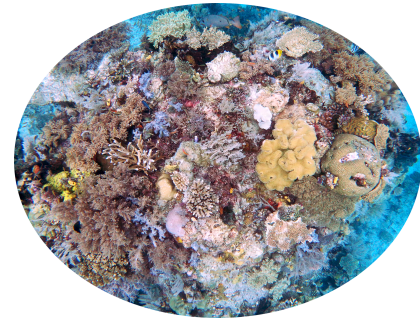


**Dr. Coral**

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## Education

**University of Hawaii, Manoa, Department of Zoology**, Honolulu, Hawaii. **Ph.D., Zoology**. Fall 2009.  
Supervisor: Dr. Ruth Gates, University of Hawaii, Manoa/Hawaii Institute of Marine Biology  
**University of Hawaii, Manoa, Department of Zoology**, Honolulu, Hawaii. **M.S., Zoology**. Fall 2007.  
Supervisor: Dr. Ruth Gates, University of Hawaii, Manoa/Hawaii Institute of Marine Biology  
**Duke University**, Durham, North Carolina. **B.S., Biology**. Fall 2003. GPA: 3.8/4.0 (*magna cum laude*)  
**James Cook University**, Townsville, Australia (study abroad). Fall 2003.  
**Bermuda Institute of Oceans Sciences**, Bermuda (study abroad). Spring 2003.  
**Duke University Marine Laboratory**, Beaufort, North Carolina. Spring 2003.  
Financed 100% of undergraduate education through employment and early graduation.

## Professional research experience

**National Oceanic & Atmospheric Administration (NOAA)/Cooperative Institute for Marine & Atmospheric Studies (CIMAS; University of Miami)**, *assistant scientist*, Apr. 2019-Jul. 2022.

## Postdoctoral research experience

**Khaled bin Sultan Living Oceans Foundation (LOF)**, *postdoctoral researcher*, Jan. 2013-Mar. 2019. Conducted research aboard the *Golden Shadow* as part of the LOF “Global Reef Expedition” to 1) understand the molecular basis of the coral stress response and 2) develop molecular diagnostic tools for assessing reef coral health.  
**National Science Foundation (NSF) international postdoctoral research fellowship (OISE-0852960)**, **National Museum of Marine Biology and Aquarium (NMMBA)**, **Checheng, Taiwan**, *postdoctoral researcher*, Feb. 2010-Dec. 2012. Investigated the physiological and sub-cellular impacts of climate change on reef-building corals.  
**NSF grant OCE 04-17412 to Peter Edmunds** (The Mo’orea Coral Reef Long Term Ecological Research [LTER] program), **Mo’orea, French Polynesia**, *postdoctoral researcher*, Feb.-Apr. 2011. Investigated the impacts of ocean acidification on reef-building coral larvae.

## Master’s and Ph.D. research experience

**NSF grant OCE-0752604 to Ruth Gates**, **Hawaii Institute of Marine Biology (HIMB)**, **Kaneohe, HI**, *graduate researcher*, Oct. 2008-Jun. 2009. Developed new molecular markers for the coral endosymbiont *Symbiodinium* sp.  
**NSF East Asia and Pacific Summer Institutes fellowship**, **NMMBA, Checheng, Taiwan**, *participant*, Summer 2008. Conducted research on molecular regulation of coral physiology.  
**NSF graduate research fellowship**, **HIMB, Kaneohe, HI**, *graduate researcher*, Fall 2005-Fall 2008.

Developed molecular methodology for reef corals at the Hawaii Institute of Marine Biology. **Pauley Summer Program, HIMB, Kaneohe, HI, research technician**, Summer 2007. Trained foreign students in coral molecular biology techniques (e.g., DNA/RNA extractions, PCR, and qPCR). **Northwest Hawaiian Islands (NWHI) research cruise, research assistant**, Summer 2006. Collected corals on an HIMB-sponsored NWHI research expedition aboard the NOAA ship *Hi'ialakai*.

### Undergraduate and post-baccalaureate research experience

**Centro Ecológico Akumal (NGO), Akumal, Mexico, coral reef ecologist/volunteer**, Spring 2004. Assessed health of coral reefs along the Mayan Riviera, with an emphasis on reefs of Akumal. **Duke University Marine Laboratory, Beaufort, NC, undergraduate research project**, Summer 2003. “Triclosan-induced oxidative stress in the whip coral *Leptagorgia virgulata*.” **Duke University, Durham, NC, experimental test subject**, Winter 2002. Participant in the Divers Alert Network’s “flying after diving” study at the Duke University hospital’s hyperbaric chamber.

### Peer-reviewed publications ([Orcid](#), [Google Scholar](#))

- (78) **Mayfield AB**, Aguilar C, Manzello DP ([in prep.](#)) Elucidating the molecular cascades underlying Caribbean coral thermotolerance using proteomic technologies.
- (77) **Mayfield AB**, Dempsey AC, Chen CS ([in prep.](#)) Profiling reef-building coral health in the Republic of Palau.
- (76) Fan TY, Huang YL, **Mayfield AB** ([in prep.](#)) Effects of light level and food regime on aquaculture of the model reef coral *Pocillopora acuta*.
- (75) Wainwright B, **Mayfield AB**, Dempsey AC, Huang D ([in prep.](#)) Microbial communities of corals from a near-pristine region of the Indian Ocean. *Coral Reefs*
- (74) **Mayfield AB** ([in prep.](#)) Towards predicting reef coral fate with a molecular biotechnology+ artificial intelligence approach. Target journal=*Diversity*
- (73) **Mayfield AB**, Dempsey AC, Lin C ([in prep.](#)) Resolving heterogeneity in coral health across environmental gradients in the Solomon Islands. Target journal=*Applied Sciences*
- (72) Morris J, Kolodziej G, Enochs IC, Traylor-Knowles N, **Mayfield AB** ([in prep.](#)) The effects of ocean acidification on bioeroding sponges of the Caribbean.
- (71) Ye ZM, **Mayfield AB**, Fan TY ([under review](#)) Variable responses to marine heat waves in five fringing reefs of Southern Taiwan. *Diversity*
- (70) Awaluddin K, **Mayfield AB**, Liu PJ ([under review](#)) Effects of simulated climate change on calcifying marine macroalgae. *Coral Reefs*
- (69) **Mayfield AB**, Gates RD, Fan TY, Putnam HM ([under review](#)) Physiological and molecular responses to ocean acidification in a model marine symbiosis. *Marine Biology*
- (68) Gan C, Wang YB, Chen WNU, **Mayfield AB**, Peng SE ([under review](#)) Developing a laboratory system for the culture of the sea anemone *Exaiptasia pulchella*. *PeerJ*
- (67) **Mayfield AB** ([in press](#)) Multi-macromolecular extraction from endosymbiotic anthozoans. Invited book chapter, *Lipidomics* (Elsevier), Bhattacharya S (ed.)
- (66) Liu PJ, Chang HF, **Mayfield AB**, Lin HJ (2022) Assessing the effects of ocean warming and acidification on the seagrass *Thalassia hemprichii*. *Journal of Marine Science and Engineering* 10, 714.
- (65) Demerlis A, Kirkland A, Kaufman M, **Mayfield AB**, Formel N, Manzello DP, Lirman D, Traylor-Knowles N, Enochs IC (2022) Variable temperature treatments alter *Acropora cervicornis* response to acute thermal stress. *Coral Reefs* 41, 435-445.
- (64) Martinez-Castillo V, Rodriguez-Troncoso AP, **Mayfield AB**, Rodriguez-Zaragoza FA, Cupul-Magana AL (2022) Coral recovery in the Central Mexican Pacific 20 years after the 1997–1998 El Niño Event. *Oceans* 3(1), 48-59.

