



**GLOBAL
REEF
EXPEDITION**

Prospectus



Khaled bin Sultan
Living Oceans Foundation

SCIENCE WITHOUT BORDERS®



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Introduction

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THE KHALED BIN SULTAN LIVING OCEANS FOUNDATION WAS ESTABLISHED SEPTEMBER, 2000 IN THE UNITED STATES AS A 501(C)(3), PUBLIC BENEFIT, NON-PROFIT ORGANIZATION DEDICATED TO CONSERVING AND RESTORING LIVING OCEANS THROUGH RESEARCH, EDUCATION, AND A COMMITMENT TO *SCIENCE WITHOUT BORDERS*[®].

Since its inception, the Living Oceans Foundation has been conducting cutting-edge coral reef ecosystem research in remote locations around the world. The Foundation's strength is in its multi-disciplinary network of marine scientists, a state-of-the-art research ship, dedication to applied science, and a commitment to leveraging technology to efficiently conduct rapid ecological assessments. These strengths, along with the Foundation's global scientific experience, place the Living Oceans Foundation in a leadership role to address the global coral reef crisis. The Khaled bin Sultan Living Oceans Foundation has, therefore, committed to an ambitious and unprecedented *Global Reef Expedition* program that will contribute significantly to the preservation of coral reef resources worldwide.

The Living Oceans Foundation embraces *Science Without Borders*[®] in all facets of its operations. *Science Without Borders*[®] is registered to the Foundation for financial sponsorship of marine conservation programs and scientific research and to promote public awareness of the need to preserve, protect and restore the world's oceans and aquatic resources. *The Global Reef Expedition* will build upon the Foundation's *Science Without Borders*[®] program through both an unprecedented level of collaborative scientific research and an ambitious education and outreach program. Through the Foundation's scientific work, local resource managers and scientists from developing countries around the globe will receive critical scientific information and tools that can assist in management and conservation of their precious resources. Additionally, local scientists will work side-by-side with internationally



acclaimed coral reef scientists. Emphasis will be placed on training local scientists and resource managers to continue rigorous environmental monitoring long after the *Golden Shadow* departs the region. This international team of scientists will assemble aboard the *Golden Shadow* for the purpose of closing critical gaps in scientific knowledge. Following the field work in each region, the Living Oceans Foundation and partners will compile and analyze comprehensive coral reef data, photos and video, and use the knowledge to guide development of regional and global conservation tools and tactics to counter the most serious threats impacting the health of coral reefs. Deteriorating ocean health is an urgent problem that requires decisive action. Timely scientific knowledge resulting from the *Global Reef Expedition* will reveal the

THE MOTOR YACHT *GOLDEN SHADOW*, A 219 FT RESEARCH VESSEL PROVIDED BY PRINCE KHALED BIN SULTAN, AFFORDS THE FOUNDATION'S SCIENTISTS FULL ACCESS TO SOME OF THE WORLD'S MOST VALUABLE AND REMOTE RESEARCH SITES. THE ABILITY TO DEPLOY SUCH A STATE-OF-THE ART RESEARCH VESSEL, THROUGH THE GENEROSITY OF THE FOUNDATION'S CHAIRMAN, ALLOWS FOR UNPARALLELED OPERATIONAL EFFICIENCIES AND HIGH SCIENTIFIC RETURNS AT MINIMAL COST.





major problems confronting coral reef ecosystems and will be used to guide the development of decision aids and tools, to facilitate spatially-based ecosystem management. The *Global Reef Expedition* is an action-oriented, solution-based project, focused on providing timely, critical knowledge to decision-makers and resource managers.

The *Global Reef Expedition* was announced at the World Conservation Congress in Barcelona, October 2008. The announcement included an invitation to all countries to submit requests and proposals for the Living Oceans Foundation to conduct collaborative research in their waters. Since then, the Foundation has reviewed all of the proposals, considered logistical constraints and liaised with interested countries to determine alignments of research priorities with the Expedition's goals and objectives.





ALL LIFE ON EARTH IS STRONGLY DEPENDENT UPON HEALTHY OCEANS. FUNCTIONAL AND RESILIENT CORAL REEFS ARE FUNDAMENTAL TO THE OCEAN'S ROLE AS A LIFE SUPPORT SYSTEM. MANY OF THE WORLD'S CORAL REEF ECOSYSTEMS ARE CRITICALLY ENDANGERED AND REQUIRE URGENT CONSERVATION ACTIONS BASED ON SOUND AND RELIABLE SCIENTIFIC DATA.

