Newsletter of the Conservation Paleobiology Network

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CPN Newsletter

Conservation Paleobiology Network

INSIDE THIS ISSUE:

Intro to Working Group	1
Research Highlight	2
Practitioner Perspective	3-5
Student Section	6
Paleo Proxy Spotlight	7
Postcard from the Field	8
Invite Others & Contact Info	9

Diversity, Equity, and Inclusion Statement:

The CPN upholds a commitment to diversity, equity, and inclusion as a core value. We seek to build on this commitment by striving to create an inclusive community whose members represent diverse cultures, backgrounds, career stages, and life experiences. This commitment is critical to strengthening our relevance, credibility, and effectiveness within the field of conservation paleobiology and broader STEM community. Through these efforts, we strive to transform the field in practice, while diversifying the face of conservation paleobiology for the future.

Supported by RCN-NSF Award: EAR-1922562

Introducing: An Interdisciplinary Working Group to Catalyze the Science of Species' Pre-Impact Distributions

Principal Investigators: Molly Grace and H. Reşit Akçakaya

Species conservation has long focused on preventing human-driven extinctions. However, recently calls have been made for a parallel focus on species recovery. This call to action within the conservation community is fueled 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. A new IUCN assessment of species recovery, the Green Status of Species, formalizes this need, requiring assessors to identify species' baseline status at the time when humans first became a major factor influencing their abundance and distribution. This Working Group will leverage the wealth of paleoecological and historical ecological data to facilitate estimation of species pre-impact distribution baselines. We will do so in a way that is accessible to conservation practitioners, helping to unshift the baseline and bring species recovery into the mainstream.

For more info and updates: https://conservationpaleorcn.org/pre-impact-distributions-working-group/

Photo caption: Screenshot from the working group's first virtual meeting in October 2021.

About CPN Working Groups: The Conservation Paleobiology Network sponsors working groups focused on research questions that integrate conservation paleobiologists, academic partners, wildlife managers, and stakeholders to develop effective strategies for translating products of historical research into conservation and management actions. Outcomes may include publications or other products developed by working groups, tutorials and lectures contributed to the CPN webinars, and/or proposals to funding agencies to support further activities. The working group panel oversees solicitation, selection, development, and assessment of working groups.

Conservation Paleobiology Research Highlight

By Erin Dillon, PhD Candidate, McCauley Lab, UC Santa Barbara, USA

Shark scales reveal shifting shark communities on a Caribbean coral reef over millennia

"A swirl of shadows beneath the rippling surface of the sea coalesced into a school of sharks ... Los tiburones surrounded the ships and terrorized the sailors." – Caribbean coast of Panama, 1502

Explorers' logs from the Caribbean are replete with stories of seas teeming with sharks, yet empirical evidence of past shark abundances is limited. Over the last half century, many shark populations have collapsed due to overfishing and habitat degradation, with some populations declining by as much as 70-99%. These dramatic losses have resulted in complex and sometimes surprising consequences for ecosystem functioning, particularly on coral reefs. However, monitoring often began long after fishing commenced so it is rarely clear what reef shark communities looked like before human impacts became pervasive.

Microscopic shark scales can help us go back in time to uncover pre-exploitation shark baselines. Shark skin is covered by millions of durable, tooth-like scales called dermal denticles, which are shed and accumulate in sediments. These denticle assemblages provide insight into shark abundance and functional diversity through time. We recovered denticles from a mid-Holocene (~7ka) reef in Bocas del Toro, Caribbean Panama to reconstruct an empirical shark baseline before major human impact. This fossil reef provided a unique window into shark communities in this region of the Caribbean before humans began using marine resources. We then compared this historical reference point with denticles found in nearby modern reef sediments to quantify the magnitude of change over time.

We found that the rate of denticle accumulation—and by proxy shark abundance—declined by 71% since the mid-Holocene. Although all denticle types decreased in abundance over time, those found on commercially valuable, fished species declined the most. As a result, shark communities were compositionally different in the past, containing a higher proportion of fast-swimming pelagic sharks (e.g., requiem and hammerhead sharks). In contrast, demersal species such as nurse sharks are relatively more common today than they were historically, suggesting a shift in the dominant ecological roles played by sharks on reefs in this region. Overall, we demonstrate that the denticle record can reveal changes in shark communities over long ecological timescales. This information can help us better understand what was natural in the coastal seas before humans and can be used to guide more appropriate place-based shark management goals.

