

Khaled Bin Sultan

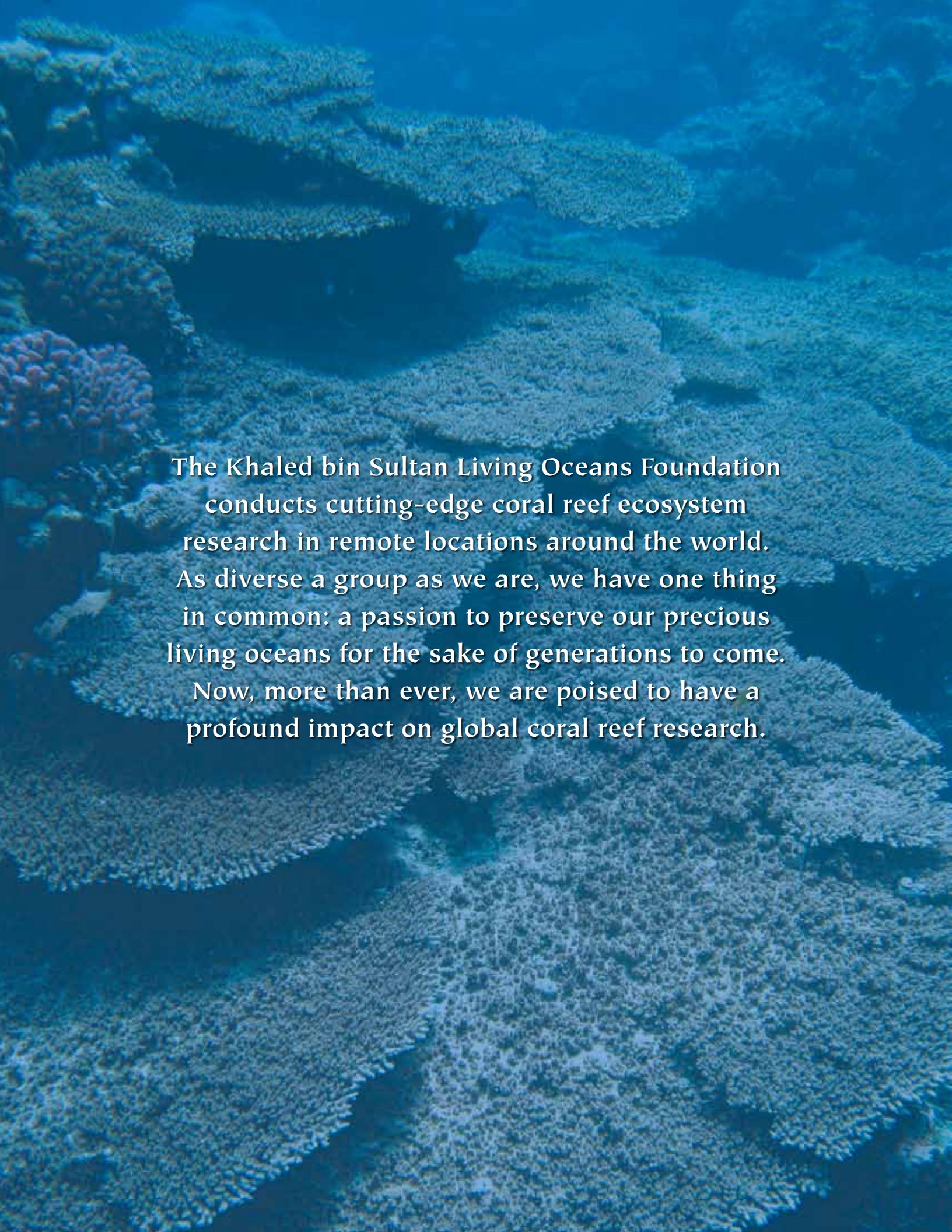
Living Oceans Foundation



PEOPLE. PASSION. PROGRESS.



2009 Annual Report



The Khaled bin Sultan Living Oceans Foundation conducts cutting-edge coral reef ecosystem research in remote locations around the world. As diverse a group as we are, we have one thing in common: a passion to preserve our precious living oceans for the sake of generations to come. Now, more than ever, we are poised to have a profound impact on global coral reef research.

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“We do not want the priceless treasure of the oceans to be lost to future generations. We will welcome all who can help us.”

His Royal Highness General Khaled bin Sultan Founder, Living Oceans Foundation

A destiny fulfilled

“As a young boy in Riyadh, I was surprised to find the fossilized remains of sea creatures. I realized then that much of the flat, endless desert of Arabia was in fact an ancient seabed.”

A boy’s discovery led to a lifelong passion for our oceans and the life they sustain. Prince Khaled established the Living Oceans Foundation devoted to the mission of ocean conservation and restoration.

What drives his passion

“I’m dedicated to preserving and protecting the fragile balance of the seas, not only for my children, but also for future generations throughout the world.”

Prince Khaled has personally witnessed the rapid deterioration of the world’s coral reefs due to numerous anthropogenic causes and human impacts.

Knowing that healthy reefs are a crucial measure of the vitality of the earth itself, he feels fortunate to be able to support leading scientists in their efforts to preserve marine environments, create detailed habitat maps from satellite data, survey and characterize the condition of reef ecosystems, and measure various indicators of reef resilience.

“We have accomplished much. But we cannot stop here—there is much more that must be done to guarantee the integrity of our oceans.”

Message from the Executive Director

The theme for our 2009 annual report is “People, Passion, Progress.” That slogan truly captures the essence of the Khaled bin Sultan Living Oceans Foundation. Given our scientific nature, I converted that slogan into an equation for success: People + Passion = Progress. It’s an equation that works well for us. We have a small, dedicated, passionate staff at the Living Oceans Foundation headquarters, but the success of our operations is vastly increased through our large network of affiliates. Our extended team of scientists provides resources, capabilities, and capacity, which add great value to our mission.

The operational highlight of 2009 was our successful research expedition to the Farasan Banks: a rich coral reef ecosystem in the Red Sea, offshore of the Saudi Arabian coast. *Science Without Borders*® was embodied by this expedition. We mobilized coral reef scientists from Saudi Arabia, Australia, USA, UK, Austria, and Egypt to work in unison aboard the *M/Y Golden Shadow* research ship towards the common goal of mapping and characterizing this remote reef system. The expedition marked the conclusion of our rewarding four-year research program in the Red Sea and our hope is that the results of our work will have a positive influence on the conservation policies of tomorrow. It has been said that when one door closes, another one opens. With that perspective, the conclusion of our Red Sea program heralds a new phase of operations for the Living Oceans Foundation—the *Global Reef Expedition: Science Without Borders*® program. Over the coming years, we will circumnavigate the globe aboard the *M/Y Golden Shadow* on an ambitious scientific expedition to study coral reef resilience and assist many countries with their coral reef conservation efforts.

