COASTAL SCIENCE SYMPOSIUM 2019 PROCEEDINGS

Hosted by the College of Coastal Georgia

15 November 2019
9:00 am – Noon
Stembler Theatre, Campus Center

WELCOME

Welcome to Coastal Science Symposium 2019, hosted by the College of Coastal Georgia. The annual event brings together students, faculty, collaborators, and community partners to explore coastal and marine science research and applications to society. This year's program features a keynote address by shark biologist Dr. Toby Daly-Engel, poster presentations of student research and service-learning, and exhibits by partner organizations engaged in science and conservation on the Georgia coast.

Thank you for participating and for supporting Coastal Georgia students!

Symposium Organizers: Tate Holbrook, Deborah Browning, Kelly Clark, James Deemy, Heather Farley, Janet Gannon, Holly Nance, Traesha Robertson, and David Stasek

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Dr. Johnny Evans, Provost and Vice President for Academic Affairs
Dr. Holly Nance, Assistant Professor of Biology, Department of Natural Sciences

9:45 Keynote Address: SHARKS: Research, Conservation, and the Myth of Shark Attack
Dr. Toby Daly-Engel, Assistant Professor of Biology, Florida Institute of Technology
Followed by Q&A

Campus Center Lobby
10:45 Student Poster Presentations
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Refreshments

KEYNOTE ADDRESS ABSTRACT

SHARKS: Research, Conservation, and the Myth of Shark Attack

Dr. Toby Daly-Engel, Assistant Professor of Biology, Florida Institute of Technology

Sharks are famous for being dangerous to humans, but as major predators in the world's oceans they are also a crucial part of the marine ecosystem, responsible for keeping all the other parts of the food web healthy. Despite their ecological importance, almost 25% of shark and ray species are currently at risk of extinction, with 45% listed as Data Deficient by the International Union for the Conservation of Nature. Though many people are familiar with great whites and a few other charismatic species, few realize that there are over 1000 known species of sharks and rays, with more being discovered every year. Now, through the use of genomics and other cutting-edge research tools, scientists are finding out that sharks are even more diverse than we suspected, especially in the rarely-explored reaches of the deep sea. We now know that in some ways, sharks are more like humans than other types of fish, with long, mammal-like reproductive cycles, slow growth, and low rebound potential that makes them highly vulnerable to extinction in the face of climate change. Here we discuss the current state of shark research, how scientists are working on conservation measures to protect these animals, and the myths and realities of shark attack.

POSTER PRESENTATION ABSTRACTS

presenter(s) in bold

Marine science internship at GA DNR: Coastal Resources Division (CRD)

Cameron C. Atkinson, College of Coastal Georgia, Department of Natural Sciences

The Georgia Department of Natural Resources: Coastal Resources Division (CRD) strives to balance coastal development and protection of the coast's natural assets, socio-cultural heritage and recreational resources for the benefit of present and future generations. This summer, I had the opportunity to assist CRD in their mission while working as an intern supported by a Georgia Natural Resources Foundation scholarship. Throughout the summer, I was afforded the opportunity to assist the Wetlands, Coastal Management, Fisheries, Fish Habitat, and Water Quality groups with their on-going projects. While working with each of the groups, I gained a wide variety of skills and provided contributions toward their objectives. I was able to contribute by assisting with field work, data collection, and report compilation. Amassing a wide breadth of experiences has undoubtedly helped to prepare me for graduate school and my future career. My time at CRD proved to grow my passion for marine science exponentially and helped to solidify my career goal of working as a fisheries biologist for a government agency.

Evaluation of physicochemical parameters along the Georgia coast to prioritize sites for Eastern Oyster (*Crassostrea virginica*) reef restoration

Cameron C. Atkinson & James B. Deemy
College of Coastal Georgia, Department of Natural Sciences

