought the field should be more applied but that most do not currently engage with conservation practice. Reflecting on how conservation paleobiology has developed over the last two decades, we discuss opportunities to promote community cohesion, strengthen collaborations within conservation science, and align training priorities with the field's identity as it continues to crystallize.

Keywords: cross-disciplinarity, conservation science, geohistorical records, survey, systematic literature search

Dillon, E., J. Pier, J. Smith, N. Raja, D. Dimitrijević, E. Austin, J. Cybulski, J. De Entrambasaguas, S. Durham, C. Grether, H. Haldar, K. Kocáková, C.-H. Lin, I. Mazzini, A. Mychajliw, A. Ollendorf, C. Pimiento, O. Regalado Fernández, I. Smith, and G. Dietl, 2023. What is conservation paleobiology? Tracking 20 years of research and development. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):74. https://doi.org/10.58782/flmnh.bvfu8994

OYSTER DEATH ASSEMBLAGES AS ARCHIVES OF HISTORICAL INFORMATION FOR STUDYING LONG-TERM TRENDS IN OYSTER BODY SIZE

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A lack of location-specific, long-term data is a common obstacle to assessing trends in condition of coastal habitats over time. Without historical monitoring records or other documentation, filling such data gaps can be difficult, but sedimentary records such as death assemblages (DAs; the accumulated, identifiable remains of organisms that lived in or near the habitat in the past) are relatively untapped, location-specific archives of ecological information from the past. In 2018, the Florida Department of Environmental Protection and the Paleontological Research Institution began a collaboration to study the use of oyster reef (*Crassostrea virginica*) DAs to address monitoring information gaps for oyster size. To-date, our project has sampled DAs from over 30 intertidal oyster reefs around Florida, radiocarbon dated most of the samples, and measured over 26,000 oyster shells. In the process, we found that *C. virginica* DAs are recent and high-resolution archives, with most samples from 15-35cm burial depth dating to within the last 80 years. We also developed a model to combine the DA data with real-time monitoring data on live oyster sizes from the same reefs to estimate reef- and locality-level size trends from as early as the 1960s to the present. This information is adding temporal context for our overwhelmingly short (~5-10 years) and recent (many post-2010) time series of live *C. virginica* size data. This case study demonstrates the potential utility of DA data for supplementing real-time monitoring data during the assessment and management of coastal habitats.

Keywords: oyster, death assemblage, *Crassostrea virginica*, resource management

Durham, S. R., G. P. Dietl, J. C. Handley, Q. Hua, C. P. Clark, J. Q. Pier, and D. S. Kaufman, 2023. Oyster death assemblages as archives of historical information for studying long-term trends in oyster body size. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):75. https://doi.org/10.58782/flmnh.otub3709

LIVE-DEAD SHIFTS IN MOLLUSCAN FUNCTIONAL DIVERSITY IN COASTAL ALABAMA

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Abiotic and biotic environmental factors shape species behavioral, physiological, and morphological traits. Shifts in the diversity of these functional traits therefore can serve as an indicator of spatial and temporal changes in environmental conditions. In recent centuries, the delivery of nutrients to coastal ecosystems has increased markedly through changing waste management and land-use practices. Nutrient enrichment has increased rates of primary productivity, resulting in greater organic accumulation on the seafloor and the development of hypoxic conditions in some areas, due to the aerobic decomposition of phytoplankton blooms. Anthropogenic eutrophication and associated hypoxia have been monitored annually in the northern Gulf of Mexico for over four decades, with an emphasis on areas surrounding the Mississippi River Delta. To further understand how anthropogenic eutrophication affects functional diversity in benthic marine communities, we collected live and dead assemblages of bivalve mollusks from surficial sediments at five stations along the -20 meters isobath in coastal Alabama. Bivalves were categorized into functional groups using information about their mobility, fixation, feeding type, substrate preference, and body size. Consistent with our hypotheses, preliminary results indicate a temporal shift from benthic communities dominated primarily by epifaunal and infaunal suspension-feeding species to communities characterized primarily by deposit feeders, many of which dwell on the seafloor surface. Ongoing analyses will help identify the functional traits that are most sensitive to these changing environmental conditions. Understanding functional diversity shifts in the recent past can provide insight into how anthropogenic eutrophication may further impact benthic marine ecosystems in the future.

Keywords: functional diversity, mollusk, live-dead, eutrophication, hypoxia

Filipovich, C.L., P. G. Harnik, and K. S. Collins, 2023. Live-dead shifts in molluscan functional diversity in coastal Alabama. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):76. https://doi.org/10.58782/flmnh.xkhw5897

PALEOECOLOGICAL IMPLICATIONS OF TREMATODE-INDUCED PIT SIZE IN CHAMELEA GALLINA FROM THE ADRIATIC SEA, ITALY

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Gymnophallid trematodes are complex life cycle parasites that induce characteristic pits in their bivalve intermediate hosts, which serve as their sole fossil record. Previous work demonstrated that trematode prevalence increases with rising sea levels, but little has been done to investigate patterns of trematode pit size in relation to Holocene sea-level and environmental changes. Here we focus on trematode pits preserved in the bivalve *Chamelea gallina* from five late Holocene core samples (2510-3140 y BP) and eight modern death assemblages from the Po-Adriatic system (northern Italy). Using ImageJ, we measured 838 total pits, with 715 from the core samples and 123 from the death assemblages. The geometric mean of the primary and secondary axis was used as a proxy for trace size, which ranges from 0.117 mm to 1.708 mm. The median size of Holocene pits (0.497 mm) is significantly larger (pWilcoxon = 1.73e-05) than the median size of modern pits (0.396 mm), indicating a decrease in trematode metacercariae body size over this time. There was no significant relationship between trematode pit size and host bivalve body size and only whole, well-preserved Holocene valves were analyzed to minimize the influence of taphonomy. We interpret a change in *C. gallina*-trematode parasite-host interactions over the last 3 ky, which could be the result of several scenarios. Modern pits could be created by different taxa, which have smaller body sizes, or the pits could be formed by the same parasitic taxa which now may have a decreased body size, perhaps due to stress. These results, coupled with a survey of modern metacercariae sizes, suggest that the trematode pit size record can provide relevant information on parasite paleoecology and, perhaps, identity. Such information will enable more nuanced analyses of parasite-host response to environmental change in the past with an eye to the future.

Keywords: parasitism, bivalves, paleoecology

Fitzgerald, E., D. Scarponi, and J. W. Huntley, 2023. Paleoecological implications of trematode-induced pit size in *Chamelea gallina* from the Adriatic Sea, Italy. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):77. https://doi.org/10.58782/flmnh.gvjd1610

TRANSFERABLE SKILLS AND BIG IDEAS FOR THE NEXT GENERATION OF (PALEO)ENVIRONMENTAL DECISION MAKERS: A CURRICULAR EXAMPLE USING SALMON RESTORATION AND CONSERVATION IN THE PACIFIC NORTHWEST FOR UNDERGRADUATE AND GRADUATE STUDENT TRAINING

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Future (paleo)environmental and Earth scientists will need to partake in interdisciplinary dialogue and apply systems thinking to address current and projected environmental problems. Towards this goal, undergraduate and graduate student training should include transferable skills, such as the ability to identify policy claims and understand the role of values, beliefs and attitudes when engaging potential stakeholders. Students should also have robust opportunities to practice these skills in the context of big ideas or issues that are environmentally-relevant. Here we present an example of a project-based scenario which has students first build a set of physical, biological, geohistorical, regulatory, social, and environmental justice "landscape" layers at the watershed-level. Second, the students consider real proposed restoration projects to recover salmon, and convince stakeholders and funding agencies to support their highest priority project. The projects are scored and ranked using Washington State Salmon Funding Recovery Board (SRFB) technical and social criteria. Students gain experience in; 1) analyzing interactions among the science and policy landscape layers in their watersheds, 2) navigating the process of individual and collective decision making regarding restoration and conservation, and 3) communicating to broad audiences, such as the SRFB which includes indigenous, government agency, academic, industry, and non-profit representatives. The ability to connect scientific understandings of the natural world, including paleobiological perspectives, to policy and decision making is a skill-set that needs to be taught and practiced at the undergraduate and graduate levels. While the connections are often clear, acting on those connections is usually the challenge, and student training prepares the next generation of (paleo)environmental decision makers.

Keywords: education, decision making, policy, curriculum, salmon restoration

Fox-Dobbs, K., D. Sherman, and P. Wimberger, 2023. Transferable skills and big ideas for the next generation of (paleo)environmental decision makers: A curricular example using salmon restoration and conservation in the pacific northwest for undergraduate and graduate student training. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):78. https://doi.org/10.58782/flmnh.smfb7791

SHED FEMALE ANTLERS AS A MINERAL RESOURCE FOR CARIBOU ON SPRING CALVING GROUNDS

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Caribou (*Rangifer tarandus*) is the only extant deer species in which females produce antlers, but what are the roles and biological benefits of this feature? Female antler shedding is roughly synchronous with calving and, within populations, occurs at approximately the same time and place every year. Interestingly, spring and summer forage on caribou ranges can be insufficient in key minerals (calcium and phosphorus) that support nursing, and strategies for offsetting these deficits are poorly understood. We test the hypothesis that female caribou antlers, rich in calcium and phosphorus, provide mineral supplements for nursing females. Using antler and bone materials collected from the Coastal Plain calving grounds of the Porcupine Caribou Herd (Arctic National Wildlife Refuge, Alaska), we assessed the consumption of bone-derived nutrients by ungulates (*Rangifer*), carnivorans (*Ursus, Canis, Vulpes*), and rodents (*Urocitellus, Microtus*). Taphonomic surveys yielded over 1,300 antlers and hundreds of skeletal bones. We visually inspected each element for modifications and compared observed features to those generated by candidate modifiers. We identified 20 modification classes within the collection and attributed 10 to caribou. We found caribou gnawing on ~90% of shed antlers, but <10% of skeletal material, indicating a clear focus on antler resources. Co-occurring mammals rarely targeted antlers, with rodents gnawing 30%). On the calving grounds, caribou monopolize antler nutrients, likely driven by nursing females. Antlers can form dense accumulations on caribou calving grounds (>1,000 antlers/km2) and persist for centuries or longer, potentially serving as an important mineral-rich attractor. The annual return to calving grounds, during which females consume available antler resources and contribute new ones, may function as an unrecognized feedback mechanism for maintaining calving ground fidelity.

Keywords: ungulate, taphonomy, Arctic, antler

Gaetano, M., J. Miller, E. Wald, and P. Druckenmiller, 2023. Shed female antlers as a mineral resource for caribou on spring calving grounds. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):79. https://doi.org/10.58782/flmnh.zaam7004

A 55,000-YEAR RECONSTRUCTION OF VEGETATION IN THE LOS ANGELES BASIN: INSIGHTS INTO FUTURE CHANGE AND A BETTER GUIDE FOR THE PRESENT

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The California Floristic Province is a biodiversity hotspot. Endemic flora is threatened by climate change, habitat fragmentation and destruction. It is also host to the La Brea Tar Pits (LBTP), which in addition to its famous megafauna, preserves a rare long-term plant macrofossil record with taxonomic resolution to genus and species. The LBTP flora has the potential to provide a comprehensive vegetational history for the Los Angeles Basin and a dynamic baseline for modern conservation efforts. We used accelerator mass spectrometry (AMS) radiocarbon dating to establish a 55 ka timeline of plant presence in Los Angeles, California. We identified and radiocarbon dated 188 plant macrofossils from the La Brea Tar Pits collections. Eight distinct phases of vegetation were identified based on the loss or appearance of key taxa in the timeline. Pairwise similarity was calculated between each identified phase to compare changes to phase species makeup through time. The transition periods between phases were compared to existing climate proxy records to better understand forcings behind vegetation shifts. Two transition periods in the record are of interest to modern conservation efforts. First, fog-dependent closed cone pine species, *Pinus muricata* and *Pinus radiata*, become extirpated from the Los Angeles Basin at 48 ka. This disappearance corresponds with a period of extended drought. Second, repeated patterns of juniper species replacement during periods of megadrought, and their eventual extirpation at 12.8 ka, indicate the importance of land management choices in the ability of juniper populations to rebound after drought-induced die-off. Understanding the long-term dynamics of plant community structure in a region is crucial to managing landscapes in the context of global change, and these data are now being leveraged to inform local conservation efforts in the city of Los Angeles.

Keywords: La Brea Tar Pits, paleobotany, drought

George, J., R. Dunn, E. Lindsey, A. Farrell, and G. MacDonald, 2023. A 55,000-year reconstruction of vegetation in the Los Angeles basin: Insights into future change and a better guide for the present. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):80. https://doi.org/10.58782/flmnh.ejtz3128

PER-SIMPER, AN INNOVATIVE METHOD FOR IDENTIFYING COMMUNITY ASSEMBLY PROCESSES WITHIN MODERN, RECENT, AND DEEP-TIME PALEONTOLOGICAL ASSEMBLAGES

Gibert, Corentin, Georgia Institute of Technology, SEPL, USA; **Escarguel, Gilles**, Université Lyon 1, LEHNA, France; **Vilmi, Annika**, University of Oulu, SYKE, Finland; **Wang, Jianjun**, Nanjing Institute of Geography and Limnology, China; **McGuire, Jenny L.**, Georgia Institute of Technology, SEPL, USA

How biological communities are assembled is an old but lively debate, especially today, as the efficiency of conservation policies depend on our capacity to correctly identify the assembly processes at play within the species assemblages we aim to protect. The wide range of assembly modes, once seen as mutually exclusive hypothesis are now seen as part of a continuum where the opposite ends correspond to niche- and dispersal-assembly perspectives. Niche-assembled communities are closed and balanced with a stable taxonomic composition depending on deterministic processes when dispersal-assembled communities are open, in non-equilibrium state with constantly changing compositions depending on historical process and continuous dispersion between communities. The former must be protected by increasing habitat diversity and heterogeneity when the latter needing high connectivity to ensure dispersal between habitats. Protecting modern at-risk communities will require an understanding of how assembly processes have been affected by past climate change (both recent and ancient) or by the historical exploitation of ecosystems by humans. However, few methods exist that are capable of identifying assembly processes within paleontological datasets and producing time series at multiple scales due to missing information in the vast majority of the fossil record (e.g., abundance, environmental information, highly-resolved phylogeny) or due to limited precision of compatible methods (i.e. random vs. non-random patterns). The new PER-SIMPER method (and its associated DNCImper R package) can be used to identify and quantify the respective roles of niche and dispersal processes from the distribution of occurrences of extinct and extant species. Based on three modes of permutation of the occurrence matrix, I will illustrate PER-SIMPER with deep-time (e.g., trilobites), ancient (e.g. Cenozoic mammals) and modern datasets (e.g. small mountain mammals, host-flea assemblages).

