

# How can you use the spatial information for the Upper Keys?

**-natural resources-**

- **NOAA – Florida Keys National Marine Sanctuary**
- **Florida Fish and Wildlife Commission**
- **NOAA – National Centers for Coastal Ocean Science**



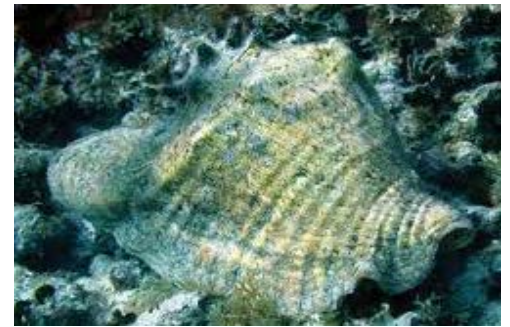


Where are locations of 'special places'?

# Natural Resource Info

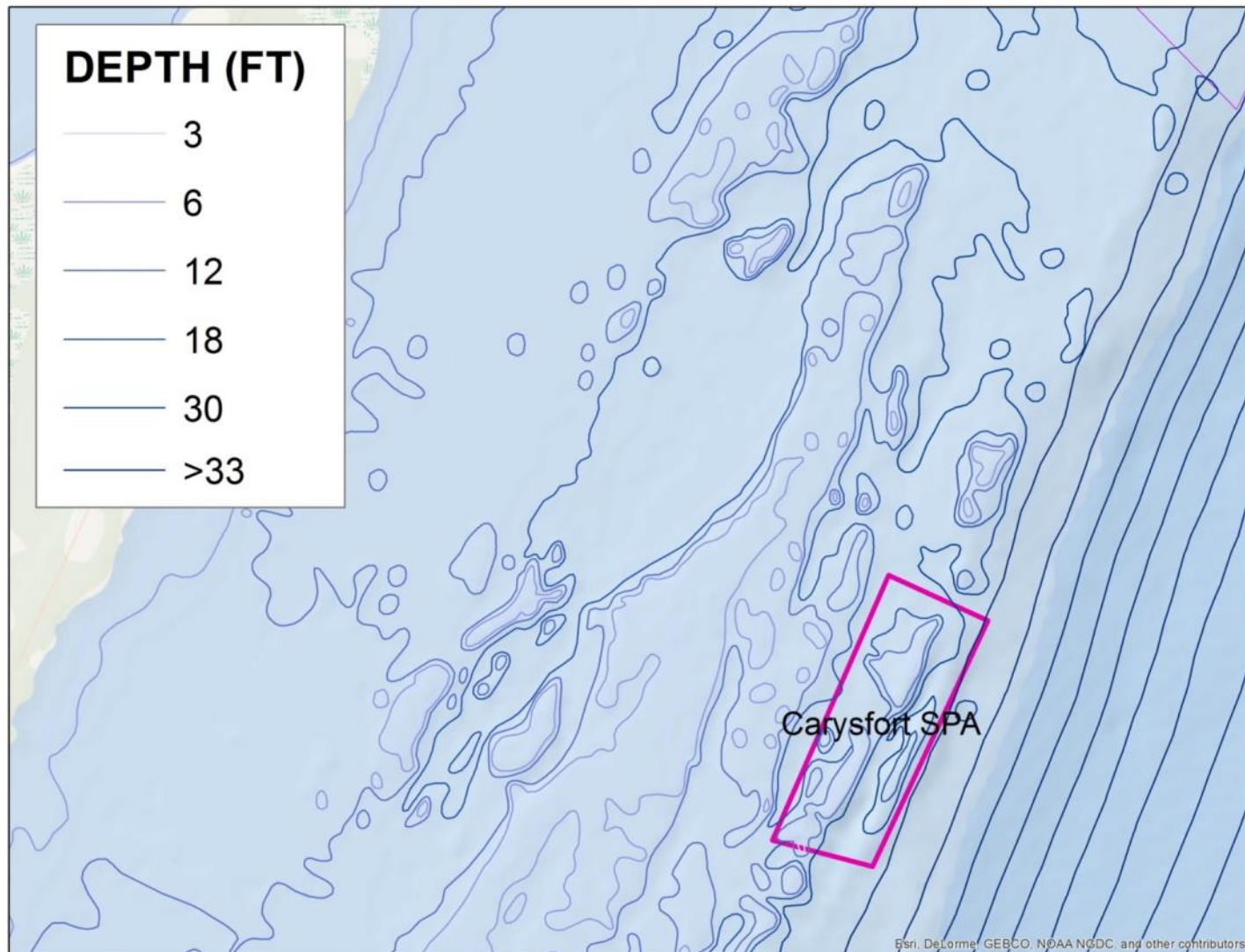
## Metrics

- Habitat
  - Habitat types
  - Patch & linear reef
  - High relief reefs
  - Turtle grass density
- Coral
  - Stony coral
  - Soft coral
  - Resilient reefs
- Fish
  - Reef fish surveys
  - Fish aggregations
- Fauna
  - Conch aggregations



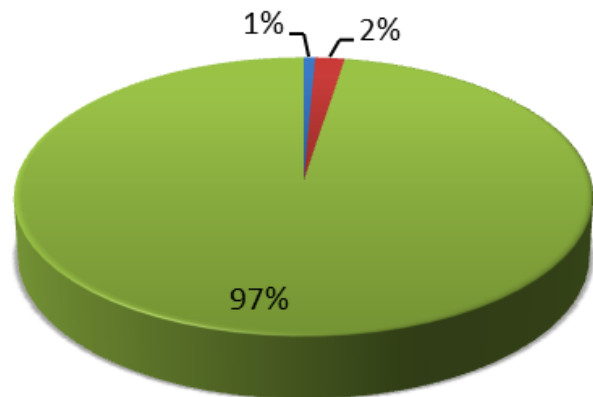


# Depth Contours



# How much **area** is currently within zones?

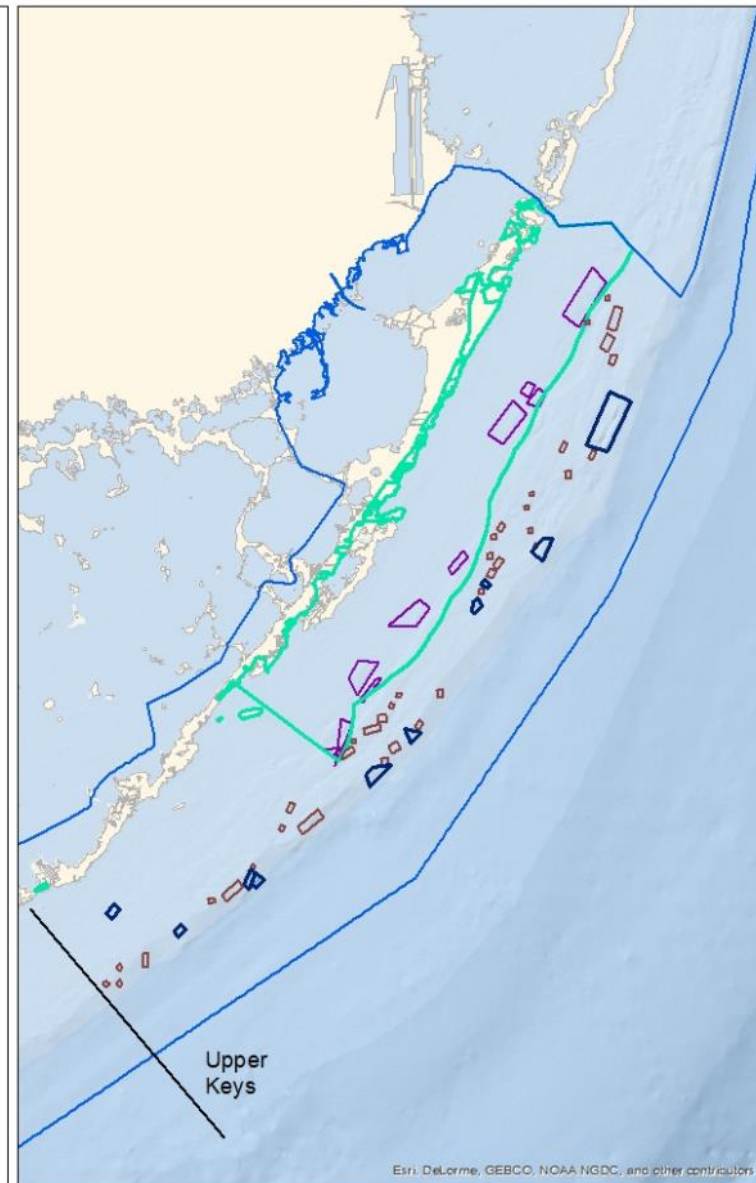
Management Zone	Area (km <sup>2</sup> )
SPAs, SUAs	10
NMFS & Pennekamp Lobster management areas	26
Remaining FKNMS	1373
<b>Resource Total</b>	<b>1409</b>



- SPAs, SUAs
- NMFS & Pennekamp Lobster management areas
- Remaining FKNMS

## Upper Keys

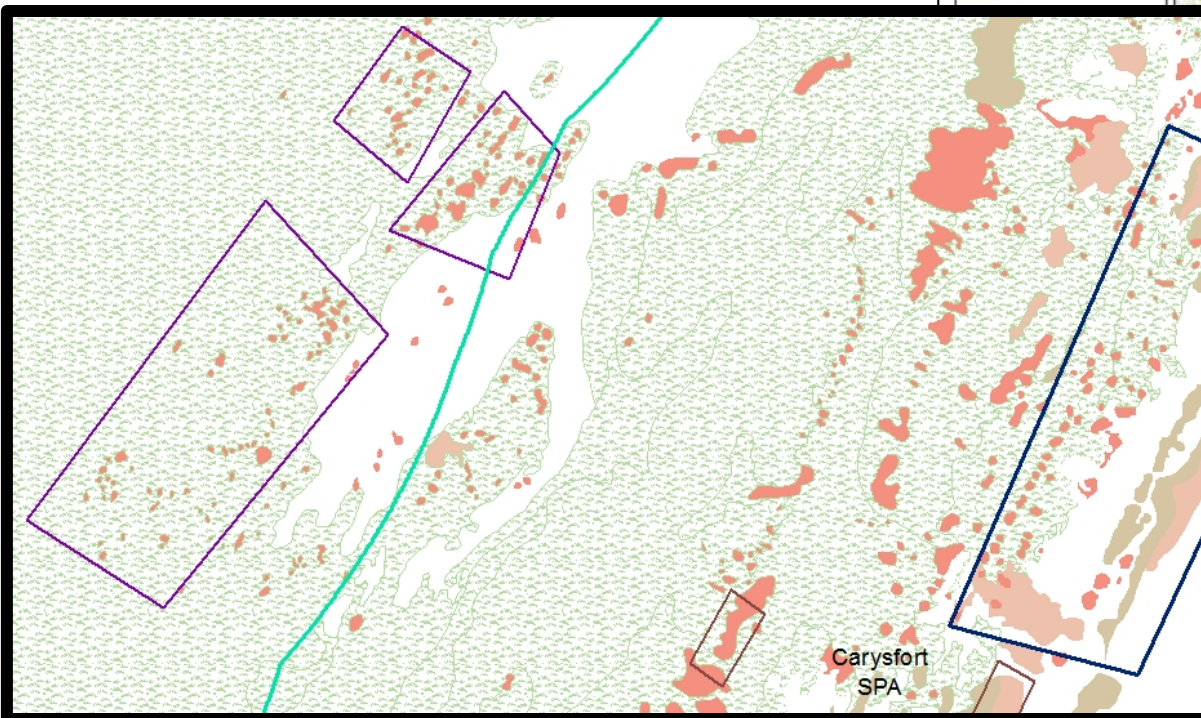
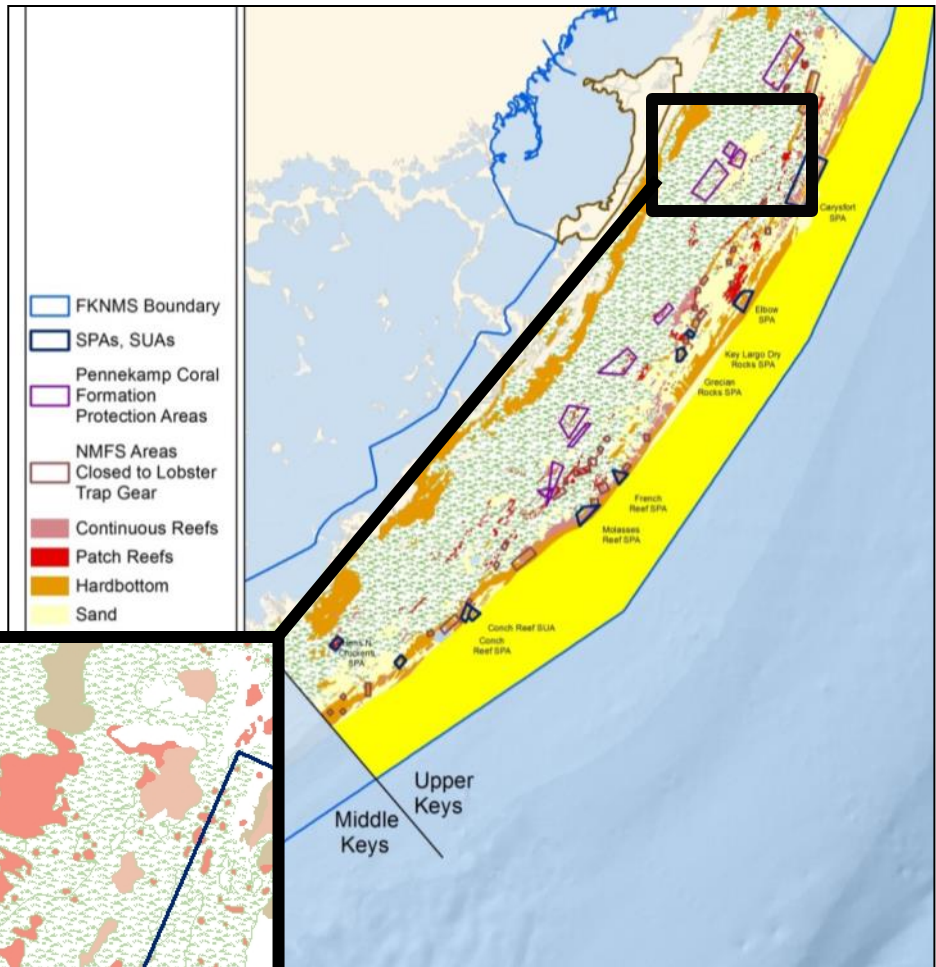
- FKNMS
- SPAs, SUAs
- ▨ Conch Reef Special Use Area
- NMFS Areas Closed to Lobster Trap Gear
- Pennekamp State Park
- Pennekamp Coral Formation Protection Areas



Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors



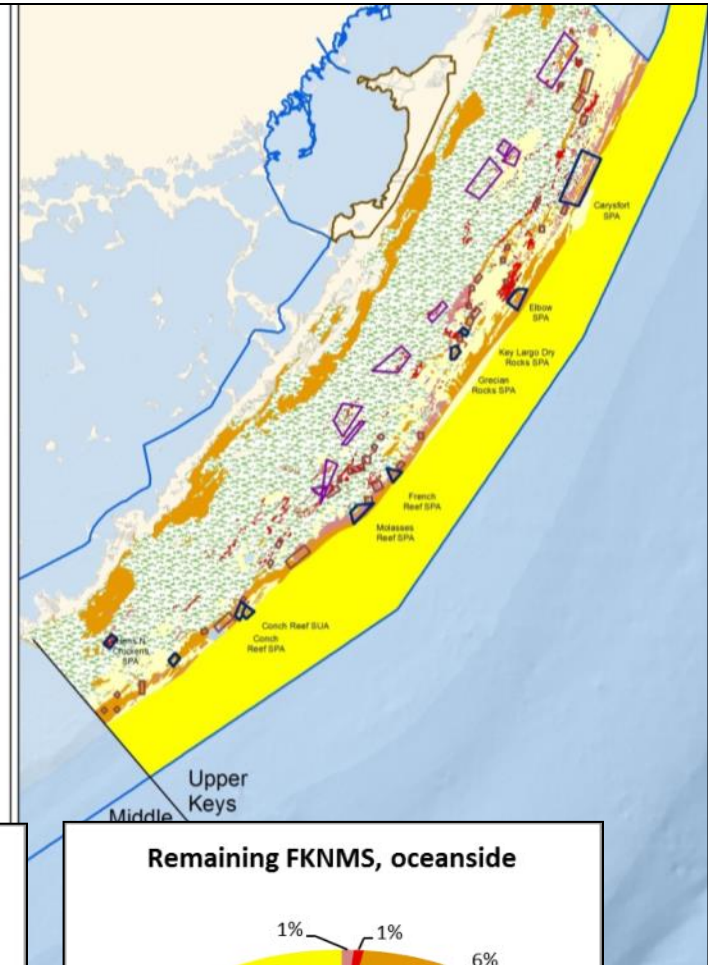
# How are **habitats** distributed?



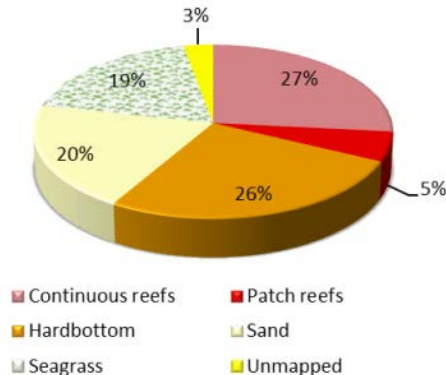
# How are habitats distributed?

