

2002 Annual Progress Report - South Florida Ecosystem Restoration Program

Reef Fish Community Dynamics and Linkages with Florida Bay

Dr. James Bohnsack, Protected Resources Division

Dr. Jerry Ault, RSMAS, University of Miami

PRD-01/02-06

May 2002

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A. Grant Number:

B. Amount of Grant: \$198,500 YEAR 1; \$208,600 YEAR 2; \$407,100 YEAR TOTAL

C. Project Title: **Reef Fish Community Dynamics and Linkages with Florida Bay**

D. Grantees: NOAA/NMFS/SEFSC/ Dr. James Bohnsack, Protected Resources Division; and Dr. Jerry Ault, RSMAS, University of Miami

E. Award Period: From 7/01/00 To 07/31/02

F. Period Covered by this Report: 2001

G. Summary of Progress and Expenditures to Date: (Year 2 of 2)

1. Work Accomplishments

a. Progress to date:

(1. Field sampling was successfully completed for a total of 306 reef blocks and 1,224 dives. These sites include a total of 278 stratified random blocks and 28 historical reference reef sites (Figs. 1 and 2).. Each block represents 4 stationary fish counts.

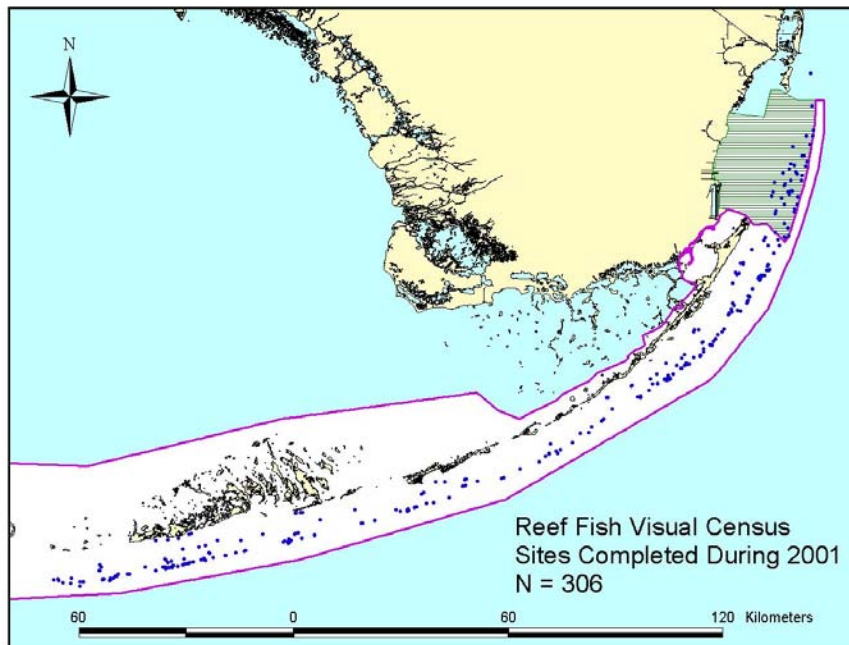


Figure 1. Location of 306 stationary fish sample sites in the Florida Keys National Marine Sanctuary (outlined in purple) and Biscayne National Park (outlined in green) sampled in the Florida Keys in 2001.