People, Passion, and Progress were in abundance during our inaugural Fellowship Development program held at the Glovers Reef Research Station in Belize. Our Fellowship program gives competitive graduate students and post-grads the opportunity to reach their goal of becoming a marine scientist. It also helps us achieve our operational goals by increasing the Foundation’s research capabilities. Each Fellow’s research topic is directly aligned with our operational objectives. It’s a win-win situation. We are fortunate to have an amazing group of aspiring marine scientists enrolled in our Fellowship program.

Delve into this annual report to examine how we are contributing to the critical mission of conserving and restoring health to our vital oceans.



CAPT Philip G. Renaud, USN (ret)

2009 Projects and Operations

EXPEDITIONS

Farasan Banks Habitat Mapping and Biodiversity Assessment

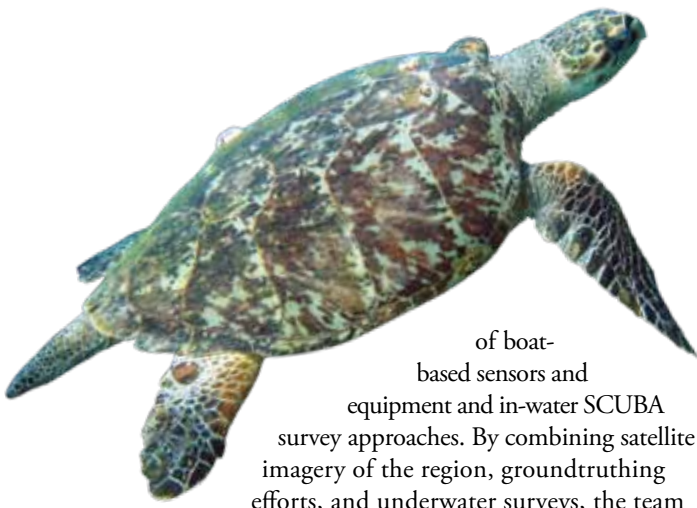
In April, the Living Oceans Foundation completed the fourth expedition of our multi-year collaborative Saudi Arabian Red Sea research program. This expedition focused on the Farasan Banks, an area visited by Jacques Cousteau in the 1950s. We collected data necessary for baseline characterization and mapping of shallow marine habitats of the Farasan Banks. We also conducted a detailed assessment of the structure, composition and condition of shallow coral reef ecosystems. This project built upon the first three expeditions of our Red Sea Research program (2006-2008) during which we surveyed the Farasan Islands, the Ra's Qisbah region, Yanbu Barrier Reef, and Al Wajh Bank area.

The Farasan Banks region begins approximately 230 km south of Jeddah, and extends south to the Farasan Islands. Unlike other locations in the Red Sea where fringing reefs predominate relatively close to the coastline, the Farasan Banks is characterized by a shallow platform that extends from the coast seaward up to 100 km offshore. It covers two degrees of latitude, and includes an estimated 6 million acres of submerged reefs, small islands, shoals and reef platforms. In addition to the seaward extension of the continental shelf, there are extensive groups of isolated reefs, pinnacles, and atoll-like formations perforated by deep-water channels. The offshore and mid-shelf reefs typically had steep walls plummeting from the reef flat to depths of more than 60 m. An overhang in the reef wall was usually present at approximately 15 m depth, with a recessed cave penetrating 2-4 m into the reef platform. The reef often enclosed deep-water lagoonal environments with seagrass beds, algal flats, and protected (leeward) coral reef environments.

Further inshore, mangroves and seagrass beds fringed the coastline. Reefs in these areas typically had a more gradual slope, with reef growth terminating in a sand flat at 15-30 m depth.

Many of the reef species occupying the Farasan Banks are common to reefs in the Indian and Pacific Oceans, although the diversity of animals and plants is lower in the Farasan Banks region. There are also species unique to the area, known as endemics, because of the relative isolation of the Red Sea from the Indian Ocean and due to warmer waters and higher salinity. There are approximately 170 known species of corals in the area, including extensive thickets of the branching staghorn-type corals (*Acropora*) intermixed with smaller bushy forms in the genera *Pocillopora*, *Stylophora* and *Seriatopora*. Other areas were dominated by rounded massive corals in the genera *Goniastrea*, *Echinopora*, *Favia*, and *Favites*, large plating corals, and the principal reef-building coral, *Porites*. This area is also known for colorful, flower-like soft corals, such as *Dendronephthya* and pulsating *Xenia* colonies, as well as large populations of black corals and sea fans. Highlights of the expedition included discoveries of a reef dominated by unusually large (10-15 m diameter) colonies of lobed brain coral (*Lobophyllia*), a mono-specific stand of bubble coral (*Plerogyra*) that extended over 200 m in water depths from 45 to 15 m, and identification of a new species of branching coral. There were also several hundred varieties of reef fishes, some which feed on algae (parrotfishes, surgeonfishes, and damselfishes), coral and sponge eaters (butterflyfishes and angelfishes), and large predators like grouper, snapper, and sharks. Besides many of the small and colorful reef invertebrates, the team documented several species of turtles, whale sharks, whales, dugong, and dolphins.

The science team focused on three key objectives: 1) collecting field data to map and characterize the different habitats types; 2) conducting underwater surveys to assess the composition and structure of corals and other invertebrates, algae, and seagrasses, as well as commercially and ecologically important reef fishes; and 3) an examination of the health and resilience of the reef systems. Surveys were completed on shallow and mid-depth reefs, comparing outer, offshore reefs with nearshore and lagoonal reefs by employing a variety



of boat-based sensors and equipment and in-water SCUBA survey approaches. By combining satellite imagery of the region, groundtruthing efforts, and underwater surveys, the team identified areas of unusual biodiversity and health, some degraded areas, some of the major threats affecting the region, as well as sites undergoing recovery following large scale disturbances.

