DISTRIBUTION OF
SPECKLED HIND & WARSAW GROUPER IN THE U.S. SOUTH ATLANTIC

Southeast Regional Office
St. Petersburg, Florida

SAFMC Meeting
Wilmington, North Carolina
December 3-7, 2012

NOAA FISHERIES
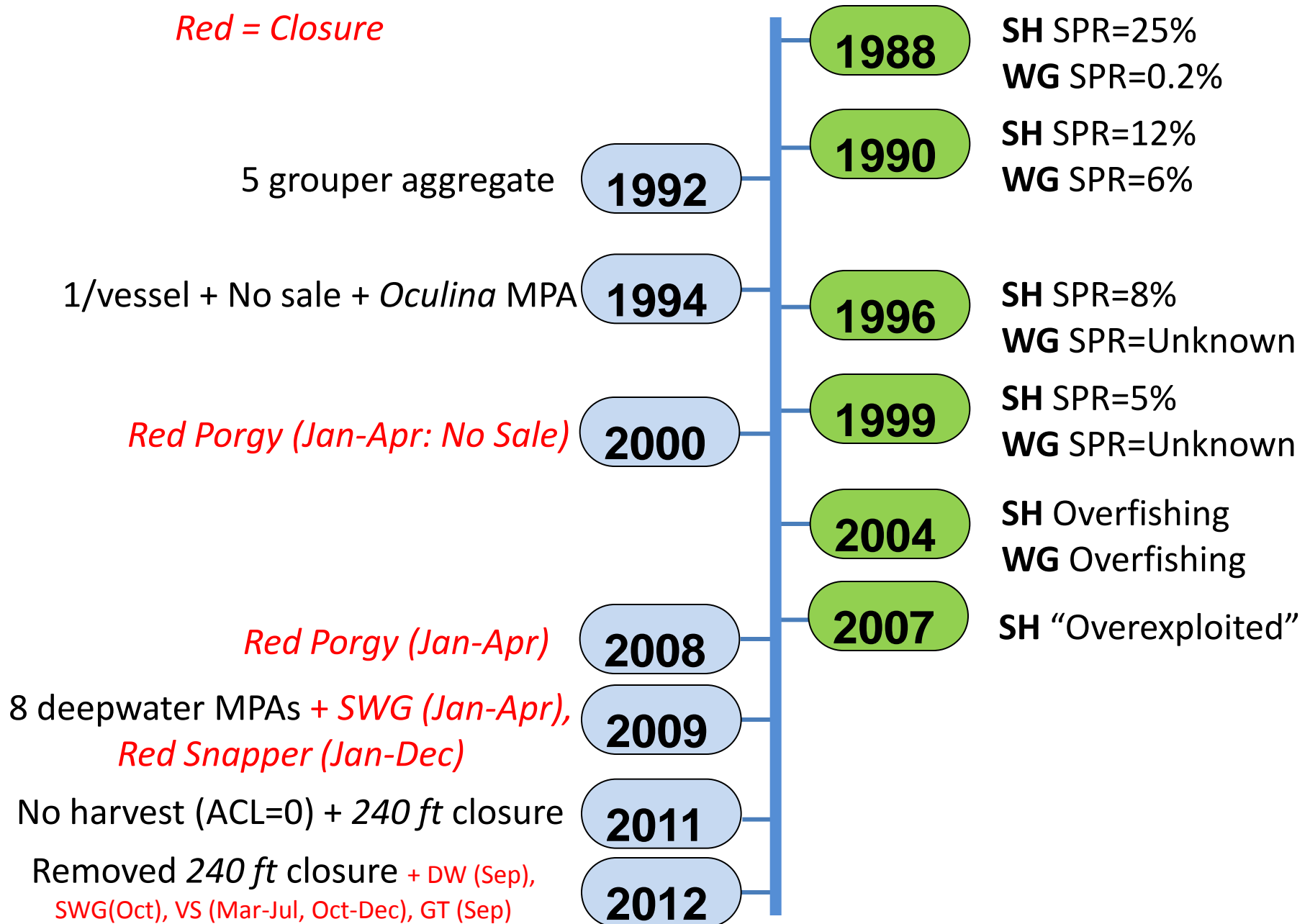
Outline

1. **Management history vs. stock status**

2. **Landing and discard trends for SH & WG**

3. **Observed and modeled distribution of SH & WG**

4. **Theory and description of spatial closures**

5. **Impacts of spatial closures on SH, WG**
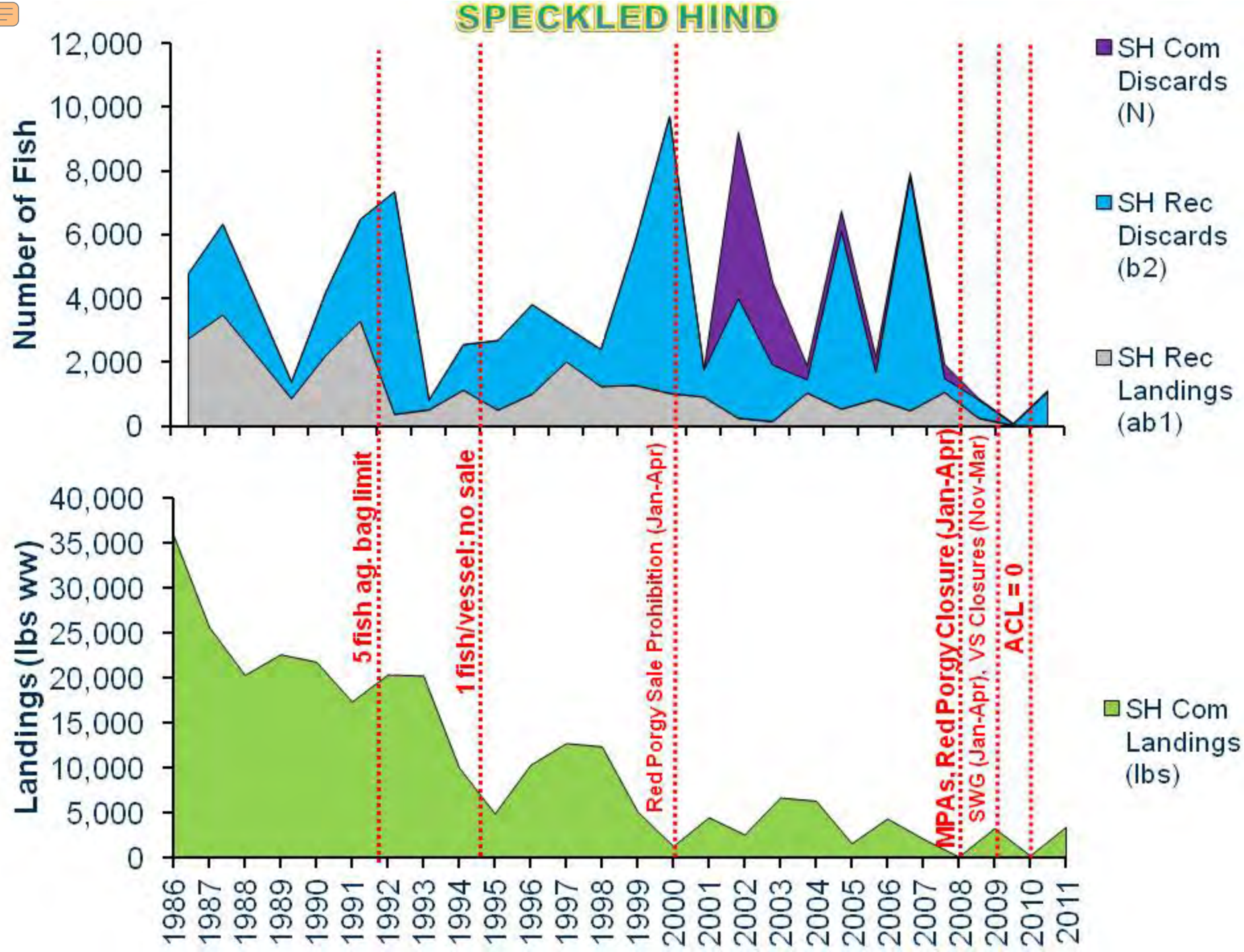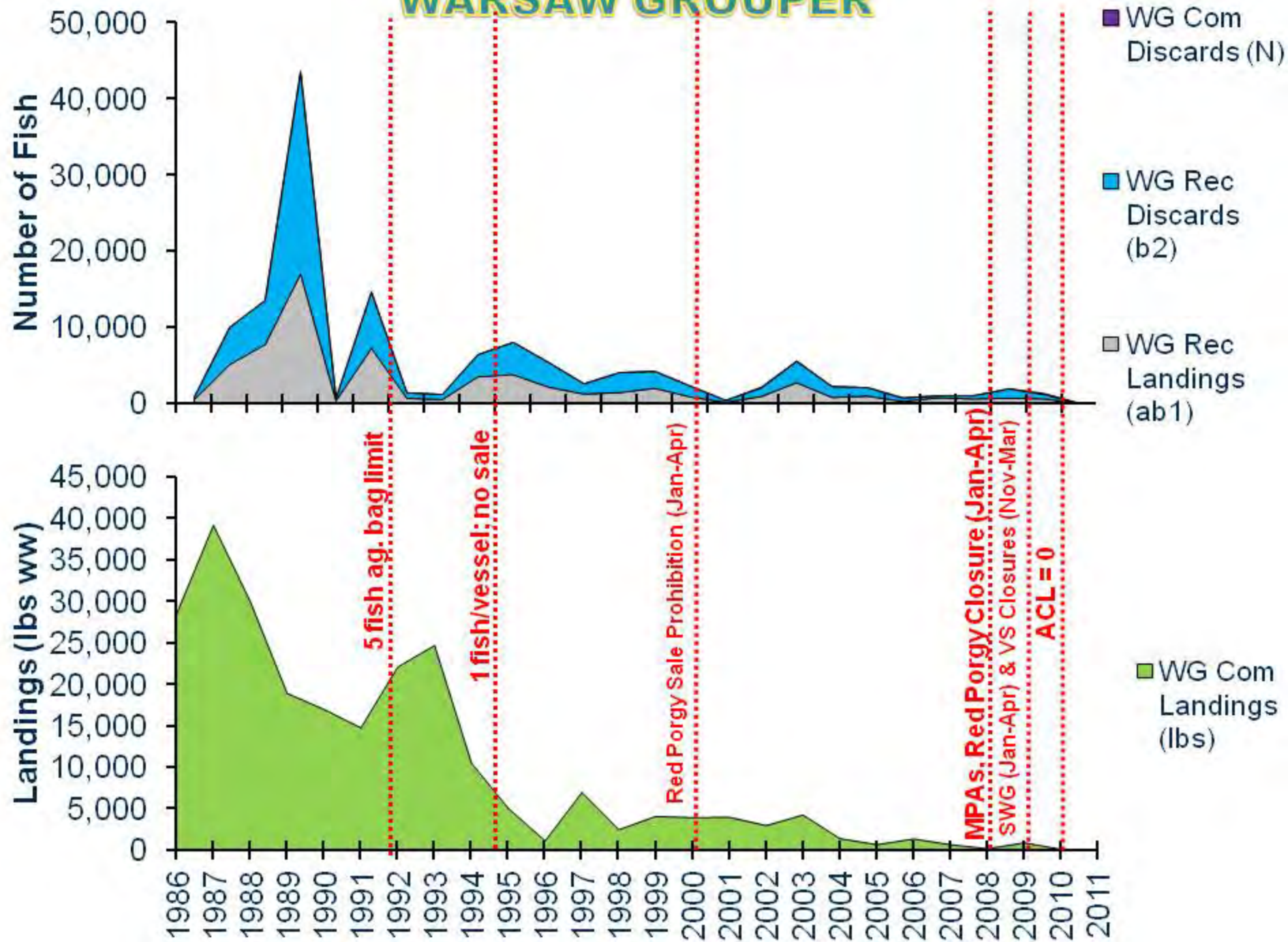
6. **Impacts on harvest of associated stocks**
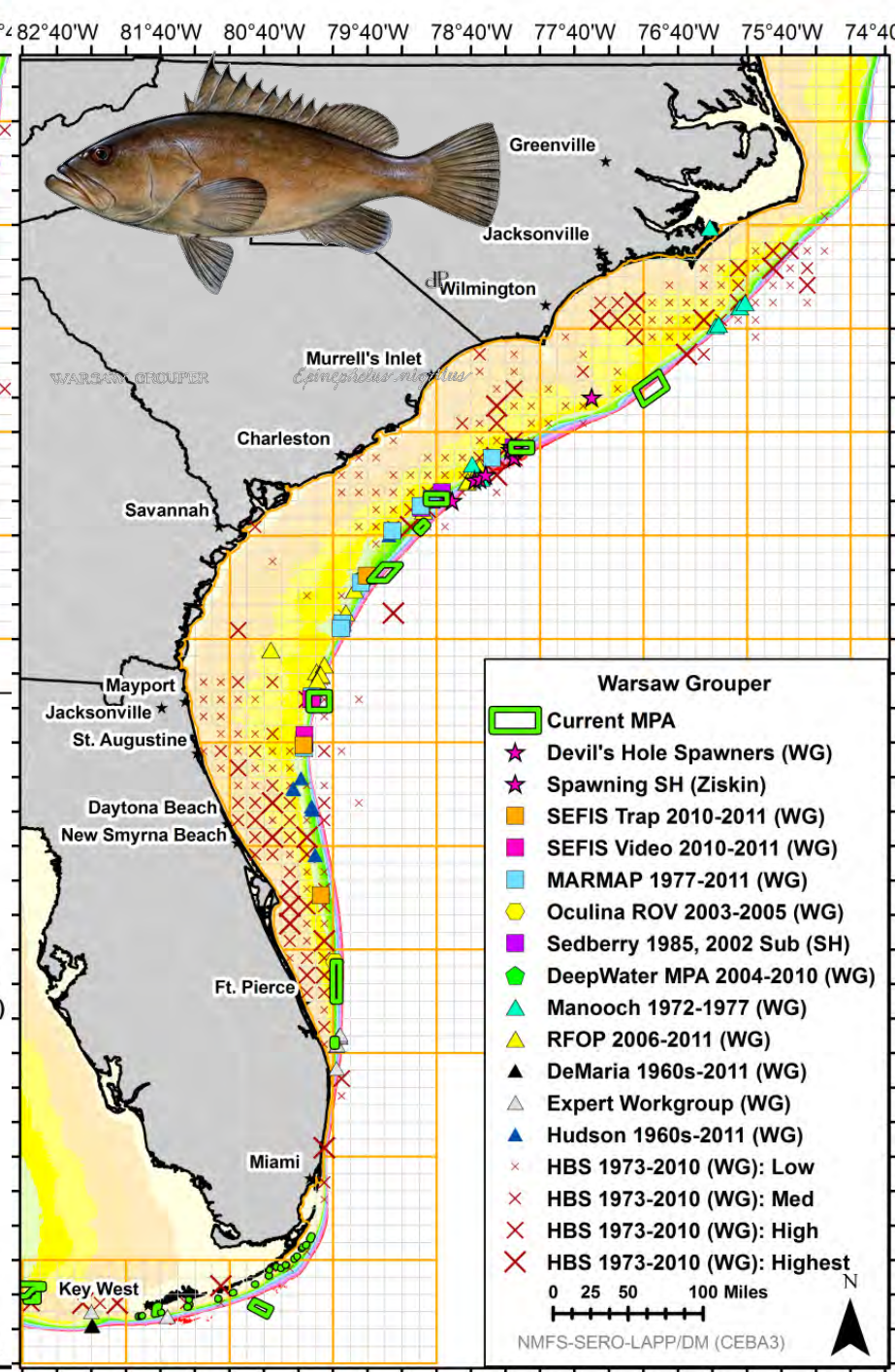
NOAA FISHERIES

