

THE SCHOOL FOR FIELD STUDIES

DIRECTED RESEARCH PANAMA

Center for Tropical Island Biodiversity Studies · Bocas del Toro. A complete record of student research projects from the four most recent semesters.



SPRING 2026

3 projects · 10 student authors

FALL 2025

4 projects · 15 student authors

SPRING 2025

6 projects · 24 student authors

FALL 2024

5 projects · 18 student authors

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RESEARCH PROJECTS

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FACULTY ADVISORS

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SEMESTERS

FALL 2024 – SPRING 2026

ABOUT THIS GUIDE

Directed Research is the capstone of every SFS semester: students work in small teams with resident faculty on questions set by the needs of the host community and its ecosystems. This guide collects the Directed Research projects completed at the Center for Tropical Island Biodiversity Studies in Bocas del Toro, Panama, over the four most recent semesters.

Projects are listed newest first. Each entry gives the project title, its faculty advisor or advisors, and the student authors with their home institutions. Each entry closes with a research summary drawn from the Center’s semester final report for that project. Where a project’s final paper carries a formal author abstract, that abstract replaces the summary and is labelled as such.

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FACULTY ADVISORS

Directed Research at the Center for Tropical Island Biodiversity Studies was advised by 4 faculty and researchers across these semesters.

ADVISOR	PROJECTS	SEMESTERS
Dr. Daniel Medina	8	All four semesters
Dr. Dagoberto E. Venera-Pontón	5	Fall 2024, Spring 2025, Fall 2025
Dr. Leon Mach	4	Fall 2024, Spring 2025, Spring 2026
Holly Hummel	3	Spring 2025, Fall 2025, Spring 2026

Center for Tropical Island Biodiversity Studies · Bocas del Toro, Panama

01 Perceptions of Human-Wildlife Conflict on Isla Colón, Bocas del Toro, Panamá

Faculty advisors: Holly Hummel and Dr. Leon Mach

Max Sidem¹, Oliver Lete-Straka¹, Benicio Martins-Caulfield²

¹ University of Wisconsin, ² University of Michigan

RESEARCH SUMMARY

This project gathered exploratory data on how residents of Isla Colón perceive human–wildlife conflict, working through interviews across the island. Settlement in Bocas del Toro is bringing people and wildlife into contact in ways that have not been documented, and the advisor describes the material collected as valuable groundwork for a fuller study.

02 Microhabitat Preference of *Andinobates claudiae* on Isla Colón, Bocas del Toro, Panama

Faculty advisor: Dr. Daniel Medina

Kena Debebe¹, Mia King-O'Brien², K.B. Wilebski-Koch³

¹ Whitman College, ² Oberlin College, ³ Longwood University

RESEARCH SUMMARY

Andinobates claudiae is an endangered dart frog endemic to Bocas del Toro, and its fine-scale habitat requirements are largely unknown. This project characterised the species' microhabitat preference on Isla Colón. It opens a collaboration with Smithsonian Tropical Research Institute post-doctoral fellow Dr. Ricardo Cossio and his intern on the fine-scale distribution and resource use of the species — work that will run for at least another year with SFS students taking part, and an SFS alumnus from Fall 2025 returning in June for a two-month internship on one of its components.

03 Phytotelmata Specialization and Niche Partitioning Observed in *Andinobates claudiae* Tadpole Deposition in Bocas del Toro, Panama

Faculty advisor: Dr. Daniel Medina

Kai Baker¹, Catherine Hernando², Maddie Mahoney¹, Breanna Pitta³

¹ Elon University, ² College of the Holy Cross, ³ Trinity College

RESEARCH SUMMARY

Dart frogs carry their tadpoles to small pools of water held in plants — phytotelmata — and which plants they choose shapes how the species uses its habitat. This project examined phytotelmata specialization and niche partitioning in *Andinobates claudiae* tadpole deposition in Bocas del Toro. It forms the second component of the Smithsonian Tropical Research Institute collaboration on the distribution and resource use of this endangered endemic, which continues with SFS students involved.

