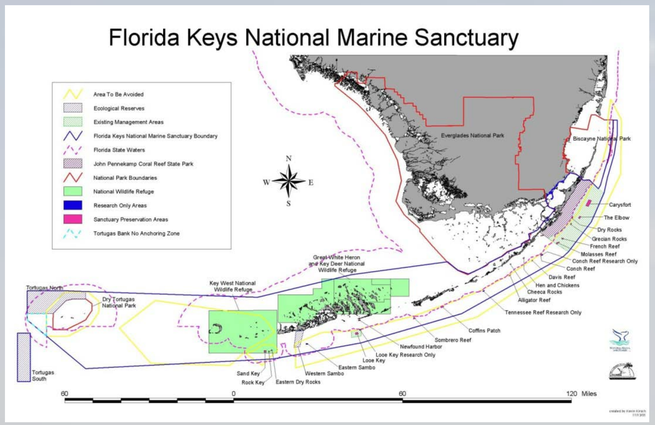
Multiple Spatial Scale Sampling of Benthic Coral Reef Organisms

S.L. Miller, D.W. Swanson, M. Chiappone, L.M. Rutten

Background

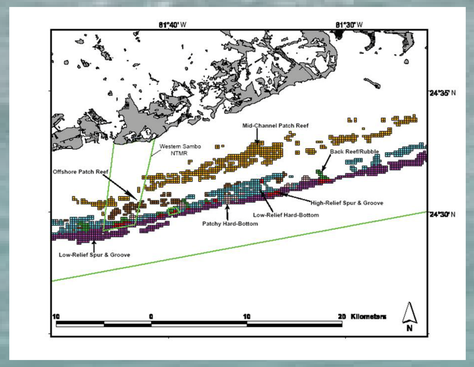
One of the principal features of the Final Management Plan for the Florida Keys National Marine Sanctuary was the creation of 23 no-take zones from Key Largo to Key West, designed to separate incompatible uses, to provide control areas for scientific research, and to protect contiguous areas off habitat. The FKNMS zones are an addition to existing zones within the S. Florida ecosystem.

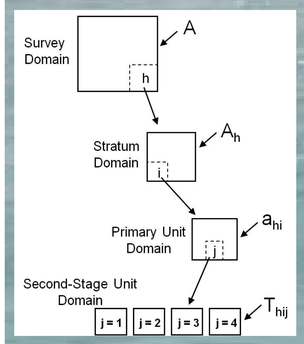


The Florida Keys National Marine Sanctuary and management zones within the larger coastal ecosystem

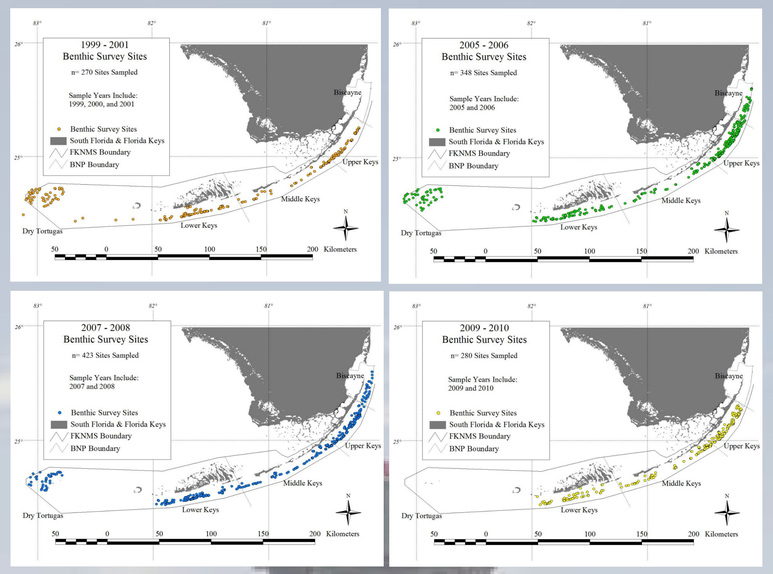
Program Objectives

- Quantify the habitat distribution, abundance, size, and condition of coral reef benthos at multiple spatial scales, including comparisons inside and outside of FKNMS no-take zones (SPAs, ERs, ROs)





The sampling design relies upon bathymetry and benthic mapping data to allocate effort. A grid of 200-m x 200-m cells are overlain on habitat maps and are the primary sampling units (left) , with randomly selected cells used as the "sites" for transect (station) placement (right)



From 1999-2010, over 1,300 sites have been sampled in the ecosystem from northern BNP to the Dry Tortugas

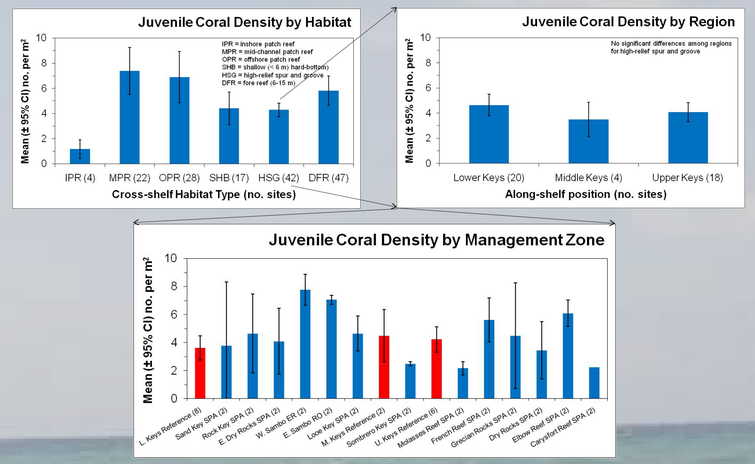
Field Methods and Variables Measured

One of the hallmark features of the sampling design is the multitude of habitats sampled, from inshore patch reefs to the deeper fore-reef slope. Transects 15-m in length are used to sample: Depth and topographic complexity, percent cover of abiotic and biotic components, species richness of sponges and cnidarians; and density/size/condition of corals, gorgonians, urchins, anemones, corallimorpharians, and selected mollusks, as well as marine debris.

A variety of hard-bottom and coral reef habitat types are sampled from inshore-to-offshore, along the shelf, and inside and outside of different management zones

Example Results

The example below highlights the hierarchical nature of the sampling design, using 2009 quadrat data for juvenile corals surveyed at 160 sites from Key Largo to Key West. Spatial and temporal comparisons can be made among habitats (top left), among regions within a habitats (top right, shallow spur and groove) and between combined or individual no-take zones and reference areas (bottom). The survey design allows for abundance estimate calculations at multiple scales.



The hierarchical nature of the sampling program, using 2009 surveys of juvenile (< 4 cm) corals. Numbers in parentheses on the x-axis are the numbers of sites, with 20 0.65-cm x 0.48 cm quadrats 6.24-m² surveyed per site.

Future Efforts

- Continue to conduct intermittent, large-scale surveys of benthic coral reef organisms in relation to cross-shelf position, along-shelf position, and inside and outside of management zones
- Focused surveys of *Acropora* corals and marine debris in 2011, including continued analysis and tracking of population sizes

Acknowledgments

NOAA's CRCP and Aquarius Reef Base Program, Emerson Associates International, FKNMS, CMS/UNCW, Biscayne National Park, Dry Tortugas National Park, O. Rutten, J. Ault, S. Smith, B. Altmeier, M. O'Connor, D. Ward, B. Keller, and J. Delaney

Reprints and quick look/data summary reports available at http://people.uncw.edu/millers