

**ERIC J HOCHBERG**  
**Senior Scientist**

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<http://www.bios.edu/about/team-members/eric-hochberg/>  
<http://www.bios.edu/research/projects/creol/>

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**CURRENT RESEARCH INTERESTS—Observing and Predicting Change in Coral Reef Systems**

1. Coral reef systems ecology—scaling processes across organisms, communities, and ecosystems
2. Remote sensing science for coral reefs and other shallow water systems
3. Environmental and biological optics in coral reefs and other shallow water systems

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**EDUCATION**

2002	PhD	Oceanography	University of Hawaii	Title: <i>Spectral Reflectance and Remote Sensing of Coral Reefs</i> Advisor: Marlin J Atkinson
1998	MSc	Oceanography	University of Hawaii	Title: <i>Radiative Transfer and the Spectral Characteristics of Coral Reef Benthic Communities</i> Advisor: Marlin J Atkinson
1991	BA	Biology	Brown University	

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**PROFESSIONAL APPOINTMENTS**

2019–Pres.	Senior Scientist	Bermuda Institute of Ocean Sciences
2011–2019	Associate Scientist	Bermuda Institute of Ocean Sciences
2011–2015	Adjunct Faculty	Oceanographic Center, Nova Southeastern Univ.
2008–2011	Assistant Professor	Oceanographic Center, Nova Southeastern Univ.
2002–2008	Assistant Researcher	Hawaii Institute of Marine Biology, Univ. of Hawaii

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**KEY ACCOMPLISHMENT—CORAL Reef Airborne Laboratory (CORAL)**

- Principal Investigator and overall lead for CORAL, a NASA Earth Venture Suborbital-2 mission
- \$15 million over four years (2015–2019)
- Conceived science, partnered with Jet Propulsion Laboratory for proposal development and mission technical implementation
- Overall mission lead, overseeing >100 scientists, managers, engineers, and support staff
- Direct lead of science team, including 11 Co-Investigators, five unfunded collaborators, and ~20 supporting technicians, students, and postdocs
- Conducted airborne hyperspectral remote sensing campaigns and in-water validation activities in (1) Great Barrier Reef, (2) Hawaii, (3) Mariana Islands, (4) Palau, and (5) Florida
- Directed development of science products and subsequent primary science output
- Recipient of NASA 2020 Honor Group Achievement Award: “For conducting the successful NASA CORAL Reef Airborne Laboratory mission, collecting and delivering unprecedented data about reef environments”

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**PUBLICATIONS**

- Google Scholar statistics as of 15 July 2022: Citations = 3,526; h-index = 27; i10-index = 33
- Number of citations in parentheses following reference

**Refereed Journal Publications**

1. 2021 Missing the Reef for the Corals: Unexpected Trends Between Coral Reef Condition and the Environment at the Ecosystem Scale (3)  
Hochberg EJ, Gierach MM  
*Frontiers in Marine Science*, 1191

2. 2021 Modes of metabolic performance of Pacific reefs  
Pisapia C, [Hochberg EJ](#), Carpenter R  
*Geophysical Research Letters* 48 (13), e2021GL092930
3. 2021 NASA's surface biology and geology designated observable: A perspective on surface imaging algorithms (58)  
Cawse-Nicholson K, Townsend PA, Schimel D, Assiri AM, Blake PL, Buongiorno MF, Campbell P, Carmon N, Casey KA, Correa-Pabón RE, Dahlin KM, Dashti H, Dennison PE, Dierssen H, Erickson A, Fisher JB, Frouin R, Gatebe CK, Gholizadeh H, Gierach M, Glenn NF, Goodman JA, Griffith DM, Guild L, Hakkenberg CR, [Hochberg EJ](#), Holmes TRH, Hu C, Hulley G, Huemmrich KF, Kudela RM, Kokaly RF, Lee CM, Martin R, Miller CE, Moses WJ, Muller-Karger FE, Ortiz JD, Otis DB, Pahlevan N, Painter TH, Pavlick R, Poulter B, Qi Y, Realmuto VJ, Roberts D, Schaepman ME, Schneider FD, Schwandner FM, Serbin SP, Shiklomanov AN, Stavrosa EN, Thompson DR, Torres-Perez JL, Turpie KR, Tzortziou M, Ustin S, Yu Q, Yusup Y, Zhang QY, SBG Algorithms Working Group  
*Remote Sensing of Environment* 257, 112349 DOI: 10.1016/j.rse.2021.112349
4. 2020 Benthic classification and IOP retrievals in shallow water environments using MERIS imagery (10)  
Garcia RA, Lee Z, Barnes BB, Hu C, Dierssen HM, [Hochberg EJ](#)  
*Remote Sensing of Environment* 249: 112015 DOI: 10.1016/j.rse.2020.112015
5. 2020 Trends and variability in spectral diffuse attenuation of coral reef waters (12)  
[Hochberg EJ](#), Peltier SA, Maritorena S  
*Coral Reefs* DOI: 10.1007/s00338-020-01971-1
6. 2020 Impact of water characteristics on the discrimination of benthic cover in and around coral reefs from imaging spectrometer data (4)  
Bell TW, Okin GS, Cavanaugh KC, [Hochberg EJ](#)  
*Remote Sensing of Environment* 239: 111631 DOI: 10.1016/j.rse.2019.111631
7. 2019 Multi-decadal change in reef-scale production and calcification associated with recent disturbances on a Lizard Island reef flat (14)  
Pisapia C, [Hochberg EJ](#), Carpenter R  
*Frontiers in Marine Science* 6: 575 DOI: 10.3389/fmars.2019.00575
8. 2019 Water Column Optical Properties of Pacific Coral Reefs Across Geomorphic Zones and in Comparison to Offshore Waters (9)  
Russell BJ, Dierssen HM, [Hochberg EJ](#)  
*Remote Sensing* 11: 1757 DOI: 10.3390/rs11151757
9. 2019 Imaging Spectrometry of Inland and Coastal Waters: State of the Art, Achievements and Perspectives (78)  
Giardino C, Brando V, Gege P, Pinnel N, [Hochberg E \[sic\]](#), Knaeps E, Reusen I, Doerffer R, Bresciani M, Braga F  
*Surveys in Geophysics* 40(3): 401–429 DOI: 10.1007/s10712-018-9476-0
10. 2018 Diel versus time-integrated (daily) photosynthesis and irradiance relationships of coral reef organisms and communities (10)  
Sawall Y, [Hochberg EJ](#)  
*PloS One* 13: e0208607
11. 2018 Hyperspectral shallow-water remote sensing with an enhanced benthic classifier (39)  
Garcia RA, Lee Z, [Hochberg EJ](#)  
*Remote Sensing* 10: 147–171
12. 2017 Airborne mapping of benthic reflectance spectra with Bayesian linear mixtures (41)  
Thompson DR, [Hochberg EJ](#), Asner GP, Green RO, Knapp DE, Gao B-C, Garcia R, Gierach M, Lee Z, Maritorena S, Fick R  
*Remote Sensing of Environment* 200:18-30
13. 2016 Comparing chemistry and census-based estimates of net ecosystem calcification on a rim reef in Bermuda (36)  
Courtney TA, Andersson AJ, Bates NR, Collins A, Cyronak T, de Putron SJ, Eyre BD, Garley R, [Hochberg EJ](#), Johnson R, Musielewicz S, Noyes TJ, Sabine CL, Sutton AJ, Toncin J, Tribollet A  
*Frontiers in Marine Science* 3:181 DOI:10.3389/fmars.2016.00181
14. 2015 Special issue on the Hyperspectral Infrared Imager (HyspIRI): Emerging science in terrestrial and aquatic ecology, radiation balance and hazards (52)  
[Hochberg EJ](#), Roberts DA, Dennison PE, Hulley GC  
*Remote Sensing of Environment* 167:1–5

