Spatial dynamics of Scleractinian coral populations in the Florida Keys.

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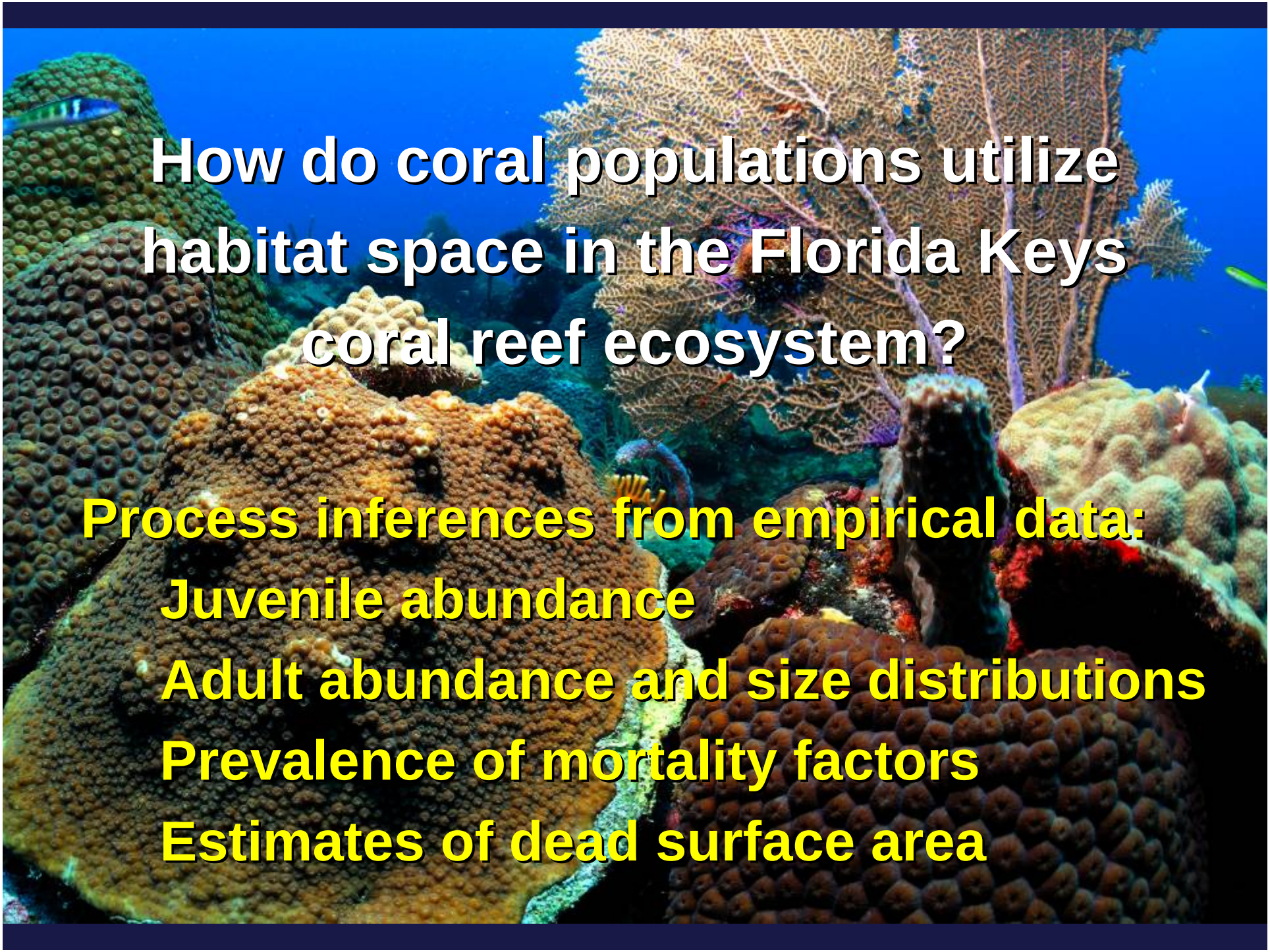
Habitat use = *amount of space utilized by a population of animals or plants over a fixed period of time*

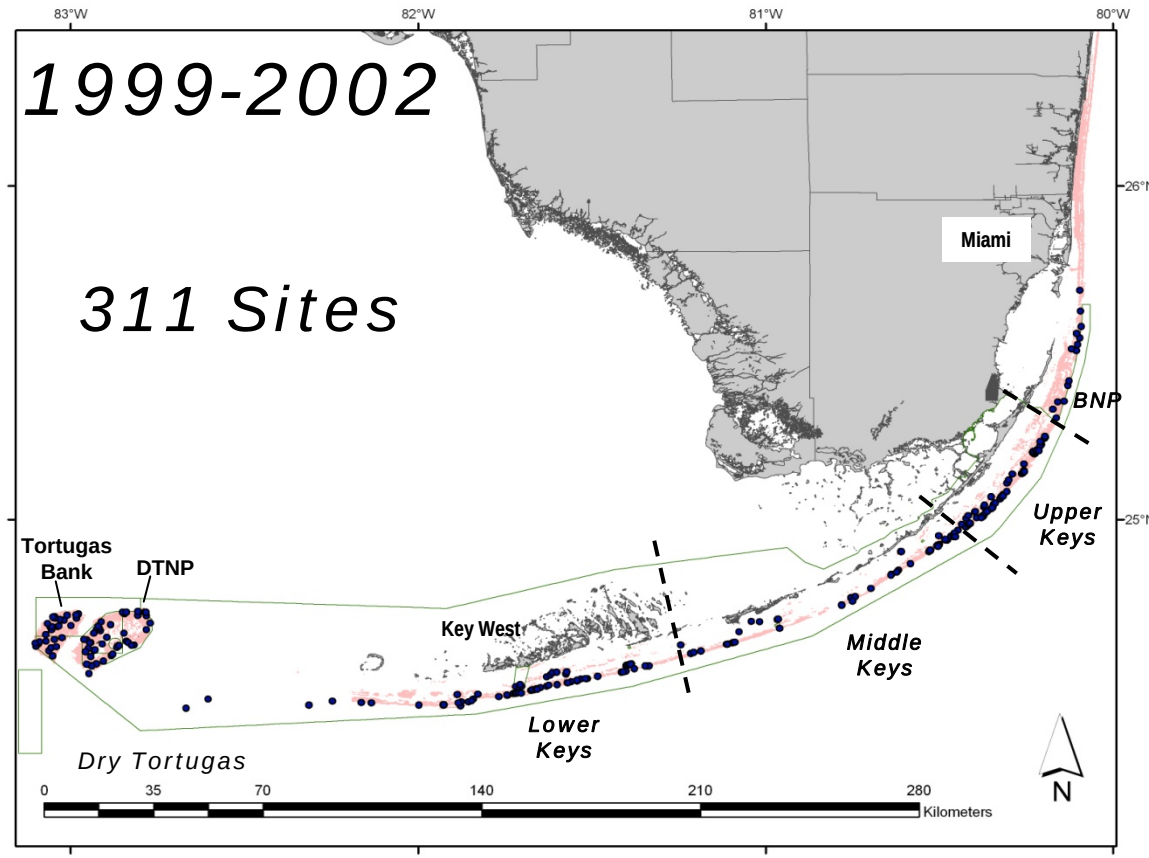
Habitat use analysis:

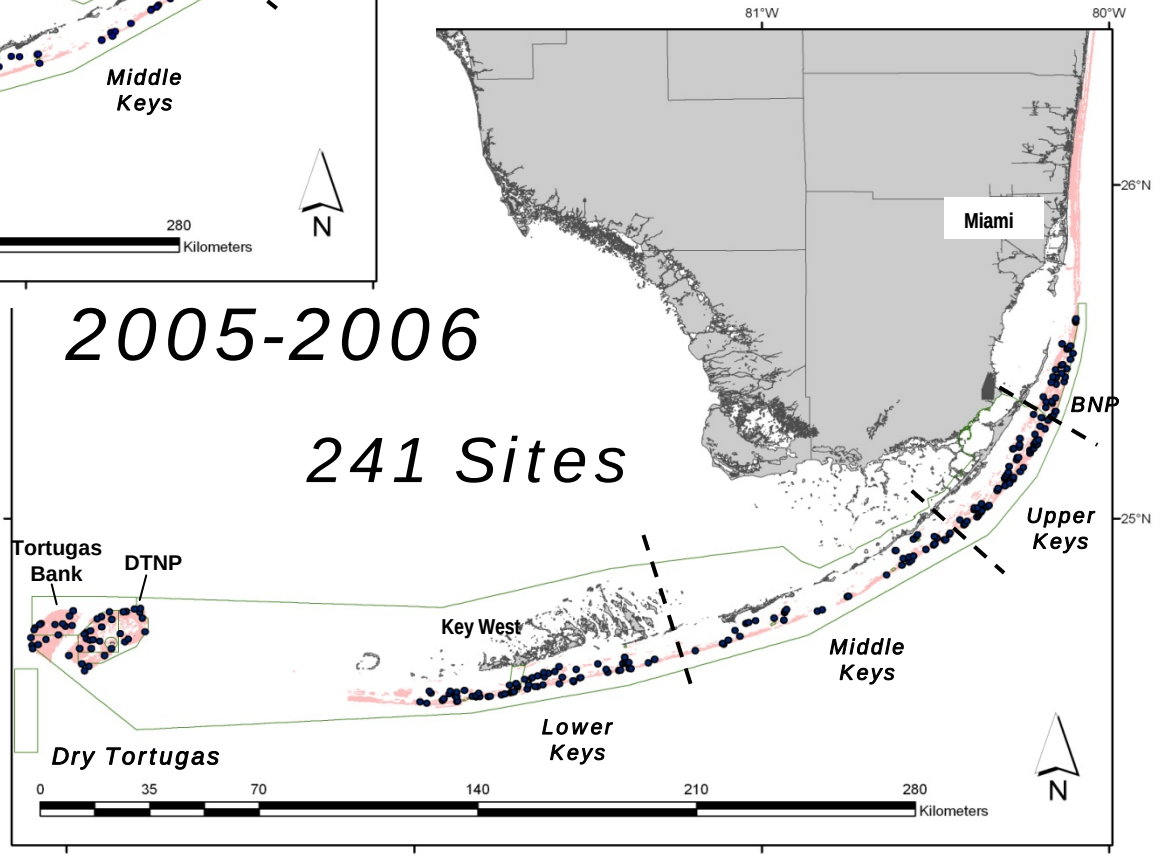
Requires quantification of habitat abundance in the environment (area) coupled with population abundance metrics

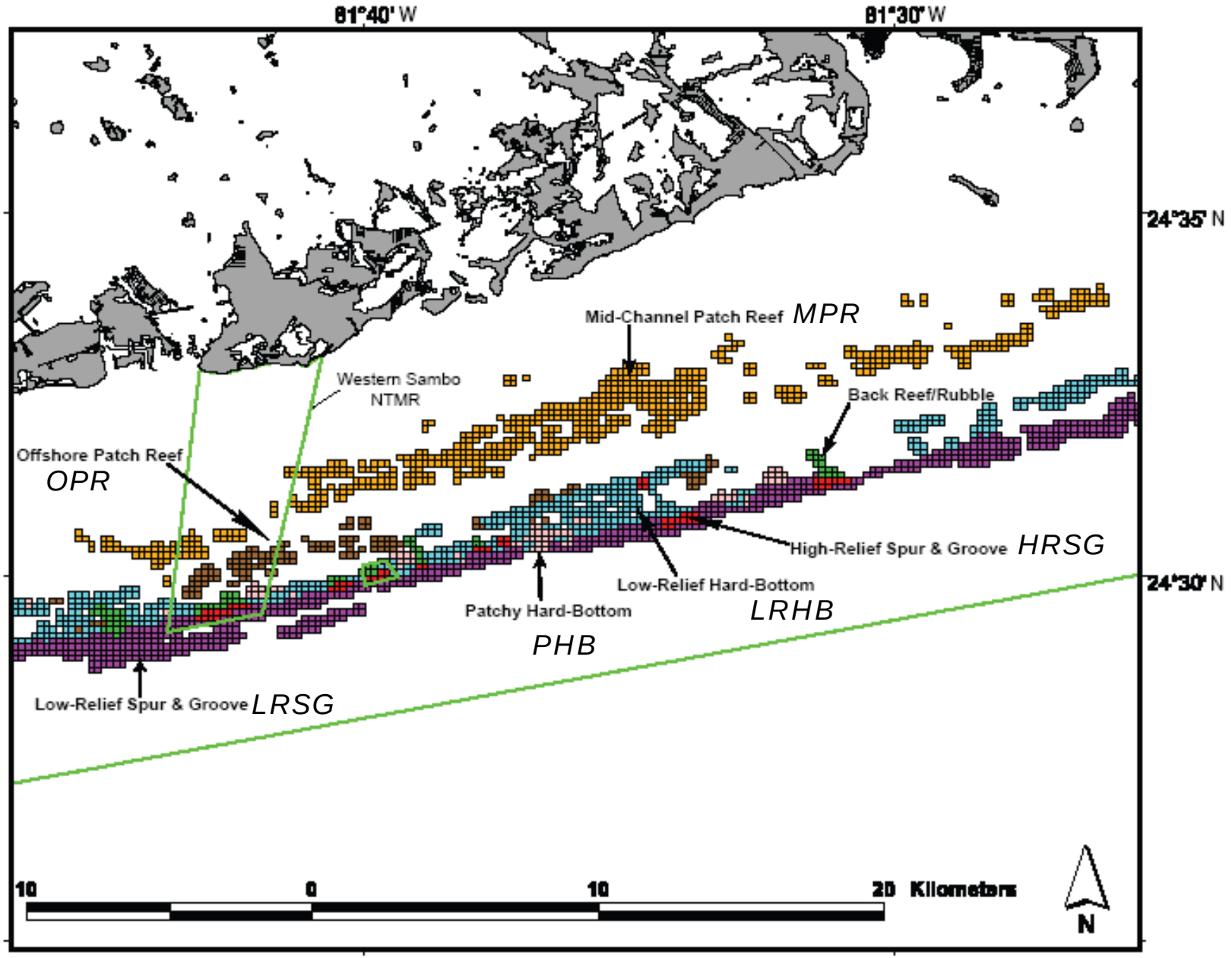
Partitions variation in population abundance