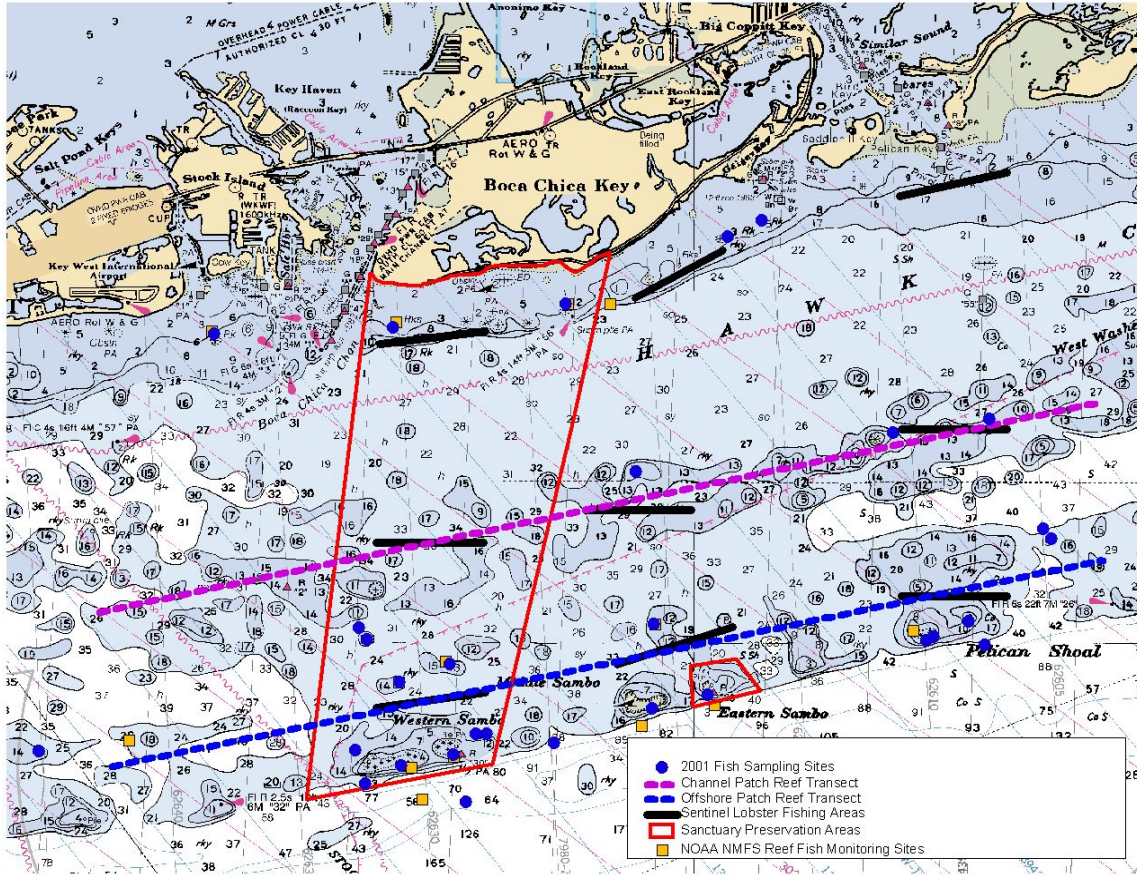


Figure 2. Fish visual survey sample sites in the lower Florida Keys showing sample in and surrounding the Sambos Ecological Reserve (large red outline) and the Eastern Sambo Research Sanctuary Preservation area (small red outline). Lobster buoy density survey transects are shown in purple and blue.

(2. NURP as a collaborative effort has collected quantitative benthic habitat samples from approximately 20% of the reef fish survey sample sites.

(3. Edge effects were documented around the Sambos Ecological Reserve by counting the density of buoys for spiny lobster traps in September of 2000 and 2001 along transects parallel to the coast. Results show a high density of traps along the edge of the Sambos Ecological Reserve (Figs 2 and 3). Transect lines (blue and purple) are shown in Figure 2.

(4. Statistical sampling improvements were made to optimize Keys-wide sampling allocation. Thanks to the improved statistical design, the sampling precision as measured by coefficient of variation for exploitable and juvenile phased gray snapper, for example, has been reduced to approximately 15% compared to 100% in the early 1980s (Fig. 4). A manuscript on the statistical survey design is in preparation.

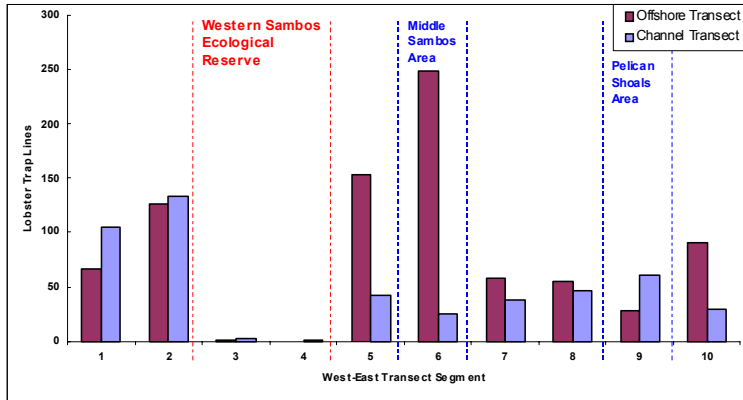


Figure 3. Relative density of spiny lobster traps adjacent to the Sambos Ecological reserve off Key West, FL. See Fig 2 for location of transects

(5. Student training opportunities were provided to Anthony Schabloski from Paul Smith College, NY. This resulted in a student paper: Effects of “no-take” marine reserves on exploited reef fish maximum lengths in the Florida Keys National Marine Sanctuary.