15. 2015 Spectral and spatial requirements of remote measurements of pelagic Sargassum macroalgae (118)  
Hu C, Feng L, Hardy RF, [Hochberg EJ](#)  
*Remote Sensing of Environment* 167:229-246
16. 2012 Efficient light harvesting in deep-water zooxanthellate corals (64)  
Kahng SE, [Hochberg EJ](#), Apprill A, Wagner D, Luck DG, Perez D, Bidigare RR  
*Marine Ecology-Progress Series* 455:65-77
17. 2009 Remote sensing of sand distribution patterns across an insular shelf: Oahu, Hawaii (16)  
Conger CL, Fletcher CH, [Hochberg EH](#) [sic], Frazer N, Rooney JJB  
*Marine Geology* 267:175-190
18. 2008 Coral reef benthic productivity based on optical absorptance and light-use efficiency (38)  
[Hochberg EJ](#), Atkinson MJ  
*Coral Reefs* 27:49-59
19. 2008 Derivation and integration of shallow-water bathymetry: Implications for coastal terrain modeling and subsequent analyses (64)  
Hogrefe KR, Wright DJ, [Hochberg EJ](#)  
*Marine Geodesy* 31:299-317
20. 2007 Near-infrared optical constants of pyroxene as a function of iron and calcium content (35)  
Denevi BW, Lucey PG, [Hochberg EJ](#), Steutel D  
*Journal of Geophysical Research-Planets* 112
21. 2006 Decorrelating remote sensing color bands from bathymetry in optically shallow waters (65)  
Conger CL, [Hochberg EJ](#), Fletcher CH, Atkinson MJ  
*IEEE Transactions on Geoscience and Remote Sensing* 44:1655-1660
22. 2006 Bio-optical modeling of photosynthetic pigments in corals (48)  
[Hochberg EJ](#), Apprill AM, Atkinson MJ, Bidigare RR  
*Coral Reefs* 25:99-109
23. 2004 Spectral reflectance of coral (143)  
[Hochberg EJ](#), Atkinson MJ, Apprill A, Andréfouët S  
*Coral Reefs* 23:84-95
24. 2004 Remote sensing of coral reefs and their physical environment (373)  
Mumby PJ, Skirving W, Strong AE, Hardy JT, LeDrew EF, [Hochberg EJ](#), Stumpf RP, David LT  
*Marine Pollution Bulletin* 48:219-228
25. 2004 Use of in situ and airborne reflectance for scaling-up spectral discrimination of coral reef macroalgae from species to communities (58)  
Andréfouët S, Payri C, [Hochberg EJ](#), Hu CM, Atkinson MJ, Muller-Karger FE  
*Marine Ecology-Progress Series* 283:161-177
26. 2003 Multi-site evaluation of IKONOS data for classification of tropical coral reef environments (430)  
Andréfouët S, Kramer P, Torres-Pulliza D, Joyce KE, [Hochberg EJ](#), Garza-Perez R, Mumby PJ, Riegl B, Yamano H, White WH, Zubia M, Brock JC, Phinn SR, Naseer A, Hatcher BG, Muller-Karger FE  
*Remote Sensing of Environment* 88:128-143
27. 2003 Multi-scale remote sensing of microbial mats in an atoll environment (29)  
Andréfouët S, [Hochberg EJ](#), Payri C, Atkinson MJ, Muller-Karger FE, Ripley H  
*International Journal of Remote Sensing* 24:2661-2682
28. 2003 Sea surface correction of high spatial resolution Ikonos images to improve bottom mapping in near-shore environments (275)  
[Hochberg EJ](#), Andréfouët S, Tyler MR  
*IEEE Transactions on Geoscience and Remote Sensing* 41:1724-1729
29. 2003 Spectral reflectance of coral reef bottom-types worldwide and implications for coral reef remote sensing (339)  
[Hochberg EJ](#), Atkinson MJ, Andréfouët S  
*Remote Sensing of Environment* 85:159-173
30. 2003 Capabilities of remote sensors to classify coral, algae, and sand as pure and mixed spectra (323)  
[Hochberg EJ](#), Atkinson MJ  
*Remote Sensing of Environment* 85:174-189

31. 2003 Airborne hyperspectral detection of microbial mat pigmentation in Rangiroa atoll (French Polynesia) (37)  
Andréfouët S, Payri C, Hochberg EJ, Che LM, Atkinson MJ  
*Limnology and Oceanography* 48:426-430
32. 2001 Change detection in shallow coral reef environments using Landsat 7 ETM+ data (215)  
Andréfouët S, Muller-Karger FE, Hochberg EJ, Hu CM, Carder KL  
*Remote Sensing of Environment* 78:150-162
33. 2000 Spectral discrimination of coral reef benthic communities (284)  
Hochberg EJ, Atkinson MJ  
*Coral Reefs* 19:164-171
34. 1999 The Biosphere 2 coral reef biome (34)  
Atkinson MJ, Barnett H, Aceves H, Langdon C, Carpenter SJ, McConnaughey T, Hochberg E [sic], Smith M, Marino BDV  
*Ecological Engineering* 13:147-171