Keywords: assembly processes, niche, dispersal, PER-SIMPER, DNCI

Gibert, C., G. Escarguel, A. Vilmi, J. Wang, and J. L. McGuire, 2023. PER-SIMPER, an innovative method for identifying community assembly processes within modern, recent, and deep-time paleontological assemblages. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):81. https://doi.org/10.58782/flmnh.dsol7912

LIFE HISTORIES VARY WITH PRIMARY PRODUCTIVITY IN THE NORTHERN GULF OF MEXICO

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Human activities have increased nutrient delivery to aquatic ecosystems around the world, spurring primary productivity, and leading to the establishment and expansion of oxygen-limited "dead zones." How will marine animals respond to these changing conditions? To address that question, we take a space-for-time approach and compare the traits of different marine invertebrates along a primary productivity gradient in the northern Gulf of Mexico. Previous studies have found that life history traits can be sensitive to prevailing environmental conditions. Using Holocene death assemblages collected from -20 meters offshore Alabama and Florida, we test the hypothesis that bivalve egg size, and bryozoan reproductive mode, vary with primary productivity. Based on previous studies, we expect populations in areas with an abundance of food to exhibit the following characteristics: 1) cupuladriid bryozoans will exhibit greater frequencies of clonal to aclonal reproduction; and 2) bivalves will produce smaller eggs due to greater juvenile survivorship and fecundity selection. We found that *Discoporella depressa* colonies show low frequencies of clonal reproduction overall, but that percent clonality was greater in coastal Alabama than Florida. *Cupuladria* colonies showed higher proportions of clonal reproduction, whereas *Reussirella doma* colonies exhibited exclusively aclonal reproduction. Egg size is positively correlated with the earliest stage of larval shell growth (PI size) in marine bivalves. *Nucula proxima* larval shell size varied inversely with primary productivity; larval shells were larger in Florida than Alabama. Preliminary live-dead results in both regions show limited evidence of change over time, in contrast with previous analyses of other bivalve species in the region. These space-for-time case studies highlight ways in which benthic marine invertebrates may respond to future anthropogenic driven changes in primary production in the coastal ocean.

Keywords: life history, primary productivity, death assemblage, marine invertebrate, Holocene

Gómez, J. J., V. K. Unnone, and P. G. Harnik, 2023. Life histories vary with primary productivity in the northern Gulf of Mexico. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):82. https://doi.org/10.58782/flmnh.ytxn5341

MODELING PRE-IMPACT BASELINES AT SCALE TO INFORM SPECIES RECOVERY

Grace, Molly K., University of Oxford, UK; **Akçakaya, Resit**, Stony Brook University, USA; **Avery, Aaron**, University of South Florida, USA; **Duncan, Clare**, Institute of Zoology, Zoological Society of London, UK; **Hansford, James**, Institute of Zoology, Zoological Society of London, UK; **Herbert, Gregory S.**, University of South Florida, USA; **Kramer, Andrew M.**, University of South Florida, USA; **Mannion, Philip D.**, University College London, UK; **Prohaska, Ana**, University of Copenhagen, Denmark; **Ravenscroft, Harri**, University of Oxford, UK; **Rodrigues, Ana**, CNRS, France; **Saupe, Erin**, University of Oxford, UK; **Stephenson, P.J.**, University of Lausanne, Switzerland; **Turvey, Samuel**, Institute of Zoology, Zoological Society of London, UK; **Welch, Jessica**, Oak Ridge National Laboratory, USA; **Williams, Jack**, University of Wisconsin-Madison, USA

This talk will describe the work of the CPN Pre-Impact Baselines Working Group to leverage the wealth of paleoecological and historical ecological data to facilitate estimation of pre-impact species distribution baselines. Species conservation has long focused on preventing human-driven extinctions, and over the past 50 years conservation success has been measured using changes in species' extinction risk. However, recently calls have been made for a parallel focus on species recovery, and on developing metrics with which to assess its achievement. This call to action within the conservation community is fuelled in part by the recognition that baselines of species abundance and distribution have shifted dramatically across human generations with globally detectable human impacts on ecosystems beginning at least several thousand years ago. While assessment of extinction risk generally only considers species' change over the past few decades, assessment of recovery requires considering change over centuries to millennia. This requires identifying the baseline status at the time when humans first became a major factor influencing the abundance and distribution of a species. Two new frameworks for considering conservation status relative to a species' pre-impact baseline have been recently released: EPOCH (Evaluation of POpulation CHange), and the IUCN Green Status of Species. These frameworks have been lauded as moving conservation in a much-needed direction, but there is also concern about whether these methods will be applicable to any but a few well-known, charismatic species. Using a combination of modelling approaches, we are working to estimate species pre-impact distributions in a way that is accessible to conservation practitioners, helping to unshift the baseline and bring species recovery into the mainstream.

Keywords: baseline, recovery, IUCN Green Status, EPOCH, species distribution models

Grace, M. K., R. Akçakaya, A. Avery, C. Duncan, J. Hansford, G. Herbert, A. Kramer, P. Mannion, A. Prohaska, H. Ravenscroft, A. Rodrigues, E. Saupe, P. J. Stephenson, S. Turvey, J. Welch, and J. Williams, 2023. Modeling pre-impact baselines at scale to inform species recovery. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):83. https://doi.org/10.58782/flmnh.wosu1828

DISTRIBUTION AND DIVERSITY OF SEDIMENT-DWELLING ECHINOIDS OF THE CENTRAL FLORIDA KEYS

Grun, Tobias B., University of Florida, USA; **Kowalewski, Michał**, University of Florida, USA.

Sediment-dwelling echinoids, such as clypeasteroids (sand dollars and sea biscuits) and spatangoids (heart urchins), are important ecosystem engineers found in many soft-bottom habitats around the Florida Keys. Several studies, conducted over the last five decades, have documented their spatial distribution and diversity in various areas of the Florida Keys. This study focuses on the central part of the Florida Keys, an area that has been subject to diverse human impacts including tourism, fishing, boating, and diving leading to pollution, eutrophication, and intrusion of non-native species. All these stressors can potentially undermine the ecosystem's composition and health, including sediment-dwelling echinoids. To assess the current state of echinoid populations, 27 sites located along the central part of the Florida Keys have been surveyed by SCUBA (2020-2021) for presence of live specimens and dead skeletal remains of clypeasteroid and spatangoid echinoids. A total of 17 out of 27 sites were inhabited by sediment-dwelling echinoids of the species *Clypeaster rosaceus*, *Clypeaster subdepressus*, *Encope michelini*, *Leodia sexiesperforata*, *Meoma ventricosa*, and *Plagiobrissus grandis*. Up to five species co-occurred at single sites, although most sites harbored only one or two species, and at all sites a single species was dominant in terms of relative abundance. The most widespread and abundant species in the surveyed area were *Clypeaster rosaceus*, *Leodia sexiesperforata*, and *Meoma ventricosa*. A comparison of live specimens with skeletal echinoid remains indicates that dead tests are typically much rarer than live specimens. However, the spatial distribution and abundance of dead remains tracks live occurrences: when dead remains are found, live specimens are always observed. The comparison of the new survey reported here with past studies and database records suggests that the faunal composition of sediment-dwelling echinoid assemblages has not changed notably over the past 50 years.

Keywords: echinoids, Florida Keys

Grun, T. B. and M. Kowalewski, 2023. Distribution and diversity of sediment-dwelling echinoids of the central Florida Keys. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):84. https://doi.org/10.58782/flmnh.pved5065

USING PAST ARCHIVES TO BETTER CONSTRAIN THE FUTURE OF *ALLIGATOR SINENSIS*

Hansford, James, The Zoological Society of London/University College London, UK; **Saupe, Erin**, Oxford University, UK; **Turvey, Samuel**, The Zoological Society of London, UK; **Ma, Heidi**, The Zoological Society of London, UK; **Tu, I-Ting**, The Zoological Society of London, UK; **Varnham, Grace**, University College London, UK; **Mannion, Philip D.**, University College London, UK

Species distribution modelling is a widely applied tool for forecasting future distributions of species under different climatic scenarios, informing conservation strategies and rewilding programs. Forecasting, however, is typically based on very recent species' records (last ~50 years). This is problematic, given that these records are strongly affected by human interactions, and we do not know whether current distributions reflect the full suite of environmental parameters a species can inhabit. If we only model data from current distributions in future projections, we are thus likely to get misleading predictions that might misdirect conservation planning. The Critically Endangered Chinese alligator (*Alligator sinensis*) is currently restricted to a single Chinese province. Historical, zooarchaeological and fossil records demonstrate a greater range across mainland China, extending its past distribution even further, to Taiwan and Japan. Species distribution models (SDMs) based only on the present-day distribution of the Chinese alligator are poorly constrained, whereas incorporation of past archives improves model fit and changes projected suitable habitat. By combining past and present data, we can provide a closer approximation of the full ecological niche of a species. For endangered species with restricted present-day ranges, additional occurrence data from past archives is critical for constraining SDMs, with potentially major misinterpretations of suitable habitats for conservation and rewilding. This research is the principal case study for an IUCN Green status of species/Conservation Paleontology Network Pre-impact distributions working group, and a test case for the inclusion of past archives in the development of species recovery baselines.

Keywords: ecological niche modelling, past archives, Crocodilia, China, climate

Hansford, J., E. Saupe, S. Turvey, H. Ma, Tu, I-T., G. Varnham, and P. Mannion, 2023. Using past archives to better constrain the future of *Alligator sinensis*. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):85. https://doi.org/10.58782/flmnh.xwfy9716

CONCORDANT SPATIAL GRADIENTS IN PREDATION INTENSITY AND PRODUCTIVITY ARCHIVED IN SURFICIAL MOLLUSK SHELL ACCUMULATIONS IN SEAGRASS MEADOWS ALONG THE GULF COAST OF FLORIDA

Hardin, Alizé M., University of South Florida, USA; **Casebolt, Sahale**, University of Florida, USA; **Hyman, A. Challen**, Virginia Institute of Marine Science, USA; **Barry, Savanna**, Nature Coast Biological Station, USA; **Cummings, Katy**, Florida Fish and Wildlife Conservation Commission, USA; **Frazer, Tom**, University of South Florida, USA; **Kowalewski, Michał**, Univeristy of Florida, USA

Seagrass meadows are highly structured habitats of great socioeconomic value but are declining globally due to human impacts. The northern Gulf Coast of Florida contains one of the largest relatively unaltered seagrass habitats (~3,000 km2), making it a model system for acquiring baselines to better manage and monitor seagrass meadows. This project investigated spatial gradients in ecological and taphonomic attributes of surficial seagrass-associated benthic mollusk death assemblages. An updated analysis of water parameters (based on project COAST data) indicated that total dissolved phosphorous (TDP) and chlorophyll-a (CHL-a) concentrations increased steadily northward. To analyze the historical ecology of local seagrass meadows, mollusk assemblages were bulk sampled at 12 stations across multiple estuaries along the gradient. Radiocarbon dating of valves (n = 90) from several estuaries indicated that the assemblages represented a multi-millennial accumulation with a median shell age of 1760 AD. Focusing on two abundant bivalves found within all estuaries, Transennella spp and Crassostrea virginica, the study evaluated spatial trends in body size, traces of predation, and post-mortem shell alterations. The results, primarily focused on Transennella spp., indicated that ecological and taphonomic characteristics varied notably, both among and within estuaries. Relative abundance, body size, and taphonomic attributes did not appear to correlate significantly with productivity or drilling frequency. However, drilling frequency correlated significantly with TDP and CHL-a, suggesting that predator-prey interactions may co-vary tightly with productivity. These results suggest that spatial gradients in predation can be archived by drilling frequencies in death assemblages. Moreover, the consistency between the long-term record of predation and modern gradient conditions suggests that long-term spatial dynamics of predator-prey interactions may be hydrologically controlled.