Management History vs. Stock Status

Red = Closure

	1988 **SH** SPR=25% **WG** SPR=0.2%
	1990 **SH** SPR=12% **WG** SPR=6%
5 grouper aggregate **1992**	
1/vessel + No sale + *Oculina* MPA **1994**	
	1996 **SH** SPR=8% **WG** SPR=Unknown
Red Porgy (Jan-Apr: No Sale) **2000**	**1999** **SH** SPR=5% **WG** SPR=Unknown
	2004 **SH** Overfishing **WG** Overfishing
Red Porgy (Jan-Apr) **2008**	**2007** **SH** "Overexploited"
8 deepwater MPAs *+ SWG (Jan-Apr), Red Snapper (Jan-Dec)* **2009**	
No harvest (ACL=0) + *240 ft* closure **2011**	
Removed *240 ft* closure *+ DW (Sep), SWG(Oct), VS (Mar-Jul, Oct-Dec), GT (Sep)* **2012**	

SPECKLED HIND

Top panel — Number of Fish (y-axis: 0 to 12,000):
- SH Com Discards (N) — purple
- SH Rec Discards (b2) — blue
- SH Rec Landings (ab1) — gray

Bottom panel — Landings (lbs ww) (y-axis: 0 to 40,000):
- SH Com Landings (lbs) — green

X-axis (years): 1986–2011

Regulation markers (red dashed lines):
- 5 fish ag. bag limit
- 1 fish/vessel; no sale
- Red Porgy Sale Prohibition (Jan-Apr)
- MPAs, Red Porgy Closure (Jan-Apr), SWG (Jan-Apr), VS Closures (Nov-Mar)
- ACL = 0

WARSAW GROUPER

Top panel — Number of Fish:
- WG Com Discards (N)
- WG Rec Discards (b2)
- WG Rec Landings (ab1)

Bottom panel — Landings (lbs ww):
- WG Com Landings (lbs)

Vertical reference lines:
- 5 fish ag. bag limit
- 1 fish/vessel; no sale
- Red Porgy Sale Prohibition (Jan-Apr)
- MPAs, Red Porgy Closure (Jan-Apr)
- SWG (Jan-Apr) & VS Closures (Nov-Mar)
- ACL = 0

Speckled Hind

- Current MPA
- ★ Spawning SH (Ziskin)
- ■ SEFIS Trap 2010-2011 (SH)
- ■ SEFIS Video 2010-2011 (SH)
- ■ MARMAP 1977-2011 (SH)
- ⬠ Oculina ROV 2003-2005 (SH)
- ■ Sedberry 1985, 2002 Sub (SH)
- ⬠ DeepWater MPA 2004-2010 (SH)
- ✕ Museum Archive 1884-1993 (SH)
- ▲ Manooch 1972-1977 (SH)
- ▲ RFOP 2006-2011 (SH)
- ▲ Hudson 1960s-2011 (SH)
- ▲ Expert Workgroup (SH)
- ✕ HBS 1973-2010 (SH): Low
- ✕ HBS 1973-2010 (SH): Med
- ✕ HBS 1973-2010 (SH): High
- ✕ HBS 1973-2010 (SH): Highest

0 25 50   100 Miles

NMFS-SERO-LAPP/DM (CEBA3)

Warsaw Grouper

- Current MPA
- ★ Devil's Hole Spawners (WG)
- ★ Spawning SH (Ziskin)
- ■ SEFIS Trap 2010-2011 (WG)
- ■ SEFIS Video 2010-2011 (WG)
- ■ MARMAP 1977-2011 (WG)
- ⬠ Oculina ROV 2003-2005 (WG)
- ■ Sedberry 1985, 2002 Sub (SH)
- ⬠ DeepWater MPA 2004-2010 (WG)
- ▲ Manooch 1972-1977 (WG)
- ▲ RFOP 2006-2011 (WG)
- ▲ DeMaria 1960s-2011 (WG)
- ▲ Expert Workgroup (WG)
- ▲ Hudson 1960s-2011 (WG)
- ✕ HBS 1973-2010 (WG): Low
- ✕ HBS 1973-2010 (WG): Med
- ✕ HBS 1973-2010 (WG): High
- ✕ HBS 1973-2010 (WG): Highest

0 25 50   100 Miles

NMFS-SERO-LAPP/DM (CEBA3)

CLOSED AREAS FOR SH & WG

Depth: 25-100 fathoms

Higher probability of encounter

Likely >50% release mortality

> percentage mature fish

Alignment and size: Large, Shelf-Edge

Cover likely foraging and spawning habitats

Efficiency and enforceability

Location selection: Source Habitats

Documented occurrences (i.e., point observations)
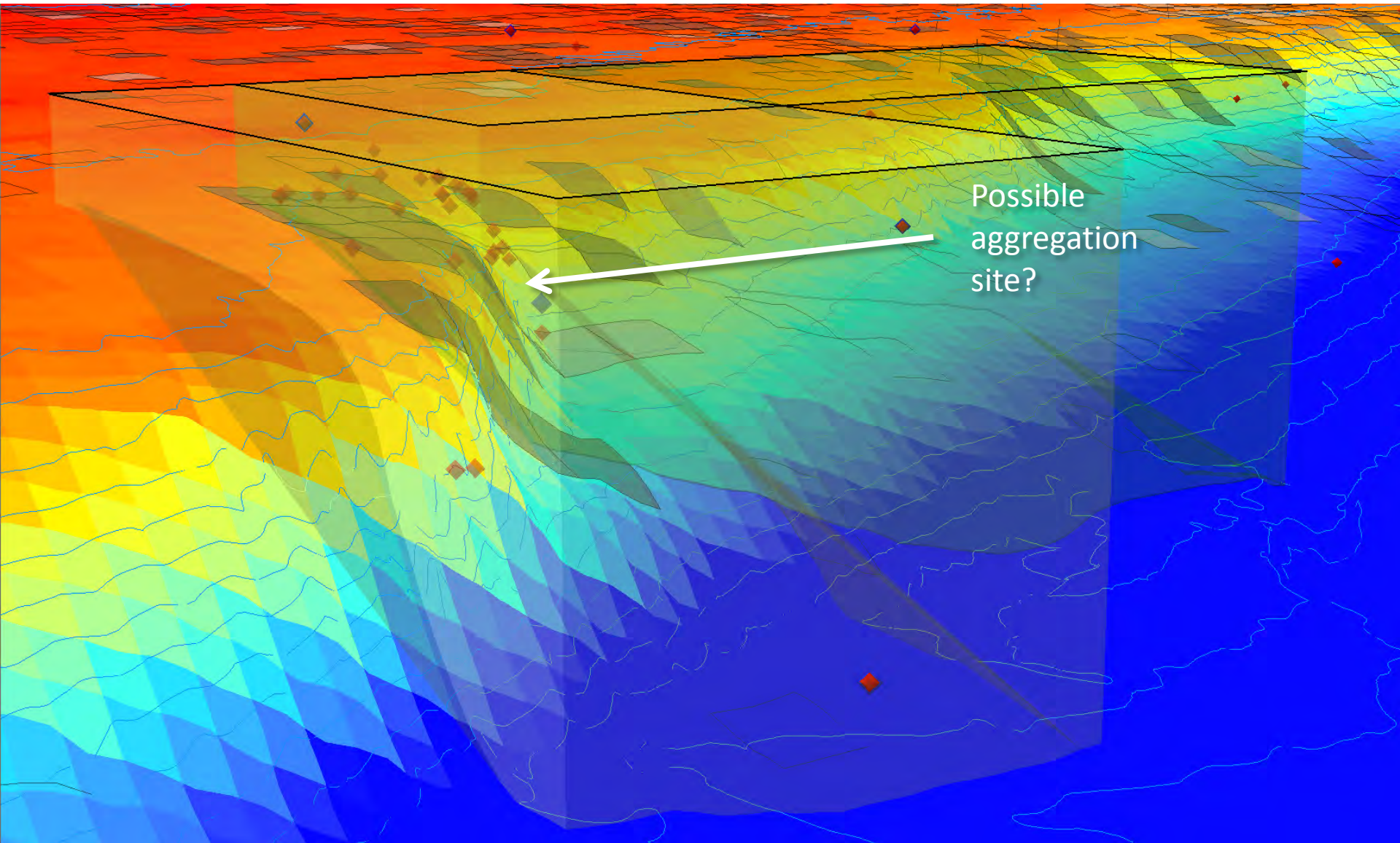
Documented hardbottom habitat

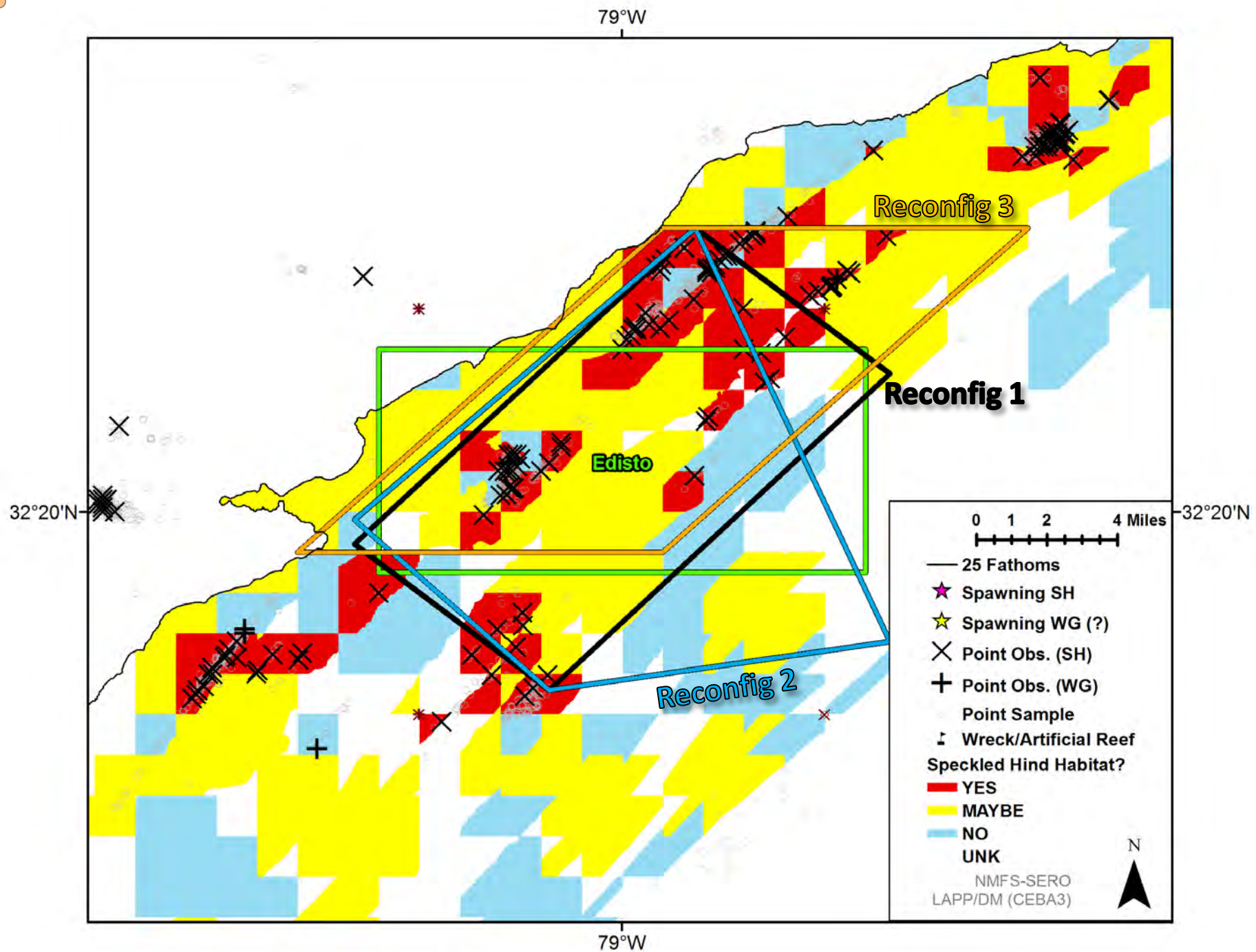Extend/modify existing MPAs or expand network

