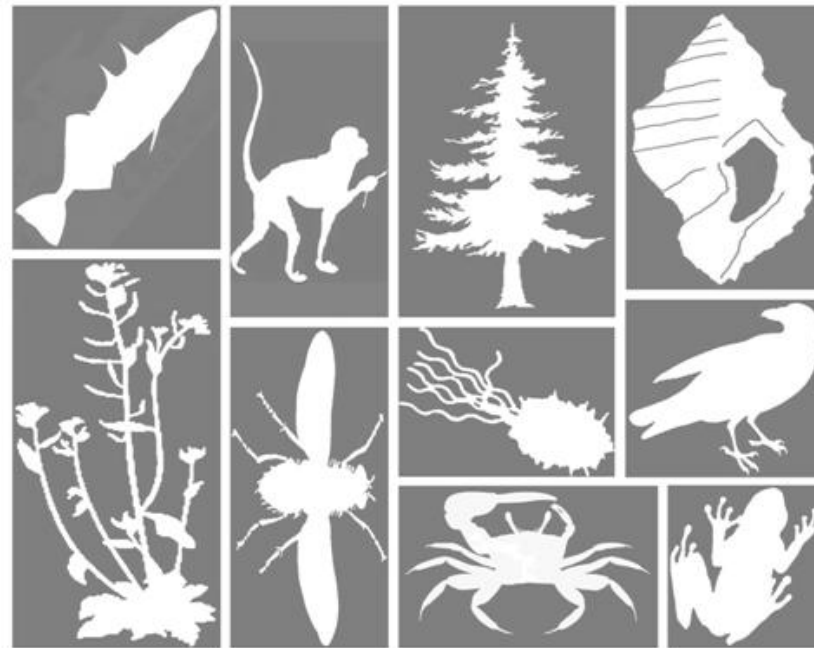


**2007 Retreat
Ecology & Evolution
Graduate Program
Stony Brook University
March 3, 2007**

Bates House, Melville Memorial Foundation Arboretum
Setauket, New York



**STONY
BROOK**
STATE UNIVERSITY OF NEW YORK

Stony Brook University
Ecology and Evolution Retreat
March 3, 2007

Full author lists and abstracts are in the attached pages.

E&E 2007 Retreat Web Page <http://life.bio.sunysb.edu/ee/retreat/retreat07program.pdf>

Stony Brook University
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9:00 BREAKFAST

10:00 Session I, Rocio Ng Chair

- 10:00 **Michael Doall**
Restoring the hard clam (*Mercenaria mercenaria*) on Long Island
- 10:20 **Rachel Przeslawski**
Hard clams and harmful algae: Effects of diet on lipids in *Mercenaria mercenaria* larvae
- 10:40 **J. Matt Hoch**
Morphological and functional variation of the barnacle penis

11:00 - 11:20 COFFEE BREAK

11:20 Session II, Jin Gao Chair

- 11:20 **James Rohlf**
The "island rule" and spurious regressions
- 11:40 **Chris Noto**
Environmental control of vertebrate preservation over space
- 12:00 **Norah Warchola**
Butterfly movement in a post-agricultural landscape

12:20 - 02:00 LUNCH
Poster Presentation

2:00 Session III, Emily Thompson Chair

- 2:00 **Josh Banta**
No local adaptation to the photoperiodic regime per se in *Arabidopsis thaliana*
- 2:20 **Jennifer Verdolin**
Resources are a determinant of social structure in Gunnison's prairie dogs (*Cynomys gunnisoni*)
- 2:40 **John Wiens**
Life history evolution in marsupial frogs: does ancestral reconstruction mislead?

3:00 - 3:20 COFFEE BREAK

3:20 Session IV, Aman Gill Chair

- 3:20 **Rodrigo Cogni**
Patterns of local adaptation in an insect-plant interaction
- 3:40 **Jon Flowers**
Adaptive evolution of metabolic pathways in *Drosophila*
- 4:00 **Windsor Aguirre**
The osteological basis of body shape evolution in threespine stickleback fish
- 4:20 **R. Geeta**
Did *Datura* occur in Asia before 1492?

4:40 - 6:00 ENTERTAINMENT, AWARDS

6:00 DINNER

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ABSTRACTS

(speakers in italics)

Aguirre, Windsor E., Sumera Akram, and Michael A. Bell

The Osteological Basis of Body Shape Evolution in Threespine Stickleback Fish.