The decline of Eastern Oyster (*Crassostrea virginica*) populations during the 1900s has negatively impacted coastal ecosystems and economies. In Georgia, as much as 85% of the native *C. virginica* population has been lost due to overharvesting, and water pollution. Oyster reef restoration projects have been effective at re-establishing these ecosystem engineers in select locations. However, few studies have focused on prioritizing restoration sites using physicochemical conditions conducive for *C. virginica* recruitment, growth, and reproduction. Our objectives were: 1) identify critical physicochemical parameters as well as optimal ranges for *C. virginica* establishment and success; 2) create a GIS index that maps low, medium-low, medium, medium-high, and high habitat quality for *C. virginica*; and 3) modify this index by incorporating exclusionary areas and bathymetric data. Parameter suitability rasters were created through reclassification of interpolated point water quality data. These data layers were then summed and normalized to create a habitat suitability index. Exclusionary areas consisted of pre-existing oyster reefs, coastal water access points, and armored shorelines. Areas in close proximity to these features were exclude from restoration consideration. The suitability index was modified further by the addition of bathymetric data. Further validation to this model could be achieved by analyzing restoration outcomes at sites across the five habitat quality ranges. Additionally, quantifying the difference in current oyster reef area across the five habitat quality ranges could provide added validation.

Monitoring the impacts of laurel wilt disease on a rare redbay population at Cannon's Point Preserve

Cameron C. Atkinson, **Alisa Iketani**, **Kristin Ruff**, **Kaitlin Spivey**, & C. Tate Holbrook
College of Coastal Georgia, Department of Natural Sciences

Throughout the southeastern United States, laurel wilt disease is contributing to the decline of members of the plant family Lauraceae. In particular, redbay (*Persa borbonia*) populations have experienced widespread die-off due to laurel wilt. This disease is catalyzed by the invasive redbay ambrosia beetle (RAB; *Xyleborus glabratus*), which harbors a symbiotic fungus that proves deadly to redbay trees. When the RAB burrows into a host tree, it introduces the fungus into the xylem vascular tissue, triggering the tree's defense system. Ultimately, the transport of water throughout the tree is blocked, leading to the systemic wilting of leaves and eventual death. As a component of our BIOL 4020 Conservation Biology service-learning project with the St. Simons Land Trust and Georgia Department of Natural Resources, we continued the annual monitoring of a rare redbay population at Cannon's Point Preserve (CPP), St. Simons Island, GA. We evaluated 28 overstory redbay trees for signs of laurel wilt or RAB infestation. We also measured the diameter-at-breast-height of each tree and recorded reproductive activity when detected. Compared to previous years, only one new case of laurel wilt was documented, bringing the total count to 23% of monitored trees that have been infected since 2016. Continued monitoring, genetic resistance studies, and management of the invasive RAB are needed to protect this rare redbay population at CPP.

Monitoring of a living shoreline at Cannon's Point Preserve

Joshua Billings, **Bridgette Hancock**, **Brianna Marquez**, **José Paiz Mazariegos**, & C. Tate Holbrook
College of Coastal Georgia, Department of Natural Sciences

A living shoreline is an eco-friendly infrastructure approach to stabilizing shores and protecting land adjacent to estuarine waters from erosion. Living shorelines provide a natural alternative to "hard" methods of erosion control, such as bulkheads, that disrupt the ecological function of the shoreline. In Georgia, a combination of bioengineering (e.g., bagged oyster shell) and native vegetation plantings have been used to stabilize tidal creek banks, provide wildlife habitat, and maintain salt marsh-upland connectivity. As part of a service-learning project, our Conservation Biology class monitored the living shoreline on Lawrence Creek at Cannon's Point Preserve (CPP), a nature reserve operated by the St. Simons Land Trust on St. Simons Island, GA. The living shoreline at CPP was constructed in 2015, and students have collected data each year from 2014 to 2019. Our objective was to assess the ecological impacts of the living shoreline, particularly on the structure of benthic invertebrate and plant communities. We measured density and diversity of species along eight transects that extended perpendicular to the creek through the intertidal and supratidal zones, focusing on populations of the eastern oyster (*Crassostrea virginica*) and smooth cordgrass (*Spartina alterniflora*), which provide shoreline stabilization and other important ecological services. The multiyear results show an increase in species diversity and population densities of key species following construction of the living shoreline. We conclude that the living shoreline has successfully stabilized the bank of Lawrence Creek and enhanced the fringing salt marsh habitat.