### Book Chapters

1. 2019 Light, Temperature, Photosynthesis, Heterotrophy, and the Lower Depth Limits of Mesophotic Coral Ecosystems (75)  
Kahng SE, Akkaynak D, Shlesinger T, Hochberg EJ, Wiedenmann J, Tamir R, Tchernov D  
In: Y. Loya et al. (eds.), *Mesophotic Coral Ecosystems*, Coral Reefs of the World 12 pp 799-826
2. 2013 Visible and Infrared Overview (7)  
Phinn SR, Hochberg EM [sic], Roelfsema C  
In: Goodman JA, Purkis SJ, Phinn SR, (eds.) *Coral Reef Remote Sensing: A Guide for Mapping Monitoring and Management*. Springer, The Netherlands pp. 3-28
3. 2011 Remote sensing of coral reef processes (25)  
Hochberg EJ  
In: Dubinsky Z, Stambler N (eds.) *Coral Reefs: An Ecosystem in Transition*. Springer, The Netherlands pp 25-35
4. 2005 Multi-scale remote sensing of coral reefs (35)  
Andréfouët S, Hochberg EJ, Chevillon C, Muller-Karger FE, Brock JC, Hu C  
In: Miller RL, Castillo CED, McKee BA (eds.) *Remote Sensing of Coastal Aquatic Environments: Technologies, Techniques and Applications*. Springer, The Netherlands pp 299-317

### Manuscripts in Review or in Preparation

1. In prep Field-based estimates of light-use efficiency for coral reef benthic functional types  
Hochberg EJ, Pisapia C, Carpenter RC
2. In prep Laboratory-based estimates of light-use efficiency for Bermuda corals and algae  
Hochberg EJ, Sawall Y
3. In prep COral Reef Airborne Laboratory: A new perspective on coral reef condition  
Hochberg EJ and CORAL Science Team
4. In prep Seasonally dynamic response of coral chlorophyll to changes in temperature and insolation  
Hochberg EJ
5. In prep Ecosystem scale relationships between coral reef condition and biogeophysical forcings  
Hochberg EJ, Gierach MM, CORAL Science Team
6. In prep Relationship between water flow and primary production in an experimental community of *Porites astreoides*  
Chan H, Hochberg EJ
7. In prep Photoinhibition by green fluorescent proteins in *Diploria labyrinthiformis* under low light  
Dawson C, Hochberg EJ
8. In prep Ranges and variabilities in spectral absorption and scattering of coral reef water  
Susner MG, Hochberg EJ
9. In prep Empirical parameterizations of coral reef water optical properties for use in remote sensing  
Hochberg EJ
10. In prep Dependence of coral reef remote sensing retrievals on water depth, water optical properties, and coral fraction  
Hochberg EJ

**EDITORSHIPS**

2021–Pres.	Co-Lead Research Topic Editor	<i>Frontiers in Marine Science: Coral Reef Research Optics and Ecophysiology of Coral Reef Organisms: Volume II</i>
2020–Pres.	Co-Lead Research Topic Editor	<i>Frontiers in Marine Science: Coral Reef Research Remote Sensing for Applied Coral Reef Science and Management</i>
2014–Pres.	Associate Editor	<i>Frontiers in Marine Science: Coral Reef Research</i>
2014–2015	Lead Guest Editor	<i>Remote Sensing of Environment</i> Special Issue for the Hyperspectral Infrared Imager (HyspIRI)
2011–Pres.	Editorial Board Member	<i>Remote Sensing of Environment</i>

**GRANTS AND CONTRACTS** (1998–2021 total \$21.31 million)

1.	2021–2023	Coral Reef Benthic Cover from Commercial High-Resolution Multispectral Satellite Imagery NASA	PI	\$197,210
2.	2021–2022	Hyperspectral Program Development Australian Institute of Marine Science	PI	\$25,580
3.	2021–2024	Impact of spatially and temporally varying thermal stress on reef functional diversity NASA	Co-I	\$92,192
4.	2020–2021	Mapping and Detailed Survey of BELCO Cable Route in the Vicinity of Grotto Bay and Ferry Reach Bermuda Electric Light Company, Ltd.	PI	\$78,739
5.	2020–2021	Alliance for Coastal Technology NOAA	Co-I	\$65,000
6.	2019–2020	Alliance for Coastal Technology NOAA	Co-I	\$80,000
7.	2018–2019	Commercial Satellite Data Assessment for Coral Reef Study NASA	PI	\$100,780
8.	2018–2019	Alliance for Coastal Technology NOAA	Co-I	\$40,000
9.	2018–2019	Marine Environmental Program FY2018–2019 Bermuda Department of Environment and Natural Resources	PI	\$120,000
10.	2017–2018	Alliance for Coastal Technology NOAA	Co-I	\$30,000
11.	2017–2018	Environmental Assessment of the Seawater Reverse Osmosis Outfall Bermuda Waterworks, Ltd.	PI	\$209,136
12.	2017–2018	Marine Environmental Program FY2017–2018 Bermuda Department of Environment and Natural Resources	PI	\$120,000
13.	2015–2020	CORAL: COral Reef Airborne Laboratory NASA	PI	\$15,000,000
14.	2015–2018	Coral reef condition across the Hawaiian archipelago and relationship to environmental forcing NASA	PI	\$248,045
15.	2016–2017	Marine Environmental Program FY2016–2017 Bermuda Department of Environmental Protection	PI	\$119,590
16.	2015–2016	Marine Environmental Program FY2015–2016 Bermuda Department of Environmental Protection	PI	\$150,000
17.	2014–2015	Marine Environmental Program FY2014–2015 Bermuda Department of Environmental Protection	PI	\$150,000
18.	2013–2014	Marine Environmental Program FY2013–2014 Bermuda Department of Environmental Protection	PI	\$150,000
19.	2012–2017	Continued Assessment of the Marine Environment and Coral Reefs in the Vicinity of the Seabright Point Sewage Outfall City of Hamilton, Bermuda	PI	\$280,436