Center for Tropical Island Biodiversity Studies · Bocas del Toro, Panama

01 Using the Q-Methodology to Understand Different Perspectives on Land Use on Isla Colón, Panamá

Faculty advisor: Holly Hummel

Alice O'Neal-Freeman¹, Isabelle Rowley², Leila Bannon³, Emily Taylor¹, Luna Wilhelm⁴

¹ Colorado College, ² Siena University, ³ Smith College, ⁴ Southern Oregon University

RESEARCH SUMMARY

Q-methodology asks participants to rank statements rather than answer questions, which surfaces the distinct viewpoints present in a community rather than an average opinion. This project applied it to land use on Isla Colón, mapping the perspectives residents hold. It was the Center's first use of the method, which participants received well; the advisor is considering repeating the study on Isla Bastimentos, Solarte, or Carenero.

02 Cacao Land Management Effects Diversity and Community Dynamics of Leaf-Litter Frogs in Bocas del Toro, Panamá

Faculty advisor: Dr. Daniel Medina

Ariel Dean¹, Forrest Kayser², Robyn Altham³

¹ Scripps College, ² Colorado College, ³ University of San Francisco

RESEARCH SUMMARY

Cacao is grown under shade in Bocas del Toro, which makes the farms a partial habitat for forest species. This project tested how cacao land management affects the diversity and community dynamics of leaf-litter frogs. The advisor considers the results very interesting and intends to combine them with two earlier Directed Research datasets, from Fall 2023 and Spring 2024, into a comprehensive paper for a peer-reviewed journal.

03 The Impact of Land-Use Changes on Habitat Use and Behavior of the Strawberry Poison Dart Frog, *Oophaga pumilio*, in Bocas del Toro, Panamá

Faculty advisor: Dr. Daniel Medina

Esther Calvert¹, Olivia Britton², Haley Novonthy³

¹ Reed College, ² University of Vermont, ³ Gonzaga University

RESEARCH SUMMARY

The strawberry poison dart frog *Oophaga pumilio* persists in altered landscapes where other amphibians do not, which makes it a useful subject for measuring what land-use change actually does to habitat use. This project examined how those changes affect the species' habitat use and behaviour in Bocas del Toro. The results will be combined with the Fall 2023 and Spring 2024 datasets toward a peer-reviewed publication.

04 Structure of Fish Communities Associated to Acroporid Patches Impacted by a Recent Coral Bleaching Event in Bocas del Toro

Faculty advisor: Dr. Dagoberto E. Venera-Pontón

Samuel Kalman¹, Atziri Fernandez², Piper Enderlein³, Samantha Chee⁴

¹ Connecticut College, ² Whitman College, ³ University of Colorado Boulder, ⁴ University of Washington

RESEARCH SUMMARY

This project is one instalment in a study running across Directed Research courses since Spring 2022. The original aim was to evaluate the population status and health of elkhorn and staghorn corals in Bocas del Toro along with their surrounding fish communities; the 2023 Caribbean mass bleaching event killed most of the colonies that had just been assessed, and the study was re-cast to track what followed. The corals have clearly declined, while the fish communities show mixed results across regions of the archipelago. The advisor was ready to submit in September 2025 but ran one further semester, which added depth and clarified aspects that had remained obscure; the manuscript goes out in the first half of 2026.

Center for Tropical Island Biodiversity Studies · Bocas del Toro, Panama

01 Understanding the Surf Community in Bocas del Toro

Faculty advisor: Dr. Leon Mach

Anna Cornell¹, Tierney Hennegan², David Leavitt³, Kennedy Reynolds⁴, Sydney Yankee⁵

¹ University of Wisconsin, ² Bates College, ³ University of Vermont, ⁴ Whitman College, ⁵ Connecticut College

RESEARCH SUMMARY

This project documented the surf community of Bocas del Toro — who surfs, what they spend, and how the community is organised. Findings included women reporting marginalisation within the surf community and young girls being kept out of learn-to-surf programmes by their parents, both flagged by the advisor as avenues for further research. The advisor also notes that Bocas has two separate surf communities, one at Carenero and one at Paunch, a division that complicates community organising and may limit collective action on threats to surf ecosystems. Next steps include surveying surf tourists in high season to produce more robust expenditure figures for the global nonprofits working in this space.