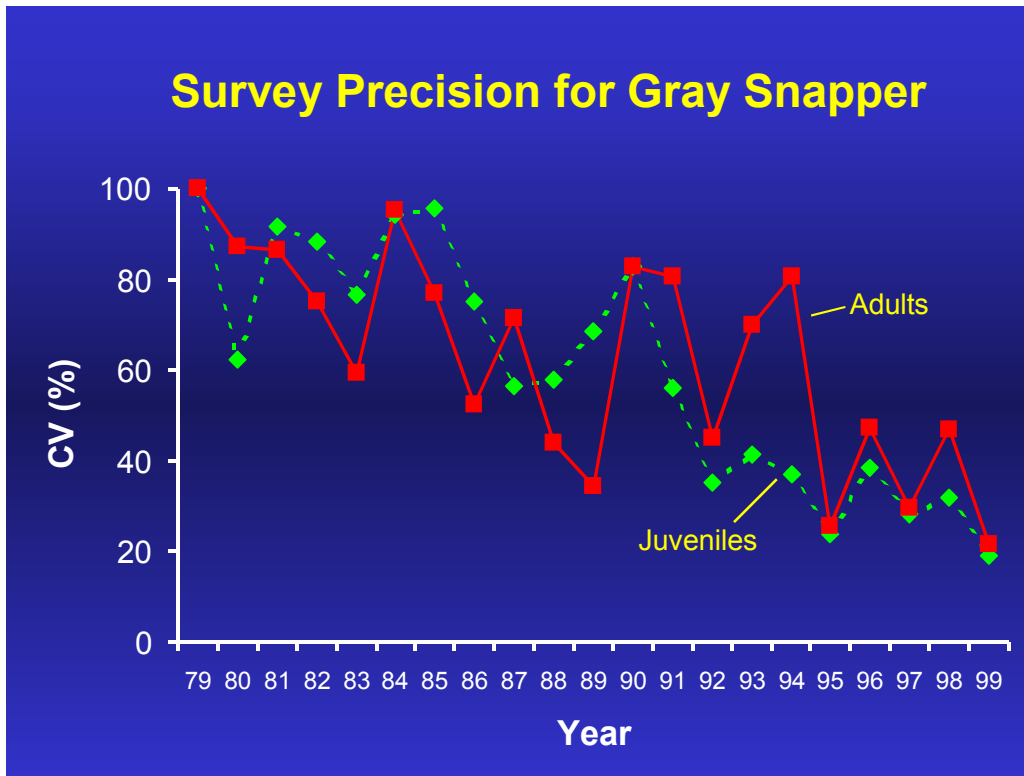


Figure 4. Improved precision in population estimates for juvenile and exploitable phased gray snapper densities in the Florida Keys.

(6. Reef fish populations were monitored within no-take Sanctuary Preservation Areas and exploited reference areas using before-and-after comparisons (BACI). Examples of observed density trends are shown for yellowtail snapper (Fig. 5) and combined grouper (Fig. 6) in protected versus fished reference areas. Exploited grouper density tended to increase throughout the Keys but more so in reserve areas. The overall density of exploited species tended to increase in reserves compared to fished areas. These differences show the influence of fishery extraction on population abundances.

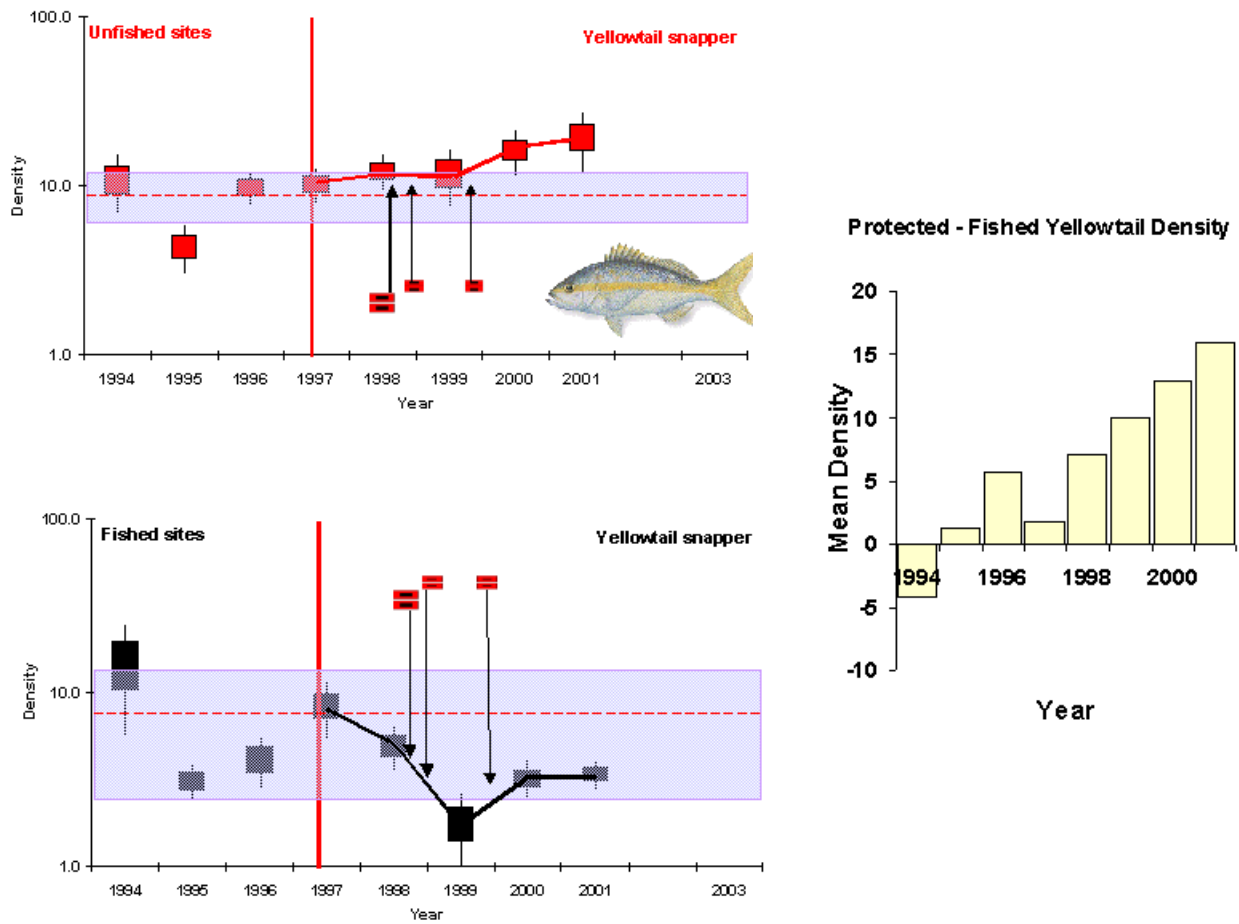
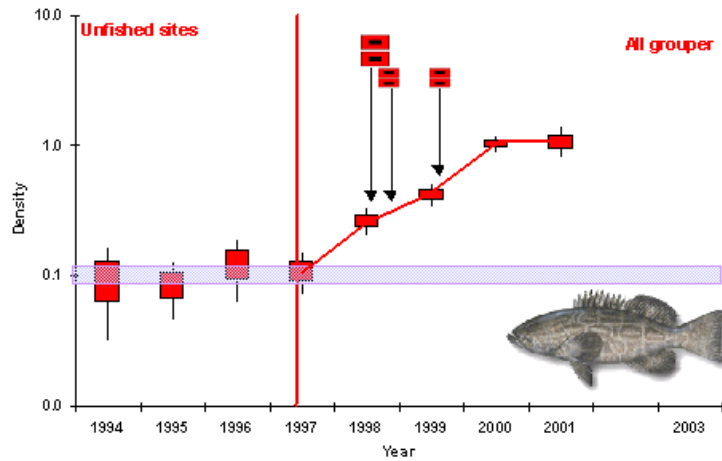