20.	2012–2013	Assessment of Benthic and Fish Community Response to Removal of Thruster Walls at Heritage Wharf, Dockyard, Bermuda Bermuda Ministry of Public Works	PI	\$26,882
21.	2012–2013	Marine Environmental Program FY2012–2013 Bermuda Department of Environmental Protection	PI	\$150,000
22.	2011–2012	Marine Environmental Program FY2011–2012 Bermuda Department of Environmental Protection	PI	\$150,000
23.	2011–2012	Guantánamo, Cuba Marine Surveys and Photomosaicking Technology Evaluation US Navy via TEC	PI	\$100,347
24.	2010	HyspIRI Sun Glint Sub-Group (Chair Activities) NASA/JPL	PI	\$12,408
25.	2010–2011	Coral Reef Resource Surveys for Apra Harbor and Four Watersheds in Southwestern Guam in Support of the Marine Corps Relocation to Guam US Navy via TEC	PI	\$252,858
26.	2009–2010	Assessment of Benthic Community Structure in the Vicinity of the Proposed Turning Basin and Berthing Area for Carrier Vessels Nuclear (CVN) Apra Harbor, Guam US Navy via TEC	PI	\$220,904
27.	2006–2008	University of Hawaii Participation in the Hyperspectral Imager for the Coastal Ocean (HICO) ONR	PI	\$300,000
28.	2006–2007	Integration of Pacific Bathymetric Data: Assessment of the Quality and Usefulness of Estimated Depths Derived from Ikonos Satellite Images When Integrated with Multibeam Bathymetric Data NOAA	Co-I	\$130,000
29.	2004–2008	Empirical Radiative Transfer Corrections for Deterministic Coral Reef Remote Sensing NASA	PI	\$297,790
30.	2004	Hyperspectral Imager for the Coastal Ocean (HICO) Coral Reef Mapping ONR	Co-I	\$322,765
31.	2003–2005	Mapping Benthic Habitats of the Main Eight Hawaiian Islands NOAA/Science and Technology International	Co-I	\$1,300,000
32.	2000–2005	CRESPO: Coral Reef Ecosystem Spectro-Photometric Observatory NASA	GA	\$291,000
33.	2000–2003	Calibration Support for Hawaiian Coral Reef Mapping NOAA	GA	\$273,261
34.	1998–2001	Hyperspectral Remote Sensing of Coral Reefs in a Tropical Estuary NASA	GA	\$225,998

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#### INVITED LECTURES

1. 2020 Coral Reef Airborne Laboratory and Beyond  
All-Atlantic Summit: The 6th High-Level Industry-Science-Government Dialogue on Atlantic Interactions  
Philadelphia, Pennsylvania, October 8
2. 2018 Coral Reef Airborne Laboratory: Not Missing the Reef for the Corals  
NASA Headquarters, Washington, D.C., August 15
3. 2016 CORAL: Coral Reef Airborne Laboratory  
NASA Jet Propulsion Laboratory, Pasadena, California, March 30
4. 2010 Status and Future of Coastal and Oceanic Shallow Water Remote Sensing  
NASA Jet Propulsion Laboratory, Pasadena, California, March 4
5. 2010 Using Remote Sensing and Optics to Study Coral Reef Ecology and Biogeochemistry  
Florida International University, North Miami, Florida, October 27
6. 2009 Using Remote Sensing and Optics to Study Coral Reef Ecology and Biogeochemistry  
Smithsonian Marine Station, Fort Pierce, Florida, February 6

7. 2008 Reef Assessment Using Remote Sensing and In Situ Optics  
Southeast Florida Coral Reef Initiative Technical Advisory Committee, Dania Beach, Florida,  
November 6
8. 2007 Coral Reefs and Light  
Carnegie Institute of Washington, Department of Global Ecology, Stanford University, Stanford,  
California, November 6
9. 2005 Coral Reefs: Views from 4 mm to 400 km  
NASA Ames Research Center, Mountain View, California, July 11

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#### CONFERENCE/WORKSHOP SESSION & TOWN HALL CONVENER/CHAIR

1. 2018 Town Hall (Lead): COral Reef Airborne Laboratory  
Ocean Optics XXIV, Dubrovnik, Croatia, 7–12 October
2. 2018 Session (Co-Chair): Remote Sensing of Coral Reef Ecosystems  
Ocean Sciences Meeting, Portland, Oregon, 11–16 February
3. 2017 Session (Co-Chair): New Coral Reef Ecosystem Studies from Remote Sensing  
Aquatic Sciences Meeting, Honolulu, Hawaii, 26 February – 3 March
4. 2016 Session (Co-Chair): Remote Sensing of Coral Reefs: Transitioning from Developmental to Operational  
13th International Coral Reef Symposium, Honolulu, HI, 19–24 June

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#### CONFERENCE/WORKSHOP PAPERS AND PRESENTATIONS

1. 2020 COral Reef Airborne Laboratory: Algorithm Concepts and Implementation  
[Hochberg EJ](#) and CORAL Science Team  
NASA Surface Biology and Geology Algorithms Working Group, 27 July
2. 2020 COral Reef Airborne Laboratory: Validation Effort and Lessons Learned  
[Hochberg EJ](#)  
NASA Surface Biology and Geology Calibration/Validation Working Group, 9 July
3. 2020 COral Reef Airborne Laboratory: Data Availability  
[Hochberg EJ](#)  
Virtual Ocean Color Research Team Meeting, 28 May
4. 2020 Hyperspectral Remote Sensing of Coral Reef Condition: COral Reef Airborne Laboratory  
[Hochberg EJ](#), Gierach MM  
Ocean Sciences Meeting, San Diego, CA, 16–21 February
5. 2019 Hyperspectral Imaging of Coral Reef Condition: COral Reef Airborne Laboratory  
[Hochberg EJ](#), Green RO  
AGU Fall Meeting, San Francisco, CA, 9–13 December
6. 2019 COral Reef Airborne Laboratory: A New Perspective on Coral Reefs  
[Hochberg EJ](#)  
Asia Oceania Geosciences Society 16th Annual Meeting, Singapore, 28 July–2 Aug
7. 2019 A New Perspective on Coral Reefs: COral Reef Airborne Laboratory  
[Hochberg EJ](#)  
Hyperspectral Imaging and Sounding of the Environment, San Jose, California, 25–27 June
8. 2019 COral Reef Airborne Laboratory: Results and Current Status  
[Hochberg EJ](#)  
Ocean Color Research Team Meeting, Busan, South Korea, 8 April
9. 2019 High Spatial and Temporal Resolution Considerations for Coral Reef Remote Sensing  
[Hochberg EJ](#)  
International Ocean Colour Science Meeting, Busan, South Korea, 9–12 April
10. 2019 Hyperspectral Remote Sensing of Coral Reefs  
[Hochberg EJ](#)  
International Ocean Colour Science Meeting, Busan, South Korea, 9–12 April
11. 2019 A New Perspective on Coral Reefs: COral Reef Airborne Laboratory  
[Hochberg EJ](#)  
ASLO 2019 Aquatic Sciences Meeting, San Juan, Puerto Rico, 25 February – 1 March