A dedicated remote sensing team is completing the classification of marine habitats and development of detailed habitat maps for the Farasan Banks using high spatial resolution (2.4 m pixel) QuickBird multispectral satellite imagery covering 12,000 km². Groundtruthing efforts consisted of drop camera assessments, continuous bathymetry soundings, sediment profiling, examination of antecedent reef topography, and SCUBA characterization of reef biotopes. Surveys included over two million bathymetric soundings covering a track of 402 km, 100 km of acoustic sub-bottom stratigraphy survey (sediment profiling), and 605 drop cameras assessments. Ten different habitat types were identified in the Farasan Banks including different coral reef habitats, reef flat communities, algal flats, grassbeds, mangroves, sandflats, and rubble fields. Through acoustic sediment profiling, the substrate beneath sandy lagoons within the Farasan Banks system was examined to identify buried reef structures. The instrument permitted the team

to look back in time to a period when the buried reefs were thriving on the seafloor. The deeper the reefs lay buried, the longer ago they lived. In the Farasan Banks, structures that lie as much as 100 m below the seabed were identified. The coral reefs which created these buried structures were drowned and subsequently buried by sediments shortly after the last ice age (~12,000 years ago).

Coral reef assessments involving quantitative SCUBA surveys, video documentation and photo transects were conducted from just below the water's surface to about 20 m depth, with supplementary observations and photographs taken to 30 m depth. SCUBA assessments typically involved paired dives conducted on the leeward and windward sides of representative emergent islands and shallow, submerged reef platforms. Most sites were examined during a single dive, however, a few sites were surveyed on multiple days and at night to better understand and characterize impacts from *Acanthaster planci* (crown of thorns, COTs) sea star outbreaks.

Coral reef habitats varied considerably throughout the region. Most striking were the differences between remote offshore locations (including exposed, highly diverse offshore reefs with >70% live coral), areas with unusually low coral cover (<5%), and turbid nearshore locations with high coral cover. Some areas exhibited high structural complexity and low amounts of recent mortality, while others were significantly degraded, low relief sites with few mature corals. Some areas were also undergoing rapid changes (loss of corals) due to outbreaks of COTs sea star predators. Most of the disturbed sites were showing encouraging signs of recovery. Notably degraded, low coral cover sites had unprecedented numbers of new recruits (juvenile corals, often 100





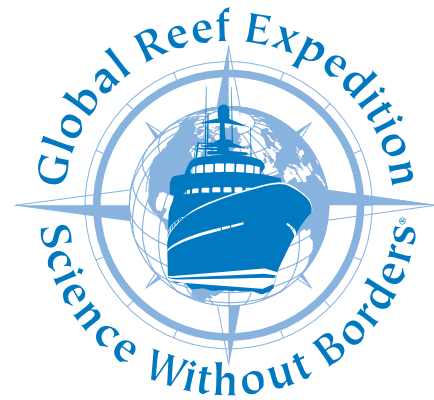
or more per square meter), high cover of coralline algae, little macroalgae, and an abundance of herbivorous reef fish populations: all signs of high resilience. The remote nature of the Farasan Banks naturally minimizes human impacts other than fishing and the unique environmental setting (deep water channels, high currents, steep reef slope, and high ecological integrity of reef assemblages) also appears to enhance the potential for recovery and resilience to future global stressors.

The research conducted in the Farasan Banks fills a major gap in the understanding of Saudi Arabian coral reefs and it provides new information on the composition, status, threats, and resilience of these ecosystems, including the degree of ongoing mortality and patterns of recovery. Knowledge of the reefs and associated habitats, including their location, size, and condition provides the baseline information needed to help manage and protect these reefs. This information and the products and tools developed during the Farasan Banks mission can help determine how likely recovery is to occur and how long it may take, whether additional interventions by man are necessary to increase chances of survival and what the specific objectives are for management and conservation.

The reefs in the Farasan Banks represent an area of high global biogeographic importance because of the high levels of endemism, and the role these communities serve as important regional stepping stones for gene flow within the Red Sea. The abundance and distribution of fish, hard coral genera, and other sessile organisms in the Farasan Banks are now known to vary with latitude and distance from the mainland. The Farasan Banks forms a biogeographic boundary separating the northern and southern Red Sea fauna, with distinct species assemblages observed during our surveys of inshore and offshore sites, as well as minor latitudinal variations in species composition and abundance. The Farasan Banks are also subject to large latitudinal and seasonal extremes in temperature (up to 38°C), and above-average salinities, which would typically kill corals in other regions. The presence of flourishing coral communities in many of the locations we examined suggests local populations are adapted to temperature stress. The environmental extremes in this region are likely to be close to their physiological tolerance maxima, which may make them particularly vulnerable to climate change. Such information may aid in site selection of marine protected areas or no-take zones for purposes of biodiversity protection. The map products will also help quantify the size of habitat types, their distribution and the physical boundaries between habitats, identify potential conservation areas and/or vulnerable ecosystems, and assist managers to define procedures and select sites for monitoring.

Global Reef Expedition: Science Without Borders®

The Living Oceans Foundation, using the 67 m motor yacht *Golden Shadow* as a research platform, is developing plans to embark upon a multiyear (2011-2014) *Global Reef Expedition: Science Without Borders*® program that will explore remote coral reef ecosystems and compare these across gradients of biological diversity, physical and oceanographic parameters, and anthropogenic stressors. The Expedition will enable scientists of many nations, under our *Science Without Borders*® program, to conduct applied research on coral reefs that will provide information and tools needed to develop regional and global conservation measures to counter the most serious threats impacting these ecosystems. The research scientists will implement a standardized protocol to map, characterize, and evaluate coral reefs throughout the Western Atlantic, Pacific, and Indian Oceans, and the Red Sea. Comparative assessments of coral reefs across gradients of biodiversity, oceanographic conditions, and human pressures will be undertaken to determine their status and major threats, and identify factors that enhance their health and resilience. In addition to the creation of high resolution habitat maps, underwater surveys will include four major components: 1) an assessment of the primary biotic compartments 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 reefs; and 4) external drivers of change, including anthropogenic and climate factors. By targeting remote locations, it will be possible to separate natural processes from confounding impacts of human stressors. This can allow evaluation of relationships between community structure and natural processes that control reef functions, as well as effects of physical and chemical parameters (e.g., temperature, salinity, alkalinity, wave action, sedimentation) and differential responses to climate change. Through identification of resilience indicators, the Expedition will fill serious knowledge gaps regarding the future of coral reefs and their capacity to adjust to climate change.





“The great objective to preserve life in our oceans brings out the best talents and energy of all who are involved in our work.”

Captain Philip G. Renaud, USN (Ret) Executive Director, Living Oceans Foundation

A lifelong connection with the sea

“I loved the ocean from the moment I first set foot in the sand. But what really triggered my passion for ocean science was when I got stationed on Andros Island, Bahamas, as a Lieutenant in the Navy.”