02 Patterns & Partners: Ecological Distribution & Space-Use Habits of *Andinobates claudiae* with *Heliconia* spp. in Tropical Rainforests

Faculty advisor: Dr. Daniel Medina

Mia Benjamin¹, Moa Lilja², Jenna Parker³, Larson Selvig²

¹ Hollins University, ² Whitman College, ³ Villanova University

RESEARCH SUMMARY

Andinobates claudiae depends on *Heliconia* and similar plants for the water-holding structures its tadpoles need. This project mapped the ecological distribution and space-use habits of the frog in relation to *Heliconia* spp. in tropical rainforest. The advisor notes the project needed more sampling time, and planned an improved study design with a follow-up the following semester.

03 Patterns of *pumilio*: Spatial Distribution and Density of *Oophaga pumilio* in Disturbed Tropical Forests

Faculty advisor: Dr. Daniel Medina

Renee Amado¹, Maya Merchant², Makai Pope³, Vivienne Scott³

¹ Skidmore College, ² University of San Diego, ³ Brandeis University

RESEARCH SUMMARY

This project measured the spatial distribution and density of *Oophaga pumilio* across disturbed tropical forest, testing how densely the strawberry poison dart frog packs into habitat that has been altered. As with its companion project on *Andinobates claudiae*, the advisor notes more sampling time was needed and planned an improved design for a follow-up.

04 Attitudes Toward Wildlife and Connectedness to Nature in Bocas del Toro

Faculty advisor: Holly Hummel and Dr. Leon Mach

Zoe Hughes¹, Yoann Beuve², Holly Pacyon³, Annaliese Mmari⁴

¹ University of Wisconsin/Madison, ² Trinity College, ³ Smith College, ⁴ University of Michigan

RESEARCH SUMMARY

This project surveyed attitudes toward wildlife and connectedness to nature among residents of Bocas del Toro, the first time it had been run at the Center. The advisor recommends a modified survey for future iterations, collecting more on which conservation efforts people would actually support, and continued work in communities such as Almirante, where fewer people have been surveyed.

05

Community Structure of Fishes Associated with *Acropora* Habitats Impacted by the 2023 Bleaching Event in Bocas del Toro, Caribbean Panama

Faculty advisor: Dr. Dagoberto E. Venera-Pontón

Abigail Enney¹, Maggie Bugler², Stella Mckitrick³, Annabel Fiero⁴

¹ University of San Francisco, ² University of Massachusetts/Amherst, ³ Denison University, ⁴ Scripps College

RESEARCH SUMMARY

Part of the multi-semester study of elkhorn and staghorn habitats in Bocas del Toro, this project examined the community structure of fishes associated with *Acropora* habitats after the 2023 bleaching event. It contributes to a dataset built across several Directed Research courses, which the advisor was re-analysing toward a manuscript during sabbatical leave from May to August 2025.

06

Functional Group Structure of Stony Corals After Significant Loss of *Acropora cervicornis* in Almirante Bay, Bocas del Toro, Panama

Faculty advisor: Dr. Dagoberto E. Venera-Pontón

Clara Hansen¹, McCulloch MacPherson², Renee Trombley³

¹ Whitman College, ² Connecticut College, ³ Trinity University

RESEARCH SUMMARY

This project examined how the functional group structure of stony corals in Almirante Bay changed after the significant loss of *Acropora cervicornis* — which groups filled the space the staghorn left. It belongs to the same multi-semester study of coral and fish communities across the archipelago, with a manuscript in preparation.

