Monitor Coral Reef Fish Populations Florida Keys and Tortugas

SEFSC, NOAA Fisheries

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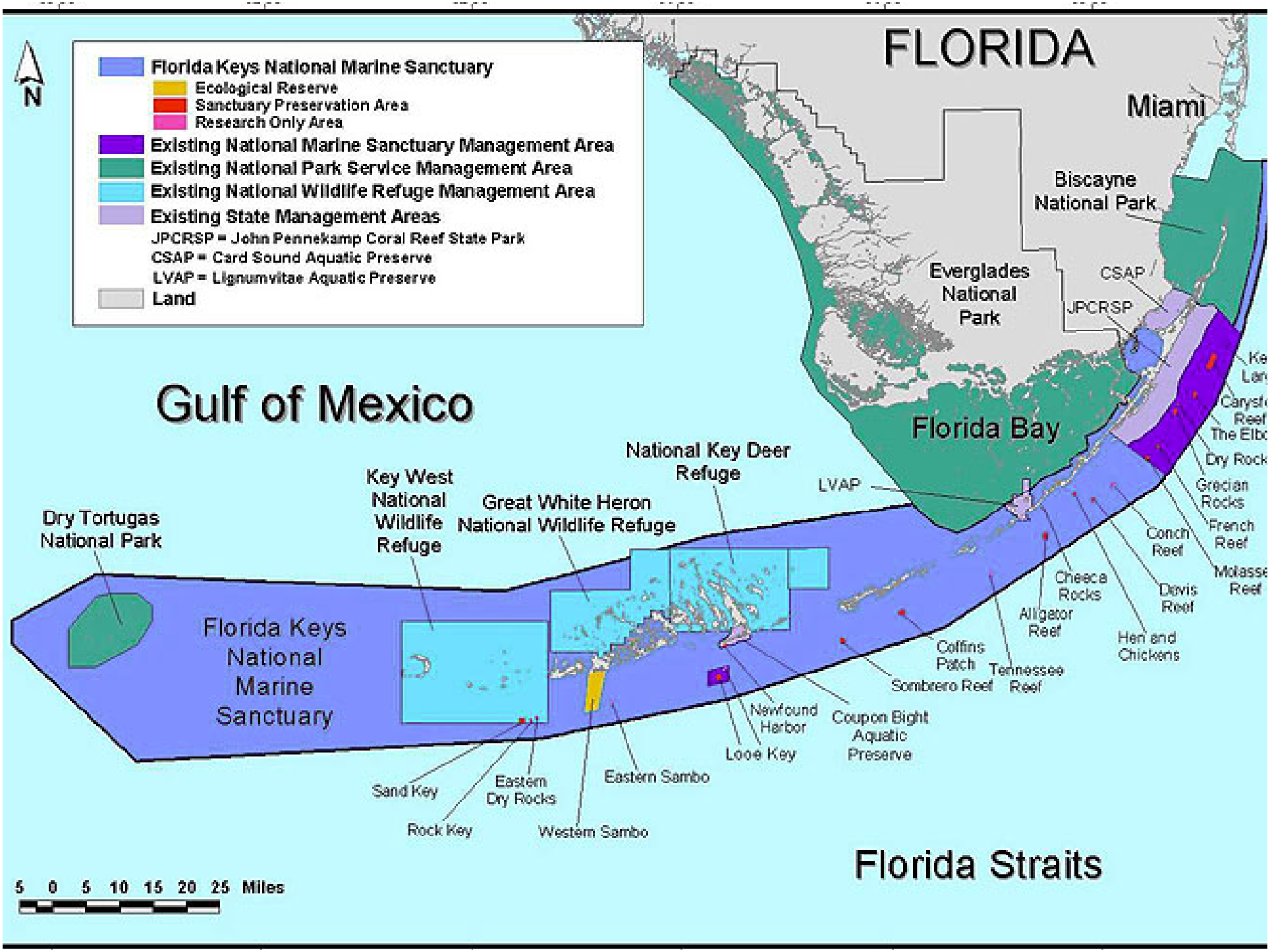
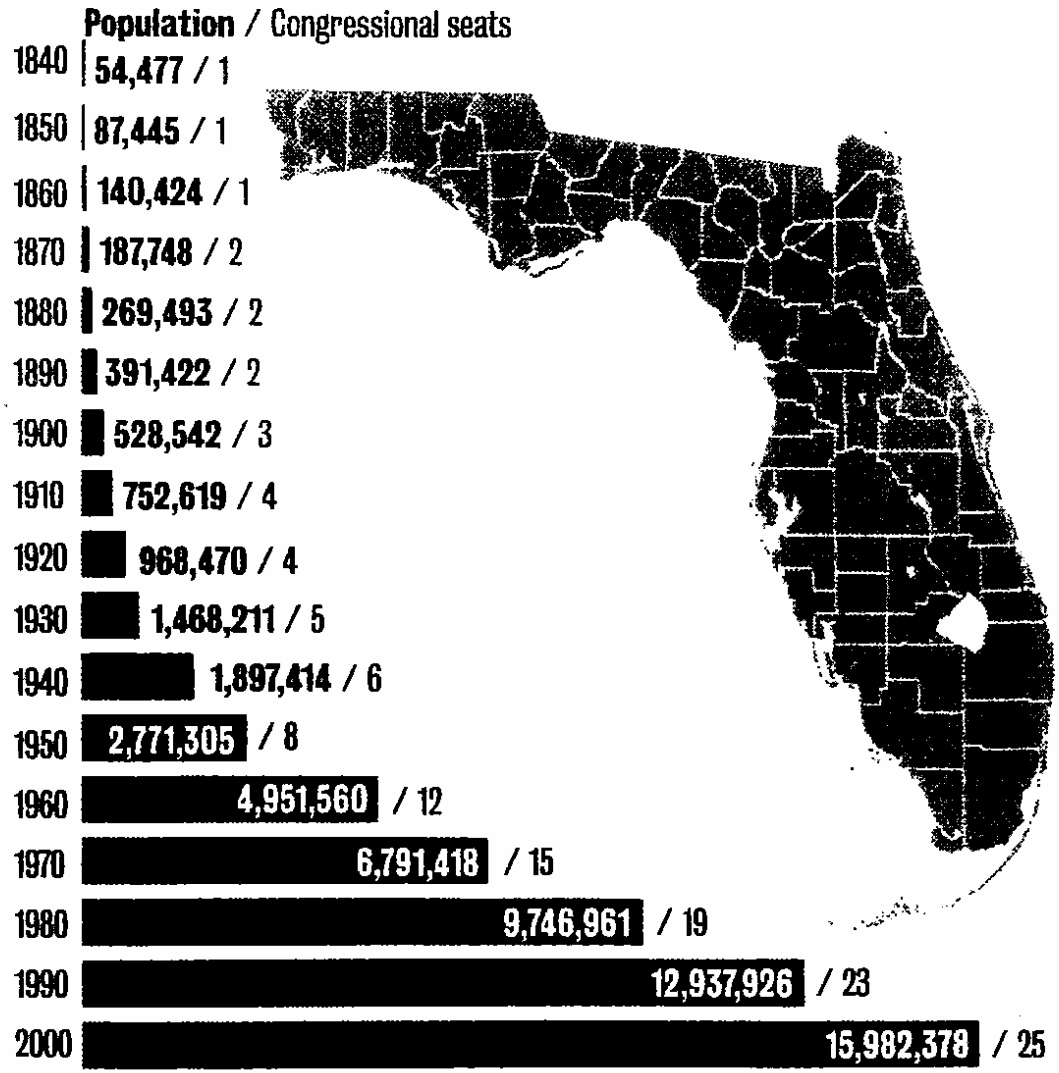

N
Florida Keys National Marine Sanctuary
Ecological Reserve
Sanctuary Preservation Area
Research Only Area
Existing National Marine Sanctuary Management Area
Existing National Park Service Management Area
Existing National Wildlife Refuge Management Area
Existing State Management Areas
JPCRSP = John Pennekamp Coral Reef State Park
CSAP = Card Sound Aquatic Preserve
LVAP = Lignumvitae Aquatic Preserve
Land
FLORIDA
Miami
Biscayne National Park
Everglades National Park
CSAP
JPCRSP
Florida Bay
Gulf of Mexico
LVAP
National Key Deer Refuge
Key West National Wildlife Refuge
Great White Heron National Wildlife Refuge
Dry Tortugas National Park
Florida Keys National Marine Sanctuary
Sand Key
Rock Key
Eastern Dry Rocks
Western Sambo
Eastern Sambo
Looe Key
Newfound Harbor
Coupon Bight Aquatic Preserve
Sombrero Reef
Coffins Patch
Tennessee Reef
Alligator Reef
Cheeca Rocks
Hen and Chickens
Davis Reef
Conch Reef
French Reef
Grecian Rocks
Dry Rock
The Elbo
Carysf Reef
Molasse Reef
Ke Lar
Florida Straits
5 0 5 10 15 20 25 Miles

FLORIDA'S POPULATION

The Sunshine State has experienced explosive growth over the years, making Florida the fourth largest state in the nation.