Keywords: estuaries, mollusks, productivity, predation, historical

Hardin, A. M., S. Casebolt, A. C. Hyman, S. Barry, K. Cummings, T. Frazer, and M. Kowalewski, 2023. Concordant spatial gradients in predation intensity and productivity archived in surficial mollusk shell accumulations in seagrass meadows along the gulf coast of Florida. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):86. https://doi.org/10.58782/flmnh.pyam8848

IMPACTS OF OCEAN DEOXYGENATION ON MARINE BENTHOS IN THE GULF OF MEXICO

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Ocean deoxygenation is a growing concern globally. Oxygen is less soluble in warm water, and warming temperatures also result in the slowdown of ocean circulation which limits oxygen delivery to deeper waters. Anthropogenic eutrophication has also contributed to the development of hypoxic conditions in many coastal areas. Here we investigate biodiversity structure along an environmental gradient in the Gulf of Mexico to see how patterns of spatiotemporal turnover can inform future biotic response of benthos to ocean deoxygenation. Live and dead assemblages of bivalve mollusks were collected at 15 stations offshore Louisiana, Alabama, and Florida. Abundance and body size data were collected, and specimens were classified functionally using information about feeding, attachment, life position, and body size. Environmental conditions were characterized using multi-decadal mean sea surface temperature (SST), dissolved oxygen (DO), and net primary productivity (NPP), and grain size data from our field samples. Stations in the north-central Gulf affected by Mississippi River discharge are characterized by higher NPP, lower DO, and higher percentages of silt and clay than stations in the northeastern Gulf. Both taxonomic and functional diversity significantly covary with this environmental gradient, with the lowest diversities observed at stations in the core of Louisiana's "dead zone." Analyses of spatiotemporal turnover patterns reveal shifts in the dominant feeding mode, with hypoxic environments containing a greater abundance of deposit and mixed feeders, compared with more oxygenated environments that host an abundance of suspension feeders and are characterized by a greater variety of feeding ecologies. Live-dead analyses reveal a shift in taxonomic and functional diversity in coastal Louisiana, that appears to coincide with the onset of anthropogenic eutrophication in these coastal settings.

Keywords: taxonomic diversity, functional diversity, live-dead, bivalve mollusk, Gulf of Mexico

Harnik, P. G., A. Chao, K. S. Collins, and M. C. Rillo, 2023. Impacts of ocean deoxygenation on marine benthos in the Gulf of Mexico. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):87. https://doi.org/10.58782/flmnh.fgco6472

MAPPING PAST DISTRIBUTIONS OF MARINE MOLLUSKS USING SHELL DEATH ASSEMBLAGES

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Marine species assessments rely heavily on baseline surveys conducted after the 1960s, long after many anthropogenic pressures began, which could lead to misinformed management decisions and poor conservation outcomes. In this study, we collaborated with Florida Fish and Wildlife to conduct stock assessments for mollusks of the west Florida shelf that incorporate shell death assemblages. One of our first assessments was of the Florida Fighting Conch, *Strombus alatus*, an abundant gastropod that is also under consideration as a replacement fishery for the threatened Queen Conch. Live and dead shells were collected from >300 dredge tows between 2008-2018 covering the entire west Florida shelf. Shells were age-partitioned by ^{14}C- and AAR-calibrated taphonomic criteria. Counts were converted to densities per m2. Inverse distance weighting interpolation of *S. alatus* death assemblages reveals multiple population centers along the coast and a rapid decrease in density with depth from 25-120 m. In contrast, live conchs were absent in our dredge samples from shelf depths deeper than 40 m. These differences are confirmed by single-visit occupancy methods that account for variation in detectability across the samples. Live-dead differences in spatial distribution are probably influenced by time averaging in death assemblages, which increases detectability of conchs in deeper habitats, where they may be too rare to be sampled alive. However, extirpation of offshore populations was also indicated by independent natural history collection occurrence records, which show numerous live-collected conchs from 1940-1980 but none afterwards, despite an increase in sampling effort. These results suggest that live-dead comparisons can reveal biodiversity loss at the scale of large marine ecosystems.

Keywords: live-dead, conch, West Florida, geospatial

Herbert, Gregory S., A. M. Kramer, S. P. Geiger, A. J. Bustos, S. A. Sanders, N. Seiden, and J. A. Rogers, 2023. Mapping past distributions of marine mollusks using shell death assemblages. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):88. https://doi.org/10.58782/flmnh.cpmy8278

PARASITE DYNAMICS: ONE PATTERN AND MULTIPLE POSSIBLE CAUSES

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How is parasitism likely to respond to anthropogenic global change? Digenean trematode prevalence among bivalve mollusk hosts in multiple coastal environments has been linked to sea-level rise on centennial and millennial time scales. Previous efforts have ruled out the influence of changing diversity, community structure, taphonomy, and salinity (fossil-based proxy) on this pattern but, until recently, we have not been able to address the role of other abiotic environmental factors. Here we present the results of stable isotope analyses ($\delta^{18}O$ and $\delta^{13}C$) of the shallow marine bivalve *Chamelea gallina* from the Holocene and modern northern Adriatic (Italy) and trace element analysis of the estuarine bivalves *Potamocorbula amurensis* and *Corbicula formosana* from the Holocene Pearl River (China) delta using Laser Ablation Inductively Coupled Plasma Mass Spectrometry (LA-ICP-MS). Generalized Linear Models (GLM) of 1,297 $\delta^{18}O$ and $\delta^{13}C$ analyses from 57 *C. gallina* valves derived from 11 modern death assemblages and four Holocene core samples reveal that elevated trematode prevalence is associated with relatively negative $\delta^{18}O$ values, relatively positive δ13C values, and a high correlation between $\delta^{18}O$ and $\delta^{13}C$ values. We interpret this to mean that trematode prevalence is higher during warm temperatures with minimal freshwater influence. GLMs of 3,295 LA-ICP-MS spot analyses on 48 valves from the two estuarine species (a separate GLM for each taxon), derived from 12 cored samples from Pearl River deposits, reveal a strong association between trematode prevalence and elevated Ba/Ca ratios and low species richness, which we interpret as high parasitic infestation of an oligotypic community in hypoxia-dominated environments. Taken together, the results suggest that parasitic patterns are linked to sea-level rise and geochemical insights point toward case-specific causal factors that are going to be more widespread due to anthropogenic climate change.

Keywords: parasitism, Gymnophallidae, bivalves, Holocene

Huntley, J. W. and D. Scarponi, 2023. Parasite dynamics: One pattern and multiple possible causes. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):89. https://doi.org/10.58782/flmnh.dzfe6064

DEEP TIME CONSERVATION PALEOBIOLOGY OF THE ATLANTIC JIGSAW PUZZLE AND THE FUTURE OF THE SOUTHWESTERN ANGOLAN COAST

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The puzzle-like fit of Africa and South America reflects the tectonically driven opening of the South Atlantic Ocean beginning over 130 mya. By 90 Ma, the North and South Atlantics were conjoined. The introduction of Cretaceous marine reptiles into the central South Atlantic from the north coincides with through-flow in the Equatorial Atlantic Gateway and with increased productivity and upwelling of the Benguela Current. The K-Pg extinction saw the demise of most marine reptiles, but upwelling apparently persisted, evidenced by a growing Cenozoic fossil record of sea turtles and marine mammals from the Angolan coast. Convergent similarities between the Cretaceous marine reptile vertebrate community and the modern vertebrate community of the Benguela Large Marine Ecosystem suggest essentially continuous productivity related to upwelling along the southwest African coast since Cretaceous time. Paleolatitude reconstructions show that predicted positions of coastal upwelling of the Benguela Current have moved south along the coast as Africa drifted northward through the descending limb of the southern Hadley Cell. The Cretaceous and modern faunas were both adapted to a productive upwelling zone. The Cretaceous relict *Welwitschia mirabilis* is consistent with coastal aridity alongside upwelling. Thus, the sediments of coastal Angola and the fossils they entomb are relevant to conservation paleobiology because they provide a baseline through deep time. Comparisons underscore the resilience of the Benguela Current on the one hand and emphasize human-driven threats to the Benguela Large Marine Ecosystem on the other. Solutions are being sought; for instance, through the evaluation of Ecologically or Biologically Significant Marine Areas (EBSA) in the Benguela Current Large Marine Ecosystem. In Angola, the geologic record of the opening of the South Atlantic, the fossils, public interest, and the value for sustainable development are positive indications for the future.

Keywords: Angola, Benguela Current, marine reptiles, upwelling

Jacobs, L. L., M. J. Polcyn, O. Mateus, and A. S. Schulp, 2023. Deep time conservation paleobiology of the Atlantic jigsaw puzzle and the future of the southwestern Angolan coast. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):90. https://doi.org/10.58782/flmnh.fior9961

DEVELOPING TESTABLE HYPOTHESES OF ANTHROPOGENIC STRESS: SOME APPROACHES THAT WORK

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Conservation Paleobiology (CPB) has many aims, but ultimately depends upon our uncovering, for a target region, the history of environmental pressures and history of biological change, particularly biological change that signifies a response to anthropogenic stress: this is how we detect and correctly attribute deterioration, how we design and evaluate recovery, and how we ultimately assess resilience and sustainability. The focus of concern might be a single taxon of economic or other particular value, or larger-scale changes in biomass, taxonomic or phylogenetic diversity, or trophic complexity. One of the biggest challenges for natural scientists can be building the requisite history of cultural stressors – i.e., uncovering the diverse economic, industrial, social, and regulatory activities that might have affected the system. Such information is commonly not accessible via the Web of Science; it can be extremely important but qualitative or can be quantitative but highly variable in units or methods of measurement; and, with the exception of data on commercial harvesting (e.g., fishing, logging) and human population size, useful time-series are scarce. The CPB scientist thus typically needs to compile their own, original history of human activities having potential to affect natural systems, either to evaluate the (paleo)biological data that they already have on hand (from biomonitoring, live-dead analysis, sedimentary cores) or to frame a new campaign of data collection. Here, I describe approaches to finding and merging cultural data that have worked both for research and for class projects, using two coastal marine examples: (1) testing the effects of historical over-fishing (meta-analyses from the early 2000s), and (2) the unexpected role of land-use in the collapse of the open-shelf benthic ecosystem of southern California.

Keywords: methods, cultural stressors, cross-ecosystem effects

Kidwell, S. M., 2023. Developing testable hypotheses of anthropogenic stress: Some approaches that work. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):91. https://doi.org/10.58782/flmnh.kywo4390

MONITORS WITH MEMORIES: DEATH ASSEMBLAGES RECORD A CENTURY OF WASTEWATER POLLUTION AND REMEDIATION

Kokesh, Broc S., University of Chicago, USA

Biotic indices are often used to assess ecological condition using the abundance-weighted stress tolerances of taxa. Applying such indices to recent fossil records – e.g., time-averaged death assemblages (DAs) – is a promising method to (1) characterize conditions from before monitoring began, and (2) detect otherwise unappreciated strain using discordance with the living assemblage (LA). However, the robustness of regionally-specific biotic indices when applied to paleoecological data is under-explored. Here, I assess the power of three indices: Southern California's Benthic Response Index (BRI), ATZI's Marine Benthic Index (AMBI), and BENTIX. Our test material is (a) a 50-year-long dataset of macrobenthos from the Palos Verdes shelf in Southern California, sampled annually at 44 sites to monitor the effects of treated wastewater effluent, and (b) bivalve DAs from the 2008 survey. The time series was parsed into temporal bins based on wastewater treatment phases, and we calculated indices for the whole fauna, bivalve LAs, and bivalve DAs. All indices demonstrated that benthic conditions improved with remediation, and the greatest changes were close to the outfall source. Values generated for bivalves were strongly correlated to those of the whole fauna, indicating that bivalves are a strong surrogate for macrobenthic condition (second only to polychaetes when compared among other clades). Indices for bivalve DAs – which include shells >100s yrs old on this shelf – indicated less strain than was observed in early communities (1970s-80s) and either agreed with or overestimated the strain in more recent communities (2000s-10s). This live-dead discordance suggests that time-averaging causes DAs to retain a signal from pre-pollution benthic conditions that the shelf benthos is now re-attaining. Bivalve DAs, combined with long-term benthic time series data, can reveal both the existence and direction of change in ecological strain relative to historic conditions.

Keywords: Biotic Index, Benthic Monitoring, Time Series, Bivalvia, Southern California

Kokesh, B. S., 2023. Monitors with memories: Death assemblages record a century of wastewater pollution and remediation. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):92. https://doi.org/10.58782/flmnh.arcl8610

UNDERSTANDING BOTANICAL TRAITS OF RANCHO LA BREA FOSSILS FOR CONSERVATION PURPOSES

Mendoza, Steven Joseph, La Brea Tar Pits, Natural History Museums of Los Angeles County, USA

The La Brea Tar Pits and Museum in Los Angeles is home to over four million Pleistocene fossils that help us better understand California during the last Ice Age. While the focus of Rancho La Brea research has often been on understanding the site's megafauna, the plant fossils of this site hold a wealth of information that remains untapped. Seeds, nuts, pods, leaves, and entire trees have been preserved in the asphalt to such a degree that researchers have identified over 150 different species of plants. These plants document the environmental changes Southern California has experienced from before the Last Glacial Maximum until today. The plants found at La Brea Tar Pits have proven their resilience during extreme climatic changes. Their botanical characteristics and traits are valuable for conservationists and land managers to consider as they plan landscapes for the changing climatic circumstances of today. To translate this deeper-time information into actionable conservation recommendations, we are developing a database of biological, environmental, and ethnobotanical characteristics for each of the 163 species of plant fossils identified at La Brea Tar Pits. By recording botanical temperature ranges, drought tolerances, soil preferences, fire responses, and organisms associated with each species, we can recommend which La Brea plants can thrive in certain regions, maximizing functional ecosystem services with minimal human investment. Researchers, land managers, conservation specialists, urban planners, and homeowners can use this database to create sustainable climate change-resistant parks, gardens, habitats, and recreational/educational spaces utilizing plants native to Los Angeles for the past 50,000+ years.

