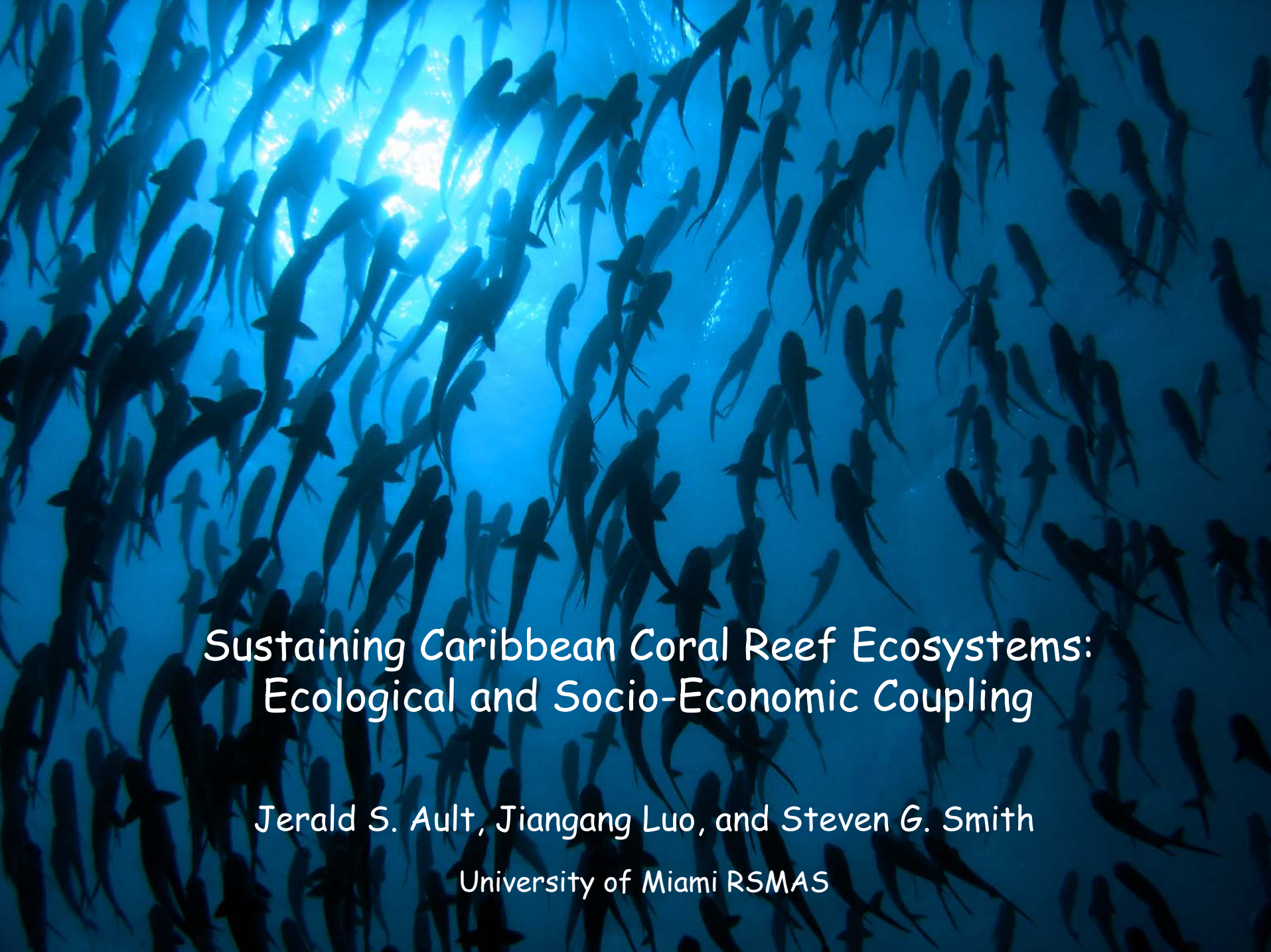
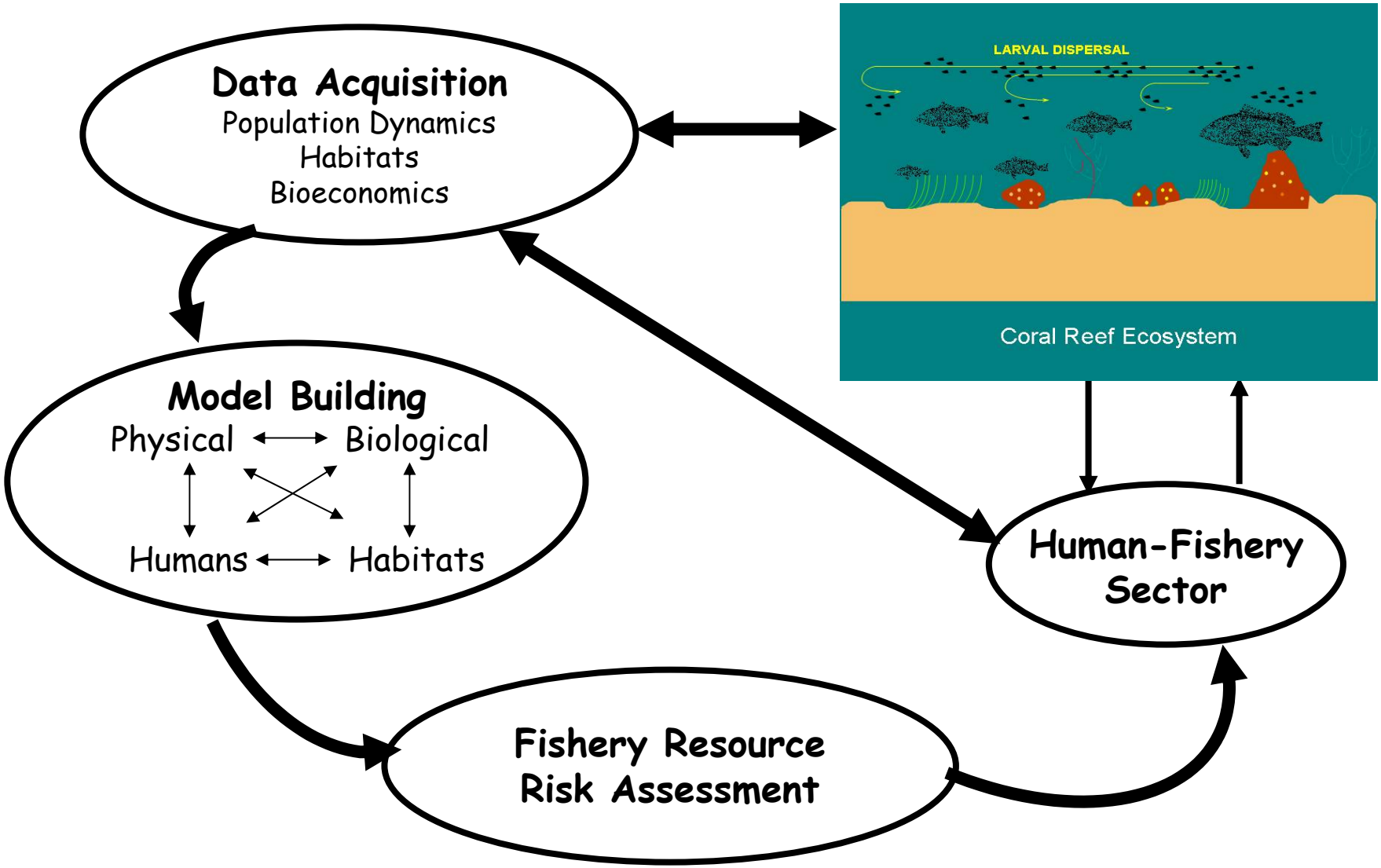


Sustaining Caribbean Coral Reef Ecosystems: Ecological and Socio-Economic Coupling

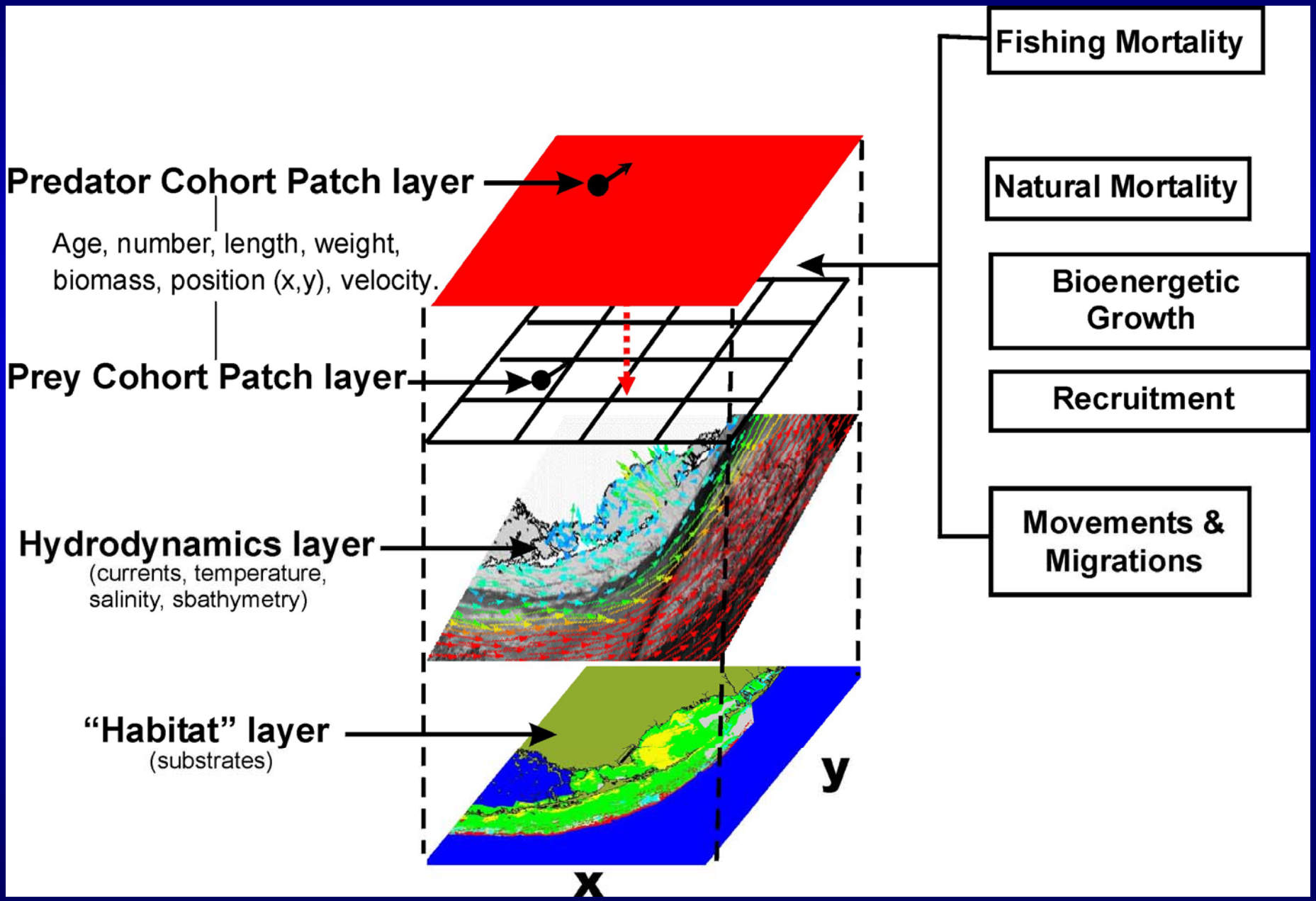
Jerald S. Ault, Jiangang Luo, and Steven G. Smith

