
Patrick M Kiel

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EDUCATION

Ph.D. Marine Biology and Ecology, January 2022-Present

Rosenstiel School of Marine, Atmospheric, and Earth Science, Miami, FL

- Advisors: Drs. Ian Enochs, Vivek Prakash, Prannoy Suraneni
- Topics: coral reefs, biophysics, ocean acidification, alkalinity enhancement

Bachelor of Science in Marine and Atmospheric Science, May 2020

University of Miami, Coral Gables, FL

- Majors: Marine Science and Biology
 - Thesis: “Examining structural and mechanical properties of the threatened coral *Acropora cervicornis*: Effects of nursery grow-out platforms on mechanical strength”
 - Study Abroad: UGalapagos - International Outreach Initiative, Galapagos Islands, Spring 2019
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PROFESSIONAL EXPERIENCE

Research Assistant I

October 2020 - December 2021

NOAA’s Atlantic Oceanographic and Meteorological Laboratory (AOML) Coral Program

Supervisors: Dr. Ian Enochs, Nathan Formel

- Developed the *Acropora cervicornis* Data Coordination Hub: an open-access database to align datasets and evaluate genet performance and restoration potential
- Designed processing code for automated incubation chambers designed to rapidly assess coral physiology and calcification rates
- Conducted carbonate budget surveys in support of the National Coral Reef Monitoring Program
- Supported diverse projects within the AOML Coral Program and Experimental Reef Laboratory investigating coral disease, ocean acidification, heterotrophy, and thermal tolerance

Undergraduate Research Assistant and Scientific Diver

September 2018 - May 2020

Lirman Benthic Ecology and Coral Restoration Lab, University of Miami

Supervisors: Drs. Diego Lirman, Jane V. Carrick

- Led independent research project investigating mechanical strength of coral skeletons and role of coral restoration to increase wave attenuation of degraded reefs to support coastal resilience
- Conducted monitoring of seagrass and mangrove communities and coral restoration projects
- Collaborated with team of researchers and graduate students conducting research projects and ecological assessments of reefs and seagrass beds in South Florida

Undergraduate Research Assistant

August 2017 - May 2019

South Florida Corals and Climate Change Laboratory, University of Miami

Supervisor: Dr. Chris Langdon

- Analyzed *Acropora cervicornis* under experimental ocean acidification conditions to determine effects on calcification rate, tissue lipid content, symbiont density, and chlorophyll-*a* concentration
 - Maintained coral mesocosms and microcosms in forecasted high CO₂ reef conditions
 - Collected and analyzed seawater samples of experimental aquarium
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COMMUNITY OUTREACH

Coral Restoration Educator

May 2019 - present

Rescue a Reef, Miami, FL

- Communicated economic and social value of coral reefs to the public in outreach events and lab tours
- Taught citizen scientists coral restoration principles and techniques during field excursions

Science Communicator

May 2021 - present

Multiple initiatives including, *Skype a Scientist*, *4-H*, *MacArthur Beach State Park's Marine Biology Camp*, *Miami-Dade County Girl Scouts*, *Miami Waterkeeper*, *Miami Children's Trust STEM Summer Program*

- Presented coral reef science to 16 school and summer camp groups aged 6-16 throughout the United States and Canada
- Demonstrated how technology can help scale coral reef science and restoration to local political leaders and general public audience

President

May 2019 - April 2020

University of Miami Scuba Club, Coral Gables, FL

- Organized twice-weekly dive trips, training courses, and managed gear procurement and maintenance for membership of 400+ students, faculty, and alumni.
- Worked closely with University officials to obtain \$60,000 in annual funding and ensured proper risk management and dive safety policies.
- Previous roles: Dive Safety Officer (2016-2017), Treasurer (2017-2018), Vice President (2018-2019)

Divemaster and Science Educator

May 2017 - August 2018

Florida National High Adventure Sea Base, Boy Scouts of America, Islamorada, FL

- Guided divers between the ages of 14-18 around local reefs and instilled safe diving practices
- Revised seminar curriculum and taught local ecology, fish and coral identification to a public audience
- Additional responsibilities included dive equipment maintenance, boat handling, boat maintenance

TEACHING & MENTORSHIP

Teaching

- Teaching Assistant, "MBE 408, Climate Change: Limits of Marine Invertebrate Adaptability". Guided 11 students through a research-focused course investigating chronic hypoxia stress on coral health. Student learning outcomes included proficiency in analytical water chemistry, measuring metabolic enzyme activity, respirometry, experimental design, and data analysis.
- Teaching Assistant, "MSC 112, Introduction to Marine Science Laboratory" - 2 sections. Taught 24 students in a laboratory and field-based course. Student learning outcomes included understanding the scientific method, scientific writing, and data analysis.

