

# Florida Keys National Marine Sanctuary

## Coral Reef Management

### Management Issue

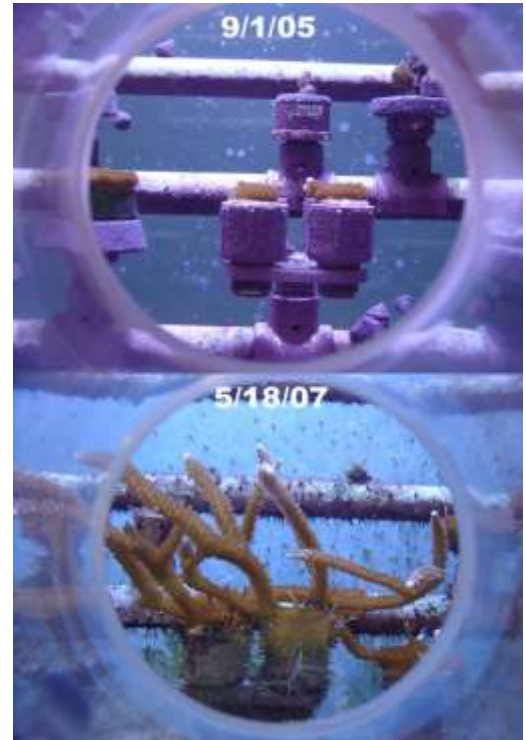
The Florida Keys National Marine Sanctuary (FKNMS or Sanctuary) includes 1,400 km<sup>2</sup> of coral reefs and several other distinct habitats. Human activities, such as boat and ship groundings, accumulation of marine debris, and improper anchoring cause extensive physical damage to reefs. In addition, a range of anthropogenic and natural stresses affect reef-building corals and associated organisms. The collective effects of physical damage and stresses are manifested as decreases in coral cover and species diversity and increases in coral diseases and coral bleaching in the Sanctuary. How much these changes in coral reef health are driven by anthropogenic factors that could be ameliorated by management actions are not known, due in part to the poor understanding of the population dynamics of reef building species, and what levels of climate change, fishing pressure, habitat loss, and land based sources of pollution will be realized over the next three decades.

### Description

Process-oriented research is needed to elucidate the many factors that contribute to coral reef decline, including trends in reproductive effort and success, limitations to settlement, limitations to recruitment, limitations to growth and development, genetic diversity, susceptibility to bleaching and disease. Additionally, the effects of changes in water quality associated with climate change (e.g., high surface temperatures and increasing ocean pH) and nutrient-rich waters on the processes described above is important to help managers distinguish natural variation in community composition from anthropogenic influences. This in turn will facilitate the development of management strategies that will contribute to the long-term maintenance and enhancement of the coral ecosystem of the Florida Keys.

### Questions and Information Needs

- 1) What factors are contributing to coral reef decline and what are the specific ways each factor is influencing ecosystem health??
- 2) What are the life history characteristics of the reef building corals and how are those characteristics affected by changing water quality (e.g. nitrogen flux, dissolved oxygen, increasing pH, etc.)?
- 3) What are the effects of bleaching on coral survival and susceptibility to diseases?
- 4) What is the genetic diversity of reef building corals throughout the FKNMS, and can this diversity support long term reproductive success?
- 5) What are the ecological bottlenecks during coral life histories, and are they correlated to human activities?
- 6) Does the presence of contaminants in the ocean surface layer effect viability of coral gametes or larvae?
- 7) What are the most effective and efficient ways to create or maintain suitable habitat for coral settlement, growth, and reproductive success?
- 8) Does an increasing coral predator population explain the changing coral cover and diversity more than stressors directly influenced by human activities?



*Example growth of *Acropora cervicornis* fragments in a coral aquaculture facility: culture of fragments began in 2005 (top panel) and growth documented 20 months later (bottom panel). Photo credit: Dave Lackland, Mote Marine Laboratory.*

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- 9) How do changing coral predator populations contribute to the changing coral cover and diversity?
- 10) How does coral reef health change as exotic species (e.g., lion fish and *Tubastrea coccinea*) proliferate?
- 11) How is coral reef health related to seagrass and mangrove health (i.e., connectivity in the food web)?

### Scientific Approach and Actions

- Develop a refined coral monitoring program using existing data and assessment techniques, which includes periodic broad, synoptic “snapshot” surveys in all forms of coral reef habitats
- Integrate existing monitoring programs in order to develop water quality thresholds for corals.
- Develop new hypotheses about trends in coral reef health and examine those which can be influenced by management actions
- Develop and implement invasive exotic species response plans
- Develop coral nurseries to maintain genetic stocks
- Develop aquaculture programs that contribute to coral reef restoration (e.g., *Diadema* nurseries, *Acropora* nurseries, other coral species)

### Potential Key Partners and Information Sources

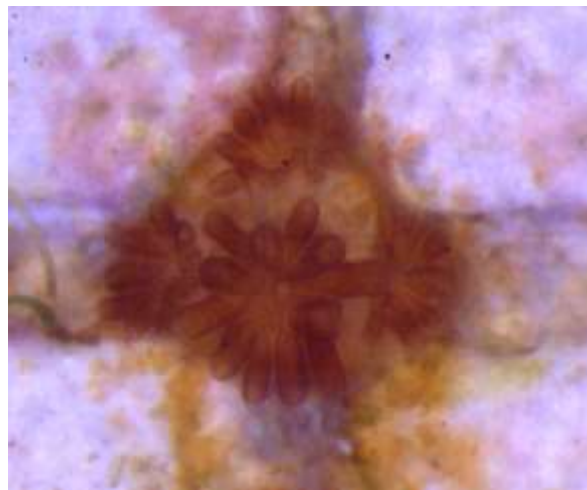
NOAA Fisheries, NOAA’s Atlantic Oceanographic and Meteorological Laboratory, Florida Fish and Wildlife Conservation Commission, Florida International University, University of Miami, NOVA Southeastern University, Reef Environmental Education Foundation, Coral Restoration Foundation, Mote Marine Laboratory, and volunteers.

### Management Support Products

- A refined coral monitoring program using existing data and assessment techniques, which includes periodic broad, synoptic “snapshot” surveys in all forms of coral reef habitats
- Water quality thresholds for corals
- Invasive exotic response plans.
- Coral nurseries
- Coral and invertebrate aquaculture programs

### Planned Use of Products and Actions

- Results of these products would be used during management plan review, specifically for marine zoning evaluation and development
- Information will help managers to distinguish natural variation in coral community composition from anthropogenic influences. This will facilitate the development of management strategies that will contribute to the long-term maintenance and enhancement of the coral ecosystem of the Florida Keys
- Results will complement those in the physical oceanography and water quality sections of this needs assessment portfolio
- Use results to develop or enhance education and outreach products



*Early stage Acropora palmata development at an aquaculture facility. Photo Credit: Dave Lackland, Mote Marine Laboratory.*

### Program References

#### FKNMS Management Plan

- Research and Monitoring Action Plan (Chapter 3.1.2)

#### Other Documents

- FKNMS Comprehensive Science Plan (2002)
- FKNMS Condition Report (2011)

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