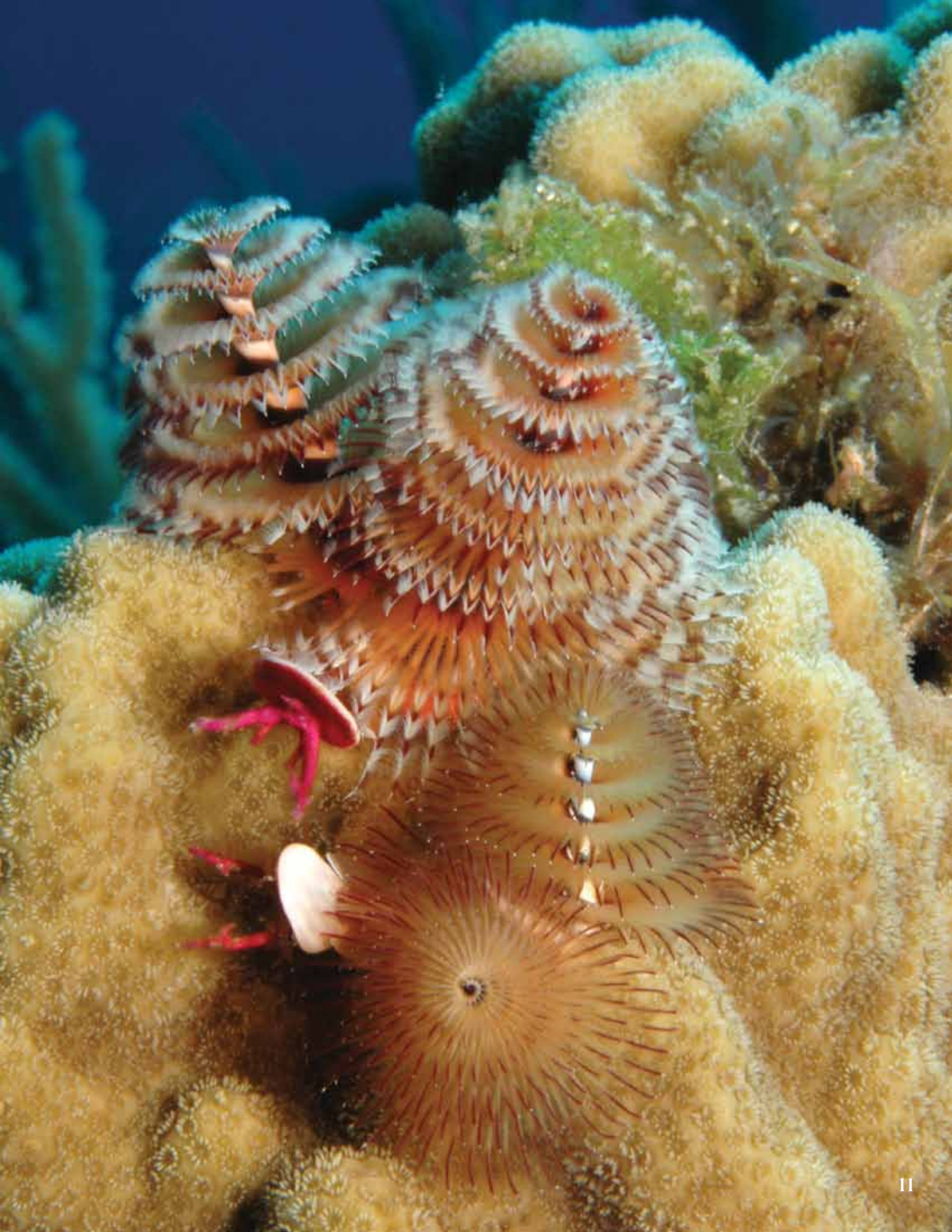
One dive along magnificent coral reefs was all it took to hook Philip Renaud into ocean conservation forever.

An urgent mission and exciting adventure

After retiring from the Navy, Captain Renaud was thrilled to begin a second career doing two things he loves: improving ocean health and diving extensively. *“Expedition diving is a great way to immerse myself with the research divers and really understand the important work they’re doing.”*

In six years under his leadership, the Foundation has conducted numerous research expeditions in remote coral reef regions, applying science to management and conservation objectives. Mapping and surveying coral reef ecosystems is a critical first step to effectively manage the resources. That’s the niche that the Living Oceans Foundation fills so well.

“I really can’t think of anything more fulfilling than taking care of the earth and ocean that sustains all life on the planet.”



RESEARCH AND CONSERVATION

University of Cheikh Anta DIOP de Dakar, Senegal

The Living Oceans Foundation continued its support for the development of the Khaled bin Sultan Living Oceans Foundation Laboratory of Aquatic Animal Health at the Université Cheikh Anta DIOP de Dakar, Senegal (“Laboratoire des Pathologies d’Animaux Aquatiques—Khaled Bin Sultan Living Oceans Foundation.”) The grant provided to the University in 2009 was used to purchase laboratory equipment, literature, and consumable supplies and to provide student fellowships to work in the laboratory. The laboratory has successfully identified various parasitic diseases to assist in the management of aquaculture in Senegal. Other scientific activities of the laboratory included collection and examination of freshwater and marine fishes, identification of parasites, and a pathological study.

Arfang Diamanka was the recipient of the Laboratory’s Ph.D. fellowship. Currently, he studies the use of *Monogenea*, a flatworm parasite that embeds in the gill and skin of fish, as biological indicators of fish health and water quality, based on the assumption that the parasite abundance is correlated to pollution levels. To complete the analysis of his data, Arfang attended training at the Institute of Sciences of the Evolution, University of Montpellier, France, and also at the Laboratory of Biodiversity and Aquatic ecosystems, Faculty of Sciences of Sfax, Tunisia. Arfang’s training has improved the capacity of the Laboratory to use molecular biology techniques and to compare hosts and parasites, and to examine the presence or lack of cryptic species.

MARINE SCIENCE KNOWLEDGE MANAGEMENT

Geographic Information Systems Data Portal



In August, an interactive Geographic Information Systems Data Portal was completed, located on the Foundation’s homepage. The GIS Data Portal was developed by Felimon Gayanilo (RSMAS, University of Miami) in collaboration with Amanda Williams (Living Oceans Foundation GIS Analyst) and Claire Knight (Living Oceans Foundation Web Developer). The purpose of the GIS Data Portal is to make the Foundation’s GIS datasets available to the public in support of *Science Without Borders*.[®] The intent for the Data Portal is to permit university students, research scientists, and local resource managers to download the data for biogeographic studies. The functionality of the GIS Data Portal includes a 2-D Google-powered map with political boundaries, satellite imagery, terrain, and relief maps. The map contains color-coded pins to identify available datasets (green pins) and interactive map viewers (yellow pins) for the Bahamas, US Virgin Islands, and the Seychelles. Users must register to download data so that the Foundation may track demand for its research. New data will be periodically published to the Portal as a result of Foundation-related research expeditions, such as the upcoming *Global Reef Expedition: Science Without Borders*[®] program.