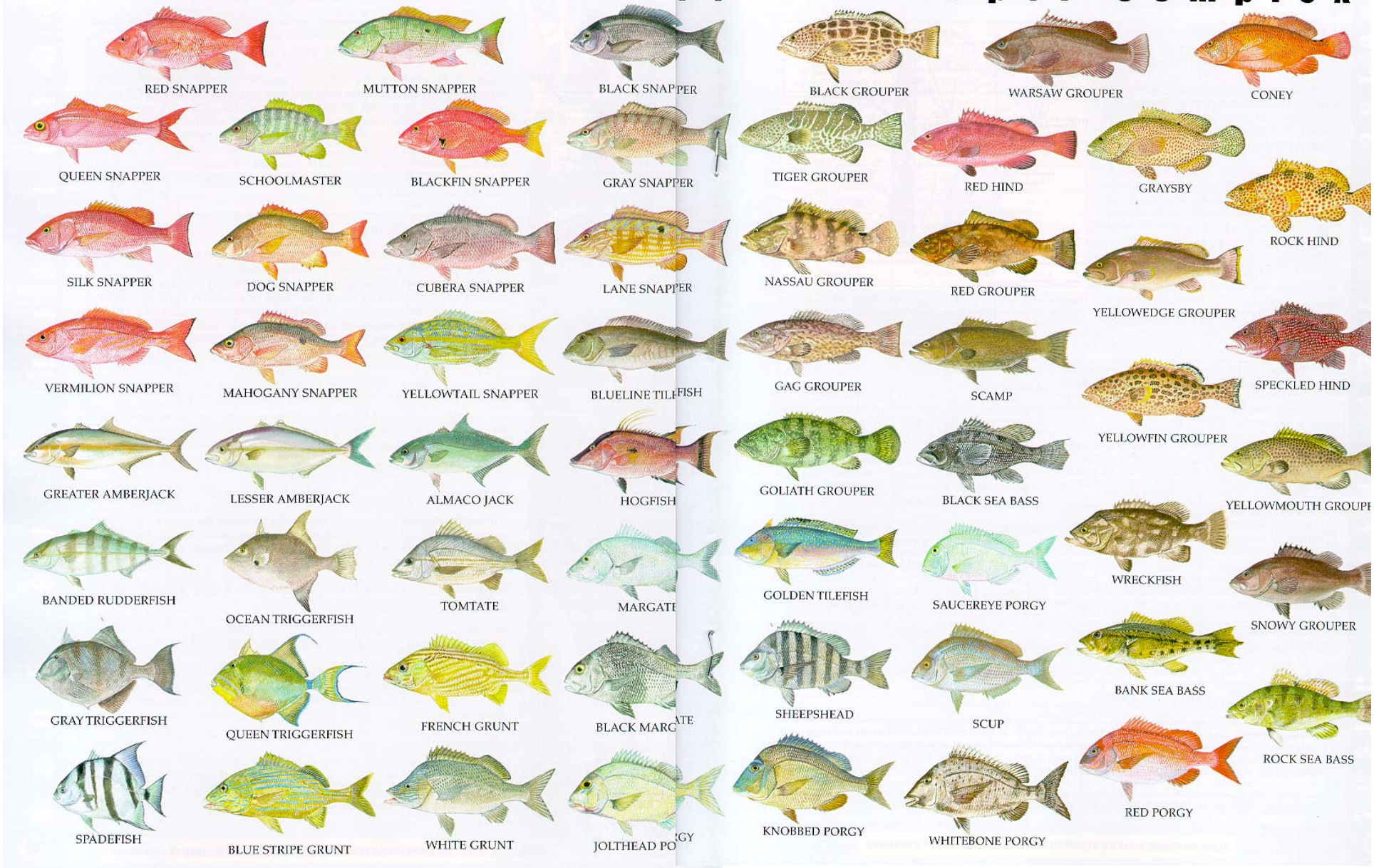


SOURCE: U.S. Census Bureau

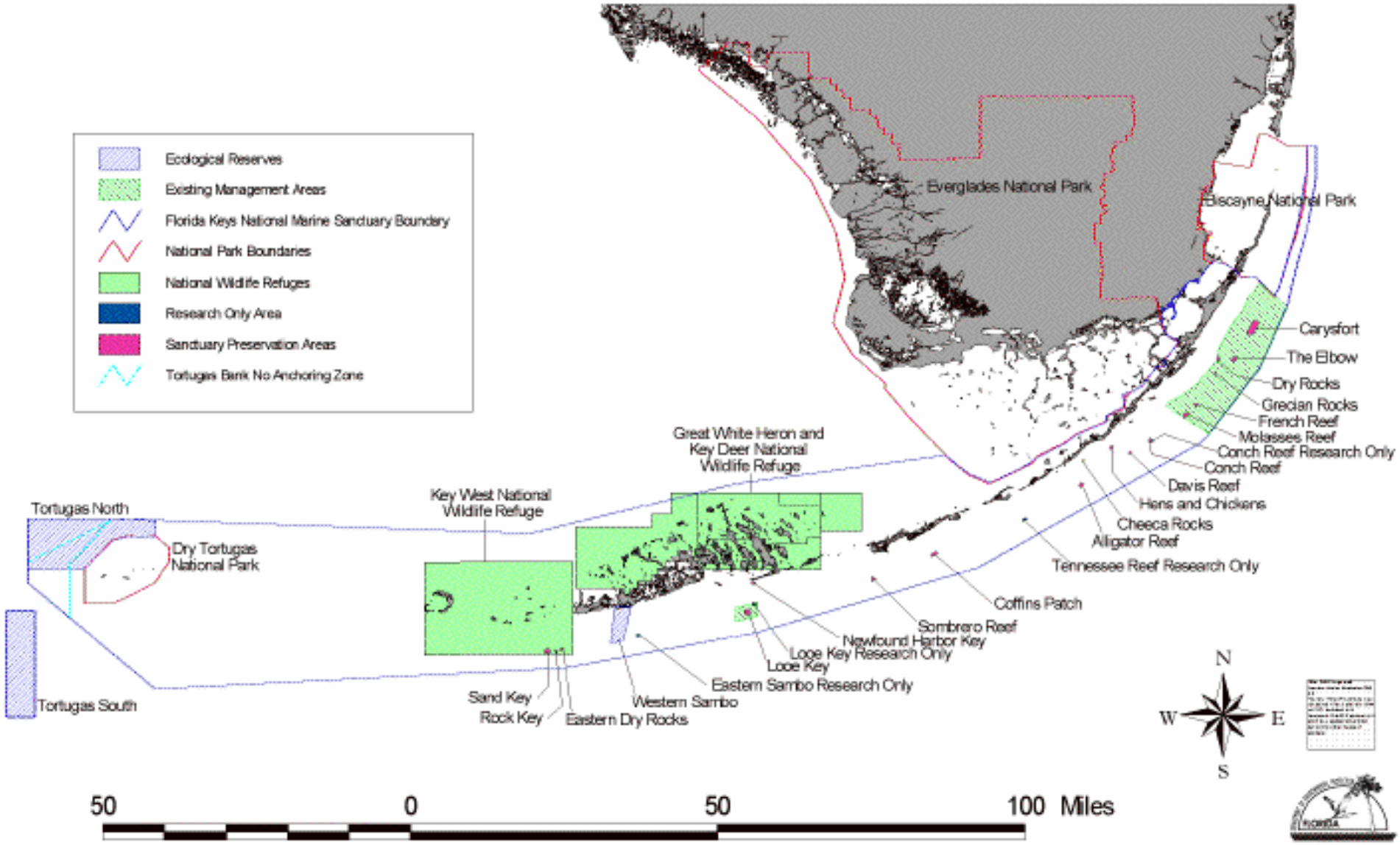
MAA122900

JERE WARREN / HERALD STAFF

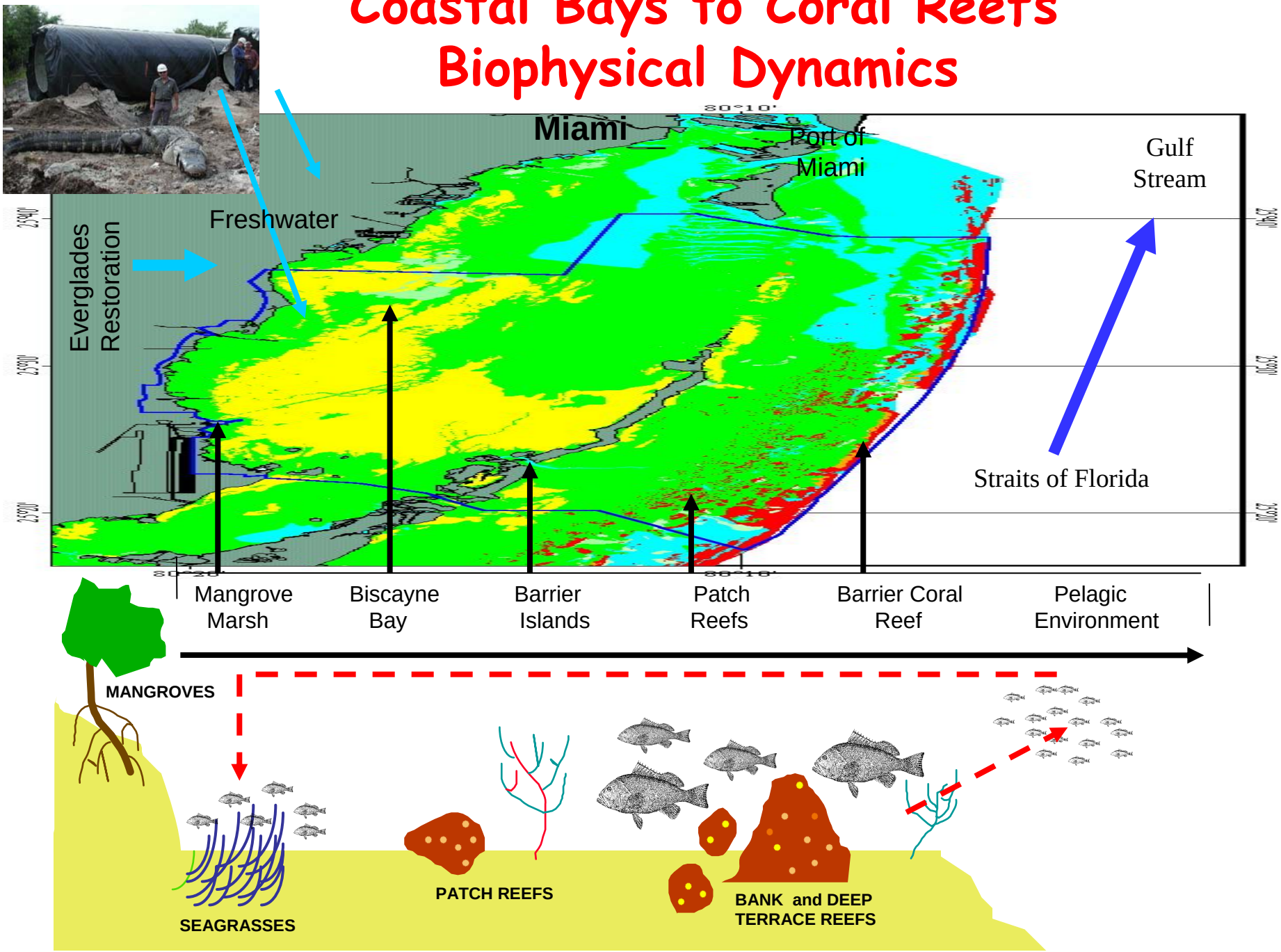
South Atlantic Snapper/Grouper Complex



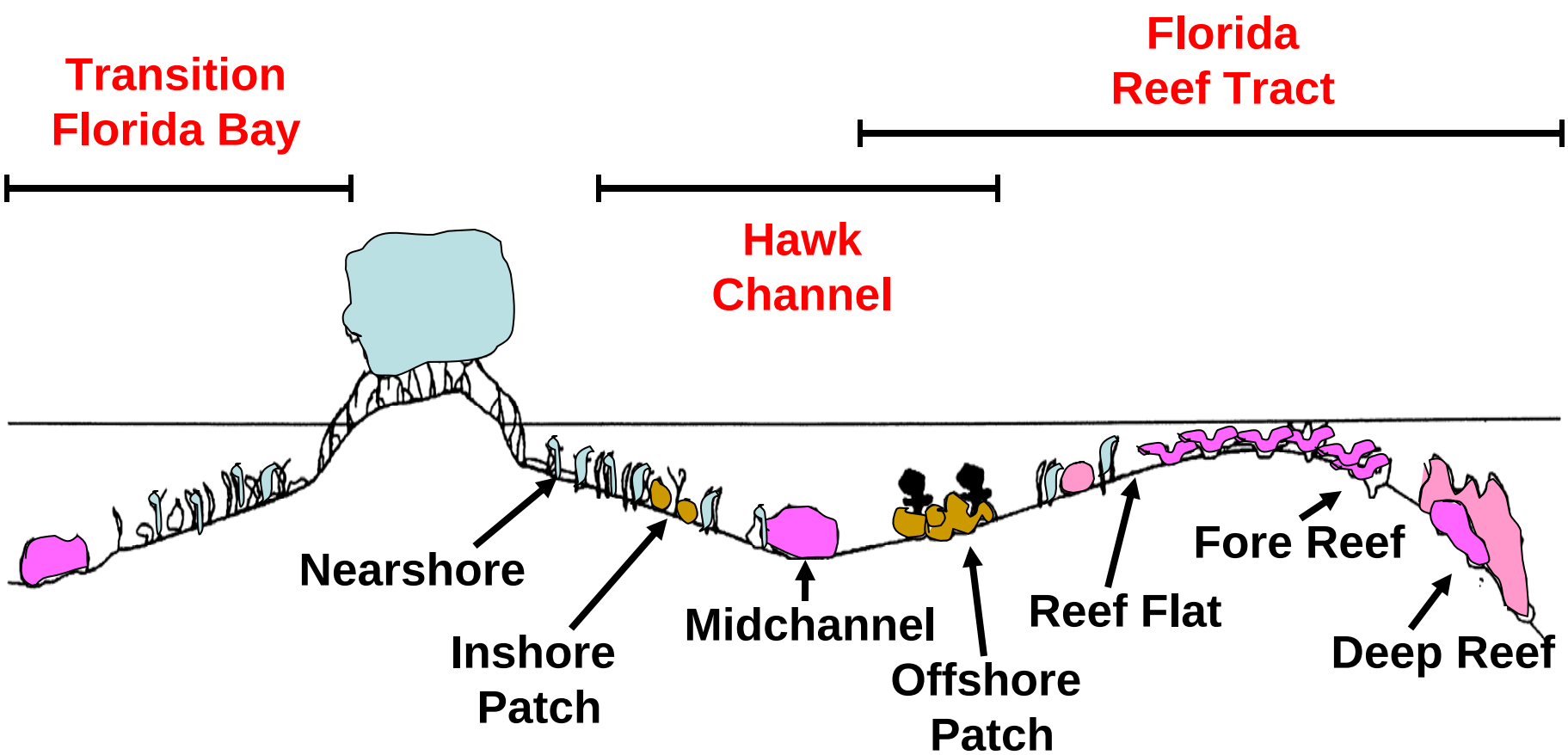
Florida Keys National Marine Sanctuary



Coastal Bays to Coral Reefs
Biophysical Dynamics



Cross-Shelf Habitat Classification



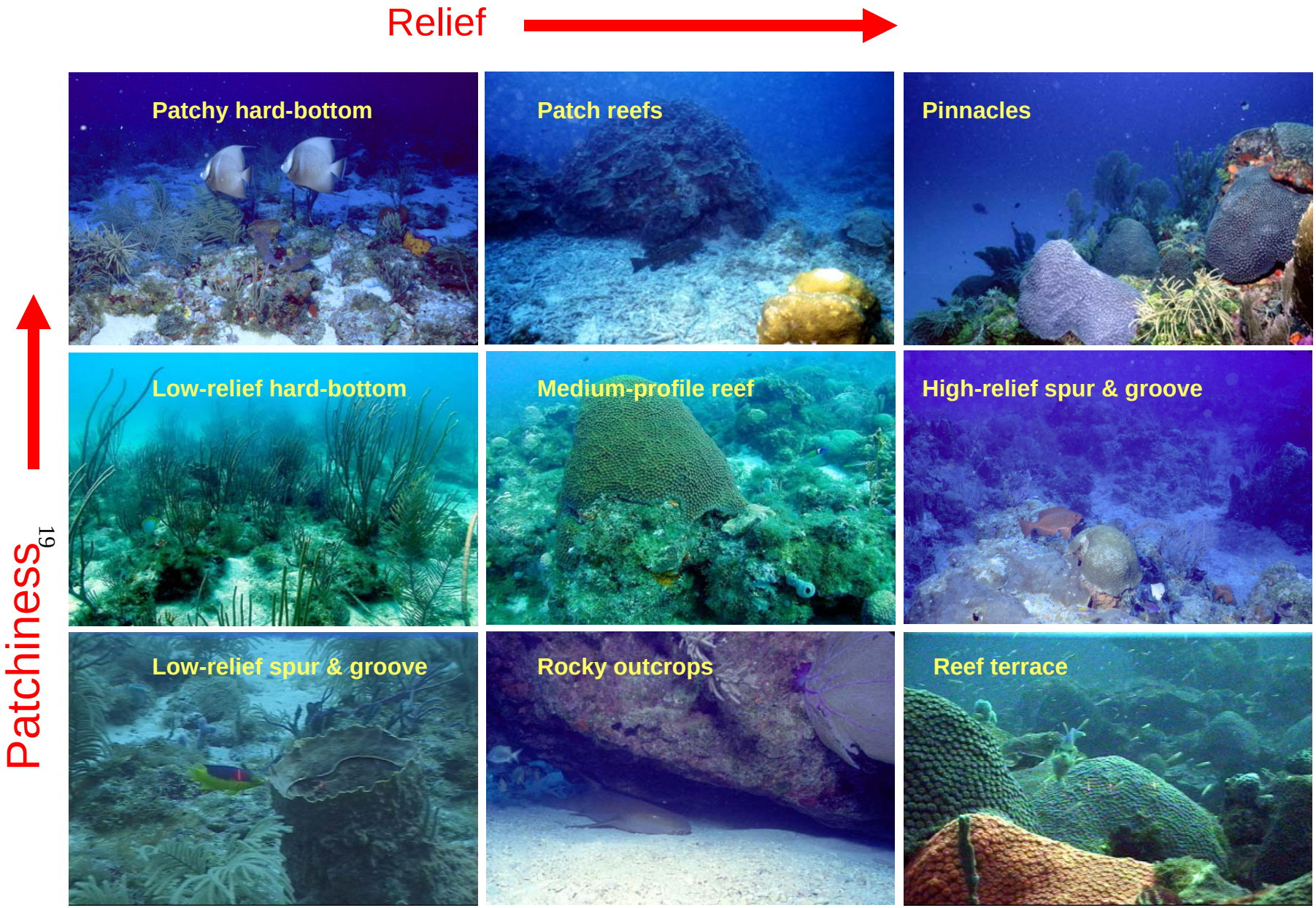
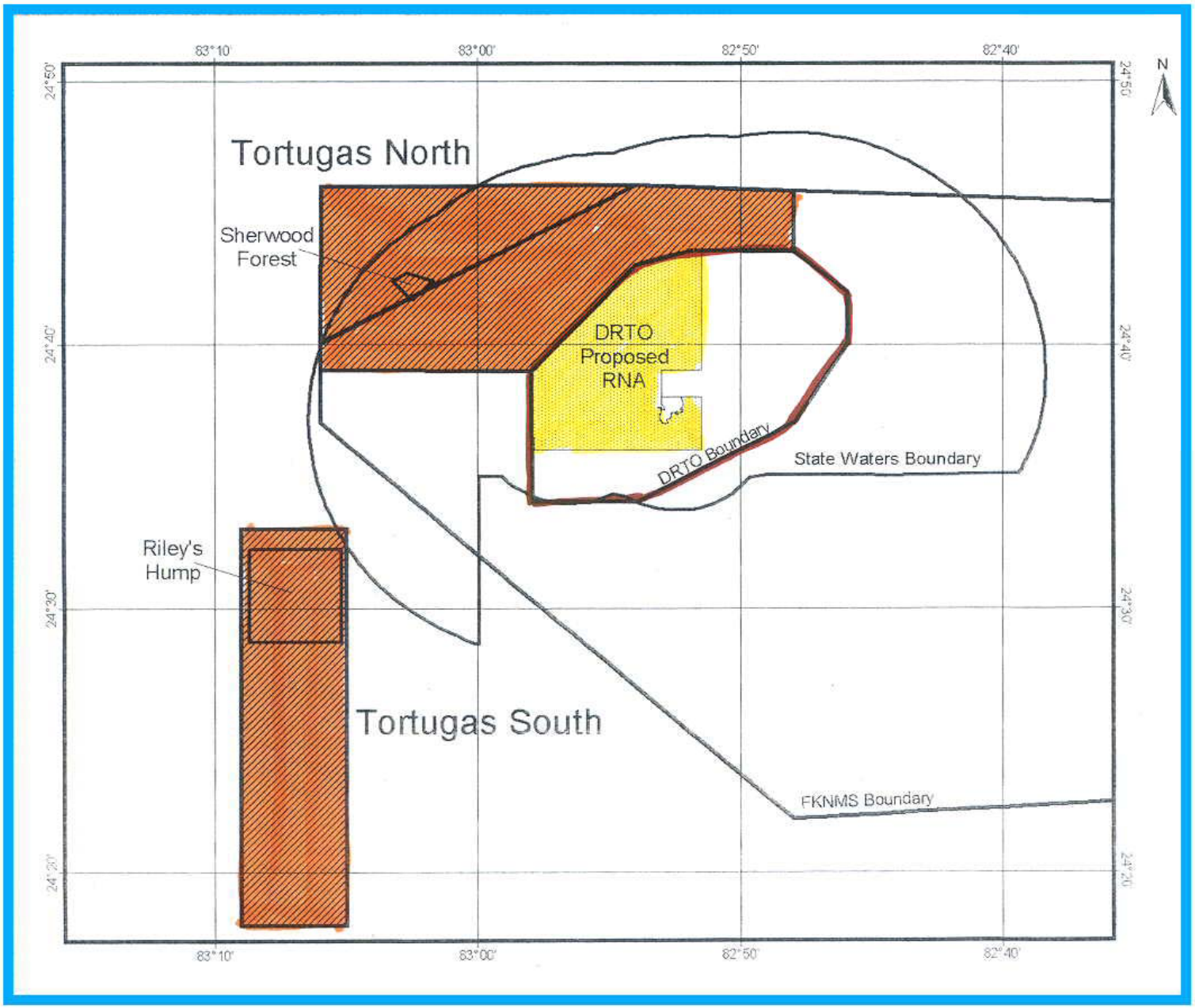
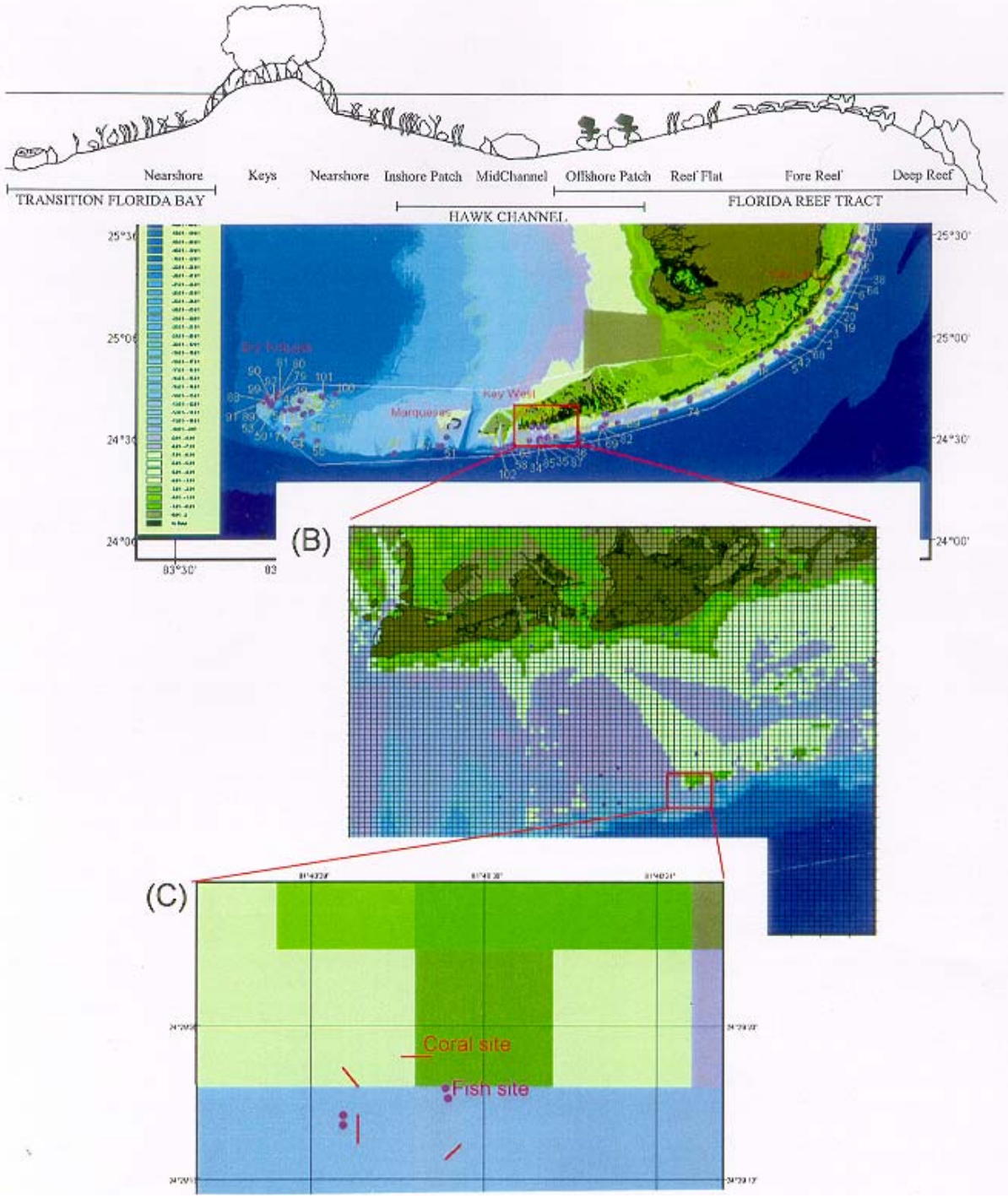
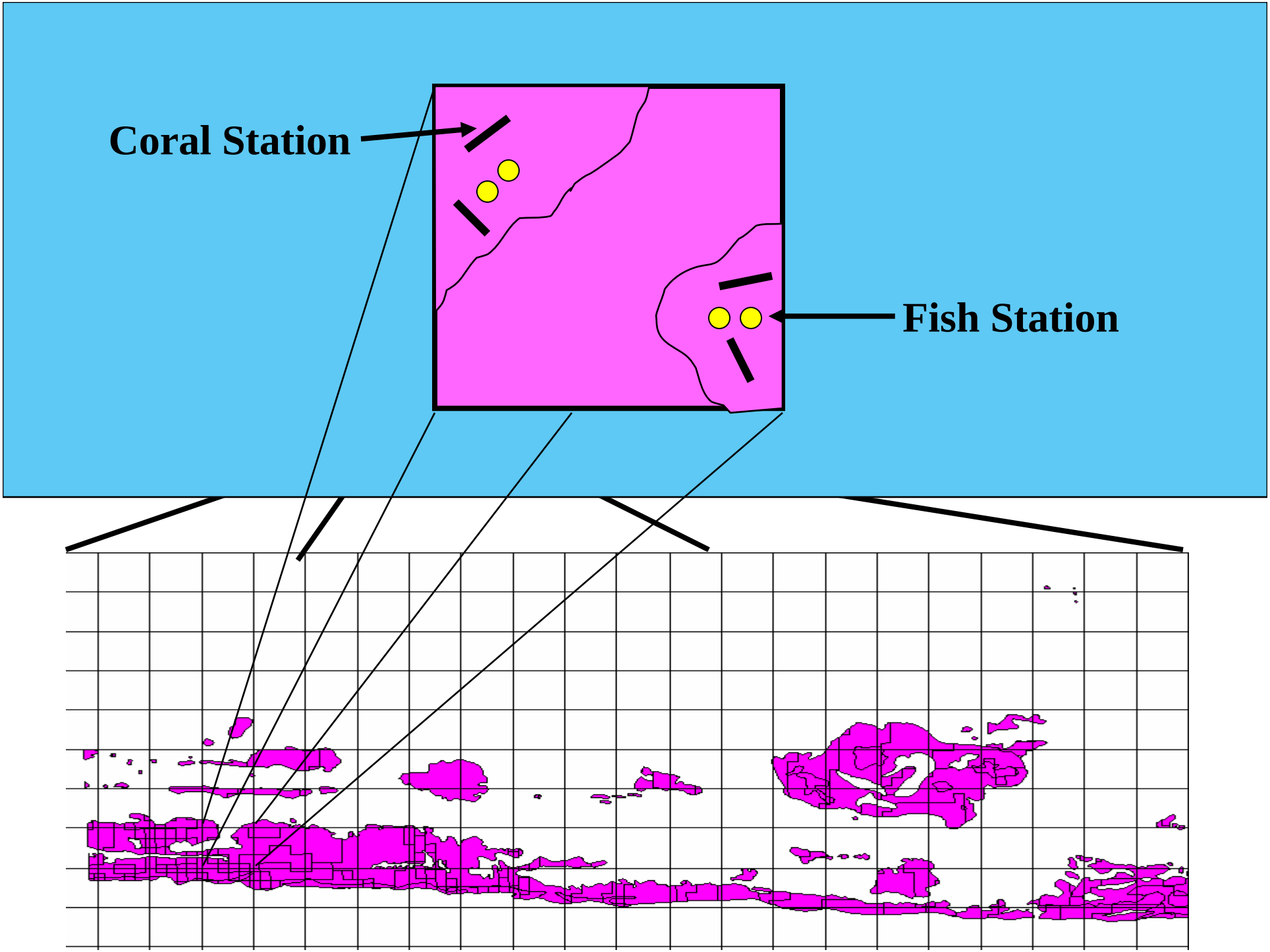


Figure 2.6 – Photographs depicting the benthic classification scheme of hard-bottom and coral reef habitats for the Tortugas region including the Dry Tortugas National Park and western Florida Keys National Marine Sanctuary.