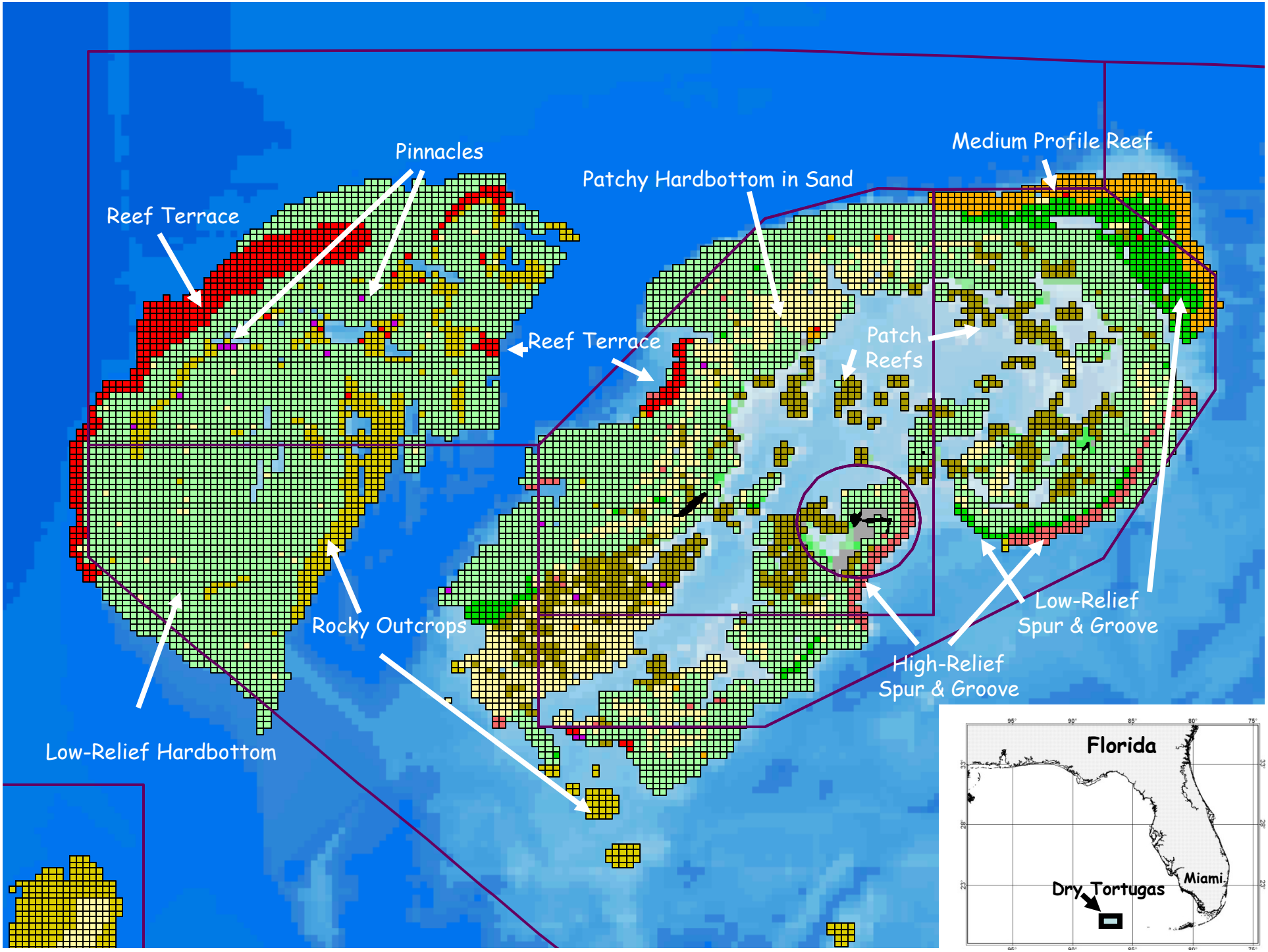
Identifies areas where physical and biological factors that affect population dynamic rates may vary


How do coral populations utilize habitat space in the Florida Keys coral reef ecosystem?
Process inferences from empirical data:
Juvenile abundance
Adult abundance and size distributions
Prevalence of mortality factors
Estimates of dead surface area


1999-2002
311 Sites
83°W
82°W
81°W
80°W
26°N
25°N
Miami
BNP
Upper Keys
Middle Keys
Lower Keys
Key West
Tortugas Bank
DTNP
Dry Tortugas
0 35 70 140 210 280
Kilometers
N


