14th Annual
EEMB Graduate Student Symposium
Saturday, February 3rd, 2018
Marine Science Research Building Auditorium

09:00 am – Registration (with light breakfast and coffee)
09:45 am – Welcome: Debora Iglesias-Rodriguez, EEMB Faculty Graduate Advisor
10:00 am – Keynote Speaker: Synth-Pop: NCEAS and the new wave of synthesis science - Geoff Willard, Deputy Director of National Center for Ecological Analysis and Synthesis (NCEAS) and the Science for Nature and People Partnership (SNAPP)

- Coffee Break (10:45 am) -

11:00 am – Die another day: The strategy of sporulation in insect-vectored yeast communities - Kelly Thomasson
11:15 am – Comparative limnology of oligotrophic lakes and reservoirs and their effects downstream ecology - Adam Cohen
11:30 am – Speed talks by… “Art & Science--A Beautiful Dance”: Lessons learned on stage, in the lab, and at sea
   - Xochitl Clare
      An Introduction to… - Jason Johns
      An Introduction to… - Jannine Chamorro
      Why I Swiped Right on UCSB - Jake Sarver
11:50 am – Harnessing ecological processes to facilitate coral restoration - Mark Ladd
12:05 pm – Enzyme differences shape the evolution of bioluminescent courtship displays - Nicholai ("Niko") Hensley
12:20 pm – Speed talks by… From volcanoes to fire, a disturbance ecology journey - Kathryn Culhane
   Put a grid on it: a love of salamanders over a heterogeneous landscape - Tatum Katz
   An introduction to… - Bart DiFiore
   An Introduction to Fish Pee and Me - Katrina Munsterman

- Lunch (12:40 pm) -

1:45 pm – The genetic evolution of reproductively isolating male pheromone preference in Drosophila simulans and sechellia - Michael Shahandeh
2:00 pm – Individual variation in queen morphology and behavior predict colony performance in the wild - Colin Wright
2:15 pm – Speed talks by… An Introduction to… - Samantha Csik
   Field research and field learning through the UC Natural Reserve System - Michelle Lee
   Effects of Spatial Heterogeneity in Browsing on Coral Reef Community Structure and Dynamics - Dana Cook
2:30 pm – Prolific origination of eyes in Cnidaria with co-option of non-visual opsins - Natasha Picciani
2:45 pm – Investigating Benthic Marine Sediments as a Nutrient Source to the Overlying Water Column - Heili Lowman
3:00 pm – Speed talks by… Full circle: convergence in life and science - An Bui
   An Introduction to… - Kenneth Gilliland
   An Introduction to… - Grant Doering

- Coffee Break (3:15 pm) -

3:30 pm – Exploring the utility of dermal denticles to characterize shark assemblages on coral reefs - Erin Dillon
3:45 pm – Habitat structure enhances the relationships between predator behavior, prey behavior, and prey survival rates - James Lichenstein
4:00 pm – Speed talks by… An Introduction to… - Emily Hardinson
   An Introduction to… - Krista Kraskura
   An Introduction to… - Rachel Behm
   An Introduction to… - Terra Dressler

- Happy Hour on MSRB Balcony (4:30 pm) -
- Dinner in the Graduate Student Association Lounge (6:30 pm) -

Funding provided by: Graduate Division, Graduate Student Association, Associated Students, EEMB Department
KEYNOTE

Geoff Willard (Deputy Director of NCEAS and SNAPP)

For over two decades, the National Center for Ecological Analysis and Synthesis has innovated new synthesis and data science methods in ecology, and has supported diverse teams of scientists in the production of groundbreaking research. Geoff will describe the vision for synthesis science that NCEAS is based upon, and share ideas for how early career ecologists can get involved.

FULL TALKS

Kelly Thomasson
Die another day: The strategy of sporulation in insect-vectored yeast communities.

_Saccharomyces cerevisiae_ is a unicellular fungus that shows global dispersal despite its lack of functional mobility. These eukaryotic microbes rely on water and other mobile organisms to transport them to new locations. When the vector of dispersal is an insect, this movement can be deadly, as the cells are often ingested and digested in order to be moved. The outcome of this gut-based dispersal is dependent on the life history state these yeast cells occupy when they are transported: actively dividing vegetative cell or quiescent spore. What is less clear is how long should a yeast cell wait to sporulate? I performed a spore-vegetative survivorship assay which allowed me to quantify the probability of surviving insect digestion in both life history states. Results of this assay will be used to parameterize a model of this trade-off in the yeast system.