University of Miami RSMAS

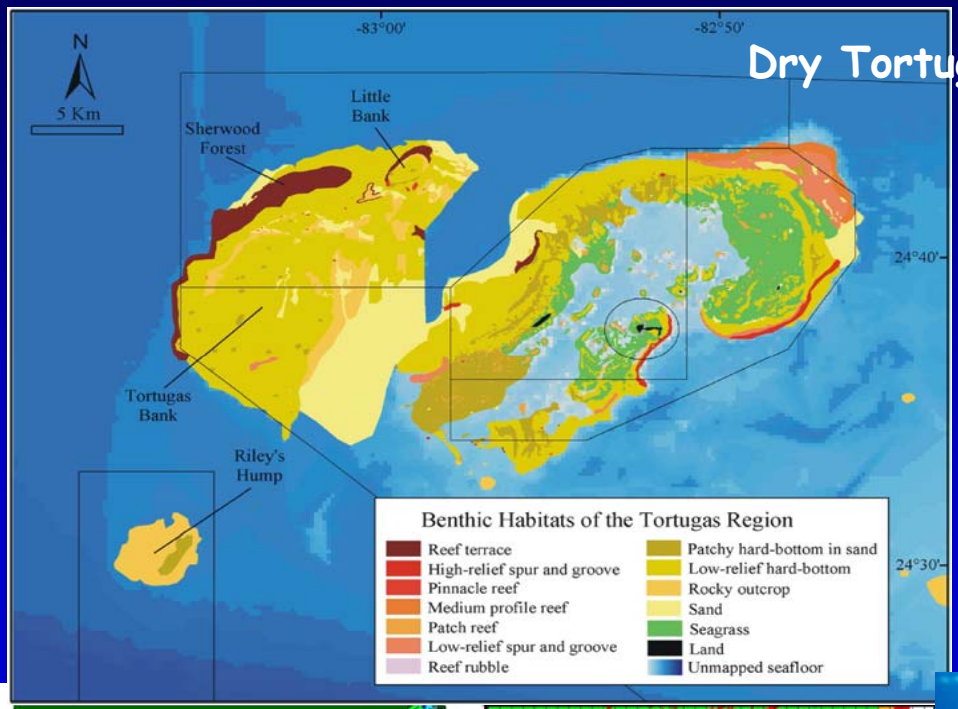
Fishery Systems Science

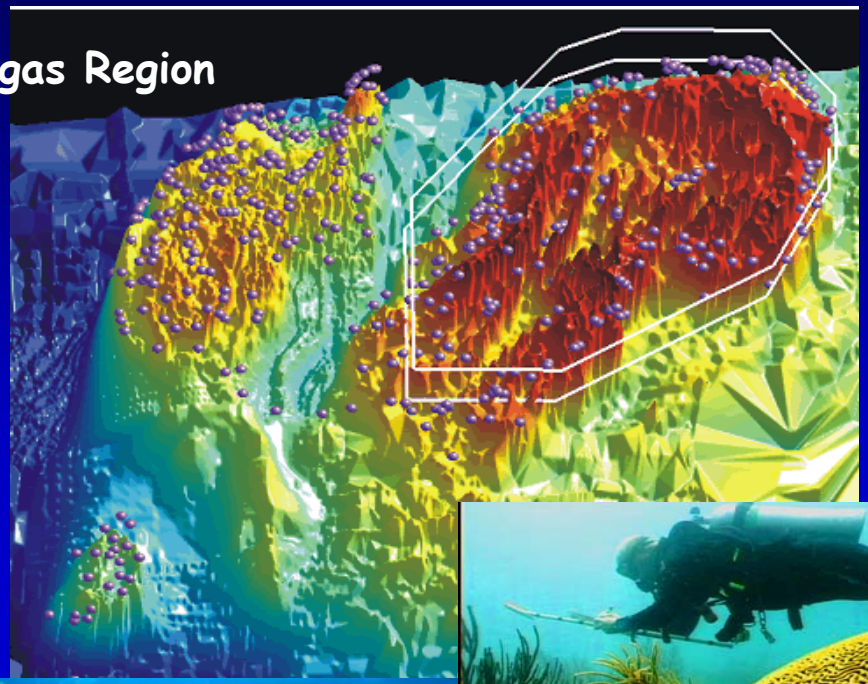


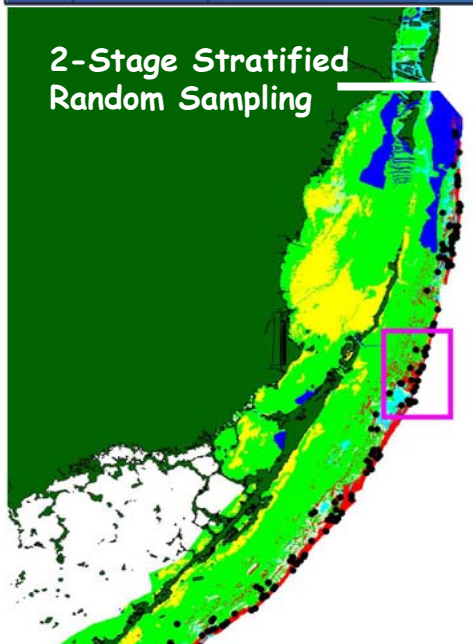
GeoSpatial Model of Biophysical Dynamics

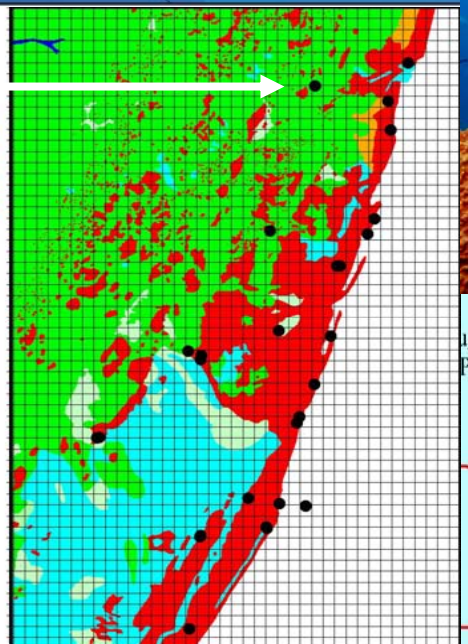


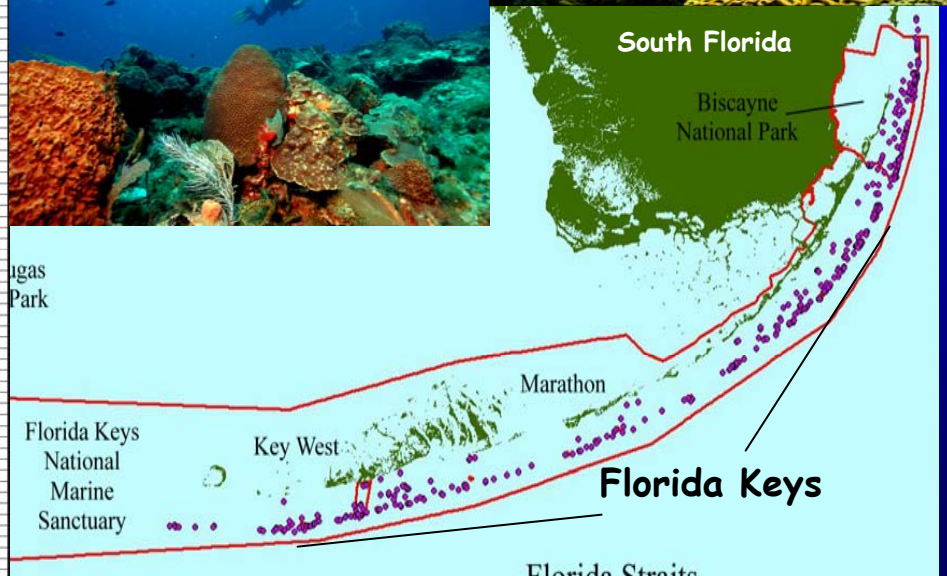
Ecosystem-based Fishery-Independent Survey Sampling Strategy