Habitats	Area (Km <sup>2</sup> )		
	SPAS, SUAs	NMFS & Pennekamp lobster management areas	Remaining FKNMS, oceanside
Continuous reefs	3	2	19
Patch reefs	1	3	16
Hardbottom	3	3	134
Sand	2	2	100
Seagrass	2	15	550
Unmapped	0.3	0	789

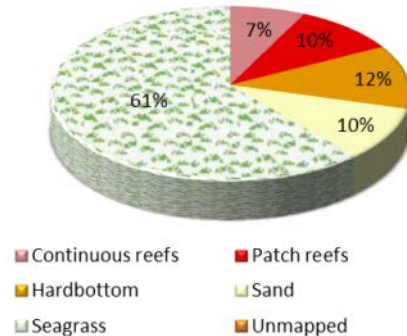
- FKNMS Boundary
- SPAs, SUAs
- Pennekamp Coral Formation Protection Areas
- NMFS Areas Closed to Lobster Trap Gear
- Continuous Reefs
- Patch Reefs
- Hardbottom
- Sand
- Seagrass
- Unknown



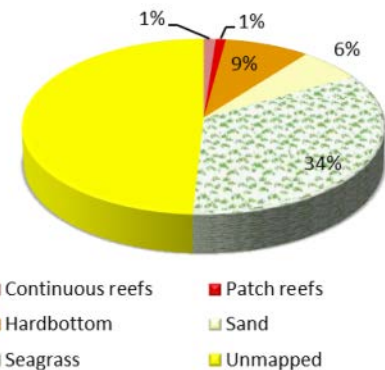
**SPAS, SUAs**



**NMFS & Pennekamp lobster management areas**

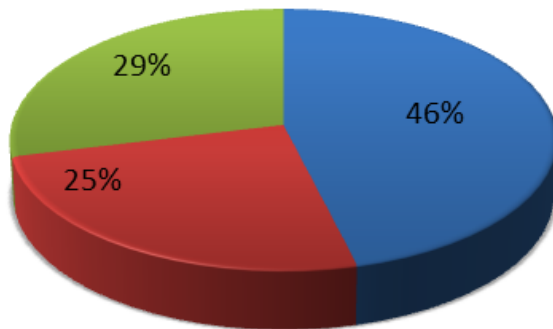


**Remaining FKNMS, oceanside**



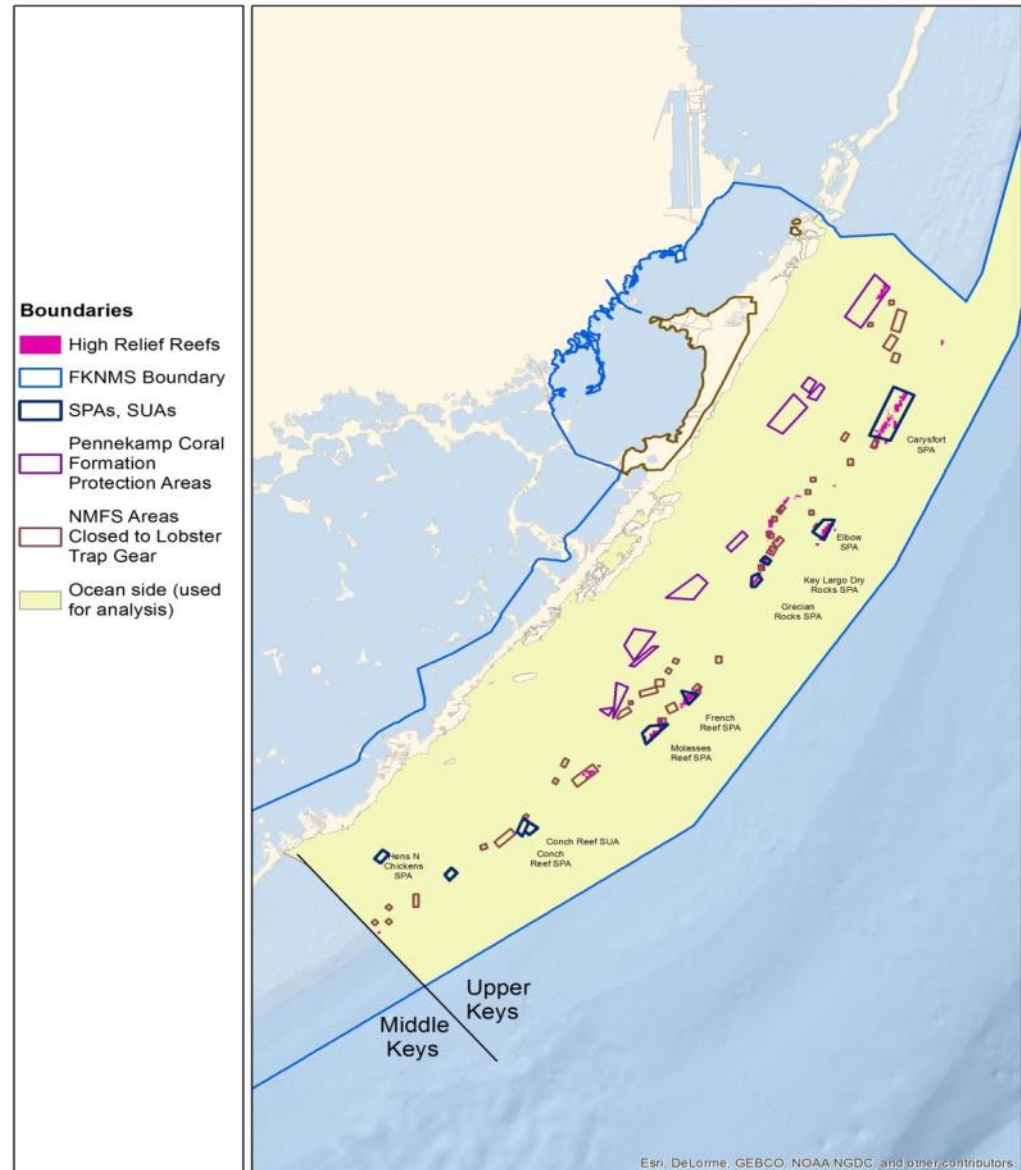
# Where are locations of high relief reefs?

Management Zone	Area (km <sup>2</sup> )
SPAs, SUAs	0.23
NMFS & Pennekamp lobster management areas	0.13
Remaining FKNMS, oceanside	0.14
<b>Resource Total</b>	<b>0.50</b>



- SPAs, SUAs
- NMFS & Pennekamp lobster management areas
- Remaining FKNMS, oceanside

Note: Area refers specifically to reef area.





Where are locations of known fish spawning aggregations?

## Fish spawning aggregations

### Fish aggregations

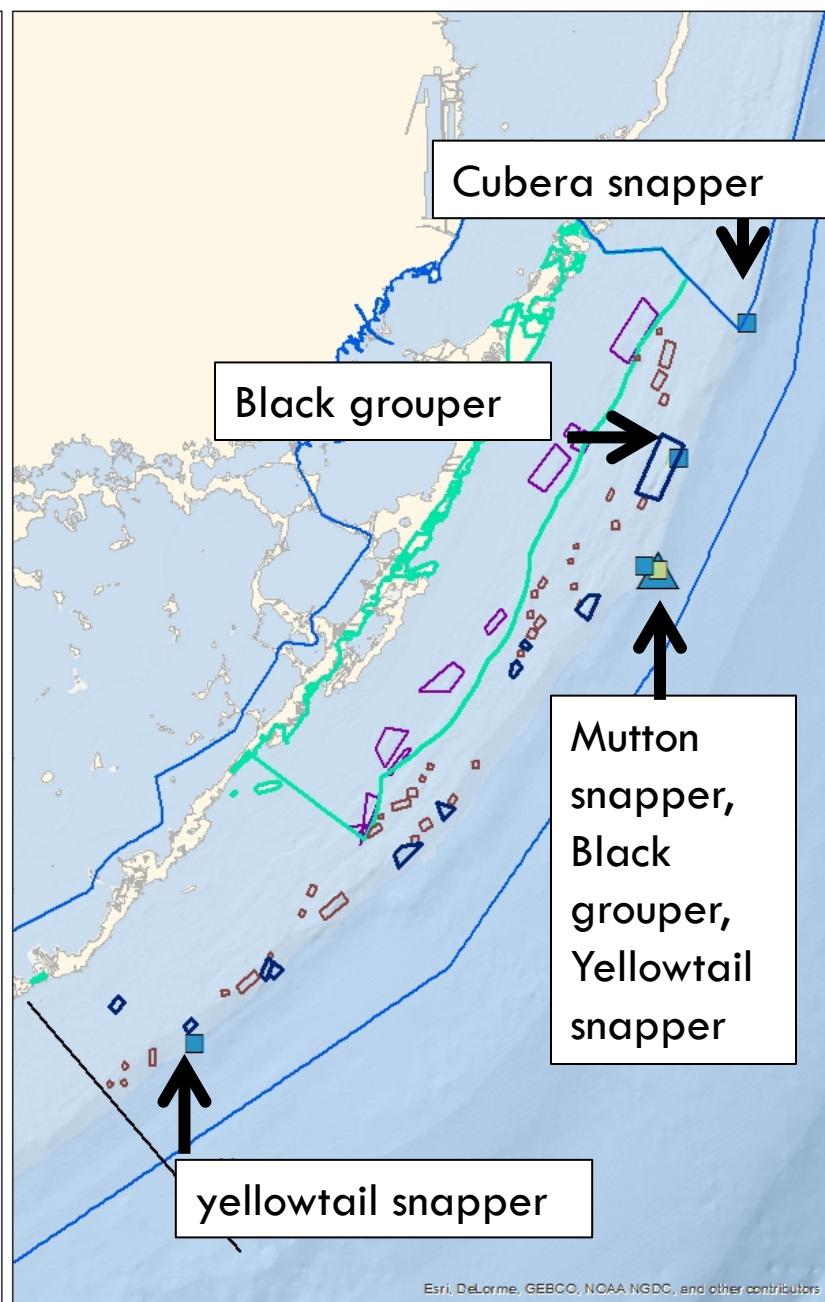
#### Single Species

- Present
- Probable
- Potential
- Reported

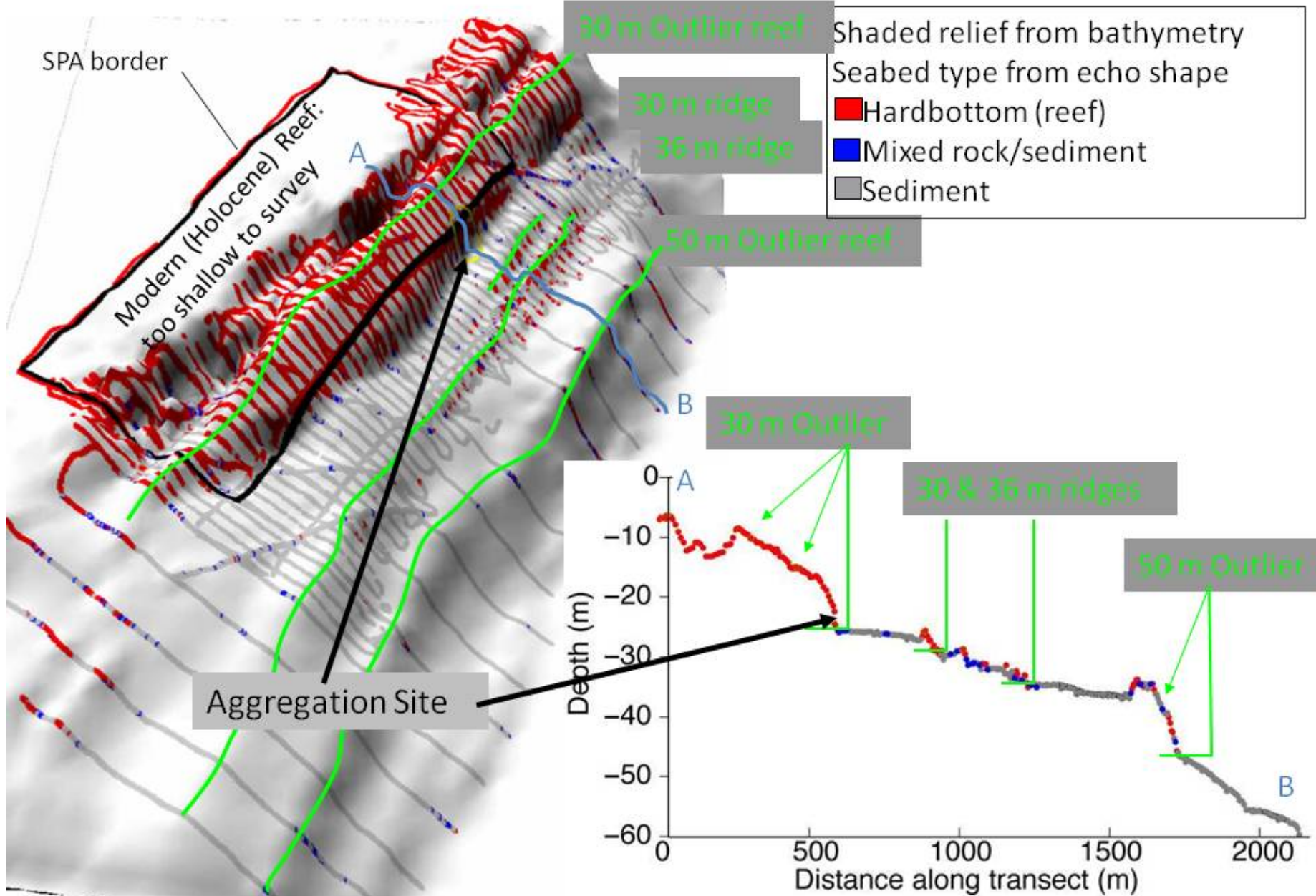
#### Multi Species

- ▲ Present
- ▲ Probable
- ▲ Potential
- ▲ Reported

- FKNMS
- SPAs, SUAs
- Conch Reef Special Use Area
- NMFS Areas Closed to Lobster Trap Gear
- Pennekamp State Park
- Pennekamp Coral Formation Protection Areas



# Carysfort survey results

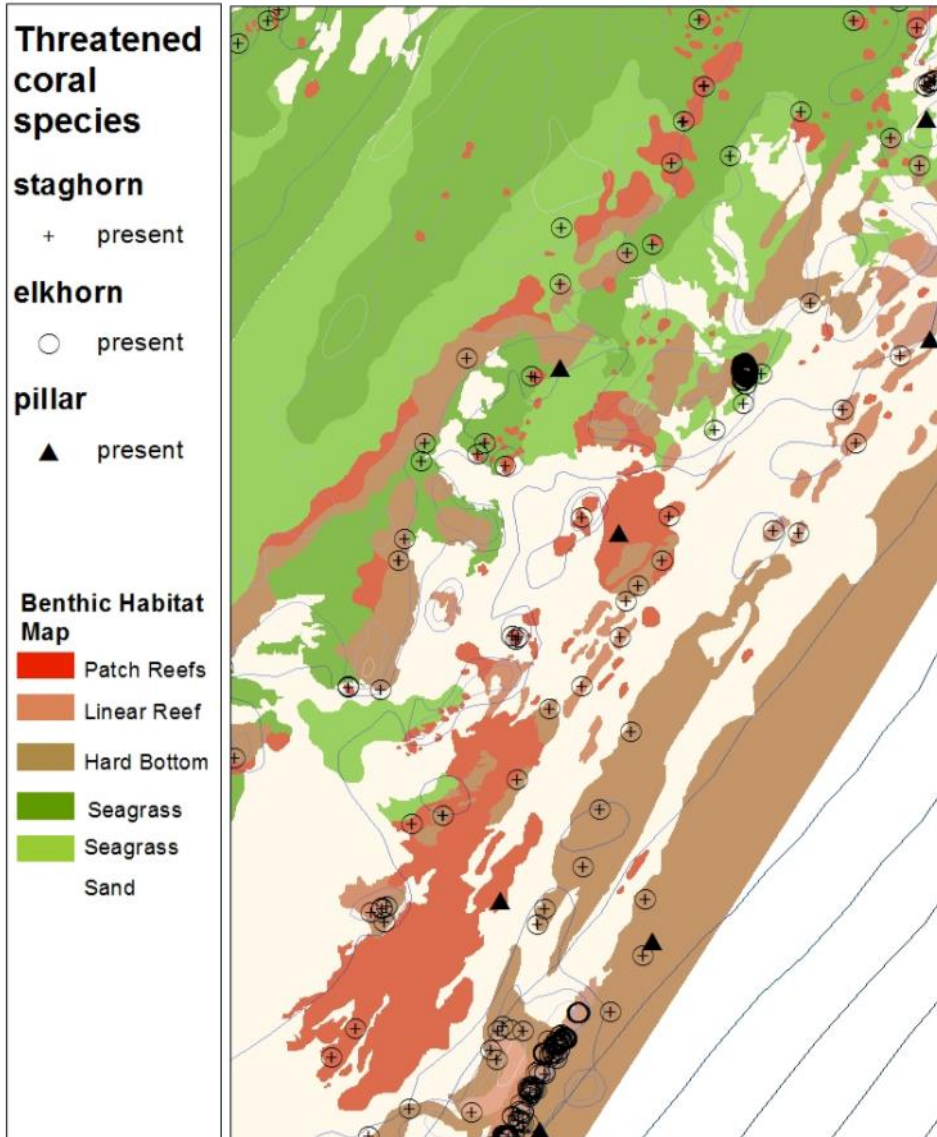
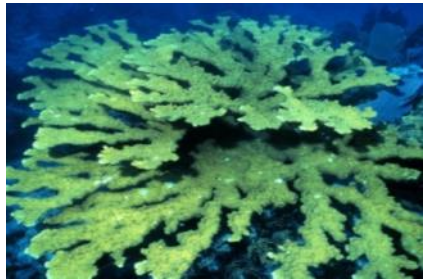


What proportions of sites with ESA coral species are present in current zones?





# Threatened Coral Species



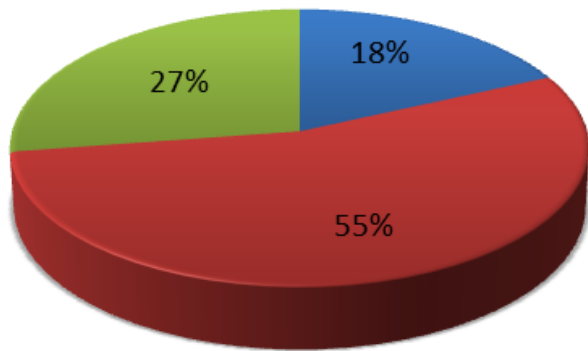
# What proportion of sites with Threatened Staghorn corals are present in current zones?



Greatest colony densities and sizes in mid-channel & offshore patch reefs.  
Source: <http://floridakeys.noaa.gov/scisummaries/elkhornstaghorn2013.pdf>

What proportion of sites with Threatened **Staghorn corals** are present in current zones?