Figure 1. *Collecting surface sediment samples from a modern coral reef in Bocas del Toro, Panama in search of denticles. Image credit: Sean Mattson.*

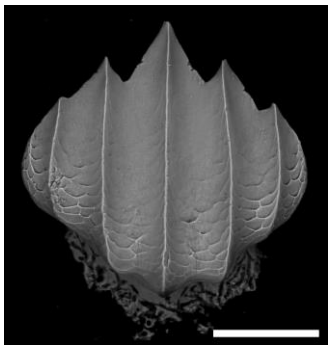

Figure 2. *Scanning electron microscope image of a silky shark (Carcharhinus falciformis) denticle. Scale bar = 100um. Image credit: Erin Dillon.*

***For more details see article by Dillon et al. (2021) in Proceedings of the National Academy of Sciences*:** https://doi.org/10.1073/pnas.2017735118

First published online: Nov 2021

Practitioner Perspective *Interview by Alexis Mychajliw*

Featured Practitioner: Michael Cove

Michael Cove is a mammalogist who combines noninvasive monitoring methods, such as camera trapping, with modeling techniques to analyze ecological community dynamics in the service of species management and recovery. He is currently the Research Curator of Mammalogy at the North Carolina Museum of Natural Sciences, where his research spans a range of taxa, from the common to the endangered, including the Baird's tapir, the endemic small mammals of the Florida Keys, and feral and free-ranging domestic cats and dogs. As a Fellow with the Smithsonian Conservation Biology Institute (SCBI), he pioneered large-scale camera trap collaborations such as Snapshot USA. Michael works at the intersection of research and management application by serving as an external reviewer on recovery criteria for the US Fish and Wildlife Service and is a member of several IUCN Species Survival Commissions including the Small Carnivore, Small Mammal, and Tapir specialist groups.

Photo caption: Michael Cove handling a Meadow Vole. Photo courtesy of Michael Cove.

1. Woodrats (packrats; genus *Neotoma*) are a paleoecologist's best friend given the giant stick nests, or middens, that they build. Can you tell me a little about your work with extant woodrats?

My PhD work [at North Carolina State University] focused on understanding the causes of decline and potential management options for the endangered Key Largo woodrat (*Neotoma floridana smalli*), a subspecies of eastern woodrat found in the Florida Keys. This protected species does build impressive middens, but has been declining due to feral cats and Burmese pythons. But predation by invasive species today isn't the first cause of decline for this species – based on genetic data, we know that today's populations are highly inbred with lingering founder effects. We know that Key Largo was the #1 producer of pineapples up until 1907, meaning that the woodrats would have had to persist in tiny forest patches around the pineapple farms.

2. What other historical information do you know about the Key Largo landscape?

The Key Largo woodrat wasn't "discovered" until 1923, and it wasn't until 1955 that the species was formally described, so our knowledge is relatively new. We can attempt to reconstruct the species history from genetic samples, but those can only get you so far: our earliest museum specimens are from the 1950s and some from the 1980s, meaning all of our data come from after the major habitat loss event. Our best habitat change estimates come from hot air balloon aerial photos taken in the 1920s.

Practitioner Perspective continued…

3. Do you think woodrats might have been used by people before Key Largo was a pineapple farm?

Woodrats are known to be tasty and they do advertise where they are with their nests, so maybe they could show up in archaeological collections.

4. The big question us paleoecologists want to know is: do their middens preserve?

Middens don't preserve as well on the US East Coast because of humidity and rain. In the Keys, if a woodrat is not actively maintaining the nest, it degrades in about a year, and today there is even less protective root or forest cover than there would have been historically. Our research group has been building supplemental nests for the woodrats out of plastic culverts.

5. What about loss of woodrats on the mainland?

In North Carolina we are at the interface of the Alleghany and eastern woodrat species ranges. We know that eastern woodrats must have occurred along the entire Atlantic ridge, but railroads and other development likely wiped them out earlier in the late 1800s, as compared with the surviving diversity on the west coast today. Unfortunately, there is not much data available on GBIF (the Global Biodiversity Information Facility, https://www.gbif.org), but we have been working to find historical occurrences from ~20 years ago and resurvey them. Given that woodrats are ecosystem engineers, this loss likely had major consequences for nutrient cycling and even microbiome changes. For example, the microbiomes of nests are distinct compared with nearby soil microbiomes, even after a hurricane.

6. Your main research focus now centers on camera trapping - you coordinate the national Snapshot USA program that is just now submitting data from cameras operating this fall. Can you tell us a little more about how this project got started?