- (63) Chen CC, Hsieh HY, **Mayfield AB**, Chang CM, Wang JT, Meng PJ (2022) The key impact of water quality on the coral reefs of Kenting National Park. *Journal of Marine Science and Engineering* 10(2), 270.
- (62) **Mayfield AB**, Dempsey AC (2022) Environmentally-driven physiological variation in a New Caledonian reef coral. *Oceans* 3(1), 15-29.
- (61) **Mayfield AB** (2022) Machine-learning-based proteomic predictive modeling with thermally-challenged Caribbean reef corals. *Diversity* 14, 33.
- (60) **Mayfield AB**, Dempsey AC, Chen CS (2021) Assessing coral health in the Kingdom of Tonga with a coral health index. *Platax* 18, 53-78.
- (59) McRae C, **Mayfield AB\***, Fan TY, Huang WB, Cote I (2021) Differing proteomic responses to high-temperature exposure between adult and larval reef corals. *Frontiers in Marine Science* 8, 716124. \*equal contribution.
- (58) Rubin E, Enochs I, Foord C, Kolodziej G, Basden I, Manzello DP, **Mayfield AB** (2021) Molecular mechanisms of coral persistence within highly urbanized locations in the Port of Miami, Florida. *Frontiers in Marine Science* 8, 695236.
- (57) **Mayfield AB**, Aguilar C, Enochs IC, Kolodziej G, Manzello DP (2021) Shotgun proteomics of thermally challenged Caribbean reef corals. *Frontiers in Marine Science* 8, 660153.
- (56) Tew KS, Kuo J, Cheng JO, Ko FC, Meng PJ, **Mayfield AB**, Liu PJ (2021) Impacts of seagrass on benthic microalgae and phytoplankton communities in a coral reef ecosystem under experimental warming- a mesocosm study. *Frontiers in Marine Science* 8, 679683.
- (55) Grottoli A, **Mayfield AB**, RCN Bleaching Working Group (+25 others)(2021) Increasing comparability among coral bleaching experiments. *Ecological Applications* 31(4), e02262.
- (54) **Mayfield AB** (2020) Exploiting the power of multivariate statistics for probing the cellular biology of thermally challenged reef corals. *Platax* 17, 27-52.
- (53) **Mayfield AB**, Chen CS (2020) A coral transcriptome in the Anthropocene as an “alternative stable state.” *Platax* 17, 1-26.
- (52) Chang TC, **Mayfield AB**, Fan TY (2020) Culture systems influence the physiological performance of the soft coral *Sarcophyton glaucum*. *Scientific Reports* 10, 20200.
- (51) Huang YL, **Mayfield AB**, Fan TY (2020) Effects of feeding on the physiological performance of the stony coral *Pocillopora acuta*. *Scientific Reports* 10, 19988.
- (50) Cruz-García R, Rodríguez-Troncoso AP, Rodríguez-Zaragoza FA, Cupul-Magaña AL, **Mayfield AB** (2020) Ephemeral effects of El Niño southern oscillation events on an eastern tropical Pacific coral community. *Marine and Freshwater Research* 71(10), 1259-1268.
- (49) Peng SE, Moret A, Chang C, **Mayfield AB**, Ren YT, Chen WNU, Chen CS (2020) A shift away from mutualism under food-deprived conditions in an anemone-dinoflagellate association. *PeerJ* 8, e9745.
- (48) **Mayfield AB** (2020) Proteomic signature of corals from thermodynamic reefs. *Microorganisms* 8(8), 1171.
- (47) Enochs IC, Formel N, Manzello DP, Morris J, **Mayfield AB**, Boyd A, Kolodziej G, Adams G (2020) Coral persistence despite extreme periodic pH fluctuations at a volcanically acidified Caribbean reef. *Coral Reefs* 39, 523-528.
- (46) Monteiro HJA, Brahmi C, Lapeyre B, **Mayfield AB**, Le Luyer J (2020) Molecular mechanisms of acclimation to long-term elevated temperature exposure in marine symbioses. *Global Change Biology* 26, 1271-1284.
- (45) Liu PJ, Chang HF, **Mayfield AB**, Lin HJ (2020) Influence of the seagrass *Thalassia hemprichii* on coral reef mesocosms exposed to ocean acidification and experimentally elevated temperatures. *Science of the Total Environment* 700, 134464.
- (44) **Mayfield AB**, Chen CS (2019) Enabling coral reef triage via molecular biotechnology and

- artificial intelligence. *Platax* 16, 23-47.
- (43) Chen TY, Hwang GW, Lin HJ, **Mayfield AB**, Chen CP (2019) The development of a habitat suitability model for sub-tropical tidal flat fiddler crabs. *Ocean and Coastal Management* 182, 104931.
- (42) Lin C, Tsai S **Mayfield AB** (2019) Physiological differences between cultured and wild coral eggs. *Biopreservation and Biobanking* 17, 370-371.
- (41) **Mayfield AB**, Tsai S, Lin C (2019) The Coral Hospital. *Biopreservation and Biobanking* 17, 355-369.
- (40) **Mayfield AB**, Chen CS, Dempsey AC (2019) Modeling environmentally-mediated variation in reef coral physiology. *Journal of Sea Research* 145, 44-54.
- (39) Rodríguez-Troncoso AP, Rodríguez-Zaragoza FA, **Mayfield AB**, Cupul-Magaña AL (2019) Temporal variation in invertebrate recruitment on an Eastern Pacific coral reef. *Journal of Sea Research* 145, 8-15.
- (38) **Mayfield AB**, Dempsey AC, Inamdar J, Chen CS (2018) A statistical platform for assessing coral health in an era of changing global climate-I: a case study from Fiji's Lau Archipelago. *Platax* 15, 1-35.
- (37) Lin HJ, Lee CL, Peng SE, Hung MC, Liu PJ, **Mayfield AB** (2018) Anthropogenic nutrient enrichment may exacerbate the impacts of El Niño-Southern Oscillation (ENSO) events on intertidal seagrass beds. *Global Change Biology* 24, 4566-4580
- (36) **Mayfield AB**, Chen YJ, Lu CY, Chen CS (2018) Exploring the environmental physiology of the Indo-Pacific reef coral *Seriatopora hystrix* using differential proteomics. *The Open Journal of Marine Science* 8, 223-252
- (35) **Mayfield AB**, Chen YJ, Lu CY, Chen CS (2018) The proteomic response of the reef coral *Pocillopora acuta* to experimentally elevated temperature. *PLoS ONE* e0192001
- (34) **Mayfield AB**, Chen CS, Dempsey AC (2017) The molecular ecophysiology of closely related pocilloporid corals of New Caledonia. *Platax* 14, 1-45
- (33) **Mayfield AB**, Chen CS, Dempsey AC (2017) Biomarker profiling in reef corals of Tonga's Ha'apai and Vava'u Archipelagos. *PLoS ONE* e0185857
- (32) Chen HK, **Mayfield AB**, Wang LH, Chen CS (2017) Coral lipid bodies as the relay center interconnecting diel-dependent lipidomic changes in different cellular compartments. *Scientific Reports* 7, 3244
- (31) **Mayfield AB**, Chen CS, Dempsey AC (2017) Identifying corals displaying aberrant behavior in Fiji's Lau Archipelago. *PLoS ONE* e0177267
- (30) Chen TY, Hwang GW, **Mayfield AB**, Chen CP, Lin HJ (2017) The relationship between intertidal soil composition and fiddler crab burrow depth. *Environmental Engineering* 100, 256-260
- (29) **Mayfield AB**, Chen CS, Dempsey AC, Bruckner AW (2016) The molecular ecophysiology of closely related pocilloporids from the South Pacific: a case study from the Austral and Cook Islands. *Platax* 13, 1-25
- (28) **Mayfield AB**, Wang YB, Chen CS, Chen SH, Lin CY (2016) Dual-compartmental transcriptomic+proteomic analysis of a marine endosymbiosis exposed to environmental change. *Molecular Ecology* 25, 5944-5958
- (27) Cheng YR, Meng PJ, **Mayfield AB**, Dai CF (2016) Copepods associated with scleractinian corals: a worldwide checklist and a case study of their impact on the reef-building coral *Pocillopora damicornis* (Linnaeus, 1758) (Pocilloporidae). *Zootaxa* 4174(1): 291-345
- (26) Tortolero-Langarica JJA, Cupul-Magaña AL, Carricart-Ganivet JP, **Mayfield AB**, Rodríguez-Troncoso AP (2016). Changes in growth and calcification rates in the reef-building coral

