

A Decade of Accomplishments

In just over one decade since the inception of the Khaled bin Sultan Living Oceans Foundation in the year 2000, there have been many notable accomplishments.

The operations and research activities conducted by the Foundation to date may be categorized into three distinct phases:

1998-2005: Scientific Capacity Building and Development of Remote Sensing Capabilities;

2006-2009: Saudi Arabian Red Sea Coral Reef Research Program; and

2010-Present: Global Reef Expedition.

A summary of research activities and accomplishments follows:

1998 (French Polynesia): This research expedition occurred prior to the formal establishment of the Living Oceans Foundation and is considered to be a genesis project for establishment of the Foundation. The research, led by Scripps Institution of Oceanography, in French Polynesia occurred at the end of an extreme ocean warming event (El Nino) that alarmed scientists around the world. Scientists on this expedition explored mass coral bleaching and examined certain fish migration habits connected to coral reefs.

2001 (Mediterranean): The Foundation supported a team of scientists from Monaco, France, Canada and the United States for this research project. The research focused on an area in the northwest Mediterranean from Toulon, in France, extending to the French-Italian border. The team employed a hyperspectral sensor installed aboard the Golden Eye aircraft to build a reference biotope database analyzing changes over time for the coastal areas of the Mediterranean Sea. These data were provided to scientific and governmental organizations to enhance broad scale monitoring of marine resources.

2001 (U.S. Virgin Islands): Dr. William Fenical of Scripps Institution of Oceanography, and Dr. Peter Mumby of University of Exeter, U.K. shared the Principal Investigator role for the Foundation's April, 2001 expedition to the U.S. Virgin Islands, during which scientists from the U.S., Canada, and the U.K. visited 400 sites and investigated the diversity of marine life in sea grass beds, shallow patch reefs, algal plains, and coral reefs. This mission proved that remote sensing, using the Compact Airborne Spectrographic Imager (CASI) is a powerful tool for producing high-resolution habitat maps that have subsequently been used for marine spatial planning and conservation management activities. In addition, Dr Fenecal's team collected numerous marine organisms to study their potential for use in antibiotic, antiviral, and anticancer pharmaceutical development.

2001 (Sea of Cortez): U.S. and Mexican scientists joined forces in the Sea of Cortez along the coast of Mexico. The science team surveyed 12 research sites covering a distance of over 500 miles. Scientists from Scripps Institution of Oceanography, again led by Dr. Fenical, collected and processed fungi, soft coral and sediment samples in an ongoing search for natural products from marine organisms that may have benefits to human medicine.

2004 (Bermuda Institute of Ocean Sciences): The Foundation's support was instrumental for the Bermuda Institute of Ocean Sciences to establish an accredited laboratory for coral ecotoxicology (the study of substances harmful to the environment). The laboratory employed a state-of-the-art process to research the effects of various toxins on coral health, which in turn influenced policy development.

2004 (Senegal Fisheries Laboratory): The Living Oceans Foundation collaborated with the University of Cheikh Anta Diop, Dakar, Senegal to establish the Khaled bin Sultan Living Oceans Foundation Laboratory of Aquatic Animal Health for the specific purpose of benefiting Senegal's fisheries management. Studies at the laboratory have focused on parasitic infections of Senegalese fish, shellfish and mollusks.

2005 (Seychelles Expedition): In January, 2005, the Foundation collaborated with Cambridge University and the Seychelles Centre for Marine Research and Technology – Marine Parks Authority (SCMRT-MPA) to conduct habitat mapping and surveys of the Amirantes islands. A three-week expedition to the area was conducted to map the shallow marine ecosystems using a Compact Airborne Spectrographic Imager (CASI) mounted on the Golden Eye. These high-resolution maps of the Amirantes are the first of their kind for the Seychelles and have proven to be a vital resource to the Seychelles Government in marine ecosystem management. The Atlas of the Amirantes was produced by Cambridge University and the Living Oceans Foundation as a capstone product of this expedition. All maps are available freely to the public in an interactive, web-based application via the internet accessible through the Foundation's website.

2005 (Coral Reef Rapid Assessment Survey, Sumatra, Indonesia): Responding to international requests and in collaboration with the International Union for the Conservation of Nature (IUCN) and ReefCheck, a rapid response scientific expedition was launched to survey coral damage resulting from the disastrous Indian Ocean earthquake and tsunami that occurred on December 26, 2004. Data and reports from this expedition greatly contributed to scientific understanding of the physical impacts of tsunamis on coral reefs and have influenced resource management.

2006-2009 (Red Sea Research Program): The Foundation implemented four large-scale research expeditions in the Saudi Arabian Red Sea from 2006-2009 using the M/Y Golden Shadow as a research platform. The research was undertaken to improve the understanding of the spatial distribution, size and condition of shallow marine habitats, and to identify options to enhance the conservation and management of Saudi Arabian coral reef ecosystems. The research program began in 2006 with a survey of the Farasan Islands. In 2007, an expedition took place in the northern Red Sea in the vicinity of Ras Al-Qasabah. Then, in 2008, the Foundation surveyed and mapped a large region of Al Wajh and Yanbu. Finally, in 2009, the vast expanse of the Farasan Banks was mapped and surveyed by the Foundation. Outputs of this four-year research program include a Geographic Information System (GIS) database, detailed high resolution habitat maps, the Khaled bin Sultan Living Oceans Foundation Atlas of Saudi Arabian Red Sea Marine Habitats, comprehensive final reports, and numerous scientific presentations and publications. The Red Sea Research Program was conducted in collaboration with the Saudi Wildlife Authority (SWA), the Regional Organization for the Protection of the Red Sea and Gulf of Aden (PERSGA), the National Coral Reef Institute (NCRI), Cambridge University, and others.