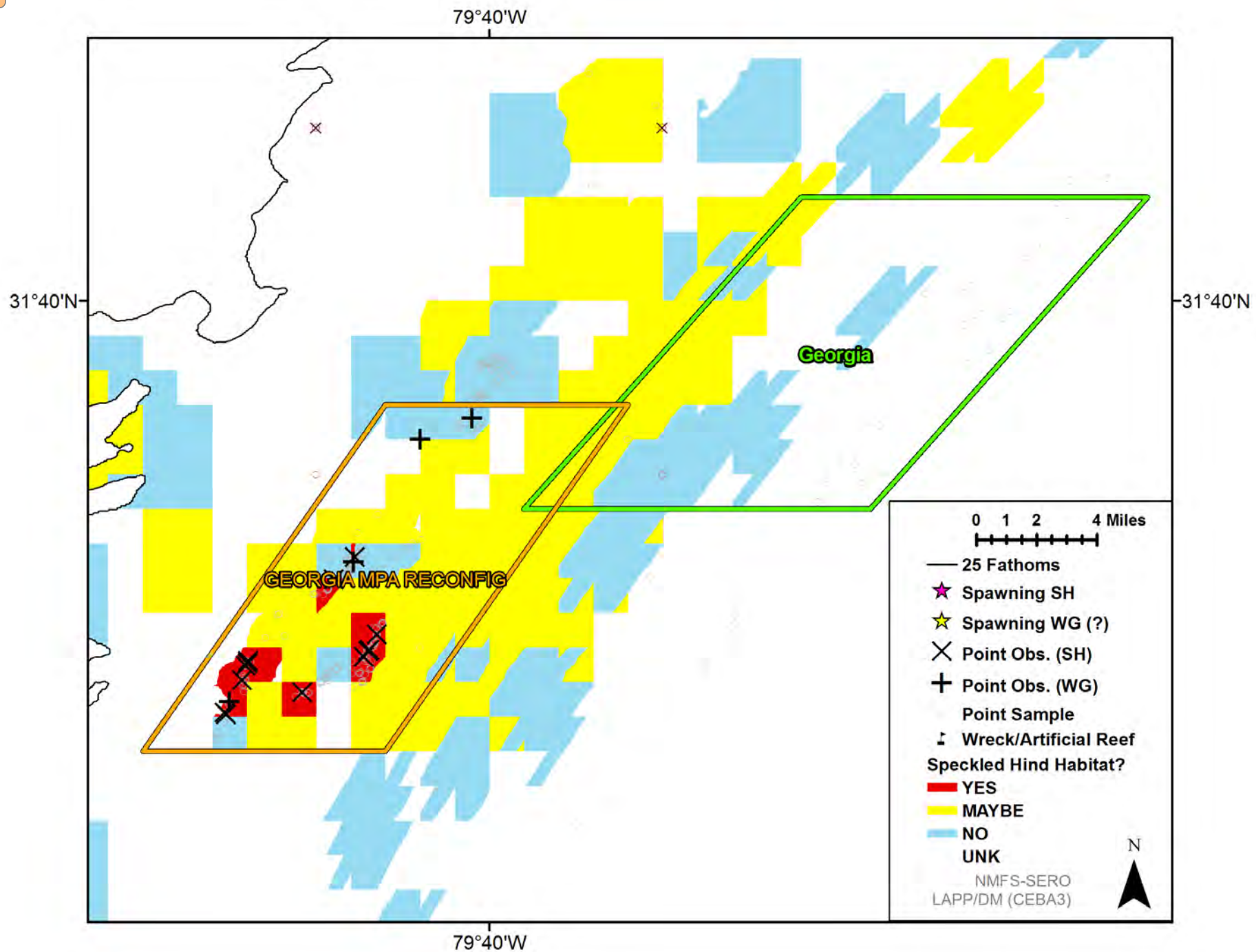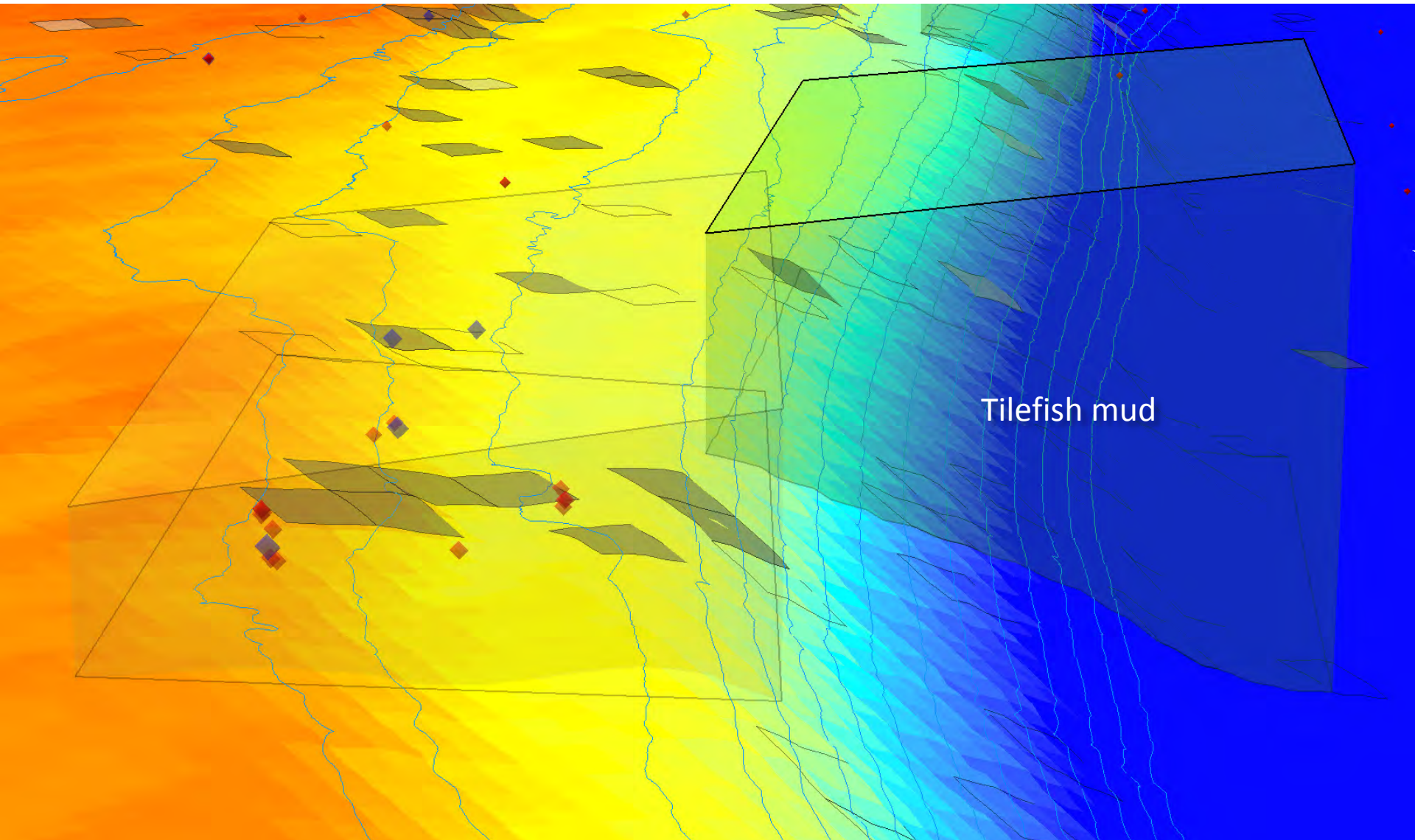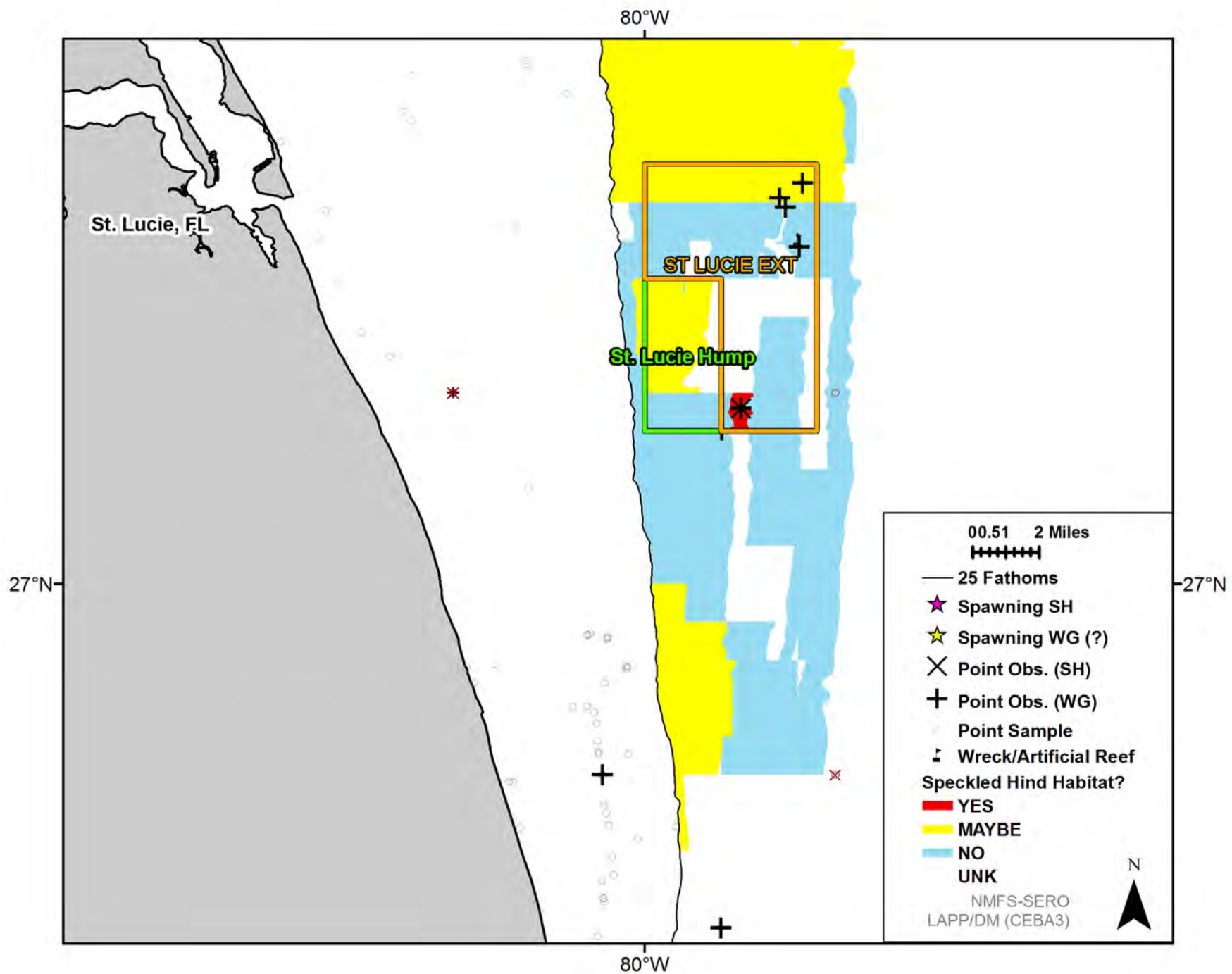| MPA	HABITAT	STOCKS PROTECTED	COMMENTS
Snowy Wreck	Wreck + Deep HB	snowy grouper, speckled hind, gag, red porgy, red grouper, graysby, and hogfish	spawning aggregations of snowy grouper (?)
Northern SC	Shelf Edge HB	snowy grouper, yellowedge grouper, speckled hind, small vermilion snapper, red porgy, triggerfish, and gag	
Edisto	Shelf Edge HB	vermilion snapper, red porgy, gag, scamp, black sea bass, juvenile snowy grouper, speckled hind, and blueline tilefish	may be larval source/sink due to Charleston Gyre
Charleston Deep	No HB		artificial reef never implemented
Georgia	Mud	tilefish	east of popular fishing ground
North Florida	Shelf Edge HB + Mud	snowy grouper, speckled hind, tilefish, vermilion snapper, hogfish, scamp, red porgy, and tomtate	popular fishing grounds to north and south
Oculina ECA	Deepwater Coral	snowy grouper, speckled hind, warsaw grouper, deepwater complex	protect coral from shrimp trawling
St. Lucie Hump	Shelf HB	speckled hind, juvenile snowy grouper, warsaw grouper, black sea bass, red porgy, and red snapper	
East Hump	Deep HB + Mud	snowy grouper, warsaw grouper, tilefish	

Northern South Carolina

NORTHERN SC REORIENT

0 1.25 2.5	5 Miles

Symbol	Description
—	25 Fathoms
★	Spawning SH
★	Spawning WG (?)
✕	Point Obs. (SH)
✛	Point Obs. (WG)
	Point Sample
♪	Wreck/Artificial Reef

Speckled Hind Habitat?

Color	Label
■	YES
■	MAYBE
■	NO
	UNK

NMFS-SERO
LAPP/DM (CEBA3)

N

Possible aggregation site?

GEORGIA (RELOCATE)

Tilefish mud

Legend:

- — 25 Fathoms
- ⭐ Spawning SH
- ⭐ Spawning WG (?)
- ✕ Point Obs. (SH)
- ✚ Point Obs. (WG)
- Point Sample
- Wreck/Artificial Reef

Speckled Hind Habitat?
- **YES** (red)
- **MAYBE** (yellow)
- **NO** (blue)
- **UNK**

NMFS-SERO
LAPP/DM (CEBA3)

St. Lucie, FL

ST LUCIE EXT

St. Lucie Hump

80°W

27°N

00.51   2 Miles

N

"Push Button Hill" aggregation site

WD Anderson wreck

IMPACTS OF CLOSED AREAS

IMPACTS OF CLOSED AREAS

Evaluated existing and proposed closed areas:

Qualitative Habitat Suitability

ratio of known and probable areas

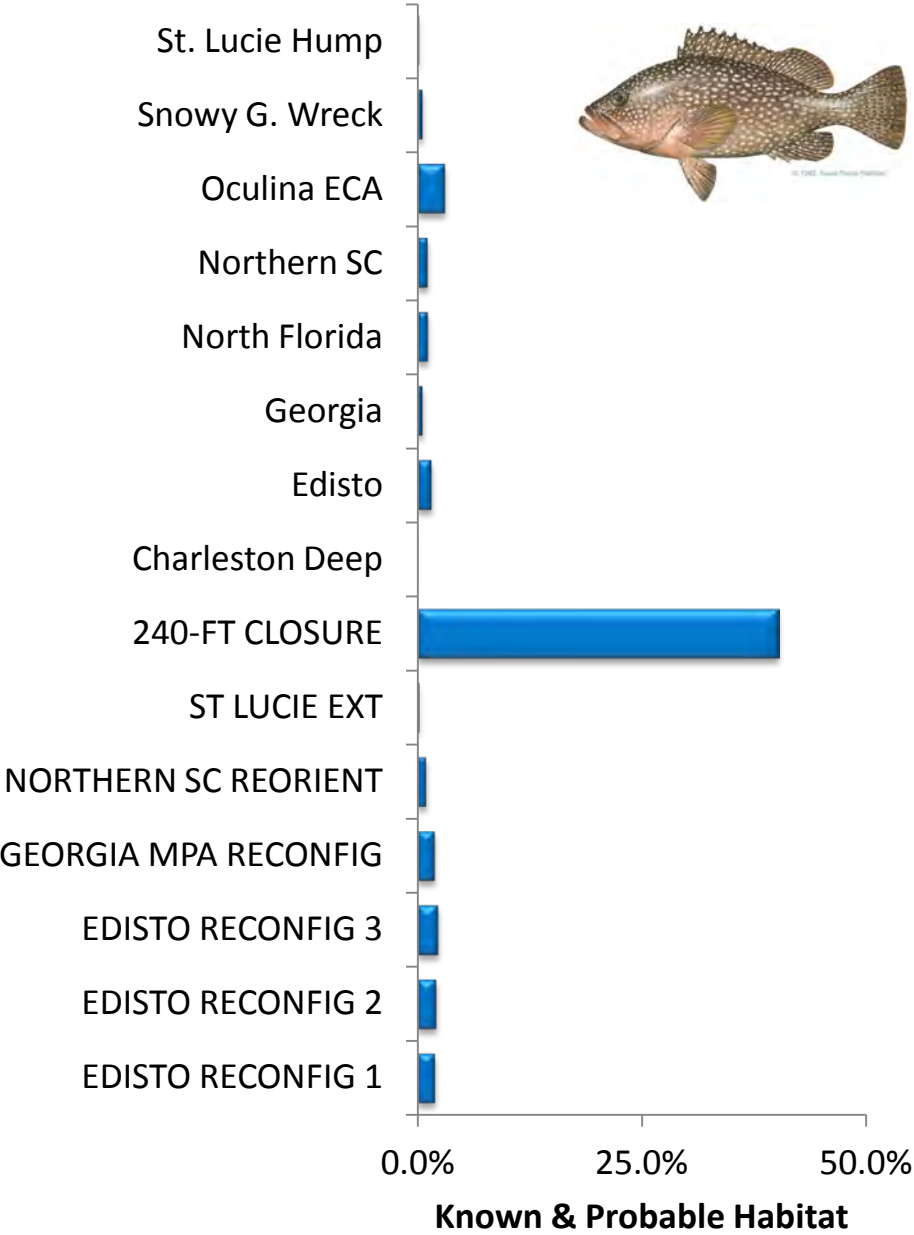**Quantitative Habitat Suitability**

ratio of area-weighted probabilities

Percent Obs./Gear Samples

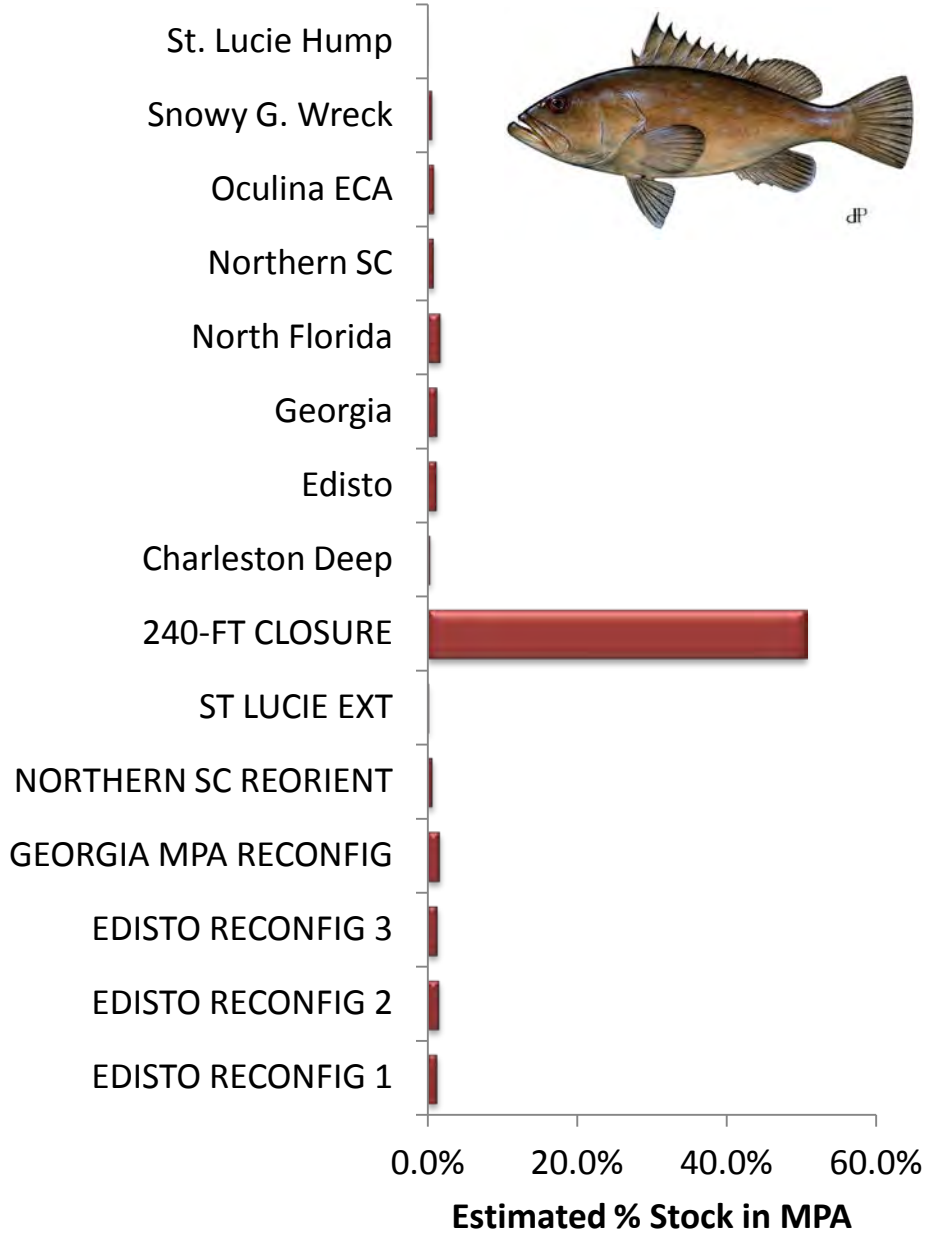**fishery-dependent (FD) and fishery-independent (FID) ratios of positive obs. to samples**
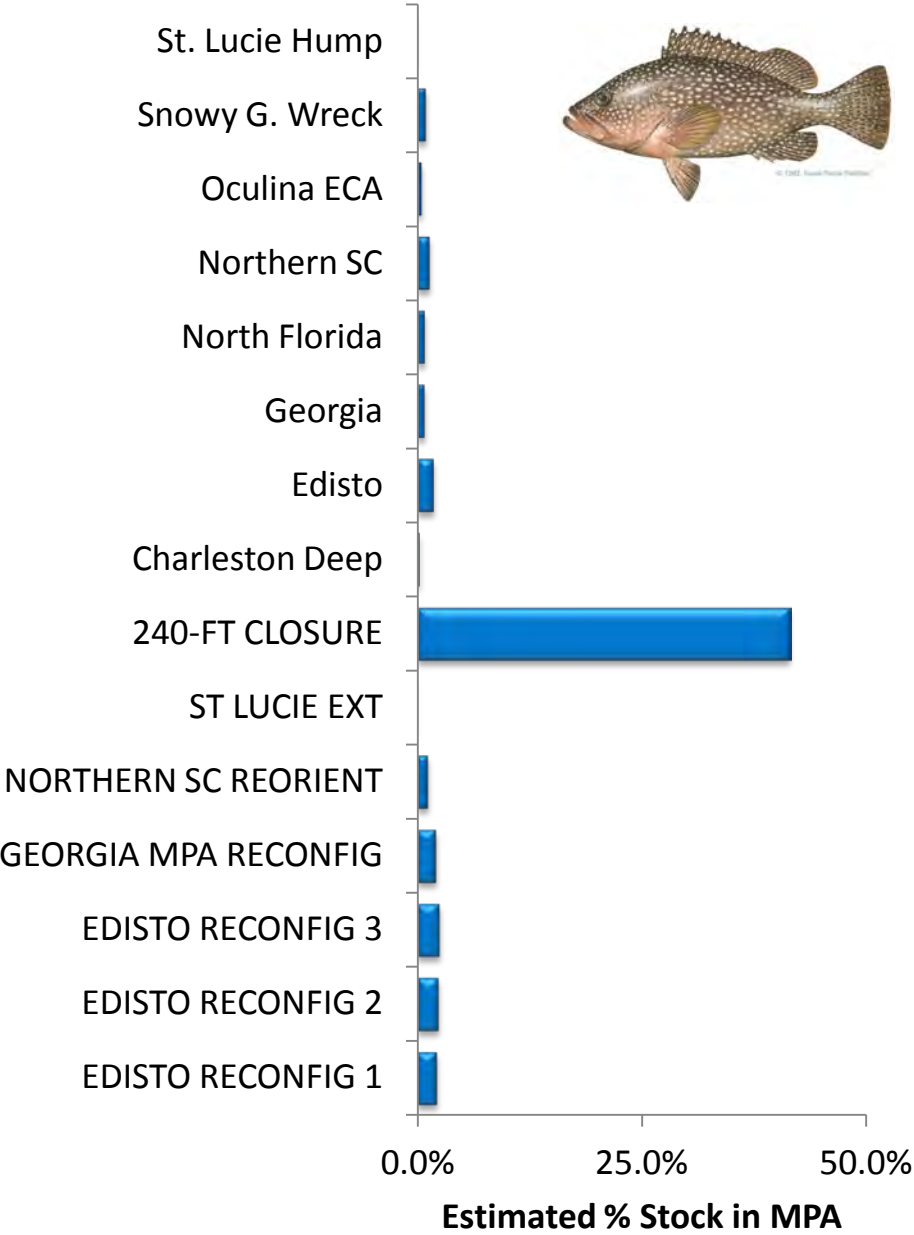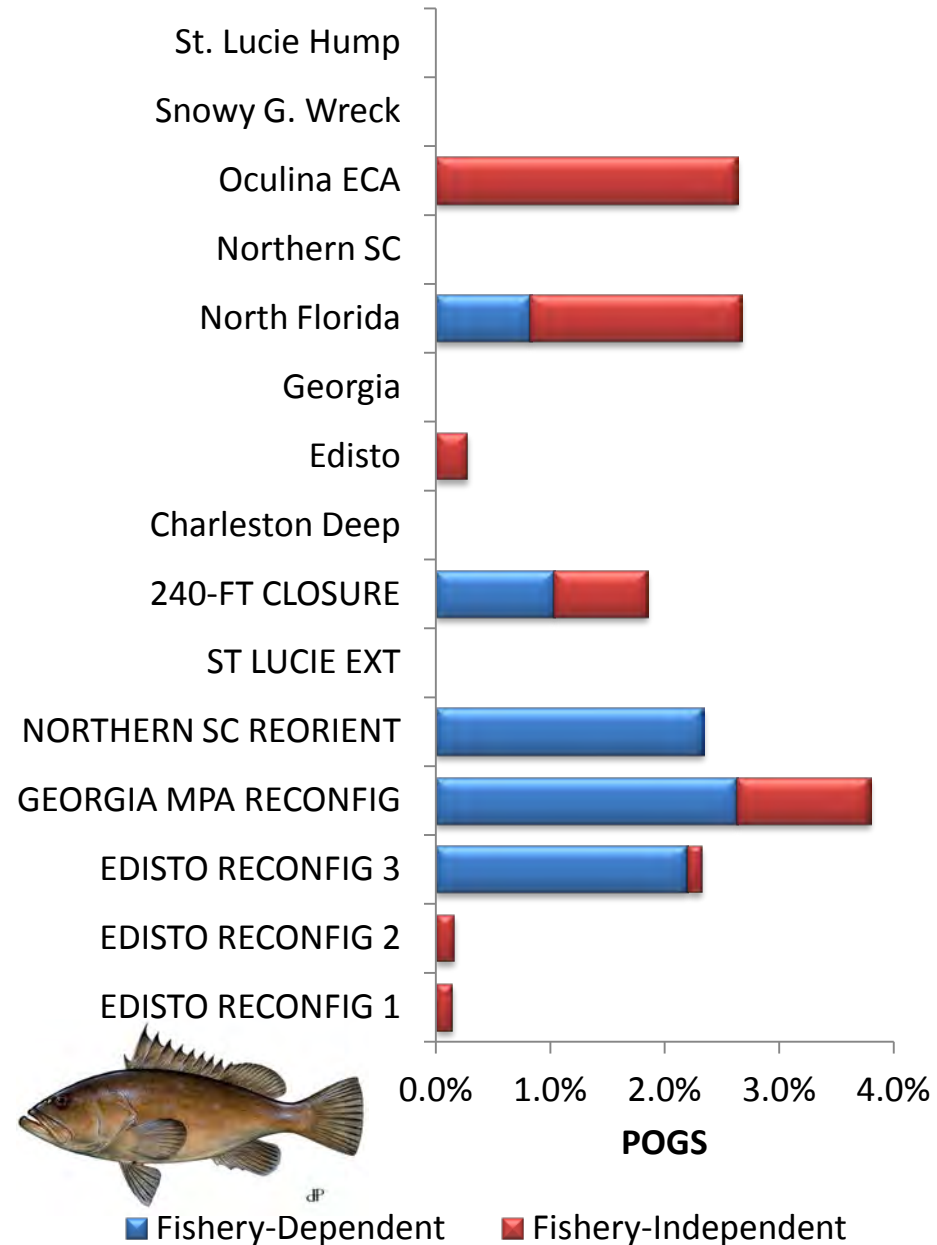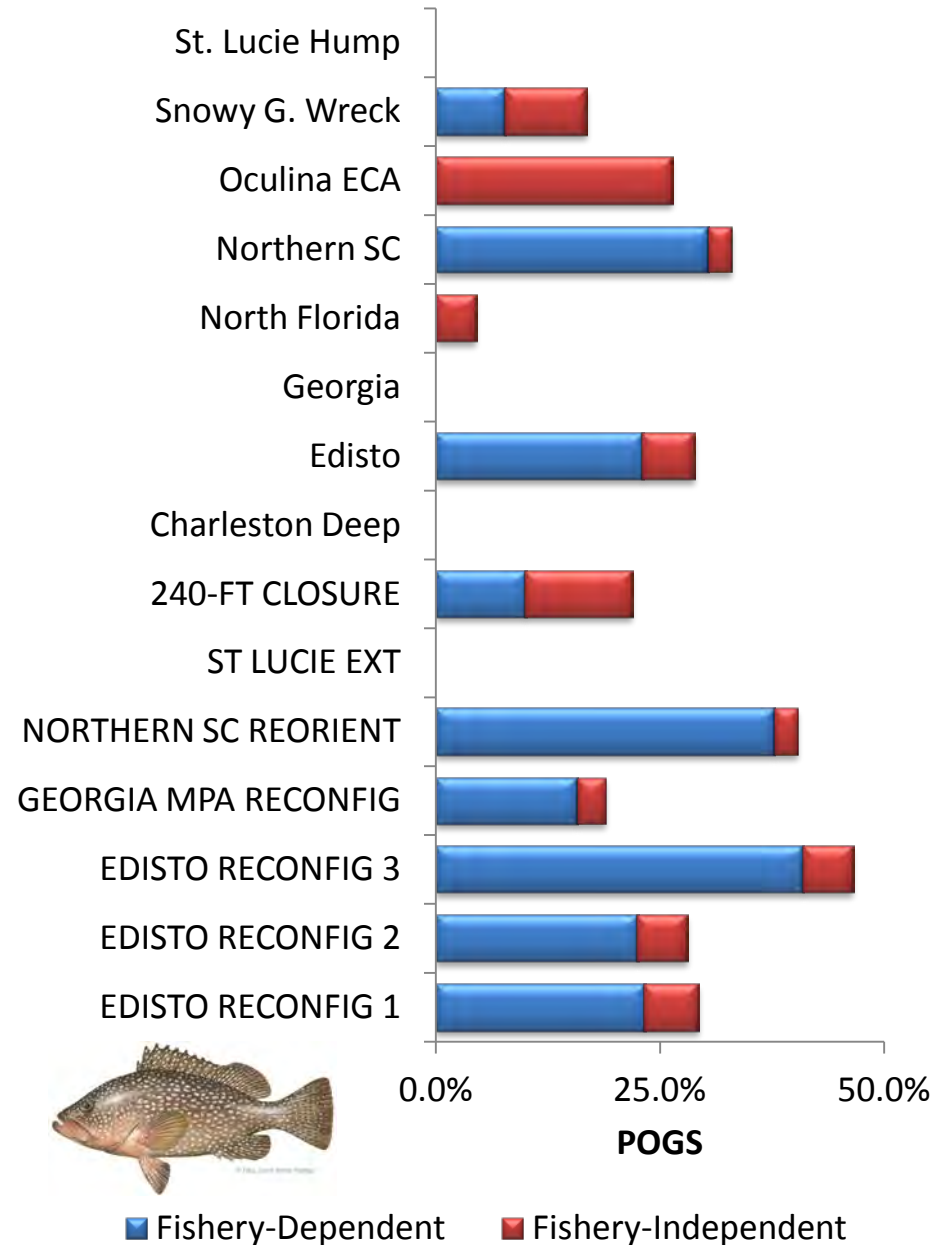
Rudershausen et al. (2010) observations

Snowy Grouper Wreck

Legend:
- 25 Fathoms
- ★ Spawning SH
- ☆ Spawning WG (?)
- × Point Obs. (SH)
- + Point Obs. (WG)
- Point Sample
- ⌇ Wreck/Artificial Reef

Speckled Hind Habitat?
- YES
- MAYBE
- NO
- UNK

NMFS-SERO
LAPP/DM (CEBA3)