The Living Oceans Foundation, using the state-of-the-art research vessel *Golden Shadow* to support an international team of marine scientists, is initiating a multiyear (2011-2015) *Global Reef Expedition* program. Over \$30 million in funding has been secured to support the research vessel operations and the scientific infrastructure for the *Global Reef Expedition* program. This core funding will facilitate unique scientific access to remote coral reef ecosystems that have been relatively unaffected by human-induced stressors. Comprehensive reef resilience surveys of remote coral reefs will yield critical scientific knowledge on the functional processes necessary to sustain reef health and promote rapid recovery from past damage. Comparing the ecological conditions between remote and relatively healthy coral reefs with reefs that have been compromised by chronic human-induced stressors will enable the Living Oceans Foundation to identify high-priority management interventions. The anticipated principal outcome of the *Global Reef Expedition* is to provide applied scientific knowledge to local resource managers and relevant environmental government agencies, bridging science with management to achieve the long-term goal of ensuring healthy and sustainable coral reef ecosystems around the globe. The Foundation will provide knowledge of the critical ecosystem components that promote coral reef resilience and produce effective reef management tools/decision-aids that will influence policy and resource management actions urgently needed to improve and sustain global coral reef health. International research scientists will employ standardized protocols to map, characterize, and evaluate coral reefs throughout the western Atlantic, Pacific, and Indian Oceans, and the Red Sea¹. Comparative assessments of coral reef biodiversity, oceanographic conditions, and human pressures will reliably describe the status of coral reef health, identify major threats, and determine processes and factors that control the health and resilience of reef ecosystems worldwide.

¹Regional and local scientists may directly apply (or be nominated) to augment the core scientific staff of the *Global Reef Expedition*. Applicants will be objectively evaluated and selected by the Foundation's Scientific Advisory Council based upon alignment of research interests with the scientific objectives of the *Global Reef Expedition*, as well as in consideration of experience and educational qualifications.



Leveraging advanced satellite technologies, the Foundation will produce high-resolution habitat maps (complemented with underwater surveys) to document and analyze four major reef components: 1) primary biotic communities that make up the reef community, 2) ecological interactions that drive dynamics within and among these groups, 3) habitat and environmental influences that directly affect the function of healthy reefs, and 4) external drivers of change, including human-induced impacts and climate factors.

The *Global Reef Expedition* will survey remote locations, making it possible to separate natural processes from the impact of human stressors, and determine the critical structural components and functional processes that maintain a healthy and fully functioning reef ecosystem. The Expedition will also characterize the effects of physical and chemical variables (e.g., temperature, salinity, alkalinity, wave action, and sedimentation) and differential responses to climate change. By characterizing resilience indicators across vast geographic scales, a better understanding of their importance in maintaining the structural integrity and health of reefs will be gained, and will be used to make predictions regarding the future health of coral reefs, including their capacity to adjust to climate change. The data will generate science-based tools and decision-aids that can also be used to mitigate the threats to and/or improve the resilience of these life-supporting marine ecosystems.

However, conducting effective scientific research and developing conservation tools is only one part of a comprehensive conservation program necessary to halt the degradation of reefs. The scale and urgency of the *Global Reef Expedition* is unprecedented and calls for an equally bold educational initiative. The Global Reef Education Program will make use of the potential of new learning technologies to deliver the urgent message of coral reef conservation to learners; to create awareness of the direct contributions reefs make to their lives no matter where they reside.

By utilizing the latest educational technologies, internet curriculum, social networks, blogs, and real-time streaming video, learners around the globe will participate directly in the Expedition and experience its scientific activities through virtual reality. Educators and students will directly interact with working scientists to gain personal insight into real-world applications of marine science.

A “Reef Science Resource Center” will be established as a web-based teaching asset designed to support in-classroom experiences for students around the globe. Teachers-at-Sea aboard the research vessel will work with web teams to deliver content to millions of virtual learners. Both on-board and underwater experiences will provide compelling educational access to the Expedition’s work and discoveries. Scientists’ journals and real-time broadcasts will engage learners on a daily basis, motivating them to track the scientific processes, progress, and results, which will lead to understanding vital coral reef ecosystems.

After each research operation, scientists will deliver their results to learners, demonstrating the value and impact of scientific inquiry, inspiring and motivating youth to become future scientists and better informed citizen decision-makers. The *Global Reef Expedition* has both the ability and commitment to deliver cutting-edge applied research and motivational, hands-on learning dedicated to improving the health and future of global coral reef ecosystems.

THE *GLOBAL REEF EXPEDITION* WILL EXPLORE REMOTE CORAL REEF ECOSYSTEMS AND COMPARE THEM ACROSS GRADIENTS OF BIOLOGICAL DIVERSITY, PHYSICAL AND OCEANOGRAPHIC PARAMETERS, AND ANTHROPOGENIC (HUMAN-INDUCED) STRESSORS. WORLD-RENOWNED CORAL REEF RESEARCHERS WILL HAVE THE OPPORTUNITY TO EXPLORE, MAP, AND CHARACTERIZE REEFS THAT HAVE NOT BEEN SUFFICIENTLY STUDIED.

The *Global Reef Expedition's* primary focus is on applied scientific research. The Foundation's Chief Scientist, Dr. Andrew Bruckner, with the assistance of scientific advisors (see Appendix 1 for names and affiliations), has designed a research plan that will enable world-renowned coral reef scientists to explore, map, and characterize reefs where insufficient scientific knowledge exists. This work will provide information and tools needed to develop regional and global conservation measures to combat the most serious threats impacting these ecosystems. As of February 2011, twenty countries have signed Letters of Engagement with the Living Oceans Foundation, inviting the Foundation to collaborate with their local scientists on specific research programs. The *Global Reef Expedition* will begin in 2011 with research projects throughout the Caribbean Sea. In 2012, the *Golden Shadow* will transit the Panama Canal to begin work in the Eastern Pacific Ocean.