Management Zone	Locations (#)
SPAs, SUAs	322
NMFS & Pennekamp lobster management areas	964
Remaining FKNMS, oceanside	484
<b>Resource Total</b>	<b>1770</b>



- SPAs, SUAs
- NMFS & Pennekamp lobster management areas
- Remaining FKNMS, oceanside

## Staghorn Coral Presence

### Staghorn

+ present

#### Boundaries

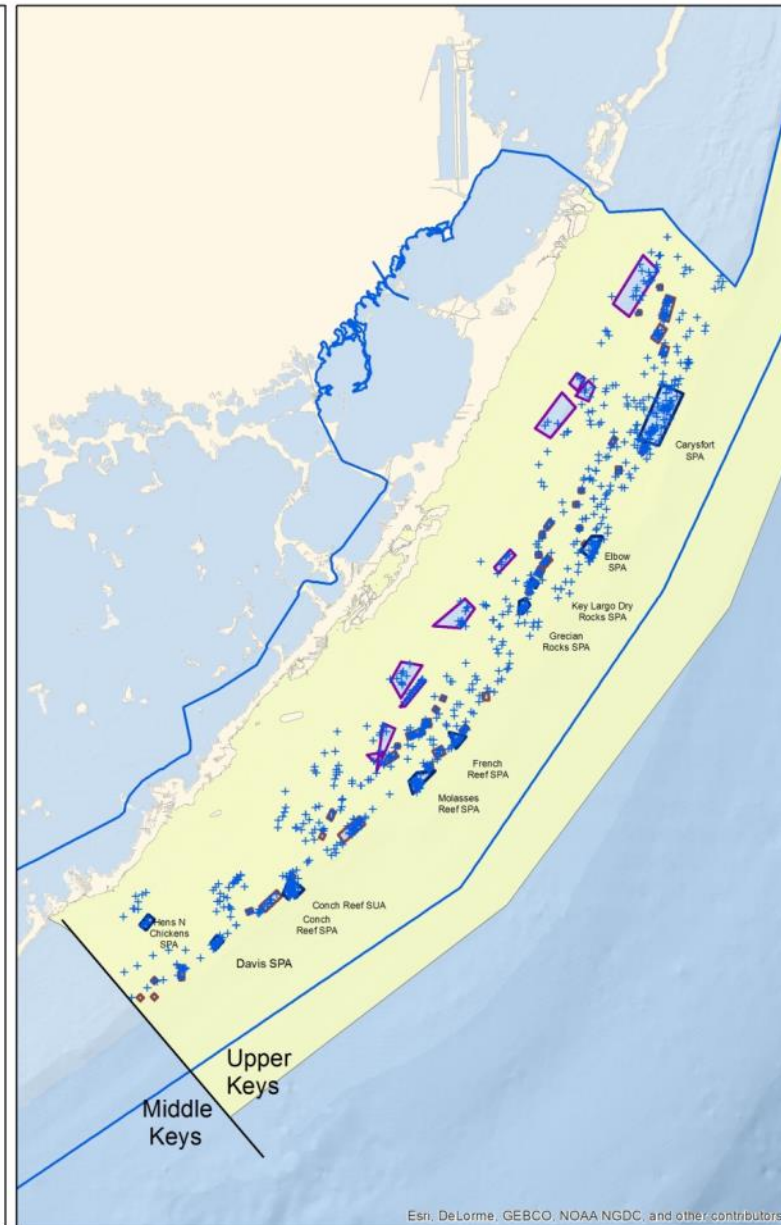
FKNMS Boundary

SPAs, SUAs

Pennekamp Coral Formation Protection Areas

NMFS Areas Closed to Lobster Trap Gear

Ocean side (used for analysis)



Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors



# What proportion of sites with Threatened Elkhorn corals are present in current zones?



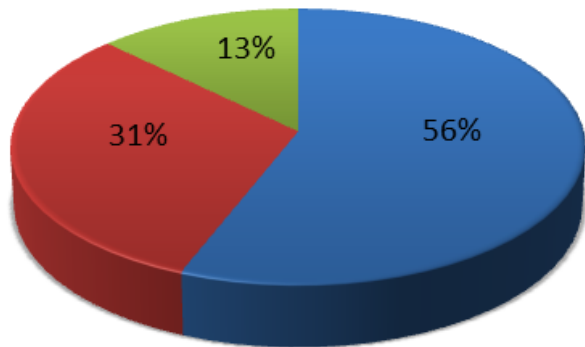
Photo credit: FWC

In 2012, nearly 80% of colonies were found in high-relief spur & groove reefs and offshore patch reefs. Coral density, size and occurrence were higher inside SPAs.

Source: <http://floridakeys.noaa.gov/scisummaries/elkhornstaghorn2013.pdf>

# What proportion of sites with Threatened **Elkhorn corals** are present in current zones?

Management Zone	Locations (#)
SPAs, SUAs	1,696
NMFS & Pennekamp lobster management areas	944
Remaining FKNMS, oceanside	387
<b>Resource Total</b>	<b>3027</b>



- SPAs, SUAs
- NMFS & Pennekamp lobster management areas
- Remaining FKNMS, oceanside

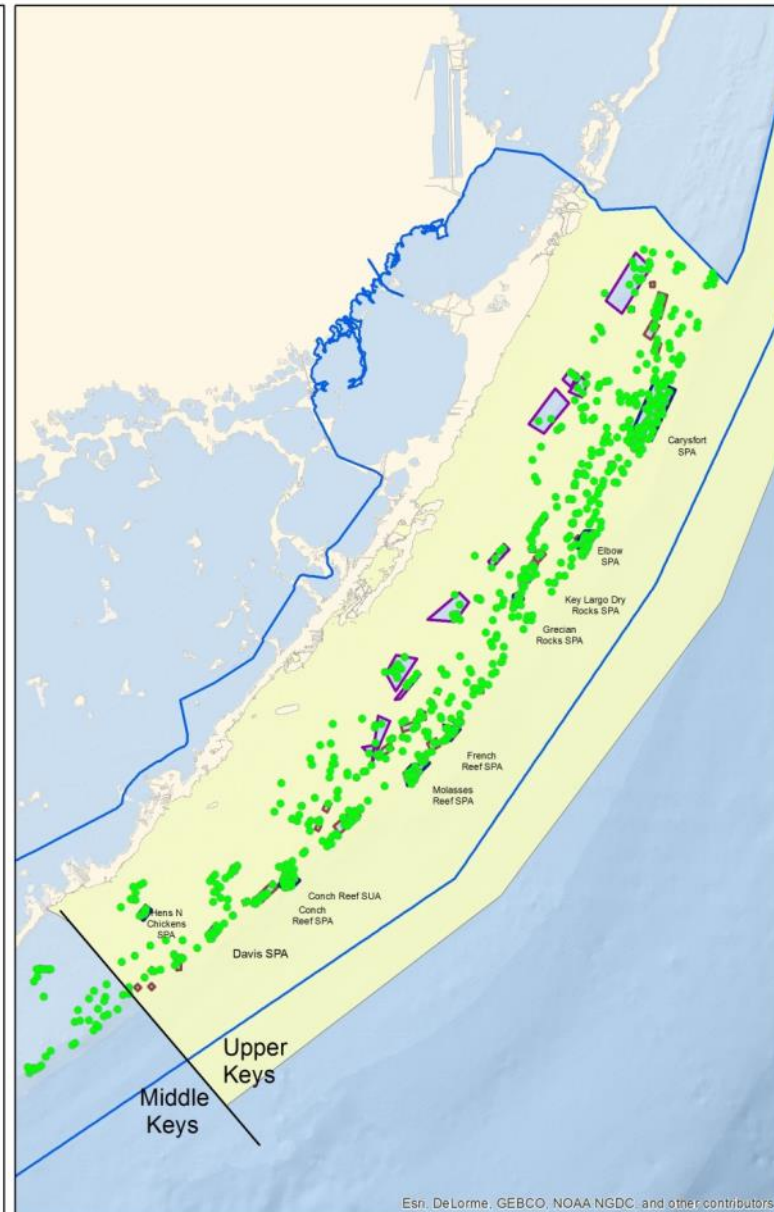
## Elkhorn Coral Presence

### Elkhorn

• present

### Boundaries

- FKNMS Boundary
- SPAs, SUAs
- Pennekamp Coral Formation Protection Areas
- NMFS Areas Closed to Lobster Trap Gear
- Ocean side (used for analysis)



Esn, DeLorme, GEBCO, NOAA NGDC, and other contributors

# What proportion of sites with Threatened Pillar corals are present in current zones?



Threatened status – State of FL; ESA candidate Endangered species  
81 known sites with pillar coral present in the Florida Coral Reef Tract.  
52 of these are in the Upper Keys Region.

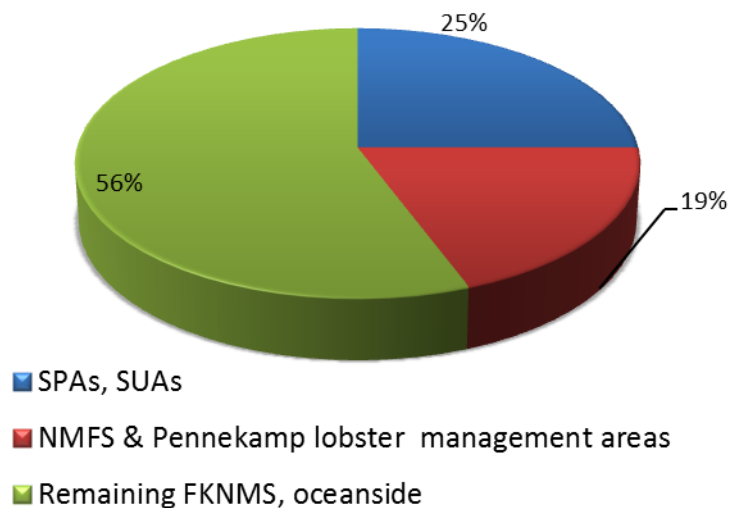
Source: FWC



# What proportion of Threatened Pillar corals are present in current zones?

Management Zone	Locations (#)
SPAs, SUAs	13
NMFS & Pennekamp lobster management areas	10
Remaining FKNMS, oceanside	29
<b>Resource Total</b>	<b>52</b>

**Pillar Coral**



**Pillar Coral Presence**

## Pillar

▲ present

### Boundaries

□ FKNMS  
Boundary

□ SPAs, SUAs

□ Pennekamp  
Coral Formation  
Protection Areas

□ NMFS Areas  
Closed to Lobster  
Trap Gear

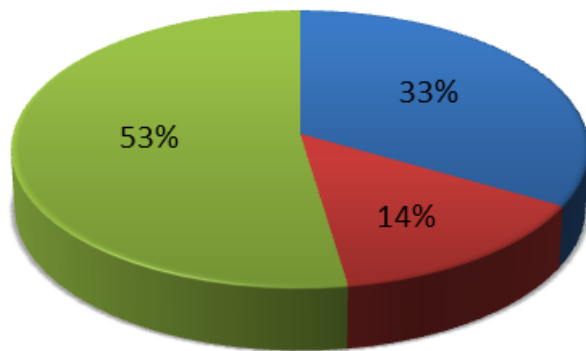
□ Ocean side (used  
for analysis)



Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors

# What proportions of sites with Candidate ESA coral species are in current zones?

Management Zone	Locations (#)
SPAs, SUAs	14
NMFS & Pennekamp lobster management areas	6
Remaining FKNMS, oceanside	22
<b>Resource Total</b>	<b>42</b>



- SPAs, SUAs
- NMFS & Pennekamp lobster management areas
- Remaining FKNMS, oceanside

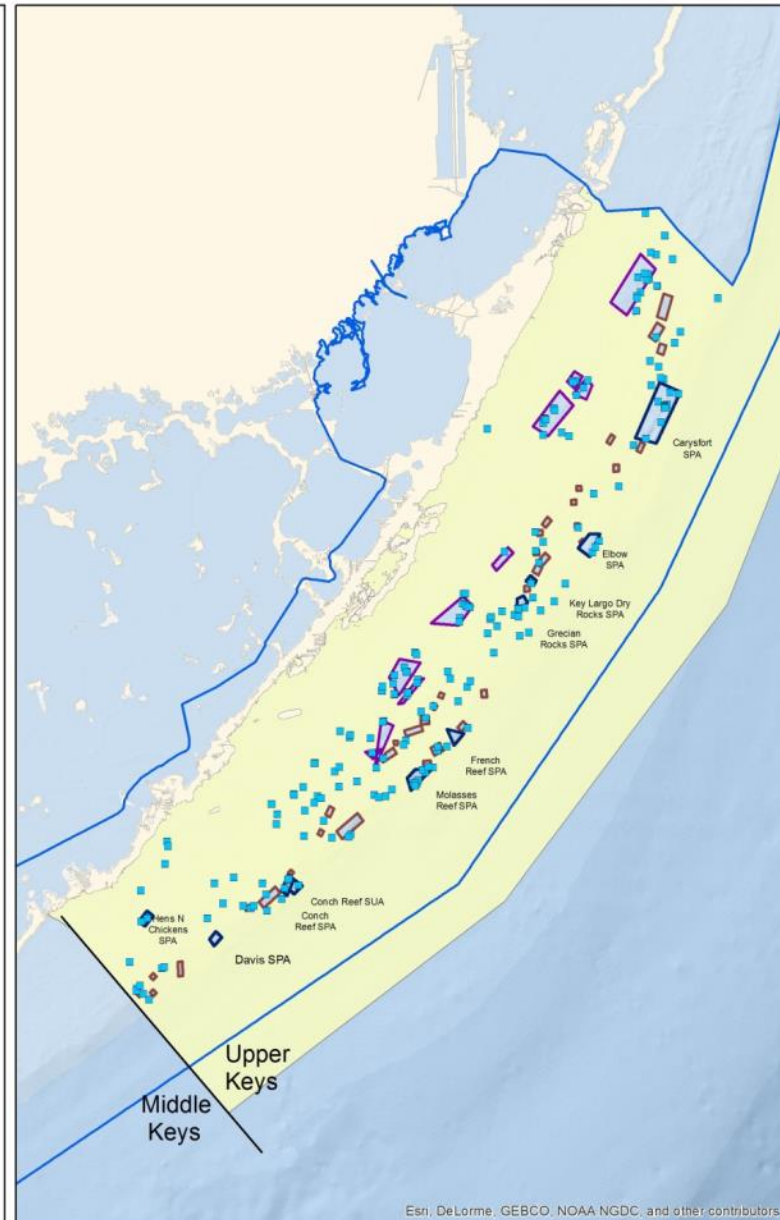
## Candidate Coral Presence

### Candidate

- Present

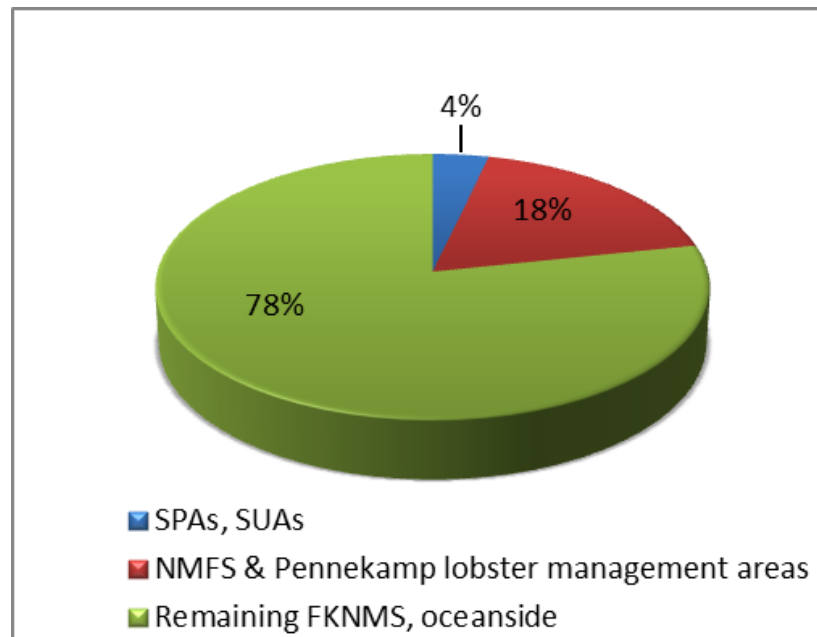
### Boundaries

- FKNMS Boundary
- SPAs, SUAs
- Pennekamp Coral Formation Protection Areas
- NMFS Areas Closed to Lobster Trap Gear
- Ocean side (used for analysis)

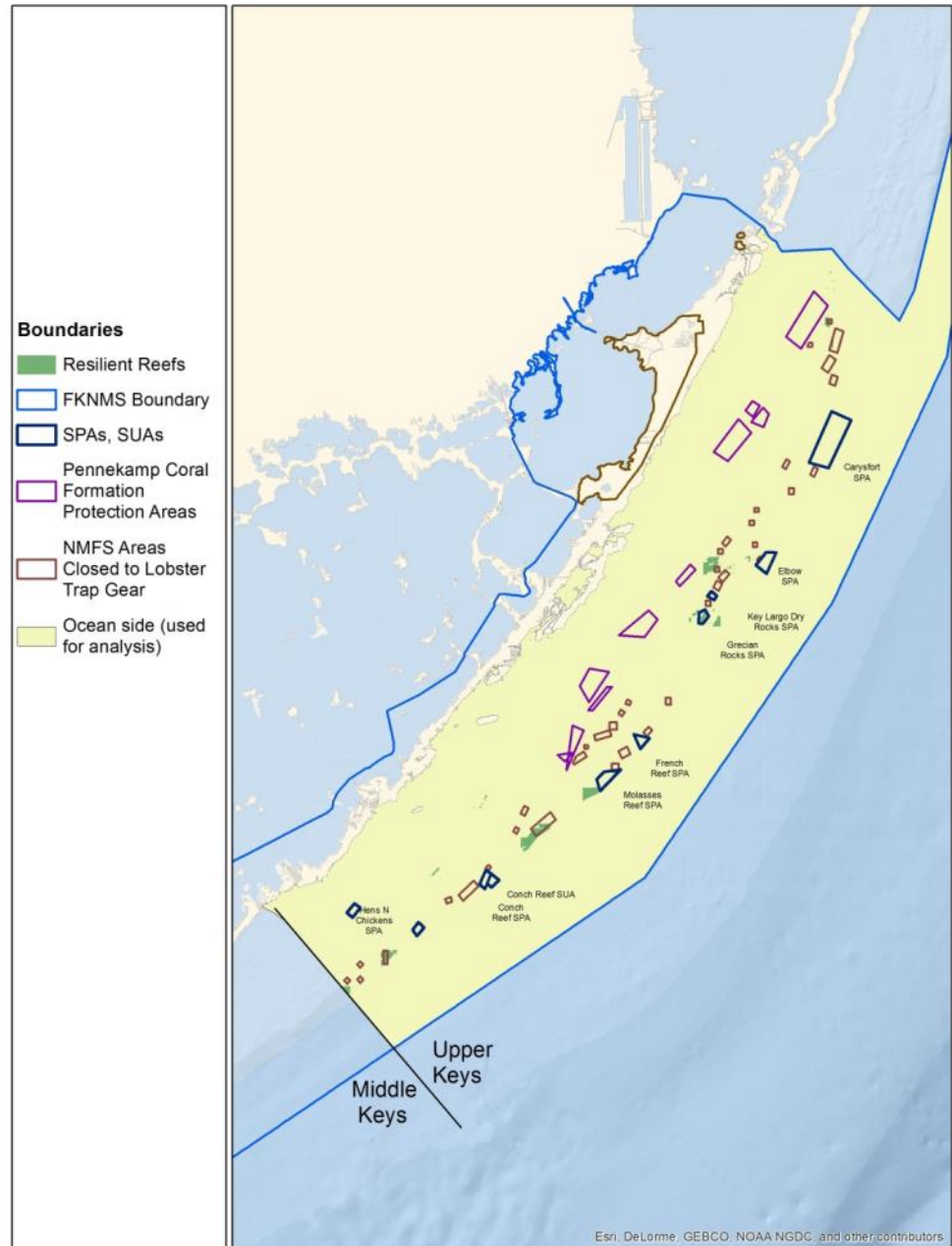


# Where are locations of resilient reefs?

Management Zone	Area (km <sup>2</sup> )
SPAs, SUAs	0.02
NMFS & Pennekamp lobster management areas	0.10
Remaining FKNMS, oceanside	0.42
<b>Resource Total</b>	<b>0.54</b>



Note: Area refers to specifically to reef area.