0 1 2 4 Miles

77°W

33°20'N

N
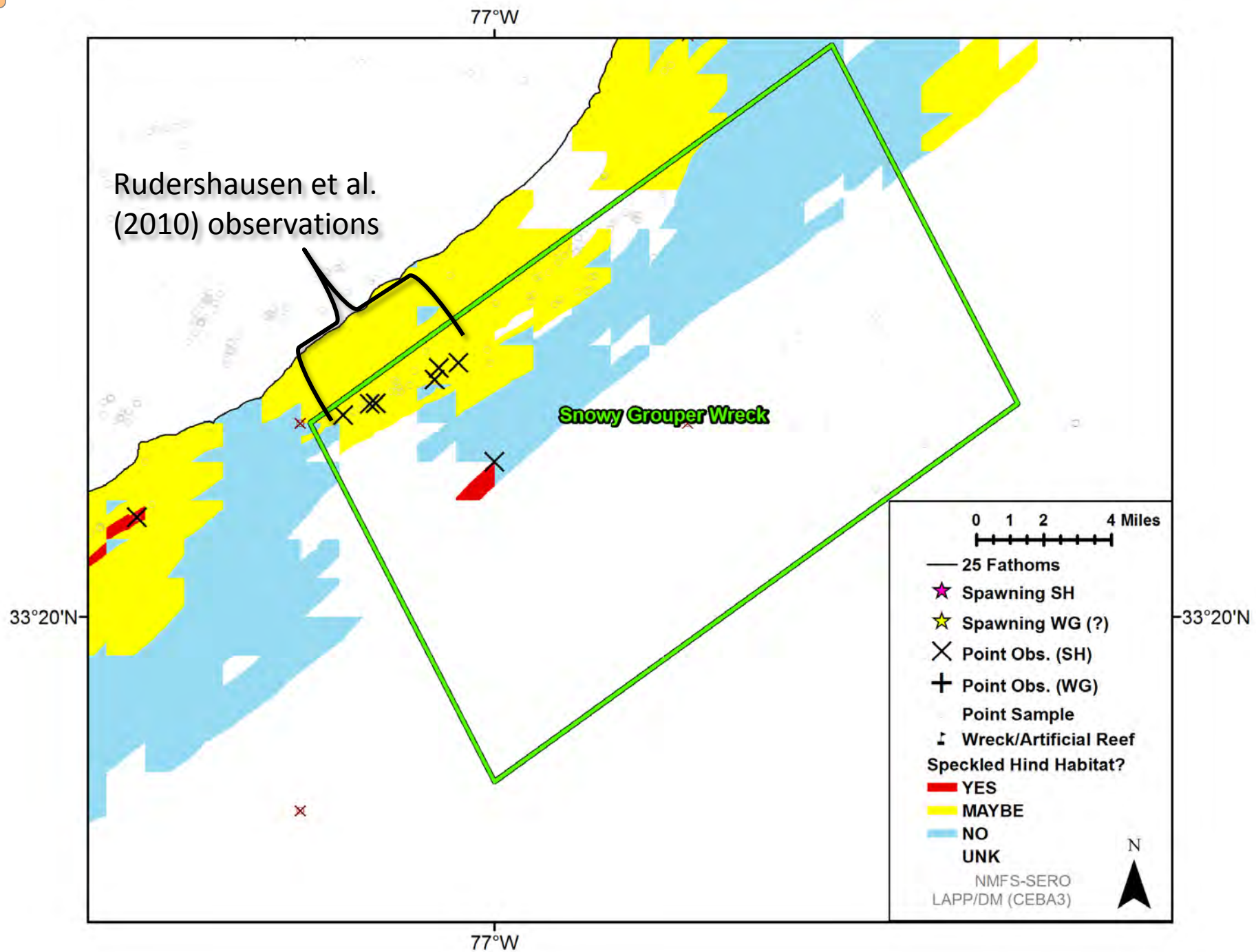
KNOWN & PROBABLE HABITATS
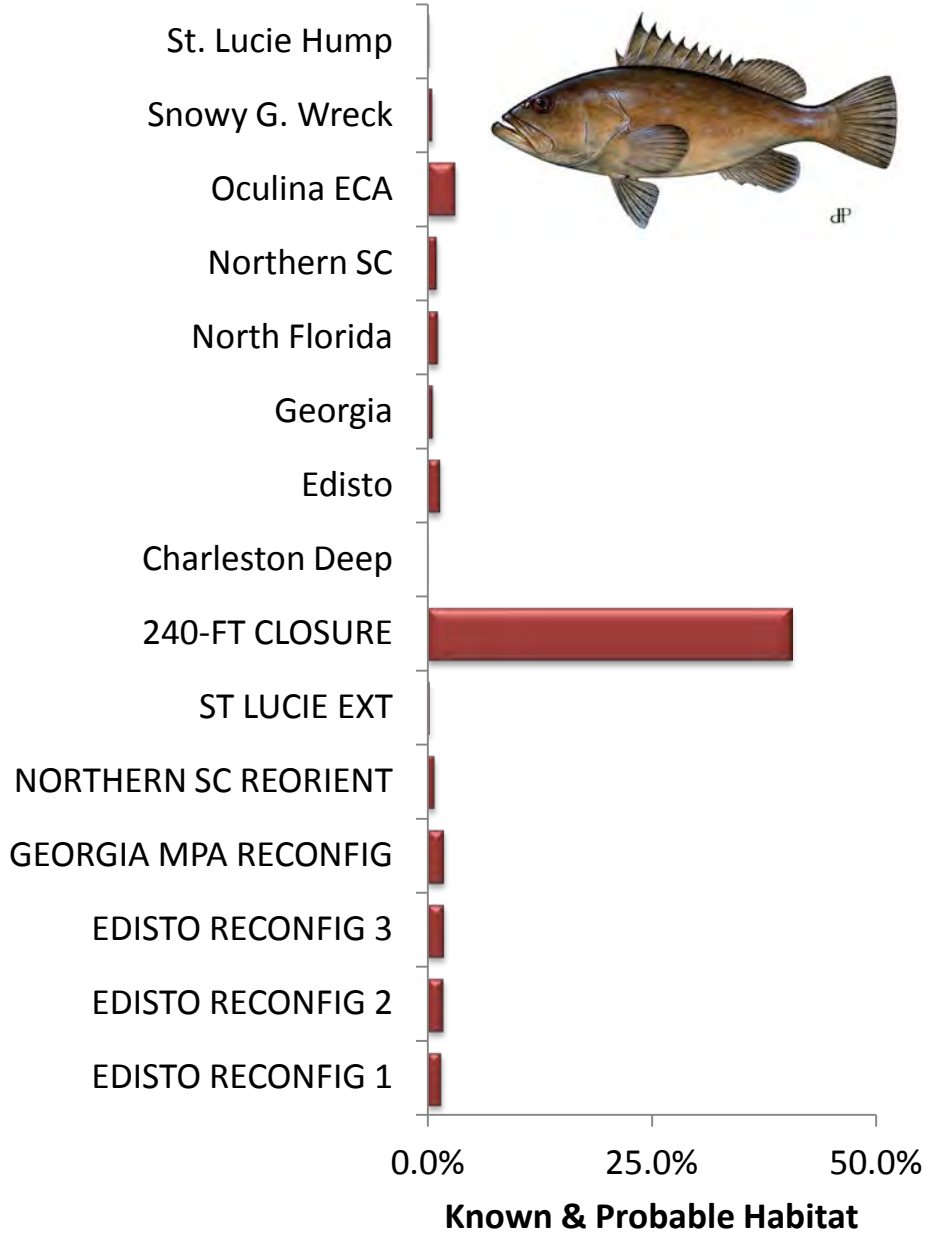
ESTIMATED PCT. STOCK PROTECTED

POS. OBSERVATIONS / GEAR SAMPLE

Left chart (POGS, 0.0% – 50.0%):

- St. Lucie Hump
- Snowy G. Wreck
- Oculina ECA
- Northern SC
- North Florida
- Georgia
- Edisto
- Charleston Deep
- 240-FT CLOSURE
- ST LUCIE EXT
- NORTHERN SC REORIENT
- GEORGIA MPA RECONFIG
- EDISTO RECONFIG 3
- EDISTO RECONFIG 2
- EDISTO RECONFIG 1

Right chart (POGS, 0.0% – 4.0%):

- St. Lucie Hump
- Snowy G. Wreck
- Oculina ECA
- Northern SC
- North Florida
- Georgia
- Edisto
- Charleston Deep
- 240-FT CLOSURE
- ST LUCIE EXT
- NORTHERN SC REORIENT
- GEORGIA MPA RECONFIG
- EDISTO RECONFIG 3
- EDISTO RECONFIG 2
- EDISTO RECONFIG 1

Legend: ■ Fishery-Dependent   ■ Fishery-Independent

CLOSURE IMPACTS: SPECKLED HIND

| NAME | AREA (km2) | STATE | POS. OBS. | PosObs/Sample | | HABITAT SUITABILITY | | |
				FID	FD	KNOWN	KNOWN & PROB.	% STOCK
EDISTO RECONFIG 1	196.3	SC	68	6.0%	23.2%	16.8%	2.0%	2.2%
EDISTO RECONFIG 2	234.0	NC	57	5.6%	22.5%	14.1%	2.1%	2.4%
EDISTO RECONFIG 3	208.7	SC	253	5.5%	41.0%	17.9%	2.3%	2.5%
GEORGIA MPA RECONFIG	204.7	FL	14	3.1%	15.8%	4.9%	1.9%	2.1%
NORTHERN SC REORIENT	162.8	SC	112	2.6%	37.7%	6.1%	1.0%	1.2%
ST LUCIE EXT	71.7	FL	1	no samp.	no samp.	0.4%	0.2%	0.0%
Charleston Deep	66.0	SC	0	no samp.	0.0%	0.0%	0.0%	0.3%
Edisto	185.6	SC	31	5.7%	23.1%	8.1%	1.6%	1.8%
Georgia	154.8	GA	0	0.0%	0.0%	0.0%	0.6%	0.8%
North Florida	152.3	FL	8	4.3%	0.1%	1.6%	1.2%	0.8%
Northern SC	171.7	SC	22	2.7%	30.3%	3.2%	1.1%	1.3%
Oculina ECA	279.2	FL	10	26.3%	no samp.	3.8%	3.1%	0.5%
Snowy G. Wreck	187.4	NC	2	9.1%	7.7%	0.4%	0.6%	0.9%
St. Lucie Hump	24.4	FL	0	no samp.	no samp.	0.0%	0.2%	0.0%
EXISTING	**1221**		**73**			**17%**	**8%**	**6%**
MAX RECONFIG	**1333**		**400**			**35%**	**10%**	**8%**
240-FT CLOSURE	**13642**	**EEZ**	**1545**			**28.2%**	**40.2%**	**41.5%**

CLOSURE IMPACTS: WARSAW GROUPER

NAME	AREA (km2)	STATE	POS. OBS.	PosObs/Sample FID	PosObs/Sample FD	HABITAT SUITABILITY KNOWN	HABITAT SUITABILITY KNOWN & PROB.	% STOCK
EDISTO RECONFIG 1	196.3	SC	1	0.1%	0.0%	1.2%	1.6%	1.3%
EDISTO RECONFIG 2	234.0	NC	1	0.2%	0.0%	1.2%	1.8%	1.6%
EDISTO RECONFIG 3	208.7	SC	12	0.1%	2.2%	2.4%	1.9%	1.4%
GEORGIA MPA RECONFIG	204.7	FL	4	1.2%	2.6%	11.2%	1.9%	1.7%
NORTHERN SC REORIENT	162.8	SC	7	0.0%	2.3%	2.5%	0.8%	0.7%
ST LUCIE EXT	71.7	FL	6	no samp.	no samp.	6.5%	0.2%	0.2%
Charleston Deep	66.0	SC	0	no samp.	0.0%	0.0%	0.0%	0.4%
Edisto	185.6	SC	1	0.3%	0.0%	1.2%	1.4%	1.2%
Georgia	154.8	GA	0	0.0%	0.0%	0.0%	0.6%	1.3%
North Florida	152.3	FL	11	1.8%	0.8%	4.5%	1.2%	1.7%
Northern SC	171.7	SC	1	0.0%	0.0%	2.5%	1.1%	0.8%
Oculina ECA	279.2	FL	1	2.6%	no samp.	2.6%	3.1%	0.9%
Snowy G. Wreck	187.4	NC	0	0.0%	0.0%	0.0%	0.5%	0.6%
St. Lucie Hump	24.4	FL	0	no samp.	no samp.	0.0%	0.2%	0.0%
EXISTING	**1221**		**14**			**11%**	**8%**	**7%**
MAX RECONFIG	**1333**		**41**			**30%**	**10%**	**8%**
240-FT CLOSURE	**13642**	**EEZ**	**173**			**31.7%**	**40.5%**	**50.5%**

SPAWNING AGGREGATIONS?

NAME	FISH SPAWNING AGGREGATION SITE?			
	Speckled Hind	Warsaw Grouper	Snapper-Grouper	Geomorphology
Charleston Deep				NOT LIKELY
Edisto	OBSERVED		OBSERVED	POSSIBLE
Georgia				NOT LIKELY
North Florida				POSSIBLE
Northern SC	OBSERVED		OBSERVED	POSSIBLE
Oculina ECA				POSSIBLE
Snowy Grouper Wreck				LIKELY
St. Lucie Hump				POSSIBLE
FKNMS SPAs & Ers			OBSERVED	VERY LIKELY
EDISTO RECONFIGS 1, 2, 3	OBSERVED		OBSERVED	POSSIBLE
GEORGIA MPA RECONFIG				POSSIBLE
NORTHERN SC REORIENT	OBSERVED		OBSERVED	LIKELY
ST LUCIE EXT			ANECDOTAL	VERY LIKELY
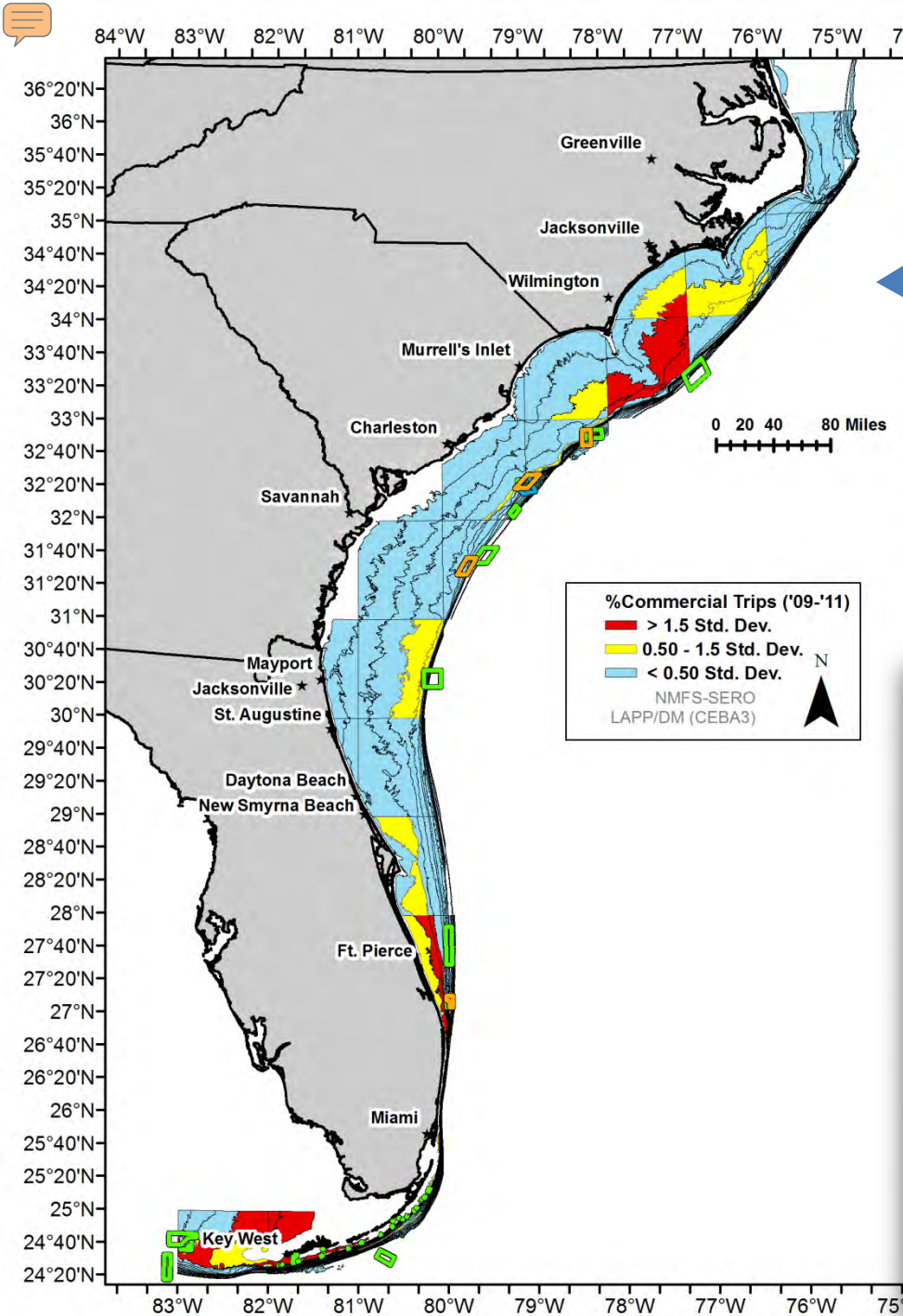
BYCATCH EFFORT

Fishing effort and fish stocks are heterogeneously distributed

Largest bycatch reductions in areas with high concentration of SH & WG <u>and</u> high fishing effort

%Commercial Trips ('09-'11)
- ■ > 1.5 Std. Dev.
- ■ 0.50 - 1.5 Std. Dev.
- ■ < 0.50 Std. Dev.

