P1.34 HERAS, J.*; GERMAN, D.P.; Univ. of California, Irvine; *herasj@uci.edu*

The monkeyface prickleback (Cebidichthys violaceus) genome: a source for understanding biology in a complex environment

We sequenced the genome of the intertidal, herbivorous fish, *Cebidichthys violaceus* (Teleostei: Stichaeidae), to elucidate the genetic underpinnings of dietary specialization and intertidal existence in this species. *C. violaceus* is part of a phylogeny that showed independent intertidal invasion and evolution of herbivory in comparison to other herbivorous stichaeids (e.g., *Xiphister mucosus*). A juvenile individual collected from San Simeon, California was used to sequence the *C. violaceus* genome, and the genome was generated with Illumina and Pacific Biosciences (PacBio) datasets with 107X and 9X coverage, respectively. From our genomic datasets, we conducted a de novo assembly of the Illumina reads and then a hybrid assembly with both Illumina and PacBio datasets. With bioinformatic tools, we estimated the genome to be 526,436,767 base pairs with a N50 scaffold size of 542 kilobases. The *C. violaceus* genome provides a multitude of opportunities to link genomic information to ecological and nutritional physiology. We are using this data set to better understand the multitude of processes that allow a fish to be herbivorous and to tolerate the vagaries of intertidal existence (e.g., temperature fluxes, and breathing water and air). Moreover, what we learn from *C. violaceus* will be used to inform analyses of other fishes in the family Stichaeidae, which features dietary diversity, ontogenetic dietary shifts (including a shift from carnivory to herbivory in *C. violaceus* and other taxa), and large biogeographic ranges spanning the eastern and western Pacific Ocean. This will be one of the most robust non-model system, vertebrate genomes available to date and will expand our understanding of the biology of fishes and beyond.

P2.173 HERNANDEZ, LP*; MCCALLEY, M; George Washington University; *phernand@gwu.edu*

Secrets of a menace: How the cypriniform palatal organ has become greatly modified to allow silver carp to thrive in eutrophic environments

Silver carp, as well as a number of other Asian carp, have garnered recent interest as invasive species well-established within several American rivers and menacing to enter the Great Lakes. Part of the reason for their overwhelming success has been their capacity to feed so efficiently within eutrophic environments. While previous research has described the structure and function of the epibranchial organ (a snail-shaped structure comprised of highly modified branchial arches used to concentrate material filtered from the water column) other aspects of their feeding anatomy have been ignored. Although concentration of phytoplankton is important for efficient feeding, the actual filtration mechanism at the level of the gill rakers has not been investigated within a functional context. This is a particularly glaring omission given that silver carp possess highly derived gill rakers that interdigitate with extended ventral folds of the palatal organ. The palatal organ is an important structure located on the dorsal pharyngeal roof. Previous work has shown that it is important in a specialized type of feeding that characterizes goldfish and carp, in which particulate matter is captured by localized protrusion of this muscular structure. Recent work in our lab has revealed that the overwhelming majority of cypriniform species examined have a muscular palatal organ, however the specialized nature of the palatal organ of the silver carp rivals anything previously described. It has been suggested that the large palatal organ is simply used as a piston pump to drive water through the gill rakers. Given the complex muscular architecture of each palatal fold this proposed mechanism seems overly simplistic.

P2.185 HERNANDEZ, A.V.*; GERVAIS, C.R.; RUMMER, J.L.; PORTER, M.E.; Florida Atlantic University, James Cook University; *ahernandez2013@fau.edu*

Comparing submerged walking and swimming kinematics in epaulette sharks

The transition from swimming to walking was an important event in the evolution of tetrapods. To understand this transition, researchers have studied movement in many extinct and extant aquatic and semi-aquatic species. The epaulette shark *Hemiscillum ocellatum* uses slow-to-medium walking, fast walking, and swimming forms of aquatic locomotion. We described kinematic differences between the three gaits in neonate (n=6) and juvenile (n=6) sharks hatched and reared in the laboratory. Neonates retain nutrition from an internal yolk until they develop a consistent feeding schedule (~35d post-hatch). They are then classified as juveniles, foraging for worms, crustaceans, and small fish. We hypothesized that changes in diet and feeding habits would affect gait performance between neonates and juveniles. Using video tracking software and 13 anatomical landmarks along the fins, girdles, and body mid-line, whole body velocity, duty factor, fin frequency, girdle rotation, and body curvature were calculated to identify characteristic movements of the gaits for each shark. Velocity was greater in neonates when compared to juveniles across all gaits; however, both groups increased velocity from walking to swimming. Regardless of gait, pelvic girdles had a greater range of motion than pectoral girdles for both neonates and juveniles. In juveniles, regardless of gait, the contralateral sides of the pectoral and pelvic girdles were synchronized during lateral excursions. Neonates, however, exhibited overlapping of ipsilateral sides of the girdles. Understanding the transition from neonate to juvenile locomotory forms in this species could provide insight on the water to land transition of tetrapods.

P3.129 HICKS, M.*; LINKEM, C.; TRUONG, L.; SUMMERS, A.; DITSCHE, P.; University of Washington, University of Hawaii at Manoa, Wellesley College; *mhicks12@uw.edu*

An easy and applicable method to measure roughness in the marine intertidal

Many animals that make their living in the rocky intertidal cope with the forces of crashing waves by securing themselves to the surface of hard substrates such as rocks in which surface roughness has a crucial impact on the animal's ability to attach. Northern clingfish inhabits the rocky intertidal and have been shown in lab studies to have the remarkable ability to stick to surfaces with a large range of surface roughness by means of their ventral suction disc. To compare this ability to the range of roughness encountered in its natural habitat we had to overcome several methodological problems. Clingfish can be found in the lower and lower middle intertidal zone causing short term access to rocks during low tide. To overcome this problem we molded the surface of the rocks where we found clingfish with a precise and fast hardening dental wax, allowing the molds to be analyzed later in the lab without time pressure and without removing rocks from the habitat. Technical devices for roughness measurements such as optical or contact profilometers, often designed to measure roughness of technical surfaces at a very fine scale, were not appropriate for this study, so we developed a simple method to measure roughness with inexpensive equipment in the range of coarser roughness orders. The roughness parameters used in this study were the maximum distance between the highest and lowest points in a segment per mold (RmaxDIN) and the total average distance between the highest and lowest points in all segments per mold (RzDIN). The results generated from this method show that the natural substrates in the rocky intertidal cover, and in few cases exceed, the range of roughness Northern clingfish can attach to.