- Porites lobata*: the implications of morphotype and gender on coral growth. *Frontiers in Marine Science* 3(179)
- (25) **Mayfield AB** (2016) Uncovering spatio-temporal and treatment-derived differences in the molecular physiology of a model coral-dinoflagellate mutualism with multivariate statistical approaches. *Journal of Marine Science and Engineering* 4:63
- (24) Chen WNU, Hsiao YJ, **Mayfield AB**, Young R, Hsu L, Chen CS, Peng SE (2016) Vertical transmission of heterologous clade *C Symbiodinium* in a model anemone infection system. *Peer J* 4:e2358
- (23) **Mayfield AB**, Chen YJ, Lu CY, Chen CS (2016) Proteins responsive to variable temperature exposure in the reef-building coral *Seriatopora hystrix*. *Coral Reefs: Ecosystems, Environmental Impact and Current Threats*. Ed. S. Ortiz, NOVA Publishing, New York. 1-72
- (22) **Mayfield AB**, Bruckner AW, Chen CH, Chen CS (2015) A survey of pocilloporids and their endosymbiotic dinoflagellate communities in the Austral and Cook Islands of the South Pacific. *Platax* 12: 1-17
- (21) Chen HK, Song SN, Wang LH, **Mayfield AB**, Chen YJ, Chen WNU, Chen CS (2015) A compartmental comparison of major lipid species in a coral-*Symbiodinium* endosymbiosis: evidence that the coral host regulates lipogenesis of its cytosolic lipid bodies. *PLoS ONE* 10(7): e0132519
- (20) **Mayfield AB**, Wang YB, Chen CS, Chen SH, Lin CY (2014) Compartment-specific transcriptomics in a reef-building coral exposed to elevated temperatures. *Molecular Ecology* 23: 5816-5830
- (19) **Mayfield AB**, Chen CS, Liu PJ (2014) Decreased green fluorescent protein-like chromoprotein gene expression in specimens of the reef-building coral *Pocillopora damicornis* undergoing high temperature-induced bleaching. *Platax* 11: 1-23
- (18) **Mayfield AB**, Chen YH, Dai CF, Chen CS (2014) The effects of temperature on gene expression in the Indo-Pacific reef-building coral *Seriatopora hystrix*: insight from aquarium studies in Southern Taiwan. *International Journal of Marine Science* 4(50): 1-23
- (17) **Mayfield AB**, Hsiao YY, Chen HK, Chen CS (2014) Rubisco expression in the dinoflagellate *Symbiodinium* sp. is influenced by both photoperiod and endosymbiotic lifestyle. *Marine Biotechnology* 16: 371-384
- (16) Doo SS, **Mayfield AB**, Nguyen HD, Chen HK (2014) Protein analysis in large benthic foraminifera. Invited book chapter in: *Approaches to Study Living Foraminifera*. Editors: Hiroshi Kitazato and Joan Bernhard. Pp. 71-89
- (15) **Mayfield AB**, Fan TY, Chen CS (2013) Real-time PCR-based gene expression analysis in the model reef-building coral *Pocillopora damicornis*: insight from a salinity stress study. *Platax* 10: 1-29
- (14) **Mayfield AB**, Fan TY, Chen CS (2013) Physiological acclimation to elevated temperature in a reef-building coral from an upwelling environment. *Coral Reefs* 32: 909-921
- (13) **Mayfield AB**, Fan TY, Chen CS (2013) The physiological impact of *ex situ* transplantation on the Taiwanese reef-building coral *Seriatopora hystrix*. *Journal of Marine Biology* Article ID 569369
- (12) Wang LH, Lee HH, Fang LS, **Mayfield AB**, Chen CS (2013) Normal fatty acid and phospholipid synthesis are prerequisites for the cell cycle of *Symbiodinium* and their endosymbiosis with sea anemones. *PLoS ONE* e72486
- (11) Putnam HM, **Mayfield AB**, Fan TY, Chen CS, Gates RD (2013) The physiological and molecular responses of larvae from the reef-building coral *Pocillopora damicornis* exposed to near-future increases in temperature and *pCO*<sub>2</sub>. *Marine Biology* 160: 2157-2173
- (10) **Mayfield AB**, Chen M, Meng PJ, Lin HJ, Chen CS, Liu PJ (2013) The physiological response of

the reef coral *Pocillopora damicornis* to elevated temperature: results from coral reef mesocosm experiments in Southern Taiwan. *Marine Environmental Research* 86: 1-11

- (9) **Mayfield AB**, Hsiao, YY, Fan TY, Chen CS (2012) Temporal variation in RNA/DNA and protein/DNA ratios in four anthozoan-dinoflagellate endosymbioses of the Indo-Pacific: implications for molecular diagnostics. *Platax* 9: 1-24
- (8) **Mayfield AB**, Chan PH, Putnam HM, Chen CS, Fan TY (2012) The effects of a variable temperature regime on the physiology of the reef-building coral *Seriatopora hystrix*: results from a laboratory-based reciprocal transplant. *The Journal of Experimental Biology* 215: 4183-4195
- (7) Doo SS, **Mayfield AB**, Byrne M, Chen HK, Nguyen H, Fan TY (2012) Reduced expression of the rate-limiting carbon fixation enzyme RuBisCO in the benthic foraminifer *Baculogypsina sphaerulata* holobiont in response to heat shock. *Journal of Experimental Marine Biology and Ecology* 430-431: 63-67
- (6) Chen WNU, Kang HJ, Weis VM, **Mayfield AB**, Fang LS, Chen CS (2012) Diel rhythmicity of lipid body formation in a coral-*Symbiodinium* endosymbiosis. *Coral Reefs* 31: 521-534
- (5) **Mayfield AB**, Wang LH, Tang PC, Hsiao YY, Fan TY, Tsai CL, Chen CS (2011) Assessing the impacts of experimentally elevated temperature on the biological composition and molecular chaperone gene expression of a reef coral. *PLoS ONE* e26529
- (4) Peng SE, Chen WNU, Chen HK, Lu CY, **Mayfield AB**, Fang LS, Chen CS (2011) Lipid bodies in coral-dinoflagellate endosymbiosis: ultrastructural and proteomic analyses. *Proteomics* 17: 3540-3455
- (3) **Mayfield AB**, Hsiao YY, Fan TY, Chen CS, Gates RD (2010) Evaluating the temporal stability of stress-activated protein kinase and cytoskeleton gene expression in the Pacific corals *Pocillopora damicornis* and *Seriatopora hystrix*. *Journal of Experimental Marine Biology and Ecology* 395: 215-222
- (2) **Mayfield AB**, Hirst MB, Gates RD (2009) Gene expression normalization in a dual-compartment system: a real-time PCR protocol for symbiotic anthozoans. *Molecular Ecology Resources* 9: 462-470
- (1) **Mayfield AB**, Gates RD (2007) Osmoregulation in anthozoan-dinoflagellate symbiosis. *Comparative Biochemistry and Physiology A: Molecular and Integrative Physiology* 147: 1-10