TORTUGAS ECOLOGIC RESERVE




Nearshore
Keys
Nearshore
Inshore Patch
MidChannel
Offshore Patch
Reef Flat
Fore Reef
Deep Reef
TRANSITION FLORIDA BAY
HAWK CHANNEL
FLORIDA REEF TRACT
Key West
Marquesas
(B)
(C)
Coral site
Fish site


Coral Station
Fish Station

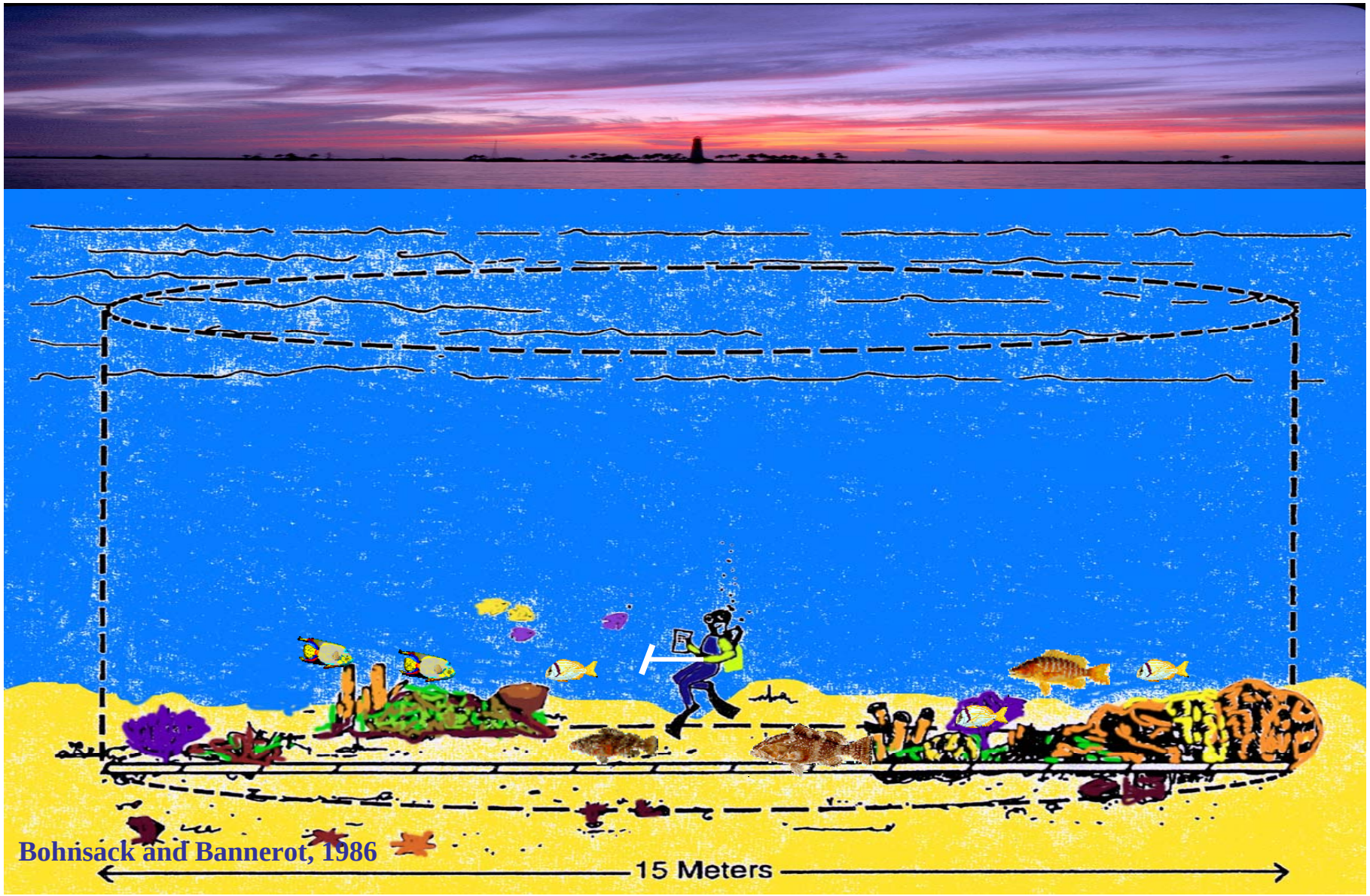
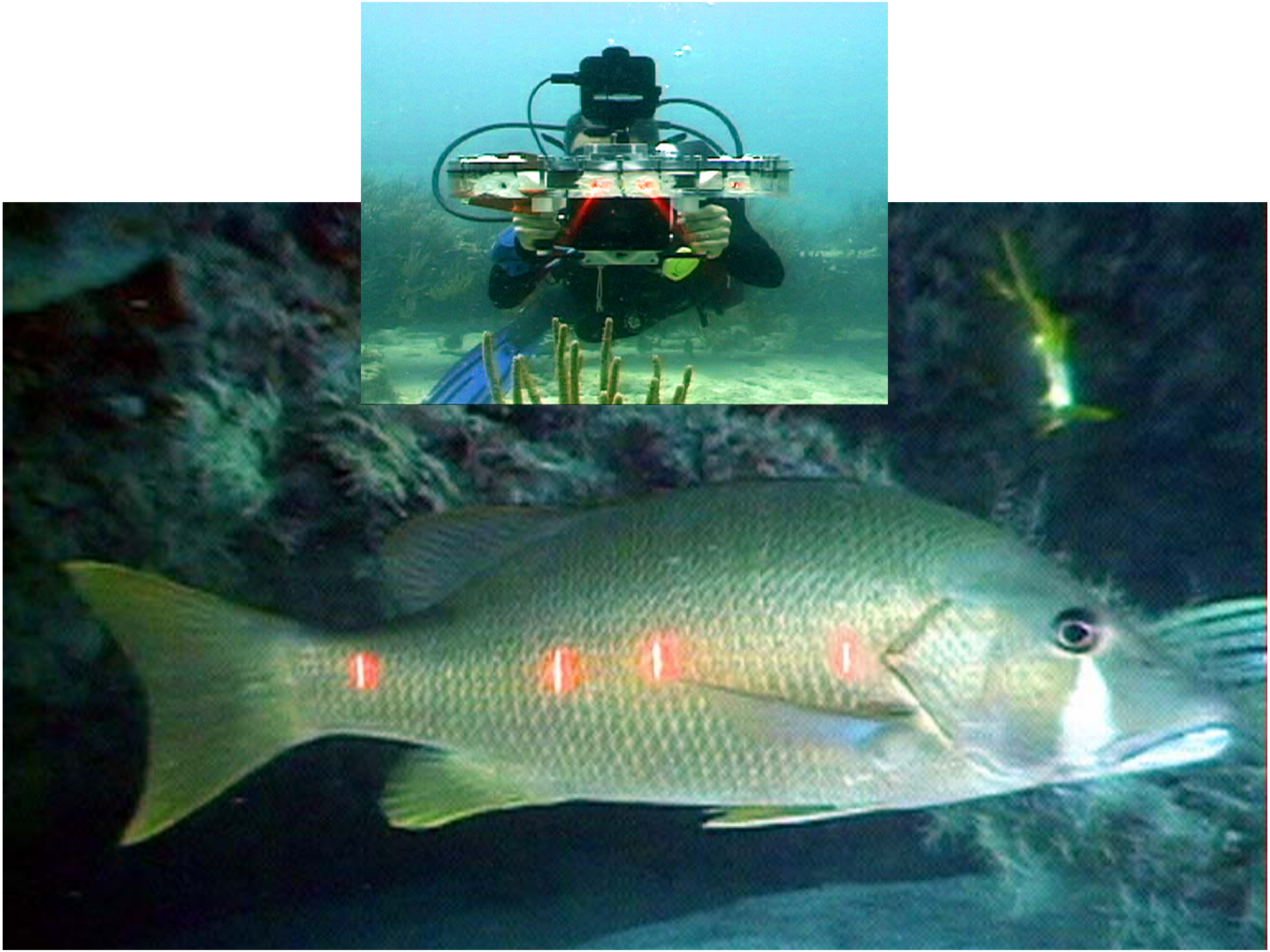


Figure 2.4 - Graphical depiction of the reef fish visual census (RVC) method (Bohnsack and Bannerot 1986).



25 12:54 PM

27 4:42PM

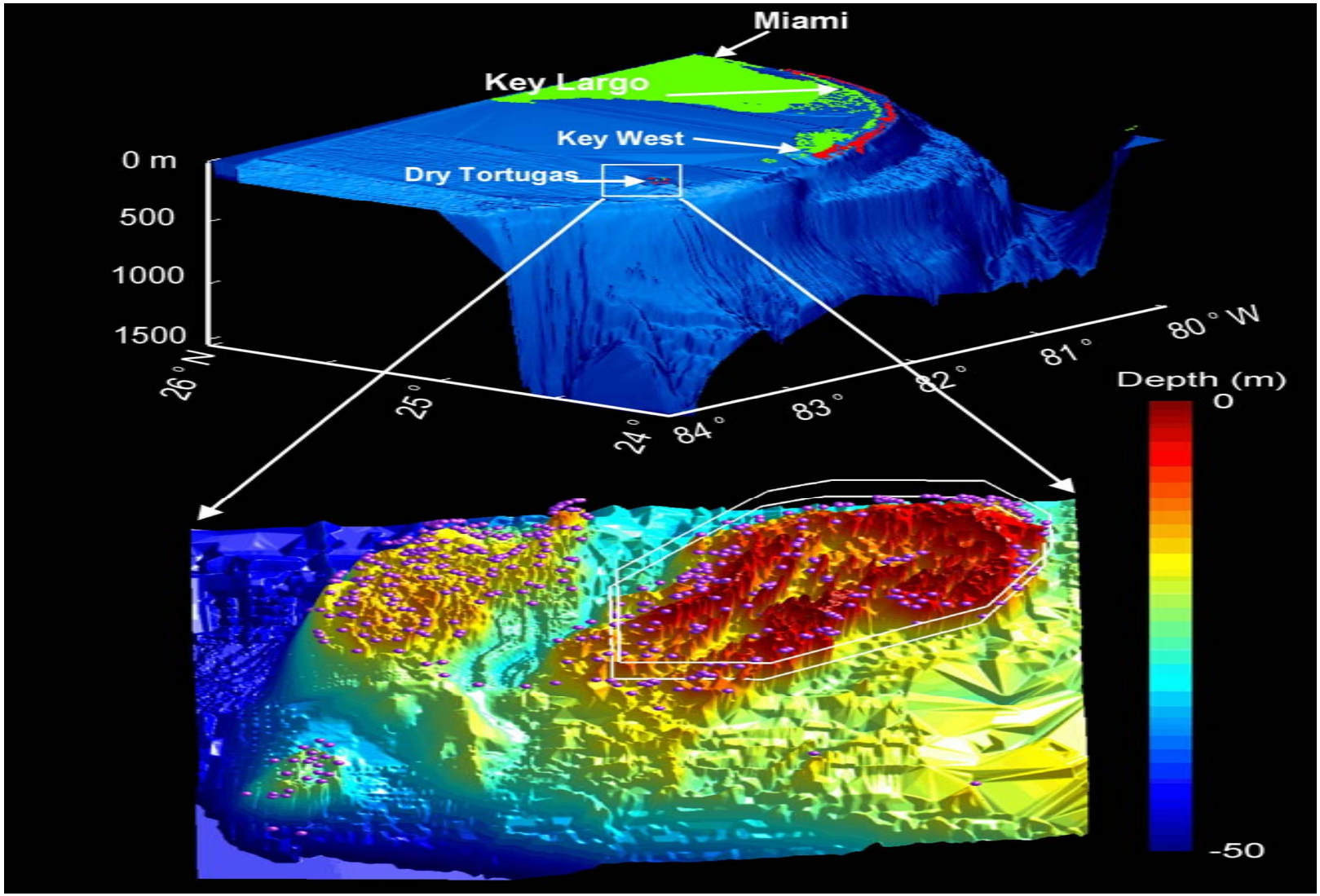


Figure 1.1 - Three-dimensional maps of the Florida Keys coral reef ecosystem showing: (A) South Florida and the coral reef tract (red) from Key Biscayne to the Dry Tortugas; and (B) the bathymetry of the Tortugas region showing Dry Tortugas National Park, Tortugas Bank and Riley's Hump where the purple balls represent primary sampling units from the millenial RVC and reef habitat surveys.