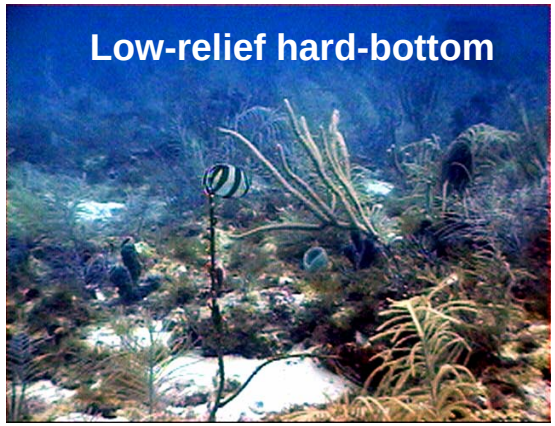


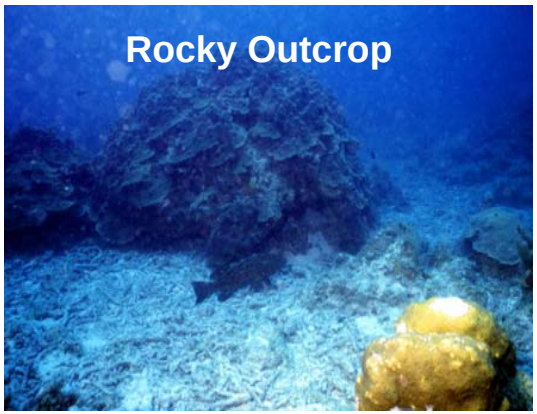


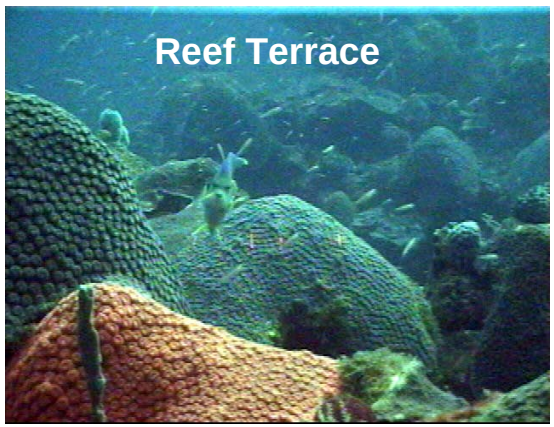


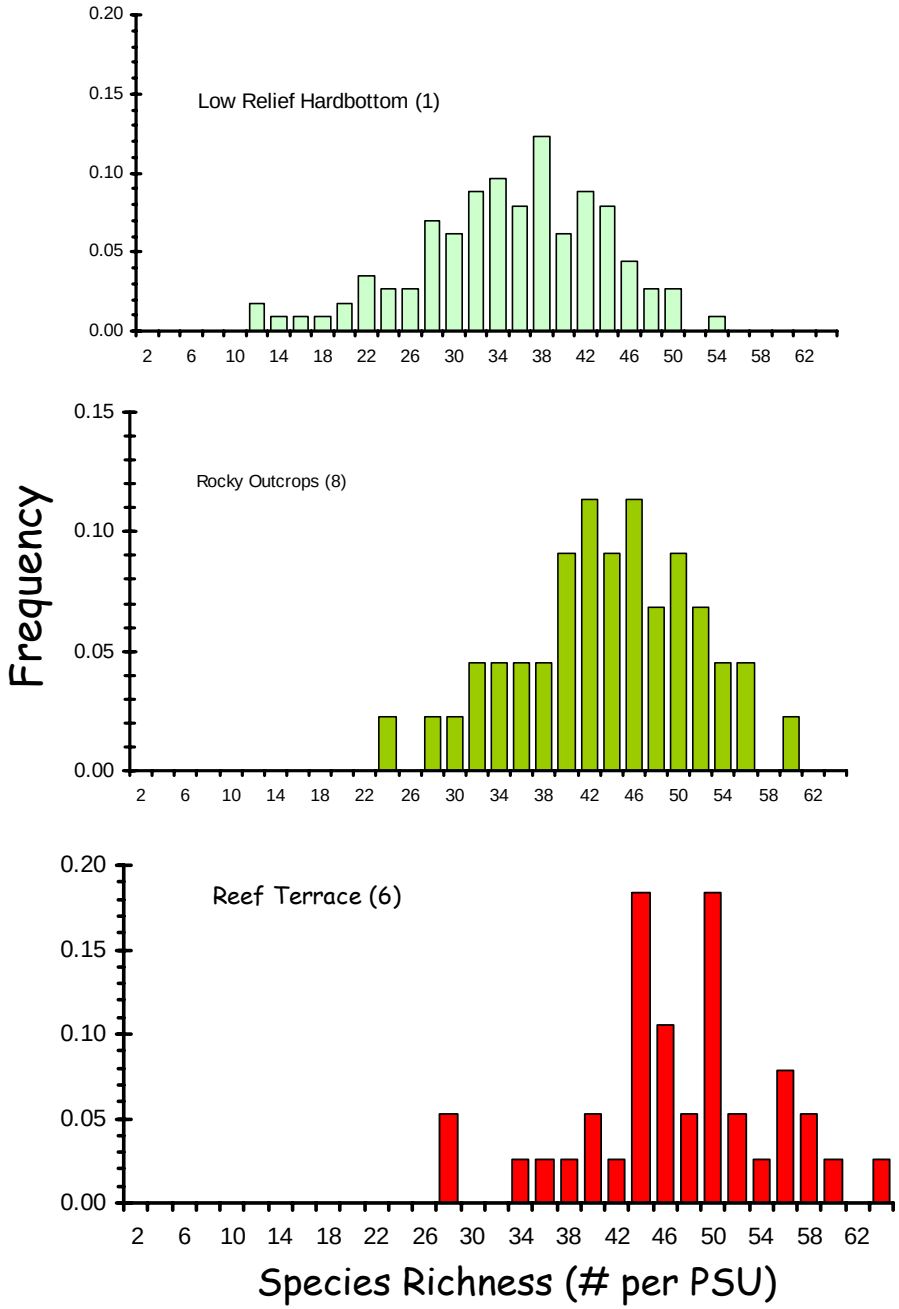


Coral Reef Fish Diversity by Habitat Types

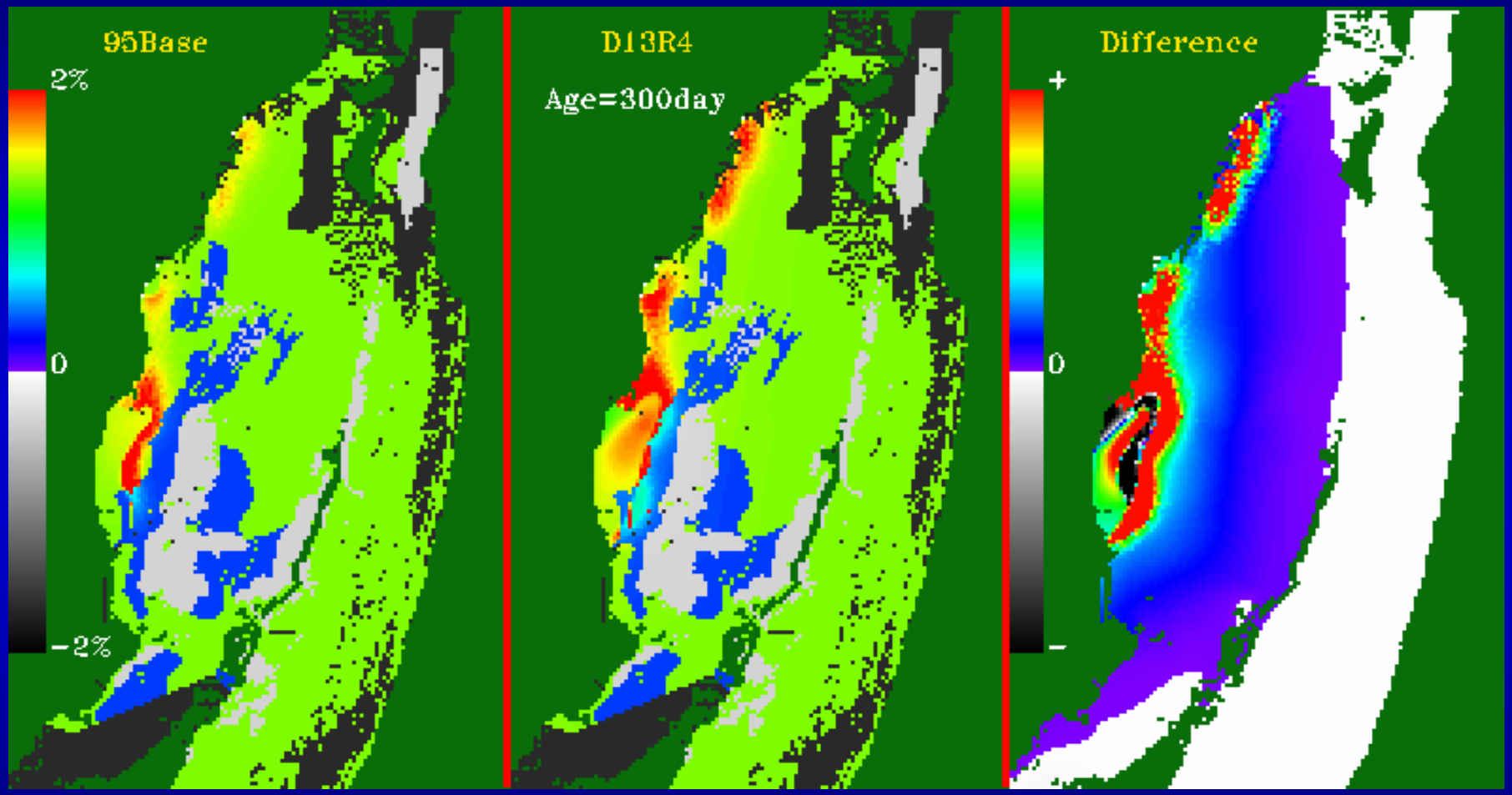






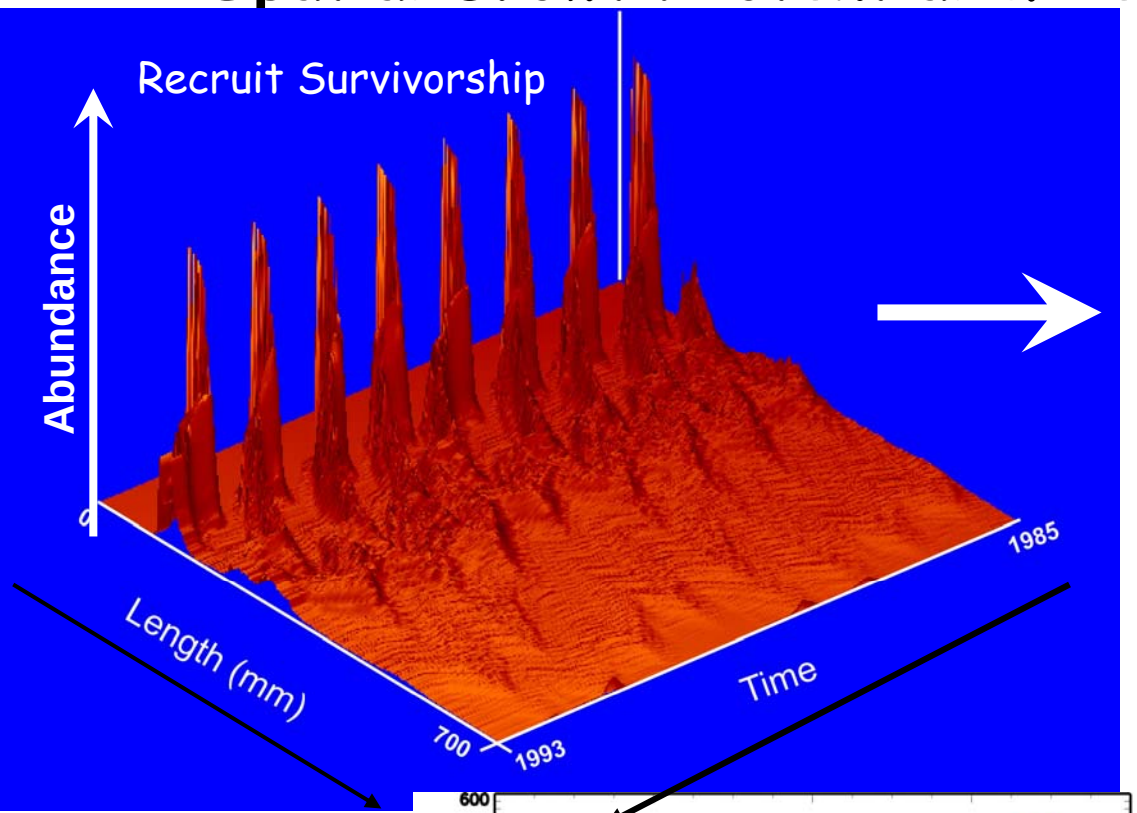


Spatial Growth Rate Potential for Predator

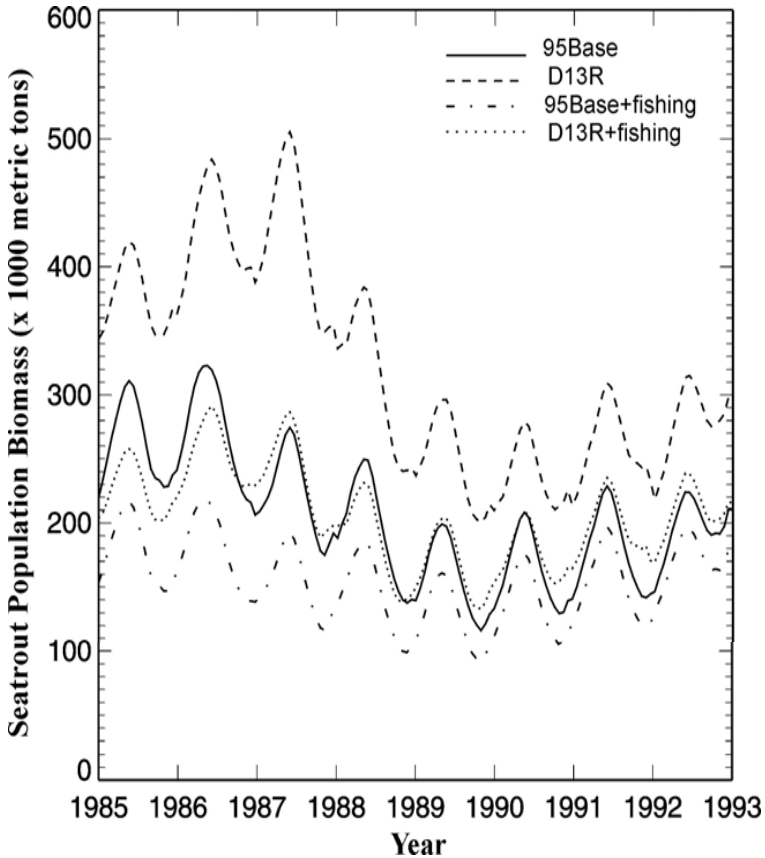