As a postdoctoral researcher at the SCBI, I worked on a big project estimating the abundance of feral cats in Washington DC, using camera traps placed in alleyways, backyards, and even near dumpsters. During that project, I joked that I bet I had enough friends running their own camera traps to cover all 50 states in a standardized way – and thus, after texting like 30 friends and some Twitter advertising, Snapshot USA was born. And we didn't have a dollar to fund it! It has been all collaboratively run. We recently published our first data paper in Ecology. We are surveying the same locations for the 3rd year in a row now and we hope this will be useful historical baseline data. Because we started in 2019, we now have before and "after" Covid-19 shutdown data, for example.

7. So Snapshot USA might be the start of a long-term camera trapping dataset in the future, but what is considered "long-term" for these types of methods, given their relative novelty?

The longest I can think of is a ~20 year dataset from Belize. Because of grant cycles and the need to re-locate cameras, people generally don't think to leave a camera in a single spot for a long time. This is why projects like Snapshot USA are important and will be complemented well by the growth of other collaborative platforms like iNaturalist.

Practitioner Perspective continued…

8. What is your favorite fossil?

I am always prepared for the "what is your favorite mammal" question, but I don't generally think about fossils. I will go with the giant ground sloth, because it blows my mind to think an animal like that lived right here [in North Carolina] within the past 10,000 years.

9. How does knowing there was a giant ground sloth change how you view present day ecosystems, if at all?

From my research perspective, we think a lot about protecting biodiversity and species interactions in a given area, but we are so focused on extant species that we forget all of the living species coexisted with things like mastodons and sloths…what was their role? I would love to get involved with that type of research and collaborate with paleontologists.

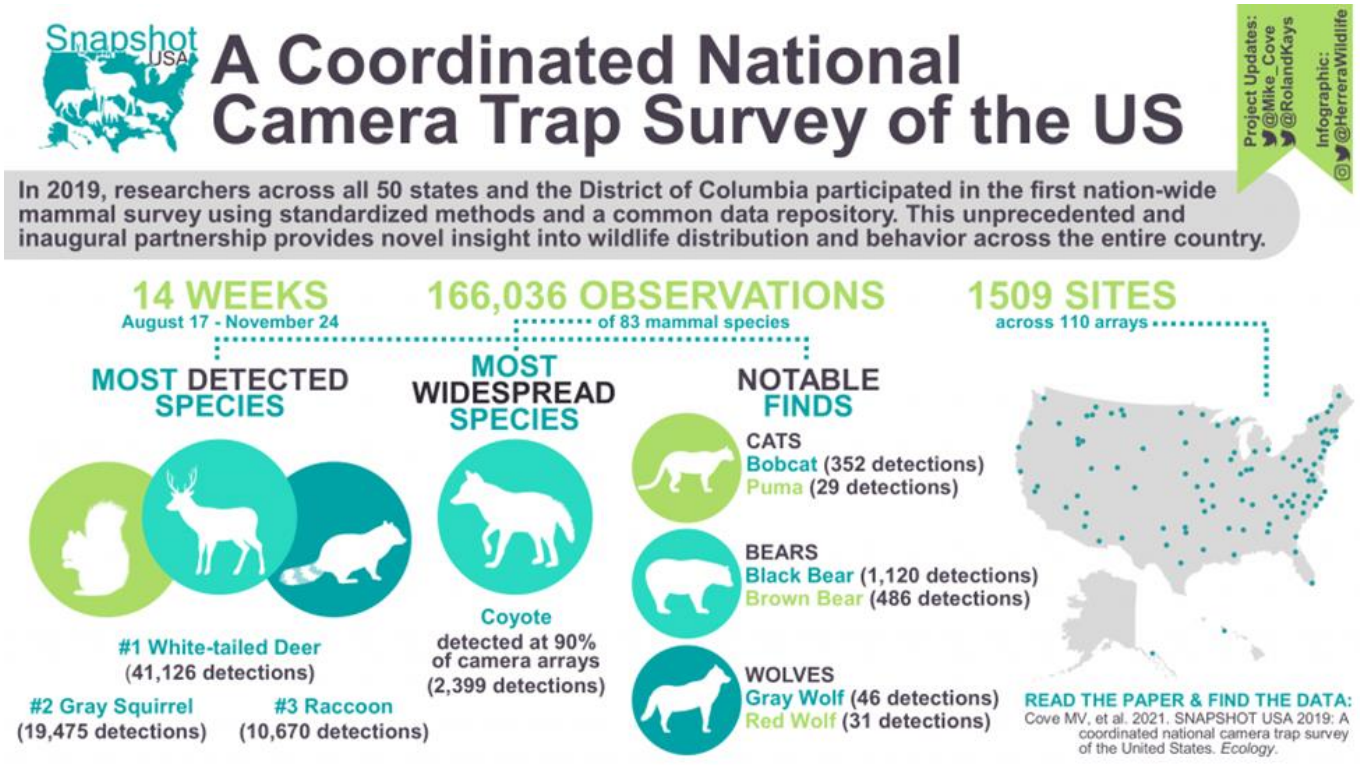

Image caption: Infographic summarizing 2019 Snapshot USA results (including an amazing 166,036 unique detections of 83 species of mammals); infographic by @HerreraWildlife.