Mentorship

- Ambar Condori-Boughton, April 2025 - present
- Merritt Sherrer, September 2023 - present
- Inge Brijker, May 2023 - December 2024
- Matthew McConnell, January 2024 - May 2024
- Samantha Levine, January 2022 - August 2023
- Carolyn Delli-Santi, May 2022 - August 2023
- Alexandra Redford, January 2022 - May 2022

SKILLS & Certifications

Research Skills

- Analytical water chemistry: spectrometric pH, dissolved inorganic carbon, total alkalinity, dissolved oxygen, nutrients (ammonia, nitrate, nitrite, orthophosphate, silica)
- Calibration, implementation, and analysis of coral reef monitoring instruments: tilt current meters, Nortek acoustic doppler current profilers, SeaBird EcoPAR and SeaFET sensors, Sub-surface Automated Samplers, HOBO pendant loggers
- Maintenance of microcosms and mesocosms for long-term experimental coral observations
- Marine invertebrate incubations to investigate respirometry and calcification
- Development of in-house custom built experimental equipment: CAD (Autodesk Fusion 360), 3D printing, laser cutting, CNC, electronics
- Microscopy/Digital Imaging: scanning electron microscope, μ CT-scanning, 3D-scanning, reef-scale photogrammetry
- Marine carbonate geochemistry ($\delta^{13}\text{C}$, ICP-QQQ)

- Spectroscopic material characterization (FTIR, Raman)
- Particle Image Velocimetry (PIV) experimental design and data analysis

Software

- R, Python, MySQL, Adobe Creative Suite, Web Design (HTML, CSS, JavaScript), Amira-Avizo, MeshLab, FlexScan 3-D Scanning, Agisoft Metashape, ArcGIS, ImageJ

Diving and Marine Operations

- Scientific Diver, University of Miami (AAUS: 100 ft, rebreather authorized)
- Small Boat Operations (US Department of Interior Motorboat Operator Certification)
- Divemaster and Rescue Diver, Professional Association of Diving Instructors
- Fundamentals Technical Pass, Global Underwater Explorers
- Closed-circuit rebreather (Optima, Inspiration, FXCCR), Technical Diving International
- DPV/Trimix open circuit cave diver, Global Underwater Explorers & Technical Diving International
- Professional First Aid/CPR/AED, Divers Alert Network/Red Cross
- Emergency Oxygen Provider, Divers Alert Network/Professional Association of Diving Instructors

FIELD EXPERIENCE

- Flower Garden Banks (2025), Florida (2018-2025), Dry Tortugas (2021), Galapagos (2019)

AWARDS & RECOGNITIONS

- NOAA Oceanic and Atmospheric Research 2023 Team Member of the Year for Outreach and Education
- National Science Foundation, Graduate Research Fellowship, \$147,000
- Dr. Linda Farmer Undergraduate Research Award, \$2,500
- University of Miami Eco Agency Programming Grant for Coral Restoration, \$1,500

Total Funding Received: \$151,000

Publications

Peer-reviewed Manuscripts (4)

1. Ruszczyc M, **Kiel PM**, Chandragiri S, Guigand CM, Xia J, Brown O, Haus BK, Baker AC., Miller MW, Suraneni P, Langdon C, Prakash VN (2024) Flumex: A modular flume design for laboratory-based marine fluid-substrate studies. *HardwareX*. doi:10.1016/j.ohx.2025.e00697
2. DeMerlis A, Studivan M, Wong K, Soderberg N, Ehrens D, Isma L, Cocson K, Rosing K, Thomas R, D'Alessandro M, Dvorkin D, Unsworth J, **Kiel PM**, Palacio-Castro A, Lirman D, Baker AC, Muller E, Traylor-Knowles N, Enochs IC (2025) Species-level differences in molecular responses to a thermally variable stress-hardening treatment for Caribbean corals. *Ecology & Evolution*. doi:10.1002/ece3.72108
3. Webb AE, Palacio-Castro AM, Cooke K, Eaton KR, Chomitz B, Soderberg N, Chakraborty M, Zagon Z, Boyd A, **Kiel PM**, DeMerlis A, Perry CT, Enochs IC (2024) Rubble persistence under ocean acidification threatened by accelerated bioerosion and lower-density coral skeletons. *Global Change Biology*. doi:10.1111/gcb.17371
4. **Kiel PM**, Formel N, Jankulak M, Baker AC, Cunning R, Gilliam DS, Kenkel CD, Langdon C, Lirman D, Lustic C, Maxwell K, Moulding AL, Moura A, Muller EM, Schopmeyer S, Winters RS, Enochs IC (2023) *Acropora cervicornis* Data Coordination Hub, an open access database for evaluating genet performance. *Bulletin of Marine Science*. doi:10.5343/bms.2022.0064