2007 (Bahamas Research): Throughout 2007, the Foundation collaborated on an endeavor to support the Bahamian government's Marine Protected Areas (MPA) decision making process. The primary effort involved in-depth analysis of data on biodiversity, fisheries habitat, and impacts of hurricanes and climate change collected in and around the Bahamas Islands. Field-work included a

comprehensive survey of coral reefs of the Exumas Land and Sea Park and Conception Island. Outcomes of the project have significantly impacted the marine reserve site selection process and will result in a more sustainable network of marine reserves in The Bahamas.

2007 (Project SeaCAMEL: Classroom Aquarius Marine Education Live): In 2007, the vision of His Royal Highness to conduct a live underwater classroom came to life with Project SeaCAMEL in an underwater laboratory called Aquarius, inhabited by six “Aquanauts” who brought live coral reef classroom teaching to the world. Live underwater classroom modules were broadcast live from NOAA’s Aquarius, the world’s only underwater laboratory, located off the coast of Key Largo, Florida. These marine science class modules are still available on the internet and have been used by many school teachers throughout the years.

2010 (Coral Reef Education Workshop, Bahamas): The Foundation held a multifaceted educational workshop in Nassau, Bahamas, for the purpose of furthering Bahamian educators’ understanding about coral reefs. The participants were provided with the knowledge, skills, and materials needed to effectively teach coral reef conservation issues in their classrooms. Ten Bahamian educators enjoyed this workshop which included certification as skin divers and a field trip aboard a dive boat to experience coral reefs first hand.

2010 (Coral Disease Rapid Response Training Workshop): At the request of the Cayman Island Department of the Environment, the Foundation conducted a Coral Disease Rapid Response Training workshop on Little Cayman Island, part of the British Overseas Territory located in the western Caribbean Sea. This workshop was conducted by the Foundation in collaboration with NOAA and George Mason University. The workshop provided classroom, laboratory, and in-water training. The emphasis of the course was on the identification of coral diseases, approaches to characterization and quantification of the severity and impacts of a disease outbreak, as well as techniques to sample coral disease and process specimens.

2010 (Cayman Islands Research Mission): A team of seven marine scientists, led by the Foundation, surveyed 41 reefs located off Little Cayman, Cayman Brac and Grand Cayman. The team used a rapid assessment protocol to assess reef health and characterize the ability of these reefs to persist and rebound following impacts associated with climate change. These surveys shed new light on many of the factors threatening the vitality of the Cayman reefs and also highlighted many of the positive attributes that are likely to help keep reefs healthy for the future. A comprehensive report was provided to the government for their use in resource management.

2010 (Bonaire Coral Reef Resilience Research Mission): Bonaire is a special municipality of the Netherlands in the Leeward Antilles islands of the Caribbean Sea. It is renowned as a special diving destination. In 2010, the Foundation collaborated with NOAA’s Office of Habitat Conservation to conduct a detailed assessment of the condition of coral reefs on the leeward side of Bonaire. Bonaire has earned the reputation for being one of the most environmentally conscious islands in the Caribbean. The waters surrounding the entire island are protected as a marine park. Over a ten day mission, the Foundation assessed the population structure and condition of important reef-building corals, condition of the bottom with emphasis on the cover of invertebrates and algae that are beneficial for the reef as well as those that are indicators of degraded condition. The team also surveyed factors that can enhance the resilience of reefs as well as factors that degrade resilience. A comprehensive report was provided to the government of Bonaire for use in resource management.

2011 (Global Reef Expedition): 2011 heralded the start of the most ambitious project to date for the Khaled bin Sultan Living Oceans Foundation. Responding to requests and invitations from coral reef

countries around the world, the Foundation is circumnavigating the globe with the Golden Fleet to map and characterize coral reefs. This program is expected to take 5 or 6 years to complete and will significantly contribute to the world's knowledge of coral reef health and resilience. The Global Reef Expedition itinerary began with the Bahamas Islands. The Foundation surveyed the remote reefs of Cay Sal Banks, the Inaguas, and Andros Island. Also, on the itinerary was an expedition to the country of St Kitts and Nevis. The Global Reef Expedition has three primary objectives: 1) Scientific Research, 2) Education, and 3) Media Relations and Outreach. The Global Reef Expedition builds 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 work side-by-side with internationally acclaimed coral reef scientists. Emphasis is place on training local scientist and resource managers to continue rigorous environmental monitoring long after the Golden Shadow departs the region. This international team of scientists assembled aboard the Golden Shadow is united in the purpose of closing critical gaps in scientific knowledge. The 2012 itinerary for the Global Reef Expedition includes Jamaica, Navassa, Colombia, Galapagos and French Polynesia. See www.globalreefexpedition.com for updates on the project.