Discovery of novel bacteriophage in Brunswick, GA, marsh mud

Benjamin Fountain, Kristel Riner, & Gerard J. White
College of Coastal Georgia, Department of Natural Sciences

SEA-PHAGES (Science Education Alliance-Phage Hunter Advancing Genomic and Evolutionary Science) is a program established by the Howard Hughes Medical Institute to promote student learning and research in the biological sciences via the discovery and characterization of bacteriophage ("phage"). Phage are viruses that infect bacteria, use them for replication, and eventually kill them via lysis. Phage are the most abundant biological entities in our biosphere, with total population estimations of 10^{30} or more, and they can be found in the same diversity of environments in which bacteria can be found. Different phage are very specific to the bacteria they infect, often only infecting one species. The use of phage to infect and kill bacteria holds a great deal of promise in medicine due to development of bacterial resistance to antibiotics. Discovery and development of new or improved antibiotics is unable to keep up with the emergence of antibiotic-resistant bacteria. Phage have been shown to have potential for use in medicine when antibiotics are not effective. Given the specificity of the phage/host relationship, it is important to isolate, characterize, and archive many different phage with the hope that these may have potential for treating bacterial infections. During this research, we isolated a phage, Φ Karate, from marsh mud collected in Brunswick, GA. We have since purified and amplified this phage for electron microscopy, DNA extraction, and future sequencing. This has been a very rewarding experience, giving us an opportunity to perform research and gain lab experience.

Georgia sea turtle nesting research internship

Jennifer Gale, College of Coastal Georgia, Department of Natural Sciences

Loggerhead sea turtles (*Caretta caretta*) are one of the main species that nest on the beaches of coastal Georgia and are classified as a threatened species. Laws and conservation efforts are used to protect the species and attempt to increase the population size and avoid extinction. I participated in an internship with the Research Department of the Georgia Sea Turtle Center on Jekyll Island, GA during the summer of 2019. I worked with research team members to survey the beaches of Jekyll each day and night throughout the Loggerhead nesting season. We focused on the female sea turtles encountered on the beach to collect and record data on the number of nests, survival rate, and genetics for each nest. The data from this survey will be used to monitor the population of Loggerheads and the changes in nesting patterns over years. We educated the general public on the laws and conservation of sea turtles to ensure a safe environment for turtles. I was able to learn research methods and perform them in the field. This internship helped me better understand the work that is put into research and conservation of a threatened species.

Environmental education and human dimensions with reptile husbandry

Bridgette Hancock, College of Coastal Georgia, Department of Natural Sciences

My summer internship revolved around the human dimensions of environmental education, focusing particularly on young children (grades 3-5) and their attitudes towards reptiles. To achieve this, I worked with both the University of Georgia Applied Wildlife Conservation Lab (AWCL—Marine Extension, Brunswick) and the Driftwood Education Center. The main parts of my work involved husbandry of reptiles used for educational programs and developing a survey that was given to summer camp children attending reptile programs. Additionally, I began conducting a synthesis of literature relevant to my internship. Last, I engaged in various field research with reptiles through the AWCL. My survey results indicated an overall decrease in negative attitudes towards reptiles and therefore an increase in positive ones. My experience with the literature synthesis and training in captive husbandry will benefit my future career endeavors tremendously.

Evaluating the effects of waste management facilities on the water quality in the surrounding ecosystems

Sabrina Hodges, College of Coastal Georgia, Department of Natural Sciences

Water quality is the physical, chemical, and biological characteristics that make up the water. It is important to monitor and measure this quality as any changes in the system can not only affect the aquatic biota but, the surrounding ecosystem. In 2008 a waste transfer station named Liberty Roll-Offs and Recycling was built next to a residential neighbored; Since then residents, in the Magnolia Park neighborhood have been vocal in the community about the negative impacts and poor quality of life cause by this facility. To address this issue, the Glynn Environmental Coalition and the College of Coastal Georgia partnered in a project to determine if the facility has an impact on the surrounding storm water ditches lining the facility. Through site visits and analyzing the property maps, six sites were identified as possible areas of discharge from the facility. The parameters decided upon for testing were dissolved oxygen, pH, conductivity, water and air temperature, nitrates, phosphates, and testing for *E. coli* bacteria. A sampling period of 6 months was selected, with sampling events scheduled once a week for the first and last month, while sampling for the 4 intermittent months was set once a month. The data will be analyzed and developed into a report to present to the community members, City of Brunswick, and the Georgia Environmental Protection Division.