Biophysical factors affecting "*spatial growth rate potential*" measured as $\frac{dW}{Wdt}$

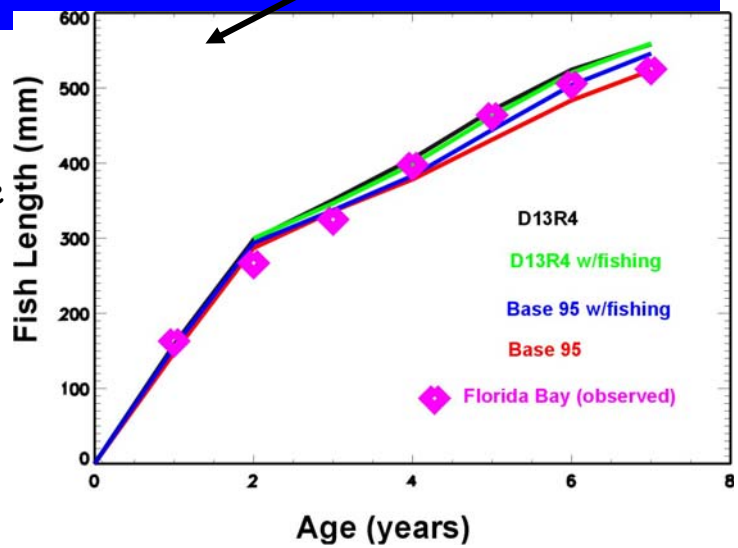
Spatial Growth Potential & Resource Abundance



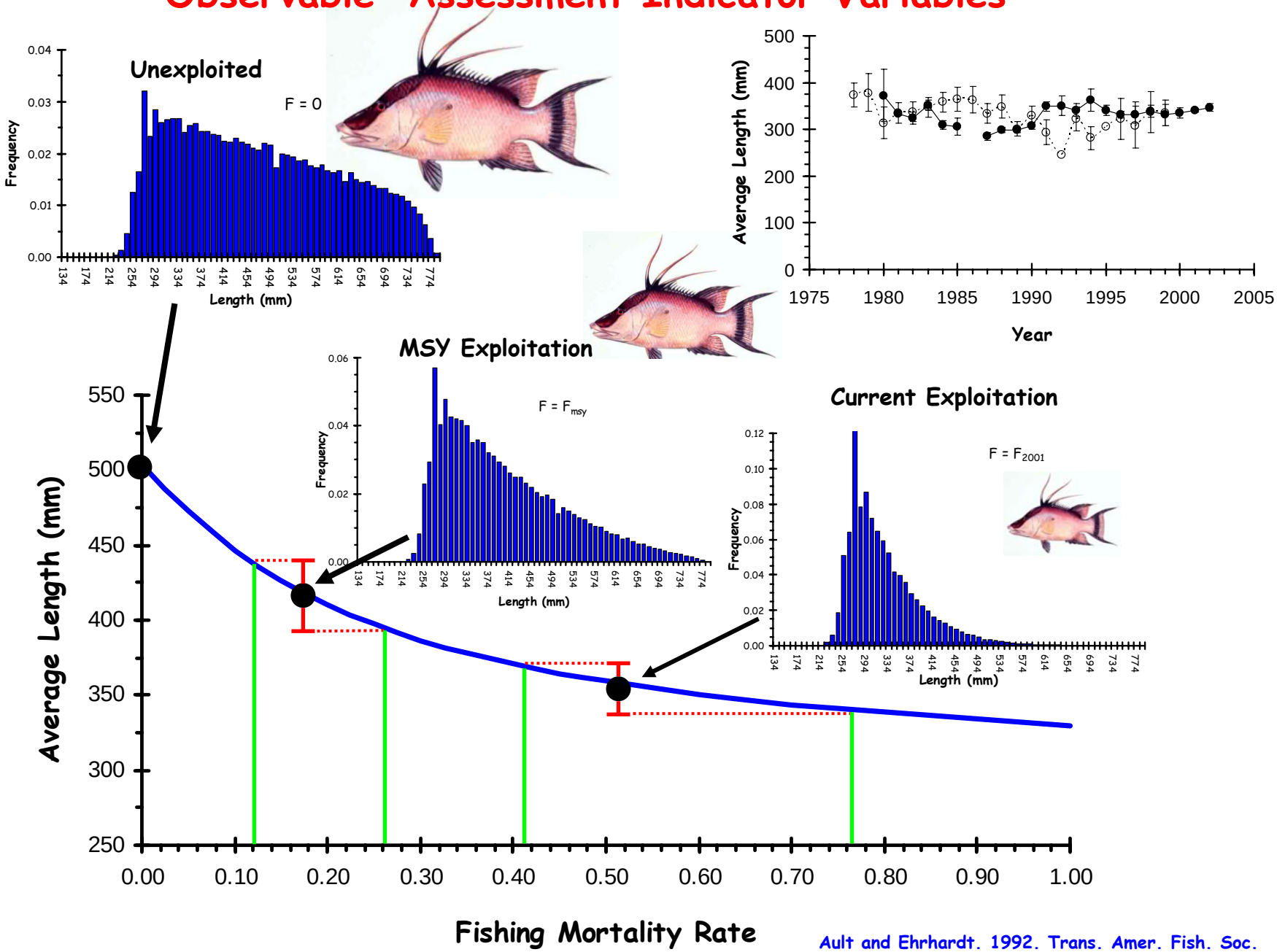
Population Biomass



Population Abundance and Growth

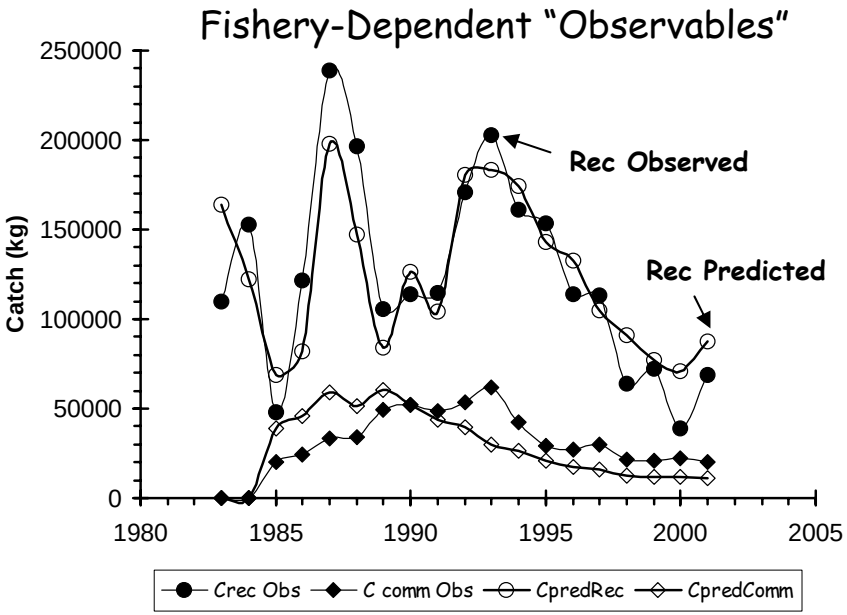


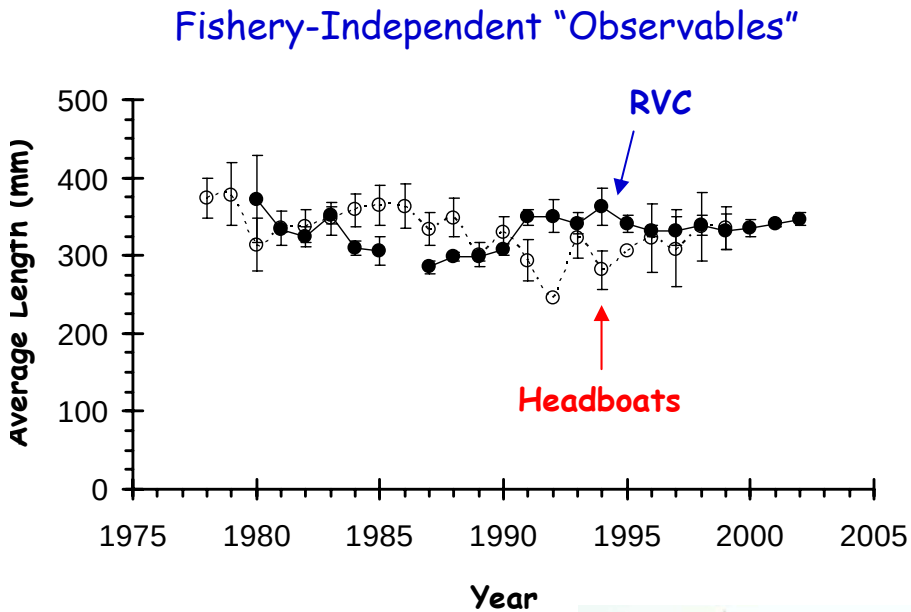
"Observable" Assessment Indicator Variables