# Other ecosystem metrics

- **Fish abundance**
- **Fish diversity**
- **Stony Coral cover**
- **Stony Coral diversity**
- **Soft Coral cover**
- **Soft Coral diversity**



# How can we tell what areas are good?

Rank survey site relative to other sites  
in upper Keys

**High**

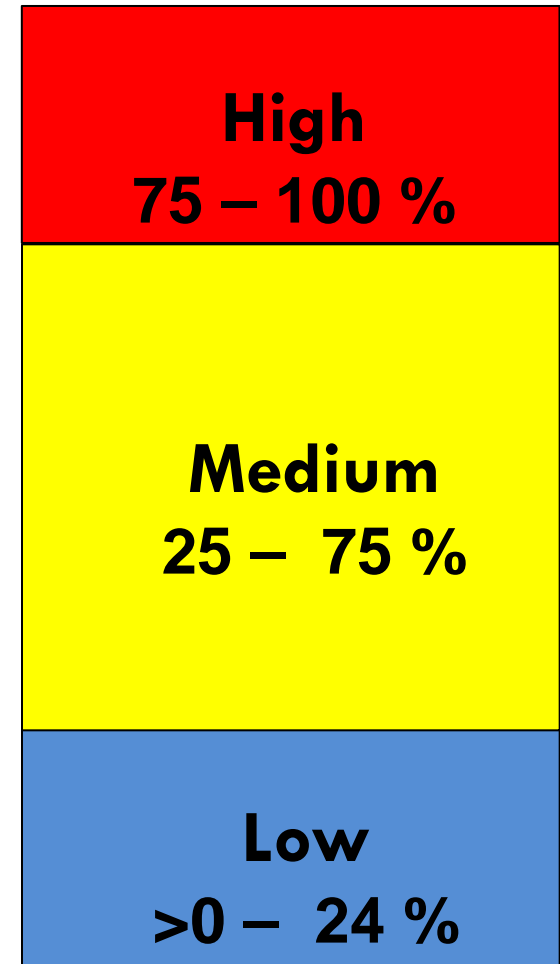
**Medium**

**Low**

**Top 25%**

**Middle**

**Bottom 25%**



# Fish Metrics

- **Fish abundance:** How many fish?
- **Fish diversity:** How many species of fish?



Photo credit: FWC

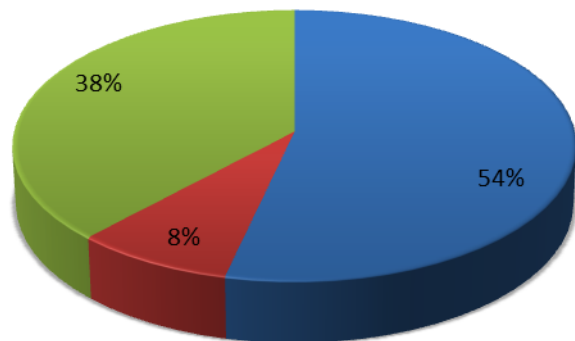


Photo credit: NOAA



# Where are locations of high fish abundance?

Management Zone	Locations (#)
SPAs, SUAs	186
NMFS & Pennekamp lobster management areas	29
Remaining FKNMS, oceanside	132
<b>Resource Total</b>	<b>347</b>



- SPAs, SUAs
- NMFS & Pennekamp lobster management areas
- Remaining FKNMS, oceanside

## Fish Total Abundance (200m)

### Abundance (200)

■ High

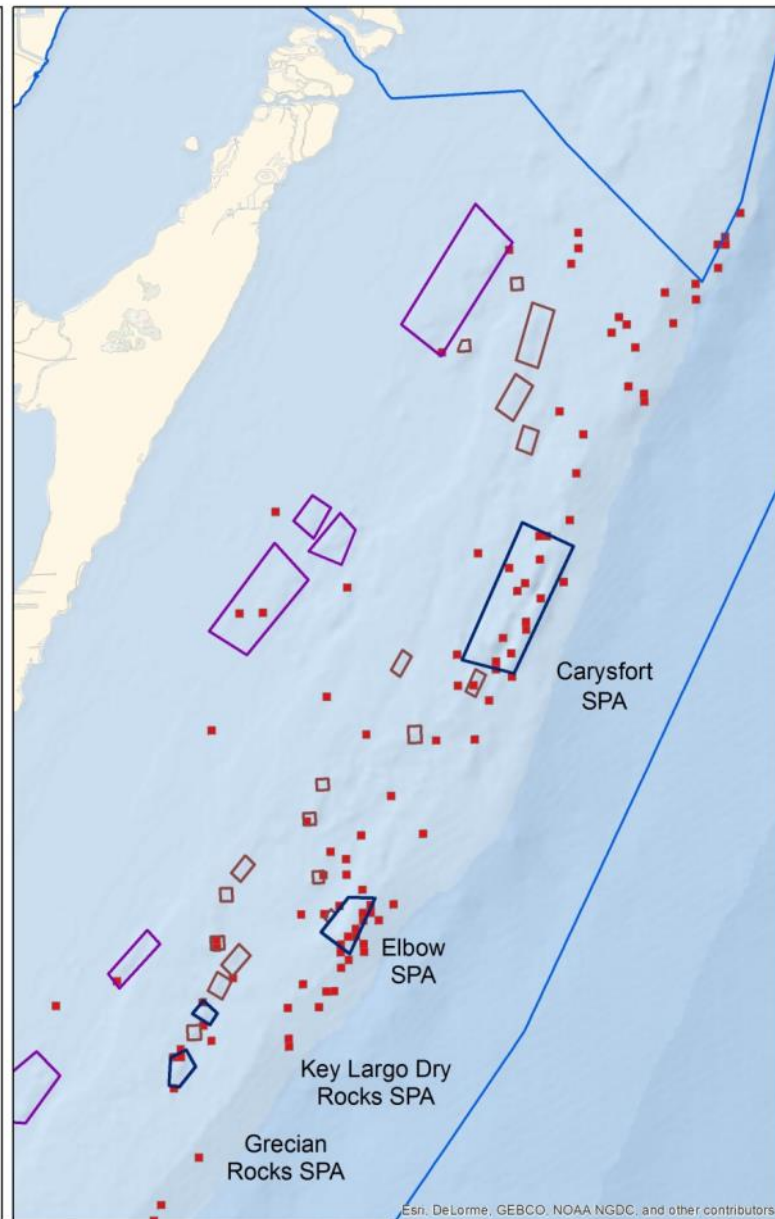
### Boundaries

FKNMS Boundary

SPAs, SUAs

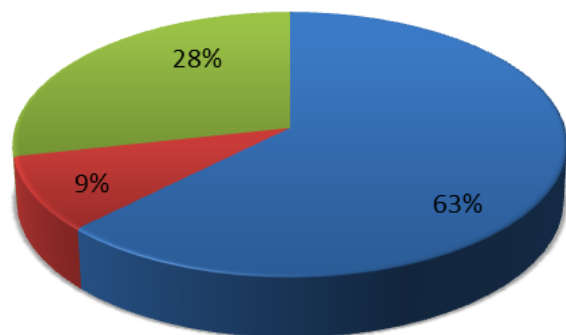
Pennekamp Coral Formation Protection Areas

NMFS Areas Closed to Lobster Trap Gear



# Where are locations of high fish species richness?

Management Zone	Locations (#)
SPAs, SUAs	220
NMFS & Pennekamp Lobster management areas	32
Remaining FKNMS, oceanside	100
<b>Resource Total</b>	<b>352</b>



■ SPAs, SUAs  
■ NMFS & Pennekamp Lobster management areas  
■ Remaining FKNMS, oceanside

## Fish Species Richness

### Species Richness

■ High

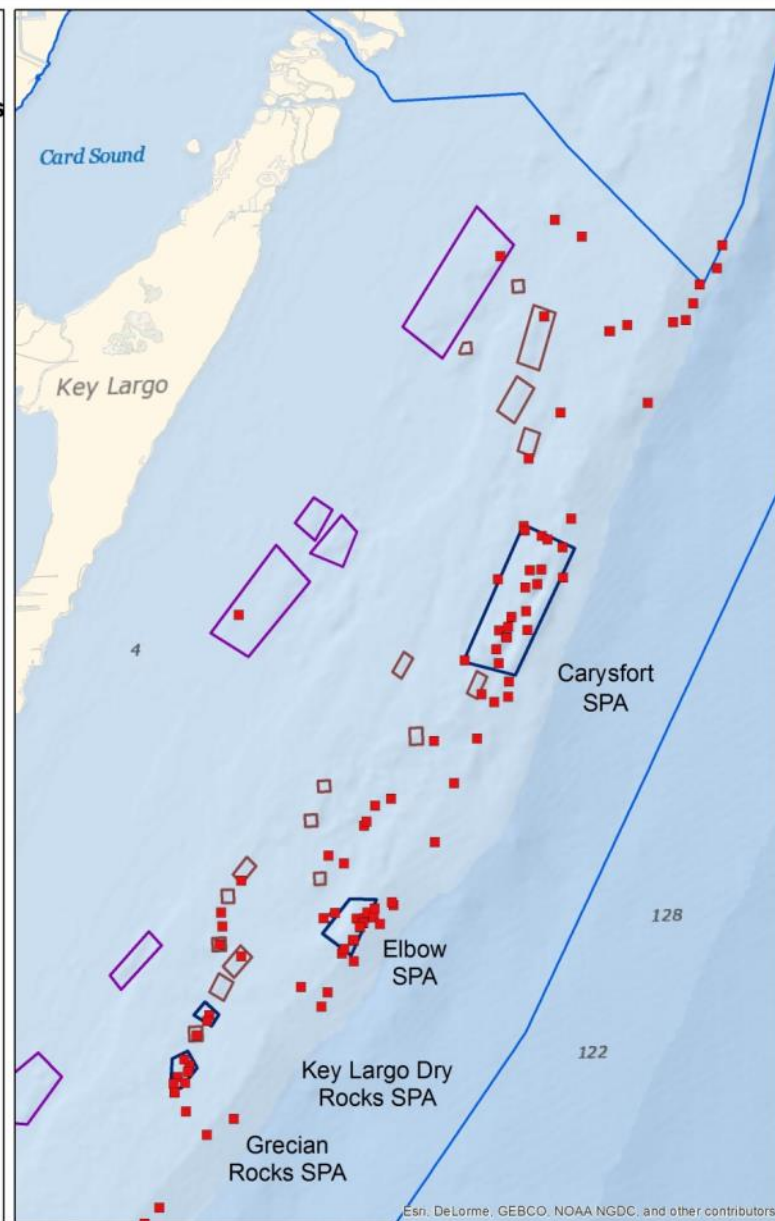
### Boundaries

□ FKNMS Boundary

□ SPAs, SUAs

□ Pennekamp Coral Formation Protection Areas

□ NMFS Areas Closed to Lobster Trap Gear



Now we have info on fish abundance  
and species richness

Let's look at them side by side



## Fish Species Richness

## Fish Total Abundance

Upper 1/3 of  
Upper Keys region

### Species Richness (200)

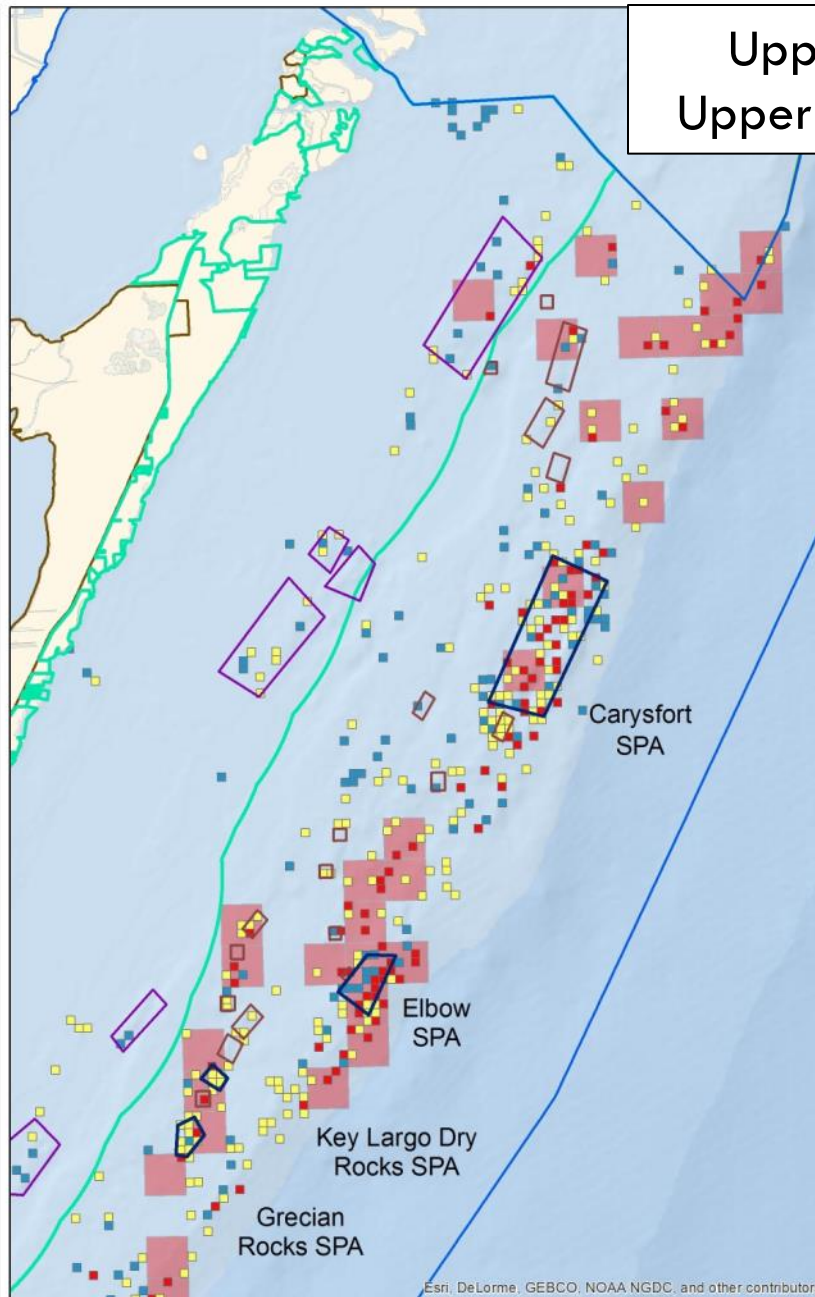
- High
- Medium
- Low

### Species Richness (1k)

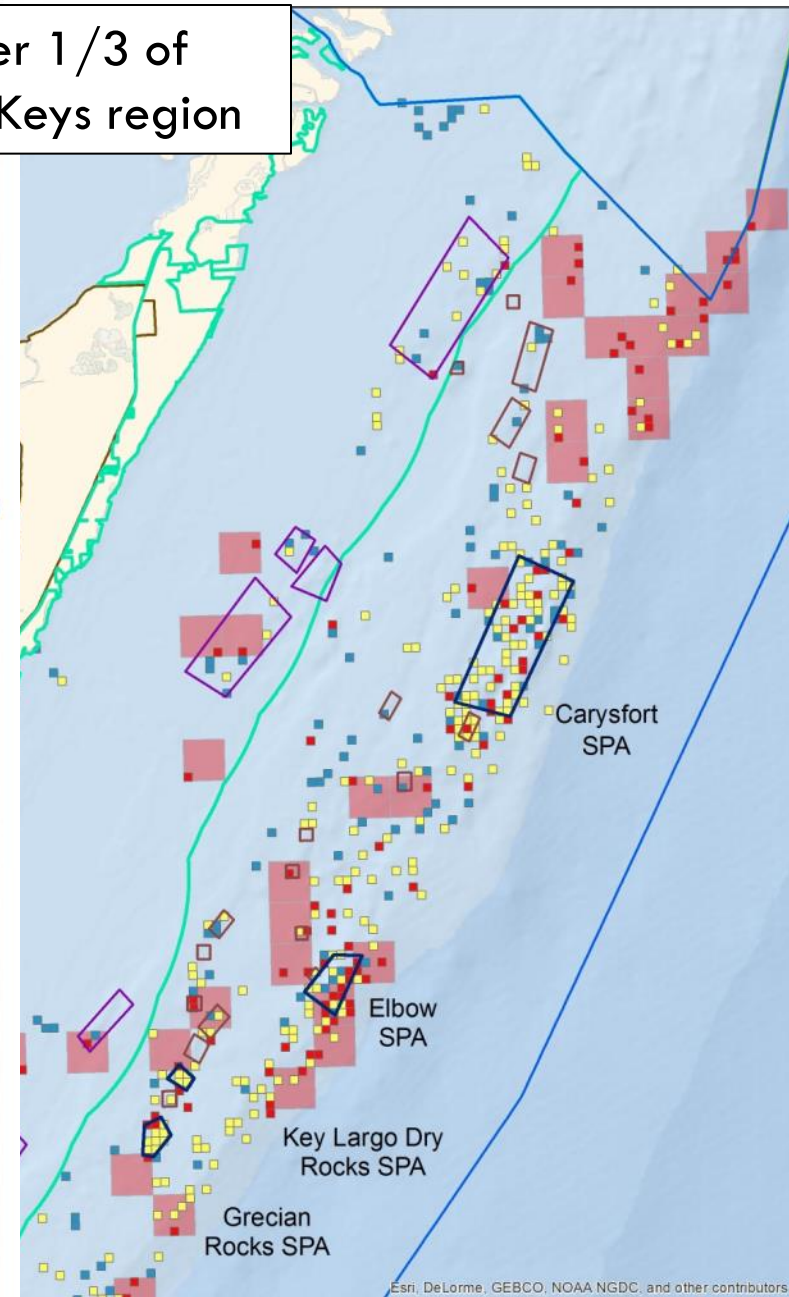
- High

### Boundaries

- FKNMS Boundary
- SPAs, SUAs
- Pennekamp Coral Formation Protection Areas
- NMFS Areas Closed to Lobster Trap Gear
- Pennekamp State Park
- National Parks
- National Wildlife Refuge