A secondary, but vital, goal of the *Global Reef Expedition* is to produce high-quality, world-class educational and outreach programs. The education plan will evolve in collaboration with leading marine educators and educational organizations.

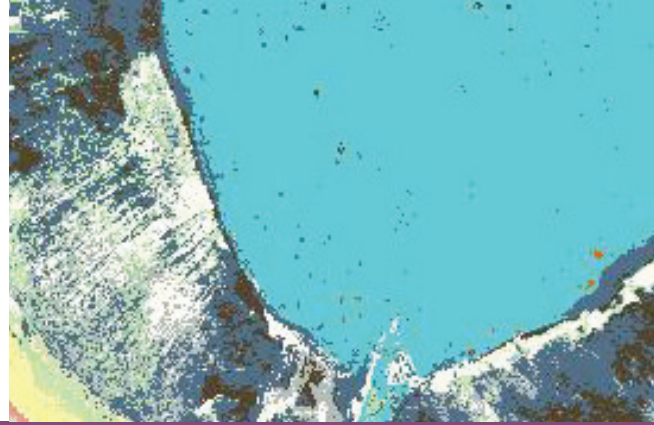


Establishing a systematic and credible media communications plan is critical to the overall success of the Expedition to ensure that the scientific results of the Expedition gain international attention. The Foundation will work closely with host governments and major regional, non-governmental environmental organizations to build public interest and support for the *Global Reef Expedition* and its findings.

Film and other documentation of the *Global Reef Expedition* will be a critical asset for the educational outreach program. Research activities will be systematically recorded in order to document progress during the entire Expedition. In addition, a major media partner will be engaged to create a full-length documentary at the end of the project. These multi-media materials, along with printed and web-based educational programs, will ensure that the research methodology and results will be important tools in continuing marine studies and coral reef preservation, as well as raising public awareness and recognizing the urgent need for coral reef conservation.

All research will encompass the *Science Without Borders*[®] program through collaborative partnerships between the Expedition's core scientists, government agencies, academic institutions, and local scientists and resource managers.

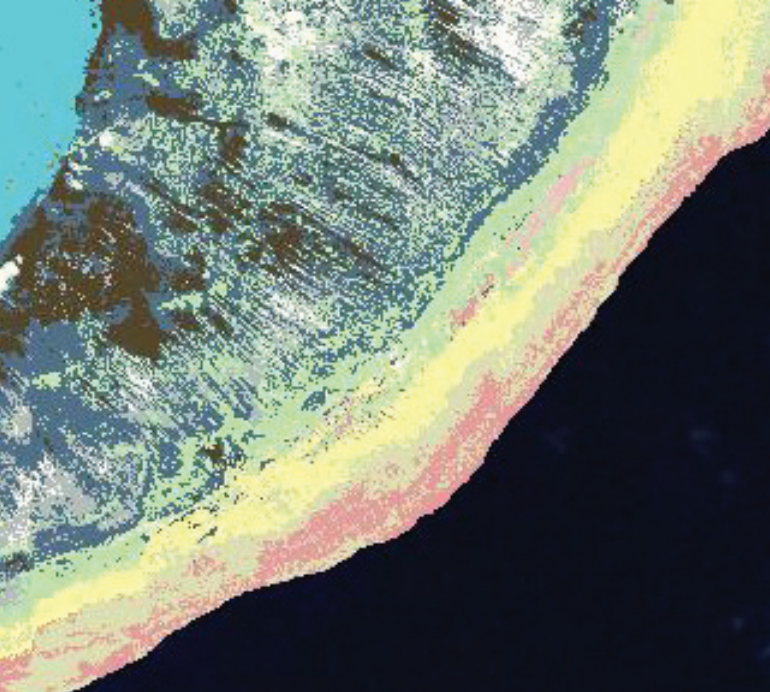




THE *GLOBAL REEF EXPEDITION* SCIENTIFIC RESEARCH PLAN IS DIFFERENTIATED FROM PREVIOUS CORAL REEF STUDIES IN THAT AN INTEGRATED, SYSTEMATIC, SCIENTIFIC RESEARCH APPROACH WILL BE EMPLOYED. BY EXPANDING UPON THE EXISTING BODY OF SCIENTIFIC KNOWLEDGE, THE EXPEDITION WILL FILL CRITICAL GAPS IN OUR UNDERSTANDING OF HOW REEFS FUNCTION AND RESPOND TO DISTURBANCE.

THE RESEARCH GOALS OF THE *GLOBAL REEF EXPEDITION* ARE TO:

- Document baseline spatial characteristics of remote coral reefs and associated habitats,
- Characterize the functional communities of coral reef ecosystems around the globe,
- Increase scientific understanding of fundamental processes controlling the structure and function of coral reef ecosystems in the context of linkages and interactions at a “landscape” scale,
- Vastly improve understanding of the current status of global coral reef health and ecological integrity of reef ecosystems,
- Identify the major threats to coral reef health,
- Produce usable knowledge that can enhance coral reef health and resilience, and
- Deliver scientifically-valid management and decision-support tools, including one of the largest integrated shallow-water habitat mapping efforts to date, necessary to advance on-the-ground coral reef conservation results.