2005-2006
241 Sites
81°W
80°W
26°N
25°N
Miami
BNP
Upper Keys
Middle Keys
Lower Keys
Key West
Tortugas Bank
DTNP
Dry Tortugas
0 35 70 140 210 280
Kilometers
N


81°40' W
81°30' W
24°35' N
24°30' N
Mid-Channel Patch Reef MPR
Western Sambo
NTMR
Back Reef/Rubble
Offshore Patch Reef
OPR
High-Relief Spur & Groove HRSG
Low-Relief Hard-Bottom
LRHB
Patchy Hard-Bottom
PHB
Low-Relief Spur & Groove LRSG
10
0
10
20 Kilometers
N


Pinnacles
Reef Terrace
Patchy Hardbottom in Sand
Medium Profile Reef
Reef Terrace
Patch
Reefs
Rocky Outcrops
Low-Relief
Spur & Groove
High-Relief
Spur & Groove
Low-Relief Hardbottom
Florida
Miami
Dry Tortugas

Benthic surveys

Adult colonies (post-recruits)

coral colonies > 4 cm

10 m x 1.0 m belt transects
(20 m^2 per site)

Juvenile colonies (recruits)

coral colonies < 4 cm

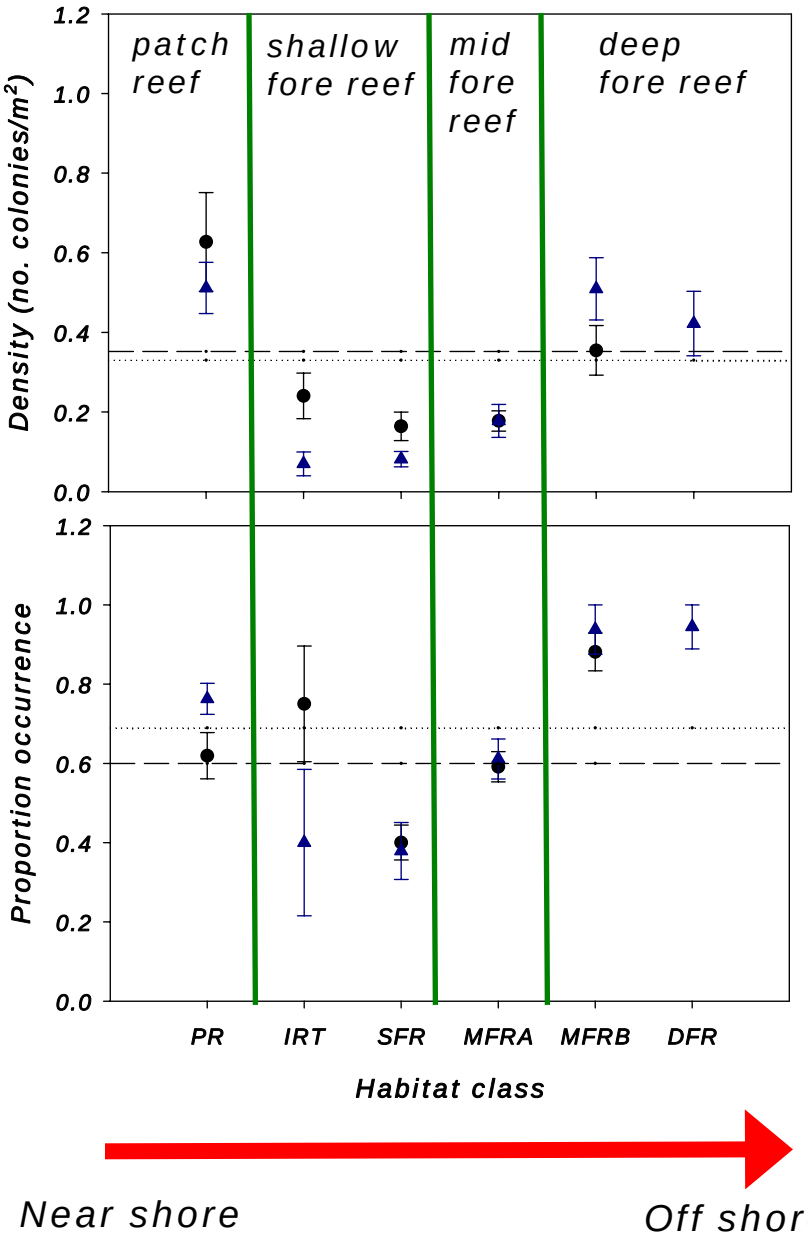
Ten (65-cm x 48-cm) quadrats
(3.12m^2 per site)