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## Fish Species Richness

## Fish Total Abundance

middle 1/3 of  
Upper Keys region

### Species Richness (200)

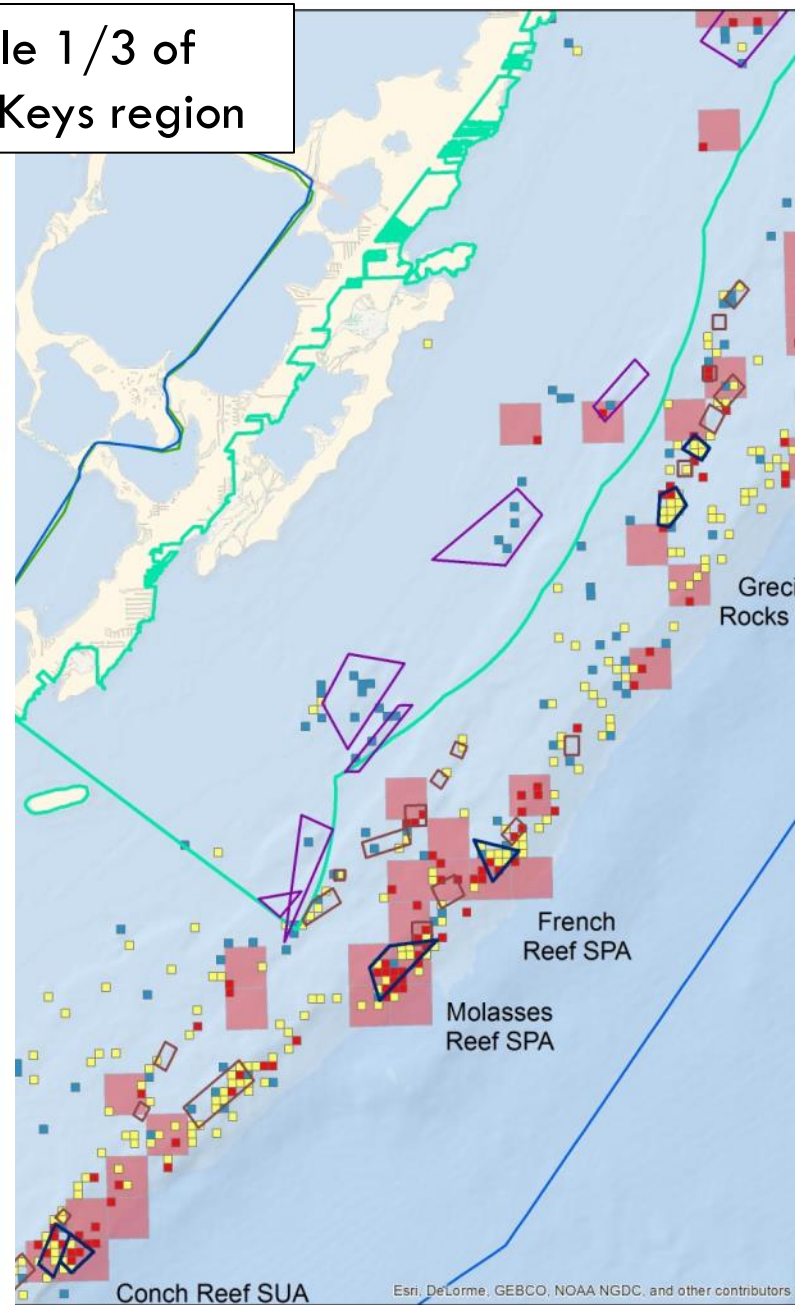
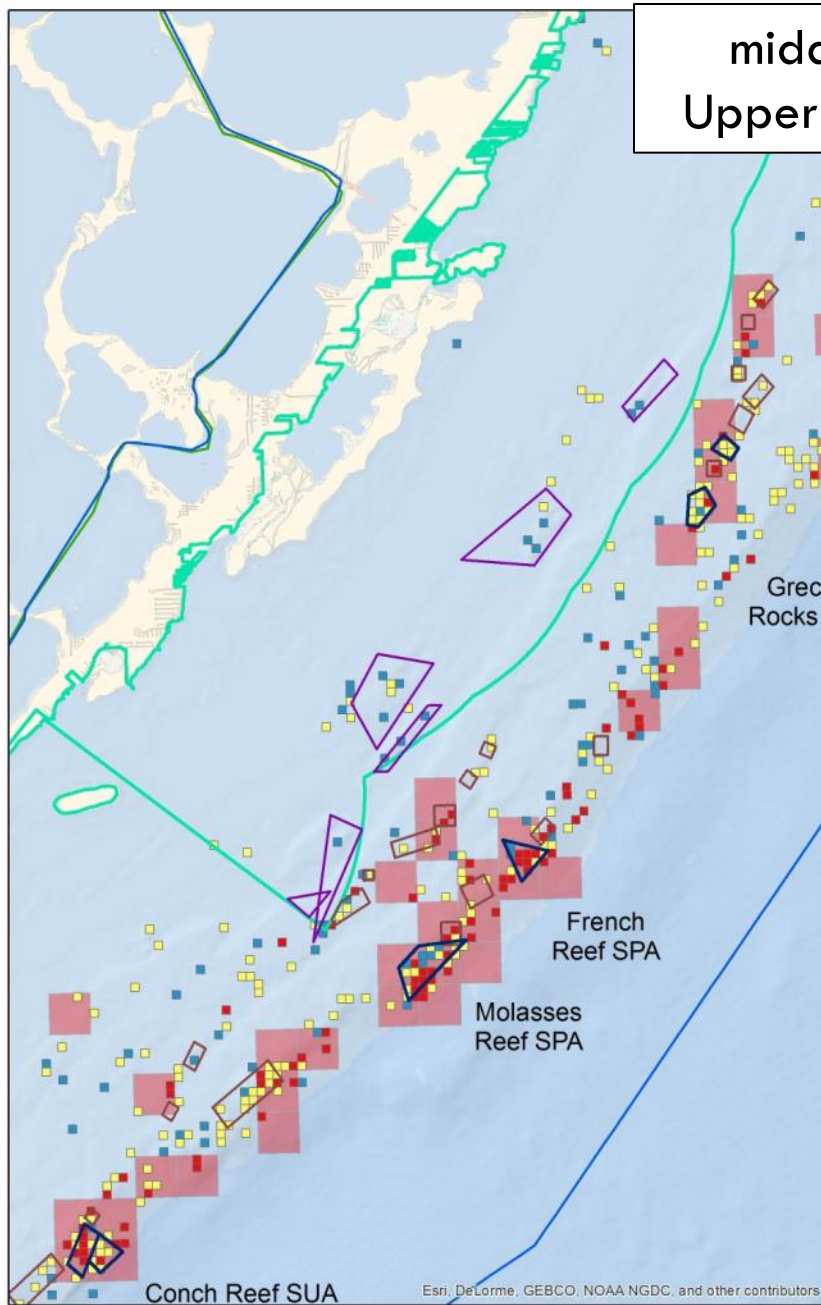
- High
- Medium
- Low

### Species Richness (1k)

- High

### Boundaries

- FKNMS Boundary
- SPAs, SUAs
- Pennekamp Coral Formation Protection Areas
- NMFS Areas Closed to Lobster Trap Gear
- Pennekamp State Park
- National Parks





## Fish Species Richness

## Fish Total Abundance

lower 1/3 of  
Upper Keys region

### Species Richness (200)

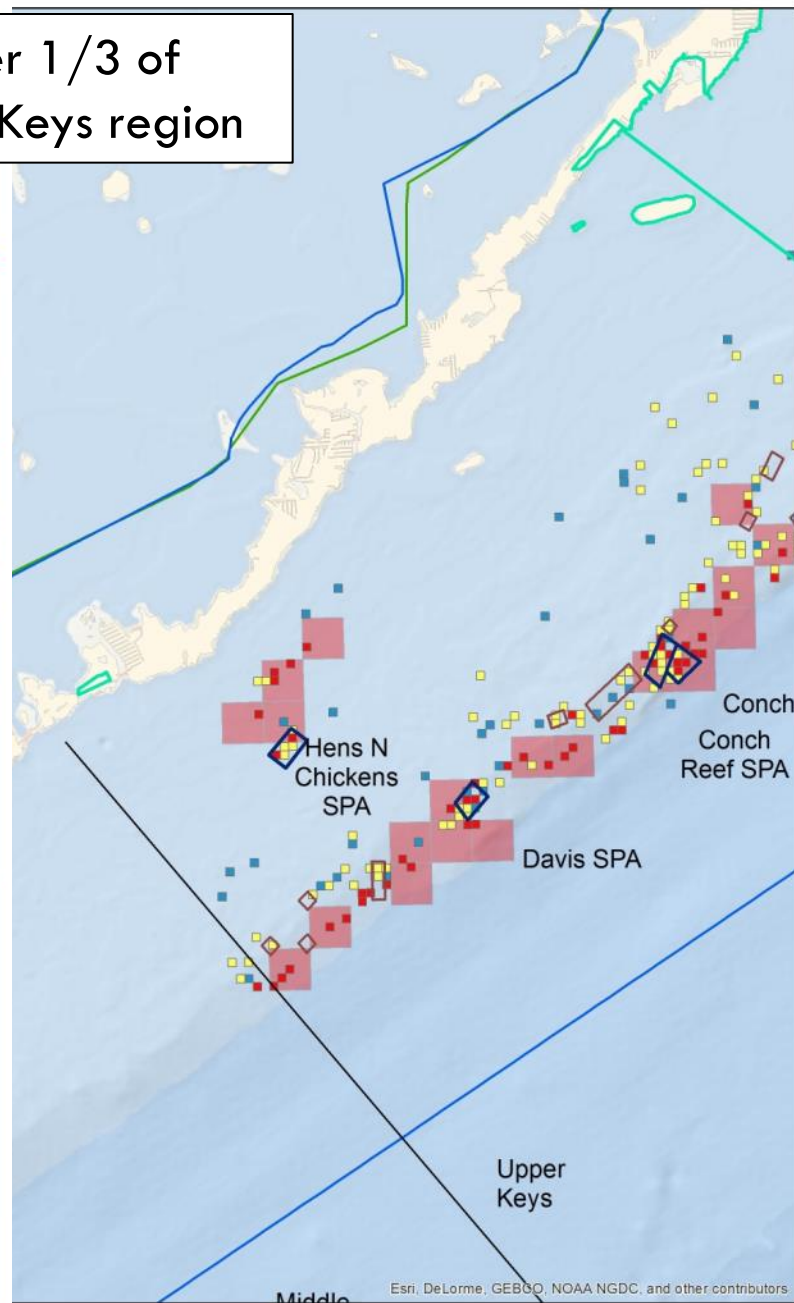
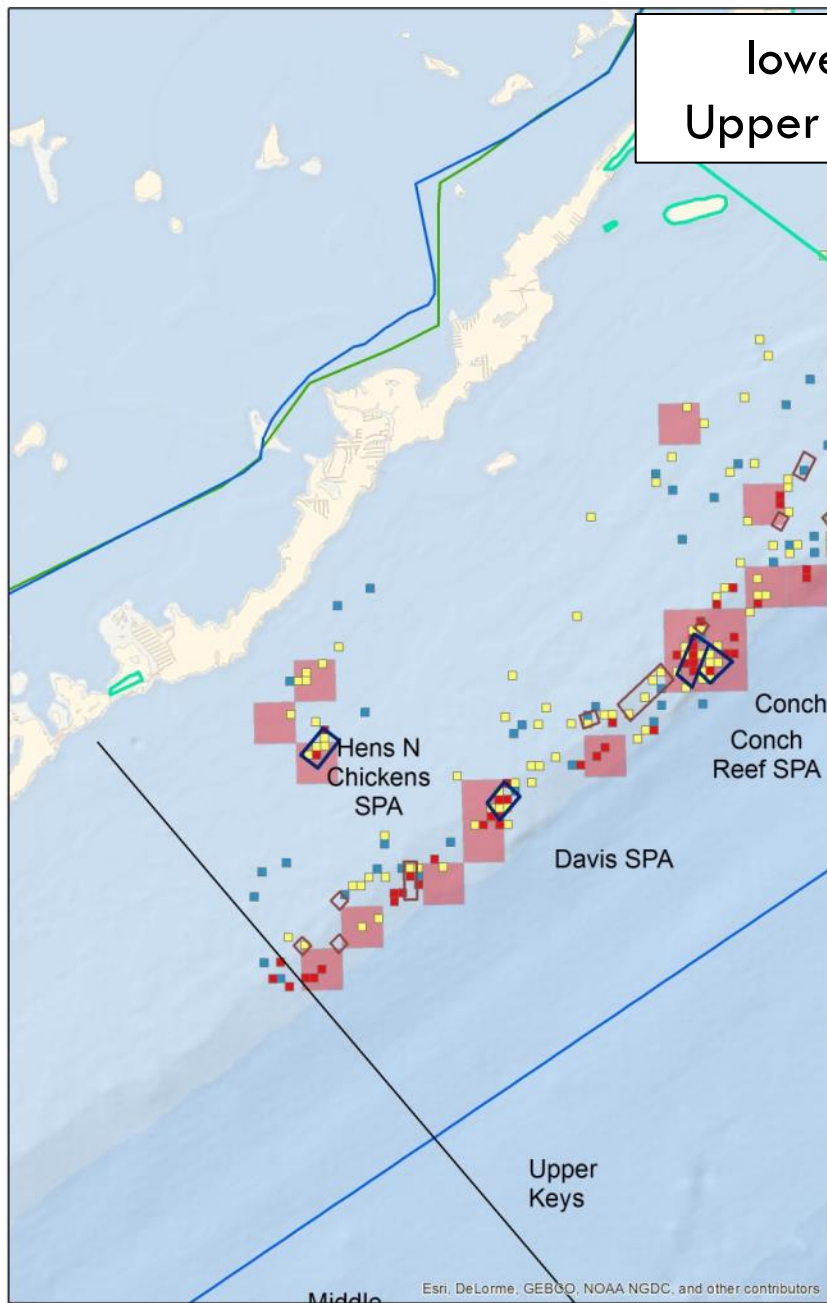
- High
- Medium
- Low

### Species Richness (1k)

- High

### Boundaries

- FKNMS Boundary
- SPAs, SUAs
- Pennekamp Coral Formation Protection Areas
- NMFS Areas Closed to Lobster Trap Gear
- Pennekamp State Park
- National Parks





# Hard Corals

- **Stony Coral cover:** How much of the hard bottom is covered in coral?
- **Stony Coral diversity:** How many species?

