

CDHC: CORAL DISEASE & HEALTH CONSORTIUM

Coral Disease & Health: The Issue

Diseases and diminishing health condition among corals have dramatically increased in frequency and distribution over the last decade, leading to unprecedented decreases in live coral and altering the function and productivity of coral reef ecosystems. Responding to this threat requires improved scientific understanding and tools to: 1) detect and assess trends in coral diseases at the necessary scales for scientific investigation and policy development; 2) determine the causes and consequences of increasing disease frequency and distribution; and 3) evaluate possible management responses designed to mitigate the spread and affects of disease on coral reef ecosystems and their users.

CDHC: Who Are We?

The Coral Disease and Health Consortium (CDHC) was created in 2002, in response to the U.S. Coral Reef Task Force's (USCRTF) National Action Plan to Conserve Coral Reefs. Our goal is to provide coastal and ocean managers with scientific understanding and tools to help protect healthy coral reef ecosystems and restore degraded ones. The CDHC is a network of field and laboratory scientists, coral reef managers, and agency representatives devoted to understanding coral health and disease. It is extensive, highly collaborative, and completely voluntary. Currently over **150 partners**, including federal agencies, EPA, DOI, NOAA along with academia, non-profit and industry, contribute their time and expertise to the CDHC, while organizational infrastructure is supported by the congressionally funded Coral Conservation Program.

The commitment to share information, ideas, and common goals led to the development of a national research plan (*Coral Disease and Health: A National Research Plan*) that has inspired many to seek funding and devote new resources to the study and amelioration of coral disease.

CDHC: The Vision

Our vision is 'to understand and address the effects of natural and anthropogenic stressors on corals in order to contribute to the preservation and protection of coral reef ecosystems'.

To realize this vision the CDHC serves to:

- unify the coral health and disease research community
- implement research priorities identified in the National Research Plan
- update and maintain the National Research Plan
- develop tools and methodologies for diagnosis and assessment
- provide an expert knowledge system for use in diagnosis and epizootiology
- provide education and outreach tools to equip a new generation of coral researchers

CDHC: What are we doing?

RESEARCH- Information is limited on the physiological parameters that define healthy coral and less on coral disease dynamics. Our challenge is to apply advanced technologies in functional genomics, proteomics and systems biology to expand our knowledge in coral health and disease dynamics. The knowledge gained from this approach will position us to move aggressively toward characterizing the processes that control ecological connectivity among reefs and discover critical control points for management strategies.

- **EST sequences available** – Over 4000 sequences have been produced from EST (expressed sequence tags) projects for *Montastraea annularis*, *Oculina varicosa*, and *Porites porites*, accessible at <http://www.marinegenomics.org/>.
- **Coral Microbial Communities** – Over 28,000 ribosomal gene sequences cloned from coral-associated bacteria are available at <http://www.marinegenomics.org/>.
- **Porites astreoides cDNAs** – New normalized cDNA library has been constructed and 12,000 sequences related to adult, and early life stage gene products are available at <http://www.marinegenomics.org/>.

This information is vital and basic to developing an understanding for how an organism responds to its environment, are key to developing diagnostic tools to assess coral health and the foundation for identifying critical control points and viable management options.

DIAGNOSTIC RESOURCES – There is limited application of medical/veterinary knowledge or protocols to the study of coral health and disease, resulting in ambiguous and often misleading communication of findings. Compounded by inadequate diagnostic tools and insufficient application of diagnostic procedures, the challenge is to develop standardized procedures based on medical principles that clearly define the terminology, pathology and diagnostic criteria.

- **Setting Diagnostic Criteria-** Experts in coral biology, pathology and veterinary science are developing web-enabled tools for use in recognizing gross signs of disease and use in clinical diagnostic pathology and developing case definitions for selected coral syndromes. The web-tool will be used to guide investigators in the diagnostic process. Additional modules are planned that will include virtual slide technologies for learning coral histology and histopathology as well as for experts to consult on disease cases.
- **Advanced Histology Workshop** Report that reviewed case studies, set nomenclature and developed extensive glossary, available on request. Contact Sylvia Galloway, Sylvia.galloway@noaa.gov

CDHC: Work In Progress

Genomics for the Non-Genomics Coral Scientist Course –

The course will introduce non-experts in genomics to the potential uses of genome science. In a week, whole genome projects, basic databases, transcriptome analysis by sequence and microarray approaches, and tools for microbial diversity assessment will be covered. Practical problem sets will be used to illustrate each of the types of data available to today's coral researcher and provide the participants with practical experience with real coral data. June 21-27, 2009.