Marine & Terrestrial Conservation GIS for Alphonse Group, Seychelles

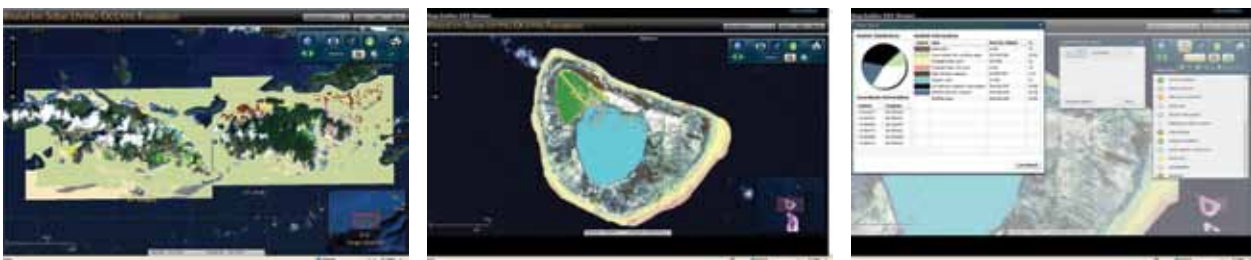
In continuation of the Foundation's long-standing partnership with the Republic of Seychelles, a Geographic Information System (GIS) is being developed in order to digitize and integrate various marine data sets collected by the Seychelles' Island Conservation Society (ICS) with the Foundation's benthic habitat maps for the Alphonse Island Group. The data encompasses the islands of Alphonse, Bijoutier, and St. François. The objective of this project is to develop a marine and terrestrial conservation GIS application to promote natural resource management of Alphonse Atoll in the Republic of Seychelles. ICS is leading efforts to conserve the terrestrial and marine habitat of Alphonse Atoll. Development of the conservation GIS

product is intended to provide ICS with a useful tool for conservation management. The Living Oceans Foundation, in collaboration with Cambridge University and the Seychelles Center for Marine Research and Technology has developed a detailed habitat map for the Alphonse Island Group resulting from the Shallow Marine Environments project. The GIS product will be completed and transferred to ICS in 2010. Additionally, the Foundation is submitting an ESRI grant in support of ICS so they may receive ArcGIS Desktop mapping software. The Foundation will continue to provide GIS support to ICS, as necessary, while this GIS product is in use.

New Seychelles GIS Viewer and USVI Viewer Upgrade

A collection of 12 habitat maps of the coral islands, reefs, and shoals of the Amirantes Archipelago (Republic of Seychelles, Western Indian Ocean), resulting from a collaborative research project with Cambridge Coastal Research Unit (CCRU), University of Cambridge, and the Seychelles Centre for Marine Research and Technology—Marine Parks Authority (SCMRT-MPA), has been “web-enabled” as an ArcGIS Server web application in partnership with Towson University's Center for GIS (CGIS, Towson, Maryland). The viewer is freely available through the GIS Data Portal located on the Foundation's homepage. The sophisticated internet map viewer integrates basic tools and functions with specialized querying tools (e.g. a unique habitat reporting tool and an enhanced

measure tool that can measure both lines and polygons in various units of length). The most innovative feature of this viewer is the habitat reporting tool. The user may draw or define an area of interest and generate a detailed report of habitat types. The report includes a pie chart depicting the percent cover of each habitat type within the defined region, a color-coded table listing of each legend area in units and percent area of each habitat type, and a table listing of each Lat/Lon corner of the polygon (or circle mid-point). The report may be saved as an Adobe PDF document. As a result of this successful collaboration, the Foundation and Towson's CGIS are in the process of upgrading the Foundation's existing US Virgin Islands web-viewer to this new and improved platform.



Video Archive Library

An historical video archive system was developed for the Foundation by award-winning filmmaker D.J. Roller (Liquid Pictures 3D) on an iMac computer located at the Foundation's headquarters. The database uses a *Final Cut Server* interface. When new video is added to the archive, key words identifying the video are entered for cataloging. The system can be searched for desired video clips by keyword, author, date, and other variables.

The Foundation has archived beautiful film clips from research expeditions conducted in Tahiti, St. Thomas, Egypt, the Mediterranean Sea, Seychelles, Red Sea, and Belize. The video archive will not only serve as an historical record of the Foundation's accomplishments, but the high-definition video may also be used to create informative films about the Foundation and its research.



“I am fortunate to spend my career working for a cause I have always deeply believed in.”

Amanda Williams

GIS Analyst, Living Oceans Foundation

A responsible citizen of the environment

For Amanda Williams, a keen awareness about global warming and human impacts on the environment came at an early age. *“In the fifth grade, I made a video about water pollution. And before there was weekly recycling pick-up, I made my family gather recyclables and take them to the recycling center.”*

Working with the Living Oceans Foundation since July, 2008, she hopes to continue realizing her passion for conserving ocean resources and helping the organization grow for many years to come.

A year of change

Seeing 2010 as a year of change, Amanda is wrapping up several big projects, such as creating a Red Sea Atlas, while also preparing for the ambitious *Global Reef Expedition: Science Without Borders*® program.

During this program, the Foundation will circumnavigate the globe over a four-year period to survey, map, and characterize coral reef ecosystems. This program will also engage local scientists with Living Oceans Foundation coral reef specialists to help various countries with their efforts to manage and conserve their ocean resources.

“Doing GIS work, coral reef research, and ocean conservation is what I had been dreaming of and working towards all my life.”



Education and Outreach

2009 Blue Vision Summit

In March, the Living Oceans Foundation co-sponsored the second Blue Vision Summit held in Washington, D.C. With two days of speakers and panels on Federal ocean action, evening ‘Celebrations of the Sea,’ and a Capitol Hill Day in which participants met with their representatives, the first ripples were made in a tidal shift of US ocean policy.