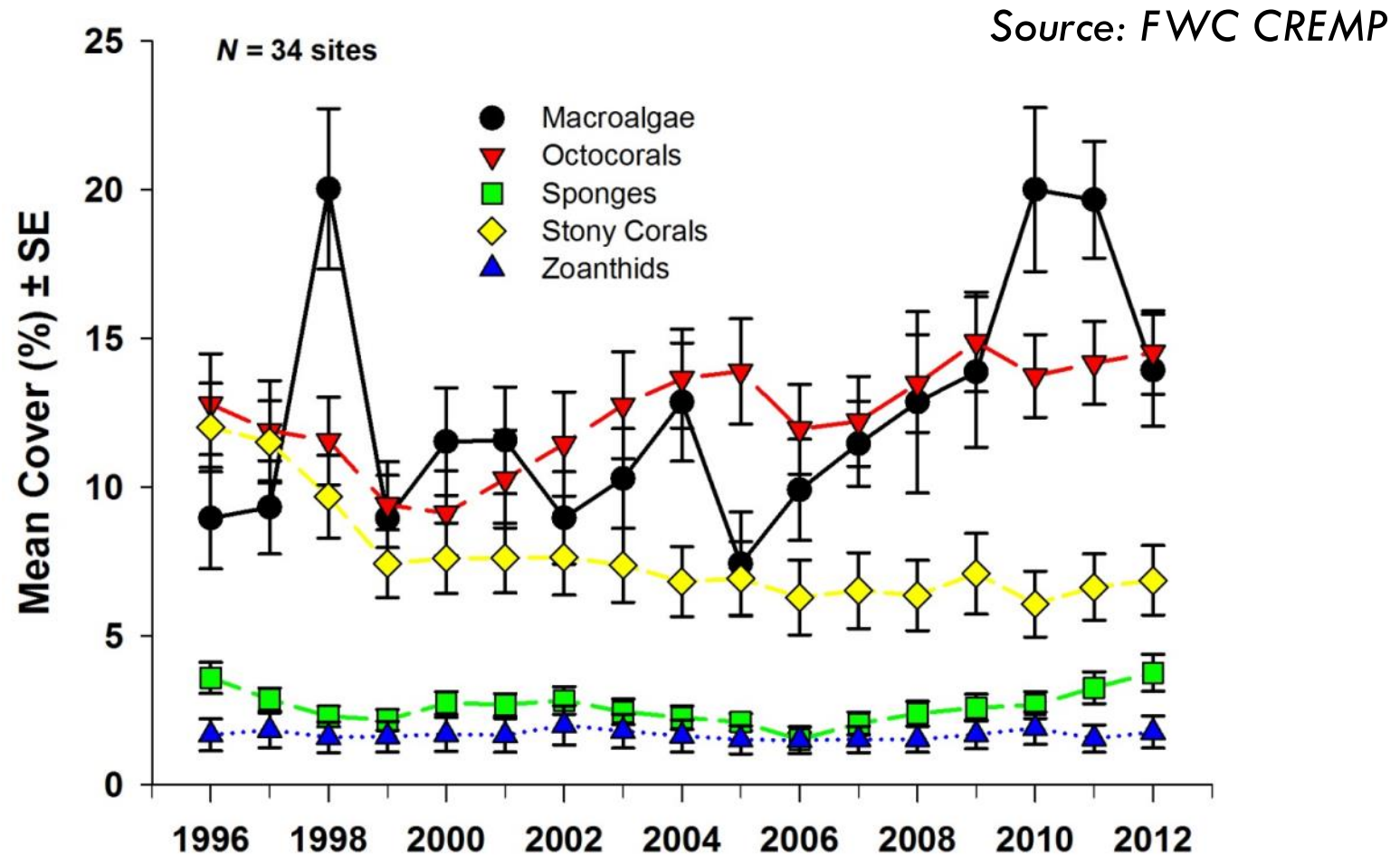


Photo credit: FWC



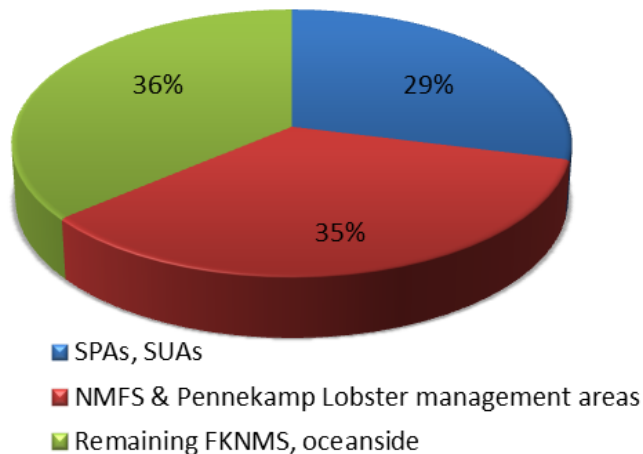
Photo credit: FWC

# What are temporal trends in coral?



# Where are locations of high coral cover?

Management Zone	Locations (#)
SPAs, SUAs	24
NMFS & Pennekamp Lobster management areas	29
Remaining FKNMS, oceanside	30
<b>Resource Total</b>	<b>83</b>



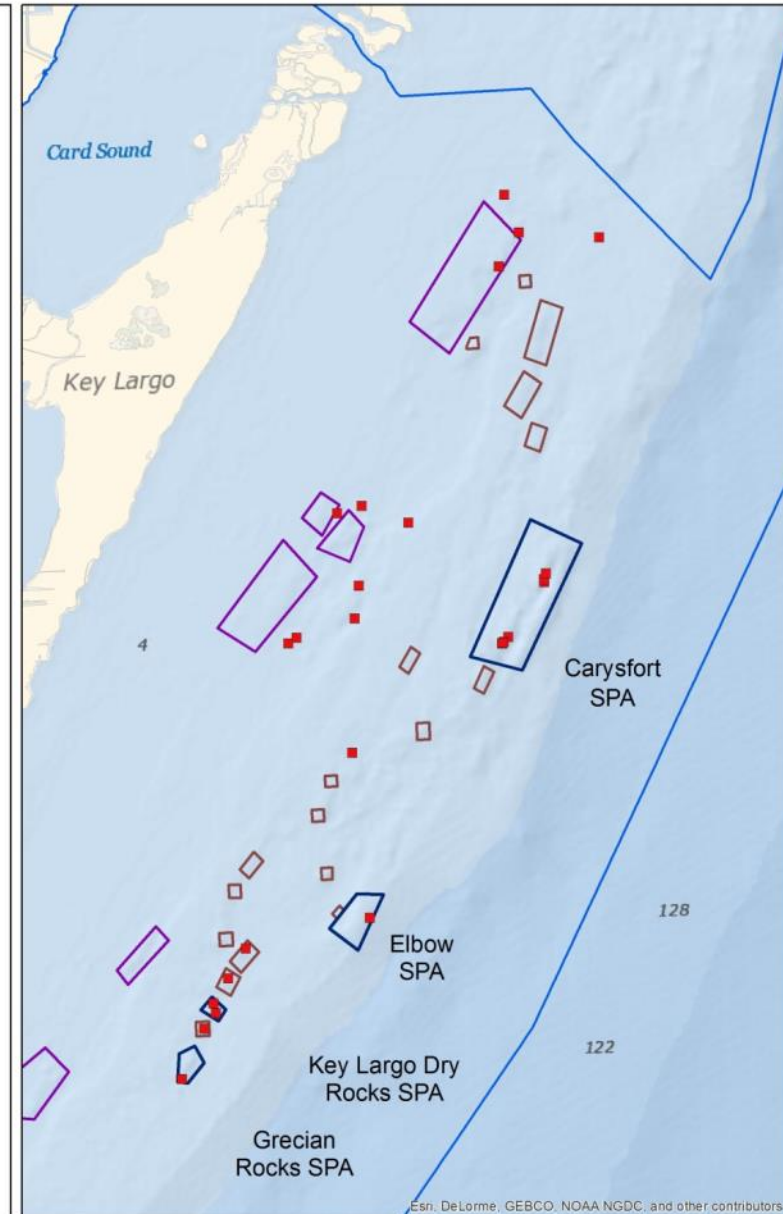
## Stony Coral Cover

### Cover

- High

### Boundaries

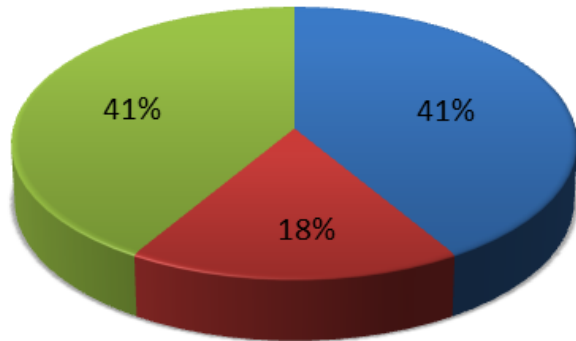
- FKNMS Boundary
- SPAs, SUAs
- Pennekamp Coral Formation Protection Areas
- NMFS Areas Closed to Lobster Trap Gear





# Where are locations of high coral species richness?

Management Zone	Locations (#)
SPAs, SUAs	64
NMFS & Pennekamp Lobster management areas	27
Remaining FKNMS, oceanside	64
<b>Resource Total</b>	<b>155</b>



- SPAs, SUAs
- NMFS & Pennekamp Lobster management areas
- Remaining FKNMS, oceanside

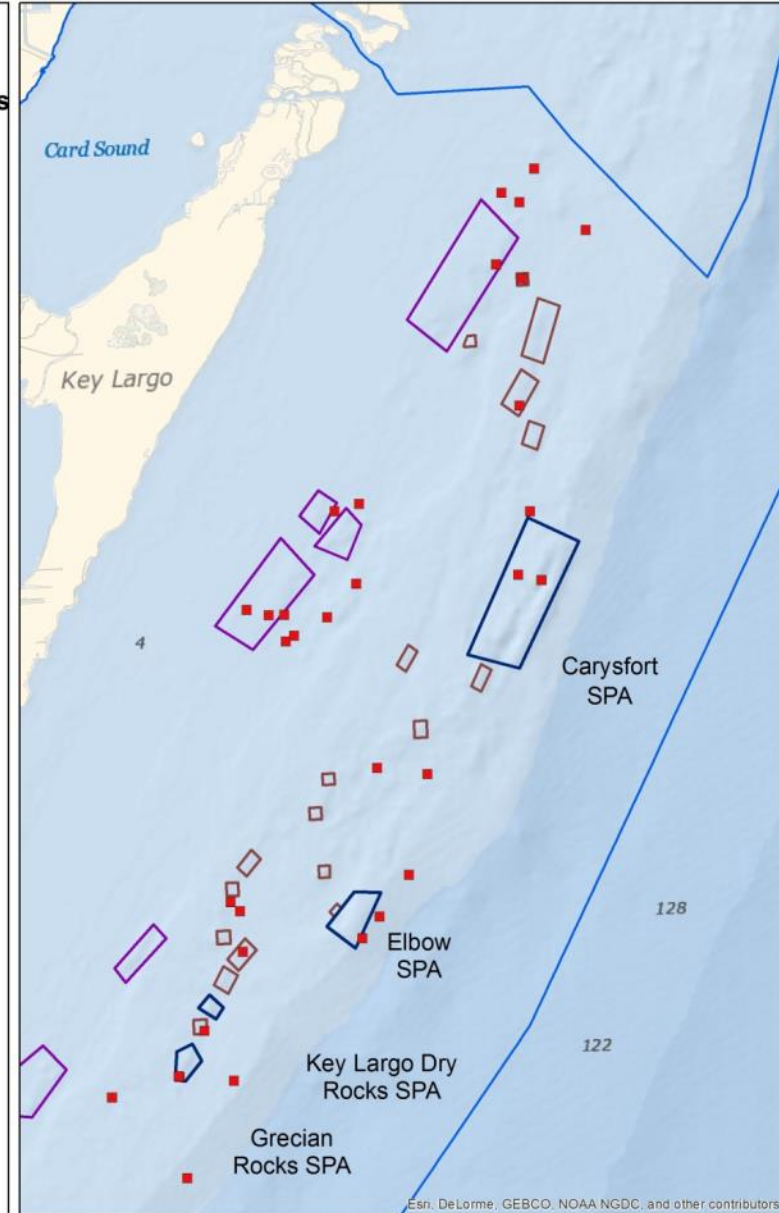
## Stony Coral Species Richness

### Species Richness

- High

### Boundaries

- FKNMS Boundary
- SPAs, SUAs
- Pennekamp Coral Formation Protection Areas
- NMFS Areas Closed to Lobster Trap Gear



## Stony Coral Species Richness

## Stony Coral Cover

Upper 1/3 of  
Upper Keys region

### Species Richness (200)

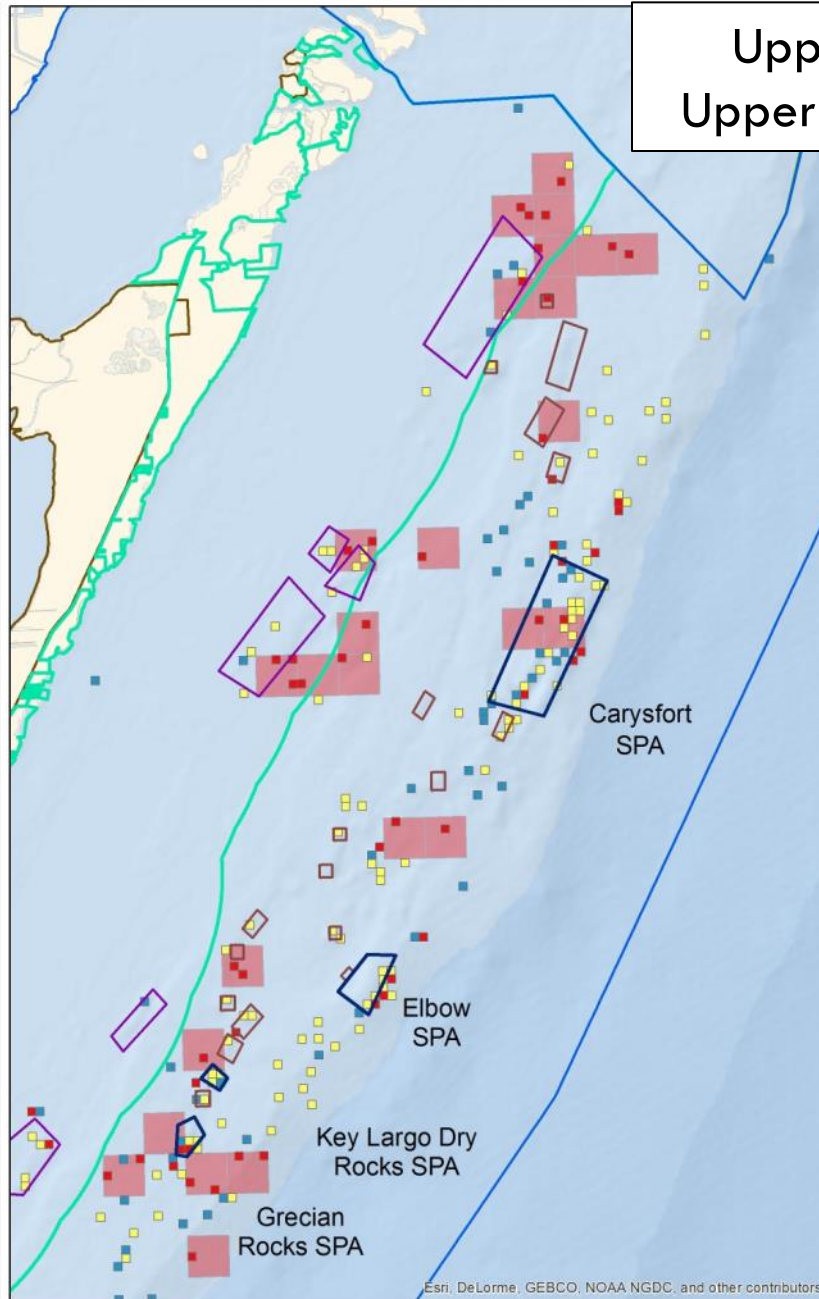
- High
- Medium
- Low

### Species Richness (1k)

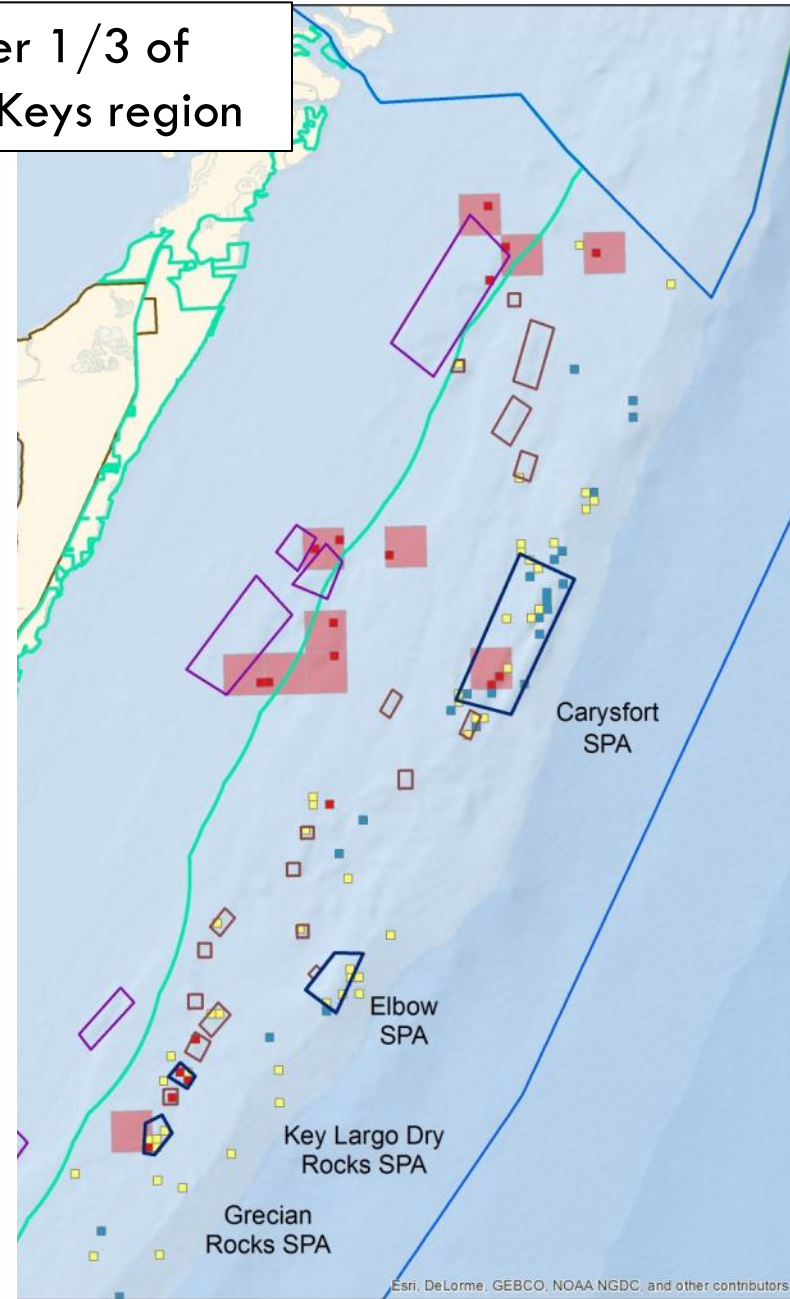
- High

### Boundaries

- FKNMS Boundary
- SPAs, SUAs
- Pennekamp Coral Formation Protection Areas
- NMFS Areas Closed to Lobster Trap Gear
- Pennekamp State Park
- National Parks
- National Wildlife Refuge



Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors



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## Stony Coral Species Richness