Mapping and characterization of high-priority coral reefs is of primary importance. The Foundation will fund and implement new technologies to improve the accuracy and resolution of marine habitat maps, and develop habitat classification schemes that are at the appropriate scale for local management interventions. The mapping products will provide a framework for the spatial organization of in situ research data, a mechanism to communicate results, and a starting point for spatially based management interventions.

THE *GLOBAL REEF EXPEDITION* SCIENTIFIC RESEARCH PLAN HAS FIVE PRIMARY OBJECTIVES:

- 1 Produce high-resolution habitat maps and characterize coral reef ecosystems, utilizing remote-sensing technologies, ground-truthing methods, and SCUBA surveys,
- 2 Identify primary drivers of coral reef community structure, composition and health,
- 3 Measure and assess the most important indicators of coral reef resilience,
- 4 Determine the impacts of global climate change on coral reef health and linkages with tractable human stressors, and
- 5 Produce reports of global coral reef status and trends.

THE *GLOBAL REEF EXPEDITION* HAS ESTABLISHED THE FOLLOWING OPERATING PRINCIPLES TO GUIDE ALL RESEARCH OPERATIONS THROUGHOUT THE EXPEDITION:

- Conduct management-centric, applied coral reef research,
- Seek science-based solutions focused on countering threats to coral reefs,
- Focus on success-based operations that build on Living Oceans Foundation expertise,
- Make contributions to advance the understanding and conservation of coral reef ecosystems,
- Leverage key skills of principal academic partners,
- Conduct efficient and effective data collection utilizing state-of-the-art remote sensing capabilities, and
- Apply standardized underwater survey techniques, replicated at each site, to obtain comparative data for coral reefs worldwide.





THE *GLOBAL REEF EXPEDITION* EDUCATIONAL CHALLENGE

The scale of the *Global Reef Expedition* is unprecedented and calls for an equally bold educational initiative. The Living Oceans Foundation education team will make use of new learning technologies to deliver the urgent message of coral reef conservation to learners around the globe, in order to create awareness of the direct contributions reefs make to their lives, no matter where they reside. Using all available electronic and digital media, the *Global Reef Expedition* will directly connect a world of learners to the sights, sounds, methods, and results of the international team of research scientists exploring the world's most pristine and remote coral reefs. By joining the Expedition digitally, aboard the ship and underwater, learners will be immersed in this intriguing program and will be motivated to work on the associated web-based educational activities to bring the message home to schools, teachers, parents, and citizens around the world. The need for education is simple: reefs affect your livelihood and health and you need to be informed and involved in their conservation. Working with a consortium of marine science educational organizations, media companies, regional governments, schools, teachers, and academic institutions, the *Global Reef Expedition* will transform its research assets into usable and mind-changing educational experiences. By using the *Global Reef Expedition* as a potent platform, the Living Oceans Foundation will deliver engaging science that will open minds. Learners will be guided by an experience of curiosity and discovery leading to a commitment of responsible action to conserve coral reefs. The need is urgent, the educational assets are available, and the technology is ready to truly make a difference in marine conservation on a global scale.



FOR FIVE YEARS, THE LIVING OCEANS FOUNDATION'S *GLOBAL REEF EXPEDITION* WILL EXPLORE, SURVEY, AND DOCUMENT MANY OF THE WORLD'S MOST REMOTE AND PRISTINE CORAL REEFS. THE EXPEDITION WILL GENERATE A MASSIVE QUANTITY OF SCIENTIFIC DATA, DESIGNED TO ADVANCE THE UNDERSTANDING OF REEFS AND ACTIONS THAT CAN ENHANCE CORAL REEF CONSERVATION GLOBALLY.



Appendix One

Global Reef Expedition Scientific Advisors

MOHAMED FAISAL, D.V.M., PH.D.

Lead Scientist, Board of Directors,
Living Oceans Foundation
Professor of Aquatic Animal Medicine
Michigan State University,
College of Veterinarian Medicine
S-110 Plant Biology Bldg
East Lansing, MI 48824

Dr. Faisal is a Professor of Aquatic Animal Medicine in the Department of Pathobiology and Diagnostic Investigation in the College of Veterinary Medicine at Michigan State University. Dr. Faisal also served as the former Executive Director of the Living Oceans Foundation. His primary research focus is on pathogenesis of diseases of aquatic animals, which includes the basic molecular, cellular, and immunological aspects of disease pathogenesis where knowledge is applied to develop intervention strategies for infectious diseases threatening aquatic animals, including fish, shellfish, and coral organisms.



ANDREW BRUCKNER, PH.D.

