

# Engaging Students in Experiential Learning: Texas Integrated Diving and Ecological Studies (TIDES) Laboratory

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## Extended Abstract

The Texas Integrated Diving and Ecological Studies (TIDES) laboratory is a collegiate multi-institutional, international research program designed to engage students through experiential and inquiry-based learning, where students develop and complete novel marine biology projects. Experiential learning is learning from life experiences and inquiry-based learning is where students are an active participant, propose questions and plan and perform research projects (Kolb, 2014). In the TIDES program, students review coral reef research literature, write proposals, develop materials and methods and then execute their research on the Mesoamerican Coral Reef bordering the island of Roatán, Honduras. To guide the development of research topics, during the spring semester, students receive lectures on oceanography, marine ecology, marine invertebrates, coral ecology, coral disease and identification, as well as fish ecology and identification. During each lecture, potential research areas are discussed. Previous research students return to speak with current students about their research topic, results and fieldwork experiences. In conjunction with traditional coursework, students become open water dive certified, receive lectures on marine field techniques and boat etiquette.

Inquiry-based learning begins as students form groups, based on research interests, and begin formulating research goals. Each week, students meet with the professors and discuss progress on research development. Students receive guidance on research proposals, methodology and materials. An exam is given over marine lecture concepts and fieldwork skills exams are tailored to each group's target species. For example, if a group is researching coral disease, they must be able to identify all coral disease and coral species, in addition to a modest list of non-focal species, such as fish, as they are common in the environment and will likely be encountered. Alternatively, if a group was researching fish diversity, they would need to identify all fish species and identification of the non-focal species would include a few select coral species. The following is a list of some of the 2019 student research projects:

- Macroorganisms within the Spongocoels of *Callyspongia vaginalis*, *C. plicifera* and *Xestospongia muta* on the Mesoamerican Reef in Roatán, Honduras
- Prevalence and Abundance of Dark Spot Syndrome on Starlet Corals on the Mesoamerican Barrier Reef in Roatán, Honduras
- Fish Assemblages of the Mesoamerican Barrier Reef, in Roatán, Honduras
- Boulder Coral Abundance and Disease Prevalence in Association with *Spirobranchus giganteus* in Roatán, Honduras
- Microplastic Loading in the Sediment of Mesoamerican Reef in Roatán, Honduras

At the end of the semester, we travel to the Roatán Institute for Marine Science (RIMS) at Anthony's Key Resort on the island of Roatán, Honduras, where students execute their proposed research (RIMS, 2018). The first few dives acclimate students to the marine environment and diving with research equipment. Typically, we have two research dives per day, with evenings dedicated to data entry. Four to five dive sites are visited twice during the trip. Students attend lectures by the Roatán Institute for Marine Science educator on dolphins and sea turtles, after which students snorkel with dolphins.

For added service efforts, in 2018 and 2019, we participated in a special dive to a coral nursery, where students participated in coral reef restoration efforts at RIMS. In 2019, a fund raiser was conducted, and we were able to purchase eight coral trees to aid with the restoration efforts at RIMS. The SOL International Foundation also has a Roatán Project designed to help improve the quality of life for the children on Roatán (SOL, 2018). We were introduced to SOL several years ago, and each year students take up a collection of needed goods to donate to the children of SOL.

Upon returning, students analyze their data, thereby honing their quantitative and critical thinking skills, and develop research posters, outlining their projects and conclusions. Many students present these posters and give oral presentations at various research conferences throughout the year (*e.g.* MCC Scholar Day, Texas Academy of Science, Texas Tech Annual Biological Symposium). Conference attendee feedback has been positive, and many have expressed surprise that undergraduate students developed and executed such challenging and compelling research projects. An impressive number of our TIDES students have won top awards at a variety of research conferences, and in 2018 our first student-led manuscript was published (Kroll et al., 2018). Many of our students go on to graduate or medical school. During the admission interviews, several students reported being asked about their TIDES research. The TIDES research experience is something the students will not forget, and it is something they can use to further their career goals. As many universities and colleges are developing 2+2 relationships with community colleges, this program could serve as a model for other multi-institutional undergraduate research programs.

**Keywords:** marine biology, coral reef research, study abroad, inquiry-based learning

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