Adam Cohen
Comparative limnology of oligotrophic lakes and reservoirs and their effects downstream ecology

California’s water management system includes more than three dozen high-elevation reservoirs, but their physical, chemical, and biological characteristics have largely not been described. The reservoirs, managed for a variety of purposes including recreation and hydropower, differ from nearby lakes primarily in their seasonally fluctuating water level, and corresponding downstream water regime. This research compares the limnological characteristics of high-elevation Sierra Nevada reservoirs to nearby natural lakes, across all seasons and multiple years. Water characteristics may also drive differences in greenhouse gas emissions and primary productivity, which are both examined during the ice-free season. Stream benthic macroinvertebrates, known to be responsive to water regime, are identified to determine the effects of flow regulation and differences in outlet chemistry on local ecology. Water chemistry was similar between the lakes and reservoirs across years, with some seasonal exceptions caused by reservoir characteristics, while benthic macroinvertebrates exhibit a strong response to flow. Carbon dioxide concentrations at all sites generally decreased through the summer, as chlorophyll-a increased with time since ice-off. This suggests that the effects of reservoir management on oligotrophic systems are limited, though downstream organisms are substantially influenced by flow regulation.

Mark Ladd
Harnessing ecological processes to facilitate coral restoration

Globally, coral restoration is gaining traction as a viable strategy to help restore degraded reefs. However, despite widespread increases in coral outplanting, there is a dearth of studies documenting the effect of these restoration efforts on coral reef communities or ecosystem functions. Here, I present a case study quantifying the success of coral restoration efforts on diversity, community structure, and ecological processes at four sites in the Florida Keys, USA spanning a decade of coral restoration effort. Despite a 4-fold increase in coral cover in restored areas, we found no differences in coral or fish diversity or community structure between restored and degraded sites. Consequently, we did not detect differences in recruitment, herbivory, or corallivory, suggesting that solely outplanting corals may not be sufficient to generate the expected benefits of coral restoration. We advocate that the next phase of coral restoration must focus on harnessing ecological processes that drive community dynamics on coral reefs. Drawing on decades of coral reef ecology research and lessons learned restoring other ecosystems, we posit that restoration practitioners control factors like the density, diversity, and identity of corals outplanted, site selection, and transplant design to restore positive- or break negative feedback processes that make restoration more successful. Ultimately, we argue that coral restoration should explicitly incorporate key natural processes to exploit dynamic ecological forces and drive recovery of coral reef ecosystems.

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Nicholai (“Niko”) Hensley
Enzyme differences shape the evolution of bioluminescent courtship displays

Understanding how mating phenotypes diversify during species radiations is of central interest to evolutionary biologists. The bioluminescent courtship displays of cypridinid ostracods (or sea fireflies) are an excellent system for this since amazing variety evolves while using a conserved biochemical mechanism. By measuring light production from induced bioluminescence in 38 species, and fitting models describing biochemical reactions to estimate enzymatic differences, we infer for the first time that changes in both enzymes (c-luciferase) and enzyme mixtures have likely contributed to phenotypic diversity in these signals. First, we discovered differences between species in the c-luciferase biochemical reaction. We also find these differences are nonlinearly correlated with the duration of natural courtship pulses. From these data, we infer that changes to both c-luciferase sequence and usage contribute to diversity in ostracod courtship displays. More generally, both types of change can influence the evolution of behavioral differences between species, but that historical reliance on either type may affect its evolutionary trajectory.

Michael Shahandeh
The genetic evolution of reproductively isolating male pheromone preference in Drosophila simulans and sechellia - 

Differences in mating behaviors are a common prezygotic mechanism preventing mating between species. However, little is known about how mating behaviors become different between species, at the genetic or neurological level. In Drosophila, pheromones act as important species-specific signals that prevent hybridization. In D. sechellia, females express the pheromone 7,11-heptacosadiene (7,11-HD); D. simulans females express a different pheromone. D. sechellia males are stimulated to court by 7,11-HD. But for D. simulans, 7,11-HD suppresses courtship behavior. Because these species overlap in range, male pheromone preference is the primary mechanism preventing hybridization. I have harnessed this difference in pheromone preference, in combination with next generation DNA sequencing technology, to identify the genetic basis of male pheromone response. A majority of the difference in pheromone preference behavior maps to a small region on a single chromosome, suggesting that behavioral isolation may be attributed to a small genomic region with large effect. This implies that substantial barriers to mating can evolve via few genetic changes, rapidly isolating populations. I will present the results of our efforts to fine-map this region and test a widely-studied gene of interest, expressed in the developing fly brain, for its role in behavioral divergence. I aim to provide an in-depth study of the mechanisms underlying the evolution of a reproductively isolating behavior—a necessary goal of behavioral research, so that we may uncover general patterns in the types of changes underlying evolutionary shifts in behaviors that isolate species.

Colin Wright
Individual variation in queen morphology and behavior predict colony performance in the wild

The term “keystone individual” describes a type of individual within a group whose presence is more impactful to the group than other “generic” individuals. The queens of social insects are good examples of keystone individuals because a queen’s influence on their colony is great, and the proportion of colony constituents that are queens is typically low. While it has been suggested that a queen’s behavioral phenotype might contribute to differences in colony success, no study has yet demonstrated these links in situ. Here we use the singly founding (haplometrotic) paper wasp Polistes metricus to examine whether queen personality, measured shortly after colony founding (pre-emergent phase), and morphology, can predict colony size (a proxy for queen fitness) and parasite load in the wild. We found that bolder, more aggressive, and larger queens gave rise to larger colonies than other queen phenotypes. Additionally, docile queens that spent less time foraging in the early spring harbored more nest parasites throughout the season than aggressive and more active foraging queens. Differences in queen traits therefore appear to be a major determinant of colony success under field conditions.