Chief Scientist, Living Oceans Foundation
8181 Professional Place, Suite 215
Landover, MD, 20785

Andrew Bruckner is a coral reef ecologist and Chief Scientist with the Khaled bin Sultan Living Oceans Foundation. He is working to develop and implement a standardized set of research activities during the *Global Reef Expedition*. Dr. Bruckner received his M.S. in marine biology from Northeastern University, Boston, MA in 1988, and his Ph.D. from the University of Puerto Rico in 1999. His Ph.D. thesis involved a study on the occurrence, impact and treatment of black band disease, a disease that affects corals worldwide.

Since the mid-1980s, Dr. Bruckner has conducted research to understand the impacts of natural and anthropogenic disturbance on coral reefs and patterns of recovery following major disturbance events. He has focused his research on the effects of coral disease, bleaching, coral predation and hurricanes on the survival of important reef-building corals, and how the prevalence and impacts of these stressors vary across gradients of human activity, combining field and laboratory studies. His most recent appointments include working as a coral reef ecologist for 12 years at the National Oceanic and Atmospheric Administration and as the Director of Hofstra University Marine Lab in Jamaica in the early 1990s.

ABDULAZIZ ABUZINADA, PH.D.

Board Member, Living Oceans Foundation
Former Secretary General, National Commission for Wildlife Conservation and Development
P.O. Box 69428
Riyadh 11547, Saudi Arabia

Professor Abuzinada earned his Bachelor's of Science in Biology from the Kingdom of Saudi Arabia (KSA) University, his Master's of Science in Plant Pathology and Microbiology from the University of Minnesota, and his Ph.D. in Ecology from Durham University, UK. He is currently on the Board of Directors for the Irrigation and Drainage Commission within the Ministry of Agriculture and Water, and was formerly the Secretary General of the Saudi Wildlife Commission (SWC). He is also the Head of Board of Directors of the Training Centre for Conservation of Natural Resources. Prior to these appointments, he previously taught botany at Riyadh University, KSA. Dr. Abuzinada has been awarded a number of research grants and has served as a member of many environmental and academic committees in the KSA. He has been heavily involved in all aspects of environmental awareness and management in the KSA.



An underwater photograph showing a diver in the lower right, surrounded by numerous small, light-colored fish swimming in clear blue water. The diver is wearing a blue tank and a mask. The background is a deep blue, suggesting a deep-sea environment.

SYLVIA EARLE, PH.D.

Explorer-in-Residence, National Geographic
President, Mission Blue Foundation
12812 Skyline Boulevard
Oakland, CA 94619

Sylvia Earle is an oceanographer, explorer, author, and lecturer with vast experience as a field research scientist. Dr. Earle currently serves as Explorer-in-Residence for National Geographic. She also serves on the board of directors for numerous corporate and nonprofit organizations, including the Aspen Institute, the Conservation Fund, American Rivers, Mote Marine Laboratory, Duke University Marine Laboratory, Rutgers Institute for Marine Science, the Woods Hole Oceanographic Institution, National Marine Sanctuary Foundation, and Ocean Conservancy. Former Chief Scientist of NOAA, Earle is founder of the Mission Blue Foundation and Chair of the Advisory Council for the Harte Research Institute for Gulf of Mexico Studies. She has a B.S. from Florida State University, an M.S. and a Ph.D. from Duke University, and 15 honorary degrees. She has authored more than 150 scientific, technical, and popular publications, lectured in more than 60 countries, and appeared in hundreds of television productions.

Earle is the author of many books on the ocean and has led more than 60 expeditions and logged more than 6,000 hours underwater, including leading the first team of women aquanauts during the Tektite Project in 1970 and setting a record for solo diving to a depth of 1,000 meters (3,300 feet). Her research concerns marine ecosystems with special reference to exploration and the development and use of new technologies for access and effective operations in the deep sea and other remote environments. Dr. Earle has been nicknamed “Her Deepness” because of her passion for the ocean and for the example she has set in the scientific world.

SHAWN MCLAUGHLIN, PH.D.

Board Member and Secretary, Living Oceans Foundation
Research Scientist, National Oceanic & Atmospheric
Administration, Oxford Laboratory
904 South Morris Street
Oxford, MD 21654

Shawn McLaughlin is a research microbiologist with the National Oceanic and Atmospheric Administration (NOAA). She is working to assess the impacts of environmental stress on aquatic animal health. Dr. McLaughlin received an M.S. degree in Microbiology from the University of Maryland in 1991 and a Ph.D. in Marine Biology from Abo Akademi University in 2000. Her dissertation elucidated the pathobiology of an emerging pathogen in softshell clams. Since the mid-1980's, her research has focused on the mechanisms of disease in ecologically and economically-valuable invertebrate species. Dr. McLaughlin's appointments at NOAA include 12 years as a fishery biologist and 8 years as a microbiologist. She also serves as Curator, International Registry of Coral Pathology. Currently, Dr. McLaughlin leads the benthic component of NOAA's Cooperative Oxford Laboratory's integrated biotic ecosystem assessment in Chesapeake Bay.

JOHN MCMANUS, PH.D.