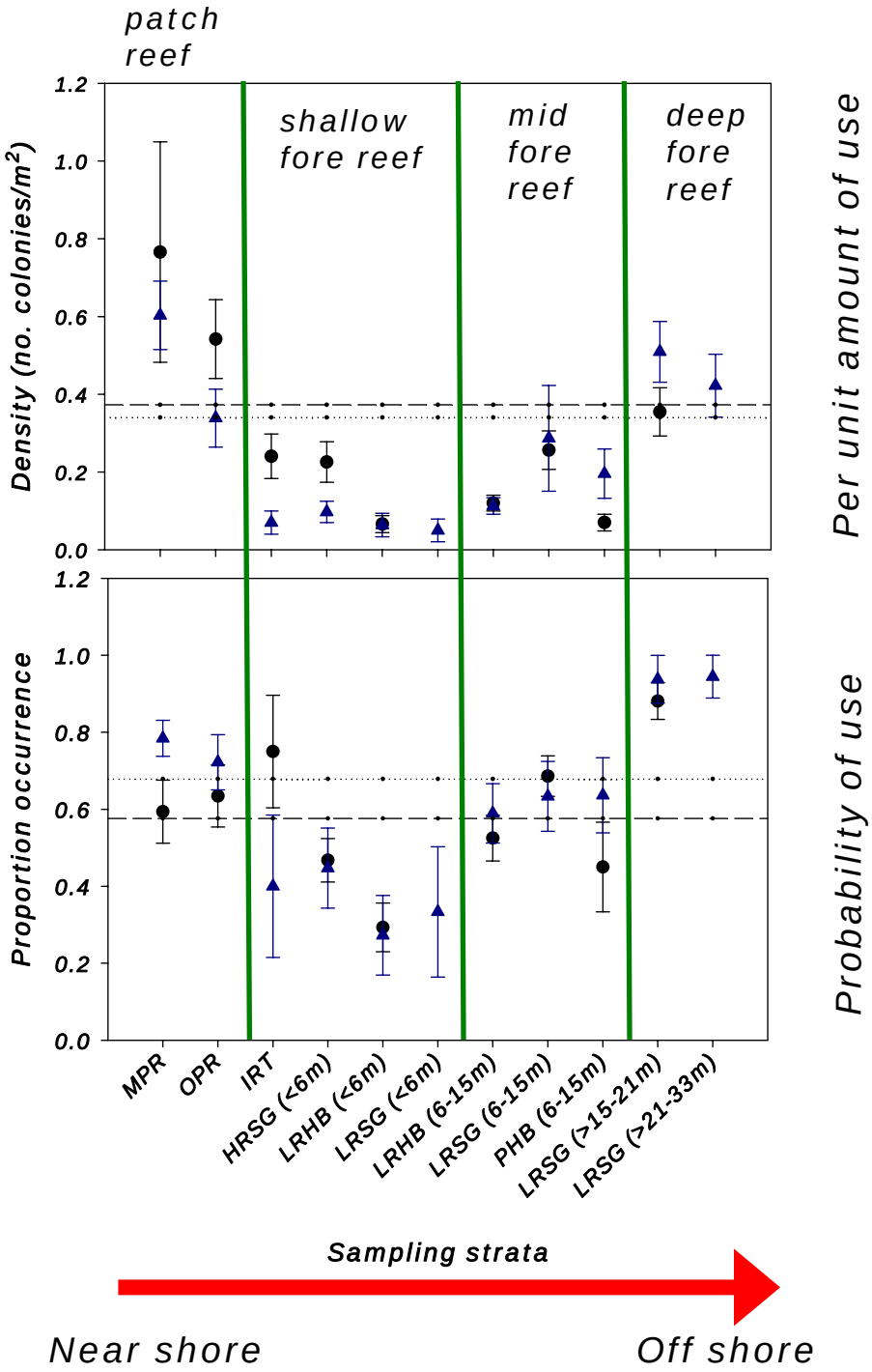
Habitat Use

- **Probability of use (proportion occurrence)**
- **Per unit amount of use (density)**
- **Population amount of use (abundance)**