NMFS-SERO
LAPP/DM (CEBA3)

Current MPA
25 Fathoms
Prob. of SH (modified)
- ■ 0.000052 - 0.001561
- ■ 0.001562 - 0.033912
- ■ 0.033913 - 0.059627
- ■ 0.059628 - 0.100037
- ■ 0.100038 - 0.290000

NMFS-SERO
LAPP/DM (CEBA3)
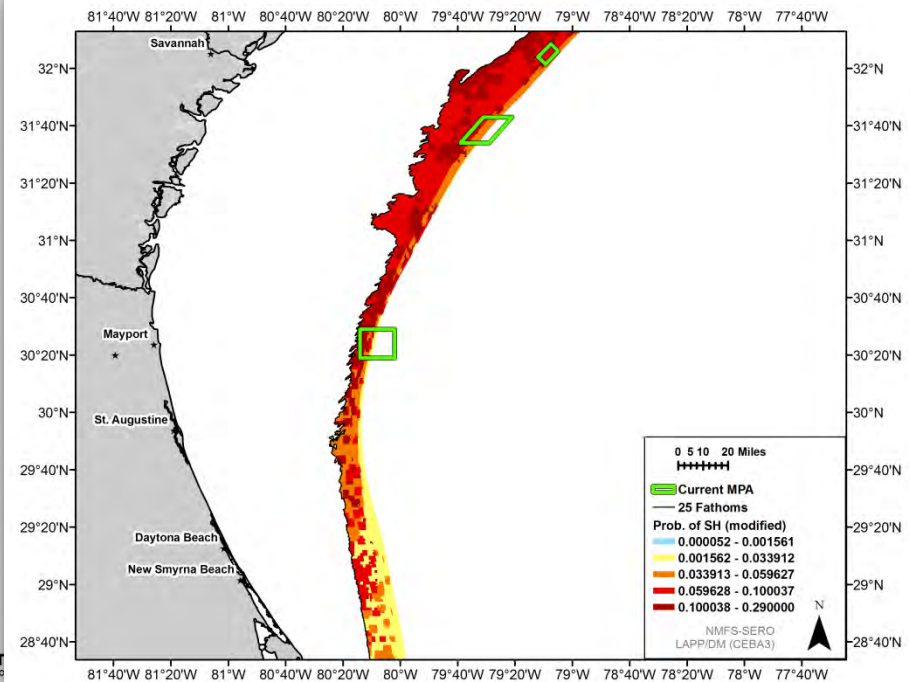
240-FT (40-FATHOM) CLOSURE

Year	Trips in >240 ft	Landings > 10,000 lbs (ww)										
2009	15%	blueline tilefish	golden tilefish	greater amberjack	snowy grouper	vermilion snapper	scamp	yellowedge grouper	gag	almaco jack	red grouper	black grouper
2010	17%	greater amberjack	golden tilefish	blueline tilefish	snowy grouper	vermilion snapper	almaco jack	gray triggerfish	yellowedge grouper	scamp		
2011	10%	golden tilefish	greater amberjack	blueline tilefish	almaco jack	vermilion snapper	gray triggerfish					
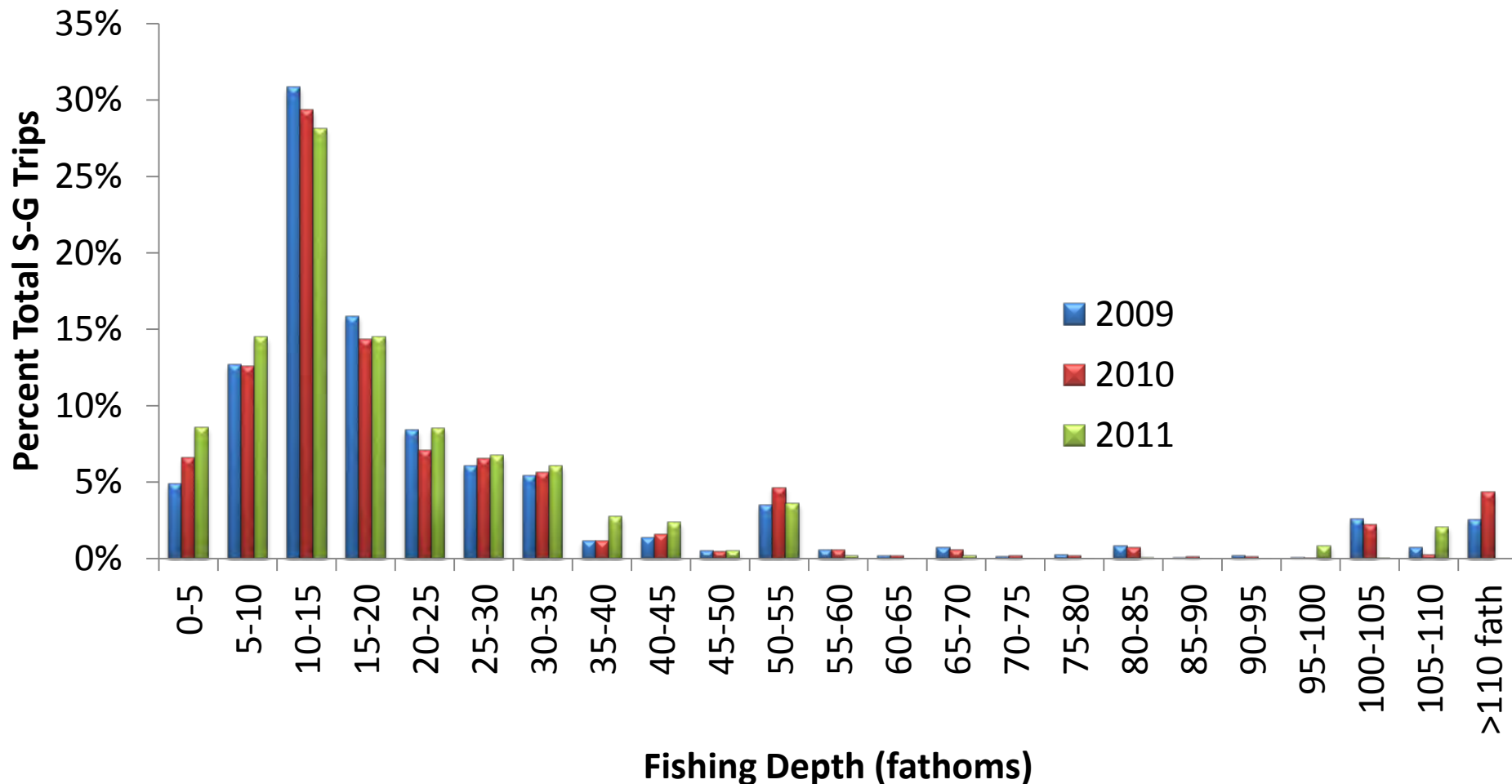
EXCLUDED BYCATCH EFFORT

Using 2010 commercial logbook trips as a baseline, assumed logbook effort uniformly distributed within depth grid, and VL and LL trips between 25-100 fathoms would potentially interact with SH and WG:

Area weighted percent of snapper-grouper trips excluded by MPA

Efficiency at relocating bycatch effort per unit area protected
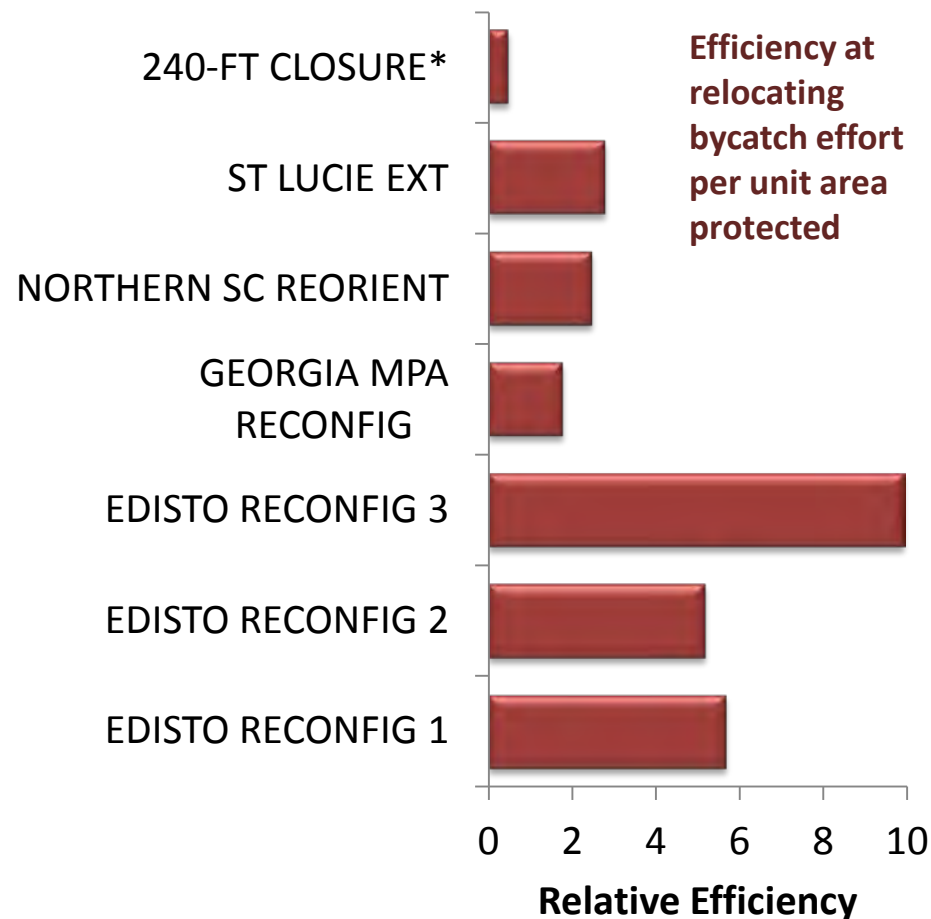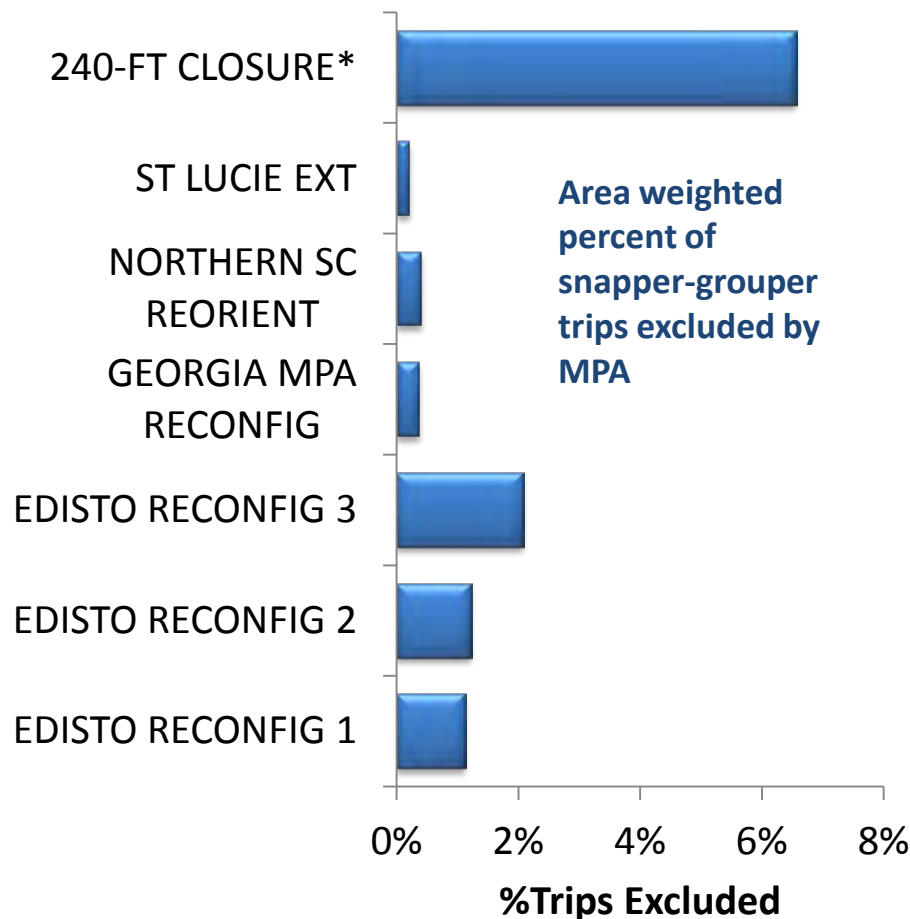
*Based on ratio of percent of 2010 to 2011 trips beyond 40 fathoms

IMPACTS ON ASSOCIATED STOCKS

Determined species associated with speckled hind and warsaw grouper using percent co-occurrence, hierarchical cluster analysis, and dimension reduction analysis

Overlaid proposed MPAs on commercial (1° tall × 5 fa) and headboat (1/6° × 1/6°) mean landings (2009-2011)

Potential reduction in landings for MPA i computed as:

$$\%Impact_i = \overline{\%Landings_i}^{2009-2011} * \frac{area_i^{protected}}{area_i^{total}}$$

Assumptions:

Landings uniformly distributed in logbook-areas

Historical locations are predictive

No effort shifting
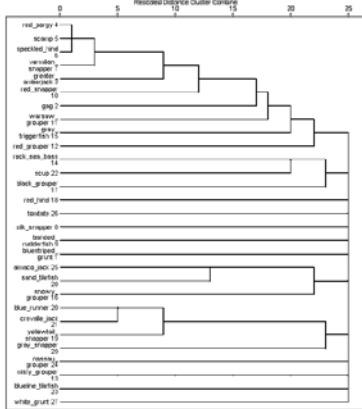
ASSOCIATED STOCKS
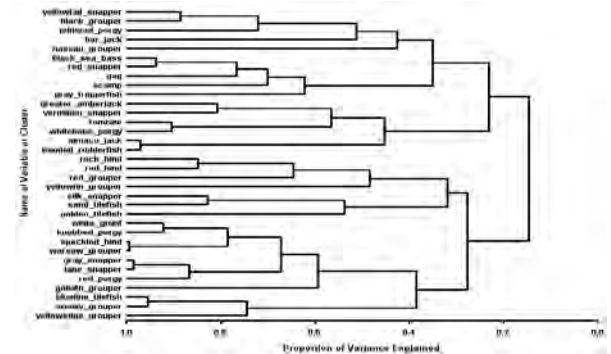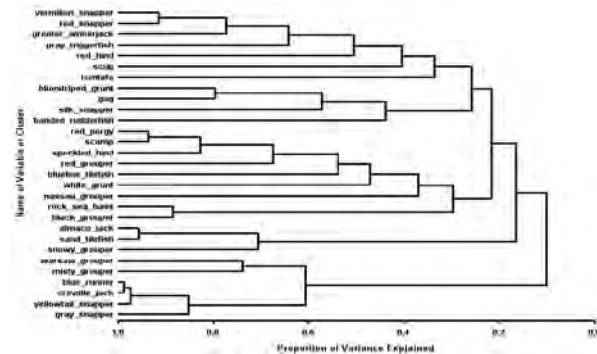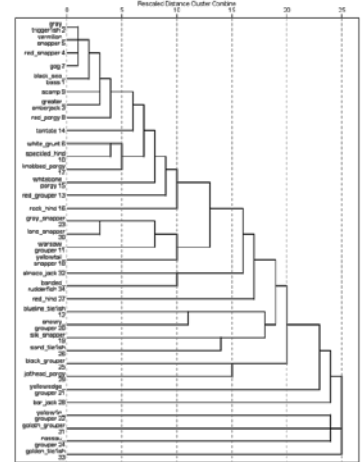
Rank	With Speckled Hind		With Warsaw Grouper	
	Commercial	**Headboat**	**Commercial**	**Headboat**
1	red porgy	vermilion snapper	red porgy	gray triggerfish
2	scamp	gray triggerfish	scamp	black sea bass
3	vermilion snapper	scamp	vermilion snapper	red snapper
4	greater amberjack	red porgy	greater amberjack	gag
5	red snapper	tomtate	**speckled hind**	gray snapper
6	gag	white grunt	red snapper	lane snapper
7	red grouper	knobbed porgy	gag	vermilion snapper
8	gray triggerfish	greater amberjack	gray triggerfish	tomtate
9	**warsaw grouper**	gag	red grouper	scamp
10	rock sea bass	red snapper	red hind	whitebone porgy
11	**snowy grouper**	black sea bass		greater amberjack