Professor, Marine Biology and Fisheries
Director, National Center for Caribbean Coral Reef
Research
Rosenstiel School of Marine & Atmospheric Sciences
University of Miami
4600 Rickenbacker Causeway
Miami, FL 33149

Dr. McManus is a Professor in Marine Biology and Fisheries at the University of Miami, and is also the Director for the National Center for Atlantic and Caribbean Reef Research (NCORE). He earned his Bachelor's of Art in Biology and Master's of Art in Zoology from the University of Connecticut and his Ph.D. in Biological Oceanography from the University of Rhode Island. Dr. McManus has been awarded numerous appointments on coral reef-related committees around the world. After serving as a U.S. Army Lieutenant in the 1970s, Dr. McManus worked as a photographer, biology instructor, marine researcher, and aquatic consultant. He was also the On-Site Scientist for the USAID Fish Stock Assessment Collaborative Research Support Program (FSA-CRSP), where he conducted research for the development of new methods to analyze, model, and manage tropical multispecies fisheries, including field, statistical, and remote sensing methods. Prior to his most recent position at the University of Miami, he was a Senior Scientist for the International Center for Living Aquatic Resources Management (ICLARM), leading various programs on coral reef conservation and management.

Professor, School of Biological Sciences
Laureate Fellow, ARC Centre of Excellence for Coral Reef
Studies
University of Queensland
St Lucia Campus
Brisbane Qld 4072, AU

Professor Peter Mumby earned his doctorate degree from the University of Sheffield, UK, in 1997 and has held prestigious fellowships in the UK since then. Prof. Mumby was awarded a 2010 Pew Fellowship in marine conservation and is conducting research at the University of Queensland, Australia as a prestigious Laureate Fellow, funded by the Australian Research Council. His work as a marine ecologist primarily focuses on tropical coastal ecosystems, and his field work spans the Caribbean and Pacific with long-term research interests in Belize, the Bahamas and Palau. Mumby's research is targeted to management questions on coral reefs and has organized local stakeholder meetings to share his group's research. He has developed advanced remote sensing techniques and geographic information systems in order to map benthic habitats and to supplement his field analyses. Prof. Mumby has also been involved with designing marine reserves in Belize through the development of remote sensing methods that provide ecologically-relevant data on tropical coastal environments. His research goals are to provide the large-scale ecology needed to interpret maps of reef habitats and use this information for resource planning, by studying the connectivity of fishes among mangroves, seagrass beds and coral reefs. Additionally, he is developing new methods to quantify the beta diversity of ecosystems, acquiring unique insight into the processes of structuring systems at a variety of scales, as well as developing simulation models of individual reef habitats. Outcomes of these models have shed new light on the sensitivity of reefs to climate change and resource exploitation and have even led to a change in fisheries policy in Belize.



Professor, Oceanographic Center
National Coral Reef Institute
NOVA Southeastern University
8000 N Ocean Drive
Dania, FL 33004

Dr. Purkis is an Assistant Professor at Nova Southeastern University Oceanographic Center. He received his B.Sc. degree in oceanography and marine biology from Southampton University, Southampton, U.K., a M.Sc. degree in geology, and a Ph.D. from the Vrije Universiteit Amsterdam, The Netherlands. He lectures at the graduate level at both EU and US universities, and is involved in local capacity building initiatives to develop expertise in the environmental agencies of Abu Dhabi and Qatar. Dr. Purkis is renowned for work on the reef-scale monitoring of coral habitats using remote sensing technologies. His expertise stretches from air- and space-borne optical instruments to vessel-mounted acoustic tools and bathymetric LiDAR. His work concentrates on using technology to resolve seabed architecture of modern and ancient carbonate landscapes, with attention to the detection of change through time. This research is relevant to modeling the degradation of marine ecosystems and the development of management plans to promote sustainability. His work stretches from field monitoring to software development and mathematical simulation.

Dr. Purkis has conducted work in the U.S.A., Egypt, Saudi Arabia, Qatar, U.A.E., Indonesia, Honduras, Malaysia, Madagascar, the Mariana Islands, Chagos, and throughout the Caribbean. Of particular focus has been the status and monitoring of seabed habitat in the Red Sea and Arabian Gulf with multiple active projects in recent years. Well-versed in state-of-the-art technological solutions for seabed mapping, his expertise is relevant to a broad spectrum of marine applications. Dr. Purkis led the habitat mapping efforts off the Red Sea coast of Saudi Arabia in 2007, 2008 and 2009, working with Gwilym Rowlands on ground-truthing and habitat characterization. During the 2009 Expedition, he employed a new acoustic sediment profiler to begin characterization of the underlying reef structure and physical processes controlling the formation of these reefs.

Associate Professor, Oceanographic Center
National Coral Reef Institute
NOVA Southeastern University
8000 N Ocean Drive
Dania, FL 33004

Dr. Riegl is the Associate Director of the National Coral Reef Institute (NCRI) and a professor at Nova Southeastern University in Fort Lauderdale, Florida. He also holds adjunct appointments at the University of Miami and the University of Graz in Austria. He has a M.Sc. from University of Vienna, Austria and a Ph.D. from the University of Cape Town, South Africa. His research centers on coral reefs and other tropical benthic biota, such as seagrass and algae. He is a hybrid earth/life scientist with an interest in coral reef biology and geology. Among his other areas of expertise are mapping reefs and the assessment and monitoring of reef quality. His research and publications have involved the paleontology, sedimentology, spatial dynamics, ecology, taxonomy and conservation biology of coral reefs and associated organisms. He is also active in hydrographic survey, particularly sonar-based seafloor discrimination, which he integrates with optical remote-sensing to provide high-resolution maps of the seafloor.