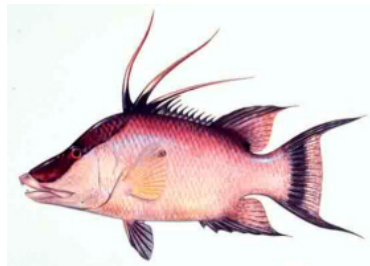


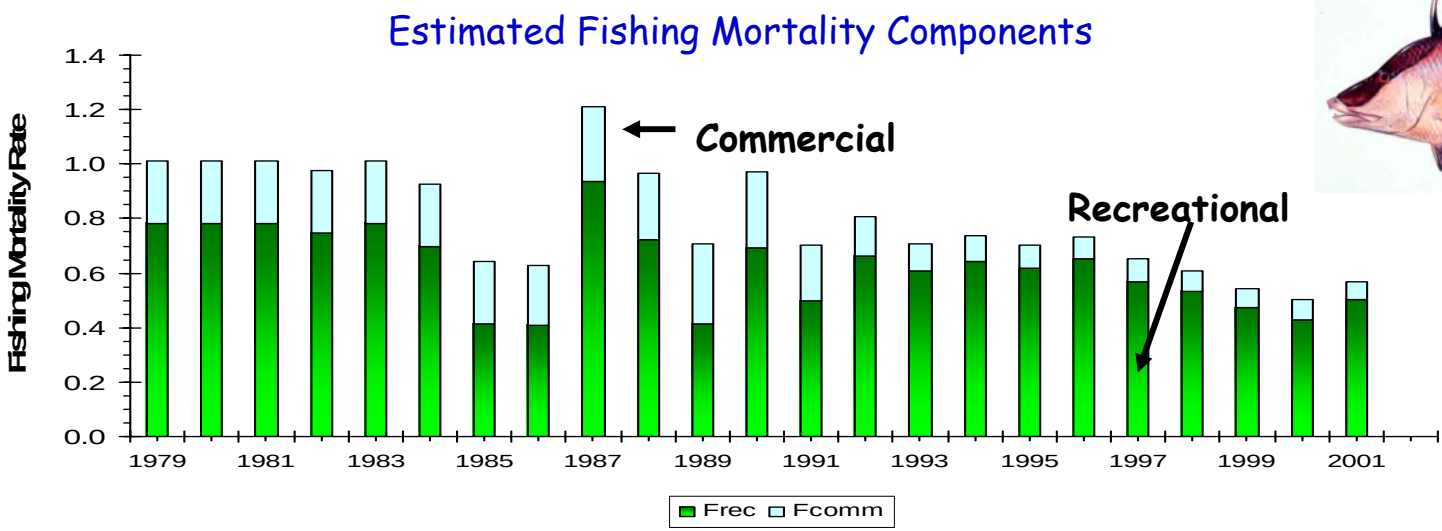
Ault and Ehrhardt. 1992. Trans. Amer. Fish. Soc.
Ault, Bohnsack, & Meester. 1998. Fishery Bulletin

Model Cross-Validations

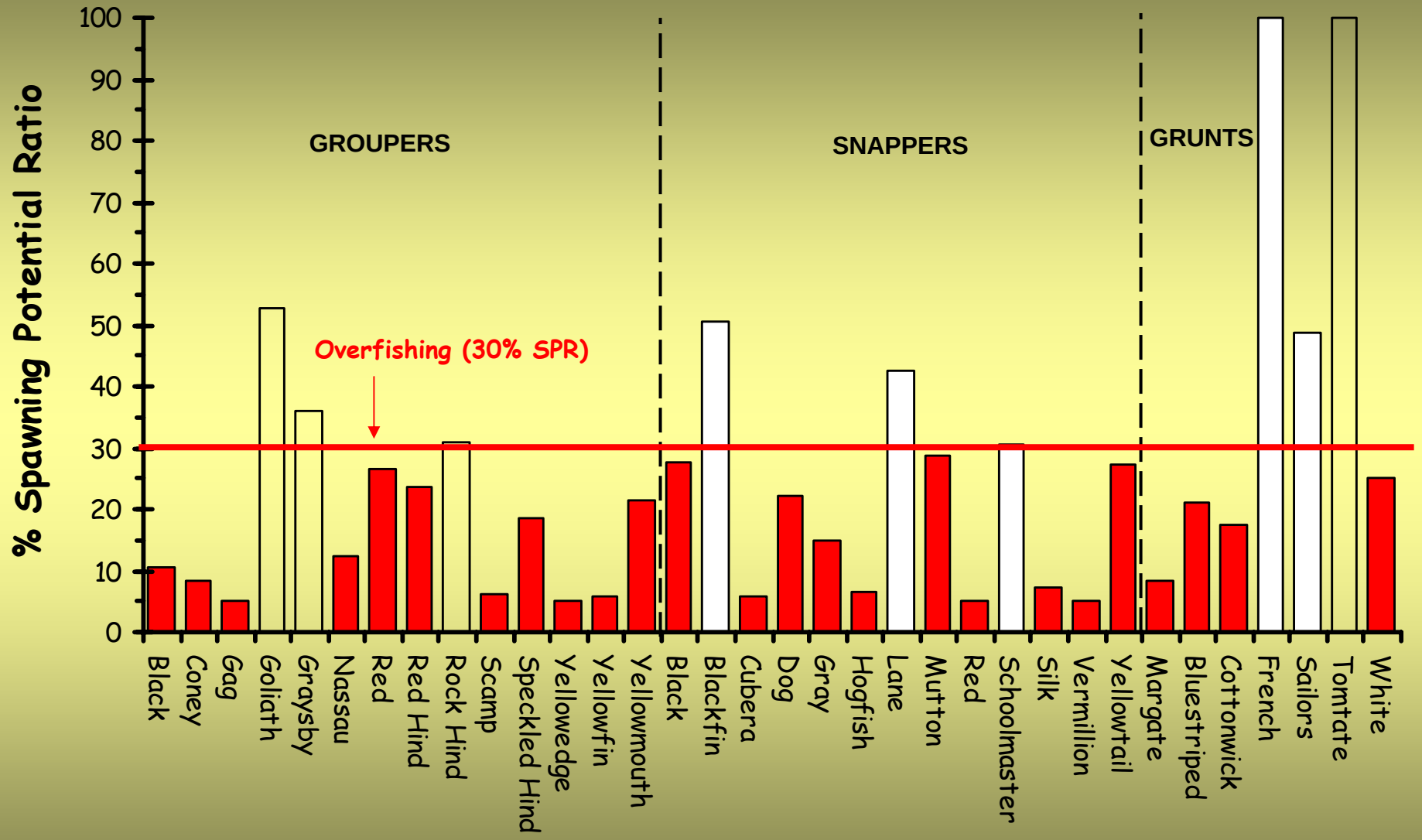






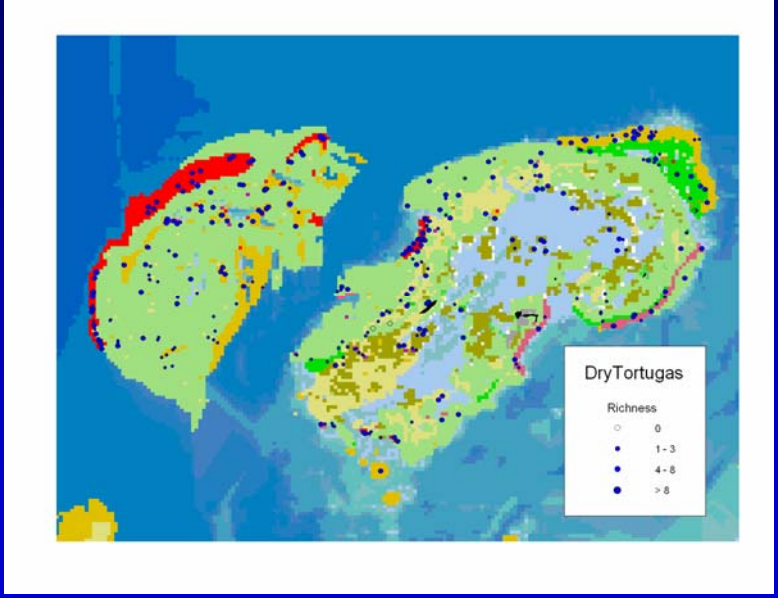


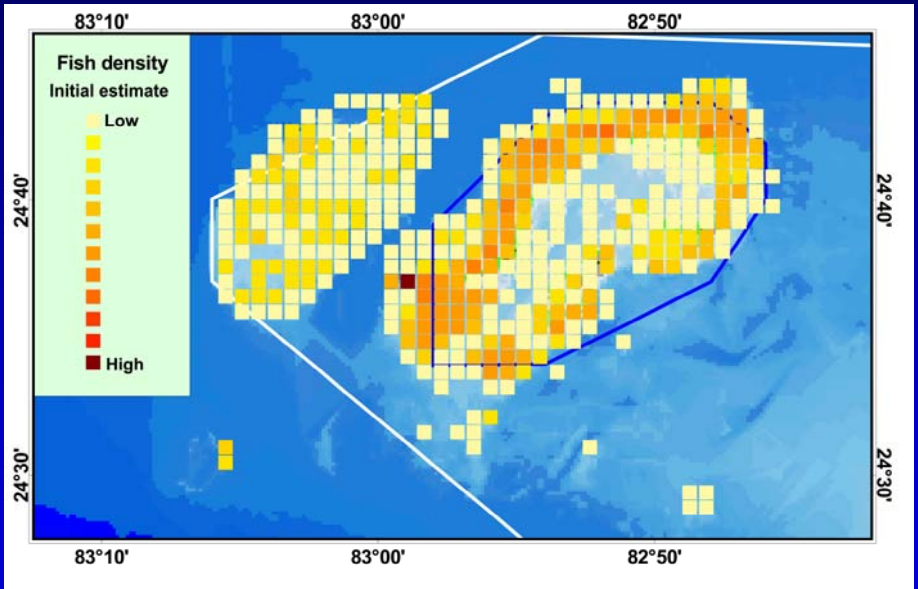
Management Benchmarks for the Multispecies Reef Fish Community