12. 2018 Airborne Imaging Spectroscopy of Coral Reef Condition  
Hochberg EJ, Gierach MM  
AGU Fall Meeting, Washington, D.C., 10–14 December
13. 2018 COral Reef Airborne Laboratory  
Hochberg EJ, Gierach MM  
Ocean Optics XXIV, Dubrovnik, Croatia, 7–12 October
14. 2018 Scaling CORAL Results with Future SBG Observables  
Hochberg EJ  
HyspIRI and SBG Science and Applications Workshop, Washington, D.C., 15–18 August
15. 2018 COral Reef Airborne Laboratory  
Hochberg EJ  
HyspIRI and SBG Science and Applications Workshop, Washington, D.C., 15–18 August
16. 2018 COral Reef Airborne Laboratory: Airborne Spectral Imaging of Coral Reef Ecology  
Hochberg EJ  
Asia Oceania Geosciences Society 15th Annual Meeting, Honolulu, Hawaii, 3–8 June
17. 2018 COral Reef Airborne Laboratory: Status and Initial Results  
Hochberg EJ, Gierach MM  
Ocean Sciences Meeting, Portland, Oregon, 11–16 February
18. 2018 In-water photomosaic validation of remote sensing benthic community maps  
Peltier SA, Hochberg EJ, Dollar SJ  
Ocean Sciences Meeting, Portland, Oregon, 11–16 February
19. 2018 Multi-decadal shifts in community metabolism of a Lizard Island, GBR reef flat associated with press and pulse disturbances  
Pisapia C, Ginther S, Hochberg EJ, Carpenter R  
Ocean Sciences Meeting, Portland, Oregon, 11–16 February
20. 2018 Light-use-efficiency of reef corals and algae and its implication for remote sensing  
Sawall Y, Hochberg EJ, Miller A  
Ocean Sciences Meeting, Portland, Oregon, 11–16 February
21. 2018 NASA Town Hall: The Future of Remote Sensing of Coastal and Inland Waters  
Kevin R. Turpie, William W. Turner, Emily Smail, Paul M. DiGiacomo, Liane S. Guild, Arnold Dekker, Erin Hestir, Nima Pahlevan, Eric J. Hochberg, Michelle M. Gierach, Kevin G. Ruddick, Martin Bergeron, Joseph D. Ortiz, Frank E. Muller-Karger, Uta Heiden, Nicole Pinnel, E. Natasha Stavros  
Ocean Sciences Meeting, Portland, Oregon, 11–16 February
22. 2017 Spectroscopy for global observation of coastal and inland aquatic habitats  
Turpie K, Ackleson S, Bell T, Dierssen H, Goodman J, Green R, Guild L, Hochberg E [sic], Klemas V, Lavender S, Lee C, Moisan T, Muller-Karger F, Ortiz J, Palacios S, Thompson DR, Zimmerman R  
IEEE International Geoscience and Remote Sensing Symposium, Fort Worth, Texas, 23–28 July
23. 2017 Remote Observation and Assessment of Coral Reefs  
Hochberg EJ  
GCRMN/GOOS “Hard Coral Cover and Composition” Essential Ocean Variable Workshop, Dar es Salaam, Tanzania, 3–4 November
24. 2017 Light-use efficiency of reef corals and algae and its implication for remote sensing  
Sawall Y, Hochberg EJ  
European Coral Reef Symposium, University of Oxford, United Kingdom, 13–15 December
25. 2017 COral Reef Airborne Laboratory Australia Campaign  
Hochberg EJ  
Aquatic Sciences Meeting, Honolulu, Hawaii, 26 February – 3 March
26. 2017 The effect of temperature changes on the light use efficiency of two coral communities  
Saraceno HM, Hochberg E [sic]  
Aquatic Sciences Meeting, Honolulu, Hawaii, 26 February – 3 March
27. 2017 Using high-resolution photomosaicking techniques to validate benthic cover data from remote sensing technologies  
Peltier SA, Hochberg EJ, Dollar SJ  
Aquatic Sciences Meeting, Honolulu, Hawaii, 26 February – 3 March
28. 2016 On the challenge of observing pelagic Sargassum in coastal oceans: A multi-sensor assessment  
Hu C, Feng L, Hardy R, Hochberg EJ  
Ocean Sciences Meeting 2016, New Orleans, LA, 21–26 February