Figure 5. Comparison of yellowtail snapper total abundance trends in no-take Sanctuary Preservation Areas (top left) and exploited reference areas (bottom left). Vertical red line shows when no-take protection occurred. Horizontal blue bands show null model predictions based on 1994-1997 95% annual performance measures projected to 2005. Boxes show annual standard errors and whiskers show 95% confidence intervals. Flags show hurricane occurrences. Annual density trends obtained by subtracting reference area densities from densities in sanctuary protected areas are shown at right.



**Grouper Density Difference
(Protected - Fished)**

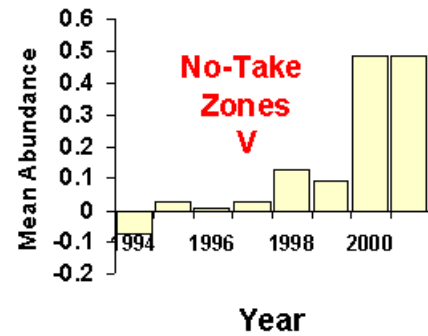
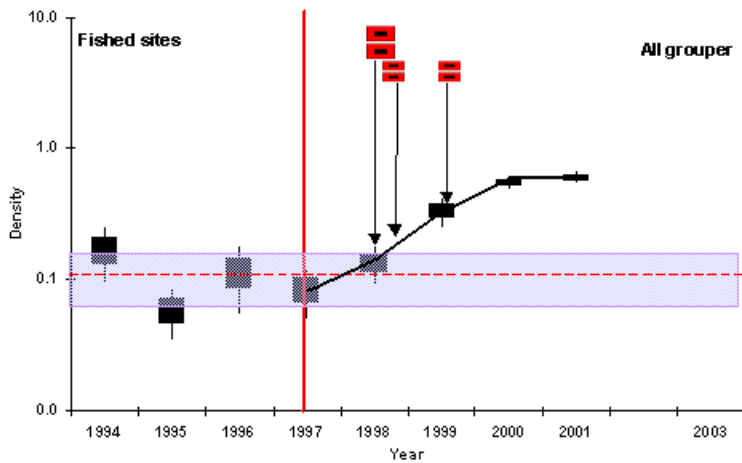


Figure 6. Comparison of combined exploitable grouper total abundance trends in no-take Sanctuary Preservation Areas (top left) and exploited reference areas (bottom left). Vertical red line shows when no-take protection occurred. Horizontal blue bands show null model predictions based on 1994-1997 95% annual performance measures projected to 2005. Boxes show annual standard errors and whiskers show 95% confidence intervals. Flags show hurricane occurrences. Annual density trends obtained by subtracting reference area densities from densities in sanctuary protected areas are shown at right.