### **Popular science articles, technical reports, & conference proceedings**

- (10) **Mayfield AB** (2022) Corals in the Anthropocene. Khaled bin Sultan Living Oceans Foundation website blog. <https://www.livingoceansfoundation.org/corals-in-the-anthropocene/>.
- (9) **Mayfield AB** (2021) Characterizing coral health in the Anthropocene: a reef in the “new normal.” *Atlantic Oceanographic and Meteorological Laboratory Keynotes*. <https://www.aoml.noaa.gov/news/characterizing-coral-resilience-in-the-anthropocene/>.
- (8) Knowlton N, Grottoli A, Kleypas J, Obura D, Corcoran E, de Goeij J, Felis T, Harding S, **Mayfield AB**, Miller M, Osuka K, Peixoto R, Randall CJ, Voolstra CR, Wells S, Wild C, Ferse S (2021) Rebuilding coral reefs: a decadal grand challenge. International Coral Reef Society (ICRS) “Science to Policy Paper.” 56 pp. [https://coralreefs.org/publications/rebuilding\\_coral\\_reefs/](https://coralreefs.org/publications/rebuilding_coral_reefs/)
- (7) **Mayfield AB** (2021) What makes heat-tolerant corals tick? CIMAS Blog (University of Miami). <https://cimas.rsmas.miami.edu/news-events/cimas-blog/coral-tick/index.html>
- (6) **Mayfield AB** (2021) From documenting coral reef decline to forecasting coral resilience. CIMAS Blog (University of Miami). <https://cimas.rsmas.miami.edu/news-events/cimas-blog/coral-reef-future/index.html>.
- (5) **Mayfield AB** (2020) Feed your corals. “Reef perspectives” piece in *Reef Encounter* (ICRS publication) 35(1): 20-24.

- (4) **Mayfield AB** (2019) Advancing reef coral diagnostic capabilities using molecular biotechnology and artificial intelligence. *IOP Conference Series: Earth and Environmental Science* 339.
- (3) Eberle M, **Mayfield AB** (2019) Big data and the race to save coral reefs. JMP® (Cary, NC). [https://www.jmp.com/en\\_us/customer-stories/living-oceans-foundation.html](https://www.jmp.com/en_us/customer-stories/living-oceans-foundation.html).
- (2) **Mayfield AB** (2018) Are reef corals stressed or just pessimistic? *The Conversation* (Jakarta, Indonesia). <https://theconversation.com/are-reef-corals-stressed-or-just-pessimistic-107361>.
- (1) **Mayfield AB** (2012) Understanding the effects of global climate change on Earth's coral reefs: cutting-edge research at Taiwan's National Museum of Marine Biology and Aquarium. 全球氣候變遷對珊瑚礁的影響 (in Chinese) *Scientific Monthly*, Taipei, Taiwan.

### **Presentations/guest lectures/movies/documentaries**

- (67) **University of North Florida**, *invited speaker*. Sept. 2022. "Coral reef health and diagnostics in a changing world."
- (66) **Discovery Summit Americas 2022 (SAS)**, *virtual speaker*. Aug. 2022. "Envisioning coral reef triage with machine learning."
- (65) **International Coral Reef Symposium**, *virtual speaker*. Jul. 2022. "From reef coral veterinary science to coral reef epidemiology: insights from machine-learning."
- (64) **International Symposium on New Frontiers in Reef Coral Biotechnology**, *keynote speaker*. May 2022. "Envisioning the future of coral reefs with machine-learning."
- (63) **Somerset Academy Silver Palms High School (FL)**, *virtual guest lecturer*. Mar. 2022. "An introduction to coral reefs."
- (62) **CIMAS "lightning" talk**, *virtual speaker*, Jan. 2022. "Forecasting coral reef fate with machine-learning."
- (61) **[Our Living Oceans](#) (EarthX film series)**, *featured scientist with Sylvia Earle*, Aug-Nov. 2021.
- (60) **Discovery Summit Americas 2021 (SAS)**, *invited (virtual) speaker*. Aug. 2021. "Towards predicting the fate of reef corals: 2021 update."
- (59) **NOAA 'Omics seminar**, *virtual speaker*, Aug. 2021. "The utility of 'Omics in environmental forecasting."
- (58) **International Coral Reef Symposium**, *virtual speaker*, Jul. 2021. "Towards predicting the fate of reef corals with molecular biotechnology and artificial intelligence."
- (57) **International Coral Reef Symposium**, *virtual speaker*, Jul. 2021. "ICRS 2021 financial report."
- (56) **AOML "Open House"**, *virtual speaker*, Apr. 2021. "Heat-tolerant corals."
- (55) **OneNOAA seminar**, *virtual speaker*, Apr. 2021. "Towards predicting the fate of reef corals."
- (54) **AOML-NCCOS collaborative meeting**, *invited (virtual) speaker*. Feb. 2021. "Predicting coral fate with artificial intelligence."
- (53) **AOML-NAIEC collaborative meeting**, *invited (virtual) speaker*. Feb. 2021. "Predicting the fate of reef corals using artificial intelligence."
- (52) **Statistically Speaking (SAS)**, *invited (virtual) panelist*. Jan. 2021. "Find meaning with purpose-driven analytics."
- (51) **Discovery Summit Americas 2020 (SAS)**, *invited (virtual) speaker*. Oct. 2020. "Towards predicting the fate of reef corals."
- (50) **OneNOAA seminar**, *virtual speaker*, Aug. 2020. "Assessing coral health in an era of changing global climate: August 2020 update."
- (49) **Miami Integrative Metabolomics Research Center Bi-Annual Meeting**, *invited speaker*. Jul. 2020. "Assessing coral health in an era of changing global climate: July 2020 update."
- (48) **AOML Ocean Research Collaborative Series**, *invited (virtual) speaker*. Jul. 2020. "Assessing coral health in an era of changing global climate: July 2020 update."