29. 2016 Coral Reef Color: Remote and In-Situ Imaging Spectroscopy of Reef Structure and Function  
[Hochberg EJ](#)  
American Geophysical Union Fall Meeting 2016, San Francisco, CA, 12–16 December
30. 2016 Seeing the reef for the corals: A quantitative case for remote sensing  
[Hochberg EJ](#)  
13th International Coral Reef Symposium, Honolulu, HI, 19–24 June
31. 2016 Preliminary measurements of coral community light-use efficiency in response to variable environmental conditions  
Wooster MK, [Hochberg EJ](#)  
13th International Coral Reef Symposium, Honolulu, HI, 19–24 June
32. 2016 Remote spectroscopic retrieval of apparent optical properties and bottom reflectance in shallow coral ecosystems  
Thompson DR, [Hochberg E](#) [sic], Dierssen H, Garcia R, Gierach M, Lee ZP, Green R, Maritorena S, Mouroulis P, McCubbin I  
13th International Coral Reef Symposium, Honolulu, HI, 19–24 June
33. 2016 Comparing chemistry and census-based estimates of net ecosystem calcification on a rim reef in Bermuda  
Courtney TA, Andersson AJ, Cyronak T, Noyes T, Bates NR, Collins A, de Putron S, Garley R, [Hochberg EJ](#), Johnson R, Tribollet A, Toncin J, Eyre BD  
13th International Coral Reef Symposium, Honolulu, HI, 19–24 June
34. 2016 CORAL: COral Reef Airborne Laboratory  
[Hochberg EJ](#)  
Ocean Color Research Team Meeting, Silver Spring, MD, 2–4 May
35. 2016 Coral reef color: Remote and in-situ imaging spectroscopy of reef structure and function  
[Hochberg EJ](#)  
Ocean Sciences Meeting 2016, New Orleans, LA, 21–26 February
36. 2015 Coral reef color: Remote and in-situ imaging spectroscopy of reef structure and function  
[Hochberg EJ](#)  
American Geophysical Union Fall Meeting 2015, San Francisco, CA, 14–18 December
37. 2015 CORAL: COral Reef Airborne Laboratory  
[Hochberg EJ](#)  
2015 HyspIRI Science and Application Workshop, Pasadena, CA, 13–15 October
38. 2015 Coral reef colour: Remote and in-situ hyperspectral sensing of reef structure and function  
[Hochberg EJ](#)  
International Ocean Colour Science Meeting 2015, San Francisco, CA, 15–18 June
39. 2014 Seasonally variable coral pigment response to and anticipation of changes in temperature and light  
[Hochberg EJ](#)  
Ocean Optics XXII, Portland, ME, 26–31 October
40. 2014 Light-use efficiency for coral reefs  
[Hochberg EJ](#)  
2014 Ocean Sciences Meeting, Honolulu, HI, 23–28 February
41. 2013 Spectral Imaging of Coral Reefs: Inversion, Classification, & Modeling Ecosystem Function  
[Hochberg EJ](#)  
2013 HyspIRI Science and Application Workshop, Pasadena, CA, 15–17 October
42. 2013 Coral Reef Products for HyspIRI  
[Hochberg EJ](#)  
2013 HyspIRI Science Symposium, NASA Goddard Space Flight Center, Greenbelt, MD, 29–30 May
43. 2012 Hyperspectral remote sensing of coral reefs: Inversion, classification, and modeling ecosystem function  
[Hochberg EJ](#)  
International Geoscience and Remote Sensing Symposium, Munich, Germany, 22–27 July
44. 2012 Optical indices for coral pigments and reef community light-use efficiency  
[Hochberg EJ](#)  
12th International Coral Reef Symposium, Cairns, Australia, 9–13 July
45. 2011 Coral Reef Remote Sensing Science Objectives and Requirements  
[Hochberg EJ](#)  
2011 HyspIRI Science Workshop, Washington, D.C., 23–25 August

46. 2011 Characterization of Glint and Its Impact on HypsIRI Aquatic Science  
Hochberg EJ, et al.  
2011 HypsIRI Science Workshop, Washington, D.C., 23–25 August
47. 2011 Coral Reefs, Climate Change, and Remote Sensing  
Hochberg EJ  
2011 HypsIRI Science Symposium, NASA Goddard Space Flight Center, Greenbelt, MD, 17–18 May
48. 2010 HypsIRI Sunglint Subgroup: Glint Characterization, Determination of Impacts on Science, and Potential Mitigation Approaches  
Hochberg EJ  
3rd HypsIRI Science Workshop, Pasadena, CA, 24–26 August
49. 2010 Remote Sensing of Productivity and Calcification of the Florida Keys Reef Tract  
Hochberg EJ  
International Geoscience and Remote Sensing Symposium, Honolulu, HI, 25–30 July
50. 2010 A Coral Reef Habitat Index Derived from Satellite Multispectral Imagery and LIDAR Data  
Hochberg EJ, Dollar SJ  
2010 Ocean Sciences Meeting, Portland, OR, 22–26 February
51. 2009 Sun Glint Correction + HypsIRI for Coral Reef Science  
Hochberg EJ  
2nd HypsIRI Science Workshop, Pasadena, CA, 11–13 August
52. 2009 Small Satellite and UAS Assets for Coral Reef and Algal Bloom Monitoring  
Dunagan S, Baldauf B, Finch P, Guild L, Hochberg E [sic], Jaroux B, Johnson L, Lobitz B, Sandor-Leahy S, Shepanski J  
33rd International Symposium on Remote Sensing of the Environment, Stresa, Italy, 4–8 May
53. 2008 Remote Sensing of Coral Reef Biogeochemistry Based on Optical Absorptance and Light-Use Efficiency  
Hochberg EJ, Atkinson MJ  
11th International Coral Reef Symposium, Ft. Lauderdale, FL, 7–11 July
54. 2007 Coral reef benthic productivity based on optical absorptance and light-use efficiency  
Hochberg EJ  
Ocean Color Research Team Meeting, Seattle, WA, 11–13 April
55. 2006 Water Column Radiative Transfer Compensations for Coral Reef Remote Sensing  
Hochberg EJ, Atkinson MJ  
Joint Workshop on NASA Biodiversity, Terrestrial Ecology, and Related Applied Sciences, University of Maryland, Adelphi, MD, 21–25 August
56. 2005 Progress Toward Launch: A Review of 2004 HICO Program Activities  
Mosher TJ, Mitchell ML, Lucey PG, Hochberg EJ, Davidson M, Wassom S  
2005 IEEE Aerospace Conference, Big Sky, MT, 5–12 March
57. 2004 Hyperspectral Imaging of Coastal Regions from the ISS  
Mosher TJ, Mitchell ML, Lucey PG, Hochberg E [sic]  
Fourth International Asia-Pacific Environmental Remote Sensing Symposium, Honolulu, HI, 8–12 November
58. 2004 Bio-optical modeling of photosynthetic pigments in corals  
Hochberg EJ, Apprill A, Atkinson MJ, Bidigare RR  
Ocean Optics 17, Fremantle, Australia, 25–29 October
59. 2004 Bio-optical modeling of photosynthetic pigments in corals  
Hochberg EJ, Apprill A, Atkinson MJ, Bidigare RR  
10th International Coral Reef Symposium, Okinawa, Japan, 28 June–2 July
60. 2004 Spectral reflectance of coral, algae and sand and implications for coral reef remote sensing  
Hochberg EJ, Atkinson MJ  
Ocean Research Conference, Honolulu, HI, 15–20 February
61. 2003 Sea surface glint correction for high resolution images of aquatic environments  
Hochberg EJ  
30th International Symposium on Remote Sensing of Environment, Honolulu, HI, 10–14 November
62. 2002 Capabilities of remote sensors to classify basic coral reef community-types  
Hochberg EJ  
7th International Conference on Remote Sensing of Marine and Coastal Environments, Miami, FL, 20–22 May