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Animal eyes vary considerably in morphology and complexity, and are thus essential for understanding the evolution of complex biological traits. While eyes evolved many times in bilaterian animals with elaborate nervous systems, image-forming and simpler eyes also exist in cnidarians, ancient non-bilaterians with only simple neural nets to process information. How often eyes of varying complexity, including image-forming eyes, arose in animals with such simple neural circuitry remains obscure. Here, we produced large-scale phylogenies of Cnidaria and their photosensitive proteins and coupled them with an extensive literature search on eyes and light-sensing behavior to show that cnidarian eyes originated at least eight times, with complex, lensed-eyes having a history separate from other eye types. Compiled data show widespread light-sensing behavior in eyeless cnidarians and comparative analyses support ancestors without eyes that already sensed light with dispersed photoreceptor cells. The history of expression of the photoreceptive protein opsin supports the inference of distinct eye origins via separate co-options of different non-visual opsin paralogs into eyes. Overall, our results show that eyes evolved repeatedly from ancestral photoreceptor cells in non-bilaterian animals with simple nervous systems, co-opting existing precursors, similar to what occurred in Bilateria. Our study underscores the potential for multiple, evolutionarily-distinct visual systems and underlying developmental pathways, even in animals with simple nervous systems.

Heili Lowman
Investigating Benthic Marine Sediments as a Nutrient Source to the Overlying Water Column

Permeable sediments were once thought to be regions devoid of significant biogeochemical processes due to consistently low concentrations of dissolved organic carbon. Recent research instead suggests that permeable sediments are hotspots of biogeochemical activity whose efflux of nutrients may support benthic as well as pelagic primary production. I aim to quantify the byproducts of organic matter breakdown, specifically dissolved inorganic nitrogen species, that could be released from sediments into the overlying water column. In order to measure the efflux of nutrients from marine sediments, I use a series of sediment bioreactors and compare results from sediments collected at estuarine and kelp forest reef sites within the Santa Barbara Channel. Results suggest that permeable marine sediments collected from reef sites are a net source of ammonium (NH4+) to the overlying water column, and additional runs are planned for Summer 2018. The results of this ongoing study will be used to inform nutrient budget calculations for nearshore regions within the Santa Barbara Coastal Long Term Ecological Research program.

Erin Dillon
Exploring the utility of dermal denticles to characterize shark assemblages on coral reefs

Assessing how and why predator assemblages vary over space and time is crucial for understanding ecosystem trophic structure and dynamics. Historical accounts often depict high shark densities that sharply juxtapose contemporary reports in the same regions. However, evaluating these anecdotes’ reliability is challenging because detailed shark surveys began after the initial degradation of marine ecosystems and quantitative pre-exploitation shark baselines are nearly nonexistent. To address this challenge, we are reconstructing historical shark communities using dermal denticles, the tiny tooth-like scales covering elasmobranch skin, which accumulate and are well-preserved in coral reef sediments. They can be extracted and identified to reveal spatiotemporal patterns of relative shark abundance and diversity. To explore the utility of the denticle record as a new paleoecological proxy, we assessed its fidelity and resolution on Palmyra Atoll (central Pacific), where shark abundance is high and well-documented. We found strong alignment between denticle abundance per kilogram sediment and censused shark abundance, and denticle diversity reflected known taxa on the atoll. Comparing the outputs of these survey methods helps standardize the denticle record and explore its limitations, enabling comparisons between denticle assemblages in congruent habitats across wide areas. This new tool could provide insight into shark communities before industrial fishing, facilitate assessments of the magnitude and ecological consequences of shark declines, and help set more appropriate, region-specific management targets.
The individual behavioral traits of predators and prey often determine the outcome of their interactions, but in some cases, they do not. Here, we examine whether changes to habitat complexity could alter the effects of predator and prey behavior on their prey survival rates. Specifically, we test whether individual behavioral traits (activity level, boldness, and perch height) of predators and prey or a composite metric of multidimensional behavioral diversity (behavioral hypervolumes) best predicts survival rates in staged mesocosms with contrasting structural complexity. We stocked mesocosms with a host plant and groups of cannibalistic predators (n = 5 mantises/mesocosm) and their prey (n = 15 katydids/mesocosm), and mesocosms varied in the presence/absence of additional non-living climbing structures. We found that mantis survival rates were unrelated to any behavioral metric considered here but were higher in structurally complex mesocosms. Unexpectedly, katydids were more likely to survive when mantis groups occupied larger hypervolumes, indicating that more behaviorally diverse predator groups are less lethal. Katydid mortality was also increased when both predators and prey exhibited higher average perch heights, but only in environments with supplemental structure. This is consistent with the expectation that added habitat complexity increases the effect of intraspecific behavioral variation on prey survival. Collectively these results convey that the effects of predator and prey behavior on prey survival could depend highly on the environment in which they are estimated.