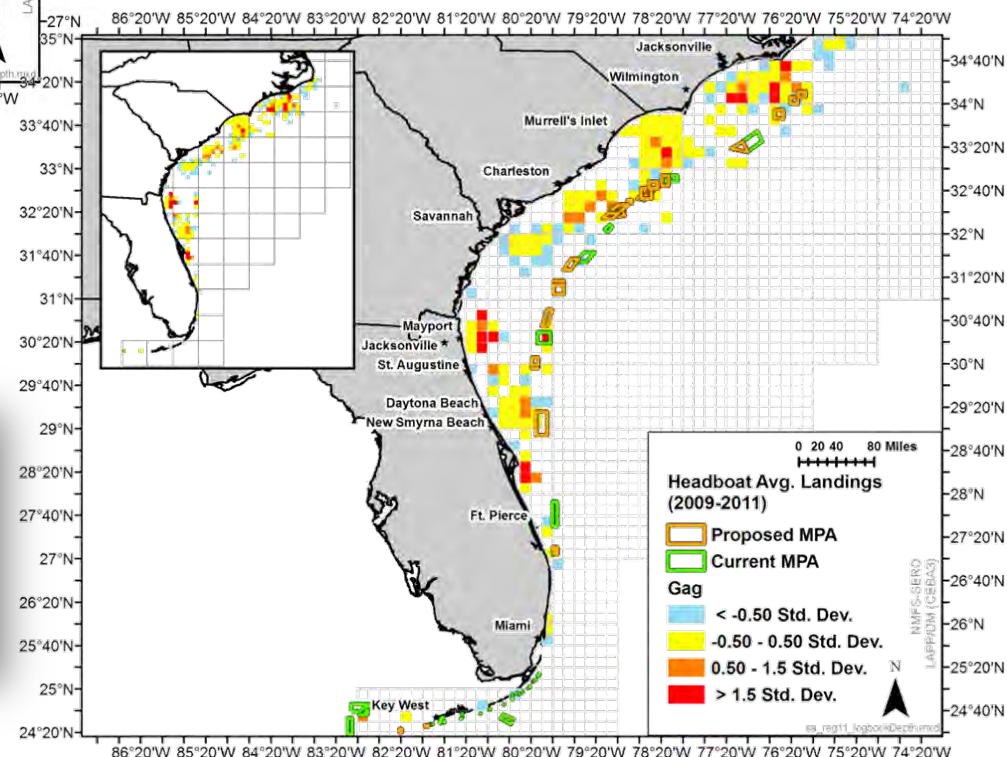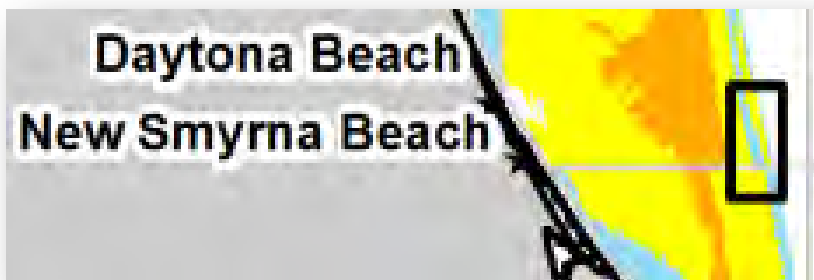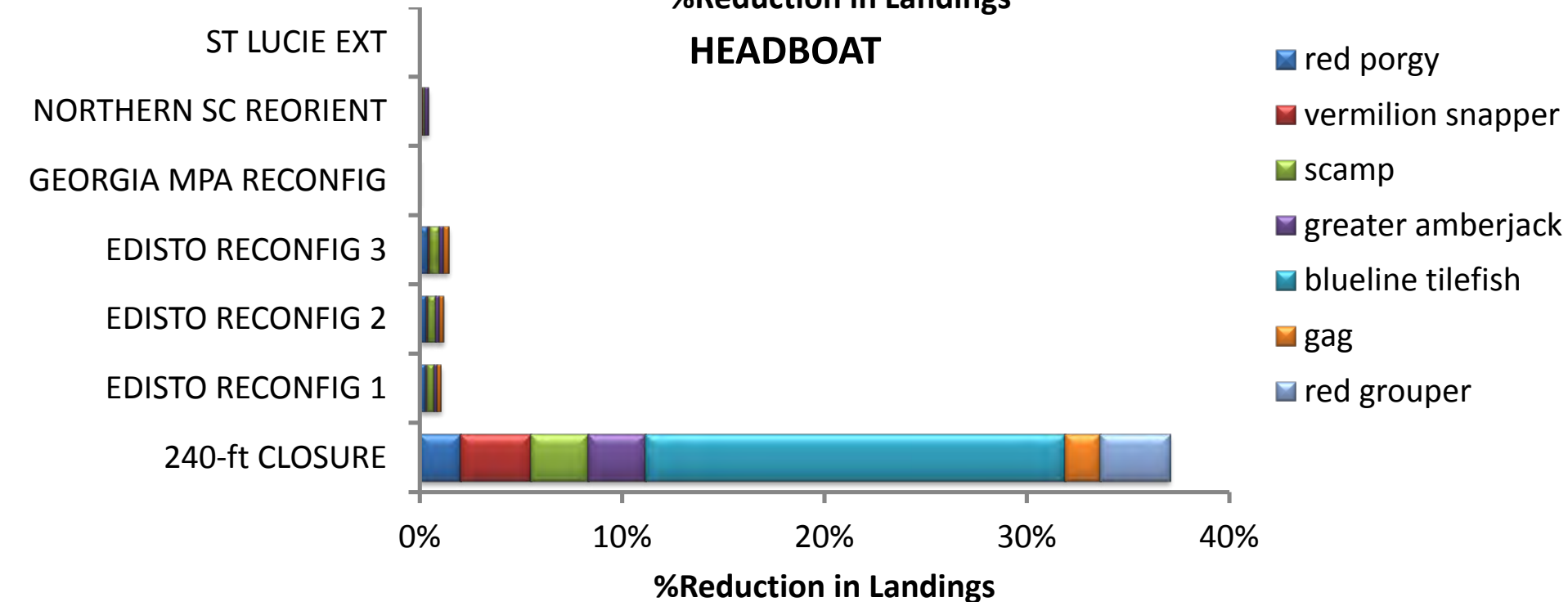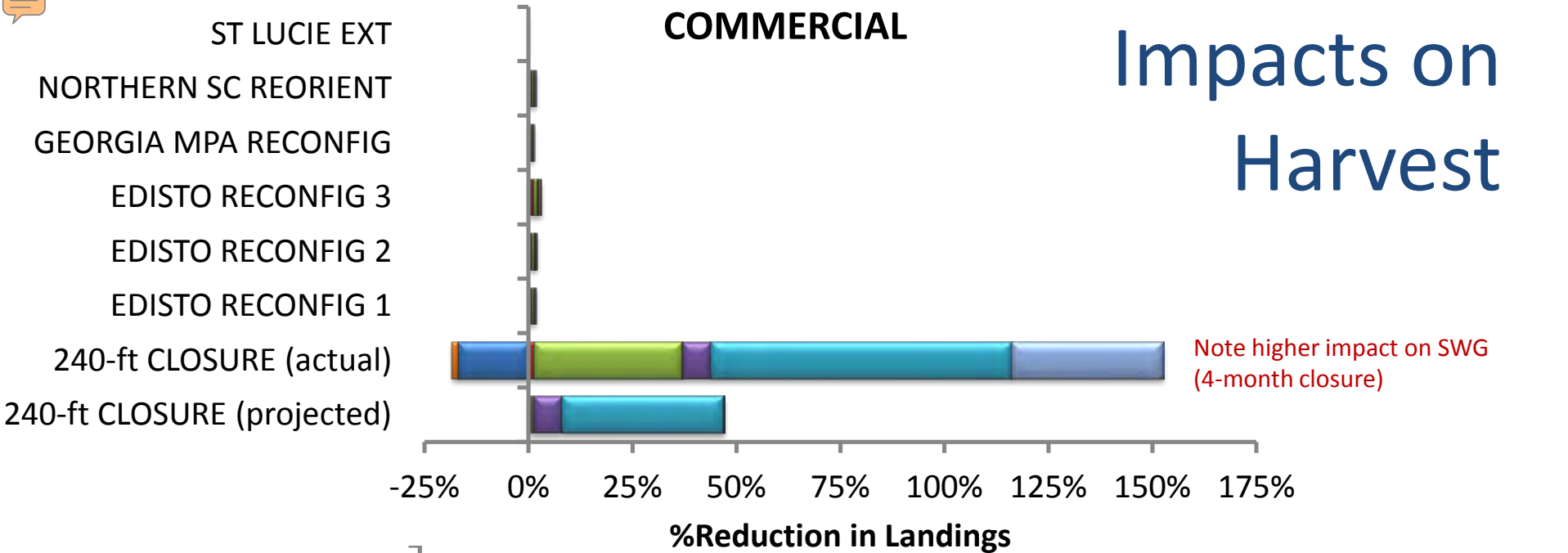**EXAMPLE:**

Possible Closure Impacts on Gag Harvest
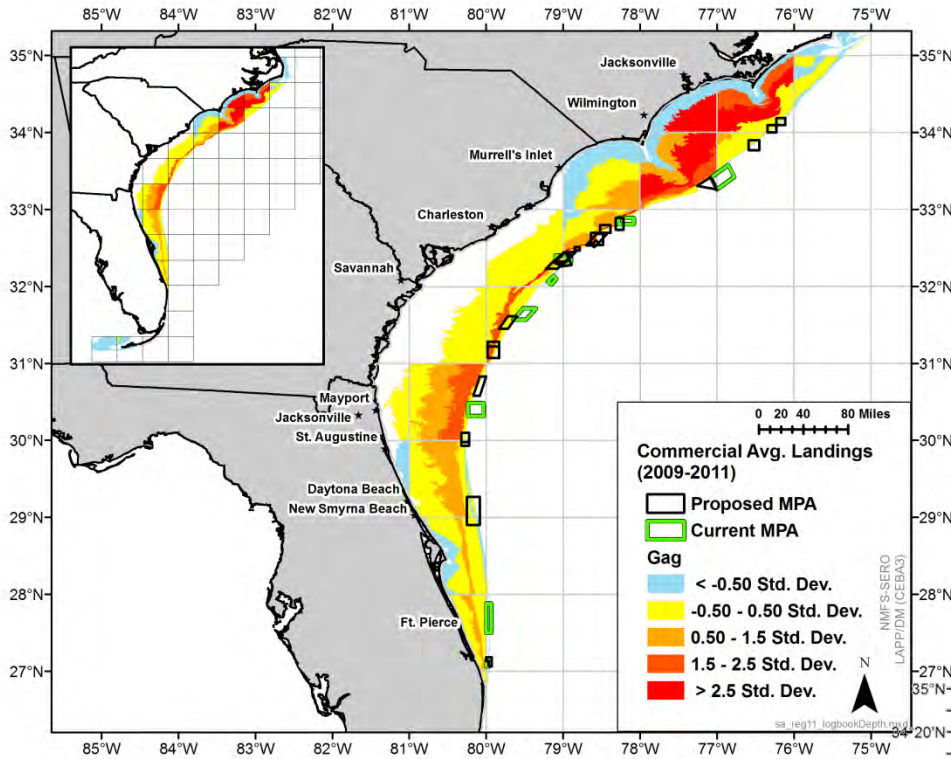
Figure 60. Average logbook-reported (2009-2011) gag overall (inset top) and core (top) commercial landings, and overall (inset bottom) and core (bottom) headboat landings.

Impacts on Harvest

Discussion: MPA Selection

1. High FD- and FID-Positive Observations / Gear Sample

2. High modeled percent stock

3. High percentage of 'Known & Probable' habitat

4. Low predicted impacts on harvest of associated stocks

5. High efficiency per unit area

6. Contain known spawning locations

SUMMARY: BEST MPAs

NAME	AREA (km2)	STATE	Fish Spawning Aggregation	SPECKLED HIND POS. OBS.	PosObs/Sample FID	FD	HABITAT SUITABILITY Known	Known & Prob.	% STOCK	WARSAW GROUPER POS. OBS.	PosObs/Sample FID	FD	HABITAT SUITABILITY Known	Known & Prob.	% STOCK
EDISTO RECONFIG 3	209	SC	S-G	253	5.5%	41.0%	17.9%	2.3%	2.5%	12	0.1%	2.2%	2.4%	1.9%	1.4%
GEORGIA MPA RECONFIG	205	FL	?	14	3.1%	15.8%	4.9%	1.9%	2.1%	4	1.2%	2.6%	11.2%	1.9%	1.7%
NORTHERN SC REORIENT	163	SC	SH	112	2.6%	37.7%	6.1%	1.0%	1.2%	7	0.0%	2.3%	2.5%	0.8%	0.7%
ST LUCIE EXT	72	FL	S-G	1			0.4%	0.2%	0.0%	6			6.5%	0.2%	0.2%
North Florida	152	FL	?	8	4.3%	0.1%	1.6%	1.2%	0.8%	11	1.8%	0.8%	4.5%	1.2%	1.7%
Oculina ECA	279	FL	?	10	26.3%		3.8%	3.1%	0.5%	1	2.6%		2.6%	3.1%	0.9%
Snowy G. Wreck	187	NC	?	2	9.1%	7.7%	0.4%	0.6%	0.9%	0	0.0%	0.0%	0.0%	0.5%	0.6%
MAX RECONFIG	**1,333**			**400**			**35%**	**10%**	**8%**	**41**			**30%**	**10%**	**8%**
240-FT CLOSURE	**13,642**	**EEZ**		**1545**			**28.2%**	**40.2%**	**41.5%**	**173**			**31.7%**	**40.5%**	**50.5%**

Reconfigured MPAs are more efficient (per unit area) than 240-ft closure at excluding effort from areas with high concentrations of SH & WG; however, total percent of stock protected is lower

Predicted maximum of 6% impact on commercial harvest, 2% on headboat harvest

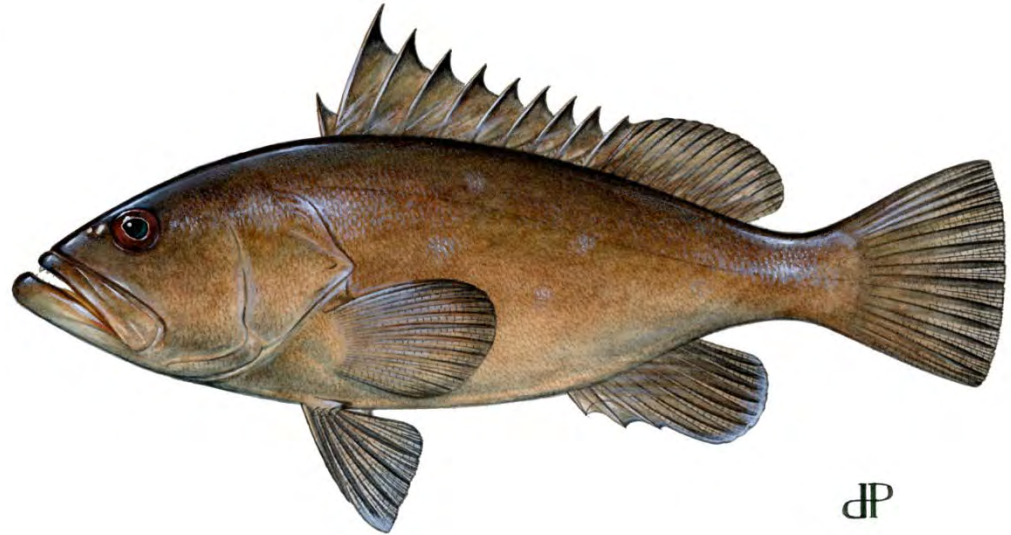Other areas proposed by Expert Workgroup & SERO likely contain source habitats and spawning sites

