71.3 GUMM, J. M.*; BURNS, H.; CHERRIER, E.; Stephen F. Austin State University; *gummj@sfasu.edu*
Mate preference based on visual and chemical cues in colorful freshwater fishes
Understanding how females identify mates is fundamental to understanding the evolution of mating preferences and reproductive isolation among species. In colorful freshwater fishes, known as darters (genus *Etheostoma*), visual signals play a role in preferences for conspecifics over heterospecifics and are used by females to prefer males within species. Darters respond to both chemical and visual stimuli for appropriate predatory avoidance behavior. The role of chemical cues for mate preference, however, remains unclear. We tested the hypothesis that female *Etheostoma stigmaeum* use chemical cues to choose mates between conspecific males and heterospecific male *E. swaini*. These two species are sympatric, and males express similar breeding colors, but hybridization is not known to occur. Female *E. stigmaeum* were tested in standard dichotomous mate choice trials with a choice to associate with chemical cues derived from conspecific males or those from heterospecific males. We found that females had significant preferences for conspecific male chemical cues. Our results establish the use of chemical cues for mate choice in darters and highlight the potential for multimodal signaling to contribute to reproductive isolation between these species.

119.1 GUTMANN, A.K.*; MCGOWAN, C.P.; University of Idaho; *agutmann@uidaho.edu*
Built to hop: functional specialization of the hindlimb of the desert kangaroo rat (Dipodomys deserti)
Kangaroo rats hop bipedally whereas most other rodents exclusively use quadrupedal gaits. One hypothesis is that hopping evolved as a means of producing the large accelerations needed to escape predators. If this is the case, one would expect the musculoskeletal anatomy of the kangaroo rat hindlimb to be extremely specialized for accelerating. We measured the mass, fascicle length, and pennation angle of all major muscles in the kangaroo rat hindlimb, and the mass and length of the ankle extensor tendons. We also measured moment arms for all major muscles in the hindlimb. Based on these data, we calculated muscle physiological cross−sectional area, tendon cross−sectional area, tendon safety factor, elastic strain energy storage, and fiber length factor. We compared these data with published data for the rat (*Rattus norvegicus*), a quadrupedal generalist. Relative to body weight, the kangaroo rats were noticeably more well−muscled than the rats (1.7 times more hindlimb muscle mass/body mass). The hip extensors and the knee flexors represented the two largest muscle groups in both the kangaroo rats and the rats, but these muscle groups were larger in the kangaroo rats (1.6 and 1.8 times more muscle mass/body mass respectively). (Note: Many muscles belong to both muscle groups.) This is due primarily to relatively longer fascicle lengths. These large muscle groups produce the power kangaroo rats need for high acceleration. Additionally, the kangaroo rat ankle extensors had a high tendon safety factor and high fiber length factor indicating that the ankle extensor tendon can withstand high forces and the ankle extensor muscle−tendon unit is better suited for joint position control than elastic energy storage. Thus, there is substantial evidence that the kangaroo rat hindlimb is adapted for accelerating.

101.1 HABEGGER, L*; MOTTA, P; PULASKI, D; HUBER, D; DUMONT, E; University of South Florida, Tampa, University of Massachusetts, Amherst, University of Tampa, Tampa, University of Massachusetts, Amherst; *mhabegge@mail.usf.edu*
Feeding biomechanics in billfishes: inferring the role of the rostrum using FEA
Perhaps the most striking feature characterizing billfishes is the extreme elongation of the premaxillary bones comprising the rostrum. Surprisingly, the role of this structure is still controversial. The goal of this study was to investigate through finite element (FE) analysis the role of the rostrum during feeding, and to predict different patterns of feeding behavior in two billfishes with different rostral morphologies. We applied three loading regimes (lateral, dorsoventral and axial) to the FE models that mimic proposed feeding behaviors, and compared the predicted stress within the rostra of the two species. We validated our FE models using stress calculated from "in situ" strain gage studies. Preliminary results of the FE analyses accord well with the strain gage data. Overall, preliminary results imply that the bill in blue marlin may be better suited to perform a wider range of motions during feeding than the bill of swordfish. Spearing behavior, for example, may be more likely to occur in blue marlin as stress along the bill was predicted to be smaller compared to the stress observed in swordfishes under the same loading regime. On the other hand, swordfishes may be more likely to hit prey with lateral shakes of the head, since models of dorsoventral movements predicted much higher stresses. In both species the middle section of the rostrum was predicted to be most highly stressed, suggesting this region to be the most likely area of breakage under higher loads. These analyses support previous hypotheses about feeding behavior in blue marlin and swordfishes. Moreover, "in situ" and modeling studies may be the most suitable approach to quantifying the biomechanics of these elusive and extraordinarily fast fishes.

14.1 HAGEY, T*; HARTE, S; VICKERS, M; HARMON, L; SCHWARZKOPF, L; University of Idaho, James Cook University; *thagey@vandals.uidaho.edu*
How Geckos Stick in Nature: Ecology and Biomechanics of Gecko Feet
Phenotype and performance play a fundamental role in evolution and ecology. Studies of form and function often use correlations between morphology, performance, and habitat use to examine patterns of ecomorphology and morphological adaptation. Geckos, of the taxonomic group Gekkota, are an understudied yet diverse clade of lizards in which studies of form and function would greatly improve our understanding of their evolution. Geckos have the rather unique trait of adhesive toe pads, enabling them to use arboreal and rocky environments in a way few other creatures can. Gecko toe pad morphology and adhesive abilities are highly variable across species, suggesting ecological adaptations may have driven their evolution, yet few studies has considered gecko adhesive morphology and performance in an ecological context. In this study, we quantified morphology, adhesive performance, and habitat use of 13 gecko species from Queensland, Australia including tropical, arid, arboreal, and rock−dwelling species. We found toe detachment angle to be correlated with residual limb length. We also found residual limb length to be correlated with the use of arboreal and rock microhabitats as well as negatively correlated with perch diameter. This study is one of the first examples investigating gecko adhesive performance and specific microhabitat parameters. We suggest additional comparative studies investigating gecko limb kinematics and setal mechanics to corroborate our observational results.