Keywords: conservation, paleobotany, landscaping, education

Mendoza, S. J., 2023. Understanding botanical traits of Rancho La Brea fossils for conservation purposes. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):93. https://doi.org/10.58782/flmnh.smlu1018

PALEOFIDELITY: AN R PACKAGE FOR MEASURING AND VISUALIZING LIVE-DEAD FIDELITY

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Live-dead fidelity analysis, one of the key approaches of conservation paleobiology, aims to measure the congruence between living communities and sympatric death assemblages. Typically, data involve compositional matrices with counts of specimens grouped by variables (typically taxa) and observations (typically sampling units). The most common targets of live-dead comparisons are diversity fidelity (especially alpha diversity and evenness) and compositional fidelity (faunal agreement). A beta version of a new package dedicated to analyzing and visualizing live-dead fidelity is available on GitHub (R package: "PaleoFidelity"). The package allows for measuring diversity fidelity (dead-live offset in sample-standardized species richness), evenness fidelity (dead-live offset in Hulbert's Pie evenness), and compositional fidelity estimated by correlation (Spearman, Kendall, and Pearson) and similarity (Bray, Chao, etc.) measures. The package includes a resampling model for assessing expected values of correlation and similarity measures under the null model of perfect live-dead congruence. In addition, tests and confidence intervals based on resampling protocols are provided to allow for statistical assessment of fidelity patterns. Finally, PaleoFidelity includes plot functions for visualizing live-dead congruence in diversity or faunal composition. The current version of the package can be installed in R or R Studio using the following statement: devtools::install_github('mjkowalewski/PaleoFidelity', build_vignettes = TRUE).

Keywords: fidelity, live-dead comparisons, statistical analaysis, software, R package

Kowalewski, M., 2023. Paleofidelity: An R package for measuring and visualizing live-dead fidelity. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):94. https://doi.org/10.58782/flmnh.ffbf2967

PLEISTOCENE DISRUPTION OF TRAIT-ENVIRONMENT RELATIONSHIPS INFORMS THE FUTURE CONSERVATION OF AFRICAN MEGAFAUNA

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Mammalian megafauna have been critical to the functioning of Earth's biosphere for millions of years. However, since the Plio-Pleistocene, their biodiversity has declined, concurrent with dramatic environmental change and hominin evolution. While these biodiversity declines are well-documented, their impacts on the ecological function of megafaunal communities remain uncertain. Here, we adapt ecometric methods to evaluate whether biodiversity losses since 7.5 Ma were coincident with disruptions to the functional link between communities of herbivorous, eastern African megafauna and their environments (i.e., functional trait-environment relationships). Herbivore taxonomic and functional diversity began to decline during the Pliocene, as open grassland habitats emerged, persisted, and expanded. In the mid-Pleistocene, grassland expansion intensified and Acheulean hominin tools emerged. It was then that phylogenetic diversity declined and the trait-environment relationships of herbivore communities shifted significantly. Our results divulge the varying implications of different losses in megafaunal biodiversity. Only the losses that occurred since the environmental and anthropogenic changes of the Pleistocene were coincident with a disturbance to community ecological function. Such a disturbance may occur in even greater magnitude in the future, as climate change and human impacts intensify. Preventing it will require that species move across landscapes, so that their traits may track changing environmental conditions. We build an ecometric model of modern megafaunal communities in Africa, and we use it to identify communities whose species will need to shift across space so that trait-environment relationships remain undisturbed. Conservation efforts that focus on movement routes between these communities will be critical if megafauna are to persist and continue providing essential ecological functions.

Keywords: Africa, dimensions of biodiversity, ecometrics, mammalian herbivores, trait-environment relationships

Lauer, D. A., A. M. Lawing, R. A. Short, F. K. Manthi, J. Müller, J, J. J. Head, and J. L. McGuire, 2023. Pleistocene disruption of trait-environment relationships informs the future conservation of African megafauna. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):95. https://doi.org/10.58782/flmnh.cpwc5265

THE PAST AS A LENS FOR BIODIVERSITY CONSERVATION ON A DYNAMICALLY CHANGING PLANET

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Both climate and land-use change have accelerated over the past decades. The cumulative effects of these disruptions are not additive or systematic, rather they pose complex, dynamic environmental challenges to ecological systems. To survive, terrestrial plants and animals will need to shift their distributions to track habitable regions or exhibit the flexibility to survive these shifting environmental regimes. As biota dramatically shift their ranges, ecological communities across Earth's natural landscapes will restructure. We must formulate effective, long-term dynamic conservation approaches to accommodate migration, adaptation, and acclimation in response to rapid change. However, given the dynamic nature of today's changes, it can be challenging to identify the most effective strategies that allow ecosystems to bounce forward. I will present research from a new special feature that argues the importance of taking a deeper-time perspective to large-scale solutions to the modern biodiversity crisis. Conservation practitioners highlight the ecological theory and hypotheses that should be examined to effectively translate historical findings into actionable conservation practices. Ecologists and paleoecologists, working across temporal scales, demonstrating approaches that have already begun to effectively inform the conservation of biodiversity on a dynamically changing planet. Studies identify resilient and connected landscapes, explore ecological movement dynamics, and evaluate how extinctions and range-shifting species lead to the erosion of functional groups that affect trait-environment dynamics through space and time. I will highlight research that addresses some of the main challenges for performing conservation paleontology at large spatial scales: 1) knowledge coproduction; 2) hypothesis development and testing using long-term historical data; 3) reporting of effect sizes for direct applications; and 4) integration into applied products.

Keywords: spatial ecology, landscape, resilience, connectivity, functional traits

McGuire, J. L., A. M. Lawing, S. Díaz, and N. C. Stenseth, 2023. The past as a lens for biodiversity conservation on a dynamically changing planet. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):96. https://doi.org/10.58782/flmnh.jtyh4635

PALEO-BIOLOGICAL APPROACHES TO PRESENT DAY WETLAND ECOSYSTEM RESTORATION PROBLEMS

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Establishing historic conditions of a site is frequently the first step in ecosystem restoration. Whether restoration to historic conditions is possible or not, recognition of change and the cause of change is critical information. Three different wetland restoration problems are addressed by paleo-biological methods. Chrono-stratigraphy was instrumental in all three cases, 210Pb at the decadal and radiocarbon for the century to millennial scale questions. In order to document salinity, change in the Southeast Saline Everglades molluscan assemblages were utilized as a proxy for salinity. Vertical changes in cores established that beginning in ~ 1900 salinity increased with the Anthropocene Marine Transgression. The freshwater-marine contact in all cores was identified and the contacts dated. The differences in time between two adjacent cores and the distance between them was utilized to determine the rate of saltwater encroachment, documenting that not all coastal basins exhibited the same rate and that the rate increased over time in response to the accelerating rate of sea-level rise, increasing from the pre-1960 rate of ~ 20 m yr-1 to > 80 m yr-1 between 1995 and 2017. This shift in regime suggests that present restoration activities are inadequate. Soon after Audubon acquired Corkscrew Swamp to preserve the largest remaining wood stork rookery, the swamp was diked to hold surface water because it was believed that surrounding land development was adversely impacting swamp hydroperiod. However, by 1970 cypress regeneration was severely reduced and hydrology and sediment core studies were initiated in an attempt to understand the driver of the change. Core analysis revealed that hydroperiod increased upwards terminating in patchy open-water peats, based upon pollen analysis, previous peat analysis and tissue recognition. Open-water peats indicate no drawdown, eliminating cypress germination. Cypress regeneration began soon after removal of the dike.

Keywords: chronostratigraphy, hydroperiod, mollusks, pollen, saltwater encroachment

Meeder, J. F. and P. A. Stone, 2023. Paleo-biological approaches to present day wetland ecosystem restoration problems. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):97. https://doi.org/10.58782/flmnh.lixp3848

HOW MANY GENERATIONS ARE AVAILABLE FOR STUDY? EXPECTATIONS AND APPLICATIONS OF HISTORICAL ECOLOGICAL INSIGHT FROM BONES LYING ON MODERN LANDSCAPES

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Skeletal remains lying on landscape surfaces are useful for evaluating historical states of living populations, but across how much time can such resources inform management and conservation? Further, how do differences in environmental setting impact the breadth of the available timeseries? Using radiocarbon dated bones from across the globe, we evaluated the relationship between the maximum duration that bones persist on landscapes and the mean annual temperature of each locality. We found that bones can persist for several millennia in cold (high-latitude) settings and that there is a strong link ($R2 > 0.9$, $p < 0.01$) between local temperature and the logged duration of maximum bone persistence. This relationship provides an initial expectation for the duration across which skeletal remains from different settings can provide historical ecological context. Across the Holarctic, caribou (Rangifer tarandus) are the most abundant large mammal and arguably the most economically significant one for multiple human cultures, including serving as a key nutritional and cultural resource. For migratory caribou, movements between winter ranges and spring calving grounds are among the longest annual migrations of any terrestrial species and maintaining access to these areas is a top conservation priority. But how long have herds used particular calving grounds? Shed female antlers lying on the tundra provide insight into historical calving geography because they are shed within days of giving birth. Following antler surveys across the Coastal Plain calving grounds (Arctic National Wildlife Refuge, Alaska) of the Porcupine Caribou Herd (PCH), we radiocarbon dated three highly weathered female antlers. Antler ages ranged between ~1,600 and >3,000 calendar years ago. These antlers provide the first physical evidence of calving activity on the PCH calving grounds from previous millennia and substantiate the long ecological legacy of the Coastal Plain as a caribou calving ground.

Keywords: time-averaging, radiocarbon dating (14C), caribou (*Rangifer tarandus*), seasonal landscape use, migration

Miller, J. H., **E. J. Wald**, **P. Druckenmiller**, and **C. Simpson**, 2023. How many generations are available for study? Expectations and applications of historical ecological insight from bones lying on modern landscapes. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):98. https://doi.org/10.58782/flmnh.lixp3848

TRIBALLY-LED CONSULTATION ON THE ETHICAL USE OF SEDIMENTARY ANCIENT DNA FOR A CULTURALLY IMPORTANT PLANT: *MANOOMIN*, *PSIN*, *ZIZANIA* (WILD RICE)

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Led by Native American resource managers, we have convened a working group across 20+ tribal entities in the north-central United States, with the goal of building consensus around the use of sedimentary ancient DNA (sed*a*DNA) to detect deep-past and recent populations of wild rice (*manoomin* in Ojibwe, *psiŋ* in Dakota, *Zizania palustris* and *Z. aquatica*) using lake sediment cores. Wild rice is of extremely high cultural and spiritual importance to many Indigenous people of the Laurentian Great Lakes region, as well as being a valuable traditional food and providing important habitat for waterfowl and other organisms. Because of its importance, any research involving wild rice must be tribally led, and outcomes designed to benefit the tribes (e.g., Matson et al. 2020). Wild rice is threatened by environmental degradation due to industrial processes and agriculture, so its protection can be a contentious regulatory and political issue in Minnesota, Wisconsin, and Michigan, involving tribal, state, and federal agencies. The wild rice paleorecord has tremendous potential for detecting and tracking past changes in wild rice distributions. Until recently, however, proxies for wild rice were either ineffective (pollen, seeds), or low-throughput and thus not scalable to region-wide use (phytoliths). Sed*a*DNA would supplement Indigenous knowledge and Western scientific methods to inform conservation, management, designation for protection, and the enhancement of cultural and historical records. In this presentation, we will describe how we are synthesizing output from facilitated online meetings with and presentations to tribal resource managers into a white paper providing guidance from these sovereign Nations to academic researchers, agencies, and policymakers on restrictions on the utilization of sed*a*DNA of wild rice, the leadership roles tribal entities should take in all research, and tribal priorities for the application of this technique.

Keywords: wild rice, Indigenous knowledge, sedimentary ancient DNA, environmental DNA, lake sediments

Myrbo, A., D. **Vogt,** N. **Schuldt,** H. **Thomas**, R. **Schirmer,** and K. **Diver, 2023.** Tribally-led consultation on the ethical use of sedimentary ancient DNA for a culturally important plant: *Manoomin, psin, zizania* (wild rice). In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):99. https://doi.org/10.58782/flmnh.xhge9262

ESTABLISHING MODERN PEAT ANALOGS TO DECIPHER MANGAL SUB-HABITATS FROM HISTORICAL PEATS

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In mangroves of South Florida, plant debris accumulates and humifies to form peat. The structure and composition of mangrove peat differs among mangal sub-habitats, leading to categorically distinct peat types reflective of the taphonomically active zone (TAZ). Here, taphonomic processes degrade and shape the peat until it is sequestered in the depth of final burial (DFB). Sequestered peats provide historical archives of the mangal depositional environment and the palaeoecological context of peat formation that are used to reconstruct mangal sub-habitats. However, as peat passes through the TAZ, information about the precursor mangal sub-habitat is reduced, which may skew mangrove community reconstructions. To better understand the influence of the TAZ on peat formation, we analyzed plant organ- and taxon-based measures by characterizing surficial mangrove peats from two contrasting mangal sub-habitats in Barnes Sound, Florida: a tidally influenced, Rhizophora-dominated fringe sub-habitat; and an inundated, interior mixed forest basin sub-habitat. We found (1) peats formed in basin sites have greater amounts of leaf litter, which correlates with reduced tidal activity and restricted detritivore access to the litter layer; (2) peats formed in fringe sites have higher root percentages, or root–shoot ratios, which provide a reliable method to differentiate between peats at depth, and (3) mangal sub-habitats differ in preserved organismal signals, such as foraminifera and insect parts. Further, we compare our surficial core samples to historical, deep core samples from other South Florida mangrove peat deposits to establish modern peat analogs needed to decipher preserved mangrove peats. These comparisons suggest that few aerial plant organs survive the TAZ and sequestered peats are biased towards root-rich peats characteristic of fringe sub-habitats; however, sequestered peats with lower root-shoot ratios indicate leaf litter-rich peats formed in basin sub-habitats.