Editorials and Commentaries

1. **Kiel PM**, Prakash VN (2022) Coral physiology: Going with the ciliary flow. *Current Biology* (32):998–1022. doi:10.1016/j.cub.2022.08.049

Manuscripts in Review

1. **Kiel PM**, McConnell M*, Boyd A, Soderberg N, Suraneni P, Prakash VN, Enochs IC (2025) Electrochemically induced alkalinity enhancement increases coral growth rates in the local microenvironment. *Research Square* [Preprint], 11 July 2025. doi:10.21203/rs.3.rs-6917096/v1
2. Cooke K, Palacio-Castro AM, Boyd A, Soderberg N, **Kiel PM**, Stevens A, Langdon C, Enochs IC (2025) Alkalinity enrichment stimulates calcification and linear extension in *Acropora cervicornis*.

*undergraduate mentee

PRESENTATIONS

- **Kiel PM**, Karp R, Jankulak M, Enochs IC (2025, June 4-6) Expanding the *Acropora cervicornis* Data Coordination Hub, an Open Access Tool for Evaluating Coral Genotype Performance. 3rd United Nations One Ocean Science Congress, Nice, France. **Poster Presentation**
- **Kiel PM**, McConnell M, Boyd A, Soderberg N, Suraneni P, Unsworth J, Lirman D, Prakash V, Enochs IC (2024, December 9-13) Increasing massive coral growth rates with electrochemically induced alkalinity enhancement. Reef Futures Conference, Riviera Maya, Mexico. **Oral Presentation**
- **Kiel PM**, Karp R, Enochs IC (2024, December 9) The *Acropora cervicornis* Data Coordination Hub, an Open Access Tool for Evaluating Coral Genotype Performance. **Hosted Workshop**
- **Kiel PM**, Enochs IC, Lirman D, Prakash VN, Suraneni P, Boyd A, Chomitz B, Oehlert A, Pollier C, Pourmand A, Sharifi A, Soderberg N (2024, May 26-31) Surface Roughness Induces Intraspecific Ocean Acidification Resistance. 7th Microscale Ocean Biophysics Meeting, Heron Island, Australia. **Poster Presentation**
- **Kiel PM**, Eaton K, Enochs IC (2023, November 8) The *Acropora cervicornis* Data Coordination Hub, an Open Access Tool for Evaluating Coral Genotype Performance. **Hosted Workshop**
- **Kiel PM**, Enochs IC, Lirman D, Prakash VN, Suraneni P, Boyd A, Chomitz B, Oehlert A, Pollier C, Pourmand A, Sharifi A, Soderberg N (2023, April 26-29) Can genet-specific morphology ameliorate the effects of ocean acidification? 51st Benthic Ecology Meeting, Miami, FL. **Oral Presentation**
- **Kiel PM**, Enochs IC, Lirman D, Prakash VN, Suraneni P (2023, March 21) Engineering corals for climate change resilience. University of Miami Graduate & Postdoctoral Research Symposium. **Poster Presentation**
- **Kiel PM**, et al. (2022, September 26-30) *Acropora cervicornis* Data Coordination Hub: An open-access tool for coordinating datasets and evaluating genet-specific performance of *Acropora cervicornis*. Reef Futures Conference, Key Largo, FL. **Oral Presentation**
- **Kiel PM**, et al. (2022, July 3-8) *Acropora cervicornis* Data Coordination Hub, an open-access tool for aligning datasets and evaluating genotype-specific performance. 15th International Coral Reef Symposium, Bremen, Germany **Oral Presentation**
- **Kiel PM**, Carrick JV, Ramanathan S, Suraneni P, Rhode-Barbarigos L, Lirman D (2020, April 28) Examining structural and mechanical properties of the threatened coral *Acropora cervicornis*: Effects of nursery grow-out platforms on mechanical strength. Rosenstiel Undergraduate Research Symposium (RURS), Miami, FL. **Poster Presentation**

Management Tools & Data Portals

- Gill T, Jankulak M, **Kiel PM**, Enochs IC Mission Iconic Reefs Environmental Monitoring Portal <https://coral.aoml.noaa.gov/mir/>
- Webb AE, **Kiel PM**, Jankulak M, Enochs IC Reef Persistence Evaluation Tool. https://coral.aoml.noaa.gov/RPTool_simulation/
- **Kiel PM**, Karp R, Formel N, Jankulak M, Enochs IC The *Acropora cervicornis* Data Coordination Hub. <https://www.coral.noaa.gov/AcDC/>

Professional Service

Scientific Journal Reviews (10)

- Current Biology, Ecological Engineering, Frontiers in Marine Science, Scientific Reports, Global Change Biology