CORAL EARLY LIFE HISTORY
General restoration activities (Miller et al)

Given the paucity of coral resources available for coral reef restoration in the Florida Keys, there is a need to develop tools to enhance coral abundance, especially of broadcast-spawning, hermatypic species, for application in reef restoration endeavors. NOAA has an interest and, in some cases, legal mandate to undertake habitat restoration to enhance fisheries and repair natural resource damage (e.g., in National Marine Sanctuaries). Over the past several years, we have dramatically improved our success in collecting, culturing, and settling larvae of the fast-growing elkhorn coral, *Acropora palmata* in the northern Florida Keys. This increased success has resulted from new research indicating that the abundant and robust elkhorn coral stand where we had previously attempted to collect and culture spawn/larvae was in fact composed of a single genotype. In Aug 2004 we obtained high (up to 90%) fertilization success by combining gametes from two different sites (i.e. outcrossing genetically distinct individuals). We raised large numbers of elkhorn larvae to competence in 2004, but hurricane activity prevented us from attempting an in situ seeding. Instead, we settled the elkhorn larvae on pieces of reef rubble in the laboratory. These settlers fared extremely well during a three week period when we had placed them on racks at a back reef grow-out site, taking up algal symbionts and budding new polyps (up to 4 or 5 polyps in size). Unfortunately, these settlers perished after an additional two weeks kept in coolers due to additional hurricane activity in Sept 2004.

We currently aim to refine methods for larval seeding of hermatypic corals to enhance NOAA's strategies and capacity for coral reef restoration. Specifically, we collect, culture, and seed elkhorn coral (*Acropora palmata*) larvae to in situ reef and/or restoration structure substrates, as well as onto pieces of reef rubble that can be used to evaluate different grow-out conditions.

RELEVANT LINKS
NOAA Coral Reef Conservation Program
http://www.coralreef.noaa.gov

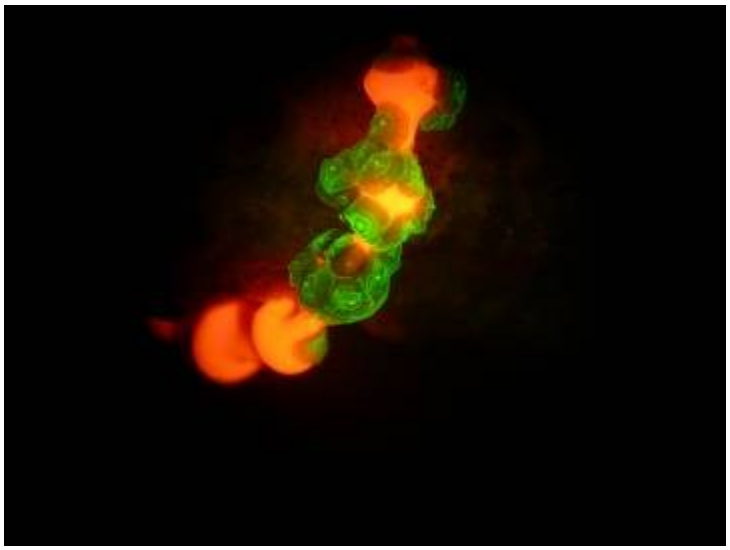
Florida Keys National Marine Sanctuary
http://floridakeys.noaa.gov

Dr. Alina Szmant, UNCW
http://people.uncw.edu/szmanta/szmant.htm

CORAL EARLY LIFE HISTORY

Photoreception in coral larvae and the role that it plays in substrate selection during settlement. (Mason and Miller)

Chemical cues in crustose coralline algae (CCA) and microbial biofilms have been shown to induce settlement and metamorphosis of coral larvae. However, light is also known to influence larval behavior and settlement. We have preliminary data that suggests larvae of *Porites astreoides* and *Acropora palmata* display long-wavelength sensitivity that may play a role in substrate selection by settlement stage larvae. Using antibodies directed against squid rhodopsin we have confirmed the presence of a 49 kDa opsin-like protein in *Diploria strigosa* and *A. palmata* larvae, with a molecular weight characteristic of cephalopod rhodopsin. In addition we have identified photosensitive cells in the larvae of *D. strigosa* and *Montastraea faveolata*. These cells resemble ciliary-type photoreceptor cells and share a structural similarity to rod cells of higher invertebrates and vertebrates. Currently we are in the process of conducting experiments to determine the spectral sensitivity of photo-pigments, screening other larvae and adult corals for photoreceptive cells and pigments and are in the beginning stages of sequencing the genes that code for these opsin-like proteins. We believe that this discovery will have implications for the ecology and evolution of corals and may provide tools to enhance coral recruitment and restoration.



CORAL EARLY LIFE HISTORY

The effects of UV and elevated temperature on the survivorship, development, and settlement of coral planulae. (Mason and Miller)

The resilience and persistence of coral reefs relies upon successful sexual reproduction and recruitment of coral larvae. Recruitment rates for most reef-building corals are extremely low and the causes for this recruitment failure are not completely known. The goal of this project is to determine the effects that two environmental parameters influenced by global environmental change have on the survival, development and settlement of the corals *Porites astreoides, Acropora palmate, Diploria strigosa,* and *Montastraea faveolata*. We are conducting experiments to look at survival and settlement rates of these larvae, as well as investigating sub-lethal physiological stress. Sub-lethal stress is being evaluated by estimating changes in lipid concentrations (C:N ratios) during development in various treatment conditions and by using DNA microarrays to examine differential gene expression. Larvae exposed to elevated temperature and UV are currently being used to develop expressed sequence tags (ESTs) for these species that will then serve as molecular biomarkers and indicators of these specific forms of physiological stress. In addition, we are also investigating the effects of these stressors on the acquisition of zooxanthellae by larvae and newly settled spat. In controlled experiments we are inoculating larval cultures with various algal strains to determine whether these stressors prevent uptake or result in preferential uptake of zooxanthellae clades. Using microscopic examination and molecular techniques (RFLP and chloroplast genotyping) we are able to determine the clade(s) of zooxanthellae acquired by individual coral larvae. This research will provide information regarding the specificity of uptake by larval and juvenile corals and offer insight into the mechanisms that lead to clade specificity or dominance commonly observed in adult corals.