Philip Renaud, Executive Director of the Living Oceans Foundation, was one of the featured speakers on the opening night, along with Dr. Sylvia Earle, Dr. Enric Sala, Philippe Cousteau, Dr. David Guggenheim, grass-roots advocate David Helvarg, and ocean rower Roz Savage. The 2009 Summit brought together nearly 500 key leaders and activists from over 200 marine conservation organizations, aquaria, science centers, public agencies, maritime labor, ocean-dependent businesses, public health groups, coastal tribes, and others. The three key themes of the 2009 Summit were: 1) to identify solutions that are working at the local, state, and regional level and how to expand them; 2) how the marine community can develop a common voice and plan of action to address climate change impacts on the ocean and coastal environment; and 3) how to influence federal legislation in order to promote ocean governance reform. The Blue Vision Summit demonstrated that there is a strong and diverse constituency ready to work for ocean and coastal protection and restoration.



“In the spring of 2009, over 400 ocean leaders gathered in Washington, D.C. We came to demonstrate the vital role a healthy ocean can and must play if we’re to restore our economy, our security, and climate stability. We called our gathering the Blue Vision Summit.”

—Dr. Sylvia Earle

International Marine Conservation Congress

In May, the Society for Conservation Biology sponsored the 2nd International Marine Conservation Congress (IMCC) which was hosted by the Department of Environmental Science and Policy at George Mason University in Fairfax, Virginia. Dr. Andy Bruckner, Living Oceans Foundation Chief Project Scientist, led a symposia entitled *Understanding mechanisms and processes that maintain biodiversity and enhance resilience of shallow coral reef communities across global and regional scales*, which included presentations from other scientists on this topic and a discussion following each presentation. The IMCC attracted over 1,200 participants from all over the world and is believed to be the largest marine conservation conference ever held. The goal of the IMCC was to put conservation science into practice through public and media outreach and the development of science-based deliverables (e.g., policy briefs, blue ribbon position papers) that will be used to drive policy change and implementation. Major themes included global climate change, the land-sea interface, ecosystem-based management, and poverty and globalization. In addition to a contributing sponsorship of the IMCC, the Foundation also hosted a booth to publicize the upcoming *Global Reef Expedition: Science Without Borders*® program. The Foundation’s participation in the IMCC resulted in the formation of new marine science relationships and a stronger base in the Washington, D.C. area.



U.S.-Russia Aquatic Animal Health Conference

In July, the Living Oceans Foundation, the National Fish Health Research Laboratory of the USGS-Leetown Science Center (Kearneysville, WV), the United States Fish and Wildlife Service, and the United States Geological Survey jointly sponsored the Third Bi-lateral Conference on Aquatic Animal Health between the United States and Russia, held in Shepherdstown, WV. The symposium fostered collaboration between scientists in Russia and the United States on issues affecting aquatic and marine animal health. The two co-chairmen, Dr. Rocco C. Cipriano, Senior Research Microbiologist of the National Fish Health Research Laboratory in WV, and Dr. Igor S. Shchelkunov, Head of the Laboratory of Aquatic Animal Health, All Russia Research Institute for Veterinary Virology and Microbiology from Pokrov, Russia, were joined by 18 invited speakers from Russia and 25 from the USA and Canada; all experts in their respective fields and dedicated to transcending national boundaries and collaborating on the health, restoration, and protection of aquatic organisms.

Historically, the conference is an integral part of an ongoing environmental conservation treaty, initiated 34 years ago between the former Soviet Union and the USA. In 1982, the program added the study of “Fisheries and the Environment.” In 1994, an agreement provided for further cooperation between the two countries to bilaterally protect the environment and natural resources.

Crucial to the success of the Conference was Prof. Mohamed Faisal, Lead Scientist for the Khaled bin Sultan Living Oceans Foundation, Doctor of Veterinary Medicine and Zoology, and Professor of Aquatic Animal Medicine at Michigan State University; Dr. Andrew Bruckner, Chief Project Scientist at the Living Oceans Foundation; and Dr. Shawn McLaughlin, the Foundation’s Board Secretary and Research Microbiologist and Curator, International Registry of Coral Pathology at NOAA.



“People said that it was the greatest conference we ever took part in... it was interesting to watch how many different and unfamiliar people became a solidified group.”

—Natalia Chukalova,
Atlantic Research Institute of Marine Fisheries and Oceanography,
Kaliningrad, Russia.



American Fisheries Society Annual Meeting

In August, the Living Oceans Foundation's Chief Project Scientist, Dr. Andy Bruckner, participated in the symposium "Sustainable Fisheries: Multi-Level Approaches to a Global Problem" at the annual meeting of the American Fisheries Society (AFS). The main objective of the session was to gain support for an international UN conference that would draw media and policy makers' attention to key global problems affecting fisheries and identify potential institutional and governance changes that would prevent the exhaustion of capture fisheries and promote sustainability. The participants gave presentations on: 1) institutional and ecological challenges to sustainable fisheries; 2) case studies on unsustainable fisheries from different regions of the world; and 3) mechanisms to improve sustainable global fisheries. Dr. Bruckner presented a case study on Red Sea coral reef fisheries and new approaches for coral reef fisheries management that could improve the resilience and enhance the sustainability of coral reef ecosystems. Each presenter also developed a chapter for an upcoming book that will serve as a key directive for convening a UN conference on Sustainable Fisheries.

National Ocean Sciences Bowl

The Khaled bin Sultan Living Oceans Foundation was a proud co-sponsor of the 2009 National Ocean Sciences Bowl (NOSB) conducted by the Consortium for Ocean Leadership, which represents leading oceanographic institutions, universities, and aquaria. The NOSB is a nationally recognized and highly acclaimed high school academic competition that provides a forum for talented students to test their knowledge of the marine sciences including biology, chemistry, physics, and geology. Created in 1998 in honor of the International Year of the Ocean, the competition has grown to include 300 schools and over 2,000 students participating annually. The competition was held this year in Washington, D.C., giving students the opportunity to work with local scientists at the Chesapeake Bay Foundation, and visit the capitol's museums and historic sites.

OCEANS 2009 Conference

In October, the Living Oceans Foundation co-sponsored one of the country's premier ocean technology conferences and expositions, OCEANS 2009. Hosted by the Marine Technology Society (MTS), the conference took place in Biloxi, Mississippi. This year's topics of interest were coastal restoration, ocean observing systems and operational oceanography. More than 140 exhibitors participated and session topics ranged from ocean renewable energy to ocean data visualization to the role of information technology in oceanography. The Foundation's sponsorship was directed towards a special High School Outreach Program to spark the younger generation's interest in science and technology.