## Stony Coral Cover

middle 1/3 of  
Upper Keys region

### Species Richness (200)

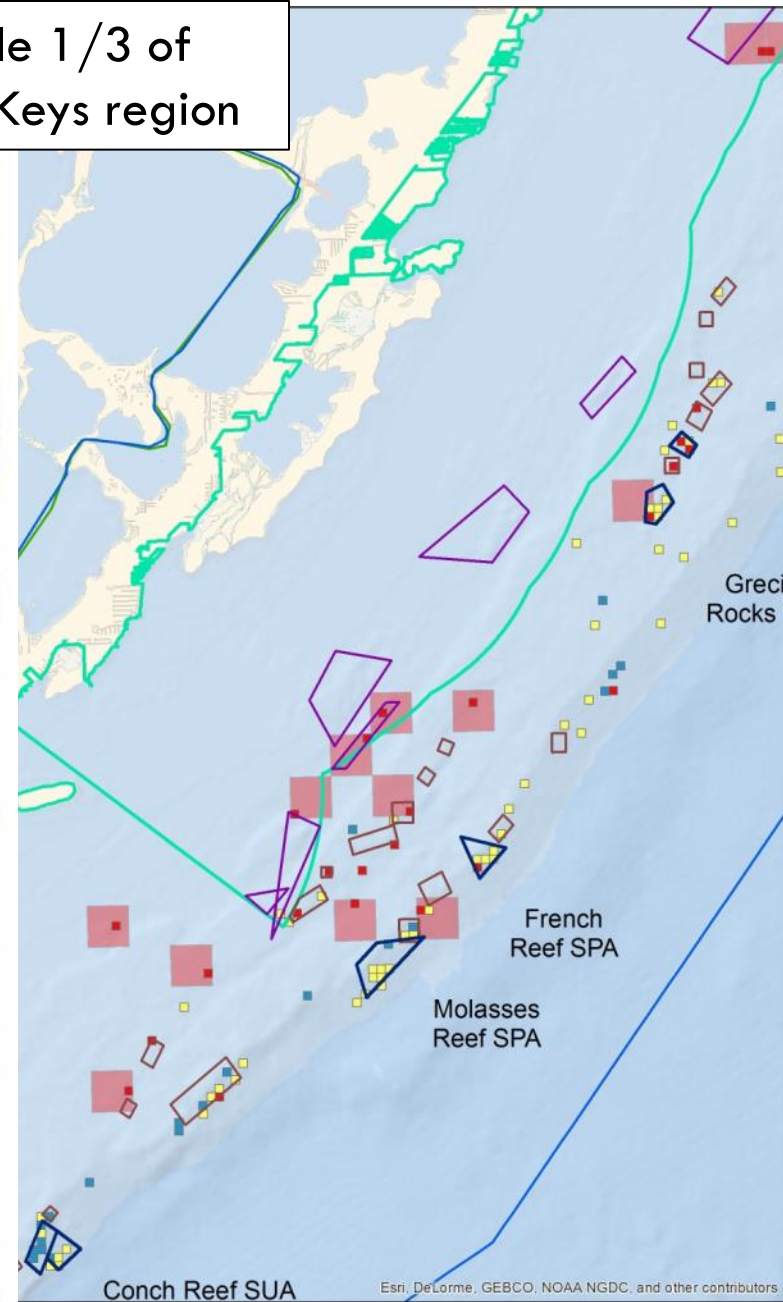
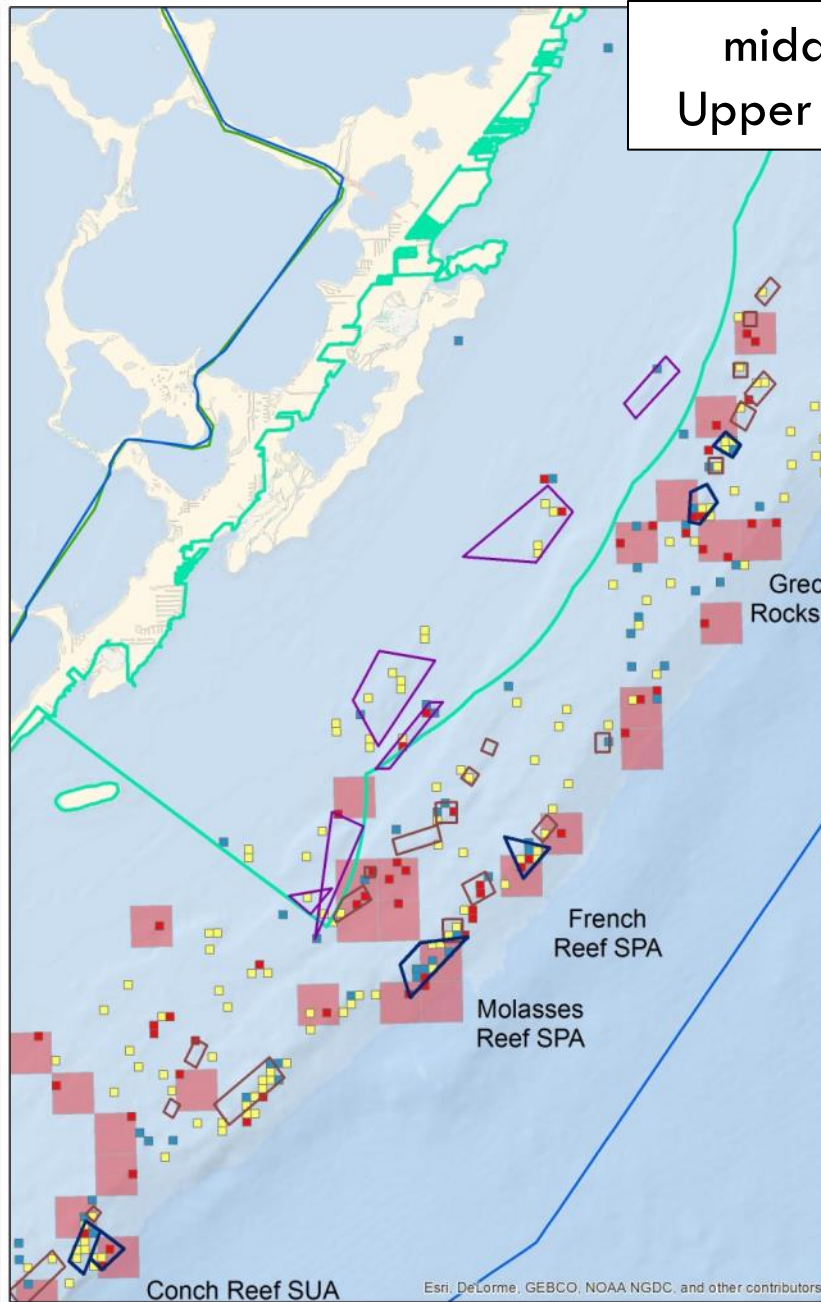
- High
- Medium
- Low

### Species Richness (1k)

- High

### Boundaries

- FKNMS Boundary
- SPAs, SUAs
- Pennekamp Coral Formation Protection Areas
- NMFS Areas Closed to Lobster Trap Gear
- Pennekamp State Park
- National Parks





# Stony Coral Species Richness

# Stony Coral Cover

lower 1/3 of  
Upper Keys region

## Species Richness (200)

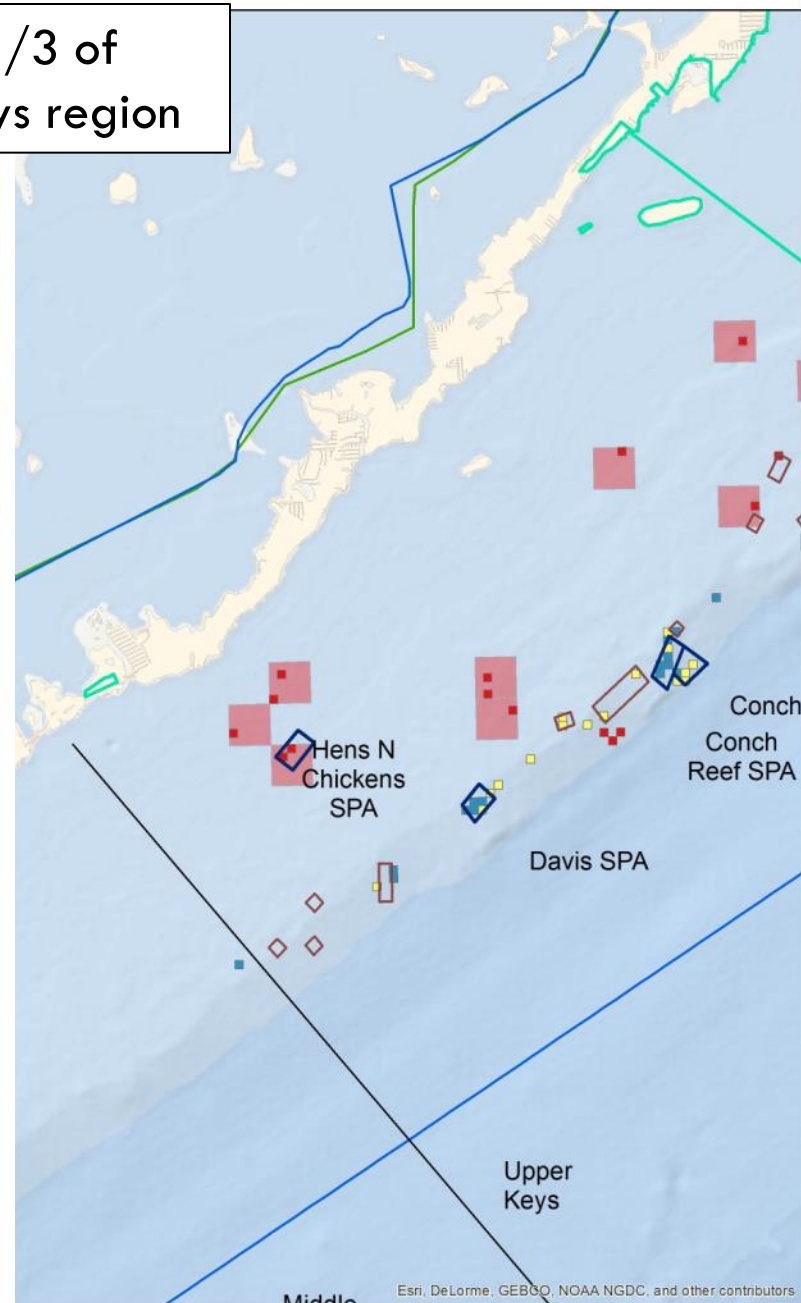
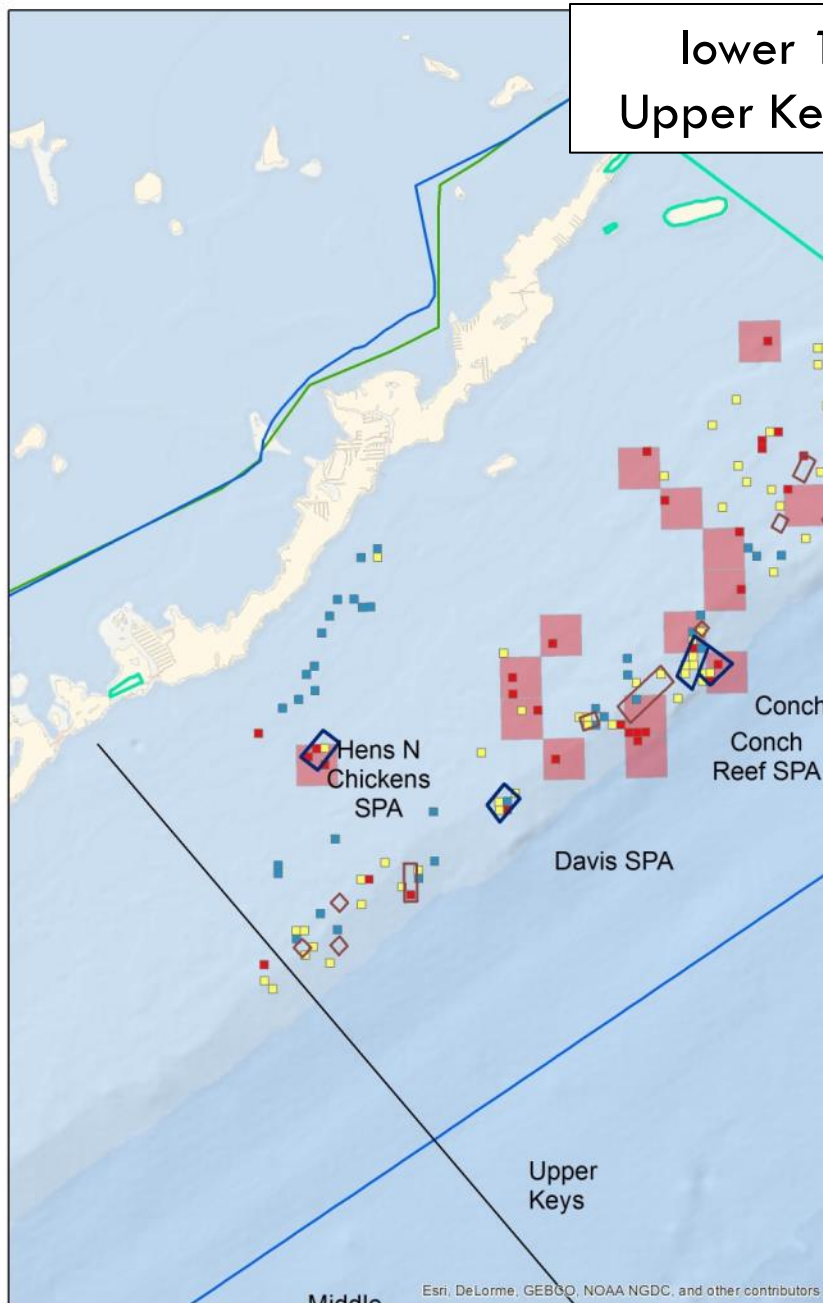
- High
- Medium
- Low

## Species Richness (1k)

- High

## Boundaries

- FKNMS Boundary
- SPAs, SUAs
- Pennekamp Coral Formation Protection Areas
- NMFS Areas Closed to Lobster Trap Gear
- Pennekamp State Park
- National Parks



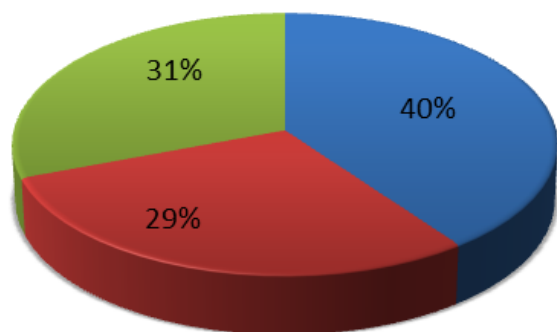
# Soft Coral

- **Soft Coral cover:** How much of the hard bottom is covered in soft coral?
- **Soft Coral diversity:** How many species?



# Where are locations of high soft coral cover?

Management Zone	Locations (#)
SPAs, SUAs	26
NMFS & Pennekamp Lobster management areas	19
Remaining FKNMS, oceanside	20
<b>Resource Total</b>	<b>65</b>



- SPAs, SUAs
- NMFS & Pennekamp Lobster management areas
- Remaining FKNMS, oceanside

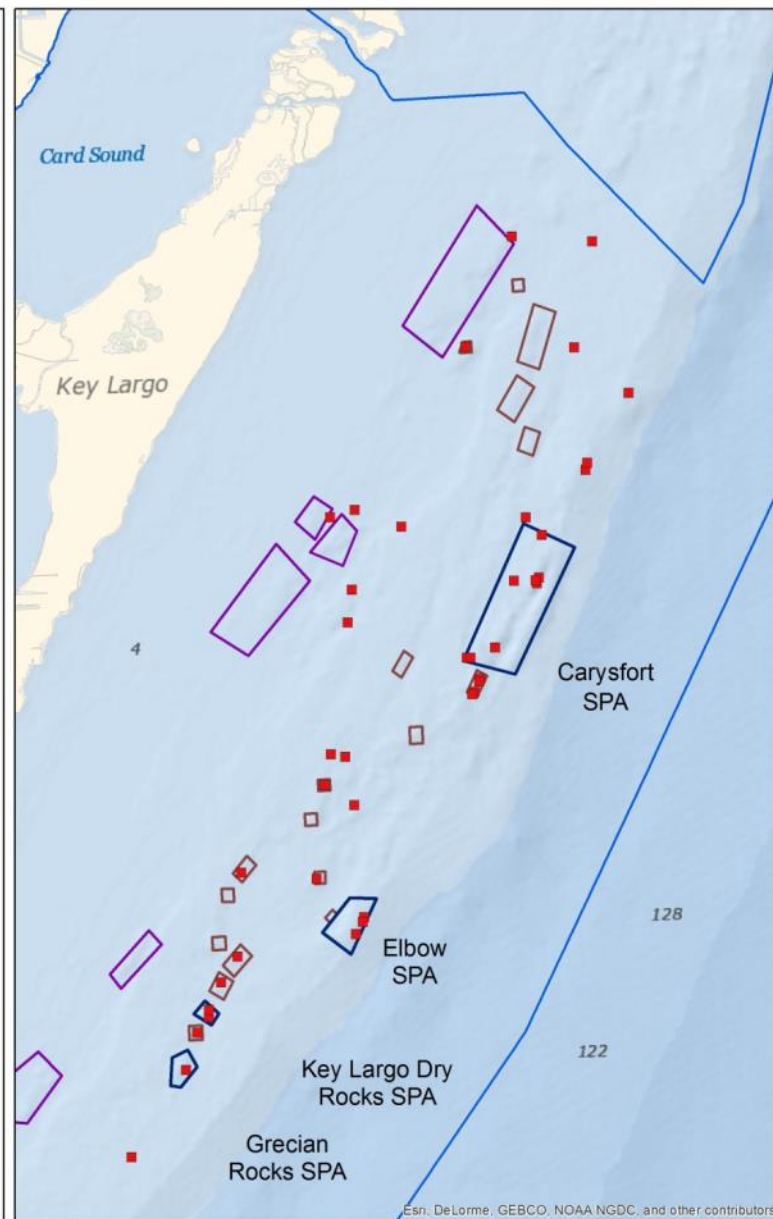
## Soft Coral Cover

### Cover

- High

### Boundaries

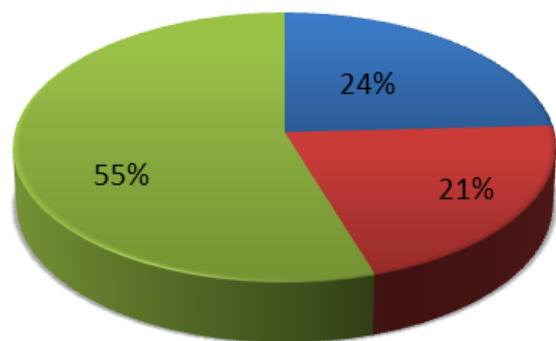
- FKNMS Boundary
- SPAs, SUAs
- Pennekamp Coral Formation Protection Areas
- NMFS Areas Closed to Lobster Trap Gear