- (47) **Earth Day 2020, JMP®, SAS Institute, Cary, NC, USA, invited (virtual) speaker.** Apr. 2020. “Exploring the reef coral response to changing environments.”
- (46) **International Society for Biological and Environmental Repositories annual meeting, Anaheim, CA, USA, virtual keynote speaker.** Apr. 2020. “Biopreservation of reef corals.”
- (45) **Miami Integrative Metabolomics Research Center Bi-Annual Meeting, Miami, FL, USA, invited speaker.** Jan. 2020. “Reef coral proteomic analyses via protein labeling and mass spectrometry.”
- (44) **AOML-SEFSC ‘OMICS workshop, Miami, FL, USA, invited speaker.** Jan. 2020. “Assessing reef coral health using ‘OMICS technologies.”
- (43) **Atlantic Oceanographic and Meteorological Laboratory, Miami, FL, USA, invited speaker.** Aug. 2019. “Assessing coral health in an era of changing global climate.”
- (42) **Indo Aggressor Deep South Komodo National Park coral reef expedition, Nusa Tenggara, Indonesia, invited speaker.** Jan. 2019. “An introduction to reef corals.”
- (41) **The First Maluku International Conference on Marine Science and Technology, Ambon, Moluccas, Indonesia, invited speaker.** Oct. 2018. “Coral reef diagnostics in a changing world.”
- (40) **Department of Biology-National University of Singapore, invited speaker.** Oct. 2018. “Reef coral diagnostics in an era of changing global climate.”
- (39) **East Coast Marine Sustainable Tourism Conference, Taitung, Taiwan, keynote speaker.** Sept. 2018. “Assessing ocean health in an era of changing global climate.”
- (38) **JMP®, SAS Institute, Cary, NC, USA, invited speaker.** Aug. 2018: “Assessing coral health in an era of changing global climate.”
- (37) **Pattimura University, Ambon, Moluccas, Indonesia, invited speaker.** Apr. 2018. “Reef coral health assessment in the Indo-Pacific: the development of biotechnological tools for gauging coral sensitivity to climate change.”
- (36) **I-Shou University, Kaohsiung, Taiwan, invited speaker.** Apr. 2018: “Reef coral health assessment in the Indo-Pacific.”
- (35) **Northwestern University, Chicago, IL, USA, invited speaker.** Nov. 2016. “An introduction to coral reefs: microbiology, threats, and diagnostics.”
- (34) **University of the Philippines, Los Baños, Philippines, invited speaker.** Oct. 2016. “Reef coral health assessment in the South Pacific: preliminary results from Fiji’s Lau Archipelago.”
- (33) **The Omics in the Ocean: 7<sup>th</sup> International Symposium for Marine Biology and Biotechnology, Checheng, Taiwan, invited speaker.** Sept. 2015. “Proteins involved in acclimation to a variable temperature regime in the reef coral *Seriatopora hystrix*.”
- (32) **Asia Pacific Coral Reef Symposium, Kenting, Taiwan, oral presentation,** July 2014. “Exploring the genetic basis of thermotolerance in the model reef coral *Pocillopora damicornis*: an RNA-Seq approach.”
- (31) **National Taiwan University, Taipei, Taiwan, invited speaker,** May 2014. “Reef coral health assessment in the South Pacific: the “Global Reef Expedition.”
- (30) **I-Shou University, Kaohsiung, Taiwan, invited speaker,** Feb. 2014. “Coral reef health assessment in the Indo-Pacific: the Global Reef Expedition.”
- (29) **National Museum of Marine Biology and Aquarium, Checheng, Taiwan, invited speaker,** Feb. 2014. “Coral health assessment in the Indo-Pacific: the Global Reef Expedition.”
- (28) **American Society for Cell Biology annual meeting, New Orleans, LA, poster,** Dec. 2013. “Molecular diagnostics and reef-building coral health assessment: can biomarkers be utilized with confidence in the absence of their functional characterization?”
- (27) **Mote Marine Laboratory, Sarasota, FL, invited speaker,** Mar. 2013. “Physiological acclimation to elevated temperatures in a reef-building coral from an upwelling environment.”
- (26) **National Chung-Hsing University, Taichung, Taiwan, invited speaker,** Mar. 2013.



“Physiological acclimation to elevated temperatures in a reef-building coral from an upwelling environment.”

- (25) **City University of Hong Kong, Kowloon, Hong Kong, invited speaker**, Jan. 2013. “The complex physiological response of two life history stages of the model reef coral *Pocillopora damicornis* exposed to climate change simulations.”
- (24) **National Museum of Marine Biology and Aquarium, Checheng, Taiwan, invited speaker**, Dec. 2012. “Taiwan’s coral reef biodiversity: threats and diagnostics in an era of global climate change.”
- (23) **Hengchun Community College, Hengchun, Taiwan, invited speaker**, Dec. 2012. “Taiwan’s coral reef biodiversity: threats and diagnostics in an era of global climate change.”
- (22) **National Museum of Marine Biology and Aquarium, Checheng, Taiwan, invited speaker**, Dec. 2012. “Physiological acclimation to elevated temperature in *Pocillopora damicornis* specimens from an upwelling reef.”
- (21) **Mindao University, Beidou, Taiwan, invited speaker**, Dec. 2012. “Taiwan’s coral reef biodiversity: threats and diagnostics in a time of global climate change.”
- (20) **Academia Sinica, Nangang, Taiwan, invited speaker**, Dec. 2012. “The complex physiological response of two life history stages of the model reef coral *Pocillopora damicornis* exposed to climate change simulations.”
- (19) **National Museum of Marine Biology and Aquarium, Checheng, Taiwan, invited speaker**, Feb. 2012. “The physiological response of reef corals exposed to climate change simulations.”
- (18) **Hengchun Community College, Hengchun, Taiwan, invited speaker**, Nov. 2011. “An introduction to Taiwan’s coral reefs: biodiversity and threats in a changing climate.”
- (17) **Mindao University, Beidou, Taiwan, invited speaker**, Oct. 2011. “An introduction to Taiwan’s coral reef inhabitants: threats and diagnostics in a changing climate.”
- (16) **The Omics in the Ocean: 3<sup>rd</sup> International Symposium for Marine Biology and Biotechnology, Checheng, Taiwan, invited speaker**, Sept. 2011. “Coral health diagnostics in a changing ocean: assessing the physiological response of reef-building pocilloporids to global climate change scenarios.”
- (15) **National Cheng-Chi University, Taipei, Taiwan, invited speaker**, July 2011. “An Introduction to Taiwan’s marine biodiversity.”
- (14) **National Museum of Marine Biology and Aquarium, Checheng, Taiwan, invited speaker**, April 2011. “Conveying scientific discoveries in the English language.”
- (13) **University of Louisiana, Lafayette, invited speaker**, Jan. 2010. “Understanding the physiological impacts of global climate change on reef-building corals of Taiwan.”
- (12) **Mindao University, Changhua, Taiwan, invited speaker**, Dec. 2010. “An introduction to Taiwan’s coral reefs: threats and diagnostics in a changing climate.”
- (11) **National Chiayi University, Chiayi, Taiwan, invited speaker**, Dec. 2010. “An introduction to Taiwan’s coral reefs.”
- (10) **25<sup>th</sup> Symposium on Natural Products, Checheng, Taiwan, poster**, Nov. 2010. “Sub-cellular mechanisms of acclimation to altered temperature regimes in the coral *Seriatopora hystrix*.”
- (9) **National Museum of Marine Biology and Aquarium, Checheng, Taiwan, invited speaker**, Nov. 2010. “Investigating the sub-cellular impacts of global climate change on the reef-building corals of Taiwan.”
- (8) **Marine Environmental and Biodiversity Conservation in the South China Sea, Kaohsiung, Taiwan, talk**, Jul. 2010. “The search for physiologically relevant biomarkers for coral health assessment: two case studies from pocilloporids exposed to acute temperature increases.”
- (7) **Asia Pacific Coral Reef Symposium, Phuket, Thailand, talk**, Jun. 2010. “Absence of a molecular chaperone response in *Seriatopora hystrix* colonies exposed to an acute thermal perturbation.”

- (6) **Moorea Coral Reef Long-Term Ecological Research annual meeting, Santa Barbara, CA, talk**, Nov. 2009. “Using functional genomics to understand the biology of reef corals.”
- (5) **“Responses of Coral Holobionts Under Impact of Climate Change” Conference, Taipei, Taiwan, poster**, Jun. 2009. “Diel variation in cytoskeleton gene expression in the reef coral *Seriatopora hystrix*: evidence for dynamic changes in cell volume resulting from photosynthesis.”
- (4) **Marine Biotechnology Conference, Checheng, Taiwan, poster**, Sept. 2008. “Diel variation in cell volume gene expression in the reef-building coral *Seriatopora hystrix*.”
- (3) **Tester Symposium, Honolulu, HI, talk**, Mar. 2007. “Osmoregulation in coral-algal symbiosis.”
- (2) **Symbiosis cell biology workshop, Heron Island, Australia, poster**, Jan. 2007. “Osmoregulation in coral-dinoflagellate symbiosis.”
- (1) **Tester Symposium, Honolulu, HI, poster**, Mar. 2006. “Osmoregulation in coral-dinoflagellate endosymbiosis.”

