teractive STEM activities. Using a mixed-methods research design, surveys and course artifacts were used to analyze the impact of this experience on both the undergraduate students and the participating children. Results indicated that the Service-Learning course significantly increased the undergraduate students' interest in STEM and teaching STEM. Additionally, participating children showed slight increases in their interest in STEM and a strong desire to continue in the program. Recommendations and implications for this work are shared to advance equitable and inclusive STEM education for all.

Ontogeny of anatomical and ecological adaptations in Hawaiian large-bodied flightless waterfowl

Michael Hanson, Helen James

Large flightless island endemic birds have been characterized as paedomorphic with respect to their flighted relatives; "frozen" in earlier growth stages resembling juveniles. Prior to human arrival, Hawaii was home to several such birds: The moa-nalo species of Kauai, Oahu, and islands of Maui-Nui, descended from dabbling ducks, and a flightless goose of the genus Branta on the Island of Hawaii. These waterfowl convergently adapted to a flightless, fully terrestrial, herbivorous lifestyle. They exhibited an enlarged abdominal region, and graviportal body structure, with modifications to the hindlimb, pelvis, and vertebrae to support their mass, their wings and thoracic girdles highly reduced, and bills large, robust, and in some cases serrated to process tough plant matter. Fecal analyses indicate they processed this diet via hindgut fermentation, at least in the case of the moa-nalo. Juvenile and adult skeletons of moa-nalo (Ptaiochen pau) found in Maui lava tubes provide a growth sequence revealing differences in timing of development in different skeletal regions, with the juvenile skull similar to that of the adult moa-nalo, while limb proportions resemble hatchling mallards. Based on egg size, we show that moa-nalo hatched at a much larger body size than expected for typical ducks, potentially facilitating acquisition of efficient hindgut fermentation. Finally, we address a growth series of the flightless Hawaiian goose (Branta rhuax), which was converging upon similar ecological niche.

Fast and forceful: comparative scaling analysis of mantis shrimp strikes

Sophie Hanson, Erica Staaterman, Mireille Steck, Thomas Claverie, Megan Porter, Sheila Patek

Mantis shrimp (Stomatopoda) use their small raptorial appendages to produce intense impacts at high accelerations. While strike force has been studied across a few mantis shrimp species, it has not been analyzed across the phylogeny of this group, which encompasses a range of body sizes and appendage morphologies ("smashers" and "spearers"). To understand the relationship between size and strike force, we ask: how do these intense impacts scale within and across species of this diverse group? We prompted individuals from 21 mantis shrimp species (18 smashers, 3 spearers) to strike a force sensor. We analyzed the impacts in terms of three metrics: peak force, impulse, and impact duration. Using a phylogenetic comparative approach, we then examined scaling relationships within and across species. We found that peak force and impulse increase with body size yet impact duration shows no correlation with body size. Comparisons of within-species scaling reveal variable, species-specific scaling rates for peak force and impulse. These results establish the variation of strike force within and across species and provide insight into the upper limits of high force impacts in the mantis shrimp striking mechanism.

The Subtidal Environment at Auke Bay between Spring and Fall 2021

Masaki Hara, Michael Navarro

Many studies show subtidal hydrography is influenced by environmental and biological processes. Phytoplankton blooms in spring and growth continue until late summer and early fall when light becomes limiting and phytoplankton growth fades. The study site is Auke Bay located at a confluence of environmental processes including tidal exchange and freshwater runoff, in Juneau, Alaska. The research addresses two main hypotheses: (1) Semidiurnal, diurnal, and seasonal physical processes affect the subtidal hydrography, specifically temperature, and salinity, and (2) Phytoplankton growth events (e.g. blooms, and growth declines) will be detected by sensor pH and O2 measurements. In the research, three sensors: SeapHOx, Pendant, and TidbiT were used to measure environmental factors, such as water temperature, salinity, dissolved oxygen, pH, pressure, and light, and show physical dynamics (based on temperature and salinity) and biological dynamics (based on pH and dissolved oxygen) in spring and fall. Throughout data analysis, tidal processes have dominant nearshore hydrographic properties. Moreover, biotic events were observed on April 20th and again on April 26th when pH and O2 remained elevated. Furthermore, seasonal effects are driven by both physical and biotic mechanisms as both were observed. Thus, the subtidal ecosystem hydrography is heavily impacted by