Keywords: mangroves, peat formation, taphonomically active zone

Neely, S. H. and A. Raymond, 2023. Establishing modern peat analogs to decipher mangal sub-habitats from historical peats. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):100. https://doi.org/10.58782/flmnh.wyms3450

BASELINE CARIBBEAN REEFS

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Caribbean coral reefs started to deteriorate before systematic monitoring began and so questions remain about how reefs have changed since human impact and if they have transitioned into functionally 'novel' states. To explore these questions, we mapped and bulk-sampled several hectares of mid-Holocene reefs in Caribbean Panama and the Dominican Republic and compared the composition and ecological function of these pre-human impact reefs to nearby modern reefs. We quantified the remains of all major reef groups, but focus here on molluscs, corals, and fishes. Filter feeding molluscs are twice as abundant relative to other feeding modes on modern reefs, commensurate with eutrophication from land use changes. At the same time, large herbivorous gastropods declined significantly in size due to millennia of human selective harvesting. We observed the well-documented loss of Acroporid corals and a functional shift in coral communities towards weedier, slower growing, and brooding species. Some modern coral communities appear to retain some historical functions, and isolated *Acropora* refugia do persist, but the corals in them are less robust than those in the mid-Holocene, questioning their functional resilience to future change. Reef fish otolith assemblages suggest an 80% decline in non-harvested fish and a relative increase in planktotrophy—patterns best explained by the loss of coral structure and eutrophication. Counterintuitively, otolith sizes suggest that non-harvested fish are larger than they were in the past, a result that suggests lower mortality rates from reduced predation due to a loss of predators. This conclusion is supported by the estimated 71% decline in shark abundances and 400% increase in evidence of damselfish algal-gardening on modern reefs. These examples illustrate how both bottom-up and top-down processes have reshaped the structure, trophic interactions and ecosystem functions of Caribbean reefscapes.

Keywords: coral reefs, fishes, shifting baselines

O'Dea, A., B. de Gracia, J. Briand, J. Cybulski, M. Ureña, K. García-Méndez, J. Lueders-Dumont, E. Dillon, 2023. Baseline Caribbean reefs. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):101. https://doi.org/10.58782/flmnh.tffb5439

HUMAN-DRIVEN DIVERSITY CHANGES IN CARIBBEAN PARROTS ACROSS THE HOLOCENE

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Islands are windows for studying how humans have shaped biogeographic distributions. However, modern diversity patterns on islands are the outcome of evolutionary, ecological, and anthropocentric factors across long-temporal scales that often leave little evidence of the interactions among them. One exception are the parrots of the Caribbean which have a close commensal relationship with humans and an extensive fossil and archaeological record in the Holocene. Using modern and ancient DNA and radiocarbon dating, we present a temporal and spatial overview of the evolution, extirpation, and translocation of *Amazona* parrots across the Caribbean. Amazona colonized the Greater Antilles in the Pliocene and the most widespread parrot species, the Cuban Parrot, exhibits inter-island divergences throughout the Pleistocene. Within this radiation, we discovered a now extinct, genetically distinct lineage that survived on Turks & Caicos until human settlement of the islands. We also found that the narrowly distributed Hispaniolan Amazon had a range that once included the Bahamas and was introduced by indigenous people to Grand Turk and Montserrat. Our results show that datasets that transcend the extinct-living continuum highlight the long-term role of humans in altering the diversity and distribution of Caribbean biota.

Keywords: extinction, extirpation, biogeography, Anthropocene, psittaciformes

Oswald, J. A., B. T. Smith, J. M. Allen, R. P. Guralnick, D. W. Steadman, and M. J. LeFebvre, 2023. Human-driven diversity changes in Caribbean parrots across the Holocene. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):102. https://doi.org/10.58782/flmnh.wvej4221

DOES FIRE DRIVE QUATERNARY ECOSYSTEM TRANSFORMATION AT LAKE TULANE, FLORIDA?

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Ecosystems across the world are experiencing seemingly unprecedented fire activity due to changes in land use and climate. However, disentangling the drivers of fire regime intensification is difficult when climate and land use changes occur simultaneously. Thus, multi-proxy paleoecological records with evidence for climate, vegetation composition, and fire regime changes can provide valuable frameworks in which to interpret modern environmental shifts. Lake Tulane, Florida, offers an iconic record of vegetation responses to Heinrich Events and other climate variations over the last 60,000 years, but its fire history is unknown. Here we present the results of a 60,000-year fire history from Lake Tulane, Florida, based on sedimentary macro charcoal data at ca. 30-year resolution. Charcoal accumulation rates are highest in pre-32,000 year old sediments and decline toward the end of the Pleistocene. Fire activity was lowest during the period directly before the last glacial maximum (32,000 to 23,000 years ago). The end-Pleistocene record indicates on-going oscillations in fire activity from 22,000 to 10,000 years ago, but fire activity does not appear to be closely linked with pine/oak oscillations, thus indicating differential drivers of vegetation and fire change. Ultimately, the fire history at Lake Tulane is best understood in the context of other environmental factors such as millennial-scale climate variability, human influence, and megaherbivory.

Keywords: ecosystem transformation, fire, multi-proxy, Quaternary

Perrotti, A. G., M. Siedelmann, J. Lam, J. Russell, and J. W. Williams, 2023. Does fire drive Quaternary ecosystem transformation at Lake Tulane, Florida? In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):103. https://doi.org/10.58782/flmnh.bbxn9730

USING THE PAST TO TELL MORE PERSUASIVE CONSERVATION STORIES

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Conservation biologists are increasingly realizing the power of telling stories, which can persuade people to get involved and take action towards conservation goals. Stories connect with a wide variety of audiences by means of transporting them to captivating narrative worlds. The feeling of being swept into a story, referred to as transportation, is the mechanism through which persuasion takes place. Once a reader becomes absorbed into a story, they become removed from the real world and their own personal experiences, making them more likely to believe the story's central message and change their behavior. Here, we argue that conservation biologists can tell more persuasive stories if longer-term perspectives available from geohistorical records, such as sediment cores and fossils, are incorporated. By providing a richer context or starting a story from a point further back in time, a different story can be told, which may help motivate audiences towards achieving specific conservation goals. Developing storytelling skills is a necessary addition to any conservation paleobiologists' 'toolbox.'

Keywords: storytelling, persuasion, communication, conservation action, conservation paleobiology

Pier, J. Q., O. L. Olson, A. M. Mychajliw, and G. P. Dietl, 2023. Using the past to tell more persuasive conservation stories. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):104. https://doi.org/10.58782/flmnh.tmpo8835

USING SIMULATIONS TO EVALUATE THE UTILITY OF GEOHISTORICAL REFERENCE CONDITIONS FOR ASSESSING ECOLOGICAL QUALITY

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Incorporating paleontological data into the methods and formats familiar to conservation practitioners may facilitate greater use of paleontological data in conservation practice. Benthic indices (e.g., Multivariate-AZTI Marine Biotic Index; M-AMBI) utilize reference conditions for monitoring ecological conditions. However, reference conditions from monitoring records are limited in temporal scope and often represent degraded conditions, which can cause inaccurate assessments of ecological quality. Paleontological data, such as molluscan death assemblages, have potential to provide long-term, location-specific reference conditions, which are otherwise inaccessible to decision-makers. Here we use simulations of living communities under constant and changing environmental conditions to evaluate the capacity of death assemblage reference conditions to replicate M-AMBI values when used in place of reference conditions from the living communities. Reference conditions from all death assemblage scenarios successfully replicated correct remediation decisions in most simulation runs with environmental change and stability. Variations in M-AMBI values were due to overestimated species richness and Shannon entropy values in the death assemblages and effects of changes to these parameters varied across scenarios. Time averaging was largely beneficial, particularly when environmental change occurred, and short-term observations of the living communities produced incorrect remediation decisions. When the duration of time averaging is known, death assemblages can provide valuable longer-term perspectives with the potential to outperform temporally constrained baseline information from monitoring the living community.

Keywords: biotic index, reference conditions, death assemblage, time averaging

Pruden, M.J., J. A. Smith, J. C. Handley, S. R. Durham, and G. P. Dietl, 2023. Using simulations to evaluate the utility of geohistorical reference conditions for assessing ecological quality. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):105. https://doi.org/10.58782/flmnh.xhsu8871

PRELIMINARY BAT GUANO ISOTOPE EVIDENCE FOR PAST VEGETATION AND CLIMATE CHANGE IN SOUTHWEST VIRGINIA

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The Appalachian Mountains, one of the most biologically diverse regions in the temperate world, have been heavily altered by human activity for millennia yet the relative roles of human and other disturbances and climate change in creating modern landscapes are not well understood. Holocene paleoenvironmental records could provide a window into past Appalachian landscapes, but are restricted by a dearth of appropriate sites, such as natural lakes. Recent research suggests that bat guano deposits can serve as valuable archives of past environmental change. Carbon isotope ($\delta^{13}C$) values of guano from insectivorous bats can reflect the relative abundance of forest (C3) versus grassland (C4) vegetation at a regional scale, while guano nitrogen isotope ($\delta^{15}N$) values have been linked to landscape-scale N-cycling and precipitation. To investigate the paleoenvironmental history of an Appalachian site in southwest Virginia, we collected a 170 cm guano core from a limestone cave on Salt Pond Mountain. Bats are no longer active in the cave, but recovered bones indicate the past presence of Myotis species. Preliminary results show clear trends of increasing $\delta^{15}N$ values and decreasing $\delta^{13}C$ values from deep in the core toward the surface. $\delta^{13}C$ and $\delta^{15}N$ values are also significantly negatively correlated (R2=0.6, p=5.6e-15). The increase in $\delta^{15}N$ values may signal a moistening climate toward the present, a finding consistent with regional Holocene pollen records. Higher $\delta^{13}C$ values deep in the core likely indicate a greater prevalence of C4 grassland vegetation on the landscape, which could be linked to drier climate, indigenous burning, or both. Increased variation in $\delta^{13}C$ and $\delta^{15}N$ values below about 65 cm may indicate more variable climate or increased disturbance during the time represented. Forthcoming radiocarbon dates will anchor these trends in time and inform correction for the Suess effect, while other proxies could help disentangle the drivers of landscape change.

Keywords: nitrogen isotopes, carbon isotopes, Holocene, bats, guano

Reid, R. E. B., P. Harman, L. Kennedy, W. Orndorff, and K. Langwig, 2023. Preliminary bat guano isotope evidence for past vegetation and climate change in southwest Virginia. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):106. https://doi.org/10.58782/flmnh.azyz6465

FOSSIL SQUAMATES OF PEDERNALES PROVINCE, DOMINICAN REPUBLIC: NOVEL RECORD OF HUMAN-INDUCED EXTINCTION AND EXTIRPATION

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Hispaniola (Haiti & Dominican Republic (D.R.)), is the second largest island in the Caribbean and is a hotspot of squamate diversity (~184 species), yet little is known about their fossil record and how it relates to the present. Past studies on mammalian communities suggest that many rodent species go extinct after human arrival (~7,000 y.B.P.), most significantly after European colonization (~530 y.B.P.) corresponding to a rapid loss of 70-98% of original forest. Pedernales Province in the D.R., has much of its original forest cover, yet fossil squamates from this region have not been documented. Our study of Holocene dry cave fossil sites and a new archeological site located in Pedernales allows for evaluation of extinction in squamates in an area where deforestation is not a primary concern. Using dentigerous elements, several genera of squamates (*Ameiva, Anolis, Celestus, Cyclura, Leiocephalus,* and Geckos) were identified. We recorded their abundance at each depth, and found *Anolis, Celestus*, and Geckos to be the most common fossils. From this collection we discovered two new species of *Celestus*, a new species of Gecko, and revised the taxonomy of *Leiocephalus*. One of the newly identified large *Celestus* species, originally only known from fossils, was later discovered in a separate cave as a living specimen. These results suggest that deforestation is not the only driver of extinction in the D.R., and that even in well preserved areas, extinction of small taxa is happening. Additionally, some cryptic taxa may be unrecognized. The arrival of domesticated animals and associated pests (mice, rats, etc.), likely had a dramatic influence on these extinctions, as well as direct human predation, first reported here. Further radiocarbon and geochemical sampling of these herpetofaunal fossils will help assess why these species went extinct, and such trends can inform modern conservation efforts as to which taxa are most at risk.

Keywords: squamates, Dominican Republic, extinction, Pedernales Province

Riegler, M. S., L. W. Vinola, E. S. Steinberg, H. Quintal, J. N. Almonte, and J. I. Bloch, 2023. Fossil squamates of Pedernales Province, Dominican Republic: Novel record of human-induced extinction and extirpation. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):107. https://doi.org/10.58782/flmnh.fnlm5644

CLIMATE CHANGE AND THE PERSISTENCE OF CORAL-REEF DEVELOPMENT IN UPWELLING ZONES

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Upwelling exerts a major control on coral-reef development in the eastern tropical Pacific (ETP). Upwelling zones exhibit conditions that are detrimental to coral growth, such as low sea-surface temperatures and high levels of turbidity. During the late Holocene, the reefs in the strongly upwelling Gulf of Panamá (GoP) and the weakly upwelling Gulf of Chiriquí (GoC) experienced a climate-driven hiatus in coral growth and reef development, and strong upwelling exacerbated this hiatus in the GoP. Strong upwelling in the GoP is now acting as a buffer against thermal stress, providing a refuge from climatic warming, whereas corals in the GoC are highly vulnerable to increased thermal stress. Using ecological surveys and paleoecological data, we quantified calcification and bioerosion processes for the reefs in these two gulfs to develop carbonate-budget models. We determined the reef-accretion potential (RAP) for reefs in each gulf to project their capacity to keep pace with current and predicted future rates of sea-level rise. On average, reefs in the GoP exhibited an average RAP of 5.5 mm yr-1, which would be enough to keep pace with future rates of sea-level rise if CO_2 emissions were reduced under representative concentration pathways (RCPs) 2.6 and 4.5. In contrast, reefs in the GoC exhibited an average RAP of only 0.3 mm yr-1, which is not even enough to keep pace with contemporary rates of sea-level rise in Panamá (1.4 mm yr-1). Furthermore, even if the reefs in either gulf could achieve 100% coral cover, none of them has the capacity to keep pace with RCP 8.5. Although the GoP should support reef development in the near future, reducing greenhouse-gas emissions will be essential to ensure the persistence of accreting reefs and promote the recovery of those vulnerable to net erosion.