Resident freshwater threespine stickleback have evolved repeatedly from oceanic populations throughout the northern hemisphere. Oceanic populations have a consistent body shape, but freshwater populations vary in body shape according to their ecology. One of the most common themes in freshwater stickleback evolution is the evolution of benthic and limnetic (planktivore) ecomorphs. Benthics are deep-bodied, occur in structurally complex, shallow lakes, and feed on large invertebrates. Limnetics are more elongate and inhabit the water column of deep lakes. Very little is known, however, about the osteological or genetic basis of these body shape differences. We x-rayed 30 male fish from two limnetic, two benthic, and one anadromous population and measured skeletal elements throughout the body. Digital images of the external body of the same fish were taken to assess body shape. Limnetics had more vertebrae than oceanic stickleback and benthics, and the increase was especially pronounced in the caudal region. Benthics either had the same number or fewer vertebrae than oceanic stickleback, and the reduction occurred in the precaudal region, suggesting alternate mechanisms for the gain and loss of vertebrae from the ancestral condition. Changes in length of vertebrae, however, were complex. Variation in the cleithrum (a vertical shoulder bone) was substantial and strongly associated with variation in body shape among populations. Combined measures of pterygiophores plus neural or haemal spines were also strongly associated with body shape variation. Differences in elements ventral to the vertebral column appeared to be greater in some cases, suggesting that changes in body depth do not occur symmetrically about the vertebral column. We discuss the implications and directions for future research.

Keywords: *Gasterosteus aculeatus*, benthics, limnetics, body shape evolution, osteology, adaptive radiation.

Banta, Joshua, Jefferey Dole¹, Mitchell Cruzan², and Massimo Pigliucci

No local adaptation to the photoperiodic regime per se in *Arabidopsis thaliana*.

Plants can achieve an appropriate phenotype in particular conditions either constitutively or plastically, depending in part on the scale of the environmental conditions. Small-scale environmental conditions should, in some circumstances, result in adaptive phenotypic plasticity that allows individual plants to fine-tune their responses to particular microenvironments, whereas large-scale variation should result in selection for local adaptation and differences in trait means among environments. In the latter case there would be no selection directly on plasticity, so populations should generally display random plasticity in response to variation in the large-scale environmental variable. We tested this hypothesis by exposing natural populations of the well-studied wildflower *Arabidopsis thaliana* to photoperiodic regimes characteristic of their native and foreign environments. Since the photoperiodic regime varies only at very large spatial scales relative to the size and dispersal abilities of this plant, we predicted that populations would be locally adapted to their native photoperiodic regime while generally displaying random plasticity to the same environmental variable. We found that various comparisons with putatively neutral AFLP markers were consistent with the conclusion that the phenotypic means diverged adaptively, although probably not due to selection for adaptation to the photoperiodic regime per se. Interestingly, while the plasticities did not show evidence of adaptive divergence, as expected given the unlikely opportunity for the progeny of a given plant to experience a significantly different photoperiodic regime, they were generally more similar than could be accounted for by neutral AFLP marker differentiation, suggesting some sort of constraint on the plasticities to the novel environments.

Keywords: *Arabidopsis thaliana*, local adaptation, photoperiodic regime.

Cogni, Rodrigo

Patterns of local adaptation in an insect-plant interaction.

The evolution of interactions among species often happens in a geographical mosaic, in which selection, drift and gene flow affect geographically structured populations. If natural selection is a strong factor, local adaptation is expected, meaning that local resident genotypes are expected to have higher fitness than genotypes from other populations. I investigated local adaptation at different geographical scales in the interaction between the alkaloid-bearing legume *Crotalaria pallida* and its seed predator, the arctiid moth, *Utetheisa ornatrix*. I studied three populations in southeast Brazil (about 150 km apart) and compared a Brazilian population to a population from Florida, USA. Larvae from each population were fed fruit from plants from each population in a common garden. At a local scale, there was no significant interaction of plant population and moth population on any of the moth fitness components measured. At a continental scale, moths from Florida and Brazil both had significantly heavier pupa eating their local plant population than when fed on plants from Brazil and Florida, respectively. Local adaptation was observed at a continental geographical scale, but not at a local scale.

Keywords: coevolution, geographical variation, interaction, local adaptation, plant-herbivore coevolution.