Example species: *Montastraea cavernosa*

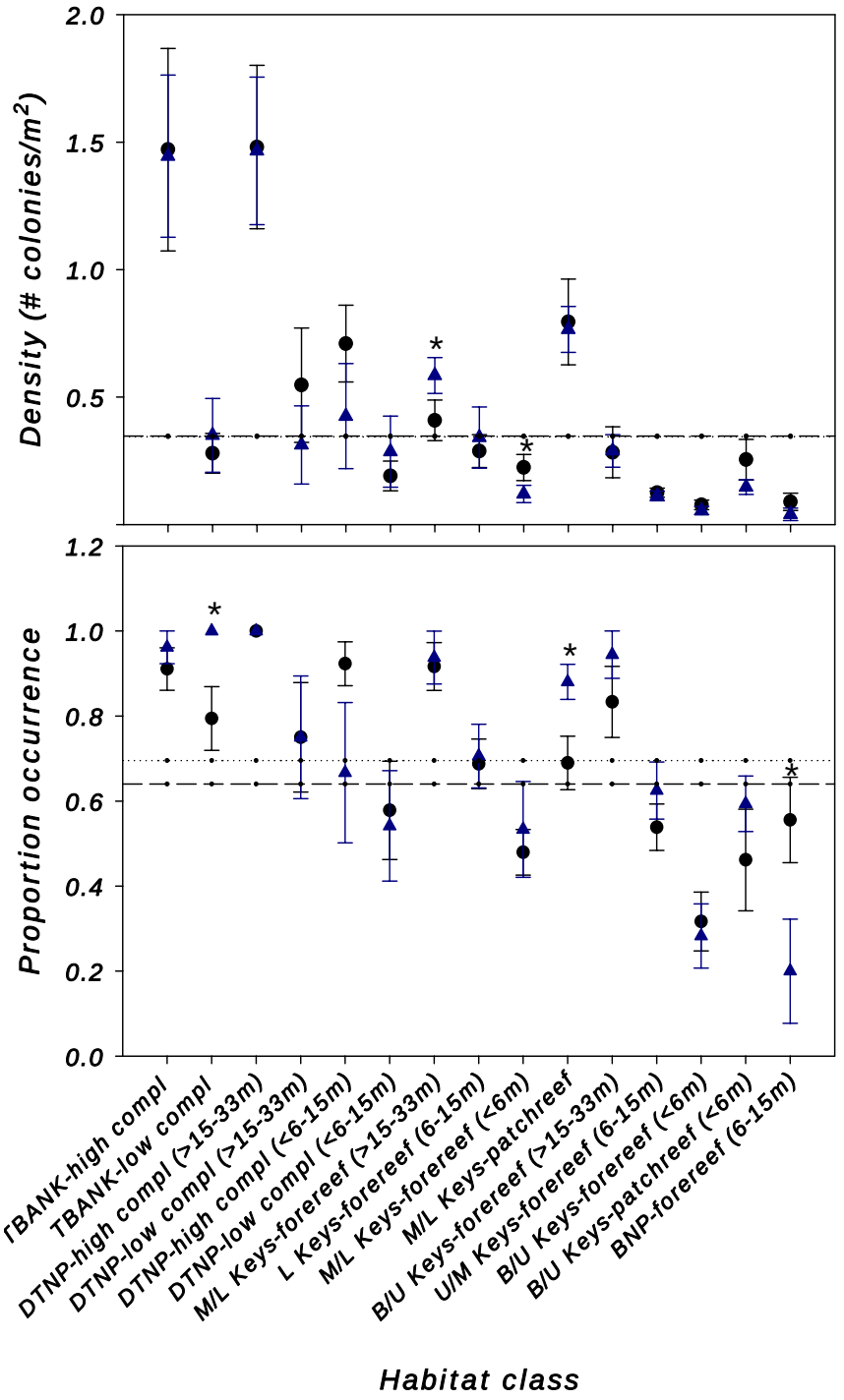
M. cavernosa: FL Keys





M. cavernosa

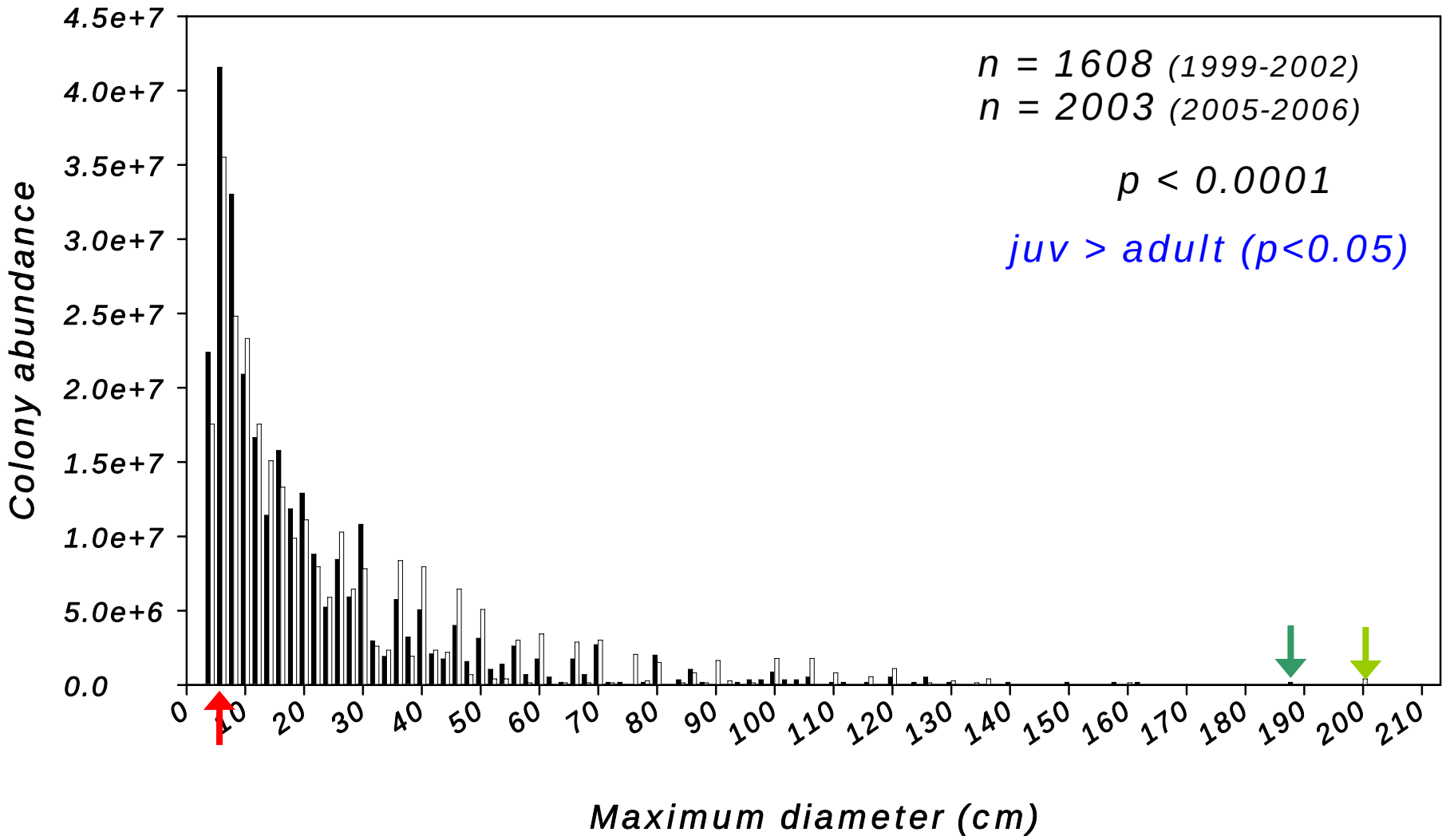
15 Habitat classes

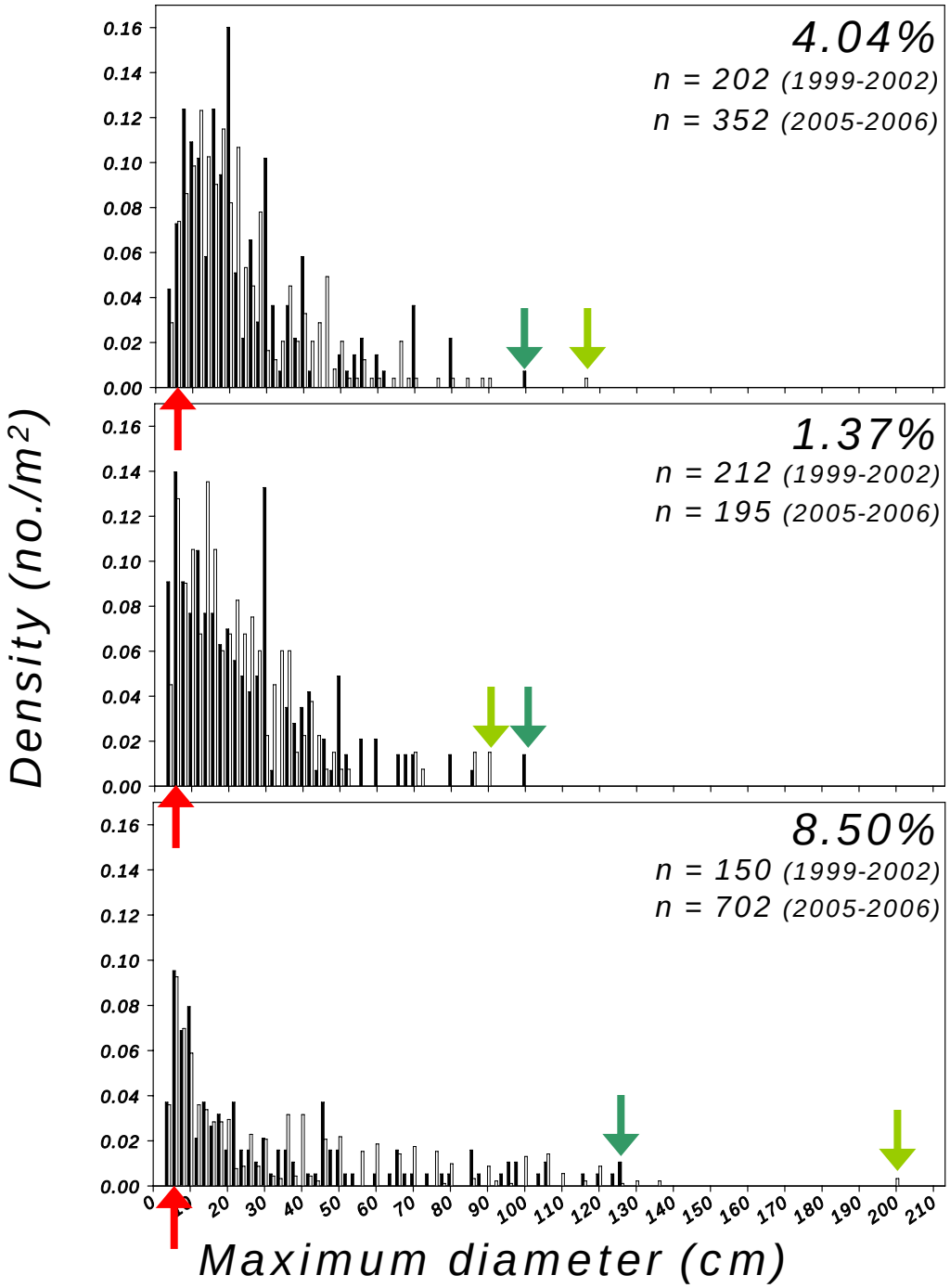


Population use:
M. cavernosa - adult vs. juvenile

Habitat classes	%(A)	Adults (>4 cm) $\%(P_A)$	Juveniles (<4 cm) $\%(P_J)$
TBANK-high compl	3.36	14.09	4.09
TBANK-low compl	11.89	12.06	21.99*
DTNP-high compl (>15-33m)	1.31	5.58	1.59
DTNP-low compl (>15-33m)	5.54	5.02	8.55
DTNP-high compl (<6-15m)	0.63	0.78*	0.84
DTNP-low compl (<6-15m)	14.73	12.22*	20.43