Keywords: coral reefs, carbonate budgets, climate change, upwelling

Rodriguez-Ruano, V., L. T. Toth, I. C. Enochs, Ian C., C. J. Randall, and R. B. Aronson, 2023. Climate change and the persistence of coral-reef development in upwelling zones. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):108. https://doi.org/10.58782/flmnh.tkof3493

STELLER'S SEA COW AND KELP FOREST REGENERATION IN THE NORTH PACIFIC

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Modern ecosystems are almost universally degraded relative to their past counterparts, from the Pleistocene to the present day. Thus, modern ecosystems may serve as poor guides to conservation actions. Conservation paleobiology is well-suited to address this challenge through enhanced understanding of systems dynamics during past periods of greater species and functional diversity, abundances, and resilience. However, past and present ecosystem dynamics must be integrated to model the future impacts of conservation actions. Here we propose a three-step, Past-Present-Future (PPF) methodology rooted in mathematical modeling. First, construct a model of primary species and interactions of the present-day ecosystem, including biotic and abiotic components. Second, integrate historical and/or paleontological data into the model to investigate past states and processes of the ecosystem, with an emphasis on critical elements (e.g., ecological engineer species) that are no longer present. Third, integrate analyses from the first two steps to predict putative future dynamics and states, and use these to make testable predictions regarding specific conservation interventions. We illustrate this approach with a study investigating impacts of the now-extinct Steller's sea cow on north Pacific giant kelp forests. The model indicates that the historical system was distinct from the modern, with differing abundances of giant kelp and understory algae. Furthermore, the familiar kelp-dominated state is metastable, capable of rapid transitions to an urchin-dominated state if perturbed by extreme hydrodynamic events, disease-driven reductions of sea-star predation, or disease coupled to extreme warming events. We explore the possibility of increasing the resilience of modern forests by artificially recreating at least some of the ecological impacts of sea cows, accounting for metabolic requirements, estimates of abundance based on recent analyses of ancient DNA, and trophic impact.

Keywords: Steller's sea cow, kelp forest, North Pacific, conservation

Roopnarine, P. D., R. M. W. Banker, and S. D. Sampson, 2023. Steller's sea cow and kelp forest regeneration in the North Pacific. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):109. https://doi.org/10.58782/flmnh.wtps7868

GIANT KELP FOREST RESILIENCE TO OCEAN WARMING; HISTORICAL AND MODERN SYSTEMS

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Giant kelp forests of the North Pacific are iconic among cool temperate marine communities. They are also amongst the most productive marine ecosystems, harboring significant biodiversity and supporting coastal economies. The fate of these systems over the next eight decades is uncertain, given the variance of outcomes for global warming scenarios and the complexities of ecological forecasting. There is a growing consensus that giant kelp will be susceptible to warming, leading to a decline of the communities. Kelp forest dynamics, however, are also controlled by biotic interactions. In the North Pacific, the main biotic factors today are kelp herbivory, especially by grazing sea urchins, and predatory control of the urchins, particularly by sea otters and sunflower sea stars. A recent study demonstrated that as late as the 18th century, the now extinct mega herbivore Steller's sea cow, an obligate kelp browser, had a significant impact on North Pacific kelp forest dynamics. Mathematical models comparing the historical community to modern ones indicated that the sea cow would have increased forest resilience against reductions of predation of urchins caused by multiple types of perturbation. In addition to epidemics and temperature anomalies, it is expected that global temperatures will increase 2-4 degrees Celsius by the year 2100. Here we use the mathematical models to explore forest dynamics under various warming scenarios, including the changing impacts of epidemics and the frequency and intensity of warming anomalies. Preliminary results suggest that in contrast to a stable temperature regime, warming to 4 degrees increases chaotic dynamics, extinction of both sea urchins and sunflower sea stars, and abundance of understory algae. Those results also suggest that chaos and algal increase would be lessened in the presence of the extinct herbivore. These findings bear implications for future kelp forest management, conservation, and human economic exploitation.

Keywords: kelp forest, Steller's sea cow, resilience, global warming, mathematical model

Roopnarine, P. D., R. M. W. Banker, and S. D. Sampson, 2023. Giant kelp forest resilience to ocean warming; Historical and modern systems. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):110. https://doi.org/10.58782/flmnh.wtps7868

USING FISH REMAINS TO TRACE DYNAMIC EXCHANGES BETWEEN ECOLOGY AND ECONOMY IN FIJI

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Island nations in the developing world are some of the communities most at-risk to the effects of climate change and are under increasing pressure from globalized seafood markets. Indigenous Fijians have a stark understanding of environmental change because of their economic and dietary reliance on marine resources, including shark fisheries and tourism. Sharks are important apex predators with deep cultural significance in Fiji and they are thus useful species to focus on when investigating historical ecology. However, they are difficult to study; sharks have cartilaginous skeletons, making full body fossils rare, and their behavior can make them difficult to survey with traditional methods. Sharks are also covered in dermal denticles which they shed throughout their lives and which compose some of the most extensive and oldest fossil types. All fish, including sharks, also shed their teeth, and together these microfossils are called ichthyoliths. Scientists in the Caribbean have developed innovative techniques to use ichthyoliths to illuminate the importance of parrotfish to coral reef ecology and trace historical and pre-anthropogenic shark populations. However, this microfossil approach has not yet reached Fiji. We developed a trait-based character coding scheme to describe denticle morphology based on both modern denticles and fossil denticles and discuss our work to expand current denticle reference collections. When combined with ecological factors, morphological analysis can identify temporal periods and spatial regions of importance in both modern and paleo-ocean ecosystem dynamics and aid historical ecologists in describing shark communities of the past. We are embarking on a research project to collect cores from Fiji to examine parrotfish and shark ecology through time. Here we summarize the methods we will use and how we have tailored them to our study region and invite input from the conservation paleobiology community on our study design.

Keywords: marine ecology, morphometrics, fisheries, coral reefs

Rubin, L. D., E. Sibert, and J. Drew, 2023. Using fish remains to trace dynamic exchanges between ecology and economy in Fiji. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):111. https://doi.org/10.58782/flmnh.quco5184

DEATH ASSEMBLAGES RECORD SIGNIFICANT RANGE CONTRACTION IN A MOLLUSCAN SPECIES OF CONCERN FROM THE EASTERN GULF OF MEXICO

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Marine habitats are in decline due to increasing anthropogenic pressures, but baseline data on species distributions needed to manage and conserve populations are lacking. Incorporating death assemblages into species assessments can create a more accurate understanding of pre-anthropogenic communities than survey records alone. In this study, we conducted a live-dead analysis on mollusks from a new 2008-2018 dredge survey in the eastern Gulf of Mexico. We selected the predatory banded tulip snail, *Cinctura hunteria*, as a test case for assessment because this species is one of several designated by the Florida Fish and Wildlife as a species of concern. Using spatial count data for shells in our samples, we estimated density values for each taxonomic grade over the sampled area using IDW spatial interpolation. These maps reveal large areas of occupation across the west Florida shelf for two taxonomic grades of dead shells but loss of offshore occurrence for live records. One explanation for the lack of occurrences in offshore habitats is that, unlike dead shell records, there is no time averaging accumulation of live shells. Time averaging increases detectability of species in habitats where they are rare. However, independent fisheries data from live-only animal surveys not only mirror our live-dead results but suggest that habitat loss in our live-dead comparisons was rapid and occurred in the late 1980s or early 1990s. Thus, live-dead comparisons reveal both natural baselines as well as anthropogenic changes in distribution without being significantly distorted by time-averaging biases. Including live-dead data can greatly improve species assessments when long-term survey records are unavailable and provide a key tool in combatting biodiversity loss across marine ecosystems.

Keywords: biodiversity, habitat loss, death assemblage, Mollusca, Florida

Sanders, S. A., G. S. Herbert, G. Trobbiani, N. Seiden, and J. A. Rogers, 2023. Death assemblages record significant range contraction in a molluscan species of concern from the eastern Gulf of Mexico. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):112. https://doi.org/10.58782/flmnh.quco5184

MOLLUSK RESPONSE UNDER OCEAN ACIDIFICATION IN SHALLOW MARINE SETTINGS OF SICILY (CENTRAL MEDITERRANEAN)

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Anthropogenic CO2 is a major driver of change in most marine ecosystems, as the consequent ocean acidification is threatening marine calcifying organisms. In this respect, long-term analyses on ocean acidification effects on marine ecosystems acclimated to high pCO_2, as found around CO_2 vents, are needed. Here we tackle mollusk assemblages from acidified shallow marine settings off the Aeolian archipelago (Central Mediterranean). The detected gradient manifests along a 34 m long transect (9.6 m and 11.4 m water depth), mostly in a *Posidonia oceanica* matte from normal (site 1) to high levels (site 3) of pCO_2 (405 µatm, pH 8.1 and 715 µatm, pH 7.8; respectively). The strongest acidified condition at the vent crater (site 4, pCO_2 1110 µatm, pH 7.7). At the vent site gaseous emissions are characterized by ~99% in volume of CO_2 and ~0.6% of H_2S. However, water dissolved H_2S was below detection limit and the sulphate content along the transect does not show significant variations with respect to normal seawater values. Preliminary paleoecologic surveys on diversity structure (diversity profiles) and taphonomic degradation (NMDS, z scored % values) were conducted on mollusk remains collected along the natural pH gradient (sites 1-4). Along the *P. oceanica* matte (sites 1-3), overall mollusk taxon diversity (alpha and beta) decreased, mollusk in site 3 were mostly juveniles and had higher overall taphonomic damages than those retrieved at normal pH conditions. Within the vent crater only fewer and highly taphonomically altered gastropod specimens were retrieved on the pebbly seafloor, suggesting a very short residence time of shell material and rapid dissolution. Even if vents are not exact predictors of the anthropogenic-designed future of marine settings, due to their limited spatial and temporal extent, they can act as natural laboratories where to evaluate the output of ecosystem processes under rising pCO_2 and the effects on the creation of the future fossil record.

Keywords: mollusk, conservation paleobiology, taphonomy, ocean acidification, Tyrrhenian Sea

Scarponi, D. A. Mancuso, S. Goffredo, and M. Kowalewski, 2023. Mollusk response under ocean acidification in shallow marine settings of Sicily (Central Mediterranean). In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):113. https://doi.org/10.58782/flmnh.tbsm5836

CHANGES IN SMALL MAMMAL COMMUNITIES OVER THE LAST 25,000 YEARS SHOW A COMPLEX RELATIONSHIP BETWEEN COMPOSITION, TRAITS, AND ARIDITY

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Many ecosystems today face increasingly frequent and extreme droughts. Small mammals can be harbingers of larger ecological changes, making them critical components for conservation. We use the fossil record to explore how small mammal communities respond to aridity changes. Recent, short-term droughts caused small mammals to increase in evenness, as dominant generalist species suffer severe population fluctuations. It has also been hypothesized that with increasing aridity, herbivore tooth crown heights increase to combat wear. Here, we examine community-level changes, including evenness, hypsodonty, and diet across a series of arid-semiarid cycles. We compare two caves: Natural Trap Cave (NTC), which is open and arid, and Samwell Cave (SC), which is closed and forested. Evenness decreased at both caves from the Late Pleistocene to the Late Holocene. At NTC, dietary generalists were more common in the Pleistocene (61%) with herbivores dominating in the Middle (62%) and Late Holocene (57%). However, at SC generalist taxa increased into the Holocene. The Pleistocene community at NTC had the highest percentage of taxa with low tooth crown heights (42%) halving into the Holocene. Changes in hypsodonty and a shift from generalist to herbivorous taxa at NTC do not align with anticipated responses to aridity, which decreased from the Pleistocene to the recent. Functional relationships of these communities to aridity may be more nuanced than previously thought. Bioavailability of water and local vegetation types at NTC can help parse out these trends. Pleistocene precipitation mostly accumulated during the winter, not aiding plant growth. Thus, generalist mammals who could survive on scant, arid-adapted plants and invertebrates dominated. Precipitation through the Holocene shifted to summer accumulation, allowing plants, like grasses, to colonize and herbivorous taxa to increase in abundance with corresponding shifts to high crowned communities.

Keywords: community ecology, small mammals, aridity, caves, functional traits

Schap, J. A., J. A. Meachen, and J. L. McGuire, 2023. Changes in small mammal communities over the last 25,000 years show a complex relationship between composition, traits, and aridity. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):114. https://doi.org/10.58782/flmnh.dykm8350

MEGASDM: MODELLING SPECIES RANGES IN THE PAST AND FUTURE

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As we enter the Anthropocene, unprecedented climatic and landscape changes are leading to global extinctions and the reorganization of many species' ranges. Understanding how species ranges have changed through time can contextualize long-term interactions between geography and ecology, offer insight into how they may change in the future, and inform conservation of vulnerable species. Species distribution models (SDMs) can be an important method for examining these range shifts, both in the future and through the past, by providing hypotheses about the responses of species' ranges to certain scenarios. Here, I present several avenues for exploring hypotheses on range shifts using the *megaSDM* R package. This package facilitates realistic spatiotemporal SDM analyses by incorporating dispersal probabilities, creating time-step maps of range change dynamics, and efficiently handling large datasets and intensive subsampling techniques, while still allowing model-specific tuning. Using megaSDM, with the ongoing expansion of the nine-banded armadillo (*Dasypus novemcinctus*) as an example, I show how dispersal rate constraints can be incorporated into predictions of range shifts through time, introducing the concept of "invadable suitability". Comparing dispersal-constrained to unconstrained models, I establish the importance of considering the dispersal ability of a species when projecting its range through time. Finally, I demonstrate the effects of transient range dynamics (e.g., a momentary range contraction in a period of prolonged expansion) on modelled species distributions, showing that these dynamics can be accounted for by incorporating many incremental time steps. These improvements in SDMs allow us to test and refine hypotheses that forecast or hindcast species range shifts. They are small but important steps towards treating conservation as a dynamic, rather than static, field and bringing a paleontological perspective to the preservation of life on Earth.