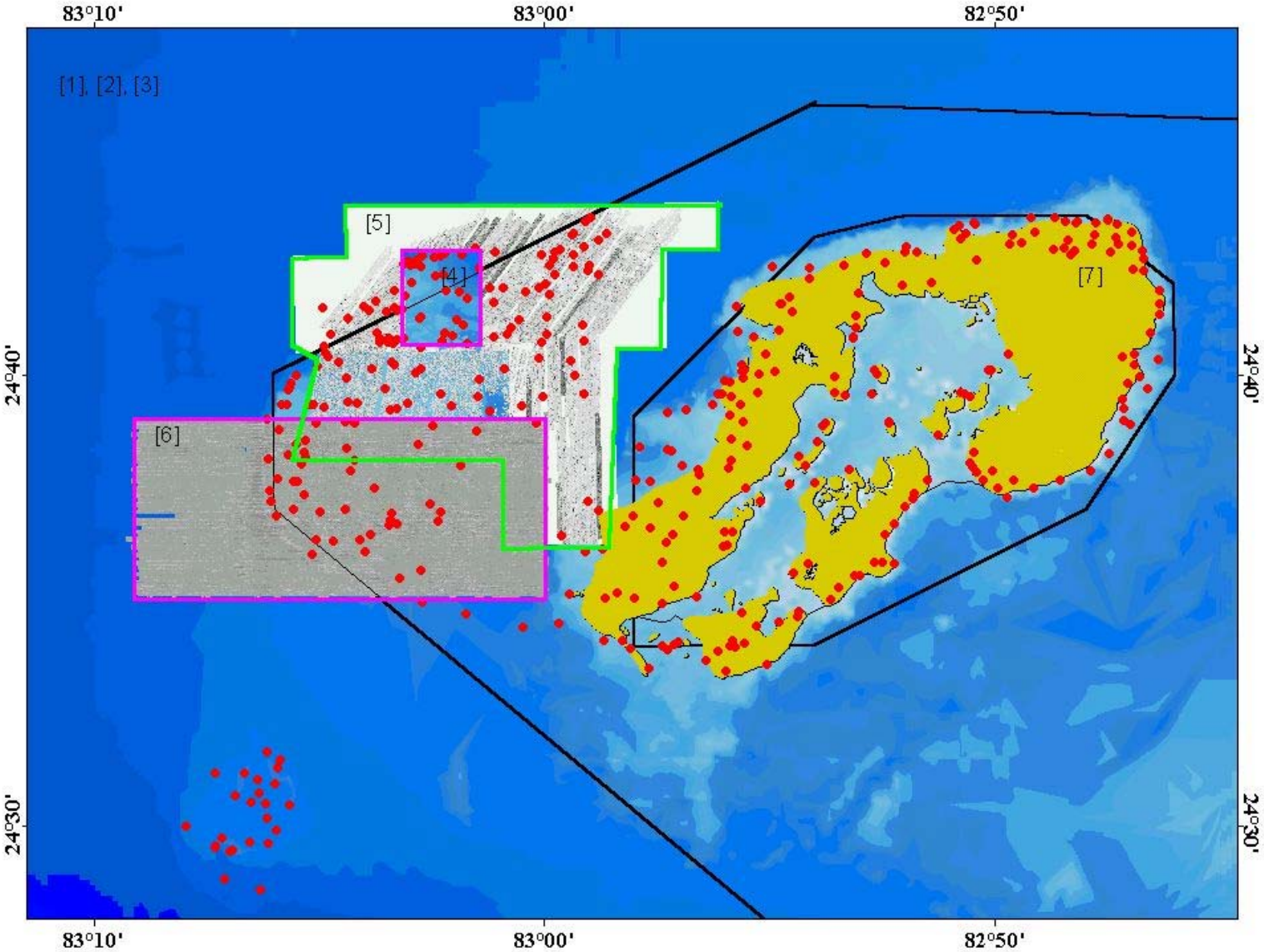
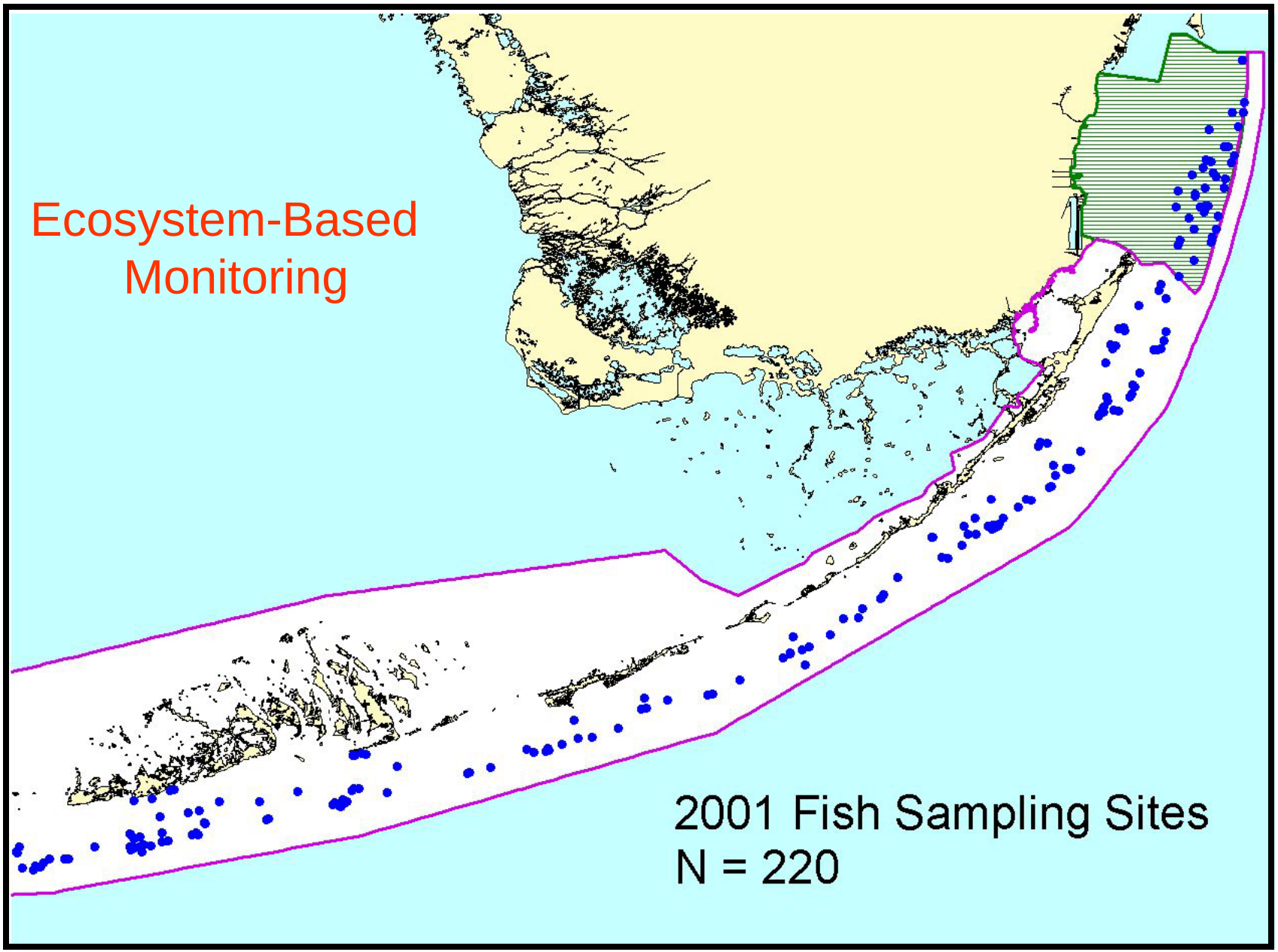
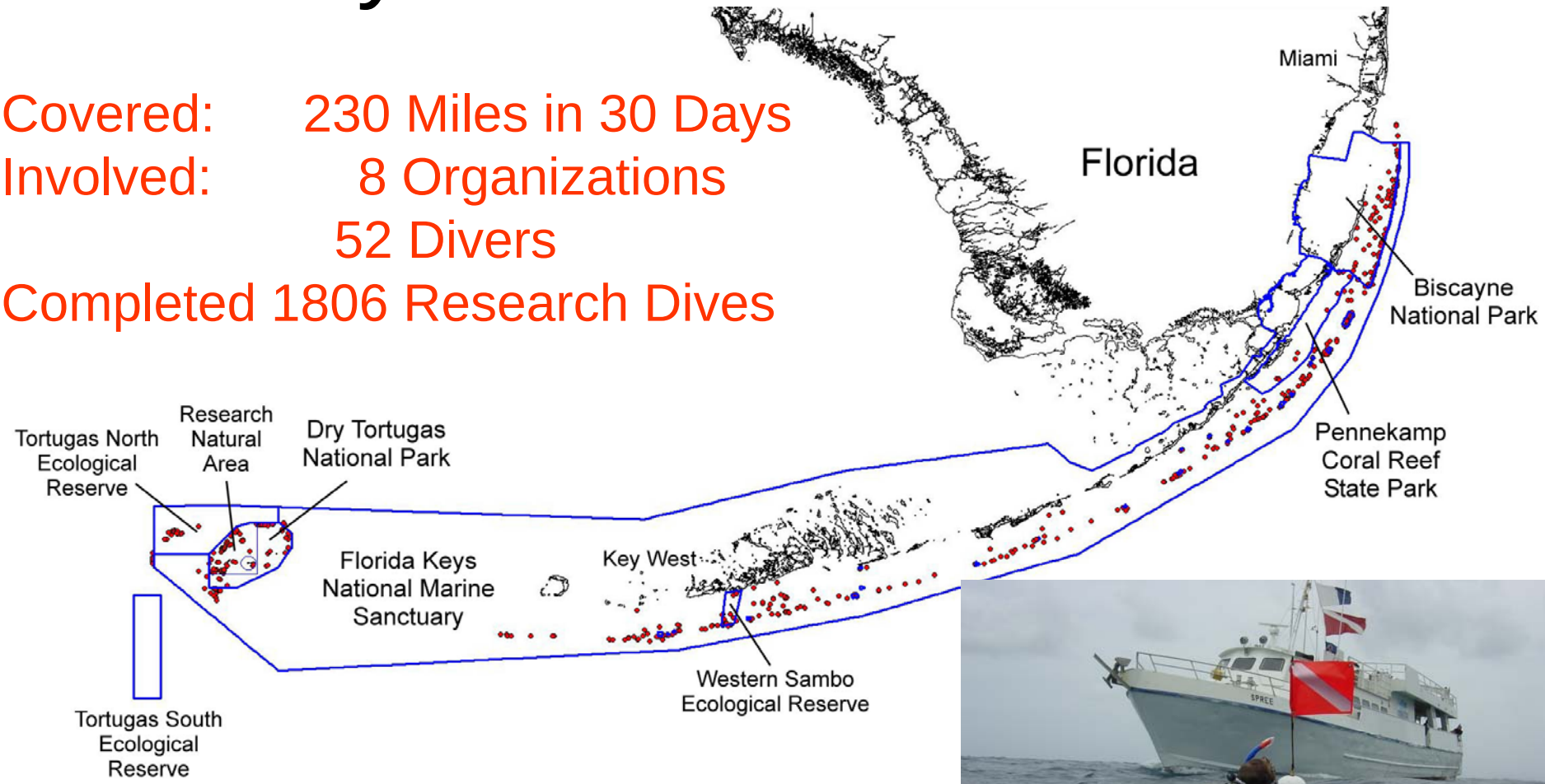


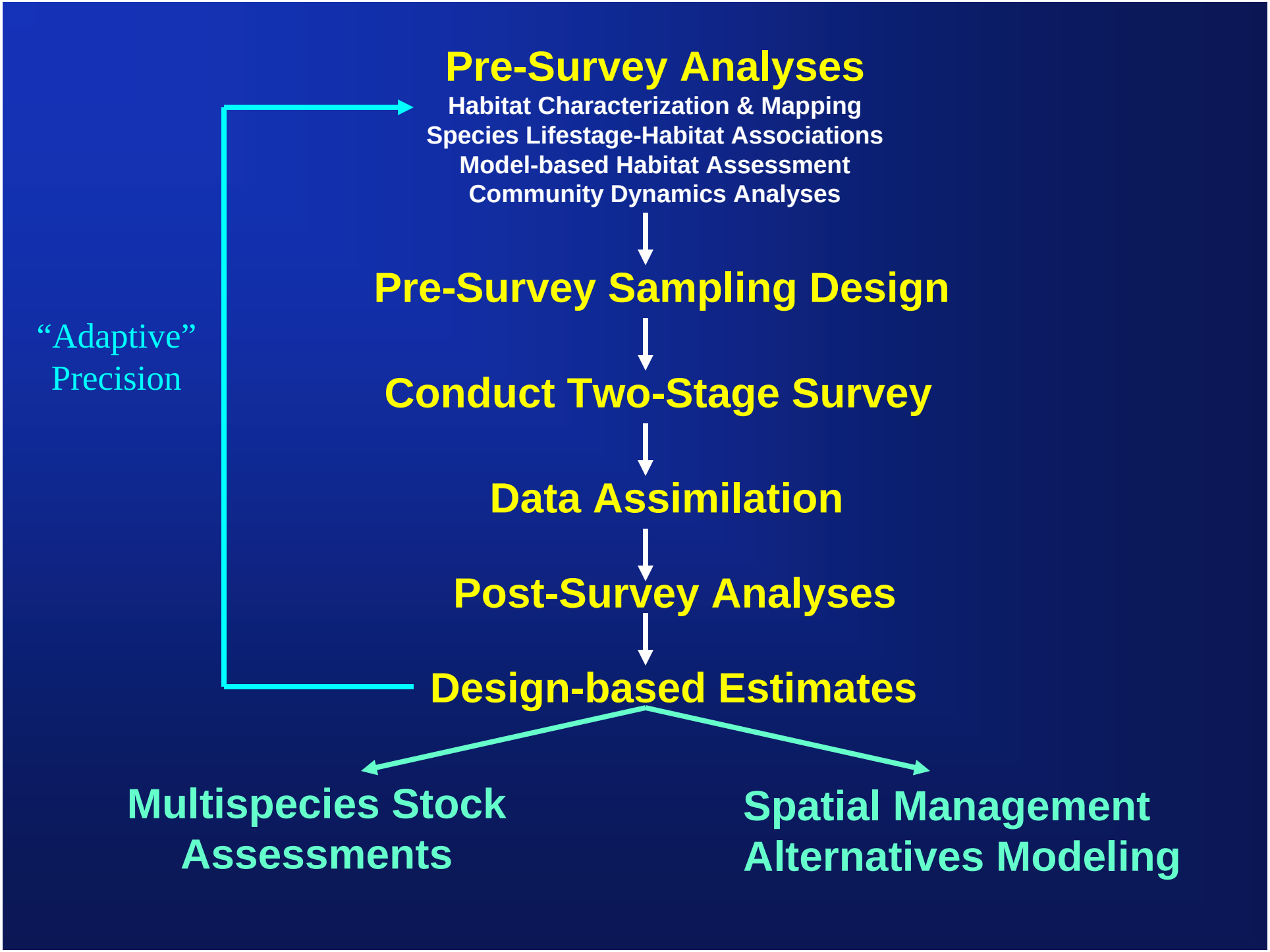
Figure 2.2 - Graphical depiction of georeferenced data sources used to characterize marine habitats in the Tortugas region. See text for further explanation.


Ecosystem-Based
Monitoring
2001 Fish Sampling Sites
N = 220

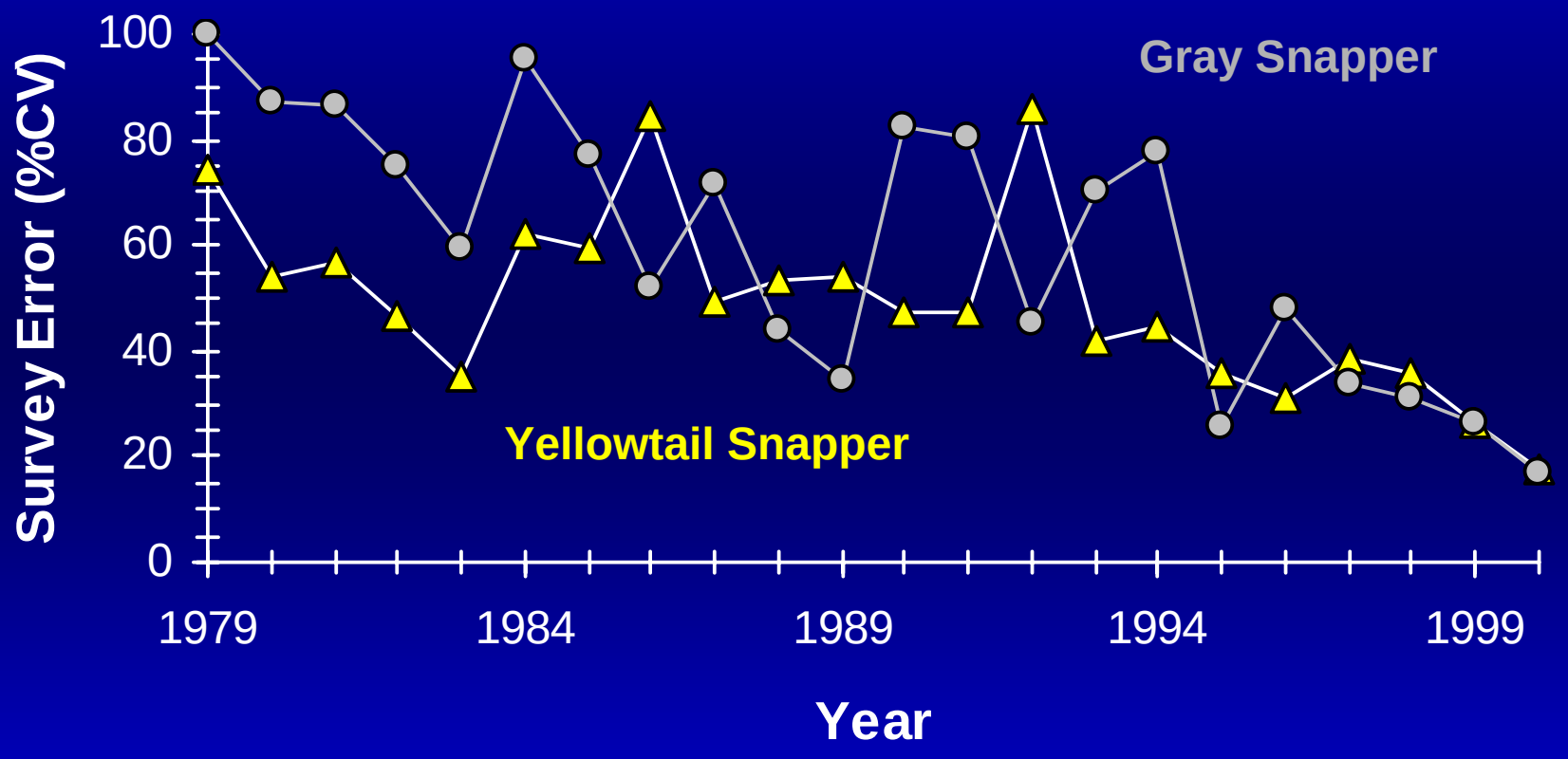
Keys Wide Cruise 2002

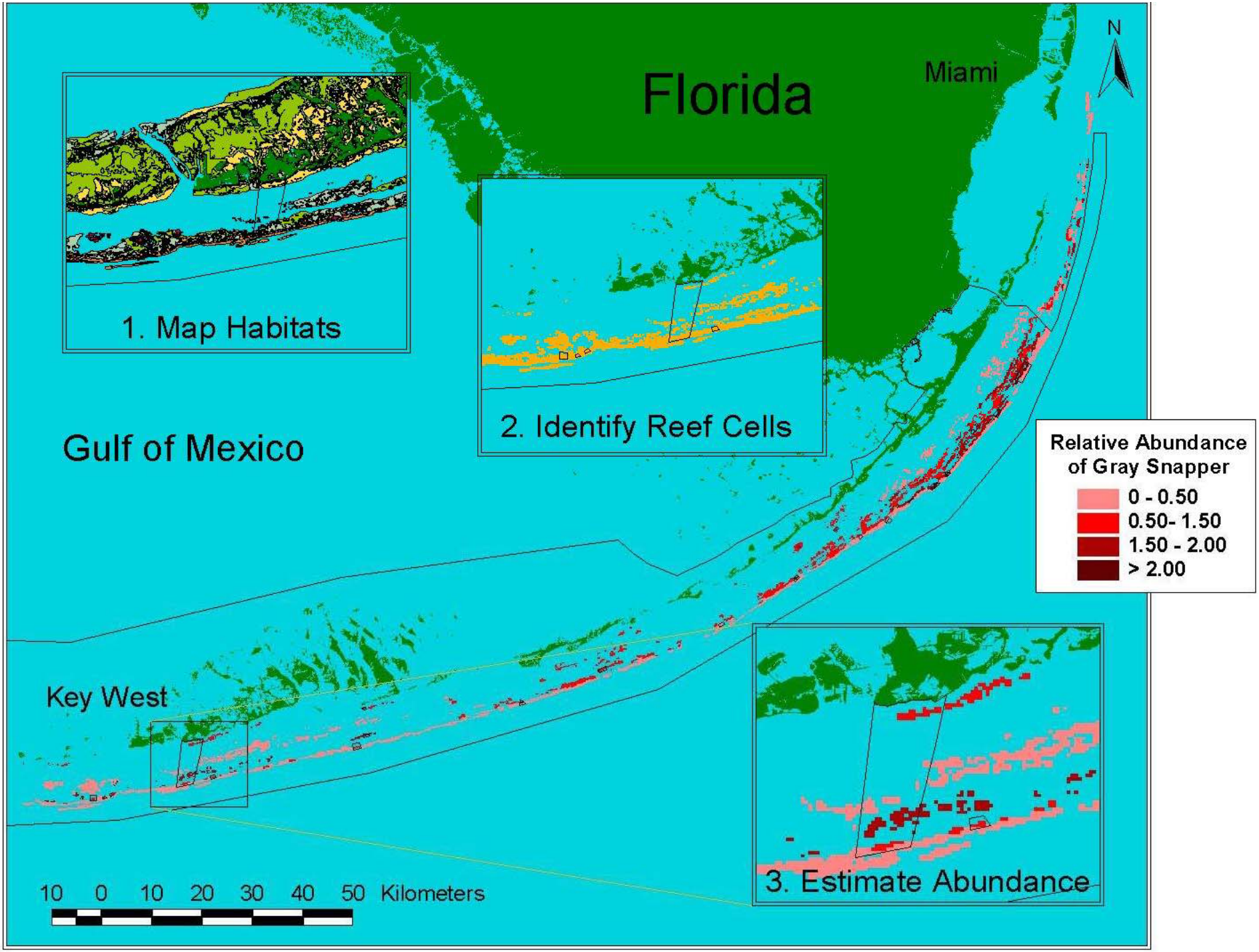
Covered: 230 Miles in 30 Days
Involved: 8 Organizations
52 Divers
Completed 1806 Research Dives



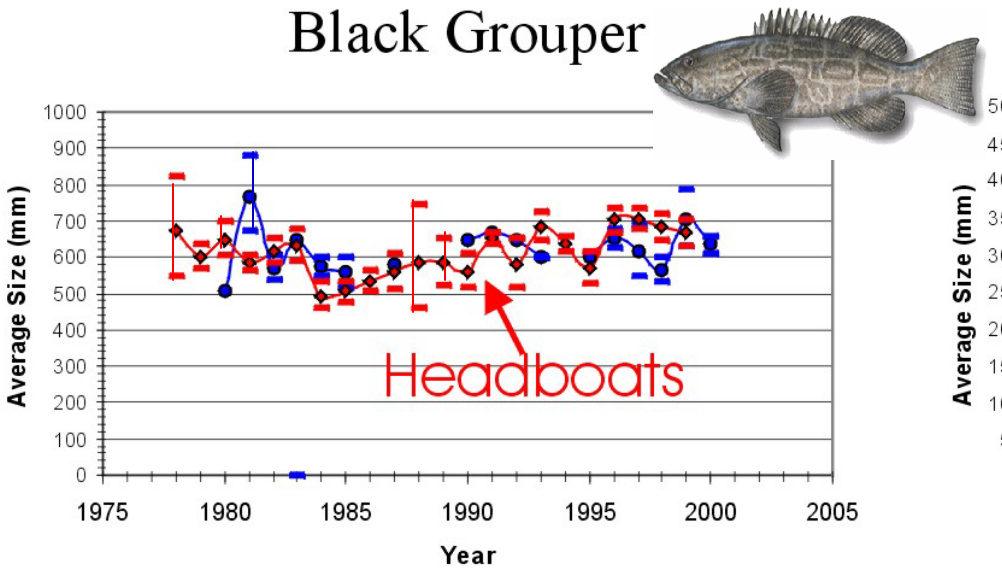

Pre-Survey Analyses
Habitat Characterization & Mapping
Species Lifestage-Habitat Associations
Model-based Habitat Assessment
Community Dynamics Analyses
Pre-Survey Sampling Design
Conduct Two-Stage Survey
Data Assimilation
Post-Survey Analyses
Design-based Estimates
"Adaptive" Precision
Multispecies Stock Assessments
Spatial Management Alternatives Modeling