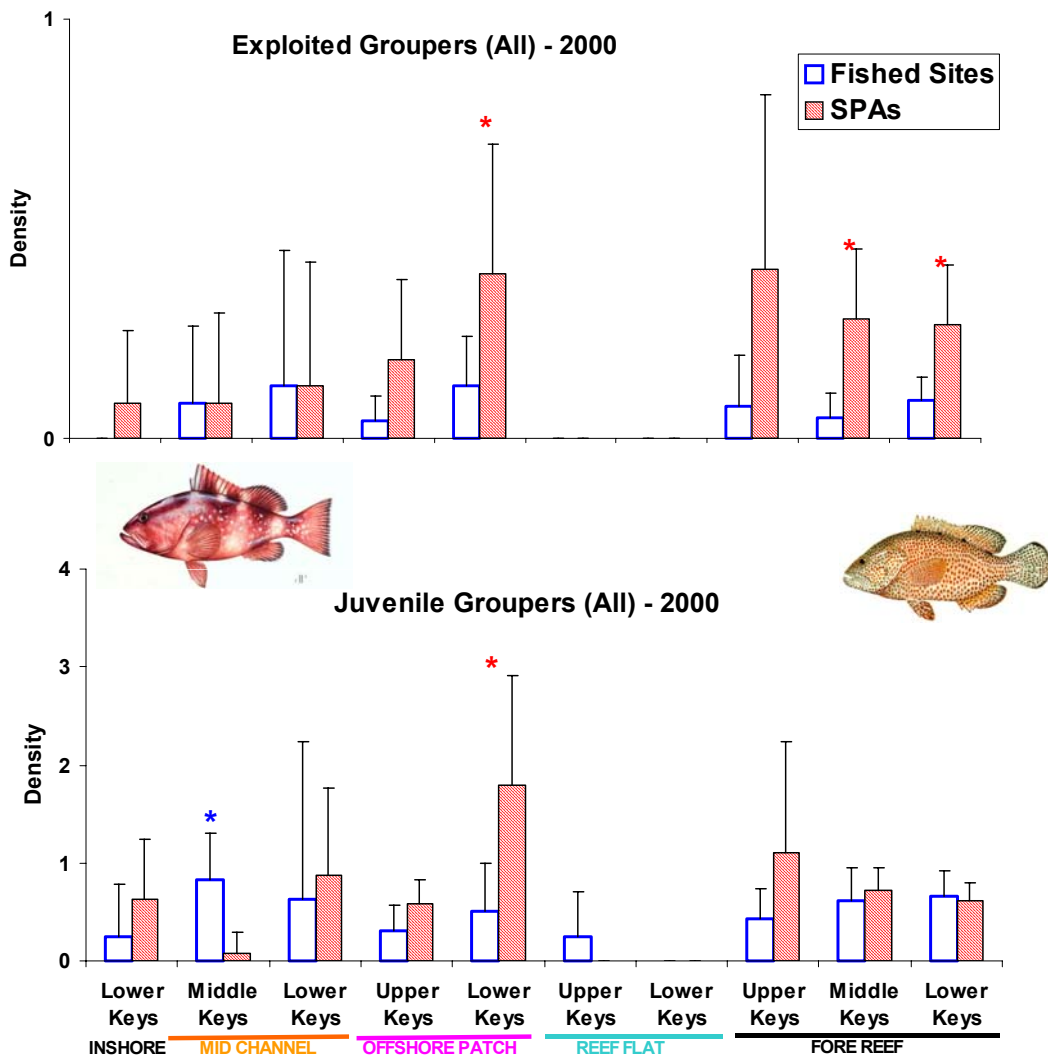


Figure 7. Density distribution of exploitable grouper (top panel) and juvenile grouper (bottom panel) in Sanctuary Preservation Areas (SPAs) and exploited reference areas by reef habitat type and region in the Florida Keys.

Figure 7 shows an example of an analysis of the density distribution of exploitable adult and juvenile grouper in Sanctuary Preservation Areas (SPAs) compared to fished area areas by reef habitat strata and by region. Significant higher density of adult exploitable grouper were observed in the Middle and Lower Keys in SPAs than in comparable fished areas in 2000.