Diseases of Coral Book– *Diseases of Coral* has been accepted by Blackwell for their veterinary series. This book will include a 1) Primer on Pathology; 2) establish diagnostic criteria for etiologic diseases and 3) uniform criteria for descriptive diseases of unknown etiology, 4) Toxicology and 5) Methods of Disease Investigation, including permitting and biological control. Expected release Fall 2009.

CDHC Pacific Workshop: *Vision for Action*. Pacific reefs are considered by some to be free of disease, yet an increasing number of reports support emerging concerns over the possibility that the health of corals on Pacific reefs are being compromised. Report from workshop held June 2006, Honolulu, HI and outlining a “Vision for Action” to avoid the devastation that afflicts Caribbean corals, is expected to be released September 2008.

Rapid Response Teams – A long-range project geared to providing local response capabilities to coral disease outbreaks. Well trained teams capable of mobilizing on short notice will be available to carry out formal disease investigations of unusual coral disease outbreak or mortality events, including potential biotic and abiotic etiologies.

Coral Histology using Virtual Slides – To accurately interpret histopathology, we must first understand normal histology. Through virtual slide technology and the World Wide Web, an online course is under development for histology of Pacific corals. This technology will provide the platform for distance learning as well as consultation with coral pathologists linked through the web and continuing education through ‘grand round’ web-conferences.

U.S. Coral Reef Task Force Resolution 16.6 requested the Coral Disease and Health Consortium to serve as a Task Force Working Group to organize and coordinate scientific resources to address coral health and disease issues and link them to coral reef management (such as Local Action Strategies), with emphasis on diagnostics, etiology, outbreak investigations, training, and responses (www.coralreef.gov)

CDHC National Office

The CDHC is a virtual entity, centralized within the US NOAA, Charleston, SC via the office of Dr. Cheryl Woodley. **Further information about the CDHC can be obtained by writing to Cheryl.woodley@noaa.gov or Andy Bruckner at andy.bruckner@noaa.gov.**



Diagnostic Tools Available- Consortium members have achieved significant advances in diagnostic assay development that will assist researchers in identifying coral stressors. Examples of new techniques include:

- DNA probe for the White Plague agent – Dr. Laurie Richardson, Florida Atlantic University
- DNA sequence analysis for the White Pox agent *Serratia marcescens* (newly designated 'White Pox Serratiosis' when the presence of *S. marcescens* is confirmed) - Dr. Kathryn Sutherland, Rollins College, Winter Park FL
- coral immuno-competence (IMCOMP) assay to assess the presence of antimicrobial agents within coral tissue by using a modified bacterial viability assay – Dr. Craig Downs, Haereticus Environmental Laboratory
- PCR-screening test for recognized pathogens – Dr. Shawn Polson, Univ. Delaware & NOAA NOS Charleston, SC
- DNA AP site lesions – NOAA NOS Charleston, SC
- Various toxicity tests are being adapted or modified to address development, mutagenesis, and cellular pathologies associated with toxicant exposures.

SPECIALIZED RESOURCES

- International Registry of Coral Pathology (IRCP) supported by NOAA, Oxford, MD, is a research tool and resource of voucher materials for the coral research community. Submission, holdings and acquisitions can be located at <http://www.chbr.noaa.gov/InternationalRegistry.htm> For more information contact Dr. Shawn McLaughlin, shawn.mclaughlin@noaa.gov
- IRCP Bibliography on coral health and disease (996 citations and associated reprint collection (352 reprints): <http://mrl.cofc.edu/oxford/coralreprint.html>.
- Annotated cnidarian biochemistry bibliography containing >5000 references and abstracts available as an ENDNOTE™ library or on CD, is supported by a complete set of reprints and is accessible on an individual basis on site in Charleston, SC. Contact Dr. Sylvia Galloway, Sylvia.galloway@noaa.gov for more information.
- CDHC Website and Listserve – Supported by NOAA's Coral Health and Monitoring Program at the Atlantic Oceanographic and Meteorological Laboratory in Miami, Florida. <http://coral.aoml.noaa.gov/mailman/listinfo/> http://www.coral.noaa.gov/coral_disease/

CDHC: Educational Opportunities

- **Pauley Program** – Hawaii Institute of Marine Biology <http://www.hawaii.edu/HIMB/>.
- **Coral Histology** – Training course and slide annotation development for normal histology of Pacific corals, using virtual slide technologies. Mote Marine Lab, Summerland Key, FL Summer 2008.
- **11th International Coral Reef Symposium** July 7-11, 2008 in Ft. Lauderdale, FL. <http://www.nova.edu/ncri/11icrs/>