

The Issue

Most animal and human research depends on the availability of animal models to elucidate basic biological processes (e.g., reproduction, physiology, biochemistry, genetics) and assess disease states. For corals, model species provide a means to focus research on fundamental biological concepts that are broadly applicable across the taxon and are critical if advances are to be made in the underlying science through the use of modern technologies. Coral research has been hampered by the lack of suitable model species and well characterized genetic strains. This deficiency has been exacerbated by the difficulty of maintaining captive colonies and making them routinely available for research purposes. The Coral Culture and Collaborative Research Facility is being used to develop, propagate, and maintain model species under well characterized conditions for use in studies of healthy and diseased states of corals.

The Vision

To identify and develop model coral species (analogous to "laboratory rats") that are biologically and genetically well characterized and suitable for laboratory experimentation by establishing a coral culture and state-of-the-art research facility where the animals are captive-reared for investigating coral health and disease issues.

Why NOAA?

NOAA has been charged with the stewardship of our ocean resources and in the case of Coral Reefs, the charge is for their conservation and protection. This requires understanding those factors that prevent robust, productive reefs i.e., "healthy" reefs, and developing strategies preventative in nature rather than reactive. This project is an inherently governmental activity; it calls for a leadership role in conducting research involving protected species, an endeavor not permissible or feasible for undertaking solely by the private business sector. Furthermore, NOAA has the ability to sustain such an operation for the longer term, which might be a more difficult prospect for academia. As a collaborative venture, our Coral Culture and Collaborative Research Facility will help meet the needs of NOAA and its partners, as well as the broader research and management communities.

Partners

Our partners, from several universities and commercial and not-for-profit organizations have recognized the value and potential this facility offers to the coral research community. By sharing their time, expertise and resources, we are able to offer a fuller complement of unique research opportunities.

Medical University of South Carolina (MUSC)

Mr. Jim Nicholson, MUSC Image Core Director, volunteer's time and expertise using fluorescence microscopy for discovery diagnostics.

University of Hawaii

Dr. Robert Richmond donated a Teflon dosing system for toxicology experiments and collaborative research.

Haereticus Environmental Laboratory

Donated technical expertise and *Pocillopora damicornis* for propagation and collaborative toxicology research projects.

Pacific East Aquaculture

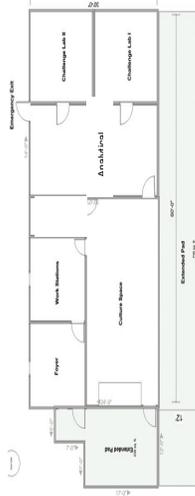
Dr. Mac Terzich offered assistance in the early design phase of the aquatic systems servicing this facility.

Hollings Marine Laboratory (HML)

The Aquatic Production unit of HML provided technical advice and assistance in design and building our closed culture system.

Coral Disease & Health Consortium (CDHC) Partners

The CDHC is a Working Group of the U.S. Coral Reef Task Force, of which NOAA is a member. The facility provides new research opportunities to CDHC affiliated partners. Contact information: Cheryl.woodley@noaa.gov or Andy Bruckner at andy.bruckner@noaa.gov.



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Updated 1-1-2009

CORAL CULTURE & COLLABORATIVE RESEARCH FACILITY



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The Facility

In 2006, NOS NCCOS initiated plans to establish a place for in-house and collaborative projects that is conducive to modern laboratory-based coral research focused on biological, physical and chemical agents impacting coral health.

The mission of this endeavor is aligned with one of the CDHC's highest priority goals: **"to establish a coral culture and experimental facility capable of providing laboratory research animals in support of coral research dealing with health and diseased states"**.

As a result of this long-term commitment, a 1,800 sq. ft. indoor coral culture facility was opened in 2008 at the NOS NCCOS Center for Coastal Environmental Health and Biomolecular Research (CCEHBR) in Charleston, SC. Research at the facility is conducted in support of NOAA's coral conservation goals and has received operational assistance from NOAA's Coral Reef Conservation Program, initially focusing on hard corals, though other relevant coral reef organisms are being incorporated into the holdings as needed.



The experimental resources available at this facility will substantially enhance research opportunities for NOAA and its partners by making available captive-reared and clonal coral specimens. The facility is equipped with four closed artificial seawater raceway systems for propagation and maintenance of corals and related organisms, a support laboratory for analyses ranging from molecular and cellular biology to physiology (e.g., biomarkers) and genetics, and separate laboratory space for conducting challenge experiments with biotic and abiotic agents of interest. Further, with growing interest and concern for deep sea corals, the facility is also uniquely poised to develop husbandry techniques for these organisms to support research needs in that area.

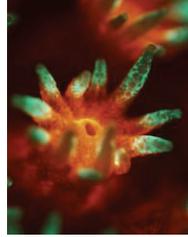
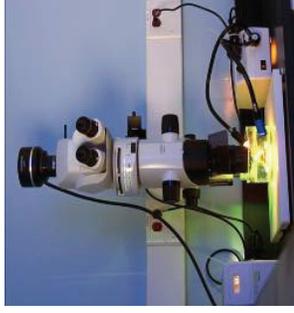
Culture Collection

We currently have over 200 individual specimens representing 11 different species of hard corals from the Caribbean and Indo-Pacific, one soft coral and four anemone species housed in our new facilities. At this time, *Porites divaricata* and *Pocillopora damicornis* fragments dominate our collection.



Specialized Resources

- Two humidity and temperature controlled challenge rooms are available for laboratory-scale experiments with biological, environmental or chemical agents.
- Novel and advanced fluorescence microscopy with stereo and dipping microscopes equipped with a PARISS (Prism and Reflector Imaging Spectroscopy System) advanced hyperspectral imaging device that simultaneously collects wavelengths between 300nm and 900nm using an imaging spectrometer coupled to a CCD camera which can provide spectral signatures from the inherent autofluorescence of corals for diagnostics and discovery research.
- A 400 sq. ft. outdoor challenge area for experiments requiring natural sunlight.



- Teflon dosing system capable of 16 independent treatments – donated by Dr. Robert Richmond, University of Hawaii



What is the Benefit to Coral Reefs and Management?

Developing a living stock collection provides an infrastructure critical for strategic research by propagating well-characterized and documented experimental corals for collaborative, laboratory-based research. **The availability of captive-reared and genetically similar organisms serves to improve experimental design and reduce variability that in turn assists in acquiring the best available science that is vital to support good management decisions.** This endeavor also underscores the value of achieving a renewable resource that in itself serves as **a model conservation tool** for reefs by reducing the need for collecting wild organisms for research purposes. For example, the outcome of these combined research and husbandry efforts can serve to identify appropriate genotype mixes more likely to succeed in restoration activities by matching an organism's cellular physiological plasticity with environmental conditions or causal effects of land-based sources of pollution.