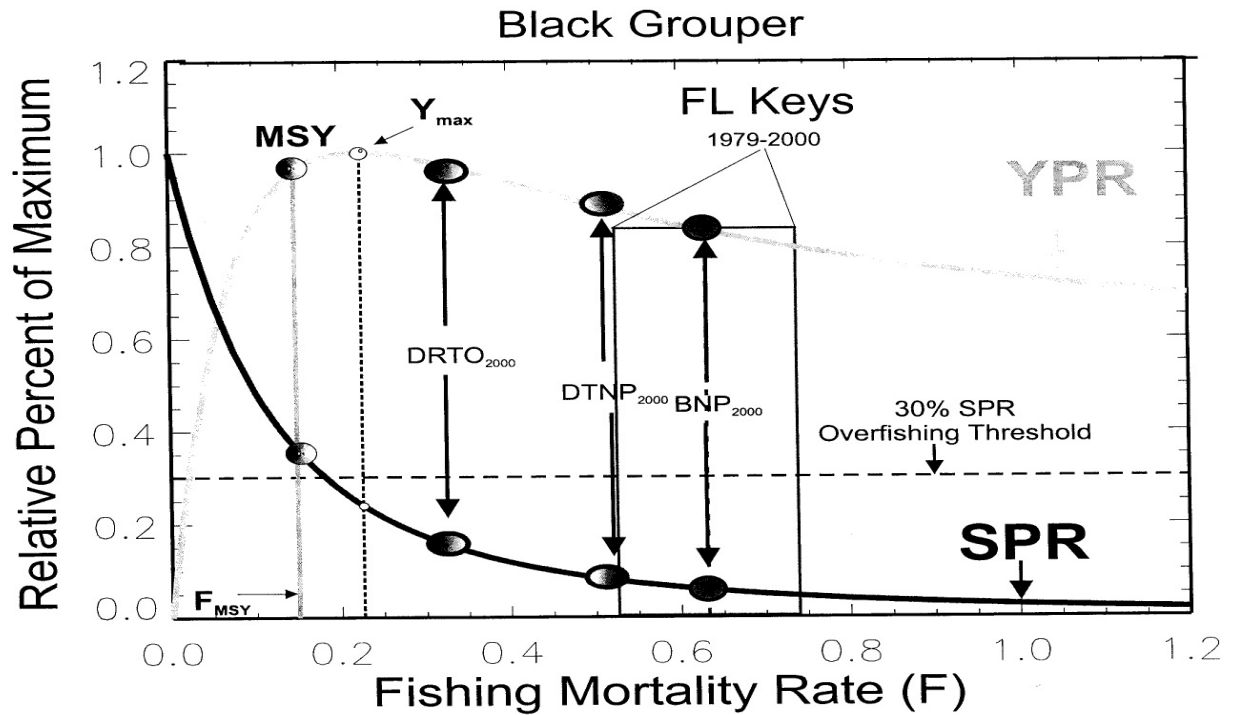


Figure 8. Regional differences of fishing mortality for black grouper determined by fishery independent monitoring of the Florida Keys (from Ault et al., 2001b).

(7. Stock assessment were generated for the Biscayne National Park (Ault et al. 2001a) and for the Tortugas region (Ault et al. 2001b). Results showed regional differences in stocks and exploitation levels for individual species of economic importance. Black grouper fishing mortality rates, for example, were most intense in Biscayne National Park and overall were many times higher than desirable to obtain maximum or optimum yield (Fig. 8). Populations of many reef fishes can be considered overfished in the Florida Keys based on calculated spawning potential ratios (Fig. 9).

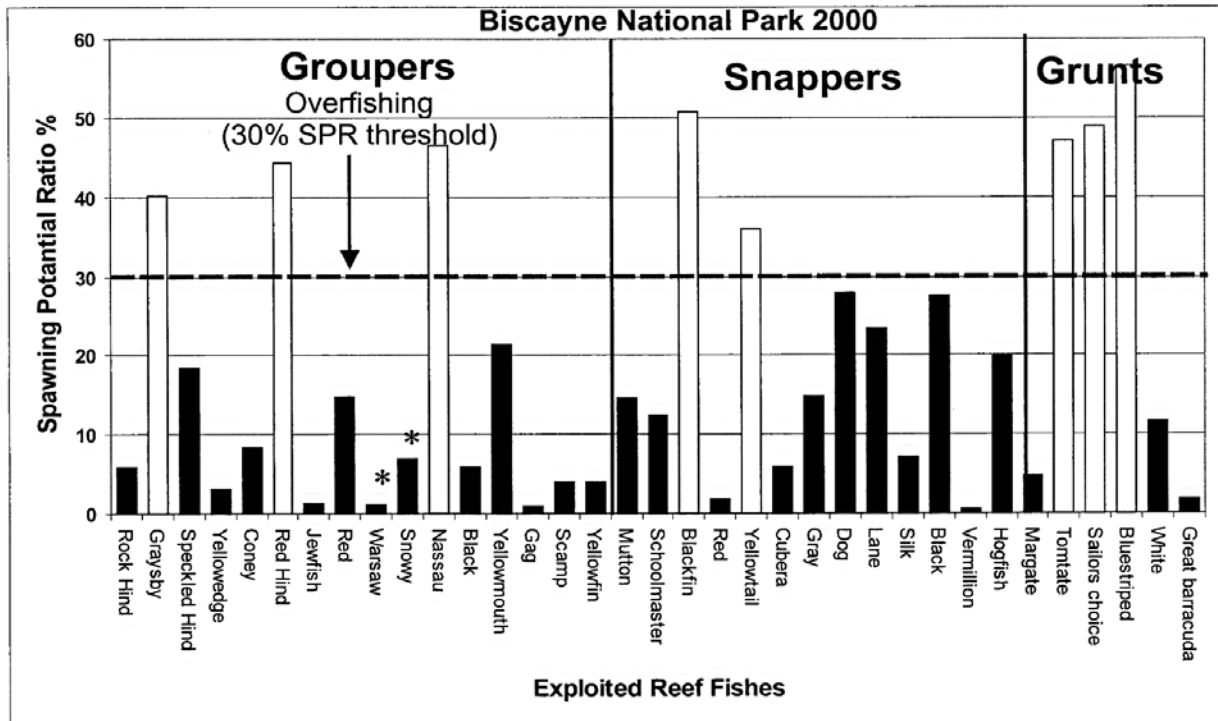


Figure 9. Calculated spawning potential ratios for reef fishes in Biscayne National Park (Ault et al., 2001a). Black bars show species considered overfished.