# Where are locations of high soft coral species richness?

Management Zone	Locations (#)
SPAs, SUAs	15
NMFS & Pennekamp Lobster management areas	13
Remaining FKNMS, oceanside	34
<b>Resource Total</b>	<b>62</b>



- SPAs, SUAs
- NMFS & Pennekamp Lobster management areas
- Remaining FKNMS, oceanside

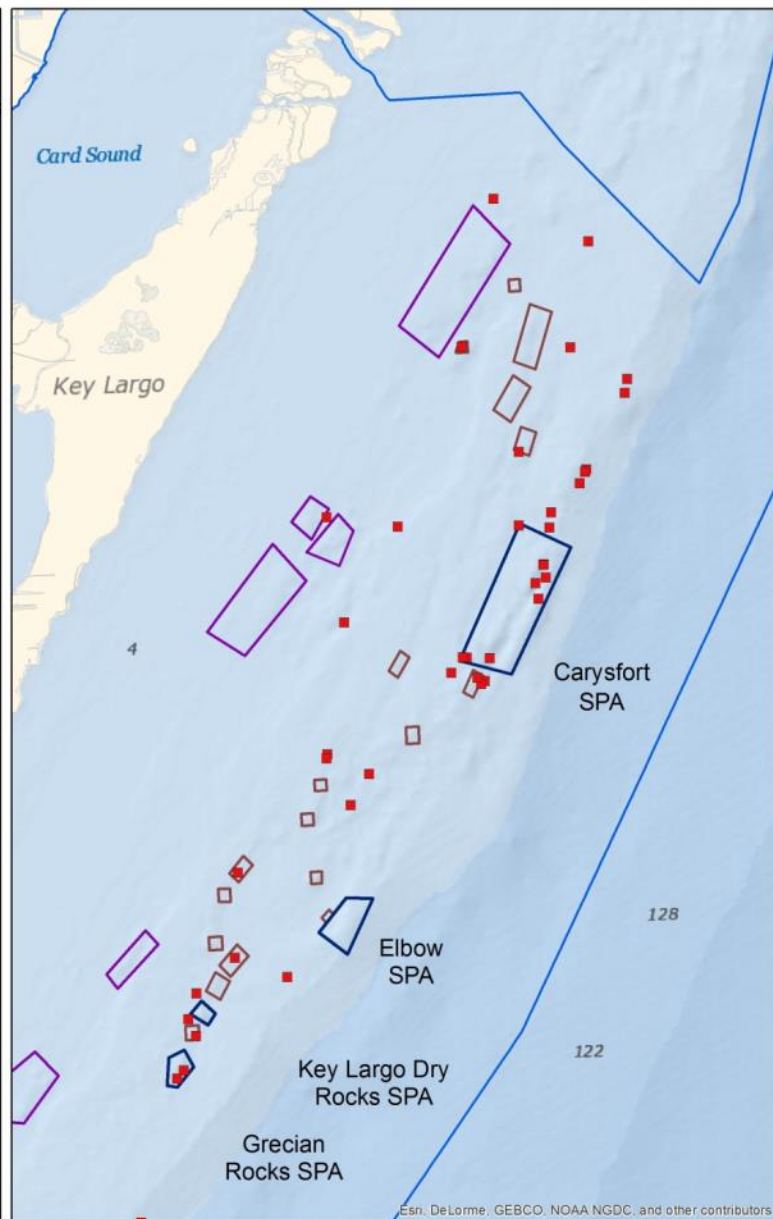
## Soft Coral Species Richness

### Species Richness

- High

### Boundaries

- FKNMS Boundary
- SPAs, SUAs
- Pennekamp Coral Formation Protection Areas
- NMFS Areas Closed to Lobster Trap Gear



Esh, DeLorme, GEBCO, NOAA NGDC, and other contributors

## Soft coral species richness

## Soft Coral Cover

### Species Richness (200)

- High
- Medium
- Low

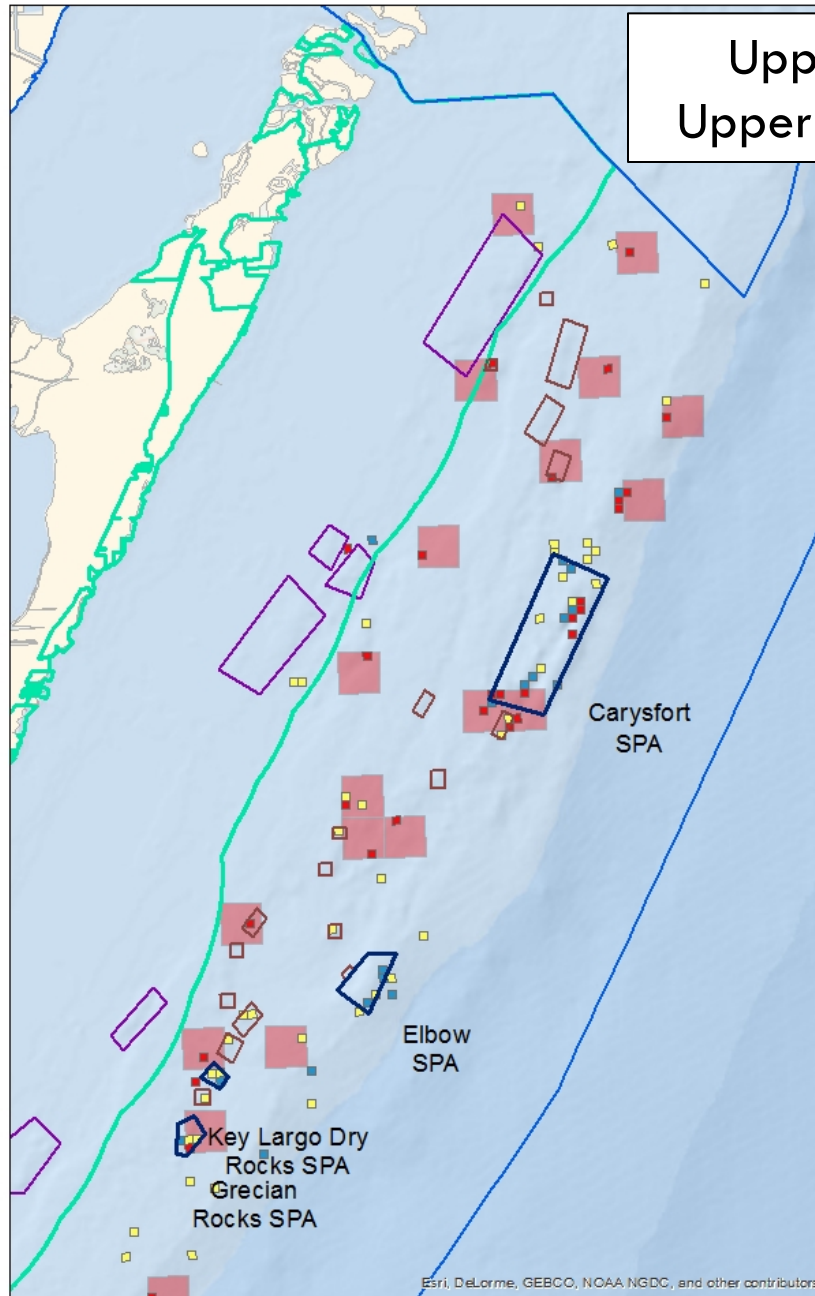
### Species Richness (1k)

- High

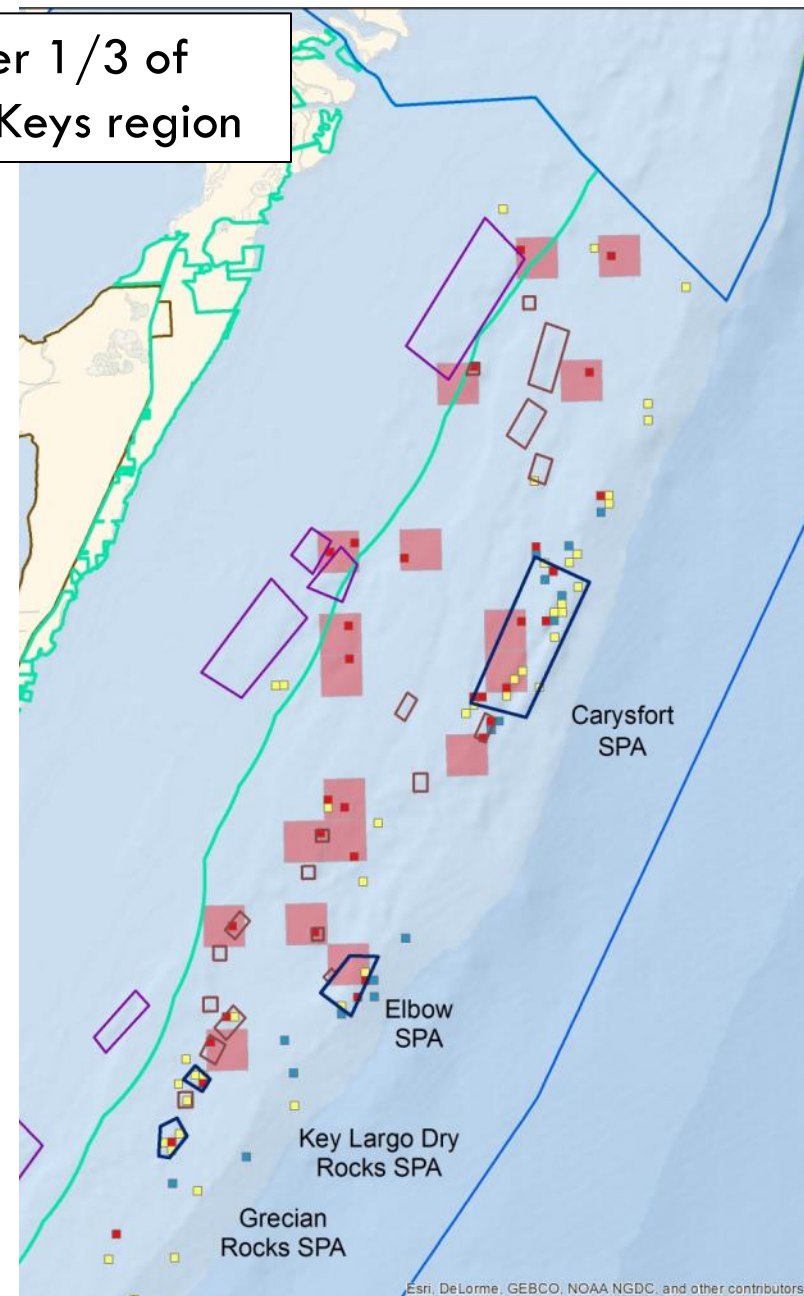
### Zones

- FKNMS
- SPAs, SUAs
- Conch Reef
- Special Use Area
- NMFS Areas Closed to Lobster Trap Gear
- Pennekamp State Park
- Pennekamp Coral
- Formation Protection Areas

Upper 1/3 of  
Upper Keys region



Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors



Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors

## Soft coral species richness

## Soft Coral Cover

middle 1/3 of  
Upper Keys region

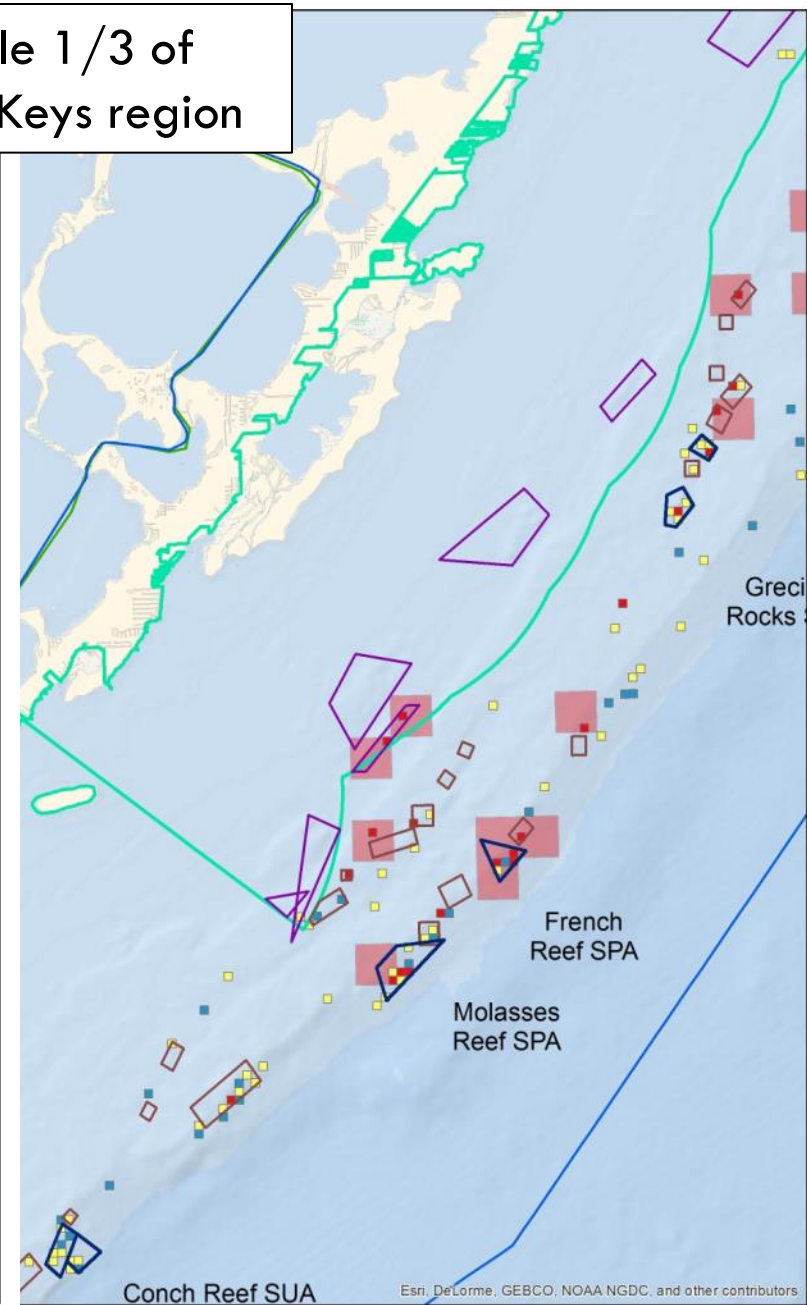
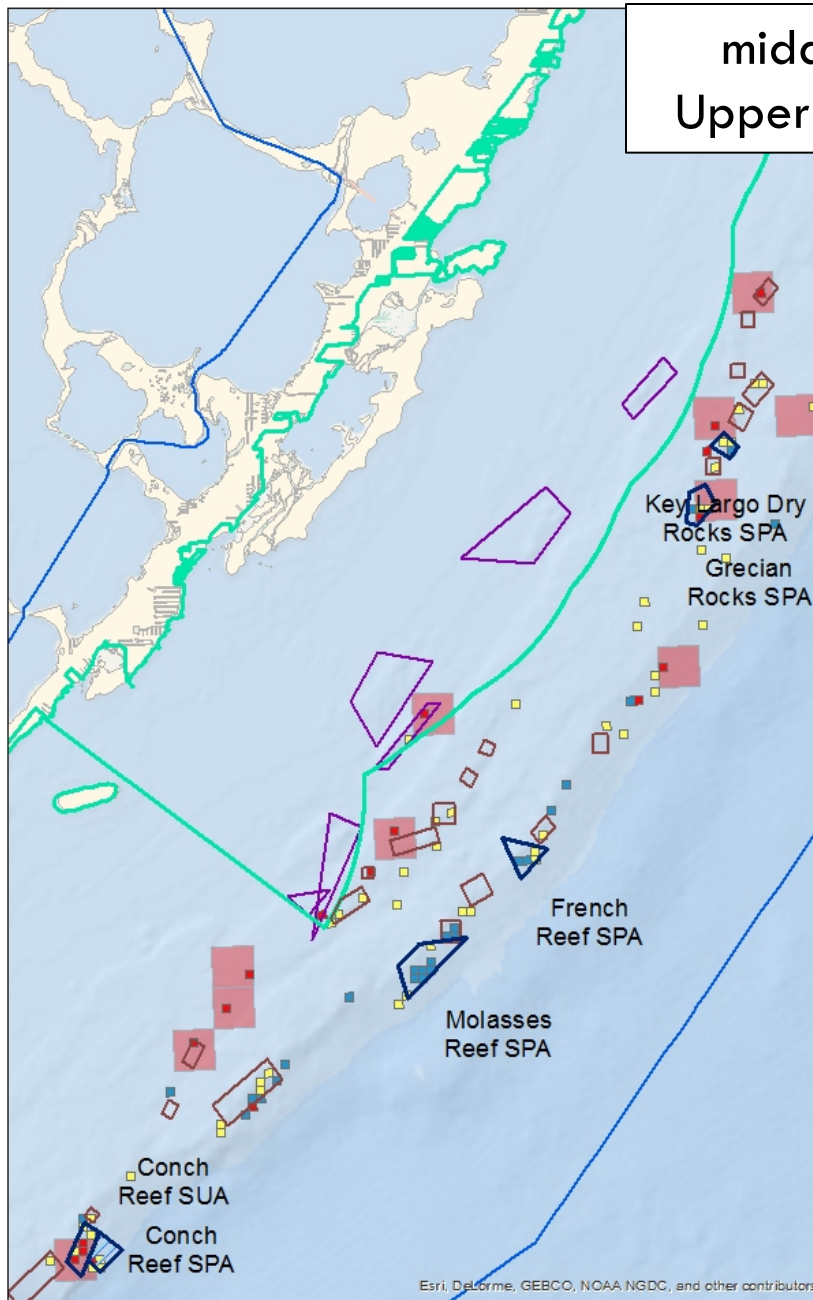
### Species Richness (200)



### Species Richness (1k)



### Zones

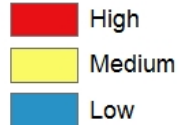




## Soft coral species richness

## Soft Coral Cover

### Species Richness (200)



### Species Richness (1k)



### Zones



lower 1/3 of  
Upper Keys region