Center for Tropical Island Biodiversity Studies · Bocas del Toro, Panama

01 Community perceptions on coastal erosion in Bocas del Toro, Panama

Faculty advisor: Dr. Leon Mach

Riley Brokaw¹, Ava Houtman², Greta Lee³, Sienna Stephens⁴, Cecelia Wasco⁵, Isabella Well⁶

¹ Ohio Wesleyan University, ² Whitman College, ³ Oberlin College, ⁴ Trinity College, ⁵ Duke University, ⁶ University of San Francisco

RESEARCH SUMMARY

This project recorded how communities in Bocas del Toro perceive coastal erosion: where they see it happening, what they attribute it to, and what they think should be done about it. The findings were shared with stakeholders at a Smithsonian stakeholder meeting, and the advisor planned to combine the research with the work of a Smithsonian fellow into a joint report and potentially a publication.

02 Investigation of thermal niche adaptations of *Oophaga pumilio* to land-use change through thermal preference experimentation and field observation

Faculty advisor: Dr. Daniel Medina

Jamie Coukos-Wiley¹, Maeli Ready², Sarah DiBiasio³

¹ Reed College, ² Oregon State University, ³ University of Vermont

RESEARCH SUMMARY

This project investigated whether *Oophaga pumilio* adjusts its thermal niche in response to land-use change, combining thermal preference experiments with field observation. The results indicate that different types of land-use change may have opposite effects on body condition and thermal ecology, and that those effects may vary across the frog's colour morphs. The advisor planned to begin work on a paper for publication.

03 Assessing the impact of land-use change on the thermal ecology of tropical frogs: A comparison of generalist and forest-restricted species in Bocas del Toro, Panama

Faculty advisor: Dr. Daniel Medina

Trinity Bohrer¹, Eamon Kenney², Pluto Wah³

¹ Rochester Institute of Technology, ² College of the Holy Cross, ³ University of San Diego

RESEARCH SUMMARY

The companion study to the *Oophaga pumilio* thermal work, this project compared the thermal ecology of a generalist frog against a forest-restricted species to see how each responds to land-use change. It points to a mechanism by which an endemic Bocas del Toro frog may be failing to tolerate cacao farming and the habitat degradation that comes with residential development. The advisor planned to combine the data with the parallel project toward a publication.

04 Herbivory and aggression between keystone herbivorous fishes in coral reef habitats of Bocas del Toro, Panama

Faculty advisor: Dr. Dagoberto E. Venera-Pontón

Avery Hough¹, Isabel Arcaris², Nicolas Darringer²

¹ Reed College, ² Whitman College

RESEARCH SUMMARY

Herbivorous fishes keep algae off coral reefs, and how much they graze depends partly on how much time they spend fighting each other. This project measured herbivory and aggression — within species, within family, and between families — across five target species on Bocas del Toro reefs. The advisor notes the sample was too small to establish whether grazing and aggression differ between life stages of the same species, and that fewer species with more individuals each would have served better. The findings will nonetheless be submitted for publication.

05 **Population structure and inter-ecosystemic ontogenic patterns of keystone herbivore fishes within the Bocas del Toro Archipelago, Caribbean Panama**

Faculty advisor: Dr. Dagoberto E. Venera-Pontón

Kiana Marckx¹, Kieren Quigley², Annabella Williams³

¹ Colorado College, ² Whitman College, ³ Bowdoin College

RESEARCH SUMMARY

This project assessed the population structure of keystone herbivorous fishes across the Bocas del Toro archipelago and their ontogenic patterns between ecosystems — how individuals shift habitat as they grow. Juveniles were clearly more frequent in mangroves and seagrass than on coral reefs. Surveying damselfishes in mangroves proved harder than expected and will require reconsidered methods; the advisor intends to repeat the work using trap cameras or non-lethal capture that allows fish to be measured, marked, and released. The findings will be submitted for publication.

THE SCHOOL FOR FIELD STUDIES

Center for Tropical Island Biodiversity Studies, Bocas del Toro, Panama. Titles, faculty advisors, student authors, and home institutions compiled from the SFS Directed Research project lists for Fall 2024, Spring 2025, Fall 2025, and Spring 2026.