Student Section

Introducing: CPN Student Coffee Hour!

The CPN student panel is excited to introduce the CPN student coffee hours. These are monthly informal meetings where students interested in conservation paleobiology and related disciplines can get to know their peers and discuss relevant topics—including the job market, publication process, conferences, meetings, research projects, policies, science communication, work-life balance, and mental health.

Separate hour-long (60 minutes) meetings will be held for the Americas and Eurasia to cover all time zones.

If you are interested in participating in or moderating a coffee hour, please fill out this Google form: https://forms.gle/Qcm7qefmGfYAwPw7A

We will then add you to an email list where the dates and zoom links for the next coffee hours will be distributed. We hope to see you there!

Reminder: We Have a Database for Student Resources

Check our Student Resources Database! To view the database, please visit our resources page: https://conservationpaleorcn.org/resources/. You will find a regularly updated database which includes lists of jobs, funding, grants, field schools and trips, conferences, and workshops.

Paleo Proxy Spotlight – Pollen *by Laura Hemmingham*

In this new feature of our newsletter, we shine the spotlight on one type of paleo proxy in each issue.

What is a proxy?

A proxy is something that can serve as a substitute for another thing which is absent or cannot be measured directly. In any discipline involving researching the past, proxies can be used to reconstruct something long after the original thing is gone. For example, there is no way of knowing the climate 10,000 years ago without the use of proxies, as past temperature cannot be measured directly. However, through the use of proxies (*e.g.* pollen counts, sediment analysis, tree rings, isotopes, etc.), we can reconstruct the most likely climate and environment that prevailed during that time.

How are proxies useful to scientists?

Proxies are useful to scientists like paleoecologists because they allow us to interpret events in Earth's history against a background of environmental knowledge. They allow us to understand things like variability in climate, vegetation cover, sea level rise, rainfall, atmospheric composition and global wind patterns, among other things. Some proxies have multiple uses, as is true for pollen, the focus of this issue.

Although the resolution and reliability of proxies can vary between proxy type and source, the combination of data from several sources, including isotopic, palynological (pollen) and plant macrofossils provide different depths of interpretation and allow scientists to piece together different layers of paleoenvironments.

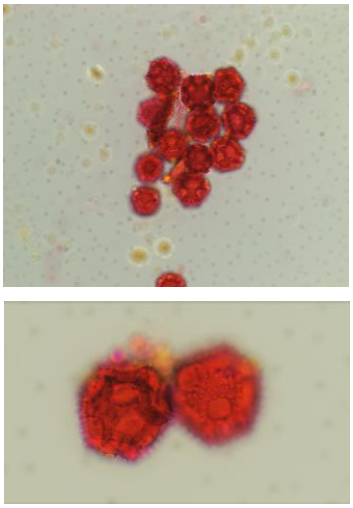

Figure 1 *Pollen grains of the Dandelion (Taraxacum) collected by Dr Marta Perez Fernandez from the campus of Royal Holloway, University of London. Photos courtesy of Dr Perez Fernandez.*

Pollen

Individual pollen grains are microscopic products, released from their parent plants. As pollen is produced in such high quantities, a large amount can get incorporated into soils, and sediments at the bottom of lakes, ponds and other bodies of water. Consequently, scientists can extract the pollen grains and study them under a microscope (figure 1). Their unique colours, shapes and sizes allow scientists to distinguish them, and assign them to a particular genus or species. As various plant and tree species have different climatic tolerances, by understanding which vegetation grew in a certain area at a specific time, an idea of the prevailing climate can be achieved. By tracking the changes in vegetation cover over time, variations in climate can also be understood from pollen grains. Therefore, by identifying the parent plants of the many different species of pollen grains in a sample, a scientist can reconstruct the prevailing environment of a location, both climatically and by vegetation cover. However, while the study of pollen, or 'palynology', is extremely useful, due to the external factors influencing pollen deposition and subsequent retrieval (*e.g.* pollen grain size, quantity of pollen grains released into the environment by the parent plant, and it's pollen dispersal mode (all of which will affect the likeliness of their retrieval), in addition to the lag between climate change and vegetation response, etc.), the use of a multi-proxy approach towards paleoenvironmental research is favourable. However, this is not always possible, as not all proxies are present for every location on Earth or time period in history.