### **Research awards** (total research awards: \$1,067,000 USD)

- 25) **PADI Foundation-under review**. \$10,000 to employ a machine-learning approach to identify coral reef “refugia” (areas likely to withstand climate change impacts).
- 24) **Ministry of Science and Technology (MOST) of Taiwan-under review** (co-PI with Chiahsin Lin). \$100,000 to use a machine-learning approach to optimize reef coral cryopreservation.
- 23) **National Science Foundation (Integrative Physiology)-under review** (co-PI with Cliff Ross & Matthew Gilg). \$550,000 to model the eukaryotic stress response via multi-‘Omic technologies.
- 22) **National Geographic Society (“Explorers” grant)-under review**. \$30,000 to develop a “coral stress test” to be employed in the Coral Triangle.
- 21) **Mote Marine Laboratory “Protect our Reefs” coral reef restoration grant** (co-PI with Cliff Ross). \$16,000 to examine the resilience of nursery-reared acroporid corals.
- 20) **NOAA Task III** (co-PI w/Derek Manzello & Carly Kenkel). \$92,239 to study heat resistant larvae of the endangered coral *Orbicella faveolata* from patch reefs of the Florida Keys.
- 19) **National Marine Fisheries Service (US Dept. Commerce; Co-PI w/ Dr. Michael Studivan)**. \$100,000 to study the molecular basis of coral thermotolerance in marginal environments.
- 18) **NOAA Task III** (co-PI w/Derek Manzello & Carly Kenkel). \$50,000 to study heat resistant larvae of the endangered coral *Orbicella faveolata* from patch reefs of the Florida Keys.
- 17) **Fulbright Global Scholar program (US Department of State)-Feb. 2019**. \$50,000 to develop a “coral stress test” in Taiwan to be employed in the field in the Philippines.
- 16) **“AI for Earth” grant (Microsoft)-Apr. 2019**. \$15,000 to develop “big data” analytical tools geared towards using artificial intelligence to conserve coral reefs.
- 15) **US National Research Council-Sept. 2018**. \$164,000 to work with scientists at NOAA’s Atlantic Oceanographic and Meteorological Laboratory (Miami, FL) on the development of a “coral stress test” (co-PI; lead PI=Dr. Derek Manzello)
- 14) **Japan Society for the Promotion of Science-Apr. 2015**. \$114,000 to conduct Japan-based coral reef research, with an emphasis on global climate change. Co-PI=Dr. Saki Harii.
- 13) **Living Oceans Foundation-Nov. 2012**. \$300,000 to conduct biomarker-based coral reef surveys.
- 12) **NSF MCR-LTER-Feb. 2010**. \$14,000 to study the impacts of ocean acidification on coral health.
- 11) **PADI Project Aware-Jun. 2009**. \$1,200 for Taiwan-based research on the coral stress response.
- 10) **NSF International Postdoctoral Fellowship- Jun. 2009**. \$126,500 for Taiwan coral research.
- 9) **Company of Biologists travel fellowship- Sept. 2008**. \$1,800 for Taiwan-based coral research.
- 8) **NSF EAPSI Fellowship- May 2008**. \$7,500 for Taiwan-based coral reef research.
- 7) **Edmondson Fund- Apr. 2008**. \$900 for coral osmoregulation research.
- 6) **PADI Project Aware- Mar. 2008**. \$1,000 for coral gene expression normalization study.
- 5) **PADI Foundation- Apr. 2007**. \$4,000 for coral gene expression normalization study.

- 4) **Edmondson Fund-** Dec. 2006. \$800 for coral stress gene transcription experiments.
- 3) **PADI Project Aware-** Nov. 2006. \$1,400 for gene expression experiments on corals.
- 2) **NSF small travel grant-** Sept. 2006. \$1,000 for collaborative visit.
- 1) **NSF Graduate Research Fellowship-** Spring 2004. \$121,500 for graduate research.

### **Service, teaching, and volunteer experiences (all unpaid)**

**Somerset Academy Silver Palms High School (FL)**, *guest marine biology lecturer*, 2022-present.

**Walt Whitman High School (NY) Coral Science Program**, *scientific advisor*, 2021-present.

**UCLA Film School**, *scientific advisor for marine environment-focused films*, 2021-present.

***International Journal of Marine Science***, *senior topic editor (coral reefs)*, 2021-present.

***International Coral Reef Society***, *treasurer*, 2020-present.

***Diversity***, *senior topic editor (marine biology)*, 2020-present.

***PLoS ONE***, *senior topic editor (marine molecular biology)*, 2018-present.

***Platax***, *lead editor*, 2012-present.

**Scientific editing/peer review**, *volunteer reviewer/editor*, 2006-present. I have gained a favorable reputation across numerous journals for my constructive, well written scientific reviews, and I routinely review and/or edit ~50-60 manuscripts for high-impact scientific journals **each year**. Here is a non-exhaustive list of journals I have reviewed for: *Science, Nature, Nature Communications, PNAS, Current Biology, PLoS Biology, PLoS ONE, Coral Reefs, Scientific Reports, Science Advances, Marine Biology, Cell, Global Change Biology, Molecular Ecology, Bulletin of Marine Science, International Journal of Marine Science, Journal of Experimental Biology, Journal of Experimental Marine Biology & Ecology, Heliyon, PeerJ, BMC Genomics, BMC Physiology, BMC Biology, Frontiers in Marine Science, Proteomics, Marine Pollution Bulletin, Proteomics, Environmental Science and Technology, Microorganisms, Platax, Algal Research, Harmful Algae, Limnology & Oceanography, ISME Journal, Functional Ecology, Journal of Proteome Research, Diversity, International Journal of Environmental Research and Public Health, Oceans, Applied Sciences*, and others.

**Guest lecturer (coral reefs)**, Fall 2020-present. Marine ecology courses of Old Dominion University, University of Florida, and University of Miami, and phycology courses at University of Oslo.

***Frontiers in Marine Science***, *senior topic editor (coral reefs)*, 2020-2021.

**Coral Reef CPR (NGO)**, *volunteer researcher*, 2016-2019. I have been working with Coral Reef CPR to help them establish high-temperature-resilient coral nurseries in the Maldives.

**Khaled bin Sultan Living Oceans Foundation (LOF)**, *volunteer researcher*, 2016-2019. I have been working with LOF to help them publish and disseminate findings from their “Global Reef Expedition” in order to aid marine managers in protecting their local coral reefs.

**Friendly Bear Editorial Service**, *president*, 2007-present. I have reviewed and edited hundreds of scientific manuscripts free-of-charge since 2007, as I feel it is my scientific duty to ensure that excellent science is not rejected by publishers and journals simply due to poor English drafting.

**Duke University**, *interviewer*, 2012-present. I am the local, on-the-ground interviewer for Taiwanese students wishing to attend my alma mater, Duke University.

***Carpe Diem fleet, Maldives***, *volunteer researcher*, Spring-Summer 2017. Trained tourists in coral reef ecology while helping to remove crown of thorns seastars from local reefs.

**Anantara Resorts-Dhigu/Veli & Kihavah, Maldives**, *volunteer researcher*, Winter 2016. Monitored reefs, sampled corals, and established long-term monitoring sites for two Maldivian resorts.

**National Museum of Marine Biology and Aquarium, Checheng, Taiwan**, *guest lecturer*, Winter 2016. Volunteered to teach college students about marine biology, specifically coral reefs.

**National Museum of Marine Biology and Aquarium, Checheng, Taiwan**, *guest lecturer*, Summer 2015. Volunteered to teach elementary school students about marine biology and diving.

**Martin Luther King Magnet High School, Nashville, TN, guest lecturer, Spring 2013.** Volunteered to teach high school seniors about coral reef biology and global climate change.

**White Creek High School, Nashville, TN, guest lecturer, Fall 2012.** Volunteered to teach high school sophomores about coral reef biology, the scientific method, and tips for excelling academically.