Survey Precision for Adult Population Size

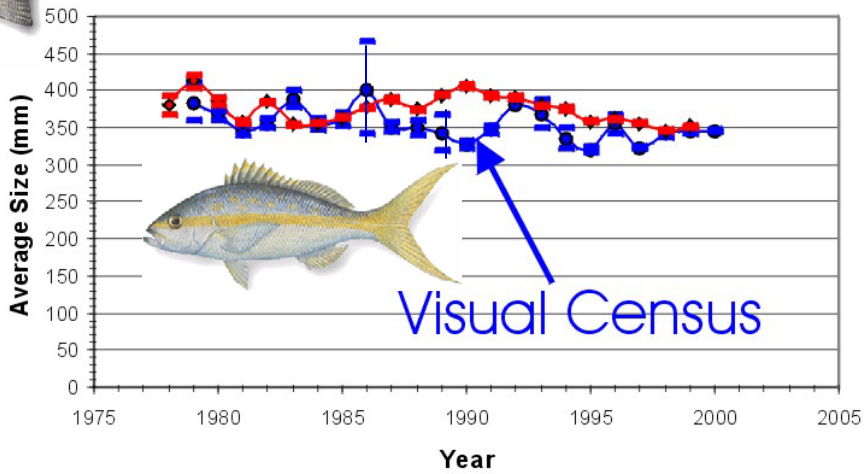



Florida
Miami
N
1. Map Habitats
2. Identify Reef Cells
Gulf of Mexico
Relative Abundance of Gray Snapper
0 - 0.50
0.50- 1.50
1.50 - 2.00
> 2.00
Key West
3. Estimate Abundance
10 0 10 20 30 40 50 Kilometers