Identifying movement patterns and habitat preferences of migratory butterflies along the Atlantic Flyway in coastal Georgia

Brandi Houser, **Daniel Staab**, **Jordan Hamby**, & C. Tate Holbrook
College of Coastal Georgia, Department of Natural Sciences

The Butterflies of the Atlantic Flyway Alliance (BAFA) is a collaboration between land management entities and citizen scientists in coastal Georgia concerned with understanding and safeguarding natural resources critical to sustaining healthy populations of migratory butterflies. The project initially seeks to document the movement patterns of fall-migrating butterfly species, identify habitats and native nectar plants utilized by fall-migrating butterflies, identify overnight roosting sites, and engage citizen scientists in butterfly conservation. In fall 2019, 10 survey sites were established across eight barrier islands and two mainland sites. Across the sites, migration survey points and habitat-nectar transects are situated in different habitats: beach, dune, grassland, shrubland, salt marsh, forest, freshwater wetland, and developed land. Through a service-learning partnership between BIOL 4020 Conservation Biology and the St. Simons Land Trust, we are conducting biweekly BAFA surveys at Cannon's Point Preserve, located on the north end of St. Simons Island. At three migration survey points, we count the number of individuals and flight direction of three focal butterfly species: the Gulf fritillary (*Agraulis vanillae*), cloudless sulfur (*Phoebis sennae*), and monarch (*Danaus plexippus*). It is too early in the fall migration season to present a quantitative summary of results. However, each of the aforementioned species has been observed flying past the migration survey points and nectaring on flowering plants—frogfruit (*Phyla nodiflora*), Nuttall's thistle (*Cirsium nuttallii*), and sage (*Salvia coccinea*)—along the habitat-nectar transects. Ultimately, BAFA findings will be used to guide conservation and management of migratory butterfly habitat on the Georgia coast.

Shark and ray research internship

Alisa Iketani, College of Coastal Georgia, Department of Natural Sciences

Most people only know about sharks based on what they see on Discovery Channel or the news. People have an unsubstantiated fear of sharks or swimming in the ocean. I want people to learn that sharks are endangered and need our help to save their ocean environment. This summer I had the special privilege to work with Coastal Marine Education and Research Academy (C.M.E.R.A.) located in Clearwater, FL. Their mission is "to provide hands on field research opportunities to college students or anyone interested in the natural sciences while conducting research to further understanding of shark and ray ecology." My internship sponsor was Moriah Moore, the co-founder of C.M.E.R.A. She has helped me become a better person and scientist. During my internship I learned how to identify local species of sharks, rays and other animals. I was taught how to tag and take DNA samples. Throughout the summer we began each day with a lecture focused on various topics including biology, conservation and marine pollution. We rotated using three different boats up to 8 hours each day. All animals caught were sexed, measured, tagged and released. My favorite experience was when I was holding a mother Atlantic Stingray and noticed she was giving birth, so I quickly assisted in the birth of two healthy baby rays. The experience I gained while working with C.M.E.R.A. impacted my personal growth and clarified my career path.

Bacteriophage research: phage hunting

Madison E. Lee & Gerard J. White
College of Coastal Georgia, Department of Natural Sciences

The SEA-PHAGES (Science Education Alliance-Phage Hunters Advancing Genomics and Evolutionary Science) research program is an international project hosted by the Howard Hughes Medical Institute in collaboration with HHMI Professor Graham Hatfull at the University of Pittsburgh. One aim of the program is to increase undergraduate interest and retention in the biological sciences through immersion in authentic research. Bacteriophages ("phage") are viruses that infect and replicate inside bacteria and are the most abundant biological entities on the planet. Phage have captured the interest of scientists because of their potential – from gene therapy to the treatment of bacterial infections. The first semester of the SEA-PHAGES program focuses on the isolation, purification, and amplification of bacteriophage collected from soil using the bacterial hosts *Microbacterium foliorum* and *Arthrobacter globiformis*. It is highly likely that any soil sample containing bacteria will also have phage, although much less likely to have phage that can infect any given species of bacteria. Because I did not isolate phage that infects our bacterial host species, I adopted a phage from my classmate, Emily Spinger. My adopted phage, Φ Baby, has been purified to ensure a clonal population, and is currently being amplified for electron microscopy and DNA extraction. This course is providing me with my first research experience, and allowing me to learn and use lab techniques that will be of benefit for my graduate school research. Although I am continuing to work with my adopted phage, I am still attempting to isolate my own phage.