Doall, Michael H., Dianna K. Padilla, and Carl P. LoBue¹

Restoring hard clam (*Mercenaria mercenaria*) populations in Great South Bay, New York: Reasons, strategies, and measures of success

The Great South Bay (GSB), a barrier island estuary on the south shore of Long Island, New York, historically has been home to some of the most productive bivalve fisheries in the USA. Although the native oyster beds have been gone for over a century, the fishery for hard clams (*Mercenaria mercenaria*) in GSB thrived into the 1980s, accounting for over half of the nation's harvest in the mid-1970s. However, decades of unsustainable harvest practices and sub-optimal environmental conditions have reduced hard clam populations to recruitment limiting levels. Their filtering capacity is no longer a dominant factor in the benthic-planktonic food web, and chronic nuisance algal blooms now plague the system. Because of their importance in estuarine ecosystems, restoration of hard clams in GSB is an important objective for The Nature Conservancy (TNC). TNC's acquisition of 11,500 acres of underwater lands in GSB has set the stage for a shellfish restoration effort on an unprecedented scale in New York waters. Establishment of "spawner sanctuaries", or harvest-free areas stocked with high densities of adult clams, is a major strategy in this effort, which is intended to increase fertilization efficiencies and rebuild the reproductive potential in the bay. To help measure success and guide implementation, the Functional Ecology Laboratory has been contracted by TNC for the past 3 years to monitor clam condition and spawning. The transplanted clams can ripen gonads and spawn in many locations across the TNC property in GSB, although large inter-annual variability exists in clam condition and spawning potential. We present an overview of the current hard clam restoration efforts in GSB and the associated monitoring conducted by FERTL.

Keywords: clams, *Mercenaria mercenaria*, monitoring, restoration, spawner sanctuary

¹ The Nature Conservancy – Long Island Chapter

Flowers, Jon. M., E. Sezgin¹, S. Kumagai, D. D. Duvernell², L. M. Matzkin³, P. S. Schmidt⁴, and W. F. Eanes

Adaptive evolution of metabolic pathways in flies and microbes.

The adaptive significance of enzyme variation has been of central interest in population genetics, but how natural selection operates on enzymes in the larger context of biochemical pathways has not been broadly explored. An important step toward understanding the broader significance of enzyme variation for adaptation of metabolic pathways is to identify the enzymatic steps that have been subjected to adaptive selection. We use population genetic methods to test for deviations from neutral expectations in the central metabolic corridor of *Drosophila* and *E. coli*. Nucleotide polymorphism and divergence data indicate that departures from neutrality are common in the pathways of central metabolism and suggest that Darwinian selection has been of central importance in the evolution of metabolic networks in both groups. We reconcile these results with population genetics theory and existing data on metabolic regulation and propose that the incidence of adaptive selection is related to the distribution of flux control. The data provide a system-wide view of natural selection and suggest that natural selection on branch point enzymes may have special significance in metabolic adaptation.

Key words: adaptation, metabolic control, network evolution, population genomics, positive selection

¹Present Address: Laboratory of Genomic Diversity, National Cancer Institute, Frederick, MD 21702, USA

²Present Address: Department of Biological Sciences, Southern Illinois University, Edwardsville, IL 62026, USA

³Present Address: Department of Ecology and Evolutionary Biology, University of Arizona, Biosciences, West 310, 1041 E. Lowell St. Tucson, AZ 85721-0088, USA

⁴Present Address: Department of Biology, University of Pennsylvania, Philadelphia, PA 19104, USA

Geeta, R. and Waleed Gharaibeh

Did *Datura* occur in Asia before 1492?

Datura (Solanaceae), a narcotic, hallucinogenic plant, is considered to be a New World genus. However, prior to the 1980's (even today, in many circles), at least one *Datura* species was assumed to be native to the Old World, possibly India, where it had an important presence in religion and traditional medicine (Ayurveda). Recent systematic assessments question this assumption. We draw on textual and graphic evidence from Indic and Arabic, as well as botanical, sources and conclude that there is sufficient evidence to point to a pre-Columbian occurrence of *Datura* in the South Asia dating to at least the 6C CE, and possibly back to the 1C BCE.

Datura may represent one (only?) case in which the hypothesis of pre-Columbian, presumably human-mediated, transfer of a plant from the New to Old World is supported by several different types of evidence

Key words: geography, history, human-mediated, systematics

Hoch, J. Matthew

Morphological and functional variation of the barnacle penis.

Simultaneous hermaphrodites are predicted to adjust their ratio of male to female allocation based on mating group size and local mate competition. The barnacle, *Semibalanus balanoides* forms mating groups in which competition for mates is constrained by the function of the penis and its ability to successfully reach potential mates. Barnacles in environments exposed to the waves of the open ocean had thicker penises than barnacles in protected areas. Barnacles in sparse aggregations had longer penises than those from crowded aggregations. Fertilization success rates dropped as neighbor distance increased, but the magnitude of the effect was much greater in sites exposed to waves of the open ocean. The results of a reciprocal transplant experiment suggest that penis morphology is adaptive for wave environment. Applying this data to sex allocation theory leads to the prediction that barnacles in sites exposed to ocean waves should have smaller functional mating groups than those in protected sites and therefore a greater relative allocation to the female role.