Keywords: range shifts, biogeography, climate change, dispersal, SDM

Shipley, B. R., B. Dilkina, and J. L. McGuire, 2023. MegaSDM: modelling species ranges in the past and future. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):115. https://doi.org/10.58782/flmnh.zwwl8127

ASSESSING IMPACT OF DOMESTIC AND NON-NATIVE SPECIES ON TRAIT-ENVIRONMENT RELATIONSHIPS USING HYPSODONTY AND PRECIPITATION SINCE THE LATE PLEISTOCENE

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Ecosystem function relies in part on aligned relationships between functional traits of animals and the environments in which they live. Studies of trait-environment relationships have largely focused on communities of native species, but domestic and non-native species also play a role in the functioning of modern ecosystems. We use ecometrics, or study of functional trait-environment relationships, to evaluate the impact of domestic and non-native species on community-level trait composition and its relationship with precipitation by comparing four community compositions: modern native, modern native plus domestic, modern native plus non-native, and late Pleistocene (0.126–0.0117 Ma). We integrate large and small herbivorous mammals into a single ecometric model of hypsodonty (i.e., tooth crown height) and annual precipitation ($n=8439$, $r=-0.7$, $R2=0.4$, $p<0.001$). We hypothesize: 1) ecometric models of modern native communities will differ from those for late Pleistocene communities, 2) inclusion of domestic species will align ecometric relationships with those from the late Pleistocene, 3) inclusion of non-native species will maintain ecometric relationships of modern native communities. We found modern communities of native species have lower hypsodonty values and higher precipitation estimates than late Pleistocene communities. Domestic species shift modern communities toward higher hypsodonty values and lower precipitation estimates like those in the late Pleistocene. Today's domestics are mostly high-crowned grazing species representative of the fauna lost prior to the Holocene. Non-native species do not shift modern native trait composition or the associated precipitation estimates, illustrating the success of non-native species due to trait alignment with their new environments. Thus, conservation and restoration efforts should consider trait composition of whole communities because it provides unique information to measures of taxonomic composition.

Keywords: Ecometrics, community ecology, hypsodonty, precipitation, domesticated species

Short, R. A., M. Sketel, J. M. Martin, J. A. Schap, J. L. McGuire, and A. M. Lawing, 2023. Assessing impact of domestic and non-native species on trait-environment relationships using hypsodonty and precipitation since the Late Pleistocene. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):116. https://doi.org/10.58782/flmnh.ueal3445

DESCRIBING A NEWLY EXCAVATED PACKRAT MIDDEN NEAR NATURAL TRAP CAVE, WYOMING TO HELP ASSESS BIASES IN FOSSIL MICROFAUNAL ACCUMULATION

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Microfauna communities resulting from packrat accumulation provide crucial information about how natural communities respond to environmental changes. However, fossil accumulation mechanisms can be complex, making it difficult to interpret these community responses. Natural Trap Cave (NTC) is an open-mouth cave with an 85-foot drop that often lies unseen by passing animals, making it a major location for fossil accumulation. NTC, located in the Bighorn Mountains of Wyoming, has accumulated a paleontological record of the local community's biota dating back to the Late Pleistocene, 25,000 years ago. The rim of the cave's mouth is home to packrat middens located directly above the major deposits of microvertebrate (<5 kg) fossils. It is hypothesized that middens along the rim have accumulated seeds, bones, teeth, and bird pellets from the local communities over time and have periodically washed into the cave below. We seek to assess the bias in microvertebrate community composition introduced by packrat accumulation. We identified bones and teeth collected from a 9-section grid of a modern midden located adjacent to the cave, which allow us to see which species dominate the NTC environment. We calculate species evenness, richness, and relative abundances using MNI. To assess local bias resulting from packrat accumulation, we compare the modern midden with live-and camera-trap data of small mammal communities. To assess which NTC fossils result from packrat accumulation, we compare the modern midden with fossil material from within the cave, ranging in age from 2 to 20 ka. Once we understand these biases present in the fossil accumulation, we can associate species' relative abundances with changes in climate, such as drought, increasing temperatures, and flooding. By knowing how climate has affected NTC species' abundances through time, we will be prepared to aid in conservation efforts by predicting how species numbers will be affected by future climate change.

Keywords: packrat middens, community bias, microvertebrates, Natural Trap Cave, climate change

Sketel, M. J., J. L. McGuire, J. Schap, and R. A. Short, 2023. Describing a newly excavated packrat midden near Natural Trap Cave, Wyoming to help assess biases in fossil microfaunal accumulation. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):117. https://doi.org/10.58782/flmnh.dsqo9692

VARIANCE OF CAROTID-RETE-MEDIATED SELECTIVE BRAIN COOLING ACROSS ARIDITY INDICES

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Species-environment interactions are integral to survivorship, especially when those environments test the extremes of organismal physiology. Large-bodied (>50kg) mammals, specifically artiodactyls and feliform carnivores, possess a specialized physiology known as carotid-rete-mediated selective brain cooling (CR-SBC), which has been established to be selectively advantageous in environments where water availability is limited and risk for dehydration is high. In this study, we investigate whether CR-SBC provides a release from physiological constraint imposed by the environment, specifically aridity. Using ^{18}O values from tooth enamel as a proxy for water metabolism, we model the range in variance across 1265 individuals from species that possess a carotid rete against those without from three different environmental categories – arid, dry subhumid, and humid – using a non-parametric ANOVA. The results of the analysis indicate there is a comparatively higher, and statistically significant, amount of variance of ^{18}O in mammals possessing CR-SBC than those without, especially within arid climates, that begins to equalize as environmental water availability increases. As environments become increasingly arid, understanding which species are more vulnerable to shifts in climate becomes more pertinent. The presence of CR-SBC provides a clear, binary feature by which to measure the relationship between the environment and species survivorship under varying levels of water availability, and is useful in informing and improving conservation tools, such as physiological distribution models.

Keywords: carotid rete, body water conservation, climate, mammal

Slenker, K., H. O'Brien, and L. Yann, 2023. Variance of carotid-rete-mediated selective brain cooling across aridity indices. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):118. https://doi.org/10.58782/flmnh.hhfe1916

A HOLOCENE SEABIRD EXTINCTION IN MAINE: THE GREAT AUK

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Seabirds are the most threatened of any living group of birds, continuing a larger pattern of elevated Holocene bird extinctions on islands and coastlines. The Great Auk (Charadriiformes: *Pinguinus impennis*) was found on both coasts of the Atlantic during the Holocene until its last sighting on Iceland in 1844. Far more is known about the population structure and genetic diversity of NE Atlantic populations, and the latest surviving populations were documented from the British Isles in 1834. While sightings from Canada suggest Great Auks disappeared by 1800, no systematic evaluation of extinction timing has been conducted for this coast. Determining extinction timing of the Great Auk in Maine allows a comparison to be made to populations in other areas of the Atlantic Ocean, and raises the question: was the Maine population's fate different due to regional, cultural, or other factors? There is a single eye-witness record in the late 17th century at "Black Point," now Scarborough, Maine. To address this gap, we compiled a radiocarbon dataset on associated material from Maine archaeological shell middens. These 91 dates from 13 sites situate the Great Auk in Maine from about 180 to 4,555 years before present. The majority of these dates are from charcoal samples, but also include shells, ceramics, and bone, and cultural contexts span the Middle and Late Ceramic Periods. To account for differences in stratigraphic control and sampling material, we assigned quality scores, and used these scores to run a sensitivity analysis in extinction timing with the GRIWM model. Disentangling the spatiotemporal dynamics of the Great Auk extinction in Maine is useful in determining how to conserve current species in decline and modern insular seabirds in Maine, such as the puffin. Future study will include new radiocarbon dating of bones as well as isotopic and morphometric analysis to unfold more chapters of the Maine Great Auk's narrative.

Keywords: extinction, Maine, Great Auk, seabird, Holocene

Snyderman, L., A. Mychajliw, and A. Spiess, 2023. A Holocene seabird extinction in Maine: the Great Auk. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):119. https://doi.org/10.58782/flmnh.awfg4811

MOLLUSCS ACROSS SPACE AND THROUGH TIME IN A HYPERSALINE COASTAL LAGOON, MEXICO

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Biotic remains have been used in paleoecological studies to provide information on past environmental conditions. Death assemblages can be used to make inferences about past environmental conditions if modern optima and ranges of taxa are known. Gaps in knowledge about historical biotic changes often stem from a paucity of information regarding species distributions, community species richness and evenness, community structure, ecological interactions, and possible factors that caused past biotic shifts. We studied mollusc assemblages in sediment cores from Río Lagartos coastal lagoon (Mexico) and compared them to present-day mollusc communities to gain insights into environmental changes that occurred in the lagoon throughout the last century. A total of 18,779 mollusc specimens, representing 20 bivalve and 45 gastropod species, and belonging to 32 families and 48 genera, were identified in three short sediment cores collected from the coastal lagoon in 2017. Molluscs in the sediment cores were compared to an inventory of modern fauna from the lagoon, which was collected along a salinity gradient in 2017 and 2018 to link species distributions with environmental variables. Mollusc communities from the sediment cores and present-day datasets possess the same ubiquitous species and feeding guilds. Nearly twice as many species, however, were identified in the sediment cores as in the present-day inventory. We report differences in mollusc abundance and taxonomic composition in the cores across space and time, which may be related to the salinity gradient in the lagoon, temporal shift in salinity, and recent human-mediated modifications of the nearby terrestrial environment. Biotic changes driven by shifts in salinity could have been reduced salinity. Such inputs may have been driven by hurricanes, along with associated high wind velocities and geomorphologic transformations. This paleobiology study will be of use for future conservation efforts in the coastal lagoon.

Keywords: Yucatan, salinity, Bivalvia, Gastropoda, 210Pb

Suárez-Mozo, N. Y., M. Brenner, W. F. Kenney, M. Díaz Asencio, J. H. Curtis, M. A. Aquino-Lopez, E. Guerra-Castro, and N. Simões, 2023. Molluscs across space and through time in a hypersaline coastal lagoon, Mexico. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):120. https://doi.org/10.58782/flmnh.frvf2187

CONSERVATION PALEOBIOLOGY AND TAPHONOMY: DIFFERENTIAL PRESERVATION AND TIME-AVERAGING OF ECHINOIDS AND MOLLUSKS

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Fossils from surficial death assemblages and shallow cores are an important archive used in the field of conservation paleobiology. Understanding the taphonomic filters and time-averaging that affect modern biomineralized taxa is crucial for using their fossil record as a source of geohistorical data. Through comparative analysis of the live-dead patterns of echinoids and mollusks, we aim to assess multiple hypotheses regarding differences between the two taxa in terms of preservation potential and fossil record resolution. In this pilot study, six sediment samples (five surface [0-10cm] and one subsurface [30-40cm]) were collected in a shallow, subtidal habitat off the coast of Cedar Key, Florida. These samples were sieved for mollusks and echinoids. Specimens were segregated by taxa and classified into live, whole dead, and fragments. Results were consistent among surface samples, which showed that, by weight, an average of 8% of all mollusk specimens and 55% of all echinoid specimens were live collected. Fragmentation rate by weight was notable higher for echinoids than for mollusks: 77% for mollusks and >99% for echinoids. The subsurface sample lacked complete echinoid tests, but complete mollusks shells, mollusk fragments and echinoid fragments remained common. These results support the hypothesis that echinoid tests degrade more quickly than mollusk shells, making them less likely to be preserved as part of time-averaged assemblages formed under low net-accumulation rates. Echinoid fragments do not seem to follow this pattern, and instead seem to preserve similarly to mollusks. The results suggest that geohistorical records provided by echinoids and mollusks may be fundamentally distinct from one another in terms of temporal resolution and completeness of the fossil record.

Keywords: mollusks, echinoids, time-averaging, taphonomy, benthic

Torres, L., M. Kowalewski, R. W. Portell, and T. B. Grun, 2023. Conservation paleobiology and taphonomy: Differential preservation and time-averaging of echinoids and mollusks. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):121. https://doi.org/10.58782/flmnh.rbof6753

SMALL MAMMAL HYPSODONTY RATIOS DO NOT TRACK PRECIPITATION CHANGES AT NATURAL TRAP CAVE, WYOMING

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With future climate change, drought events are expected to increase. Hypsodonty is an adaptation in herbivorous mammals for higher crowned teeth, which are better able to process coarse foods. Typically, animals with highly hypsodont teeth are found in arid places. This trait is considered an adaptation to aridity and drought. Many studies examined the spatial distribution of hypsodonty with respect to climate in both ungulates and Glires (rodents and lagomorphs). However, few studies have examined whether spatial trends play out across known climate shifts at a single location. Glires evolved hypsodonty millions of years before ungulates, adapt readily due to short generation times, and have relatively small home ranges, so they may provide more accurate climate predictions. Here, we use Glires from Natural Trap Cave, WY to examine whether community-level changes in hypsodonty reflect known precipitation changes. Additionally, this study investigates the effects of measurement techniques (teeth in-jaw versus out-of-jaw) and tooth wear on hypsodonty measurements. Currently, most hypsodonty studies try to use only completely unworn teeth, which are difficult to find in the fossil record. We find that community-level hypsodonty did change over time, but not in ways that corresponded with established precipitation values at Natural Trap Cave. There were likely other factors driving hypsodonty levels within this community, such as an increasing abundance of grasses with increases in temperature and precipitation. Tooth wear did not seem to have significant effects on hypsodonty measurements across time, and tooth wear only sometimes significantly affected hypsodonty measurements across taxa. With further analysis, it might be conclusively decided that samples can be expanded to somewhat worn teeth. This analysis of hypsodonty as a climate proxy can help shape both its use in future studies and our understanding of how species will respond to future climate changes.