b. Work planned for next year: Intensive sampling will continue in the Florida Keys for Year 5 monitoring. This research will result in a detailed report showing trends in the Florida Keys since the management plan for the FKNMS became effective in 1997. This report will be used to update the Florida Fish and Wildlife Conservation Commission and the Florida Governor and Cabinet on progress in the FKNMS as part of a cooperative sanctuary agreement in 1997. Additional funding from the coral reef program will be used to support an extended Keys-wide cruise including a survey of the Tortugas region and ecological reserves.

2. Applications

a. Publications, Presentations and Workshops

PUBLICATIONS:

- Ault, J.S., Meester, G.A., Luo, J., Smith, S.G., and K.C. Lindeman. 2000. Dry Tortugas National Park draft environmental impact statement: natural resources affected environment. Report to the National Park Service, Denver Service Center. 39 p. plus appendices.
- Ault, J.S., M.P. Crosby, G. Davis, and E. Reese. 2000. Ecological assessments. Chapter 4, Pages 45-48 in Alternative Access Management Strategies for Marine and Coastal Protected Areas. U.S. Man and Biosphere Program, Washington, D.C. 168 p.
- Ault, J.S., S.G. Smith, J. Luo, G.A. Meester, J.A. Bohnsack, and S.L. Miller. 2001. Baseline multispecies coral-reef fish stock assessments for the Dry Tortugas. Final Report to National Park Service and Florida Keys National Marine Sanctuary. 123 p.
- Ault, J.S., S.G. Smith, J. Luo, G.A. Meester, J.A. Bohnsack, and S.L. Miller. 2002. Dry Tortugas multispecies coral reef fish stock assessments. NOAA Technical Memorandum NMFS-SEFSC-4XX. 150 p. plus appendices.
- Ault, J.S., S.G. Smith, G.A. Meester, J. Luo, and J.A. Bohnsack. 2001. Site Characterization for Biscayne National Park: assessment of fisheries resources and habitats. NOAA Technical Memorandum NMFS-SEFSC-468. 156 pp. (Available at: <http://www.sefsc.noaa.gov/REEF/publications.htm>)
- Ault, J.S., J. Luo, and J.D. Wang. 2002. A spatial ecosystem model to assess spotted seatrout population risks from exploitation and environmental changes. Chapter 15 in *Biology of Spotted Seatrout*. S. Bortone (ed.). CRC Press, Boca Raton, Florida.
- Bohnsack, J.A., M.W. Miller, and B. Haskell. 1999. Monitoring coral reefs and fishes in the Florida Keys. Pages 105-119 in J.E. Maragos and R. Grober-Dunsmore. (eds). *Proceedings of the Hawaii Coral Reef Monitoring Workshop, June 9-11, Honolulu, Hawaii*. 334 p.
- Bohnsack, J.A., B. Causey, M.P. Crosby, R.G. Griffis, M.A. Hixon, T.F. Hourigan, K.H. Koltz, J.E. Maragos, A. Simons, and J.T. Tilmant (*in press*). A rationale for minimum 20-30% no-take reef protection. *Proceedings of the 9th International Coral Reef Conference in Bali*.
- Chiappone, M., Miller, S.L., Swanson, D.W., Ault, J.S., and Smith, S.G. (2001). Comparatively high densities of long-spined sea urchins in the Dry Tortugas, Florida. *Coral Reefs* 20(2):137-138.
- Diaz, G.A., S.G. Smith, J.E. Serafy, and J.S. Ault. 2001. Allometry of the growth of pink shrimp *Farfantepenaeus duorarum* in a subtropical bay. *Trans. Am. Fish. Soc.* 130(2): 328-335.
- Lindeman, K.C., P.A. Kramer, and J.S. Ault. 2001. Comparative approaches to reef monitoring and assessment: an overview. *Bull. Mar. Sci.* 69(2):335-338.
- Lindeman, K.C., T.N. Lee, W.D. Wilson, R. Claro, and J.S. Ault. 2001. Transport of larvae originating in southwest Cuba and the Dry Tortugas: evidence for partial retention in grunts and snappers. *Gulf and Carib. Fish. Inst.* 52:732-747.
- Meester, G.A., J.S. Ault, S.G. Smith and A. Mehrotra. 2001. Integration of simulation and operations research into spatial fishery management decision making. *Sarsia*

86:543-558.