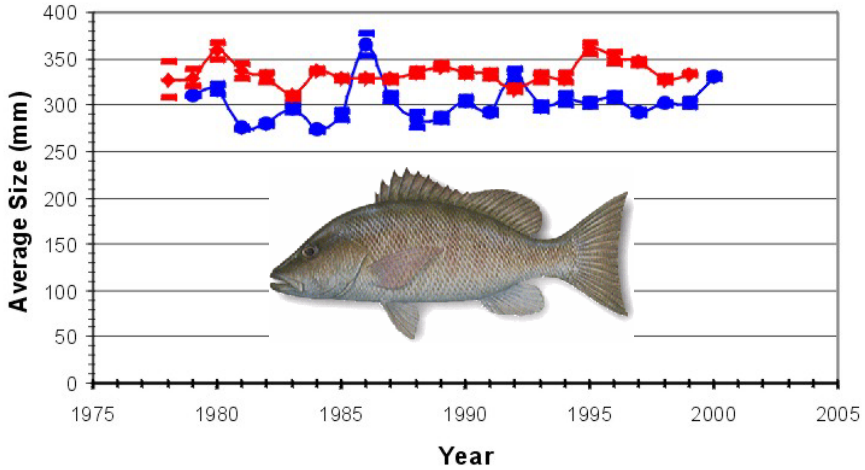
Black Grouper



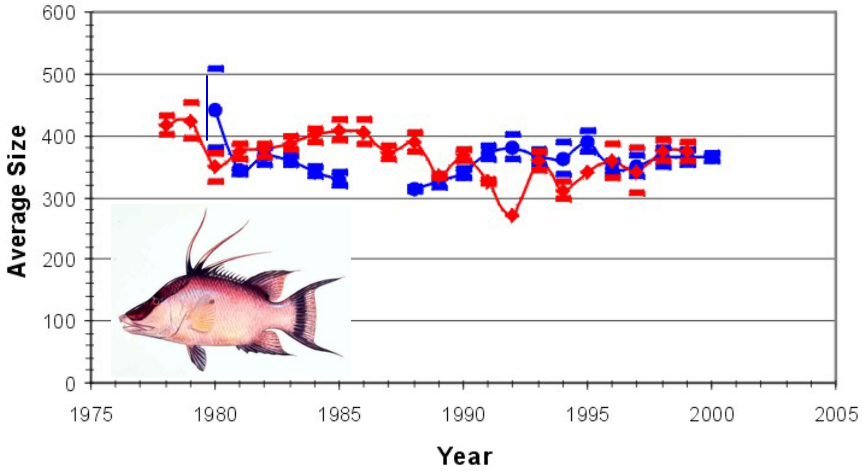
Yellowtail Snapper

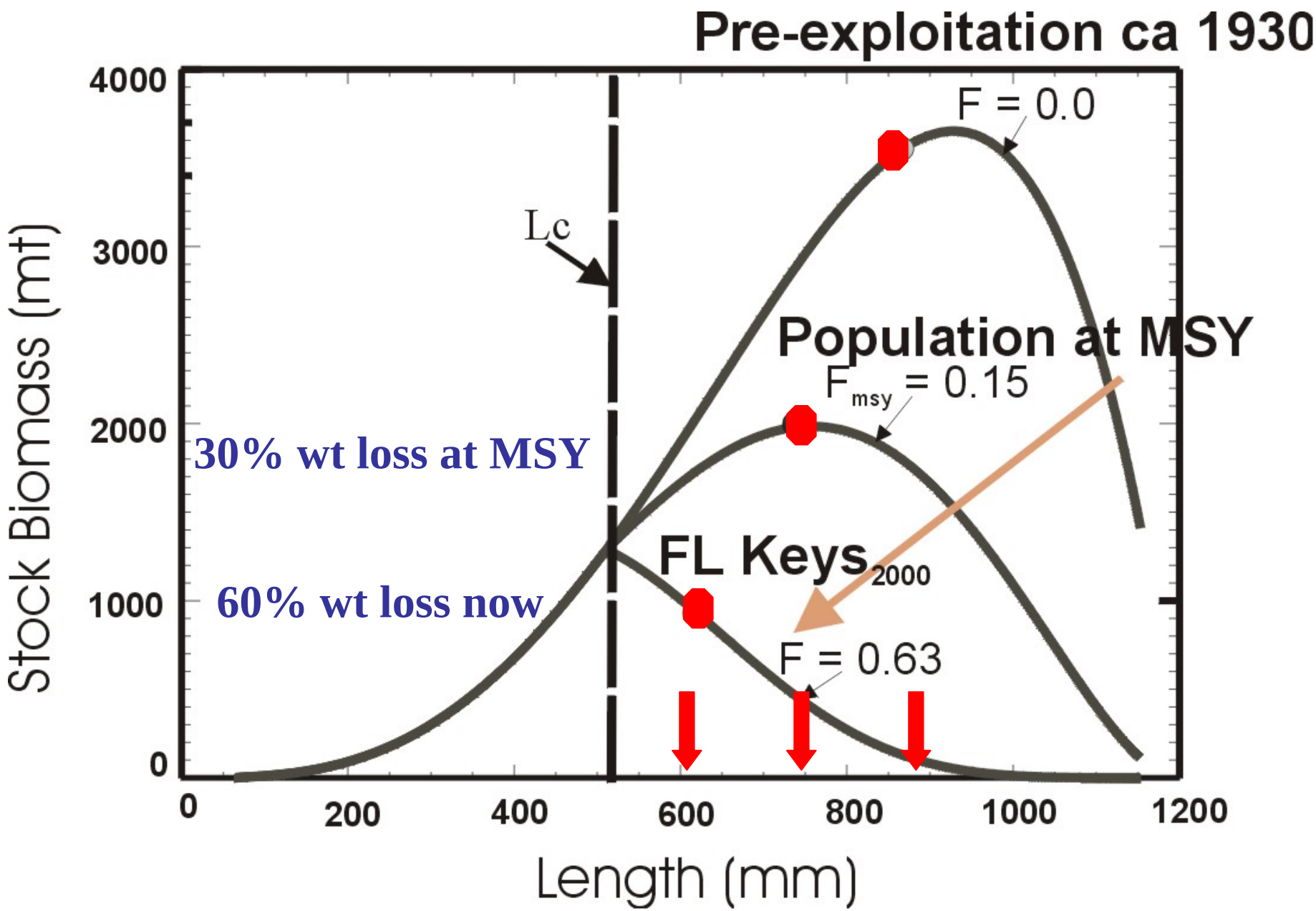


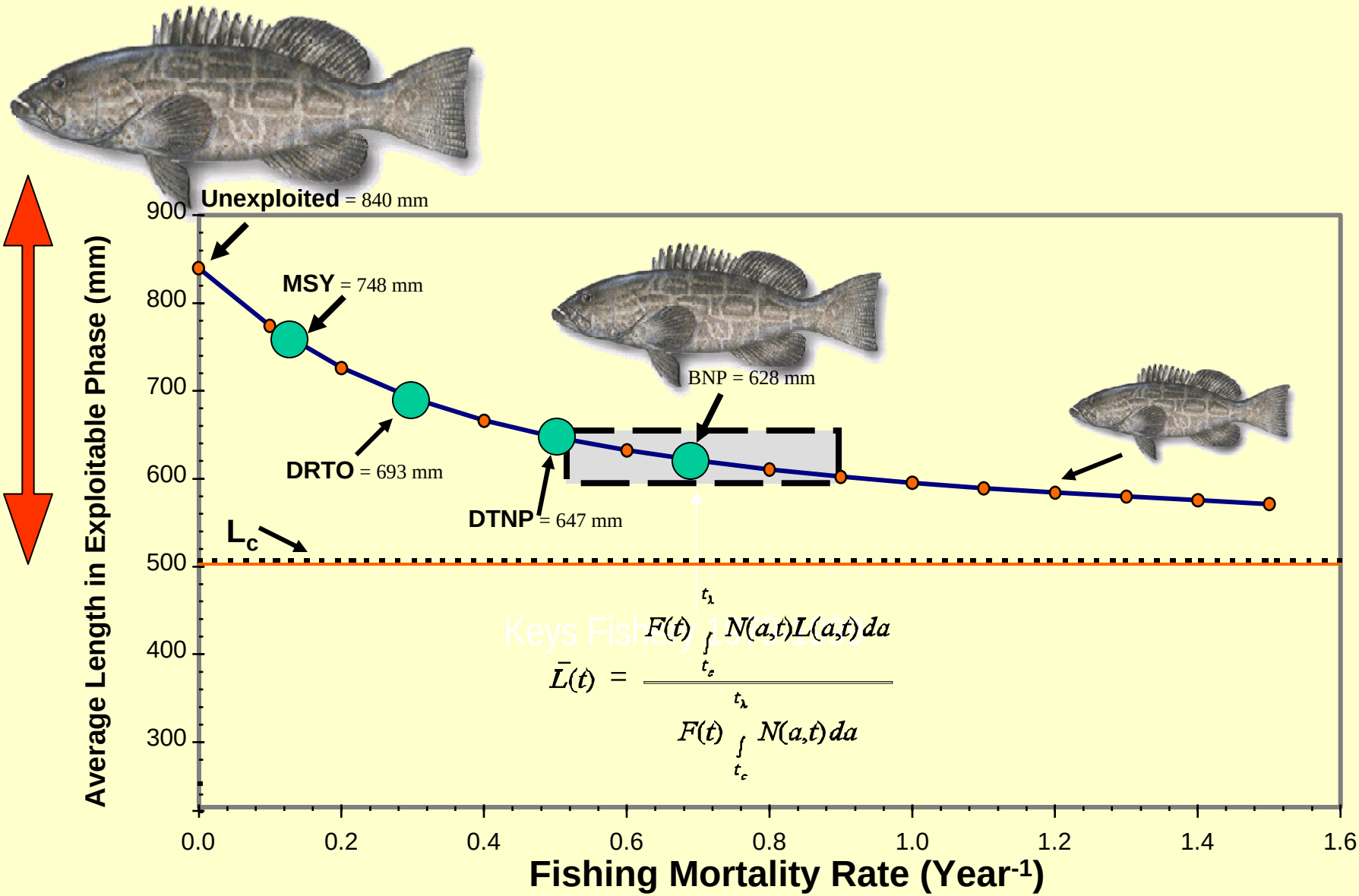
Gray Snapper

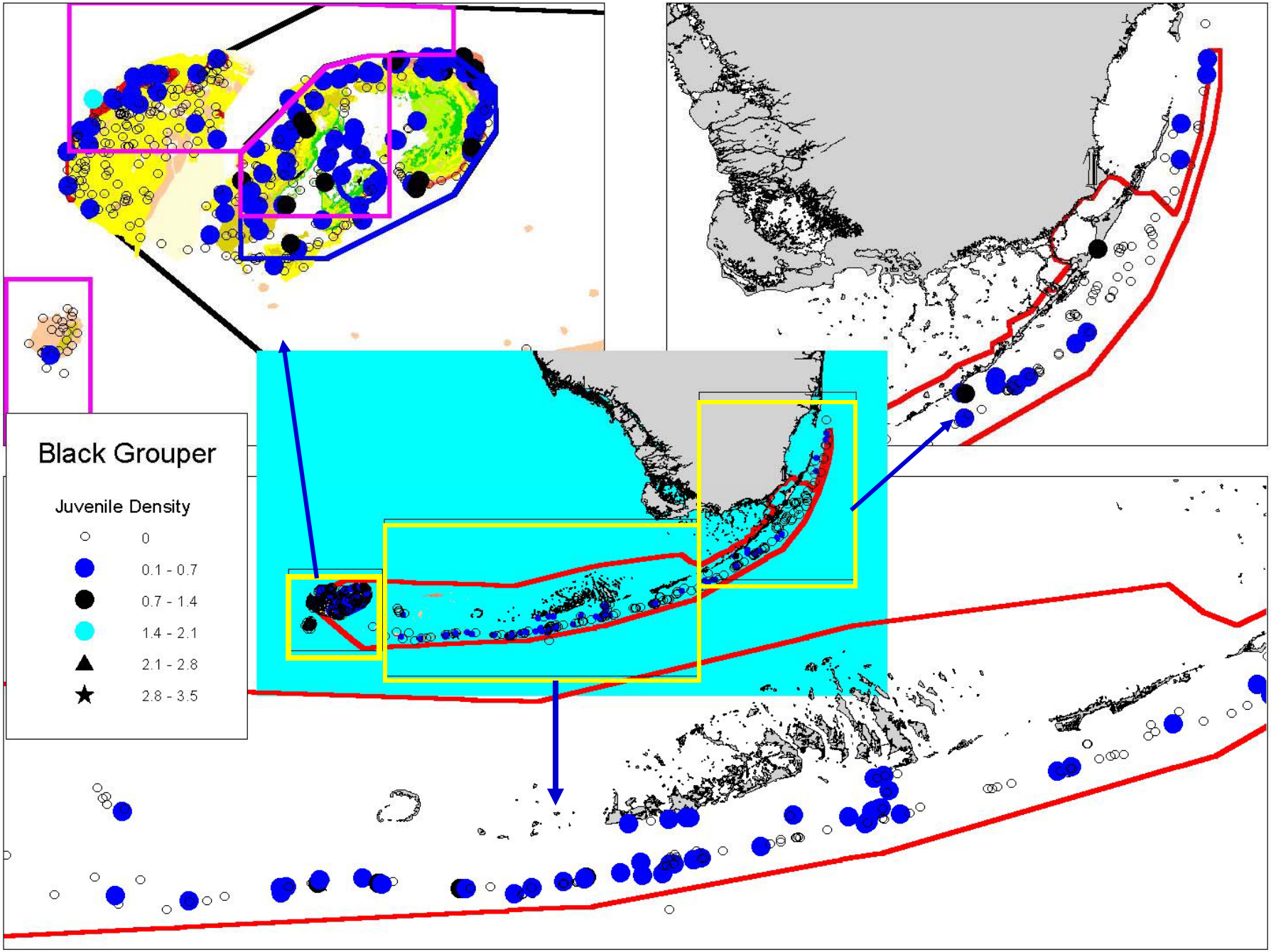


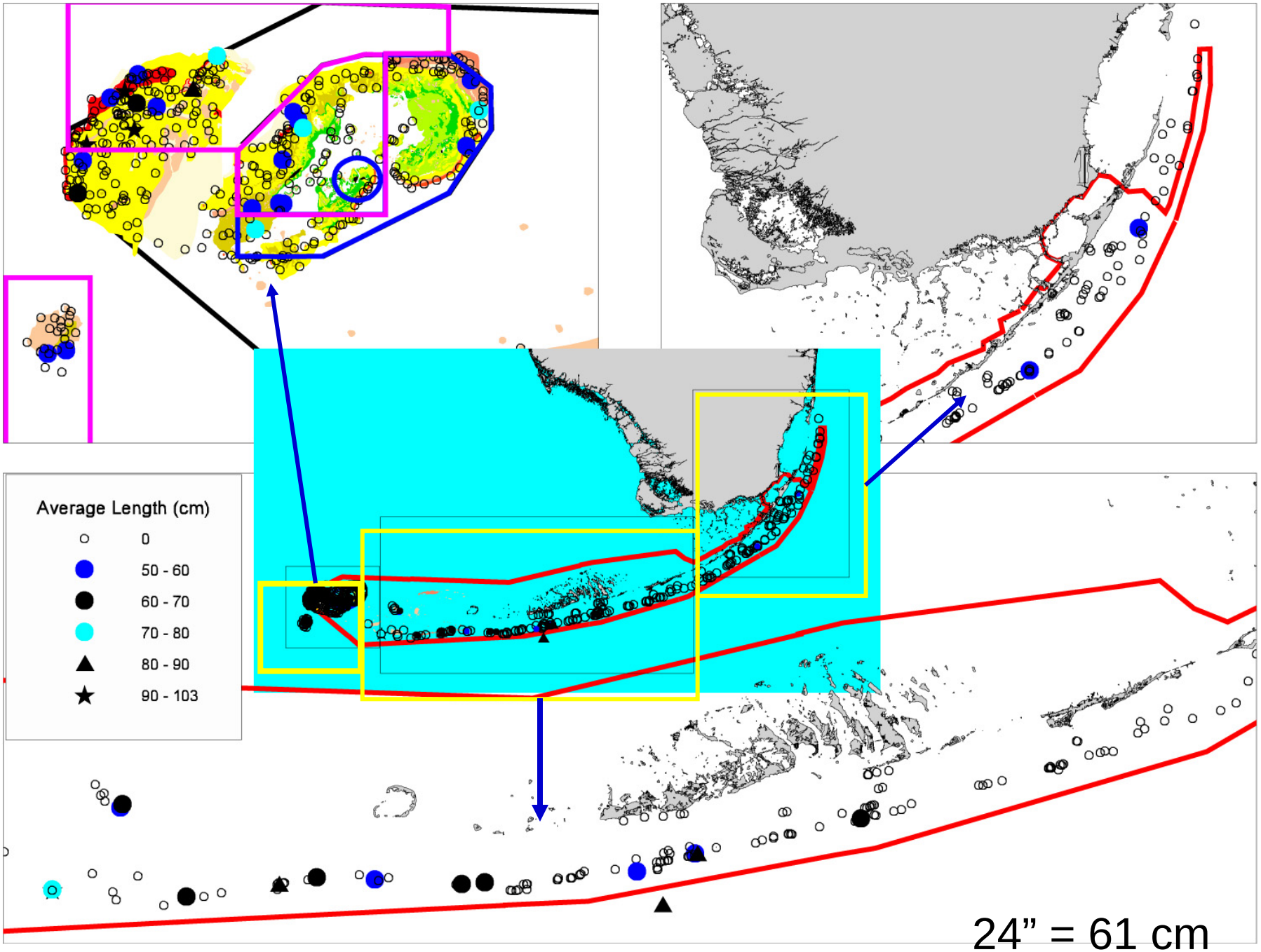
Hogfish



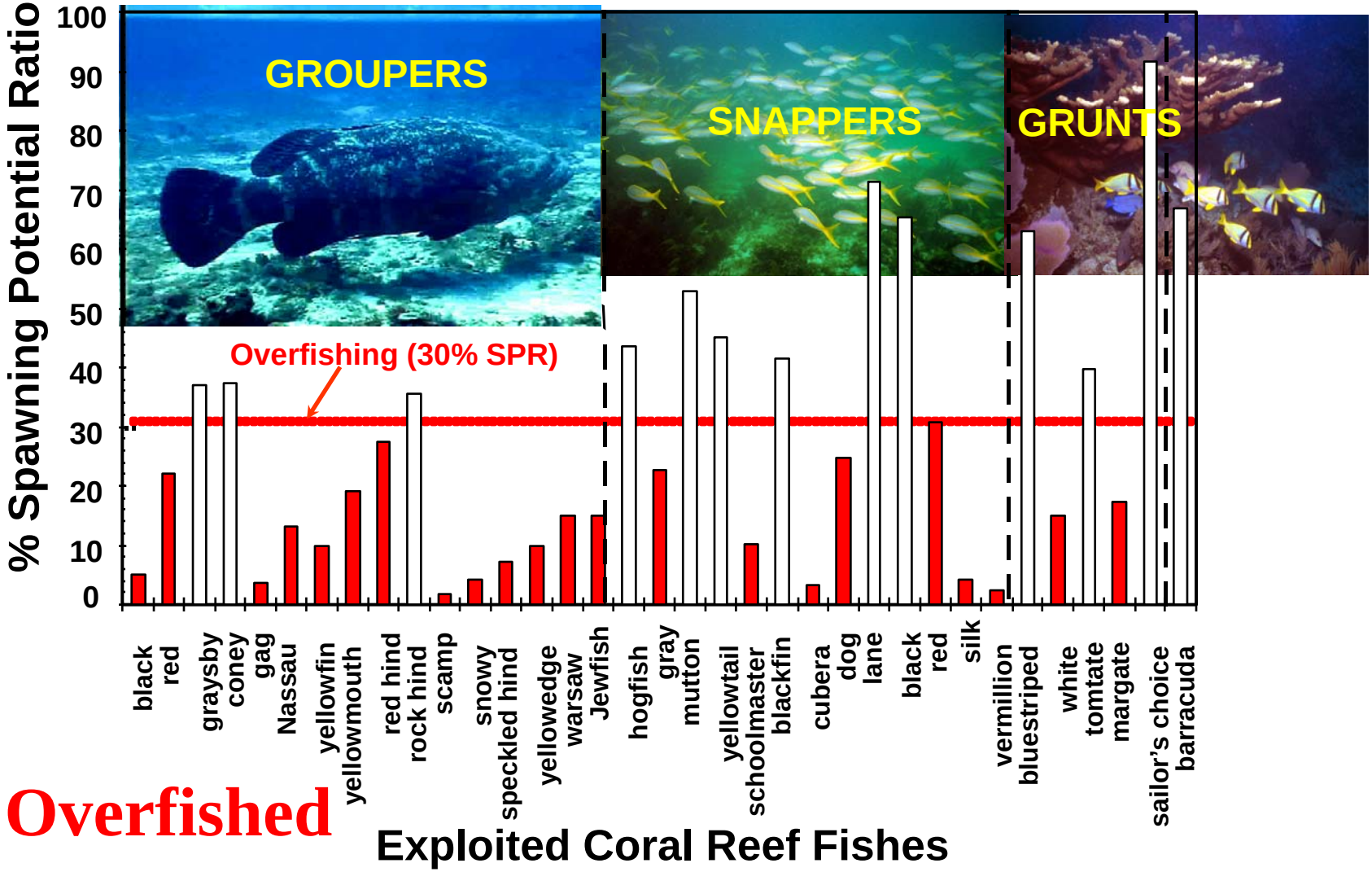

Pre-exploitation ca 1930
Stock Biomass (mt)
4000
3000
2000
1000
0
Lc
F = 0.0
Population at MSY
F_{msy} = 0.15
30% wt loss at MSY
FL Keys 2000
60% wt loss now
F = 0.63
0
200
400
600
800
1000
1200
Length (mm)


Unexploited = 840 mm
MSY = 748 mm
BNP = 628 mm
DRTO = 693 mm
DTNP = 647 mm
L_c
Average Length in Exploitable Phase (mm)
900
800
700
600
500
400
300
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
Fishing Mortality Rate (Year-1)
$\bar{L}(t) = \frac{F(t)\int_{t_c}^{t_\lambda} N(a,t)L(a,t)\,da}{F(t)\int_{t_c}^{t_\lambda} N(a,t)\,da}$


Black Grouper
Juvenile Density
0
0.1 - 0.7
0.7 - 1.4
1.4 - 2.1
2.1 - 2.8
2.8 - 3.5


Average Length (cm)
0
50 - 60
60 - 70
70 - 80
80 - 90
90 - 103
24” = 61 cm

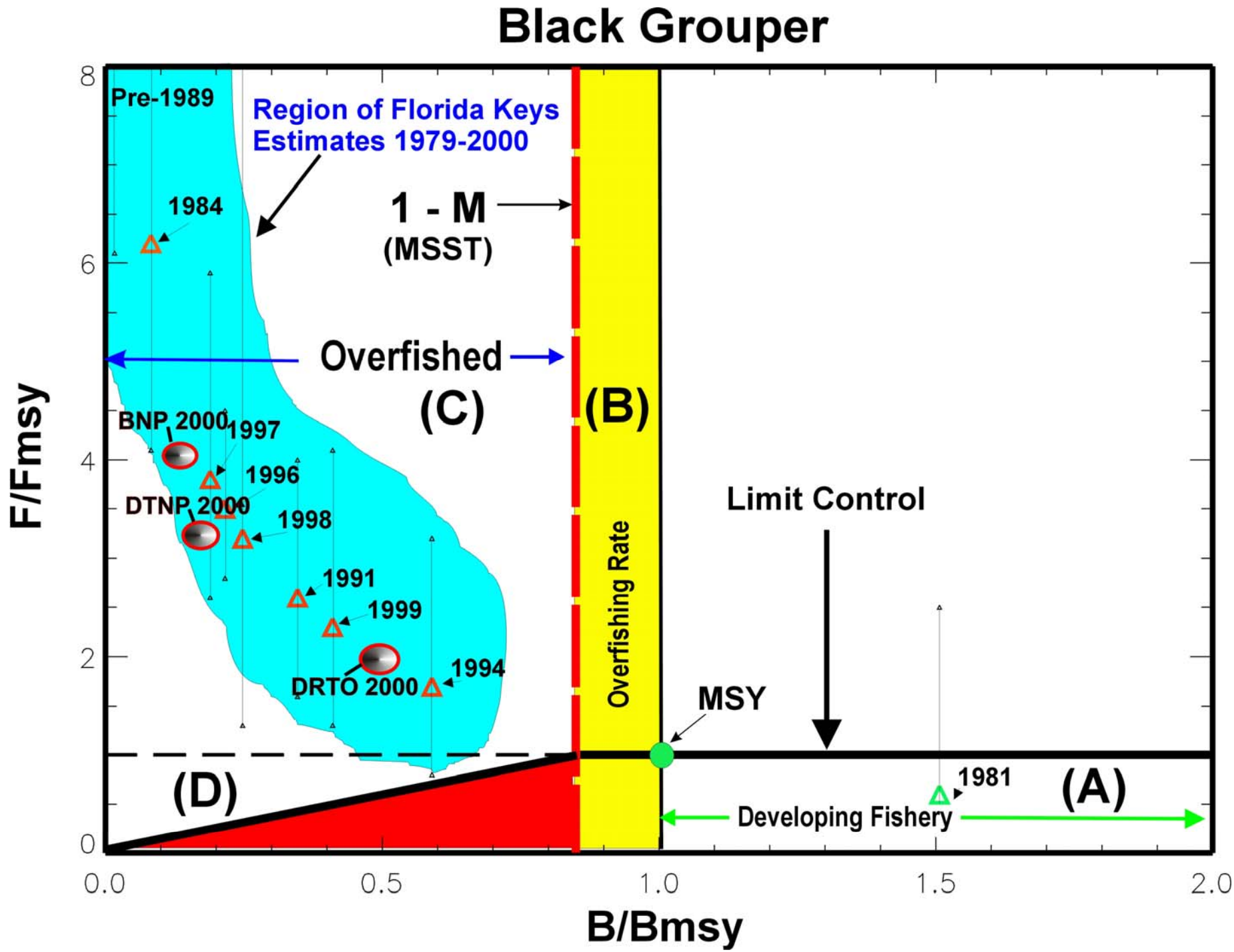
Florida Keys 2000

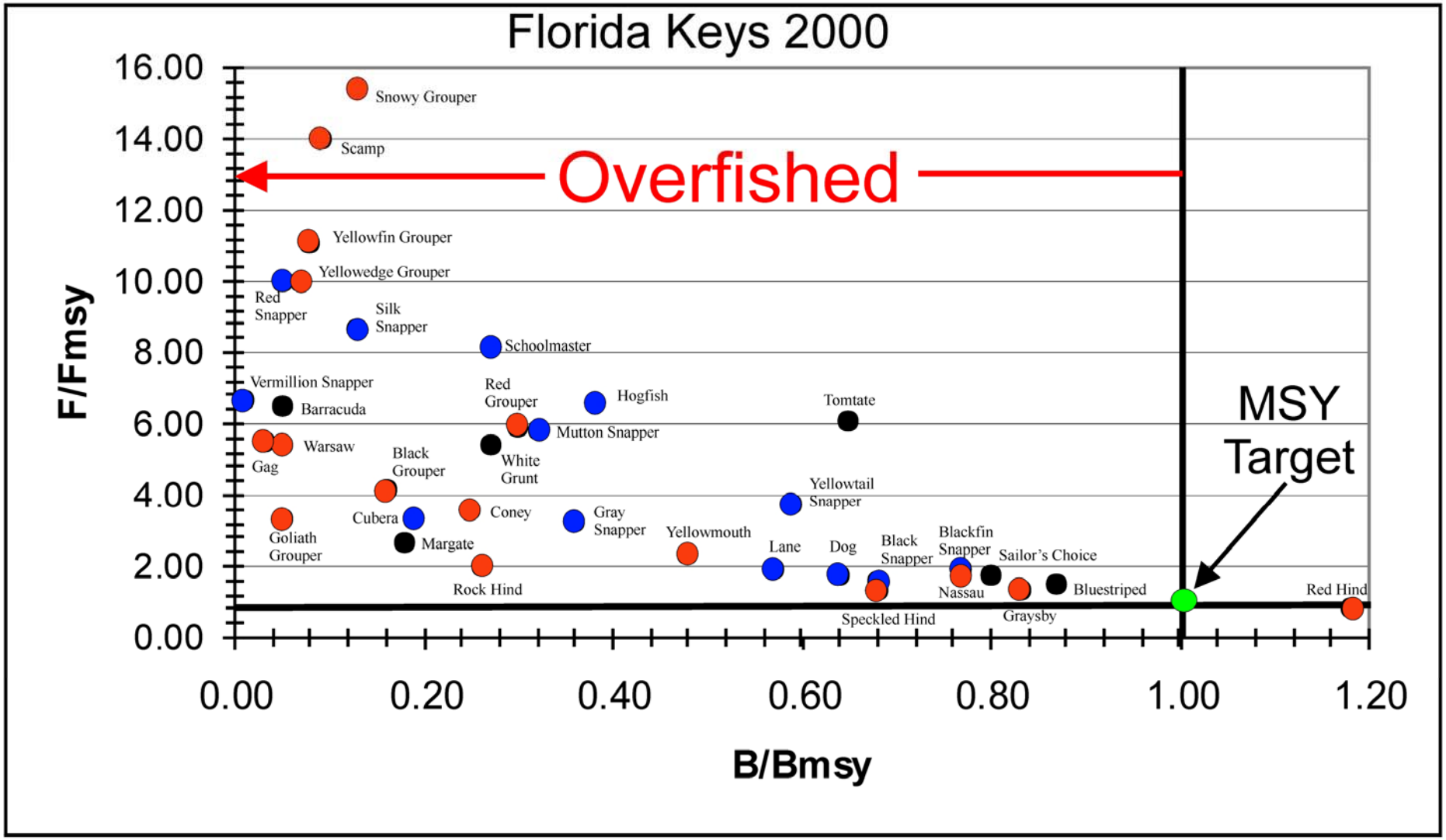


65% Overfished

88% (206 species) are unknown

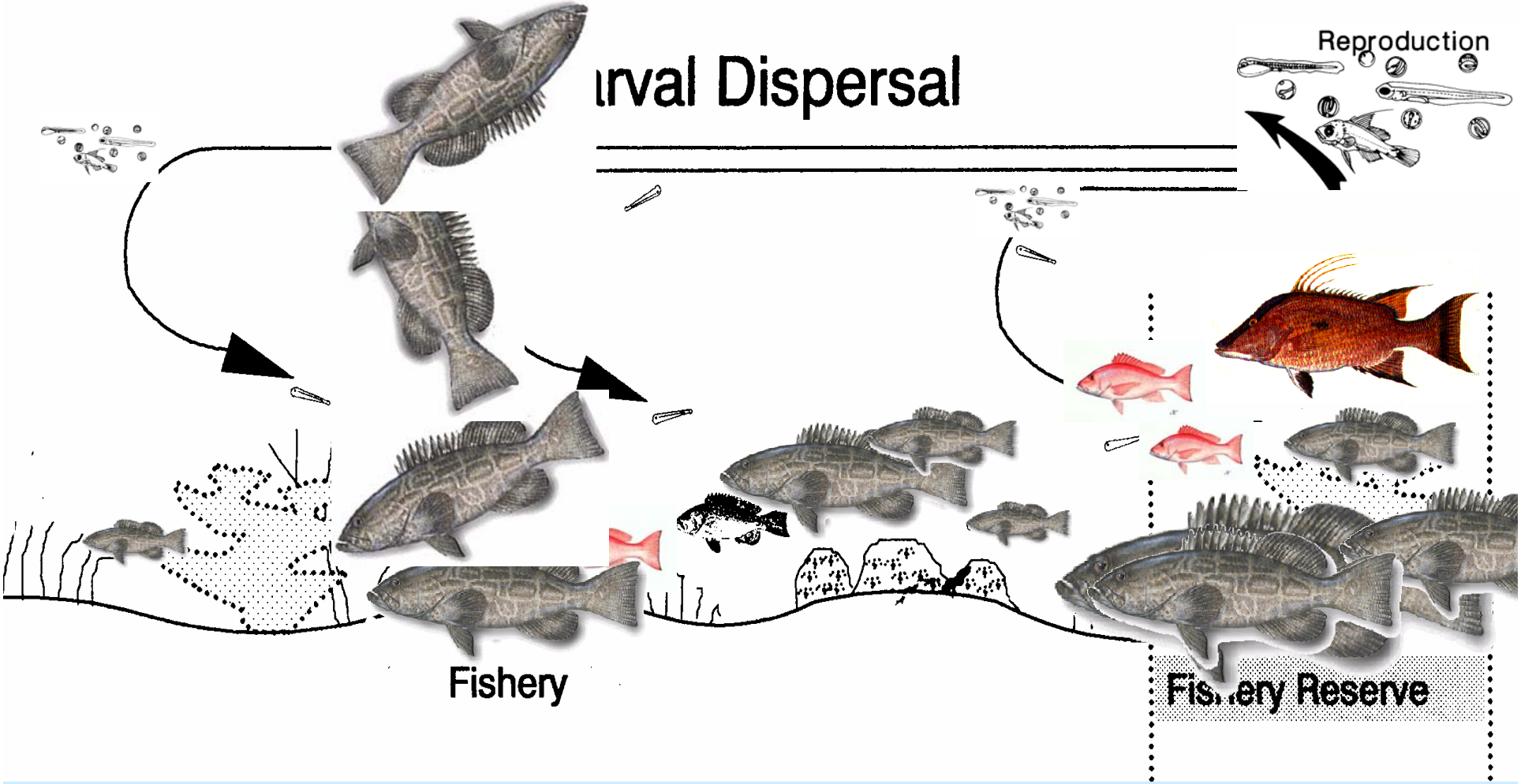
Ault et al. 1997. 2nd World Fisheries Congress
Ault et al. 1998. Fishery Bulletin


Black Grouper
Pre-1989
Region of Florida Keys
Estimates 1979-2000
1984
1 - M
(MSST)
Overfished
(C)
(B)
BNP 2000
1997
1996
DTNP 2000
1998
1991
1999
DRTO 2000
1994
Overfishing Rate
Limit Control
MSY
(D)
1981
(A)
Developing Fishery
F/Fmsy
B/Bmsy
0
2
4
6
8
0.0
0.5
1.0
1.5
2.0


Florida Keys 2000
F/Fmsy
B/Bmsy
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
0.00
0.20
0.40
0.60
0.80
1.00
1.20
Overfished
MSY
Target
Snowy Grouper
Scamp
Yellowfin Grouper
Yellowedge Grouper
Red
Snapper
Silk
Snapper
Schoolmaster
Vermillion Snapper
Barracuda
Red
Grouper
Hogfish
Tomtate
Mutton Snapper
Warsaw
Gag
Black
Grouper
White
Grunt
Yellowtail
Snapper
Cubera
Coney
Gray
Snapper
Goliath
Grouper
Margate
Yellowmouth
Lane
Dog
Black
Snapper
Blackfin
Snapper
Sailor's Choice
Rock Hind
Nassau
Bluestriped
Red Hind
Speckled Hind
Graysby