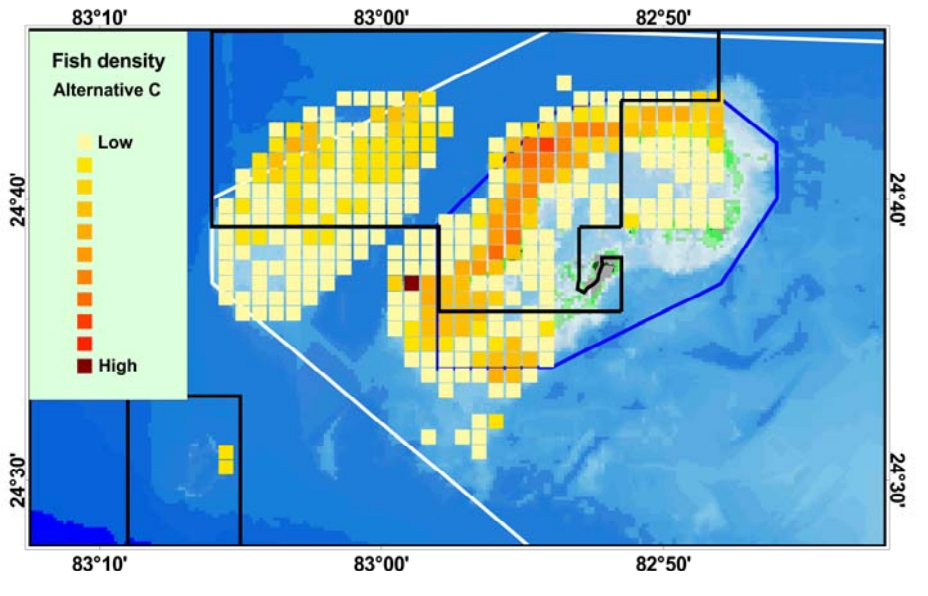


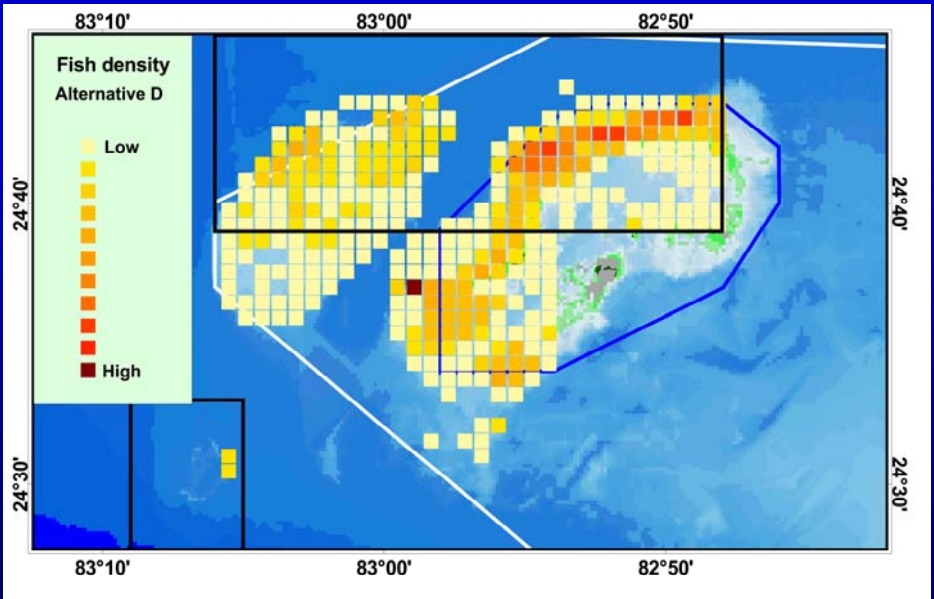
Ault, J.S,, Bohnsack, J.A., and G.A. Meester. 1998. Fishery Bulletin 96:395-414
(Best Publication Award & NOAA Certificate of Achievement 2002)

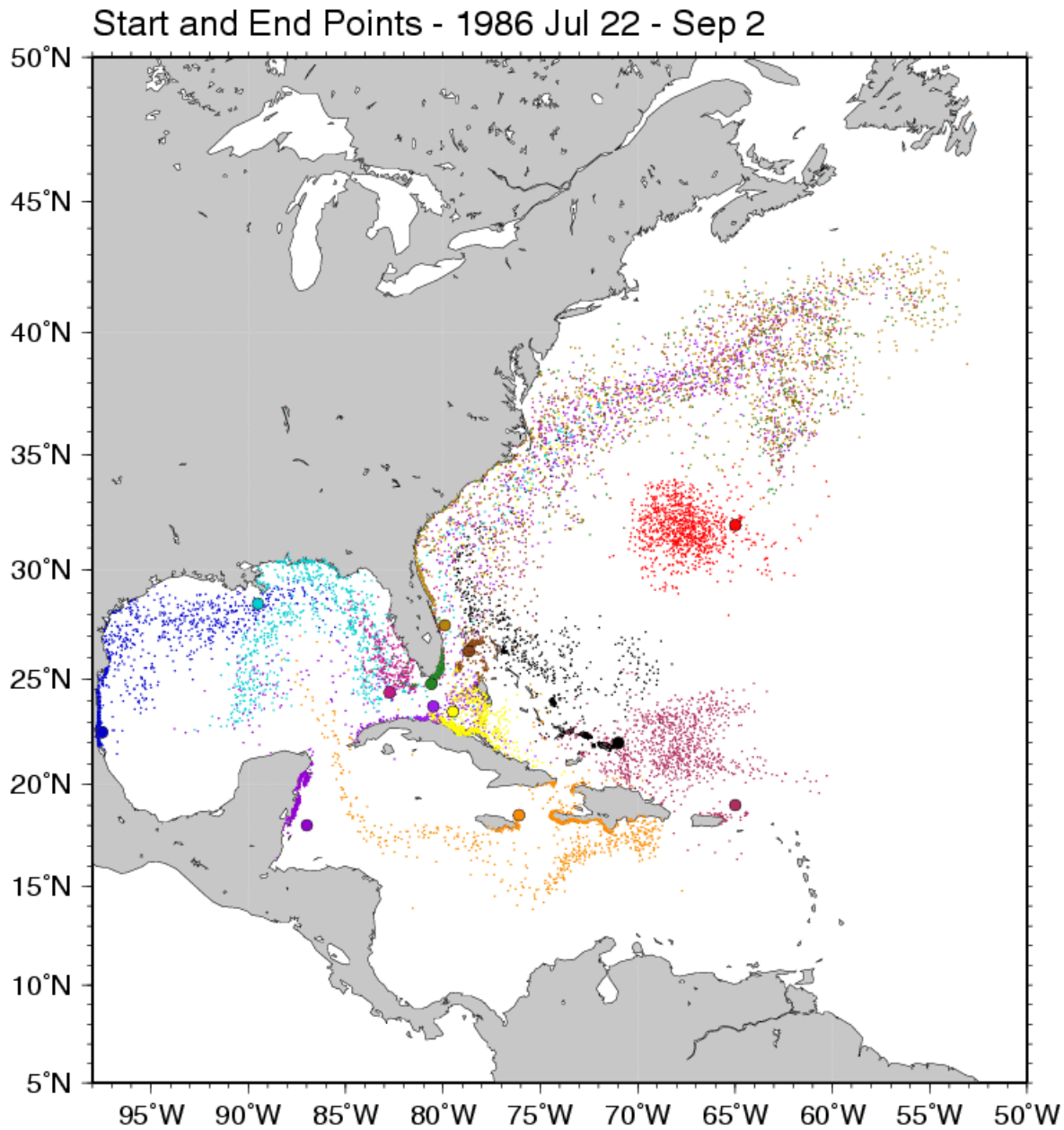
Designing Marine Reserves for Fishery Management



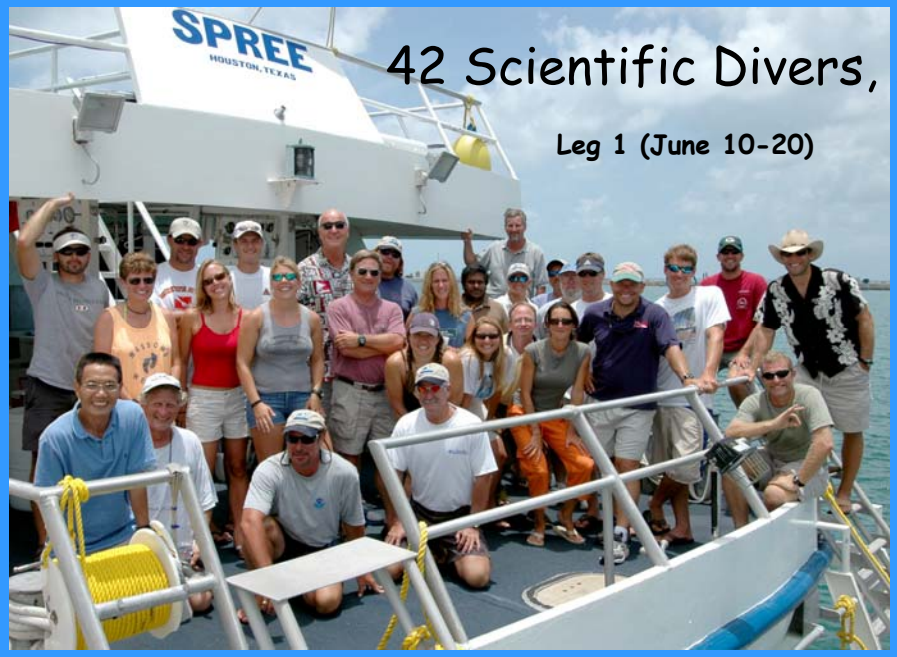







Start and End Points - 1986 Jul 22 - Sep 2
50°N
45°N
40°N
35°N
30°N
25°N
20°N
15°N
10°N
5°N
95°W
90°W
85°W
80°W
75°W
70°W
65°W
60°W
55°W
50°W

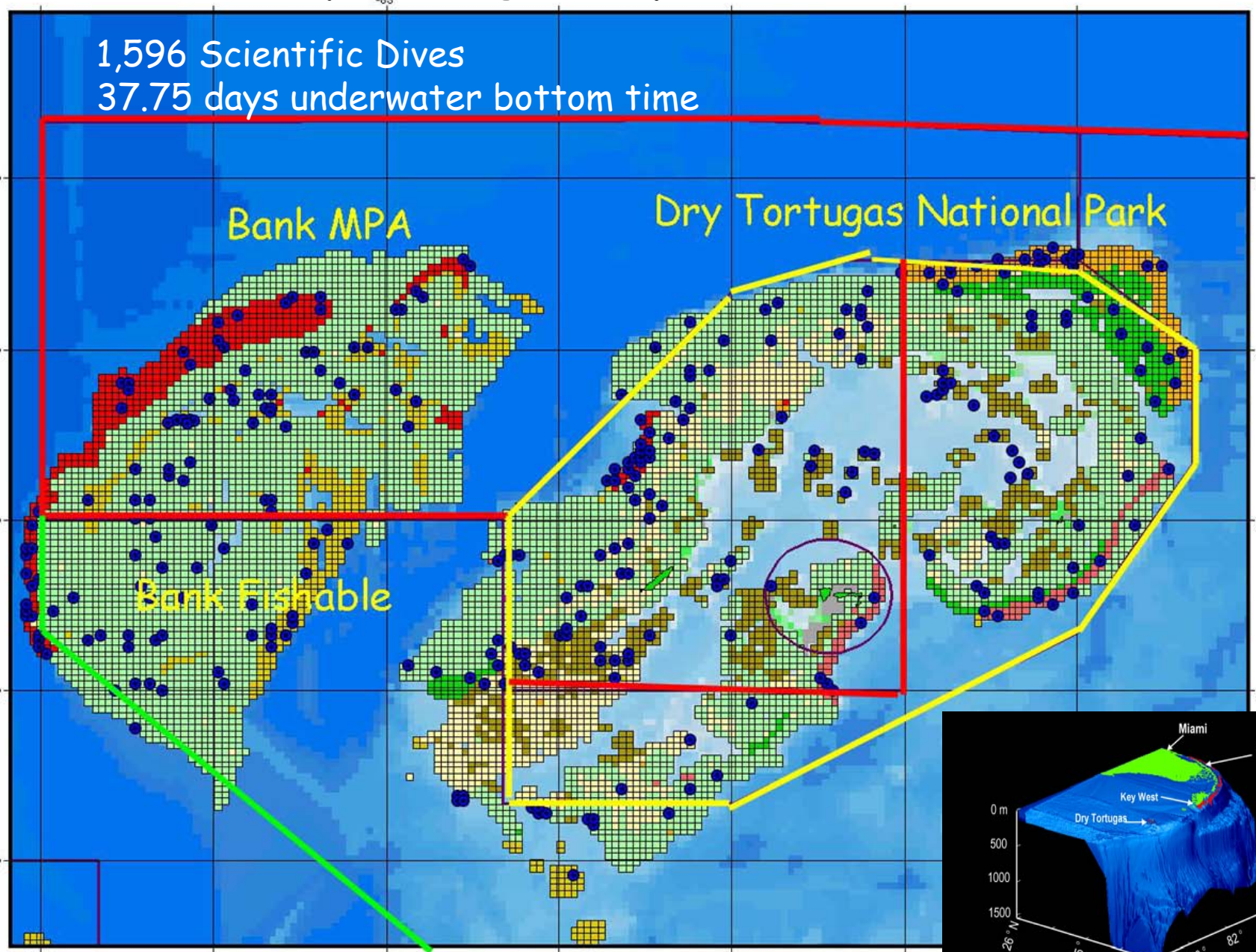
42 Scientific Divers, 10 Dive Support Personnel