Primary nursery habitat selection and parturition of requiem sharks for a Georgia barrier island

Andrew Lyons[1], Bryan Franks[1], Ashley Johnson[2], & Eric Reyier[3]
[1]Jacksonville University, Marine Science Research Institute; [2]Jacksonville University, Department of Social Sciences; [3]Kennedy Space Center, KSC Ecological Program and Integrated Mission Support Services

Understanding the reproductive habits of migratory species along the northwest Atlantic coast has become a rising topic in shark biology. There is still a great deal of uncertainty regarding the timing, queues, and habits of sharks between their sites of reproduction and secondary wintering waters. One potential nursery site is Little St. Simons Island, a barrier island on the Georgia coast. This site is an isolated island with a network of tidal creeks, unaltered shoreline, and is located at the southern-most range of the Altamaha River, the largest undammed river on the east coast. Preliminary research conducted during spring and summer 2018 suggests both shared and segregated birthing sites for several species, including the focus of this study, the lemon shark (*Negaprion brevirostris*). This would indicate the northern-most known range of their birthing sites and provide evidence of a newly described nursery habitat for the species. Understanding the importance of this location to the reproductive habits of these sharks, as well as others, is essential for developing management strategies and mitigating harvests of populations. A combination of gillnetting and rod and reel fishing will be utilized in sampling LSSI waterways from Summer 2019 through Fall 2020. 96 sites for gillnet sampling were selected through randomized point generation in ArcMap. Rod and reel fishing was conducted at a number of set locations, with preliminary data collection beginning in 2018. Sharks encountered on 263 occasions underwent a standardized workup procedure that involved measurements, sexing, umbilical scoring, genetic collection, and tagging.

Internship at Tidelands Nature Center

Taylor Martin, College of Coastal Georgia, Department of Natural Sciences

During the summer of 2018, I completed an internship with Tidelands Nature Center located on Jekyll Island. Since I am preparing for a career as a high school science teacher, my main focus was on the environmental education mission of the nature center. I helped take campers on day trips around the island and gave them hands-on field lessons about the animals, plants, and environment. I accompanied many canoe and kayak trips as well and taught the students and visitors about the importance of the marsh and identified some of the animals living there. I also talked to visitors about the animals at the nature center and participated in an outreach event where I got to take the animals out and let people get a closer look as they asked questions. Finally, I helped with animal husbandry tasks including water/bedding changes, basking, and food preparation. After the summer spent at Tidelands, I have a better understanding of environmental education and a deeper appreciation for what I am studying. Through this internship, I acquired valuable skills that will prepare me for a career in science secondary education, and I developed a greater love for coastal ecology and the Golden Isles.

Modeling small order watershed freshwater contributions to estuaries along the Georgia coast

Isabelle McCurdy & James B. Deemy
College of Coastal Georgia, Department of Natural Sciences

Small order watersheds are an understudied component of coastal hydrology relative to the area the systems occupy along coastlines. These small order watersheds could represent substantial hydrologic and water quality contributions to the estuaries and sounds in which they terminate. Our objectives were to 1) map small order watersheds (1st and 2nd order) that terminate directly into estuaries and sounds along the Georgia coast; 2) estimate monthly precipitation / evapotranspiration balances for each watershed; and 3) compare the collective contribution of these small order watersheds to larger nearby watersheds terminating within the same estuary. Our focal areas of analysis are the coastlines along Glynn and Camden counties. Elevation data (10m) was downloaded from the USGS Earth Explorer data portal. This data served as an input for the process of modeling watersheds in ArcMap 10.6. Monthly rainfall data was interpolated from NOAA Precipitation Data Frequency Server gauging stations along the coast. Evapotranspiration was collected from UGA extension service. Precipitation and evapotranspiration were combined to generate a monthly water budget estimate for each watershed. Water budgets were used in combination with land use / land cover-based runoff estimates to model freshwater contributions to streams terminating in the estuaries and sounds. Our preliminary analysis indicates several small order watersheds in each county. These watersheds are variable in magnitude, land cover, and land use. We believe that the modeling framework we have developed could also be applied in other regions with frequent small order watersheds along the coastline.