M/L Keys-forereef (>15-33m)	7.13	12.07*	11.33
L Keys-forereef (6-15m)	5.60	5.54	9.74*
M/L Keys-forereef (<6m)	2.25	0.78	0.55
M/L Keys-patch reef	8.13	18.03	4.33
B/U Keys-forereef (>15-33m)	2.48	2.08	3.19*
U/M Keys-forereef (6-15m)	13.78	4.49	10.16*
B/U Keys-forereef (<6m)	4.91	0.77	0.40
B/U Keys-patch reef	14.08	6.00*	2.03
BNP-fore reef (6-15m)	4.18	0.48	0.77*

M. cavernosa: Population size structure





Positive habitat use

T. Bank – high complexity

(+/neutral)

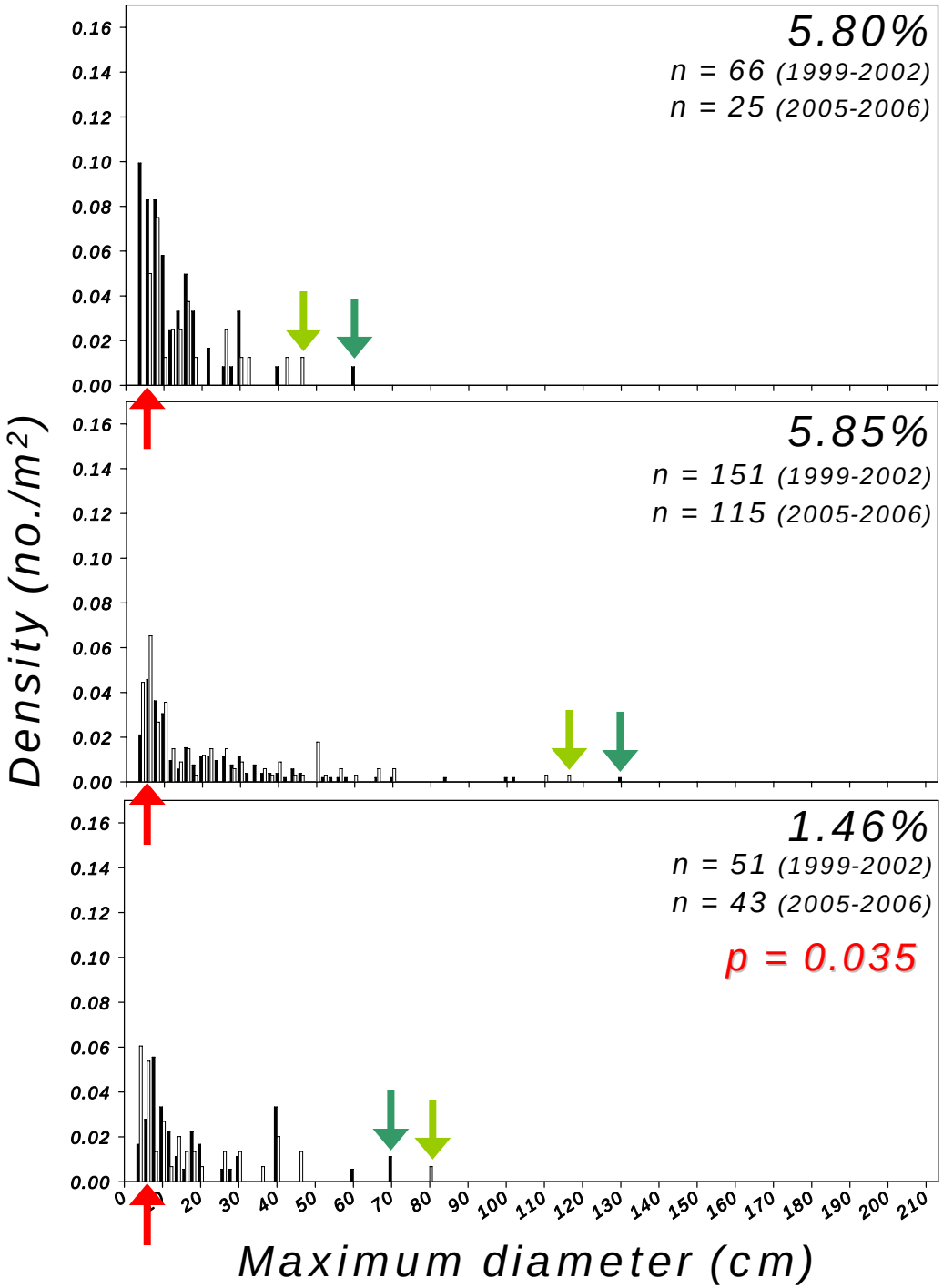
DTNP – high complexity (>15-33m)