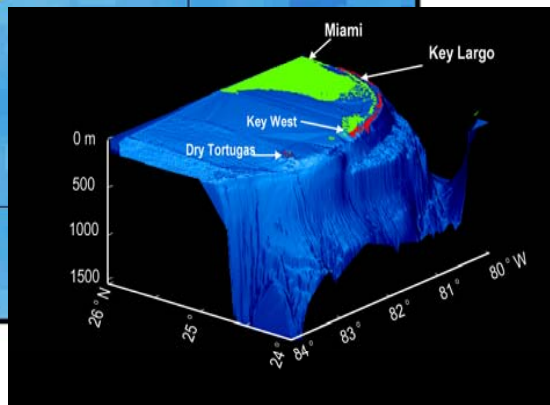


Leg 1 (June 10-20)

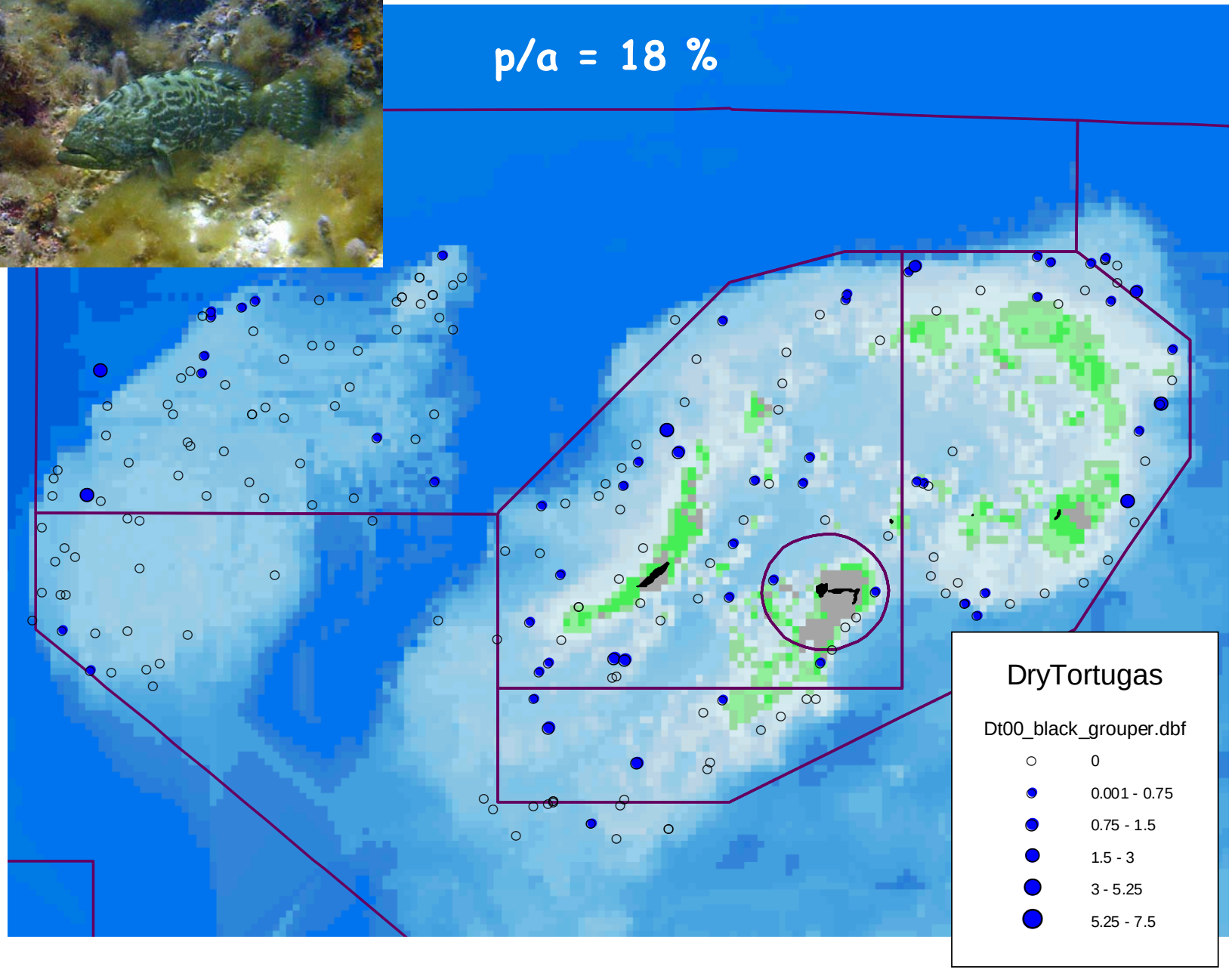
Leg 2 (June 22 - July 1)