Georgia Aquarium fishes and invertebrates internship

Kaitlin Spivey, College of Coastal Georgia, Department of Natural Sciences

During the 2019 summer, I interned at the Georgia Aquarium in the Fish and Invertebrates Department. I worked in both the Ocean Voyager and Education Loop exhibits doing hands-on animal husbandry and system maintenance. I worked with the Aquarium's collection of sharks, rays, teleosts, reptiles, amphibians and invertebrates. My daily responsibilities included diet preparation, performing daily feeds, assisting in animal handlings, collecting water samples, performing water changes, and recording daily observations and notes into 'Tracks'. Through this internship, I gained entry-level Aquarist skills that will help me in my career path.

Phage hunting: dirt diving for bacterial assassins

Kaelyn N. Tyler & Gerard J. White
College of Coastal Georgia, Department of Natural Sciences

SEA-PHAGES (Science Education Alliance-Phage Hunters Advancing Genomics and Evolutionary Science) is a two-semester, discovery-based undergraduate research course that provides students the opportunity to study bacteriophages ("phage"), environmentally ubiquitous viruses that infect bacteria. Although the most common biological entities on Earth and co-located with bacteria (e.g., marine/aquatic systems, soils, gastrointestinal tracts, etc.), phage are poorly understood. More research is needed to understand the basic biology of phage, their diversity, and their possible applications in medicine, agriculture, and industry. One goal of phage research is to isolate novel, lytic phage that will kill their bacterial hosts, with the intent of using phage when antibiotic treatments are unsuccessful for treatment of human infections due to development of antibiotic resistance. In this first semester of the SEA-PHAGES courses, the objectives are to: (i) isolate phage from soil samples; (ii) purify the phage to ensure clonal populations; (iii) amplify phage to obtain titers sufficient for electron microscopy and DNA extraction; (iv) submit DNA samples to The University of Pittsburgh (PITT) for sequencing; and (v) submit phage to PITT for archiving. PITT archives phages found through the SEA-PHAGES program and distributes samples when requested for scientific use. Using host bacteria *Microbacterium foliorum* strain SEA B-24224, I isolated phage from soil (Fountain Lake Drive, Brunswick, GA). Having been purified, the phage is currently being amplified. I feel that I have gained a better understanding of lab techniques, and research in general, through this program, and hope that I will use these in my future career.

How do the properties of cigarette butts influence the quality of fresh and saltwater?

LaTosha Walker, College of Coastal Georgia, Department of Natural Sciences

In a world of pollution, cigarettes are no different from the plastics that can be found in the oceans and rivers. The production of leachate from the combination of cellulose acetate and water serves as a detrimental aspect to aquatic life and its ecosystem. Invertebrates have a lower tolerance level to the toxicity from cigarette butts than vertebrates. This experiment served to understand what properties of water quality were affected by the leachate using Hach and La Motte equipment. The two parameters that changed from the control were freshwater and saltwater Alkalinity ($P = 0.0001, 0.0122$) and freshwater and saltwater Turbidity ($P = 0.0001, 0.0001$). It was determined that the addition of cigarettes stabilized the pH. Additionally; increased sensitivity, lack of sodium chloride in freshwater, and the presence of cadmium caused an increase in freshwater turbidity and a decrease in saltwater turbidity.

EXHIBITORS

One Hundred Miles
Altamaha Riverkeeper
Coastal WildScapes
Georgia Department of Natural Resources Coastal Resources Division
Georgia Sea Turtle Center
Georgia 4-H Tidelands Center
Glynn Environmental Coalition
Keep Golden Isles Beautiful
The Dolphin Project
UGA Marine Extension and Sea Grant
UGA Marine Institute

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Aladdin Food Management Services
CCGA Police
Center for Service-Learning
Facilities and Plant Operations Team
Student Life Team

Community Partners/Exhibitors
On The Fly Outfitters
Student, Faculty, and Staff Participants and Volunteers

Brought to you by the College of Coastal Georgia:
Department of Natural Sciences, School of Arts and Sciences

Symposium Organizers: Tate Holbrook, Deborah Browning, Kelly Clark, James Deemy, Heather Farley, Janet Gannon, Holly Nance, Traesha Robertson, and David Stasek