Keywords: barnacle, functional morphology, hermaphroditism, penis, sex allocation

Noto, Chris R.

Environmental control of vertebrate preservation over space and time.

Differential preservation of plant and animal tissues due to environmental conditions is accepted as a wide-spread source of bias in the fossil record. Therefore, drawing paleobiological inferences based on fossil distributions can be problematic. Not all environments are preserved equally well in the fossil record, and some appear to be absent altogether. Environmental variation of preservation is driven by global climate patterns, which have varied considerably in the past. Little attention has been paid to how the interplay of environment-specific tissue degradation and biased environmental preservation affect ecological, environmental and climatic reconstructions. Identification of these biases and their effects on our observations are required to improve interpretation of the fossil record.

Despite more than 30 years of research, observational studies on modern terrestrial environments are inadequate to understand large-scale biases imposed by decay and diagenesis in buried remains. Laboratory experiments can fill the gaps in our knowledge of the complex biogeochemical interactions that determine the fate of buried remains. I present preliminary results of a 14-month controlled taphonomic experiment in which the interaction of soil hydrology, soil organic content, bone size, and plant type were explored. Results indicate that more porous sediment physically degrades bone, but clayey sediment leaches more calcium. Furthermore, bone undergoes greater calcium loss in the presence of plant material than when alone. Comparison to published records for fossil plant and vertebrate assemblages shows a similar effect of sediment type and environment on patterns of preservation, confirming the experimental observations. Global-scale climate patterns are important in determining not only the distribution of species diversity, but how that diversity is recorded into the fossil record.

Keywords: climate, diversity patterns, paleoecology, preservation, taphonomy

Przeslawski, Rachel, Dianna K. Padilla, Michael H. Doall, and Paul Bourdeau

Hard clams and harmful algae: effects of diet on lipids in *Mercenaria mercenaria* larvae.

Marine invertebrates have complex life histories that often include a swimming planktivorous larval stage. These pelagic larvae are vulnerable to numerous abiotic and biotic stressors, which can affect survivorship and growth rate. In addition, sublethal effects imposed by these factors may leave a lasting legacy after metamorphosis. We are testing whether the harmful brown tide alga *Aureococcus anophagefferens* affects the growth, condition and survivorship of the commercially-important hard clam, *Mercenaria mercenaria*. *M. mercenaria* was the dominant bivalve in Great South Bay, Long Island until the mid-1970s, but very few larvae are presently found in these waters. Brown tide has been hypothesized to pose a barrier to recovery of the hard clam populations by negatively affecting clam larvae. In laboratory experiments we have found that brown tide has no effect on the survivorship of clam larvae but can affect larval growth under some circumstances. It also may affect lipid accumulation during the larval phase, which has been shown to be important in other bivalves for post-metamorphic juvenile growth and survivorship. We are currently conducting a laboratory experiment to determine if a diet of brown tide decreases lipid content of developing hard clam larvae.

Keywords: bivalve, brown tide, larvae, lipid content, phytoplankton

Rohlf, F. James

The “island rule” and spurious regressions.

The island rule is based on the common observation that larger animals are often smaller on islands and smaller animals are often larger on islands. There have been many studies trying to account for these observations. However, many of the papers attempting to demonstrate this pattern have based their conclusions on inappropriate statistical methods. Examples will be given of regressions of ratios against their denominators, differences against their reference values, and rates against their time intervals. In addition, least-squares regressions have been used even though the independent variables are measured with as much error as the dependent variables. A suggestion for a more appropriate approach will be presented.

Keywords: bias, ratios, statistics, size

Verdolin, Jennifer L.

Resources, not male mating strategies, are a determinant of social structure in Gunnison's prairie dogs (*Cynomys gunnisoni*).