Effectiveness of proposed MPAs is reduced if fishing pressure redistributed onto source habitats
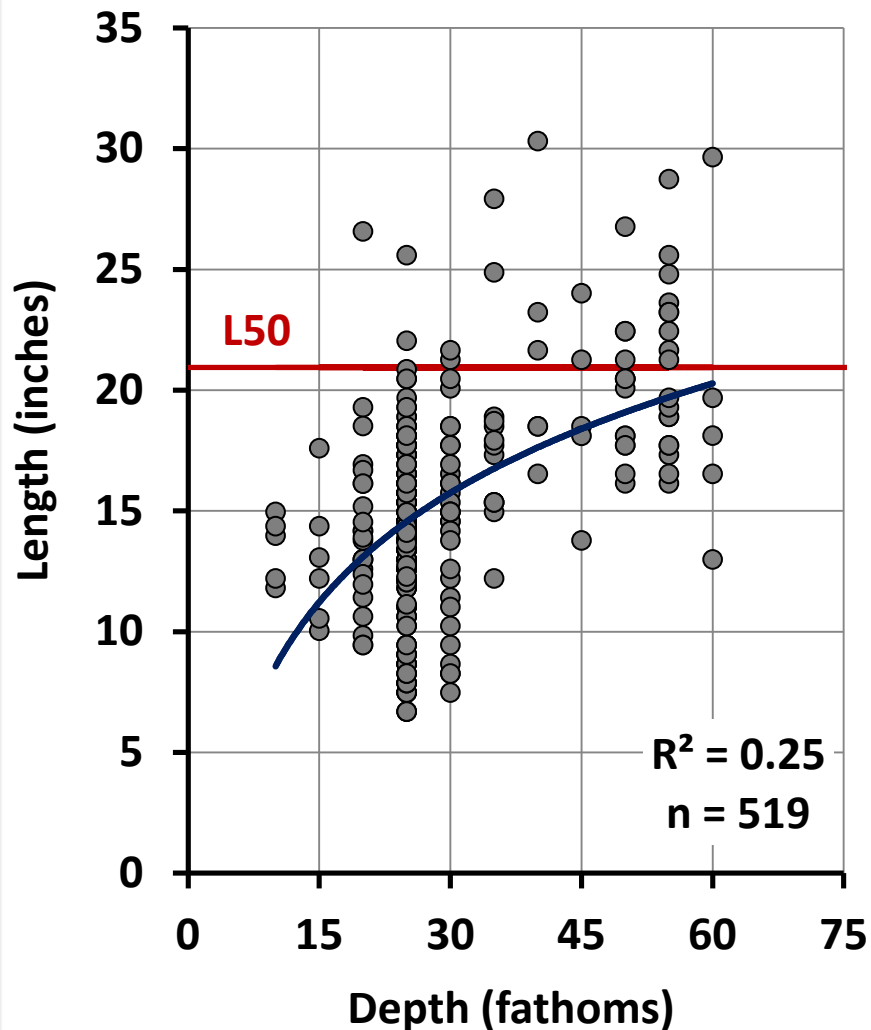
QUESTIONS?

© 1992, Diane Rome Peebles

Data Source	Years	Resolution	Discards?	Depth Info
Commercial Log	2001-2011	1° X 1° area	20% of records	2005-present
Headboat Log	1973-2011	Some 0.17° X 0.17°	2004-present	No
Reef Fish Obs.	2006-2011	Lat/Long	Yes	Yes
MARMAP	1977-2011	Lat/Long	Yes	Yes
ALS	1962-2009	State Sub-Regions	No	No
FL Trip Ticket	1986-1992	State Sub-Regions	No	No
GA & SC T. Ticket	1989-2009	State Sub-Regions	No	No
NC Trip Ticket	1994-2010	State Sub-Regions	No	No
DW ROV Survey	2004-2011	Lat/Long	Yes	Not provided
Fisher Reports	1960s-2011	Loran Lat/Long	Yes	Some
SEFIS	2010-2011	Lat/Long	Yes	Yes
REEF	1980s-2011	State Sub-Regions	Yes	No
Oculina ROV	2003-2005	Lat/Long	Yes	Yes
Manooch (FRG)	1972-1977	Lat/Long	Yes	Yes
Sedberry Sub	1985, 2002	Lat/Long	Yes	Yes
Rudershausen et al.	2007	Lat/Long	Yes	Yes
Museum Collections	1884-1991	Lat/Long	Yes	Yes

MATURITY VS. DEPTH

Speckled Hind

Length (inches) vs Depth (fathoms)

L50

R² = 0.25
n = 519

Warsaw Grouper

Length (inches) vs Depth (fathoms)

L50 = ½ L∞

spawning

min L_m*

R² = 0.01
n = 56
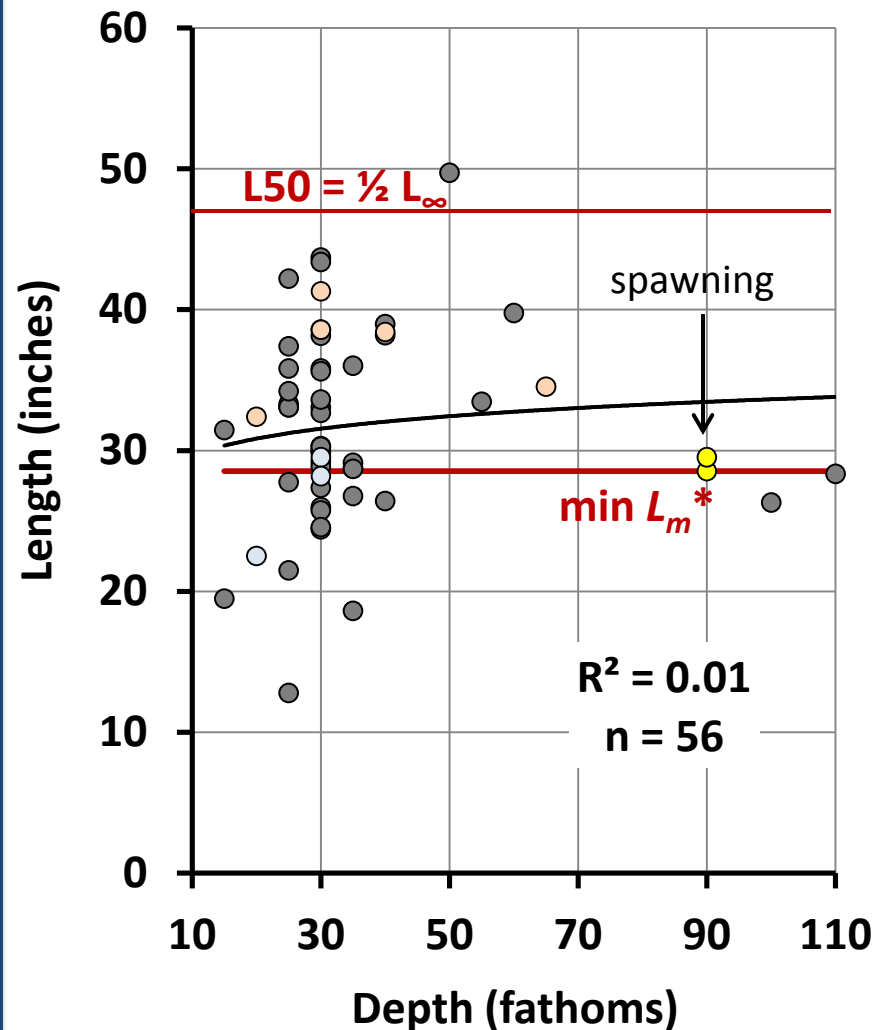
*min from n=9 mature fish (D. Wyanski, SC-DNR)

Sources: MARMAP & RFOP

RELEASE MORTALITY
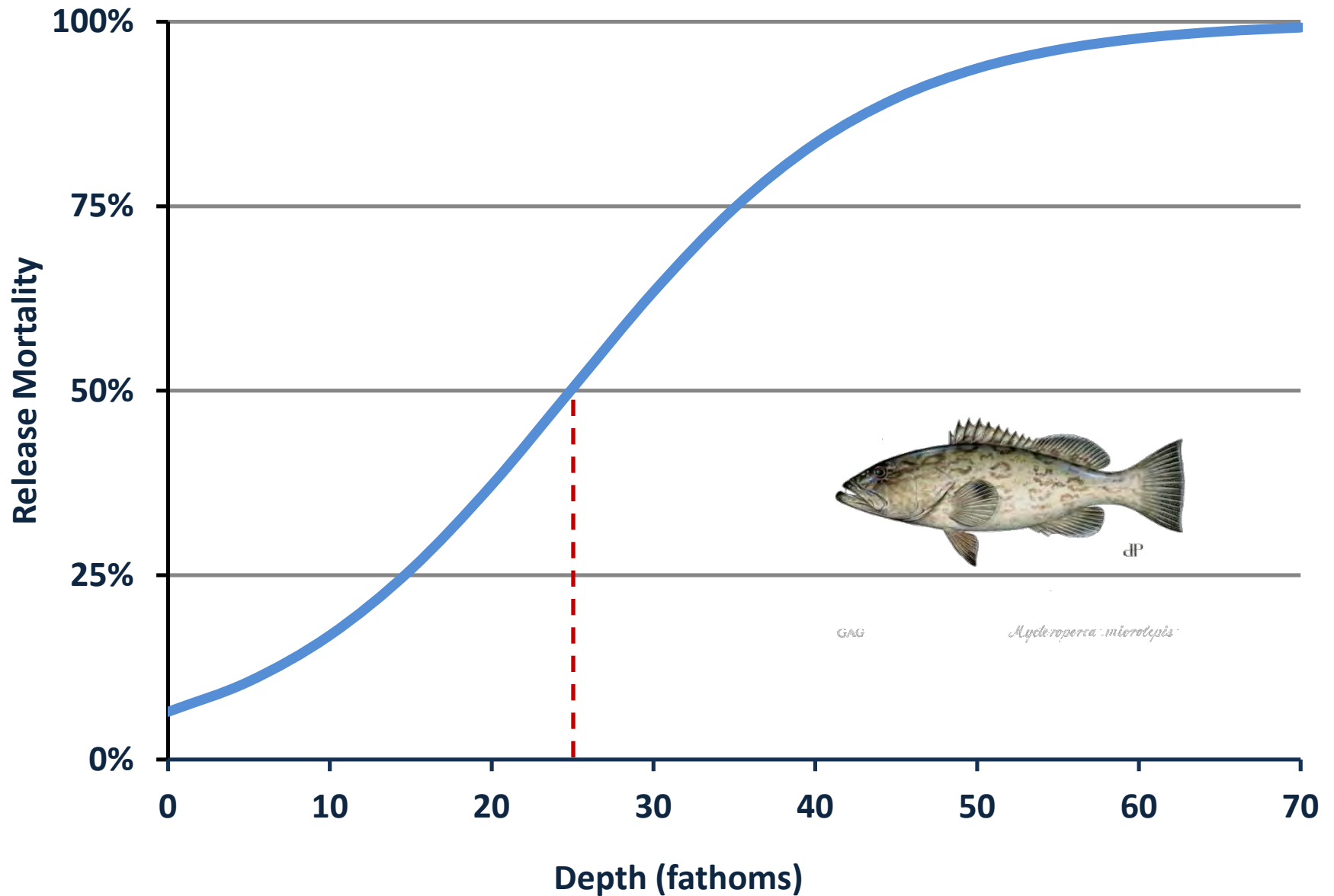
What level of protection is needed?
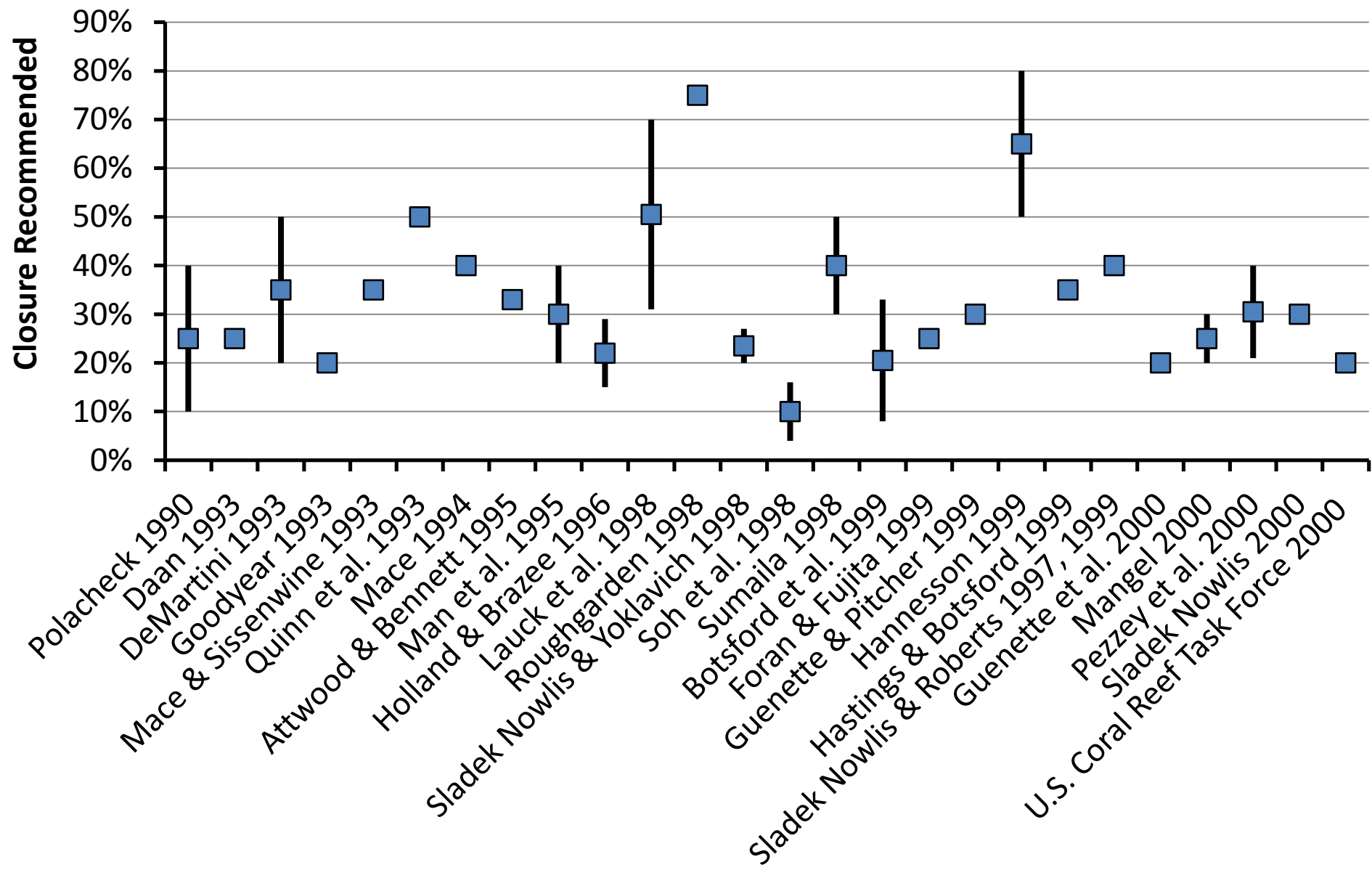
Discussion: MPA Impacts

Uniform distribution

    20% Closed → 20% Protected

Heterogeneous distribution

    20% Selectively Closed → >20% Protected

Meta-analysis:

1. Heterogeneously distributed
2. Hardbottom associated
3. Release mortality likely >50% beyond 25 ftm
4. Mature 25-100 fathoms
5. Spawning 25-100 fathoms

Discussion: Keys for Success

Public support

-Involvement in MPA selection

Quantitative measures of performance

-Baseline measures of habitat and stock condition in/out

-Space use and movements

Follow-up monitoring, simulation modeling

Adequate enforcement

-Simple regulations

-Mandatory VMS

-Passive listening devices

Adaptive management

-Boundaries and number of MPAs can be modified

-Collect data for new assessment