Keywords: hypsodonty

Turner, L., J. Schap, and J. L. McGuire, 2023. Small mammal hypsodonty ratios do not track precipitation changes at Natural Trap Cave, Wyoming. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):122. https://doi.org/10.58782/flmnh.qziu8092

BODY SIZE ESTIMATION IN TOADS (ANURA: BUFONIDAE): APPLICABILITY TO THE FOSSIL RECORD

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Organisms' body size is an important biological trait that is related to the environment and constrained by physiology. It is also one of few biological characteristics that can be inferred from fossil specimens. Variation in body size both within and across fossil communities can provide insight into their response to past climatic events, as well as morphological or ecological evolution in specific taxa. Among vertebrates, frogs and toads (Anura) are of particular interest given their sensitivity to environmental variation. Here, we propose a method for estimating body size in toads, one of the most ecologically and taxonomically diverse frog families (Bufonidae) that is cosmopolitan in distribution and contains aquatic, terrestrial, arboreal, and fossorial species. We used computed tomography scans (CT-scans) of 36 living species of toads to digitally segment five bones that are frequently found as fossil (ilium, sacrum, urostyle, humerus, and radioulna). We took nine different measurements on those bones to be used as proxies for body size and for each specimen collected a measurement of body size, snout–urostyle length (SUL). We used ordinary least square regression analysis (OLS) with 95% confidence and prediction intervals to determine if those measurements are useful to estimate body size from isolated bones and in the fossil record. Our regression analyses indicate that these measurements can serve as proxies to estimate body size in bufonids (with coefficients of determination between 0.80–0.95). The measurements with the highest coefficient of determinations are those of the ilium and humeri, both of which are abundant in the fossil record and taxonomically informative. Last, we tested our method on examples of living and fossils toads of North and South America. Our method is the first quantitative approach to estimate size in toads based on isolated bones and enables us to continue to explore the correlation between size and ecology in toads in the past.

Keywords: Bufonidae, regression, toad

Victor, M. L., M. C. Vallejo-Pareja, and D. C. Blackburn, 2023. Body size estimation in toads (Anura: Bufonidae): Applicability to the fossil record. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):123. https://doi.org/10.58782/flmnh.bnie4350

SMALL BIOLOGICAL PRESERVES AND SMALLER MAMMALS: CAN PROTECTED AREAS IN OUR MOST POPULOUS REGIONS CONSERVE HISTORIC COMMUNITY COMPOSITION?

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The multi-faceted impacts of the Anthropocene are increasingly modifying natural ecosystems and threatening biodiversity. Protected spaces in and adjacent to urban landscapes may be critical in protecting species in human-modified systems. Can small, protected spaces act as reservoirs for biodiversity across dynamic spatial and temporal gradients of human impact? To address this question, we identified small mammal remains from modern raptor pellets and Holocene archaeological sites along a human modification gradient in the San Francisco Bay Area, CA. We assessed small mammal alpha and beta diversity for both modern and Holocene sites. We tested for significant differences between sites and time bins using permutational multivariate analysis of variance (PERMANOVA) and visualized these differences using non-metric multidimensional scaling (NMDS). We found that alpha diversity decreased with increasing human modification in Anthropocene sites, with no corresponding change between Holocene sites. Additionally, the alpha diversity of modern sites with moderate/high levels of human modification was significantly lower than that of protected modern sites and all Holocene sites, driven by the dominance of human-commensal and disturbance-tolerant species. On the other hand, the small mammal communities from a small protected area (Jasper Ridge Biological Preserve) retained Holocene levels of alpha diversity. Jasper Ridge has also changed less over time in terms of overall community composition than more modified sites. Despite this, both PERMANOVA and NMDS show that Holocene and Anthropocene communities are significantly distinct regardless of collection site and level of anthropogenic modification. Our results suggest that even relatively small protected spaces within an urbanized matrix conserve native faunal communities, highlighting their important role in urban conservation.

Keywords: small mammals, protected spaces, diversity, community ecology, spatiotemporal

Viteri, M. C., M. A. Stegner, and E. A. Hadly, 2023. Small biological preserves and smaller mammals: Can protected areas in our most populous regions conserve historic community composition? In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):124. https://doi.org/10.58782/flmnh.npfm3522

EXAMINING THE BIOGEOGRAPHIC HISTORY AND EVOLUTION OF OTTERS IN THE AMERICAS TO IDENTIFY CONSERVATION SOLUTIONS

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Anthropogenic impacts affect nearly every living species. The habitats and ranges of many taxa are now so modified that modern distribution information alone is insufficient to determine what conditions they can persist in. As climate change and other anthropogenic impacts increase, clear information on species' needs and tolerances simultaneously becomes even more critical for conservation and harder to obtain. Historic records and paleontological data can provide key insights into organisms' past requirements, resilience, and adaptive capacity, which can be used to identify specific areas of vulnerability and to inform conservation policies and strategies. Here we review the evolutionary history and paleobiogeography of North and South American river otters to investigate how geography and environmental change have driven river otter evolution in the Americas, and shaped the ecology, threats, and conservation status of each of the extant species in these clades. Members of the two extant American otter genera, *Lontra* and *Pteronura*, overlap in geographic and ecological niche space, and their shared history provides an opportunity for an evolutionarily-grounded examination of relative rarity, specialization, and level of conservation concern. Integrated paleobiological, historical, and modern ecological data indicates that American otters are less habitat-specific than previously thought. We found that changes in waterway connectivity impacts speciation and population connectivity, and likely plays a role in population health and persistence in times of stress. All American river otters exhibit sensitivity to anthropogenic habitat modifications but can coexist with humans in urbanized environments with proper support. This deeper-time perspective suggests that otter conservation in regard to both habitat alteration and climate change may strongly benefit from supporting riverine ecosystem productivity and connectivity in both wild and urban settings.

Keywords: otter, Americas, paleobiogeography, evolution, conservation

DeNeve Weeks, D. and E. Lindsey, 2023. Examining the biogeographic history and evolution of otters in the Americas to identify conservation solutions. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):125. https://doi.org/10.58782/flmnh.rvlg8686

LONG-TERM CHANGE IN CARIBBEAN REEF WATER QUALITY AND ECOSYSTEM HEALTH

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Caribbean coral reef ecosystems have declined dramatically since systematic monitoring began in the 1970s. Over the past 50 years, they have lost between 50-80% of reef-building corals, their principal ecosystem architects. These declines have been attributed to climate change, introduction of invasive species, overfishing, and land-based pollution. Although recognized as a major stressor to corals, the role of land-based pollution in Caribbean coral declines has not been quantified due to the lack of consistent reef water quality monitoring. As part of our CPN-funded working group "Integrating paleo and historical data into coral reef management and policy", we compiled several metrics of reef water quality from paleoecological data and disparate monitoring efforts across the Caribbean to document multidecadal-scale change over a period of intensifying coastal land alteration. We then compared water quality trends with trends in living coral cover from these same reefs to assess the role of water quality declines from land-based runoff on coral reef ecosystem health. These analyses show that (1) an array of historical data exist for reconstructing trends in Caribbean reef water quality that are in disparate repositories and remain mostly untapped, (2) reefs across the Caribbean have experienced water quality declines over the past half century, even offshore sites that were previously thought to be unaffected by land-based runoff, (3) correlations between reef water quality and coral abundance trends are detected at select sites where water quality monitoring protocols were consistent and sustained for multiple decades, and (4) water quality declines are asynchronous across sites and are likely related to differing timing and histories of land alteration.

Keywords: eutrophication, coral, monitoring data, paleo data, land-based pollution

Whaley, Z. B., K. Cramer, L. McClenachan, A. Tewfik, L. Alvarez-Filip, M. McField, J. Carilli, and T. Vardi, 2023. Long-term change in Caribbean reef water quality and ecosystem health. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):126. https://doi.org/10.58782/flmnh.bhpv7556

COMMUNITY ABUNDANCE AND ENVIRONMENTAL MONITORING TO SUPPORT CORAL REEF MANAGEMENT IN EAST PORTLAND SPECIAL FISHERY CONSERVATION AREA, JAMAICA

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Global warming and human impacts continue to be devastating for coral reef systems. Jamaican reefs have been adversely affected by a variety of threats including hurricanes, coral bleaching, disease, and algal overgrowth, the impact of which has been exacerbated by global climate change, overfishing, and urchin disease. Despite the dire situation, with proper protection, algal coral phase shifts can be reversed. One area that is being protected is the East Portland Special Fishery Conservation Area (EPSFCA). The EPSFCA is monitored by the Alligator Head Foundation (AHF), which houses a coral nursery, mangrove nursery, and leads monitoring and restoration practices. Although reefs in Jamaica, such as Discovery Bay, were well studied in the 1970s-early 2000s, many ecological studies have not extended to other regions around the island. In particular, the unique reefs of Northeast Jamaica lack data necessary for conservation efforts; no baseline information on community composition had been collected until the establishment of the AHF. To obtain an ecological baseline, this project synthesizes environmental data (nutrient levels, temperature, light) with community assemblage data (fish counts, benthic substrate assessments, and invertebrate counts) from EPSFCA reefs. These sites will be compared using ordinations. To address a longer timeframe of reef evolution, this project will use similar techniques on a fossil reef to see how Caribbean reefs have changed over thousands of years. An analysis of EPSFCA reefs from 2017-2019 found that many sites are distinct, but most reefs show signs of degradation (e.g., high algal cover). Much of the variation between sites can be explained by the abundance of turf algae and the corals *Colopophyllia natans*, *Agaricia grahamae*, and *Acropora cervicornis*. The goal of this project is to combine the EPSFCA data with environmental information to provide a road map for where conservation efforts are likely to support recovery.

Keywords: reef, ecology, Jamaica

Williams, C. M., R. C. Martindale, D. Henry, Gordon-Smith, D.-A., and P. Bergan, 2023. Community abundance and environmental monitoring to support coral reef management in East Portland special fishery conservation area, Jamaica. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):127. https://doi.org/10.58782/flmnh.iitn6005

METABARCODING OF AMERICAN MINK SCAT TO EXPLORE SHIFTING BASELINES IN THE GULF OF MAINE

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The mink (*Neogale* sp.) has been important species in North American ecosystems and communities for millennia; before European colonization, Indigenous families hunted and trapped mink for their pelts. As part of the euro-colonial fur trade (~1600-1900), wide-spread and intense harvest of mink and other furbearers transformed ecosystems, including the likely extinction of the sea mink (*Neogale macrodon*) in the Gulf of Maine. The American mink (*Neogale vison*) has slowly moved into areas that were previously inhabited by the sea mink in coastal and island Maine. The expansion of American mink has been implicated as a potential cause for the declining seabird populations on Maine islands. Here, we use metabarcoding of American mink scat collected in the USFWS Maine Coastal Islands National Wildlife Refuge to evaluate if American mink are predating upon seabirds. Preliminary analysis of mink scat from Petit Manan Island has not implicated mink in bird predation but we did recover host DNA and dietary components including lobster and fish (Cunner). Currently, managers remove American mink from the Refuge islands to protect nesting seabirds but perhaps the seabird populations are returning to population sizes of when sea mink was present in the area. Harvest of furbearers as part of the euro-colonial fur trade may still have implications for ecosystem form and function today.

Keywords: fur trade, dietary DNA analysis

Williams, S., S. Shirazi, K. Hughes, C. Abin, L. Welch, A. Mychajliw, and C. A. Hofman, 2023. Metabarcoding of American mink scat to explore shifting baselines in the Gulf of Maine. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):128. https://doi.org/10.58782/flmnh.nkup2567

BRIDGING THE GAP BETWEEN CONSERVATION PALEOBIOLOGY AND RESOURCE MANAGEMENT: RECOGNIZING THE PAST IS THE KEY TO THE FUTURE

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A persistent challenge for conservation paleobiologists is communication of information on past environmental changes to resource managers in a way that allows them to apply these data to current restoration efforts. USGS scientists have learned a few lessons over 25 years of conducting applied paleoecology research in collaboration with the Greater Everglades Ecosystem Restoration (GEER) project. The first step is to engage resource managers in conversations prior to beginning research. What are their goals and information needs? Participation in GEER with teams of scientists and decision-makers working together to develop measures of success for Everglades restoration allowed us to overcome this first hurdle. Our initial research showed changes in salinity and freshwater influx over time, but how to use this information was not immediately apparent to management, so continued communication was critical. Through participation in meetings and presentation of our preliminary findings, the management team provided feedback that led us to develop a modern analog-based method to estimate past salinity, which was then used to adjust system-wide hydrologic models to reflect past conditions. Recently, we realized another management information gap — a set of indicator species for nearshore estuarine zones to monitor the effectiveness of upstream changes in flow. Again, by working with managers to determine needs, we combined distribution data of mollusk species in nearshore cores with our modern analog dataset to develop a suite of indicator species. These are a few examples of positive impacts from our long-term collaboration. We believe the key to advancing the use of conservation paleobiologic research in resource management is to communicate frequently and often, listen closely to management, discuss how paleo data can be applied, and be persistent. It is essential that we bridge these gaps because the past is our window to anticipating and planning for future change.

Keywords: Everglades restoration, collaboration, mollusks, modern analog, indicator species

Wingard, G. L. and B. Stackhouse, 2023. Bridging the gap between conservation paleobiology and resource management: Recognizing the past is the key to the future. In: Abstracts of the 2nd Conservation Paleobiology Symposium. Bulletin of the Florida Museum of Natural History 60(2):129. https://doi.org/10.58782/flmnh.aqkx3378

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* = presenter