Previous studies of Gunnison's prairie dogs, *Cynomys gunnisoni*, have reached different conclusions about the factors influencing sociality in this species. I tested whether Gunnison's prairie dog social structure was resource-based or whether male mating strategies drive the organizational patterns observed. Group size, where the term group refers to individuals occupying the same territory, was predicted by territory size and density of food available. The spatial overlap of adults within territories was positively correlated with spatial patchiness of food resources. All group members participated in territory defense, although adult males engaged in significantly more inter group aggressive interactions. There was no significant difference in adult male and female home range size. The number of female home ranges that any given male home range overlapped was not correlated with male body mass, male home range size, or territory size. Contrary to predictions of typical mammalian male mating strategies, adult females ranged significantly further than males during the mating period. Body mass of males and non-reproductive females was similar, whereas that of reproductive females was smaller. In addition, males and females did not differ in size, based on skull length and skull width. Results from this study strongly suggest that patterns of space use and social structure in Gunnison's prairie dogs are the result of individual responses to resource abundance and distribution and are not due to male mating strategies, such as resource defense or harem defense polygyny.

Keywords: food resource patchiness, male mating strategy, social structure

Warchola, Norah.

Butterfly Movement in a Post Agricultural Landscape.

Habitat fragmentation is a concern for species that exist in agricultural and post-agricultural landscapes. Butterflies that live in these landscapes must deal with vegetation of varying successional ages as well as heavily managed areas of lawn and crops. This study focused on the behavior of representatives from two butterfly families, Pieridae and Nymphalidae. Two species of the family Pieridae, *Pieris rapae* and *Colias philodice* were observed at vegetation borders and their movement behavior was quantified. Movement was biased towards vegetation that was structurally similar to that of open habitats that they traditionally inhabit. This movement bias could not be explained by any of the microclimatic variables measured in the study. I also studied fruit-feeding nymphalid butterflies normally associated with structurally complex vegetation of shrubland and forest. Trapping these butterflies across five habitats showed that abundance corresponded with visual observations; fruit feeding nymphalids were caught most often in structurally complex habitats. These data correspond to behavior at vegetation borders, which showed that fruit-feeding nymphalids bias their movement towards structurally complex vegetation. These studies show that movement at vegetation borders is indicative of larger habitat preferences in butterflies. Butterflies do not seem to use microclimate as a cue to make movement decisions. Future studies will test whether structural complexity and resource abundance are used as cues. Understanding the factors that butterflies utilize to make movement decisions will allow us to better manage economically important landscapes where humans and butterflies coexist.

Keywords: *Asterocampa celtis*, agricultural landscape, butterfly, conservation, landscape ecology

Wiens, John.

Life history evolution in marsupial frogs: does ancestral reconstruction mislead?

Using phylogeny-based methods to identify evolutionary transitions has become an integral part of evolutionary biology. I demonstrate the potential for these methods to give statistically well supported but misleading inferences about character evolution. I also show how inferences of character evolution can be informed using GIS-based methods to reconstruct ancestral environmental regimes. We reconstruct a phylogeny for marsupial frogs (Hemiphractidae) using nuclear and mitochondrial DNA sequences and estimate patterns of life history evolution. We find that *Gastrotheca* species with complex life cycles are phylogenetically nested among species and genera with direct development. Assuming a single rate for gains and losses, there is strong statistical support for the hypothesis that the tadpole stage was lost early in the phylogeny but re-appeared within *Gastrotheca*. Assuming different rates of gain and loss (the model with significantly higher statistical support), the tadpole stage seems to have been lost multiple times but never regained. Given that both hypotheses cannot be correct, at least one reconstruction method must be giving well-supported but misleading results. Several lines of evidence (including GIS-based reconstructions of the ancestral climatic regime) suggest that the former hypothesis is correct, and that the tadpole stage has evolved from direct development within *Gastrotheca*, the only known case of such a reversal in frogs.

Keywords: amphibians, ancestral reconstruction, development, life history, phylogeny

Posters

Aguire, Windsor E. and Michael A. Bell. **Rapid adaptation of sea-run threespine stickleback fish after introduction to a lake**

Ehmer, Adam. **Variation in Herbivore Tolerance to Induced Host Resistance**

Lachance, Joseph. **Inbreeding and the pruning of family trees**

Oikawa Patricia. **Methanol emission response to simulated herbivory in big tooth aspen *Populus grandidentata* and white pine *Pinus strobes***

True John, Joseph Lachance, and Roman Yukilevich. **X-chromosome variation among New World populations of *Drosophila melanogaster*: roles in synthetic incompatibility and phenotypic divergence**

Walls, Ramona, Christina Richards, and Massimo Pigliucci. **Phenotypic Evolution in Invasive *Fallopia* on Long Island, NY**

Yukilevich Roman and John R. True. **Using computer simulations to determine the relative importance of two alternative mechanisms of reinforcement speciation: assortative mating and migration modification**