63. 2000 Spectral reflectance characteristics of coral reef benthic communities  
Hochberg EJ, Atkinson MJ  
9th International Coral Reef Symposium, Bali, Indonesia, 23–27 October
64. 1998 Airborne hyperspectral remote sensing of a coral reef in Kaneohe Bay, Oahu, Hawaii  
Hochberg EJ, Atkinson MJ, Holasek RE  
5th International Conference on Remote Sensing for Marine and Coastal Environments, San Diego, CA,  
5–7 October

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## PROJECT REPORTS

1. 2020 Mapping and Detailed Survey of BELCO Cable Route in Grotto Bay, Bermuda  
Hochberg EJ, Peltier SA, Crossman AH, Lemieux SM  
Prepared for Bermuda Electric Light Company, Ltd.
2. 2018 Environmental Assessment of the Sea Water Reverse Osmosis Outfall, Bermuda Waterworks, Ltd.  
Hochberg EJ, Peters AJ, Noyes TJ, Peltier SA  
Prepared for Bermuda Waterworks, Ltd.
3. 2015 Coastal and Inland Aquatic Data Products for the Hyperspectral Infrared Imager (HyspIRI)  
Turpie K, Abelev A, Babin M, Bachmann C, Bell T, Brando V, Byrd K, Dekker A, Devred E, Forget M-H,  
Goodman J, Guild L, Hochberg EJ, Hu C, Jo Y-H, Kelly M, Klemas V, Lee Z, Moisan T, Moses W,  
Muller-Karger F, Palacios S, Philpot W, Toro-Farmer G, Yu Q  
Prepared for Jet Propulsion Laboratory, National Aeronautics and Space Administration
4. 2014 Evaluation of NOAA-CRED benthic monitoring data for Kahekili, Maui, Hawaii  
Hochberg EJ  
Prepared for County of Maui
5. 2013 Continued Assessment of the Marine Environment and Coral Reefs in the Vicinity of the Seabright Point  
Sewage Outfall: Year 1 Report  
Hochberg EJ, Noyes T  
Prepared for the Corporation of Hamilton, Bermuda
6. 2013 Assessment of Benthic and Fish Community Response to Removal of Thruster Walls at Heritage Wharf,  
Dockyard, Bermuda  
Hochberg EJ  
Prepared for Bermuda Ministry of Works and Engineering
7. 2012 Coral Reef Surveys at Guantánamo Bay Naval Station, 2011 and 2012  
Hochberg EJ  
Prepared for CardnoTEC, Inc. and Dept. of the Navy, Scientific Diving Service
8. 2011 HyspIRI Sun Glint Report  
Hochberg EJ, Bruce CF, Green RO, Oaida BV, Minnett PJ, Muller-Karger FE, Gentemann C, Mogley  
CD, Zimmerman RC, Park YJ, Turner W, Goodman J, Gao BC, Knox RG, Middleton EM, Turpie KR,  
Ungar S  
Prepared for Jet Propulsion Laboratory, National Aeronautics and Space Administration
9. 2011 An evaluation of causal factors affecting coral reef community structure in Ma'alaea Bay, Maui, Hawaii  
Dollar SJ, Atkinson MJ, Hochberg EJ, Nance T  
Prepared for County of Maui
10. 2010 Mitigation site surveys and evaluations of watersheds of southwestern Guam and Apra Harbor;  
Assessment of Coral Reef Resources  
Dollar SJ, Hochberg EJ  
Prepared for TEC, Inc. and Dept. of the Navy, Navy Facilities Engineering Command, Pacific Base  
Development
11. 2009 Assessment of Benthic Community Structure in the Vicinity of the Proposed Turning Basin and Berthing  
Area for Carrier Vessels Nuclear (CVN) Apra Harbor, Guam  
Dollar SJ, Hochberg EJ  
In: Habitat Equivalence Analysis and Supporting Studies. Prepared for TEC, Inc. and Dept. of the Navy,  
Navy Facilities Engineering Command, Pacific Base Development

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## DEPARTMENTAL LECTURES

1. 2013 Shedding Light on Coral Reefs  
Bermuda Institute of Ocean Sciences, March 14

2. 2008 Coral Reefs and Light  
Department of Oceanography, University of Hawaii, January 17
3. 2006 Remote Sensing of Coral Reef Ecology  
Department of Ocean Resource Engineering, University of Hawaii, January 25
4. 2004 Coral Reefs: Views from 4 mm to 400 km  
Department of Oceanography, University of Hawaii, October 21

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## TEACHING EXPERIENCE

### Bermuda Institute of Ocean Sciences: 2011–Present

- Coral Reef Ecology Summer 2013–2015, 2021 (×2), 2022 (×2); Fall 2011–2015, 2017, 2021
- Introduction to MATLAB 2012
- Biological Oceanography 2013
- Satellite Oceanography 2013

### Nova Southeastern University: 2008–2011

- Environmental Studies 2008, 2009 (×3), 2010 (×3), 2011 (×2)
- Environmental Issues 2008–2010
- Biostatistics I 2008–2010
- Biostatistics II 2009–2011

### University of Hawaii: 2003–2008

- Introduction to MATLAB 2003–2005

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## ADVISING/MENTORING

• 69 Undergrad, 18 Master's, 8 PhD, 1 Postdoc

Level	Program	No.	Individuals
Undergrad	NSF Research Experiences for Undergraduates	12	Stacy Peltier (2011), Jeremy Kravitz (2012), Ryan Jones (2013), Michael Wooster (2014), Hannah Saraceno (2015), Gabrielle Dodson (2017), Liah McPherson (2017), Kelly Chimpén MacLeod (2017), Jacob Cooper (2018), Sophie Ferguson (2019), Shannon Lemieux (2020), Siarah Hall (2021)
	BIOS Bermuda Program Summer Intern	3	Christiana Halliday (2011–2014), Celine Collis (2012–2014), Luke Young (2020)
	UK Associates of BIOS Internship	2	Michelia Wibowo (2021), Freja Azzopardi (2021)
	Canadian Associates of BIOS Internship	3	Chloe Ready (2012), Aleksandra Crossman (2020, 2023)
	Lehigh University lococca International Internship	1	Menglin Jiang (2021)
	BIOS Eckerd College Galbraith Fellow	1	Kristina Petraitis (2013)
	Princeton University–BIOS Summer Intern	3	Rebecca Terrett (2014), Konadu Amoakuh (2015), Katherine Woolford (2017)
	BIOS Cawthorne Cambridge Intern	2	Oliver Lawrence (2014), Scott Li (2017)
	Dalhousie University Honor's Committee	1	Brett Jameson (2015–2016)
	BIOS Marine Biology & Oceanographic Research Course	41	Nine students (2011), Five students (2012), Six students (2013), Three students (2014), Seven students (2015), Eight students (2017), Three students (2021)
Master's	BIOS Volunteer Intern	1	Anat Finkelstein (2015)
	University of Hawaii, Master's Committee	5	Amy Apprill (2003–2004), Christopher Conger (2003–2005), Ellen Jacobson (2004–2005), M. Grant Susner (2004–2008, <b>Chair</b> ), Joshua Levy (2015–2016)
	University of Hawaii, Advisory Committee	4	Olivia Nigro (2004–2005), Mindy Swanson (2005–2007), Allyn Fetherolf (2006–2007), Thomas Kilpatrick (2006–2007)
	Nova Southeastern University, Master's Committee	7	Shanna Dunn (2008–2010), Rolando Santos (2008–2010), Mitchell Doctor (2009–2010, <b>Chair</b> ), Harmony Hancock