His research has taken place in the Red Sea, Arabian Gulf, Indian Ocean, South Pacific, Eastern Pacific, tropical Atlantic and Caribbean. His career in coral reef research spans nearly two decades and over 100 scientific and popular publications. In the Red Sea, Dr. Riegl has been studying the persistence of corals in high-disturbance regimes and under global climate change. On a broad scale, he is looking at the spatial distribution of corals in the landscape and the size/frequency distribution of their patches. Because this coarse scale does not provide details required to model coral communities, he is also using photo-transects to obtain finer-scale information on the presence and absence of different taxa, their size frequency distribution, and interactions between species.



THOMAS SPENCER, PH.D.

Senior Lecturer, Cambridge Coastal Research Unit
Cambridge Coastal Research Unit
Department of Geography
University of Cambridge
Downing Place, Cambridge CB2 3EN
United Kingdom

Dr. Spencer has been a Senior Lecturer in the Department of Geography at the University of Cambridge, England, for over 30 years and is the Director of the Cambridge Coastal Research Unit. He earned a Ph.D. in Geography from the University of Cambridge. Dr. Spencer's research interests include tropical coasts: geomorphology of raised coral reefs and implications for ocean geophysics, sea level histories, 'biogeomorphology' of tropical coasts, global environmental change in the ocean basins; temperate coasts: hydrodynamics, sedimentation and ecological processes in natural and re-created tidal wetlands, estuarine hydro- and morpho-dynamics, coastal zone management with particular reference to global environmental change. He has vast international scientific research experience in the Caribbean, Pacific Ocean, Austral Islands, Niue, NW Tuamotu Archipelago, Society Islands, Indian Ocean, and E. Africa. Dr. Spencer has served on a number of working committees, boards and panels in the UK and internationally, and earned the Murchison Award, Royal Geographical Society 2004 'in recognition of a body of publications on coastal geomorphology'.