Spillover

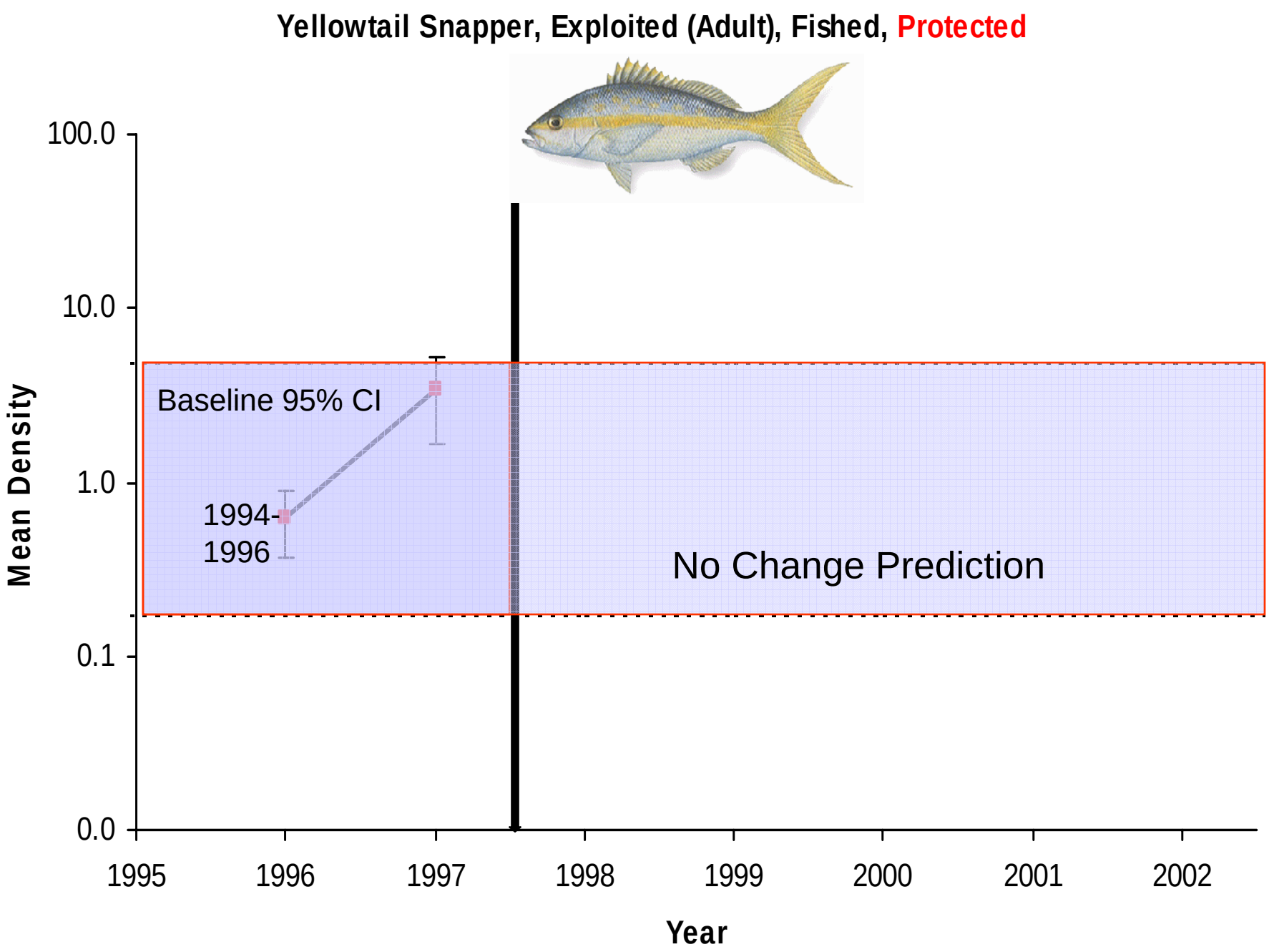
Reproduction & Dispersal

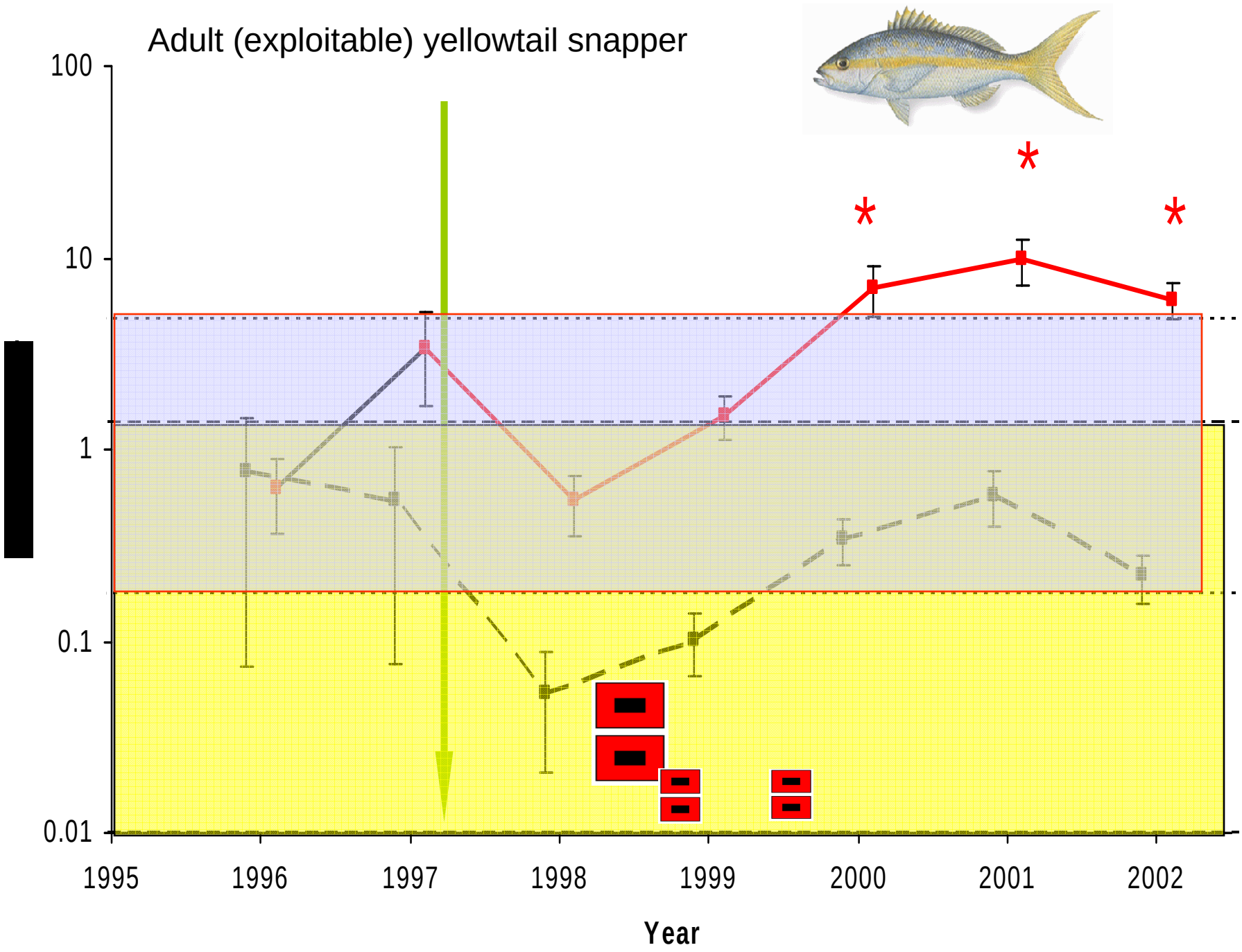


Colonization & Growth

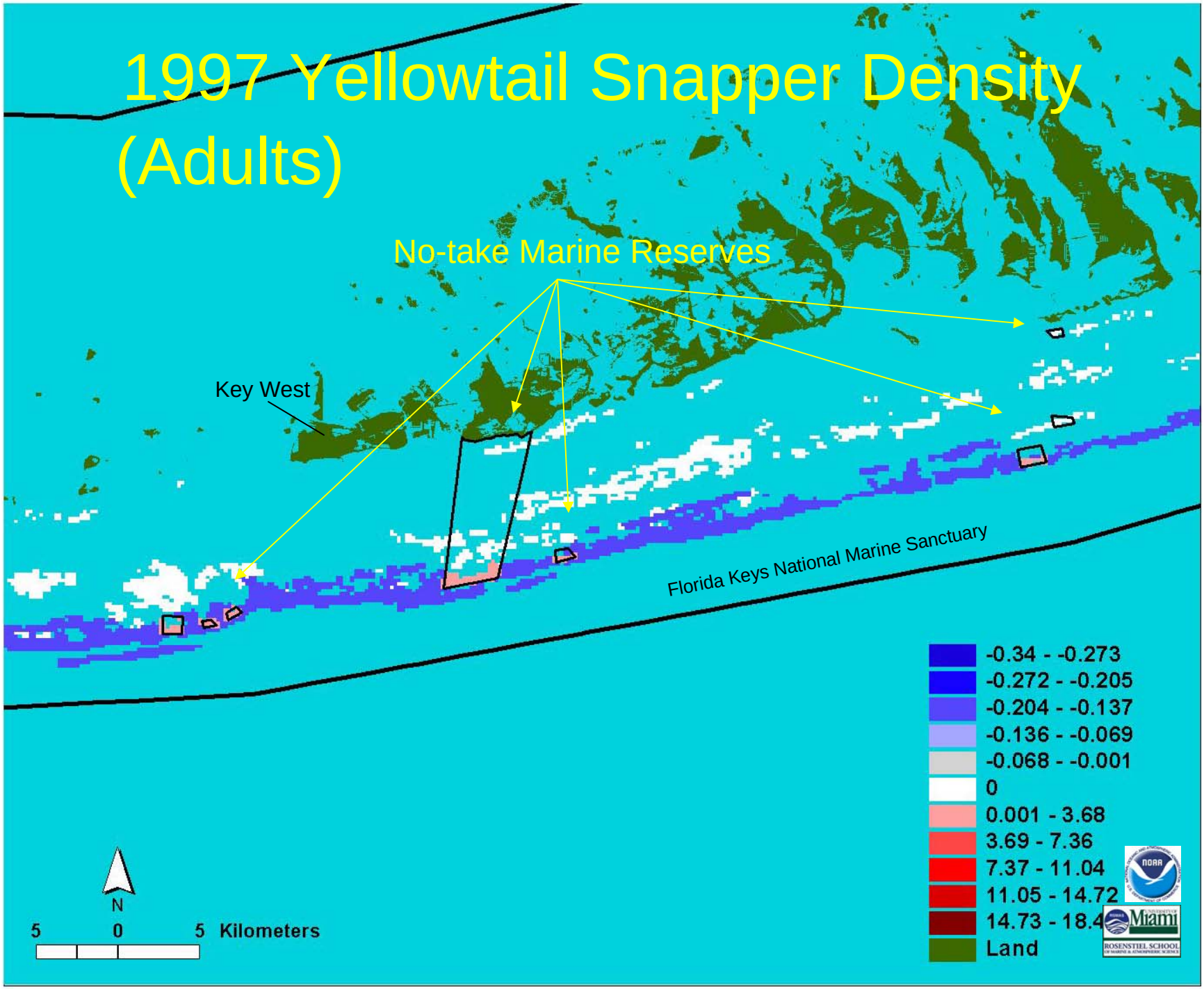
Abundance

Diversity

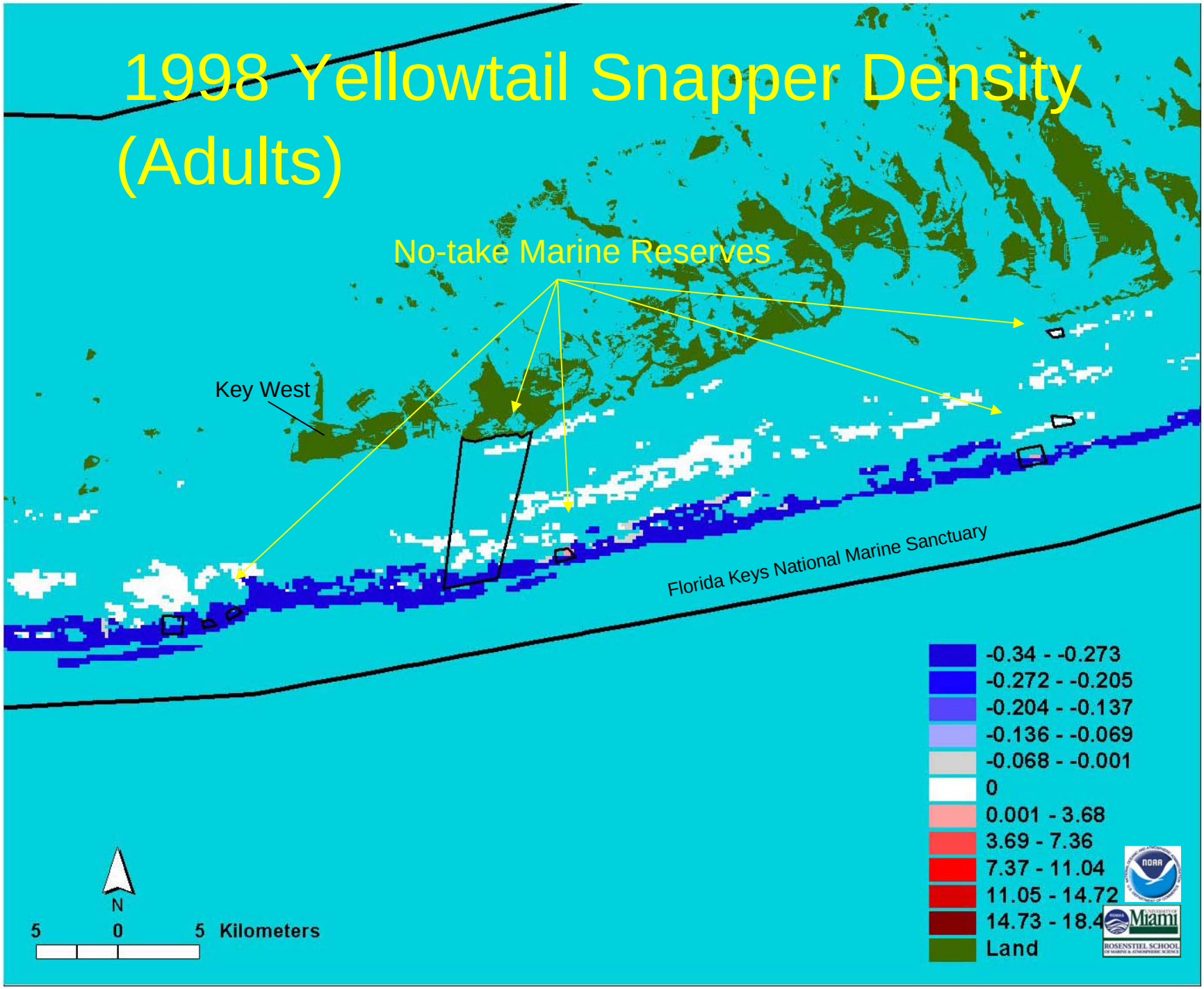

Yellowtail Snapper, Exploited (Adult), Fished, Protected
100.0
10.0
1.0
0.1
0.0
Mean Density
Baseline 95% CI
1994
1996
No Change Prediction
1995
1996
1997
1998
1999
2000
2001
2002
Year


Adult (exploitable) yellowtail snapper
100
10
1
0.1
0.01
1995
1996
1997
1998
1999
2000
2001
2002
Year
*
*
*

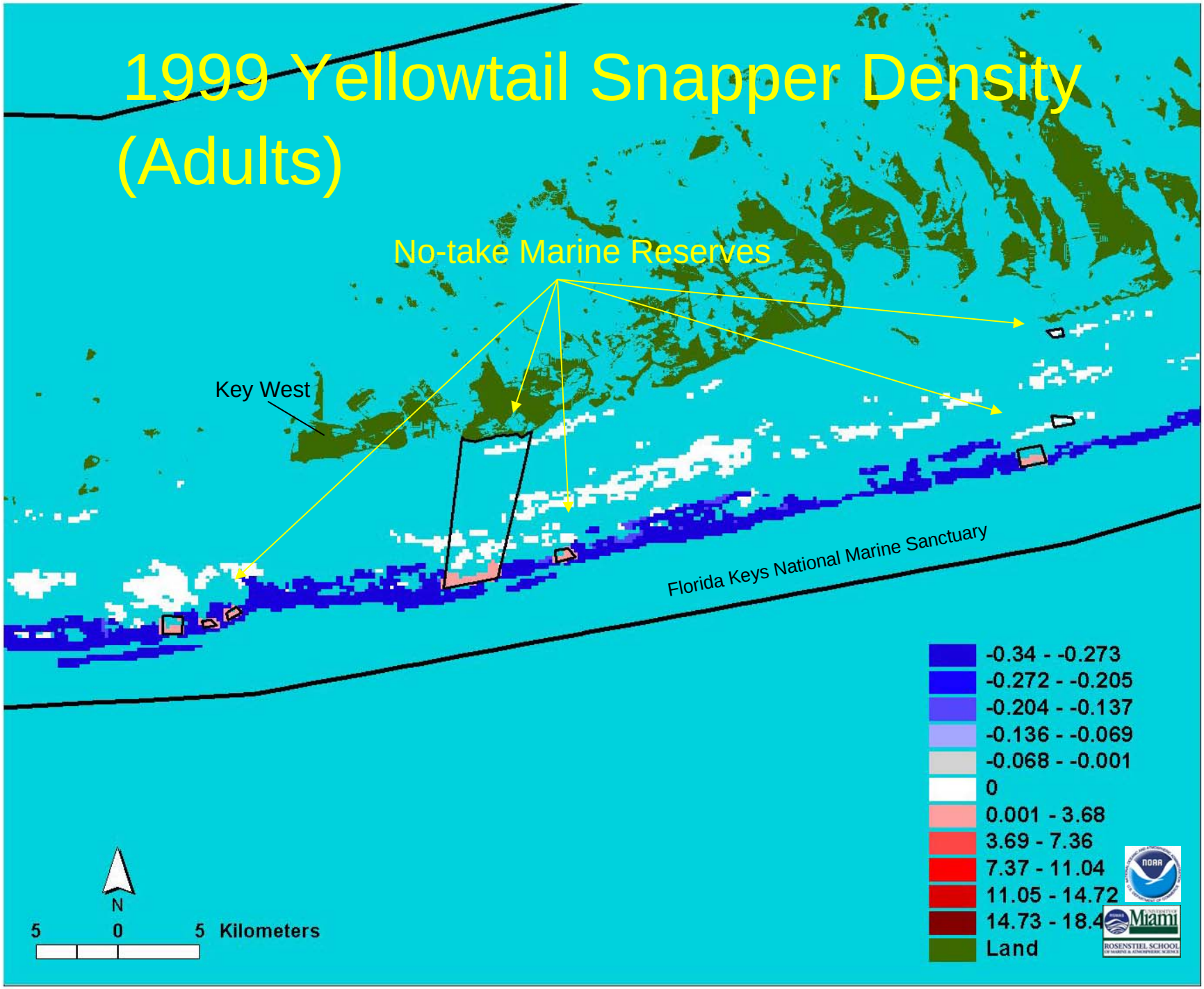
1997 Yellowtail Snapper Density (Adults)