- Miller, M.W., A.S. Bourque, J.A. Bohnsack. *In press*. An analysis of the loss of *Acroporid* corals at Looe Key, Florida 1983-2000. *Coral Reefs*.
- Miller, S.L., M. Chappone, D.W. Swanson, J.S. Ault, S.G. Smith, G.A. Meester, J. Luo, E.C. Franklin, J.A. Bohnsack, D.E. Harper and D.B. McClellan. 2001. An extensive deep reef terrace on the Tortugas Bank, Florida Keys National Marine Sanctuary. *Coral Reefs* 20(3):299-300.
- Wang, J.D., J. Luo, and J.S. Ault. 2002. Flows, salinity and some implications on larval transport in south Biscayne Bay, Florida. *Bulletin of Marine Science*, in press.

PRESENTATIONS and WORKSHOPS:

- Dec, 2001 - Florida Keys National Marine Sanctuary Report Card, NOAA Headquarters,
- Oct, 2001 - Nicholas School on the Environment, Duke University, Beaufort, N.C.
- Oct 10, 2001 - Mid Atlantic States Fishery Management Council, New Bern, NC
- Oct 19, 2001 - Florida Artificial Reef Summit. Broward Co, FL
- Oct 2-3, 2001 - Biscayne National Park and Florida Fish and Wildlife Commission workshop on Future Conditions for Biscayne National Park. Tallahassee, FL
- Sep 10-11, 2001 - Biological Review Team, Merritt Island National Wildlife Refuge, Titusville, FL
- Aug 2001 - Dry Tortugas National Park Workshop, Key West, FL
- Jun 2001 - Review of Scientific Activities at Dry Tortugas National Park, Homestead, FL
- Jun 2001 - Grays Reef National Marine Sanctuary, Savannah, GA.
- Jun 2001 - Southeast Fishermen's Association Annual Meeting, Jacksonville, FL
- Jun 2001 - Biscayne National Park and Florida Fish and Wildlife Conservation Commission meeting.
- May 2001 - Biscayne National Park and Biscayne Bay Partners Workshop, Homestead, FL
- Apr 2001 - Florida Bay Conference, Key Largo, FL
- Dec 2000 - Florida Keys Higher Trophic Level Workshop, Marathon, FL
- Nov 5, 1999 - Florida Bay Workshop, Key Largo
- Nov 1-4, 1999 - Gulf and Caribbean Fisheries Institute, Key West

- b. Applications to management or research - We have provided a baseline to evaluate long term changes in fish populations in the Florida Keys. Data are being used by Southeast Fisheries Science Center (NMFS), Florida Keys National Marine Sanctuary, Dry Tortugas National Park, Biscayne National Park, and the Florida Fish and Wildlife Conservation Commission, and the South Atlantic Fishery Management Council to revise management plans and to monitor the condition of coral reef resources in the Florida Keys. Preliminary results on no-take marine reserves have been presented at national and international fora:
- Nov 2001 - Gulf and Caribbean Fisheries Institute, Keynote Address, Turks and Caicos

Oct 2001 - Biodiversity Convention ad hoc Technical Working Group on Marine and Coastal Protected Areas, Auckland, New Zealand
 Aug 2001 - American Fishery Society Annual Meeting, Phoenix, AZ
 Aug 2001 - Second Symposium on Fisheries, Oceanography and Society, Woods Hole, MA
 Aug 2001 - Article in Miami Herald, Metro Section
 Jun 2001 - Marine Conservation Biology Meeting, San Francisco, CA
 Jun 2001 - Association of Marine Laboratories of the Caribbean Annual Meeting, Keynote Address, La Parguara Puerto Rico
 June 2001 - New York Times Science Times article
 May 2001 - SCRIPPS Center for Marine Biodiversity, San Diego, CA
 Apr 2001 - George Wright Society 2001, Denver, CO
 Feb 2001 - American Association for the Advancement of Science Annual Meeting, San Francisco

c. Data or information products: (See publications)

1. Data summaries or reports have been provided to the agencies listed in paragraph 2b. (above).
2. A summary report of monitoring SPAs in the Florida Keys National Marine Sanctuary is available on their website:
www.fknms.nos.noaa.gov

d. Partnerships established with other agencies

1. Collaboration with National Park Service to advise in revising Biscayne National Park's Management plan
2. Collaboration with National Park Service in developing Research Natural Area designation for Dry Tortugas National Park
3. Collaboration with Florida Keys National Marine Sanctuary in assessing changes in fish populations during the first 5 years within SPAs, Ecological Reserves, Research zones, and open access areas throughout the Sanctuary.
4. Collaboration with the Florida Fish and Wildlife Conservation Commission to develop management strategies for Biscayne National Park and the Florida Keys.
5. Collaboration with the National Undersea Research Program (NURP), Wilmington, N.C. for assessing reef habitat in the Florida Keys.

3. Expenditures

- a. Scheduled expenditures for this period: \$208,600
- b. Actual expenditures for this period: \$208,600
- c. Problems and differences between scheduled and actual expenditures NA