**Department of Zoology, UH-Manoa, teaching assistant, Spring 2005.** Tuesday laboratory section of Zoology 430 (animal physiology) assisting Prof. Jonathon Stillman.

**Department of Zoology, UH-Manoa, teaching assistant, Fall 2004.** Tuesday and Thursday Zoology 101 (introductory zoology) laboratory sections assisting Prof. Steven Robinow.

**North Carolina Rural Healthcare Coalition, internship/volunteer, Summer 2002.** Worked with Duke Hospital physicians as part of the MEDS program to provide medication to farmers.

**Duke Recycles, environmental manager, Spring-Fall 2002.** Coordinated campus recycling efforts.

### **Leadership (all volunteer/unpaid activities)**

**Scientific advisor-UN Environment Program's Global Fund for Coral Reefs, Fall 2021-present.**

**Scientific council- Interagency Ocean Observation Committee BIO-ICE Task Team's Coral Subgroup, Winter 2021-present.**

**Treasurer-International Coral Reef Society, Winter 2021-present.**

**Chairman-NOAA AOML Internal Review Working group, Summer 2020-present.**

**Chairman-NOAA Unified OAR 'OMICs organizational committee, Spring 2019-present.**

**President/Founder- Duke University SCUBA Club, Fall 2002-2003.**

**Vice President- North Carolina Rural Healthcare Coalition, Spring 2002-Fall 2002.**

### **Awards**

**Best Oral Presentation-Discovery Summit Americas 2020, Fall 2020.**

**Community Service Award- (for coordination of football game recycling), Fall 2001-Spring 2002.**

**Employee of the Quarter- Duke Recycles, Spring 2002.**

### **Professional references and collaborators**

**Dr. Sanjoy Bhattacharya, [sbhattacharya@med.miami.edu](mailto:sbhattacharya@med.miami.edu), University of Miami**

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**Dr. Chien-Hsun Chen, [09noodle19@gmail.com](mailto:09noodle19@gmail.com), Taiwan Ocean Research Institute**

**Dr. Chii-Shiang Chen, [cchen@nmmba.gov.tw](mailto:cchen@nmmba.gov.tw), National Museum of Marine Biology and Aquarium**

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**Mr. Vincent Chen, [chenyw10@gmail.com](mailto:chenyw10@gmail.com), CarbonZeroToo**

**Dr. Heinz Gert de Couet, [couet@hawaii.edu](mailto:couet@hawaii.edu), University of Hawaii (**Ph.D. committee**)**

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**Dr. Ruth Gates, [rgates@hawaii.edu](mailto:rgates@hawaii.edu), University of Hawaii, Manoa (**Ph.D. supervisor**)**

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**Dr. E. Gordon Grau, [grau@hawaii.edu](mailto:grau@hawaii.edu), University of Hawaii (**Ph.D. committee**)**

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**Dr. Pi-Jen Liu, [pijenliu@nmmba.gov.tw](mailto:pijenliu@nmmba.gov.tw), National Museum of Marine Biology and Aquarium**

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**Dr. Nikki Traylor-Knowles**, [ntraylorknowles@rsmas.miami.edu](mailto:ntraylorknowles@rsmas.miami.edu), University of Miami  
**Dr. Benjamin Wainwright**, [ben.wainwright@yale-nus.edu.sg](mailto:ben.wainwright@yale-nus.edu.sg), National University of Singapore  
**Dr. Virginia Weis**, [weisv@science.oregonstate.edu](mailto:weisv@science.oregonstate.edu), Oregon State University (*Ph.D. committee*)

## Professional mentees & students

**Ms. Rachel Tiersky**: mentor (current): Dartmouth University  
**Ms. Katherine Eaton**: Supervisor (current): University of Miami  
**Dr. Jean Lim**: CIMAS mentorship program (current): University of Miami  
**Ms. Aubrey Holsworth**: Ph.D. committee member (current): University of North Florida  
**Mr. David Reynolds**: Ph.D. committee member (current): University of North Florida  
**Mr. John Morris**: Ph.D. project support (current): University of Miami  
**Ms. Allyson Demerlis**: Ph.D. project support (current): University of Miami  
**Dr. Ewelina Rubin**: Supervisor (2019-2021): postdoctoral researcher at the University of Miami  
**Ms. Crystal McRae**: Ph.D. committee member (2017-present): Ph.D. candidate at National Dong-Hwa University (Taiwan)  
**Mr. Khaerul Awaluddin**: Master's committee member (2018-2020): National Dong-Hwa University  
**Dr. Hung-Kai Chen**: Ph.D. committee member (2014-2018): National Sun Yat-Sen University (Taiwan)  
**Dr. Yu-Bin Wang**: Ph.D. committee member (2013-2017): Academia Sinica (Taiwan)

## Research interests

**Fundamental cell biology of cnidarian-dinoflagellate endosymbioses**: My research interests center around three predominant themes, all of which involve photosynthetic mutualisms between anthozoans (namely reef-building corals & sea anemones) and intracellular dinoflagellates of the family Symbiodiniaceae. First, I am interested in how an anthozoan cell modifies its physiology to accommodate these dinoflagellates, which can occupy nearly the entire volume of their hosts' gastrodermal cells. I have utilized molecular, cellular (i.e., microscopic), and physiological approaches to uncover the mechanisms by which corals modulate their intracellular environments in order to carry out the myriad biochemical processes they need to survive whilst exploiting only a miniscule cytoplasmic space within which to function. Although the fundamental cell biology of anthozoans is still a passion of mine, these projects have taken a "back seat" to those listed below given the rapid rate at which coral reefs are declining across the globe on account of climate change.

**Environmental physiology of coral-dinoflagellate mutualisms:** My second interest involves the response of reef-building corals exposed to changes in their environments, particularly increases in temperature. During my first postdoctoral research project at Taiwan's National Museum of Marine Biology and Aquarium (2010-2012), I utilized molecular and microscopic tools to monitor the sub-cellular and cellular responses, respectively, of reef corals that had been exposed to elevated seawater temperature and acidity over both short- (hours-days) and long-term (weeks-months) timescales. The molecular approaches included genome-, transcriptome- (e.g., mRNA sequencing with Illumina's RNA-Seq technology), and proteome- (e.g., 2D gels, shotgun proteomics, & label-based methods, all followed by liquid chromatography+mass spectrometry) scale techniques, and the microscopic approaches featured light, scanning electron, and transmission electron microscopy. Using such methodologies, I found that elevated temperature is far more detrimental to corals than ocean acidification (now widely adopted by the field.). I was able to elucidate the cellular mechanisms underlying coral climate stressor resilience, as well those genes and proteins involved in their stress response for corals that ultimately bleached. Such data have more recently been reproduced in Caribbean coral species and are integral to the predictive models discussed below.

**Development of a “coral stress test:”** I have been developing “multi-‘Omics’-based “coral stress tests” in which a series of analytes (e.g., mRNAs, proteins, lipids, & other metabolites) are profiled to assign a level of health to a coral (analogous to a blood biomarker panel carried out by our own physicians). This first involved devising the field's first endosymbiosis-tailored molecular protocols. Then, I found that there is no correlation between gene expression and protein concentration in corals; although mRNAs could still be used as biomarkers for health assessment, their expression levels do not aid in reconstructing cellular physiology since the proteins that actually undertake cellular work do not show corresponding trends. Therefore, if we want to uncover the cellular pathways underlying coral resilience to environmental change (or their stress responses in the cases in which acclimatization or adaptation does not occur), then we need to instead target their proteomes. I consequently invested heavily in profiling the proteomes of corals from both Taiwan- and Florida- based global climate change manipulation experiments and am now the field's expert in coral proteomics.