(+/neutral)

M/L Keys patch reef

(+/-)

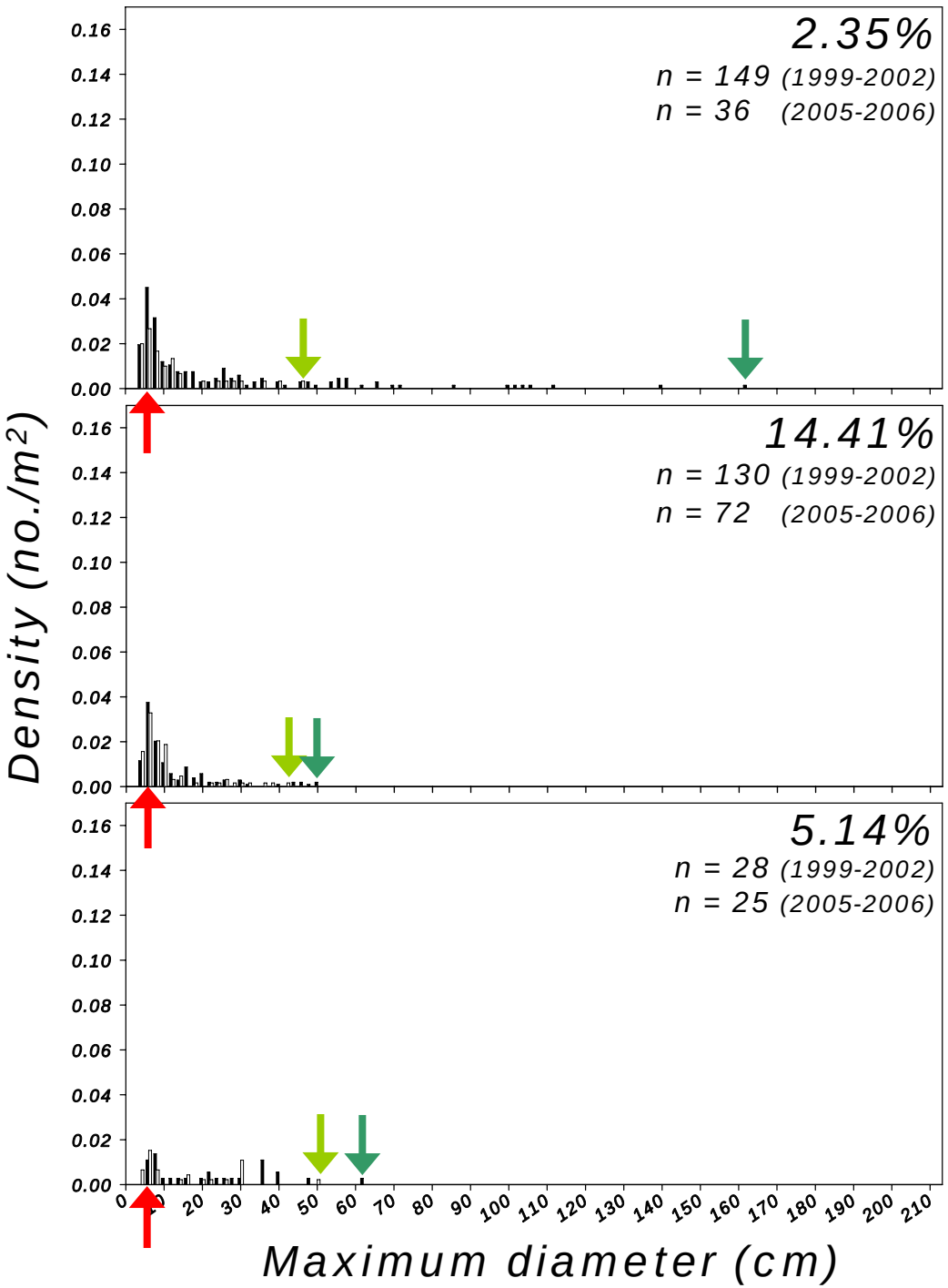
Neutral habitat use



DTNP – low complexity (>15-33m) (neutral/neutral)

L Keys forereef (6-15m)
1999-2002 (neutral/neutral)
2005-2006 (neutral/+)

BNP/U Keys forereef (>15-33m) (+/neutral)



Negative habitat use

M/L Keys forereef (<6m)
(-/-)

U/M Keys forereef (6-15m)
1999-2002 (-/-)
2005-2006 (-/neutral)

BNP/U Keys forereef (<6m)
(-/-)

Population prevalence and total surface area estimates

			Disease		Algal overgrowth	
	Total live tissue SA (cm^2)	Total recent dead SA (cm^2)	Recent dead SA (cm^2)	%p	Recent dead SA (cm^2)	%p
Domain	2.328E+11	1.236E+09	4.267E+08	0.692	1.038E+08	3.611
TBANK-high compl	4.071E+10	2.845E+08	2.254E+08	1.996	3.693E+07	3.128
DTNP-high compl (>15-33m)	1.386E+10	2.348E+08	2.014E+08	7.356	1.011E+06	0.853
M/L Keys-patch reef	9.295E+10	4.299E+08	0.00	0.000	3.473E+07	0.994
DTNP-low compl (>15-33m)	7.408E+09	2.923E+06	0.00	0.000	0.00	0.000
L Keys-forereef (6-15m)	1.288E+10	1.077E+08	0.00	0.000	2.091E+05	1.724
B/U Keys-forereef (>15-33m)	2.292E+09	1.079E+07	0.00	0.000	0.00	0.000
M/L Keys-forereef (<6m)	6.666E+08	4.947E+06	0.00	0.000	0.00	0.000
U/M Keys-forereef (6-15m)	2.375E+09	2.491E+07	0.00	0.000	5.398E+05	2.778
B/U Keys-forereef (<6m)	6.499E+08	2.262E+07	0.00	0.000	0.00	0.000

Conclusions

Spatially explicit population metrics

Habitat use

Population-dynamic rates

Sustainability metrics