Fun Proxy Fact

Did you know pollen is useful not only in paleoenvironmental reconstruction, but also in the science of the present, such as in forensics? By matching pollen grains to their parent plant, forensic scientists can reconstruct the last environment a person or object was in based on the pollen present in a sample. For example this podcast details the use of matching pollen grains in a vehicle, to the vegetation around some tyre marks in a field where a murder scene occurred.

Postcard from the Field

In this feature of our newsletter, we showcase members' research in the field, lab, or other setting.
Please submit your "postcards" with approximately 100 words of text to us at conservationpaleo@floridamuseum.ufl.edu
Submissions might also be featured as blog and social media posts. Thank you in advance for your contributions!

Lynn Wingard (PhD, Research Geologist) U.S. Geological Survey, United States

My research focuses on pre-20th century conditions in the Greater Everglades Ecosystem of south Florida to provide the context for resource managers to set targets for restoration. A primary goal of Everglades restoration is to re-establish more natural delivery of freshwater to the wetlands and estuaries in the region. By analyzing biotic assemblages from sediment cores collected from Florida Bay and Biscayne Bay, we can estimate pre-water management salinities and freshwater flow. To interpret the environments represented by the core assemblages, we investigate the environmental requirements of the living organisms. Our recent efforts have focused on the mangrove transition zone and after a pandemic-related hiatus, we were ecstatic to get back in the field in August 2021! Here, I am searching for mollusks and other invertebrates at the base of dwarf mangroves, near Whitewater Bay, Everglades National Park.

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Conservation Paleobiology Network

Supported by RCN-NSF Award: EAR-1922562

Are you interested in:

…contributing to **Postcards from the Field**?
…sharing a recent publication as a **Research Highlight**?
…being featured in a **Practitioner's Perspective** piece?
…providing other content suggestions for this newsletter?

If yes, please email us at conservationpaleo@floridamuseum.ufl.edu

Invite Your Colleagues to Join our Network!

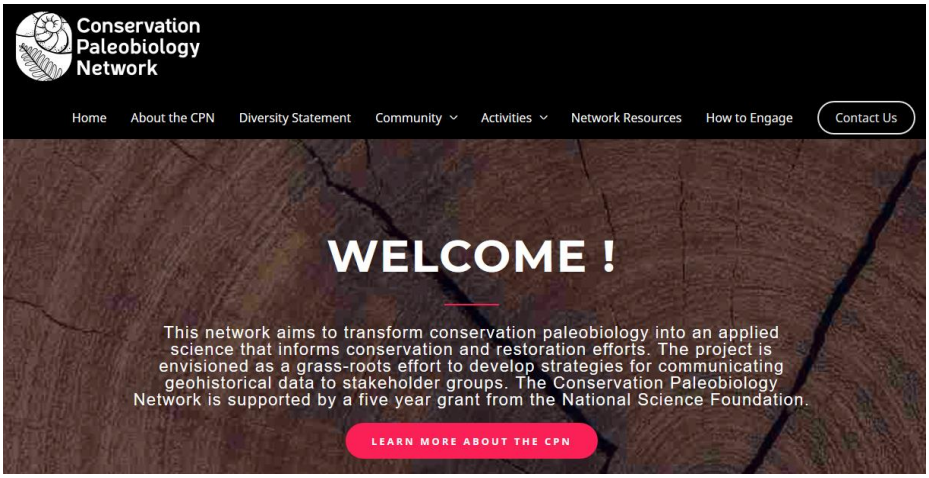
If you know people who might be interested in our network, please invite them to join. You can use the link below to extend your invitation on behalf of our network.

By joining the network, you become a member of our Community of Practice. The membership does not impose any obligations, but enables participants to engage fully in network activities. Members will be able to:

1. Participate in the CPN mailing list
2. Nominate and self-nominate for committees and panels
3. Submit announcements for publication in the CPN Newsletter
4. Apply to participate in the CPN activities such as Field Courses
5. Submit proposals for CPN field courses and CPN working groups
6. View CPN webinars and submit proposals for webinar modules

To join please go to our website and select "Join the Network".

Visit the website! https://conservationpaleorcn.org/



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