In addition to these proteomics projects, I have been using the mRNA-level molecular biomarkers that emerged from the aforementioned environmental challenge studies in Taiwan to document the health of >1,000 *P. damicornis* specimens collected at numerous points along a 4,000-km transect across the Pacific and Indian Oceans as part of the Khaled bin Sultan Living Oceans Foundation's “Global Reef Expedition” (GRE), the largest coral reef survey ever undertaken. In conjunction with the coral stress test, I have been using advanced mathematics to calculate a level of “normality” for each sampled colony of the GRE to verify whether those corals that “failed” the stress test are indeed more likely to be of compromised resilience. Future visits to the survey sites will allow me to verify the efficacy of this molecular biomarker+multivariate statistical approach.

**Developing an analytical platform for evaluating coral health in the Anthropocene.** I have been working with the data science company JMP® to develop means of assessing the health of organisms that reside in ever-changing environments. It no longer makes sense to use static, traditional approaches to analyze data from animals whose environments are in a constant state of flux as a result of rampant anthropogenic influence. Furthermore, there are no pristine reefs left on Earth due to the wide-ranging effects of climate change. We therefore do not actually know what constitutes a “healthy” coral (i.e., no “baseline” data), unless physiological data can be obtained from samples collected prior to the Industrial Revolution. If we do not know what constitutes normal coral behavior, how can we attempt to gauge coral health in survey efforts? I am attempting to use a series of novel

statistical approaches to address these questions, with an emphasis on the notion that variation/variability within a sample may be more informing as to the health and resilience of a coral than the absolute concentrations of any one particular analyte (e.g., gene mRNA). This has involved the use of machine-learning approaches, particularly neural networks. I am also working with JMP to improve means of visualizing esoteric, abstract, multivariate coral health data using features such as interactive HTML; this will not only lead to the production of better quality figures, but it will allow for greater data transparency. All data I have ever produced are either hosted on my personal website ([coralreefdiagnostics.com](http://coralreefdiagnostics.com)) or in public data repositories (e.g., NCBI, MassIVE, NCEI, etc.). The goal is to now integrate data across these seemingly disparate projects (which cover all biological scales, from the molecules to entire ocean basins) to where machine-learning models capable of accurately forecasting coral fate can be developed; this is my current research focus (2020-present).

## SCUBA diving and fieldwork

I have been an avid SCUBA diver for the past 25+ years, logging over 5,000 dives across Bermuda, the Caribbean (Barbados, Belize, Bonaire, Costa Rica, Colombia, Dominica, Florida [Miami area, the Keys, the panhandle, & Dry Tortugas & Biscayne National Parks], Honduras, Mexico, Nicaragua, Panama, St. Lucia, St. Vincent & the Grenadines, Turks & Caicos), inland United States (Alabama, North Carolina, & Tennessee), Gulf of Mexico (Florida panhandle & Texas' Flower Garden Banks [*R/V Manta* out of Galveston]), Hawaii, French Polynesia (Mo'orea & the Austral Islands), the Cook Islands, Fiji, Tonga, New Caledonia, Solomon Islands, Palau, Eastern Australia (southern & northern sections of the Great Barrier Reef), and elsewhere in the Indo-Pacific, including the British Indian Ocean Territory (Chagos Banks [south of the Maldives]), Indonesia (Bali, Lembongan/Penida, Nusa Tenggara [Flores & Komodo National Park (northern & central regions)], Sulawesi [southern & northern regions], Maluku [Ambon/Seram & the Banda Islands], and Papua [Triton Bay & Raja



Ampat]), Malaysia (Peninsular & Borneo), Maldives (central & northern atolls), Philippines (Luzon, Visayas, & Palawan/Coron), Taiwan (mainland, offshore territories, & South China Sea atolls), and Thailand (Gulf of Thailand and Indian Ocean).

I have also dived as part of a research expedition to the Northwest Hawaiian Islands, the world's largest marine protected area, on the NOAA ship *Hi'ialakai*. I have rescue, NITROX, and master diver certifications through NAUI, as well as AAUS training and certification from the University of Hawaii, Manoa (with reciprocity now through the University of Miami). From April 2013 to May 2015, I conducted fieldwork across the Indo-Pacific on the Khaled bin Sultan Living Oceans Foundation's (LOF) research vessel, the *Golden Shadow*, and logged over 600 dives across 10 nations with LOF. More recently, I have been undertaking fieldwork at Dongsha, a Taiwanese-governed atoll in the South China Sea, with plans of going even further south into the South China Sea (Nansha Atoll) in 2023.

Since 2016, I have also been volunteering (namely training tourists in marine biology & establishing long-term monitoring programs) with the NGO Coral Reef CPR in the Maldives, an opportunity that has afforded considerable diving. More recently (2019-2022), I assisted the NOAA Atlantic Oceanographic and Meteorological Laboratory's Coral Program with their National Coral Reef Monitoring Program survey efforts, which has allowed for me to continue growing my own coral biopsy archive (for testing the capacity of the molecular biotechnology+machine-learning approached referenced above to resolve heterogeneity in coral climate resilience), as well increase my prowess as a field ecologist at sites such as the Flower Garden Banks (a NOAA National Marine Sanctuary in the Gulf of Mexico) and the Dry Tortugas (a national park off Key West, Florida). Since mid-2022, I have been investigating both "extreme" (i.e., corals residing in areas where one would not expect to find them) and disease-ravaged reefs in the southeastern Caribbean, most notably those of Dominica and St. Lucia. For images of the coral reefs visited, as well as more information on various coral reef-focused projects addressed herein, please see my personal website: <http://coralreefdiagnostics.com>.

In addition to having had the good fortune to have dived in so many spectacular locales, I participated in hyperbaric physiology research while an undergraduate at Duke University. I was a test subject in one of their "flying after diving" studies sponsored by the Diver's Alert Network (which is based at Duke University's South Hospital). Briefly, we underwent dive and flight simulations in the world's premier hyperbaric chambers in order to determine whether flying after diving truly does result in bubble formation in the blood. Although no one in our test group succumbed to decompression sickness, I nevertheless do not recommend flying after diving until at least 12 hours have passed.

## **Hobbies/interests/likes**

Air guitar, Asian food, backpacking, bacon, basketball (NCAA & NBA), BBQ, beaches, biking, *Bladerunner*, Blueberry King, blue crabs, boats, camping, canoeing, cats, Central America, Chairman Meow, cheese, cliff jumping, coffee, conservation, coral reefs, Coral Triangle, craft beer, crawfish boils, Dairy Queen Blizzards, dark English milds, Dave Chappelle, David Attenborough, Devin Townsend, Diet Coke, Duke basketball, dystopian Sci Fi, ESBs, exploring, *Family Guy*, fancy cheese, forests, football (NFL), golden retrievers, grilling, guacamole, gummies, Hawaii, headbanging, heavy metal, hiking, hot chicken, hot sauce, Indiana (Pacers), Indonesia, instant noodles, international travel, islands, Jellyroll, Jim Gaffigan, karaoke, kayaking, Latin America, lobster, manatees, mangos (Taiwanese), meat, Mexico, microscopy, molecular biology, Monster Magnet, mountains, Nashville rap, national parks, NCAA, NFL, *Office Space*, *Old School*, Philippines, Philip K. Dick, photography, pork belly, proteomics, Raja Ampat, Rammstein, reading, ribs, sashimi, science, SCUBA diving,



seafood, shaming those who cut in line (huge pet peeve), snorkeling, South America, spicy food, statistics, Stephen King, *Stranger Things*, Sudoku, sunsets, *Super Troopers*, swamps, sweating profusely (among very few talents), Symbiodiniaceae, symbiosis, tacos, Taiwan, *The Big Lebowski*, The Nature Conservancy, tubing, unagi, underwater photography (see my current favorite pic from Komodo National Park, Indonesia above.), *Westworld*

