Jeremy's team collected (from left to right) bristleworms, organisms they could not identify, and cyclopoida, among many others.

THE SCIENCE

by Jeremy Hsiang

In 2003, Rick Hernandez and his students at Niceville High School in Florida set out to answer a question: Could high school students be trusted to contribute to a huge international research project? Specifically, could they provide valid, reliable samples from their local shores for a component of the Census of Marine Life called the NaGISA project?

They not only proved that they could, but have also trained students around the world in collection and analysis techniques. Now in his fourth year on this project, Jeremy Hsiang has collected and analyzed samples, given presentations, and passed the NaGISA torch to students in Greece. In the coming months, NaGISA will take him to the shores of the Black Sea and the Red Sea, where he and his team will show once again that yes, high school students can contribute to this global biological census.

Divers from Niceville's NaGISA team collect samples on their trip to Crete in 2009.

When the 7:00 a.m. tardy bell rings, some students are trying to sneak into their first class or racing to finish last night's math homework. But not us: My classmates and I are at the beach.

Known for its clear blue water and white quartz sand, Henderson Beach is also home to diverse marine life. And that's why we're here. As students in our high school's gifted program, we are conducting research for NaGISA (Natural Geography In Shore Areas), the shoreline component of the Census of Marine Life, a 10-year international scientific effort to collect, compare, and document biodiversity in the oceans.

Following Protocol

Careful not to make footprints or otherwise disturb our collection site, my three teammates and I walk to the shoreline, where we place a one-meter-square frame, or quadrat, as close to the water as possible without allowing water to flow into it. After taking a picture to record its location, we perform three very specific collections outside that quadrat.

First, we place a 50-cm. quadrat next to the upper left corner. Gently sifting through the sand within it, we place any macrofauna, organisms that we can see with the naked eye, such as crabs or shrimp, into a jar. Next, we push a 2-cm. pipe 10 centimeters into the sand and place its entire contents into a collection jar. Finally, we push a 15-cm. cylinder 10 centimeters into the sand, slide a plate under the cylinder, and pour the entire contents into a bucket. Using sea water, we rinse the sand through a net, then invert the net and backrinse it to collect any macrofauna into a jar. Each jar is precisely labeled to indicate the quadrat number and collection method, and they are all stored in an ice-packed cooler until the next day, when we will analyze the contents in the lab.

Both along the shore and under water, sample collections for NaGISA must adhere to a strict protocol.

Like the collection process, our analysis follows a strict protocol. First, I completely submerge the 2-cm. core of sand in salt water, gently swirling the jar to get the meiofauna—or microorganisms—into the water before pouring it through a net. I repeat this process three times, flip the net over, and backrinse it, collecting any meiofauna in a petri dish.

After I find an organism using a dissecting microscope, I place it on a slide for more detailed identification using a more precise microscope. I label the slide with location and as specific an identification as I can—for example, "Q3 2cm shore copepod." Our preserved meiofauna slides and our preserved macrofauna specimens will go to the University of Florida to be processed by the Florida State Museum of Natural History's DNA barcode project. We send the data from our collections to NaGISA headquarters at the University of Kyoto in Japan.

I have participated in five collections and analyses since starting with NaGISA three years ago. In that time, I've identified hundreds of roundworms (nematodes), by far the most common organism we've collected. I have found crabs, hermit crabs, shrimp, and sea fleas. I've seen sand dollars and starfish and even some coral. I have found many specimens of crustaceans, most of them copepods, that we haven't been able to identify. I have lived near the beach my whole life, but I never knew how much biodiversity was there, just beneath the surface.

Taking it Global

In addition to performing our own collections and analyses, our school has trained other high schools to participate in the NaGISA project, including three in Florida and others in Tanzania, Africa, and Crete, Greece.

The most exciting experience I've had with NaGISA was being part of our school's 15-student delegation to Crete last spring. Our trip had two purposes: to teach Greek high school students about NaGISA and to learn new analysis techniques from scientists at the Hellenic Center for Marine Research.

I especially enjoyed interacting with our high school counterparts. Working together at the research center and touring museums and the famous CretAquarium with the students, we developed friendships that we maintain online. In our work with the scientists, we learned techniques for more accurately identifying meiofauna—by cutting small sections to more easily identify mouth parts, for example. We also learned that pure alcohol preserves DNA structure for further analysis better than the formalin solution we'd been using. Everything we learned we were able to apply on our next collection later that spring.

This December, I will travel with 11 other students to Egypt, where we will help establish the first NaGISA collection site on the Red Sea. Our team is coordinating this event that will bring together researchers from Alaska, Florida, Greece, Egypt, and Kenya. All these scientists will be available to the two high school teams, making this event an unparalleled educational opportunity. We are also planning a trip in Summer 2010 to Turkey, where we will help establish a NaGISA collection site along the Black Sea.

NaGISA has been an amazing opportunity. I have worked with students and learned from scientists in different countries. I have learned how to collect organisms from their natural marine habitat, preserve them, and identify them under a microscope. All these skills have helped me in science lab experiments, and the experience as a whole has helped me envision my future. My work with NaGISA has solidified my interest in biological research, and I'm now considering the possibilities in marine research. As I decide which colleges to apply to, I'm looking for marine research facilities—or at least an ocean view. i

Jeremy Hsiang is a senior at Niceville High School, where he is the NaGISA analysis coordinator and a member of the ocean science club. He has competed for three years at the Intel International Science and Engineering Fair, placing third in the microbiology category in 2009. Jeremy also plays piano and cello.

OF THE SHORE

To contact the Niceville High School NaGISA team, send e-mail to nhsgifted@yahoo.com or call (850) 833-4114. To learn more about the NaGISA project and how to participate, visit www.nagisa.coml.org/about/contacts/education.