Dry Tortugas Expedition 2004

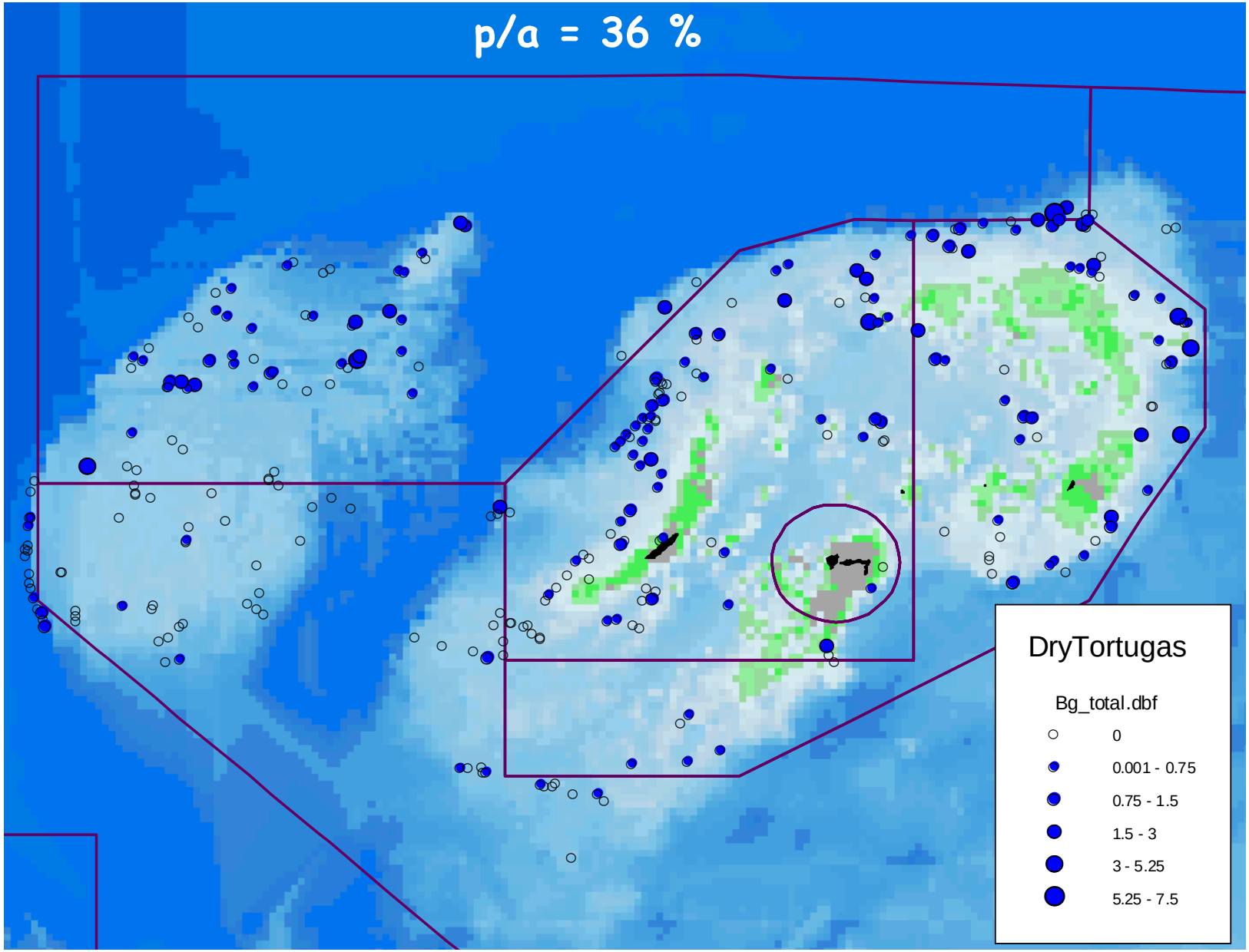




Black Grouper 2000

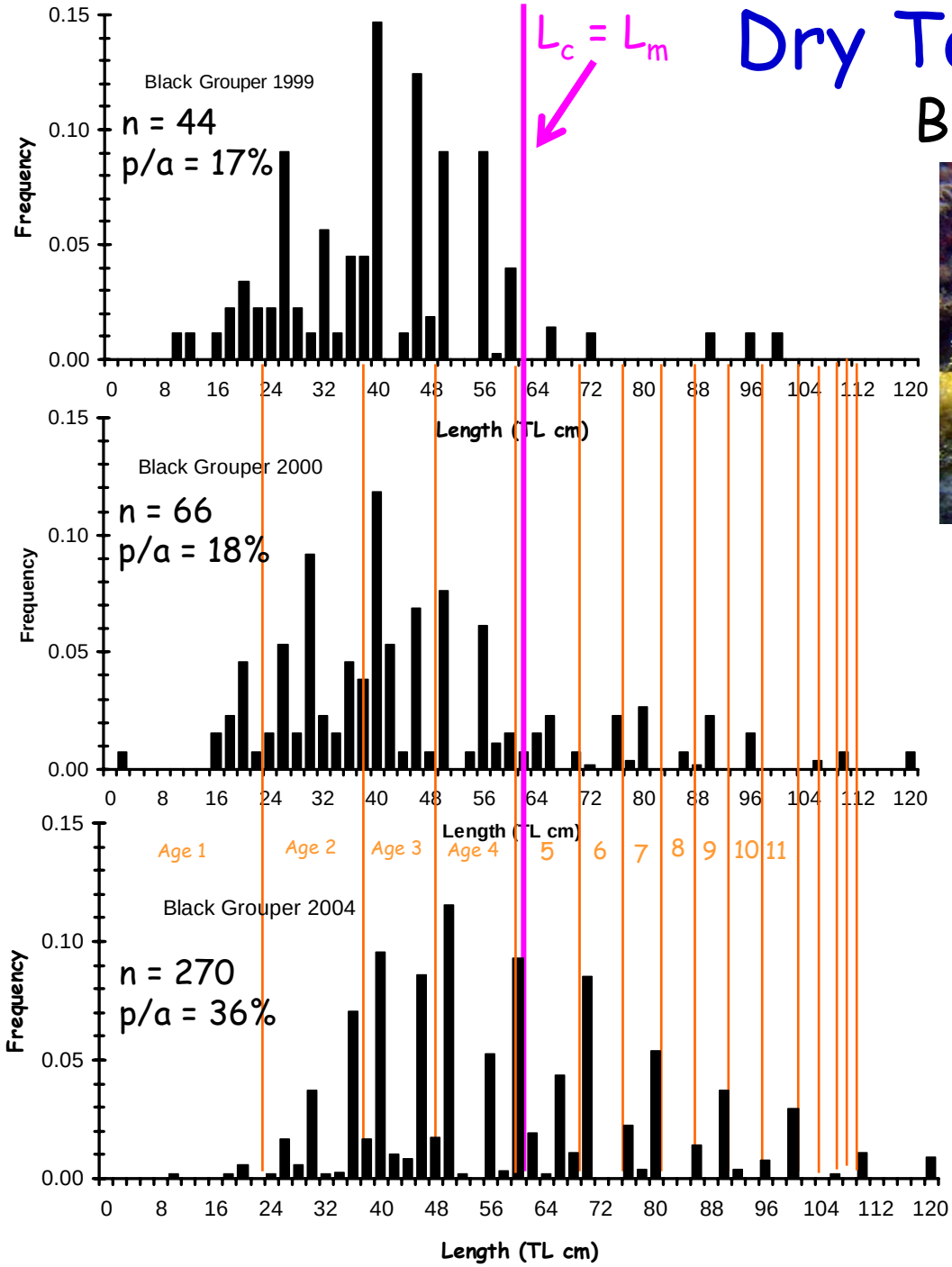


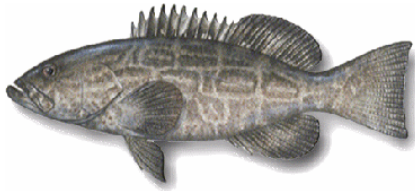
Black Grouper 2004

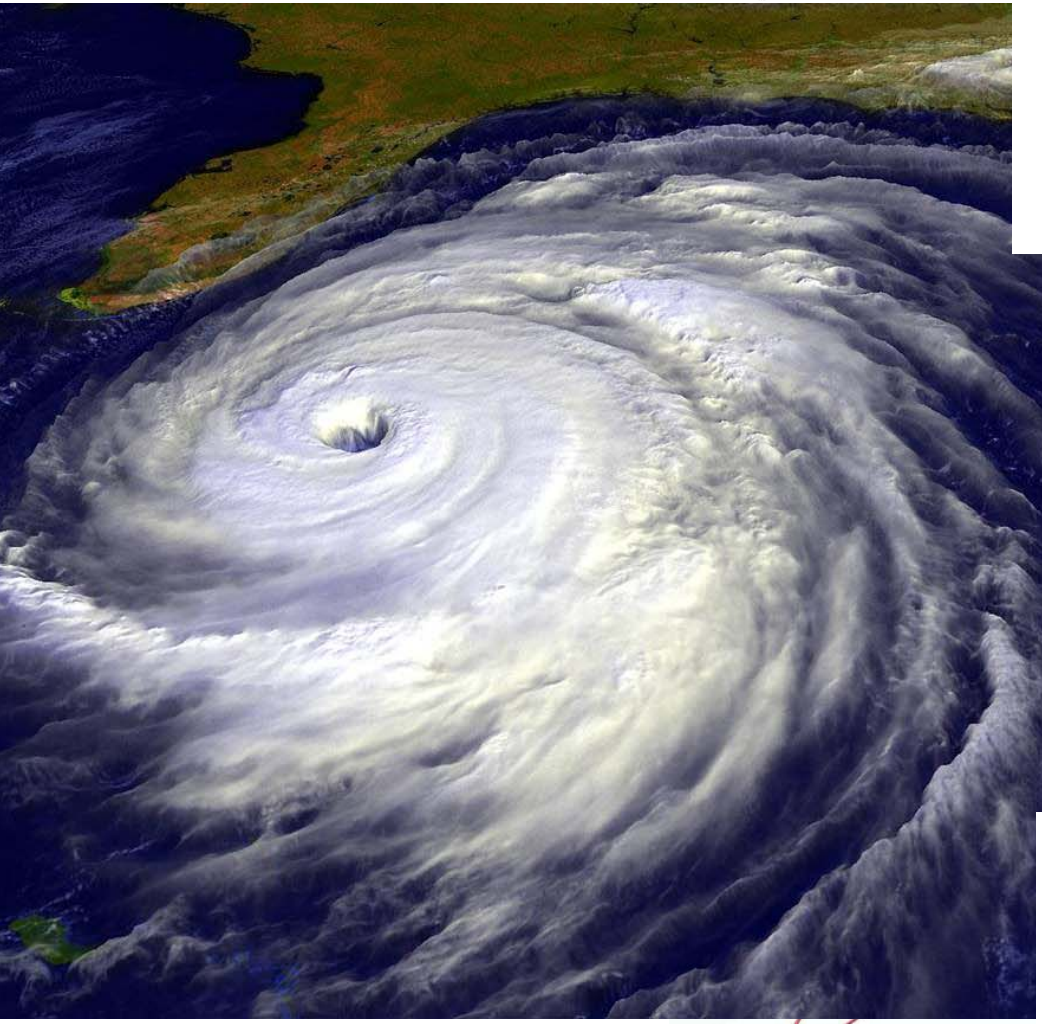


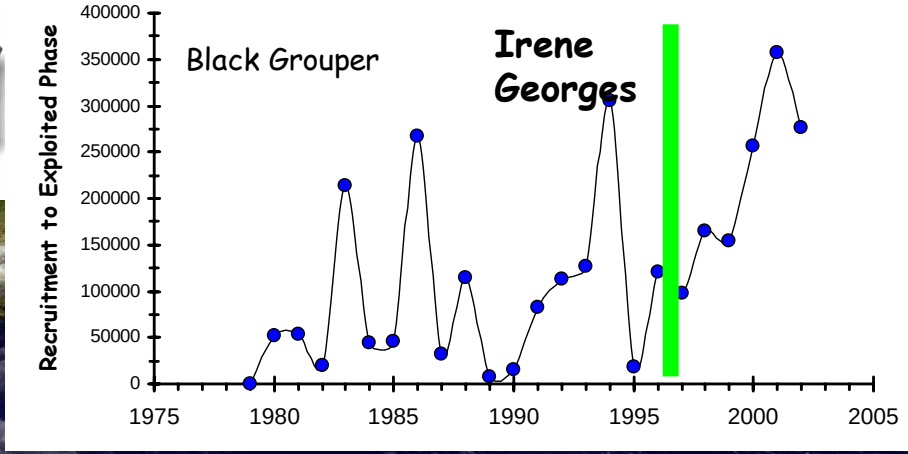
Dry Tortugas Region

Black Grouper

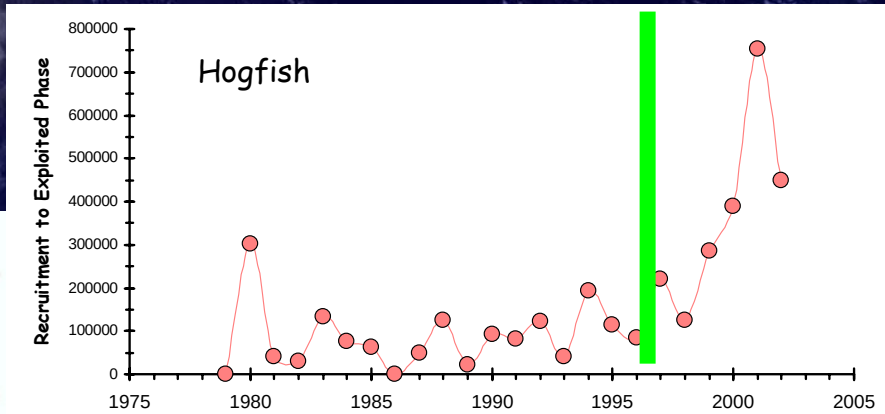








Reef Fish Recruitment & Hurricanes?



Red Grouper

Bank Fished	Bank MPA	National Park	Tortugas Region
+ 121%	+ 157%	+ 212%	+ 181%

Black Grouper

Bank Fished	Bank MPA	National Park	Tortugas Region
+ 400%	+ 590%	+ 468%	+ 492%

Hogfish

Bank Fished	Bank MPA	National Park	Tortugas Region
+ 162%	+ 137%	+ 151%	+ 149%

Yellowtail Snapper

Bank Fished	Bank MPA	National Park	Tortugas Region
+ 137%	+ 286%	+ 933%	+ 608%

Where to Look?

Ault, J.S., Bohnsack, J.A., Smith, S.G., and J. Luo. 2005. Toward sustainable multispecies fisheries in the Florida, USA, coral reef ecosystem. Bulletin of Marine Science 76(2)

Ault, J.S., Smith, S.G., and J.A. Bohnsack. 2005. Evaluation of average length as an estimator of exploitation status for the Florida coral-reef fish community. ICES Journal of Marine Science 62(3)

Ault, J.S., Smith, S.G., Bohnsack, J.A., Luo, J. 2005. Fishery-independent monitoring of coral reef fish and Macro-invertebrates in the Dry Tortugas. National Park Service/Florida Keys Nat. Marine Sanctuary/NOAA Fisheries. 66 p.

Meester, G.A., Mehrotra, A., Ault, J.S., and E.K. Baker. 2004. Designing marine reserves for fishery management. Management Science 50(8):1031-1043.

Bohnsack, J.A., Ault, J.S., and B. Causey. 2004. Why have no-take marine protected areas? American Fisheries Society Symposium 42:185-193.

Ault, J.S., Luo, J., and J.D. Wang. 2003. A spatial ecosystem model to assess spotted seatrout population risks from exploitation and environmental changes. Chapter 15, Pages 267-296 in Biology of Spotted Seatrout. S.A. Bortone (ed.). CRC Press, Boca Raton, Florida.