			(2009–2012, <b>Chair</b> ), Chris Lapointe (2009–2013, <b>Chair</b> ), Denise Perez (2010–2013, <b>Chair</b> ), Christopher Maingot (2010–2011)
	Canadian Associates of BIOS Internship Mentor	1	Samantha Hamilton (2012)
	University of Bremen, BIOS Mentor	1	Ashley Miller (2017–2018)
PhD	University of Hawaii, PhD Committee	3	William Koeppen (2004–2008), Brett Wilcox Denevi (2004–2007), Josh Cahill (2005–2008)
	University of Queensland, PhD Committee	1	Denise Perez (2015–2018)
	BIOS-POGO Student	1	Yuna Zayas (2012)
	BIOS CoEOO Student	2	Luis Medina (2013), Assefa Tegen (2013)
	UK Associate of BIOS	1	Jonathan Teague (2019)
Postdoc	BIOS/CORAL Postdoctoral Scholar	1	Yvonne Sawall (2016–2019)

### OTHER NOTABLE STUDENT INTERACTIONS

- 2018 Judge for the Outstanding Student Presentation Award  
AGU Fall Meeting, Washington, D.C., 10–14 December
- 2016 Judge for Student Presentation Awards  
13th International Coral Reef Symposium, Honolulu, HI, 19–24 June

### PEER REVIEW ACTIVITIES

#### Journals/Conference Proceedings (~175 Total)

- 9th International Coral Reef Symposium
- 11th International Coral Reef Symposium
- *Bulletin of Marine Science*
- *Canadian Journal of Remote Sensing*
- *Coral Reefs*
- *Environmental Biology of Fishes*
- *Frontiers in Marine Science: Coral Reef Research*
- *Frontiers in Plant Science*
- *Galaxea*
- *Geocarto*
- *Global Ecology and Biogeography*
- *IEEE Transactions on Geoscience and Remote Sensing*
- *Indian Journal of Marine Science*
- *International Journal of Remote Sensing*
- *ISPRS Journal of Photogrammetry and Remote Sensing*
- *Journal of Applied Remote Sensing*
- *Journal of Experimental Marine Biology and Ecology*
- *Journal of Geophysical Research - Planets*
- *Journal of Sedimentary Research*
- *Limnology and Oceanography*
- *Limnology and Oceanography: Methods*
- *Marine Ecology-Progress Series*
- *Marine Pollution Bulletin*
- *Methods in Ecology and Evolution*
- *Nature Communications*
- *PeerJ*
- *Photogrammetric Engineering and Remote Sensing*
- *Remote Sensing*
- *Remote Sensing of Environment*
- *Scientific Data*
- *Scientific Reports*
- *Sensors*

#### Research Proposals (~60 Total)

- Australian Research Council
- Gulf of Mexico Research Initiative
- International Foundation for Science
- Marine Science and Technology Foundation
- NASA Postdoctoral Program
- National Aeronautics and Space Administration
- National Oceanic and Atmospheric Administration
- NOAA Undersea Research Center
- National Oceanographic Partnership Program
- National Park Service
- National Science Foundation
- Schmidt Ocean Institute
- University of Hawaii Sea Grant College Program

### PROFESSIONAL SERVICE AND ACTIVITIES

- 2017–Pres. Co-Lead for Alliance for Coastal Technologies (ACT) Hyperspectral Activities
- 2016–2018 National Academies of Sciences, Engineering and Medicine: Decadal Survey for Earth Science and Applications from Space - Panel on Marine and Terrestrial Ecosystems and Natural Resource Management
- 2010 NIMBioS Investigative Workshop: Modeling Reef Ecosystems, 21–23 July, Knoxville, TN

4. 2009–2011 Chair of the HyspIRI Sunlint Subgroup
  5. 2009 EPA Coral Reef Decision Makers Workshop, 17–18 June, Key West, FL
  6. 2008 Awarded NASA Senior Fellow (declined due to conflicting schedule)
  7. 2008 NASA Coastal Habitats Workshop, 5–7 August, UC at Santa Barbara
  8. 2007 NASA Ocean Color Research Team Meeting, 11–13 April, Seattle
  9. 2001–2006 World Bank/Global Environment Fund Coral Reef Targeted Research Working Group on Remote Sensing, Member
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### PROFESSIONAL SOCIETIES

1. 2007–Pres. American Geophysical Union, Member
  2. 2005–Pres. American Society of Limnology and Oceanography, Member
  3. 2004–Pres. International Society for Reef Studies, Member
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### INSTITUTIONAL SERVICE

1. 2021–Pres. Dive Control Board, Member  
Bermuda Institute of Ocean Sciences
  2. 2012–2015 Information Technology Committee, Member  
Bermuda Institute of Ocean Sciences
  3. 2012–2013 Health and Safety Committee, Co-Chair  
Bermuda Institute of Ocean Sciences
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### DEPARTMENTAL SERVICE

1. 2009–2010 Internal Review Committee for the Master of Science Program in Marine Biology  
Nova Southeastern University
  2. 2008–2011 Curriculum Committee for the Environmental Science/Studies Program  
Nova Southeastern University
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### PROFESSIONAL SKILLS

1. Scientific programming (Expert user of MATLAB, ENVI and Generic Mapping Tools)
2. American Academy of Underwater Sciences Scientific Diver
3. U.S. Coast Guard Certificate in Boating Safety
4. Queensland (Australia) boating license
5. Queensland (Australia) VHF marine radio operator license