Fellows and Interns

Summer Intern Program

Our 2009 summer intern, Sara Bosshart, graduated from Northwestern University with a bachelor's degree in geology in May and began her masters in paleoclimatology/oceanography at the University of Edinburgh, Scotland, in fall 2009. She interned at the Living Oceans Foundation from July to September, digitizing and identifying corals in the photo transects collected during April's Farasan Banks Expedition and assisting the Chief Project Scientist, Dr. Andy Bruckner, with data transcription. Additionally, she transcribed interviews recorded during the Farasan Banks Expedition. Sara also had the opportunity to participate in two NOAA research missions on the Chesapeake Bay with Dr. Shawn McLaughlin where she helped collect and prepare clams for histological analyses. Sara's internship provided her with an introduction to coral reef ecosystems, investigations, and data preservation, which she hopes to incorporate into her future research on paleo-oceans. In 2010, Sara hopes to begin a Ph.D. program where she can continue researching past climate variations in an effort to understand how our oceans and climate may change in the future.



Fellowship Development Program

In December, the Living Oceans Foundation staff members joined with the current Ph.D. Fellows at the Glovers Reef Research Station in Belize to strengthen the Fellowship program. The location was a prime site because Ph.D. Fellow Renata Ferrari was just completing her year-long field research there. Gwilym Rowlands, Fellowship award student from the National Coral Reef Institute (NCRI), and Sarah Hamylton from Cambridge University, are finishing their degrees, while Sonia Bejarano and Renata Ferrari are just beginning their research as Living Oceans Foundation Fellows. The week provided a common link between the Fellows, which is intended to be maintained throughout their careers. The Foundation's staff members created greater bonds with the Fellows while on daily SCUBA dives to explore the reefs within the Glovers Reef Marine Reserve. During the dives, Renata demonstrated herbivory research she is conducting under Dr. Peter Mumby, University of Exeter, that will be used during the Global Reef Expedition. Each evening, everyone convened for engaging research seminars conducted by the Fellows. Gwilym and Sarah presented their remote sensing work resulting from field research on the Foundation's expeditions in the Red Sea. Sonia also presented herbivory and fish catch research that she will conduct while participating in the Global Reef Expedition. Dr. Andy Bruckner gave a presentation on the Foundation's coral reef resilience research as an integral component to the upcoming Global Reef Expedition. Phil Renaud, Amanda Williams, and Kathleen Frith (Harvard University) hosted a brain-storming session to discuss the educational component to the Global Reef Expedition from which an initial outline of capabilities and goals was completed. Kathleen's input has resulted in a pilot education study to be conducted in the Bahamas, May 2010. Overall, the week in Belize was a successful and enriching team-building experience.



Renata Ferrari Legorreta

Renata is currently investigating the effects of seaweed competition on coral growth rate and survival. The significance of this question lies in its relevance for predicting the response of coral reefs to the phase shift modern reefs are facing these days. Renata also looks at macroalgal patch dynamics in order to better understand the competition between corals and macroalgae (i.e., when do they result in coral recovery versus decline?)

A third component of her research looks at elucidating the spatial distribution of grazing exerted by parrotfish and determine how small-scale changes in substrate complexity (e.g. after cyclone strikes) lead to changes in grazing. During the *Global Reef Expedition: Science Without Borders*® program on board the *MIY Golden Shadow*, Renata will study the effects of biodiversity on herbivory and its consequences for coral reef resilience and tropical fisheries management. These four aspects of her research will be put together into simulation models of tropical ecosystems to predict the recovery of reef corals following large-scale disturbances. The data from the models will enable the adequate level of management and protection of coral reefs, building the ecosystems' resilience and allowing their maximum recovery in the shortest period possible.

“The KSLOF Fellowship has provided me with an unrivaled opportunity to realize my search for applicable scientific solutions to coral reef decline due to a seaweed phase shift on a global scale. As a Fellow, I have been greatly inspired working alongside people who know we must act now to save coral reefs.”

—Renata Ferrari Legorreta



Gwilym Rowlands

Gwilym spent much of this year producing habitat maps for the regions visited on past Red Sea Expeditions. Concurrently, he was engaged in preparing for the Farasan Banks Expedition, which was the most ambitious project of the entire Red Sea campaign. Unlike previous campaigns, satellite imagery was largely unavailable across this region and a mammoth tasking operation was, therefore, undertaken. Since the Farasan Banks Expedition, he has been processing these data into map products, thus completing the Red Sea GIS map database. Looking back to the start of his Fellowship, Gwilym is struck by the enormity of this achievement. There is gathering interest in the research community, as demonstrated by the positive media response at the American Geophysical Union Ocean Sciences Meeting showcasing the mapping approach undertaken. Gwilym is looking forward to the suite of publications that his analysis of the Red Sea dataset will yield over the coming year, building on NCRI's recent publication in *Geology*, which is the highest ranking journal of the earth sciences. One of Gwilym's highlights of the last year was the Fellowship Development Program in Belize, which provided a chance to engage with incoming and outgoing Fellows and discuss current and future research techniques.

“It is unique opportunities like this, combined with the power of the science that make being a Khaled bin Sultan Living Oceans Foundation Fellow such a rewarding experience.”

—Gwilym Rowlands

Sarah Hamylton

In 2009, Sarah completed her Ph.D., entitled “Modeling the structure and function of tropical marine landscapes,” in the Geography Department of Cambridge University, UK. This thesis brings together three case studies (two from the Seychelles, west Indian Ocean, and one from the Red Sea) to demonstrate the utility of remote sensing, spatial statistics, and landscape ecology for developing models relating functional drivers (mass and energy flows) to structural responses (the distribution of coral reef landforms and their associated communities). Overall, it provides a compelling demonstration of the range of environmental and data availability circumstances, in which models can be developed to link structure and function in shallow marine landscapes. This demonstration has been a long-term research agenda for Sarah, who, over the last ten years, has become increasingly aware of the opportunities for the effective uptake of remotely sensed data by coastal managers. In January, Sarah led a team of researchers from Cambridge Coastal Research Unit, the Seychelles Ministry of Environment, and the Seychelles Islands Foundation to carry out benthic mapping work in the lagoon of Aldabra Atoll, a World Heritage Site in the southern Seychelles.



“Aldabra is one of the few true marine wildernesses left in the world. At the various research stations around the atoll, you have to compete with sharks, coconut crabs, flightless rails, and giant turtles to keep your dinner. This must be what the Indo-Pacific was like 50 years ago. I feel privileged to have had the opportunity to work here.”