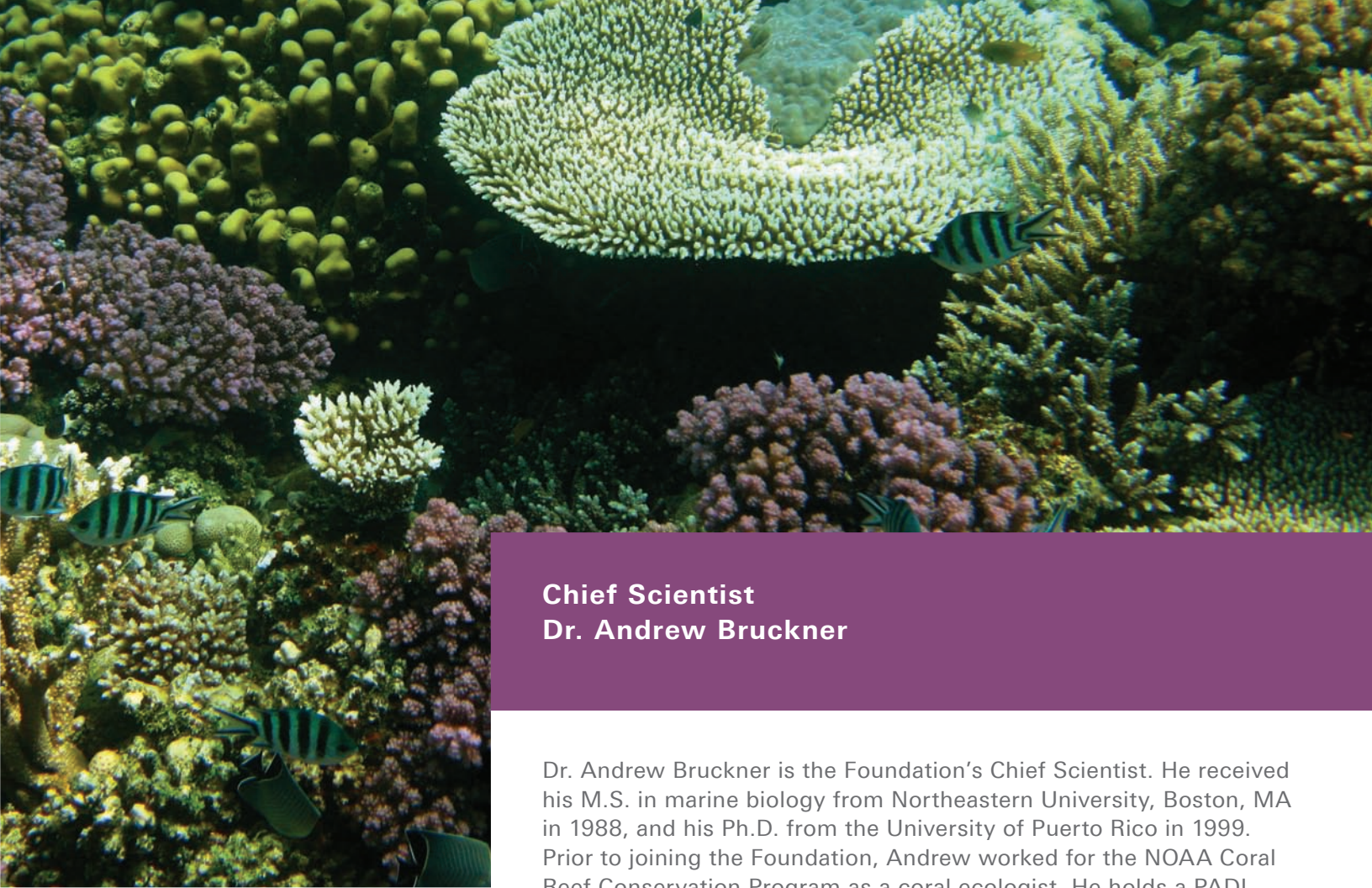
Appendix Two



Global Reef Expedition Staff Members

Executive Director **Captain Philip G. Renaud, USN (Ret)**

Captain Renaud's career in oceanography began at the Naval Academy where he earned a Bachelor of Science degree in Oceanography and his commission as a Naval Officer in 1979. His distinguished 25-year naval career took him to all corners of the earth. CAPT Renaud was the battle group oceanographer and Officer of the Deck aboard the nuclear powered aircraft carrier, USS Theodore Roosevelt, during Operation Desert Storm. He also served as the lead oceanographer for the Commander, Second Fleet, aboard the Flag Ship USS Mount Whitney and his naval career culminated as the Commanding Officer of the Naval Oceanographic Office where he directed over 1000 oceanographers, a fleet of seven oceanographic survey ships, and the Department of Defense's largest scientific super-computer center. Captain Renaud has earned graduate degrees in Oceanography, Meteorology, Strategic Studies, and an MBA in Technology Management. Since retiring from the Navy in May, 2004, Phil Renaud has been the Executive Director of the Khaled bin Sultan Living Oceans Foundation. At the helm of the Living Oceans Foundation, he has designed and led major research expeditions in the Indian Ocean, Red Sea, and Caribbean Sea. As an accomplished SCUBA diver, he is the Foundation's Diving Safety Officer and PADI Open Water Scuba Instructor. Appointed by the Secretary of Commerce, CAPT Renaud has also served as a member of the Marine Protected Areas Federal Advisory Committee. CAPT Renaud is now focused on leading the Foundation's most ambitious program, the *Global Reef Expedition*; a five-year circumnavigation of the globe aboard the Motor Yacht *Golden Shadow* to survey remote coral reef ecosystems for advancement of conservation initiatives.



Chief Scientist Dr. Andrew Bruckner

Dr. Andrew Bruckner is the Foundation's Chief Scientist. He received his M.S. in marine biology from Northeastern University, Boston, MA in 1988, and his Ph.D. from the University of Puerto Rico in 1999. Prior to joining the Foundation, Andrew worked for the NOAA Coral Reef Conservation Program as a coral ecologist. He holds a PADI advanced diver certification and was the co-lead person at NOAA's Coral Disease and Health Consortium. Andrew has numerous peer-reviewed publications, and has been the recipient of several grants and awards. He has worked closely with resource managers and government agencies in the U.S. and internationally in developing conservation, management and restoration actions for coral reefs through legislation, international (CITES) regulations, development of sustainable management guidelines, and on-the-ground monitoring, research and restoration activities. Dr. Bruckner received a bronze medal from the National Oceanic Atmospheric Administration (NOAA) for his work on elkhorn coral (*Acropora palmata*) and staghorn coral (*Acropora cervicornis*) that contributed to the listing of these species on the U.S. Endangered Species Act. He serves as a Councilor of the International Society for Reef Studies, and is a Science Advisor to SCORE, a consortium of over 50 public aquaria and zoos in the United States and Europe.





**Marine Science Geographic
Information System (GIS) Analyst
Amanda Williams**

Amanda earned her Master's Degree in Marine Science with a concentration in Marine Policy at the University of North Carolina, Wilmington and a Bachelor's of Science Degree in Geographical Sciences at James Madison University, VA. Amanda conducted her Master's research at Boracay Island, Philippines, investigating land use change with satellite imagery and mapped the geographic distribution of coral reefs utilizing SCUBA diving, GPS and video transect collection from 2006-2008. Her work at the Foundation entails synthesizing extensive coral reef data sets and developing GIS tools that will facilitate coral reef management and conservation, managing the video library, and conducting benthic point-intercept surveys during expeditions.

**Executive Assistant
Melinda Harrison**

Melinda Harrison, the Executive Assistant, has been with the Foundation since it moved to Landover, MD in 2004. She received a Bachelor's of Art in Liberal Arts, followed by a Master's Degree in Education. She taught middle school in New York, Paris, Chicago and Frankfurt, Germany. Having spent more than 20 years living in Asia and Europe, Melinda has brought her international experience and cultural awareness to the Foundation, where *Science Without Borders*[®] is our overarching theme.



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