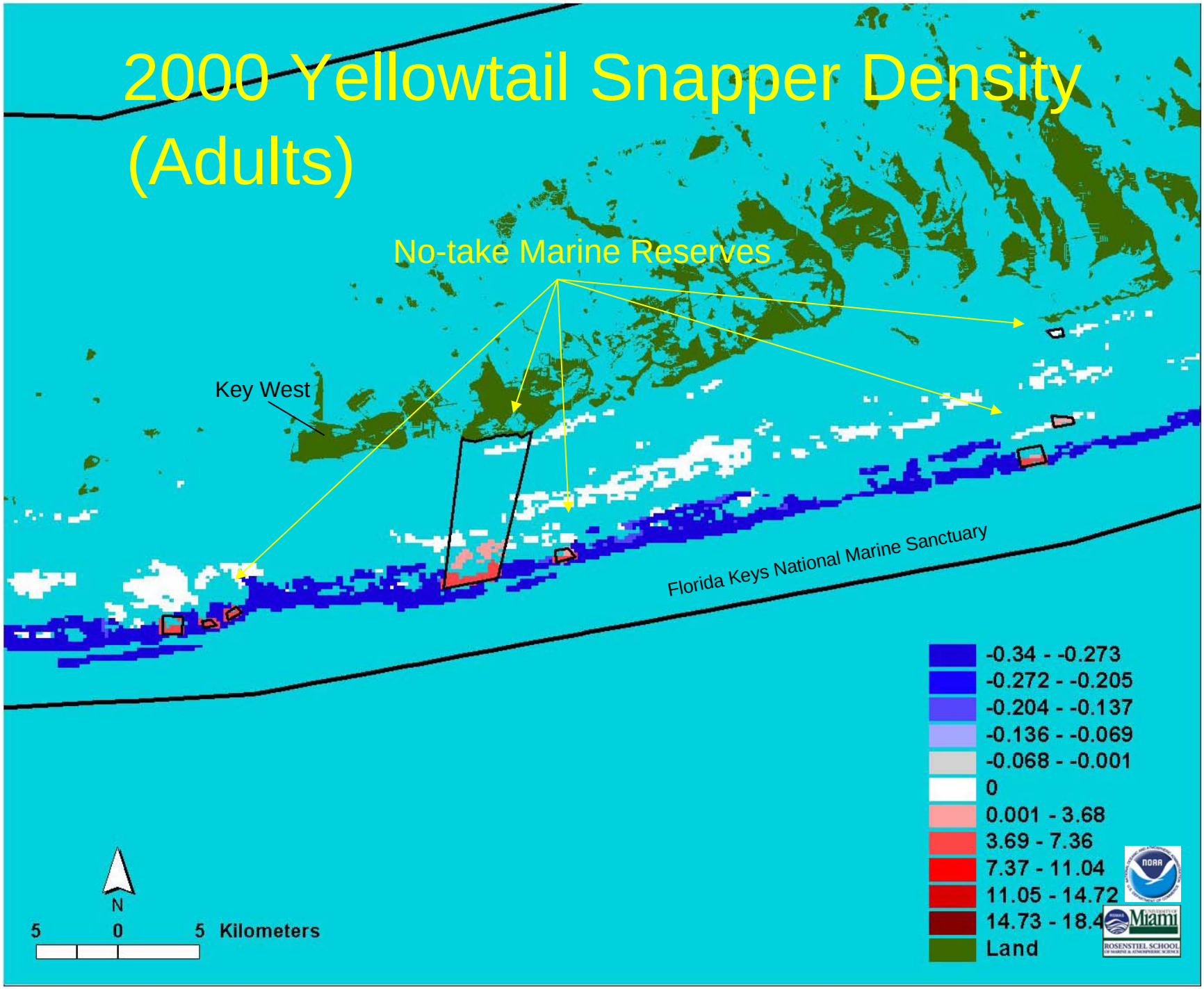
1998 Yellowtail Snapper Density (Adults)



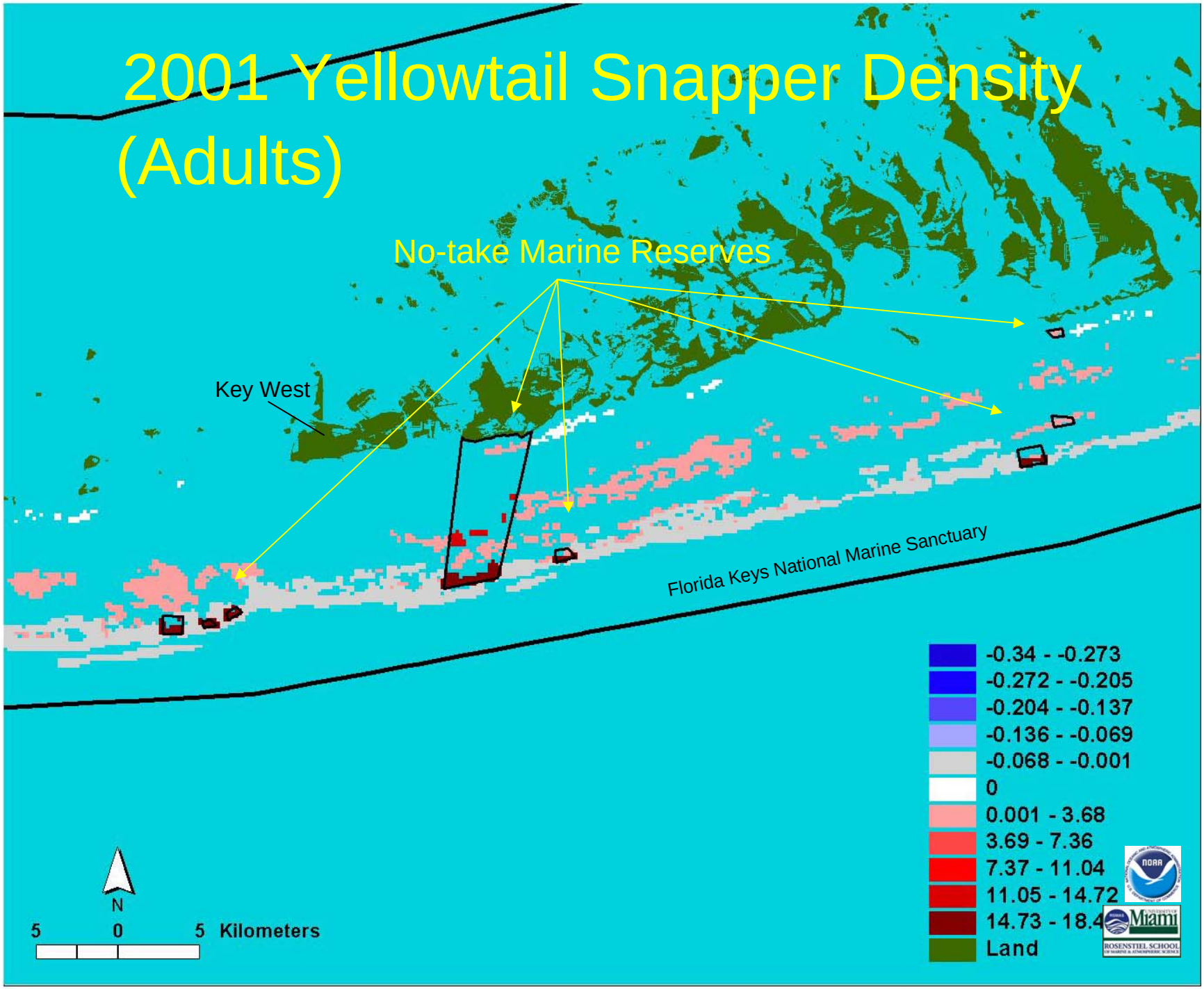
1999 Yellowtail Snapper Density (Adults)



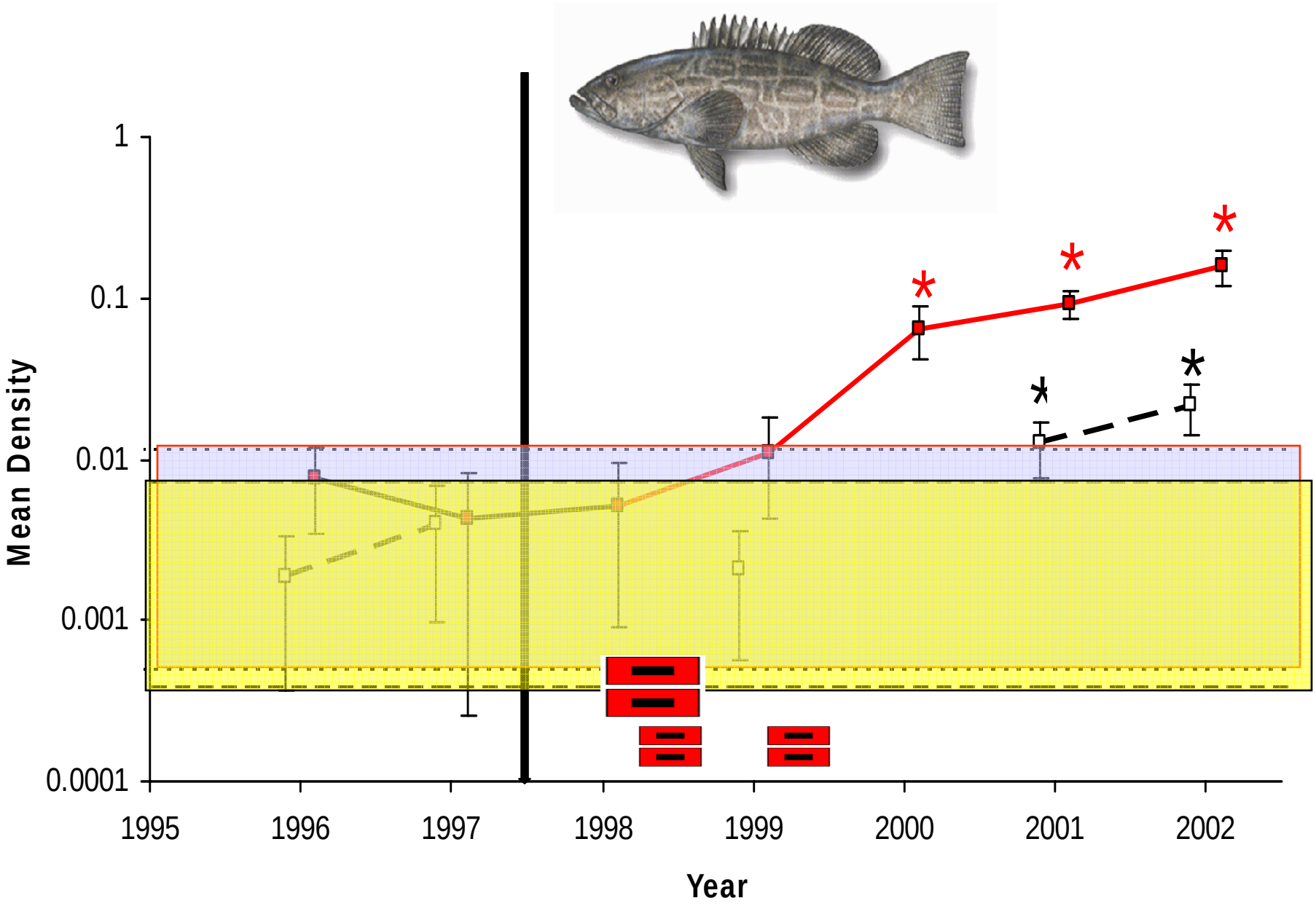
2000 Yellowtail Snapper Density (Adults)



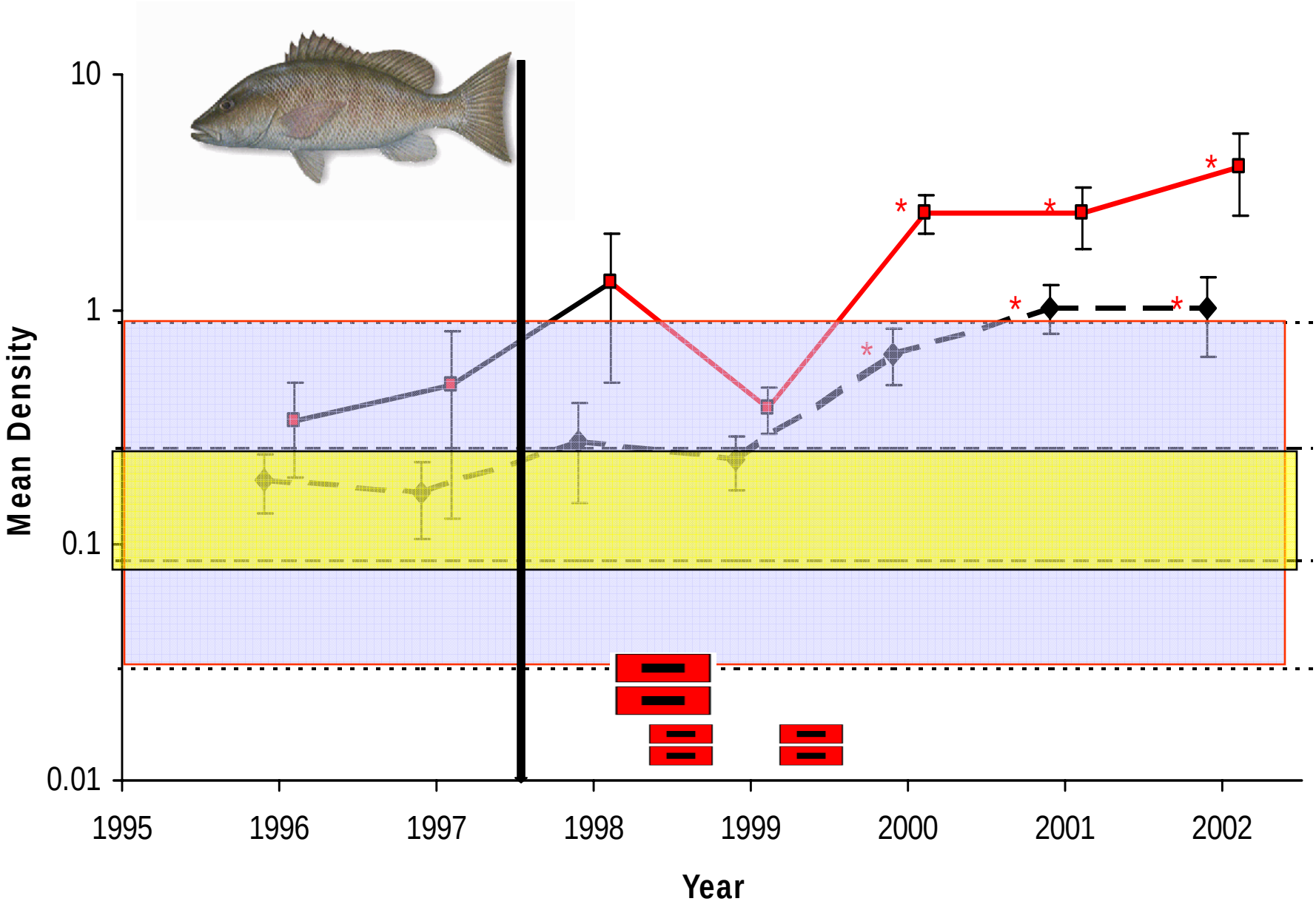
2001 Yellowtail Snapper Density (Adults)

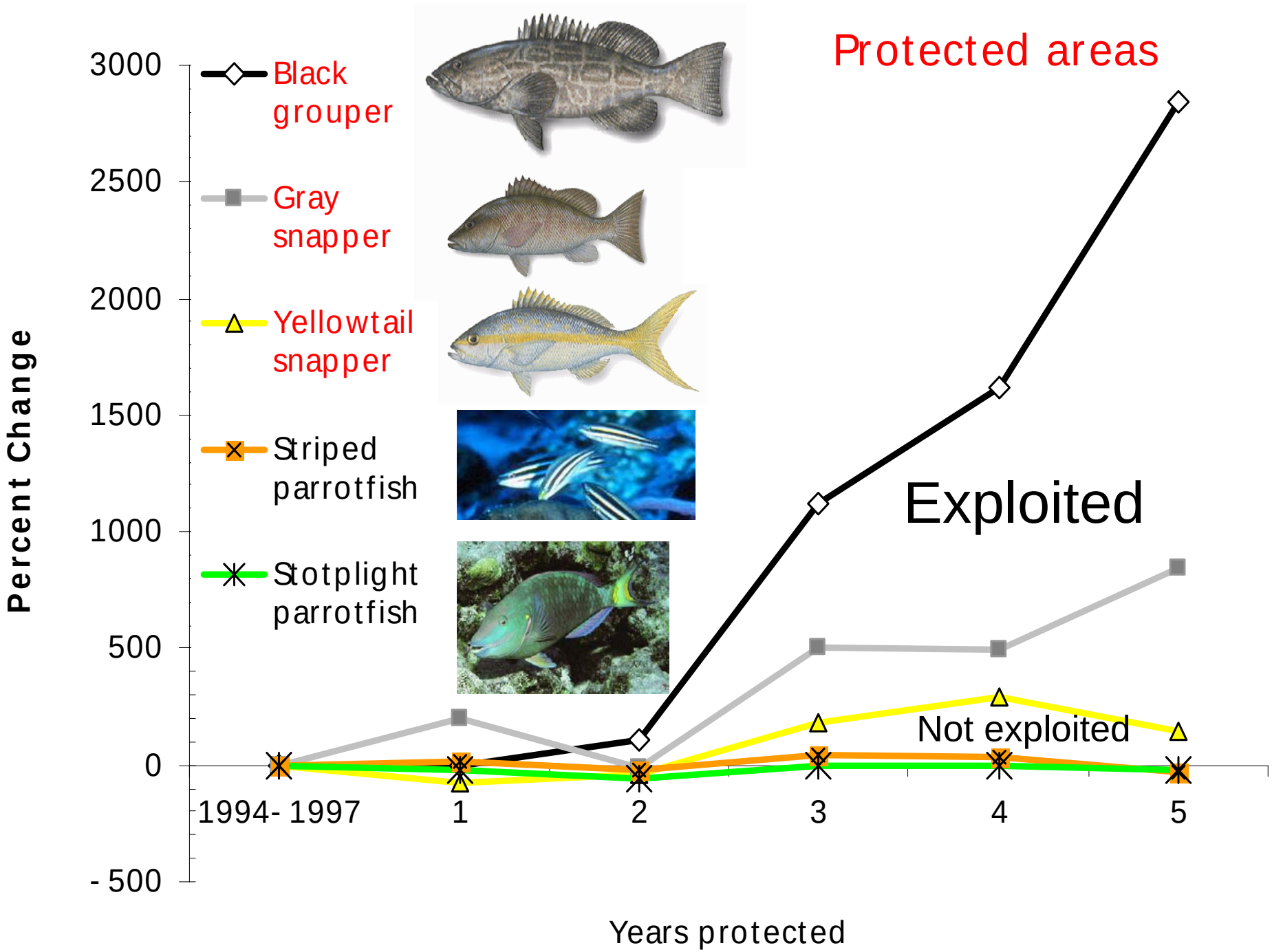


Black Grouper, Exploited, Protected and Fished



Gray Snapper, Exploited, Protected and Fished




Protected areas
Black grouper
Gray snapper
Yellowtail snapper
Striped parrotfish
Stotplight parrotfish
Exploited
Not exploited
Percent Change
3000
2500
2000
1500
1000
500
0
- 500
1994- 1997
1
2
3
4
5
Years protected

28 10:02 AM

Looe Key Reef 1983
Acropora