—Sarah Hamylton

Awards and Recognitions

Andrew Bruckner received a bronze medal from the National Oceanic and Atmospheric Administration (NOAA) for his work on deep sea corals that led to the development and publication of the first comprehensive report of the abundance and distribution of structure forming corals that occur in US waters below 50 m depth. Bruckner and coauthors published the comprehensive 365 page report in 2007 and are using this document as a framework for conservation of these resources. One component of his work has focused on the protection of pink and red corals in the family Coralliidae, the most valuable precious corals used primarily for jewelry. His efforts have included the implementation of two international workshops, one in Hong Kong and a second in Naples to evaluate the biology, management, and trade in these corals and to determine the feasibility and conservation benefits of a possible Convention on the International Trade in Endangered Species (CITES) Appendix II listing to regulate international commerce. He also developed a US listing proposal for these species, which was presented at the 15th meeting of the Conference of Parties of CITES, where 180 nations that are signatories of CITES evaluated the proposal and voted for or against its adoption. Although over half of the countries were supportive, the proposal did not achieve the two-thirds majority necessary. Sadly, the fates of these corals lie with industry and they may soon qualify as endangered species.



“My young daughter is already very concerned about the environment and talks about how the earth is sick and we need to take better care of it.”

Andrew Bruckner

Chief Project Scientist, Living Oceans Foundation

“Three Seas” Marine Biologist

Completing his undergraduate degree with back-to-back semesters in the Pacific Northwest, Jamaica and Boston, Andrew Bruckner had his first intensive courses in coral reef ecology—and he’s never looked back.

Today, he is focused on understanding factors that promote resilience of coral reefs. *“Reefs are disappearing at an alarming rate. If we can identify options to mitigate local impacts (both human and natural), we may be successful in 1) halting reef degradation, 2) restoring degraded areas, and 3) improving their chances for survival under various scenarios of climate change.”*

A passion for remote reefs and unusual animals

Working extensively with the National Oceanic & Atmospheric Administration (NOAA) Coral Reef Conservation Program, Andrew joined the Living Oceans Foundation in 2008 to be a part of the upcoming *Global Reef Expedition: Science Without Borders*® program. *“After diving in Indonesia and seeing beautiful corals, but virtually no fish, I was driven to explore more remote reefs that are difficult to access and have sharks, groupers and other large predators that are absent from other areas.”*

Today Andrew lives in Maryland with his wife, who works at NOAA leading a \$12 million community-based restoration program, and two children.

“Mankind has the ability to change our behaviors and sustainably manage our precious coral reefs so that future generations can benefit from the resources they provide.”



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Assistant Minister of Defense and Aviation and Inspector-General for Military Affairs; Full General; Educated at The Royal Military Academy, Sandhurst, UK; United States Army Air Defense Artillery School, Fort Bliss, TX, and US Army Command and General Staff College, Fort Leavenworth, Kansas. Distinguished Graduate of Air War College, Maxwell Air Force Base, AL. Co-authored with Patrick Seale, the riveting account of the Gulf War, *Desert Warrior*.



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Former Commander In Chief North American Aerospace Defense Command and U.S. Space Command, Commander, 9th Air Force and Commander, U.S. Central Command Air Forces. He commanded U.S. and allied air operations for Operation Desert Shield and Desert Storm in Saudi Arabia (1990-1991). Co-authored with Tom Clancy, the best selling non-fiction novel, *Every Man a Tiger*.



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Dr. John Ind
London Physician and Medical Advisor to the Foundation.

Scientific Advisory Council

The work of the Scientific Advisory Council includes project portfolio review, adjudication of grant proposals, and strategic planning for the Foundation. Fellowship applications are reviewed and members participate significantly in the selection process.

Sylvia A. Earle, Ph.D.

Oceanographer, marine botanist, ecologist, explorer, author, lecturer in more than 60 countries, Scientific Consultant; participant in numerous television programs concerning ocean research and exploration; leader of more than 60 research expeditions; scuba and submersible experience.

John W. McManus, Ph.D.

Director, National Center for Caribbean Coral Reef Research (NCORE), Rosenstiel School of Marine and Atmospheric Science (University of Miami), Ecosystem Management and Modeling Expert.

Peter J. Mumby, Ph.D.

Professor of Marine Ecology, Marine Spatial Ecology Lab, University of Exeter, UK. Remote Sensing Expert.

Bernhard Riegl, Ph.D.

Associate Professor, Coral Reef Institute, Oceanographic Center, Nova Southeastern University, Dania, FL; Associate Director of the National Coral Reef Institute.

Thomas Spencer, Ph.D.

University Senior Lecturer, University of Cambridge and Director, Cambridge Coastal Research Unit, Department of Geography, University of Cambridge, UK.



2009 Publications

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Statement of Financial Position

December 31, 2009

ASSETS

Cash and cash equivalents	\$ 447,245
Pledges receivable, net	1,700,000
Prepaid expenses	29,724
Investment restricted for endowment fund	1,022,197
Furniture and equipment, net	380,115
Deposits	6,466
Total assets	\$ 3,585,747

LIABILITIES AND NET ASSETS

Accounts payable and accrued expenses	\$ 75,732
Grants payable	95,000
Total liabilities	170,732
Net Assets:	
Unrestricted	
Undesignated	692,809
Board designated to endowment	201,087
	893,896
Temporarily restricted	1,500,000
Permanently restricted	1,021,119
Total net assets	3,415,015
Total liabilities and net assets	\$ 3,585,747

Statement of Activities

Year ended December 31, 2009

	Unrestricted	Temporarily Restricted	Permanently Restricted	Total
REVENUE AND OTHER SUPPORT				
Contributions	\$ 456	\$1,500,000	\$ -	\$1,500,456
Donated services and goods	303,150	-	-	303,150
Other revenue	709	-	-	709
Investment income	1,481	-	4,440	5,921
Net assets released from restrictions	2,800,000	(1,600,000)	(1,200,000)	-
Total revenue and support	3,105,796	(100,000)	(1,195,560)	1,810,236
EXPENSES				
Program services	1,305,107	-	-	1,305,107
Supporting services:				
Management and general	1,538,647	-	-	1,538,647
Fundraising	12,726	-	-	12,726
Total supporting services	1,551,373	-	-	1,551,373
Total expenses	2,856,480	-	-	2,856,480
Changes in net assets	249,316	(100,000)	(1,195,560)	(1,046,244)
Net assets, beginning of year	644,580	1,600,000	2,216,679	4,461,259
Net assets, end of year	\$893,896	\$1,500,000	\$1,021,119	\$3,415,015

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