

Genetic variability in *Acropora palmata* and *A. cervicornis*

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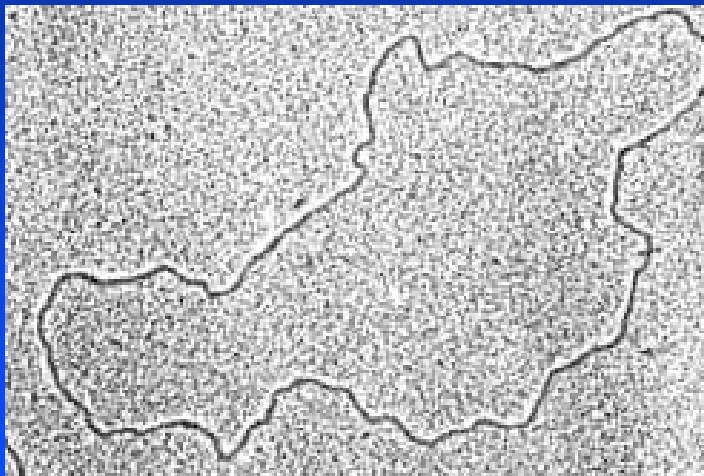
University of Puerto Rico Mayagüez



Goal of this proposal

- Evaluate the genetic variability of *A. cervicornis* and *A. palmata* at different levels of tissue organization

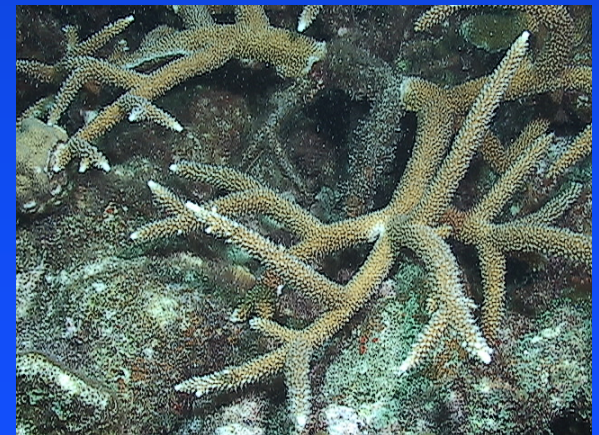
rDNA



A. palmata



A. cervicornis



Hierarchical Design

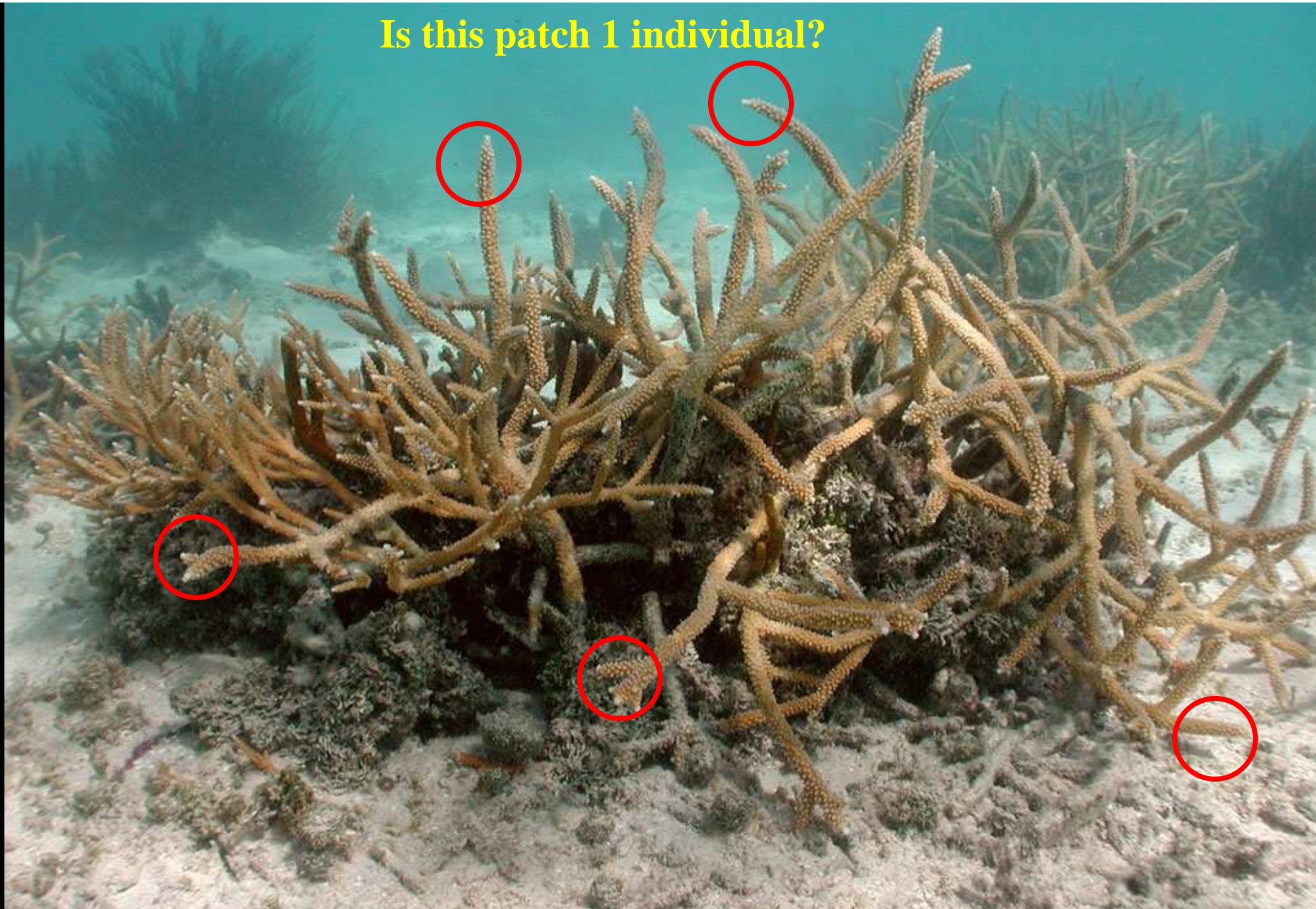
We will evaluate levels of genetic diversity:

- 1) Within discrete patches of *Acropora*
- 2) Among discrete patches of *Acropora* within sampling locations
- 3) Among sampling locations within islands
- 4) Among different islands

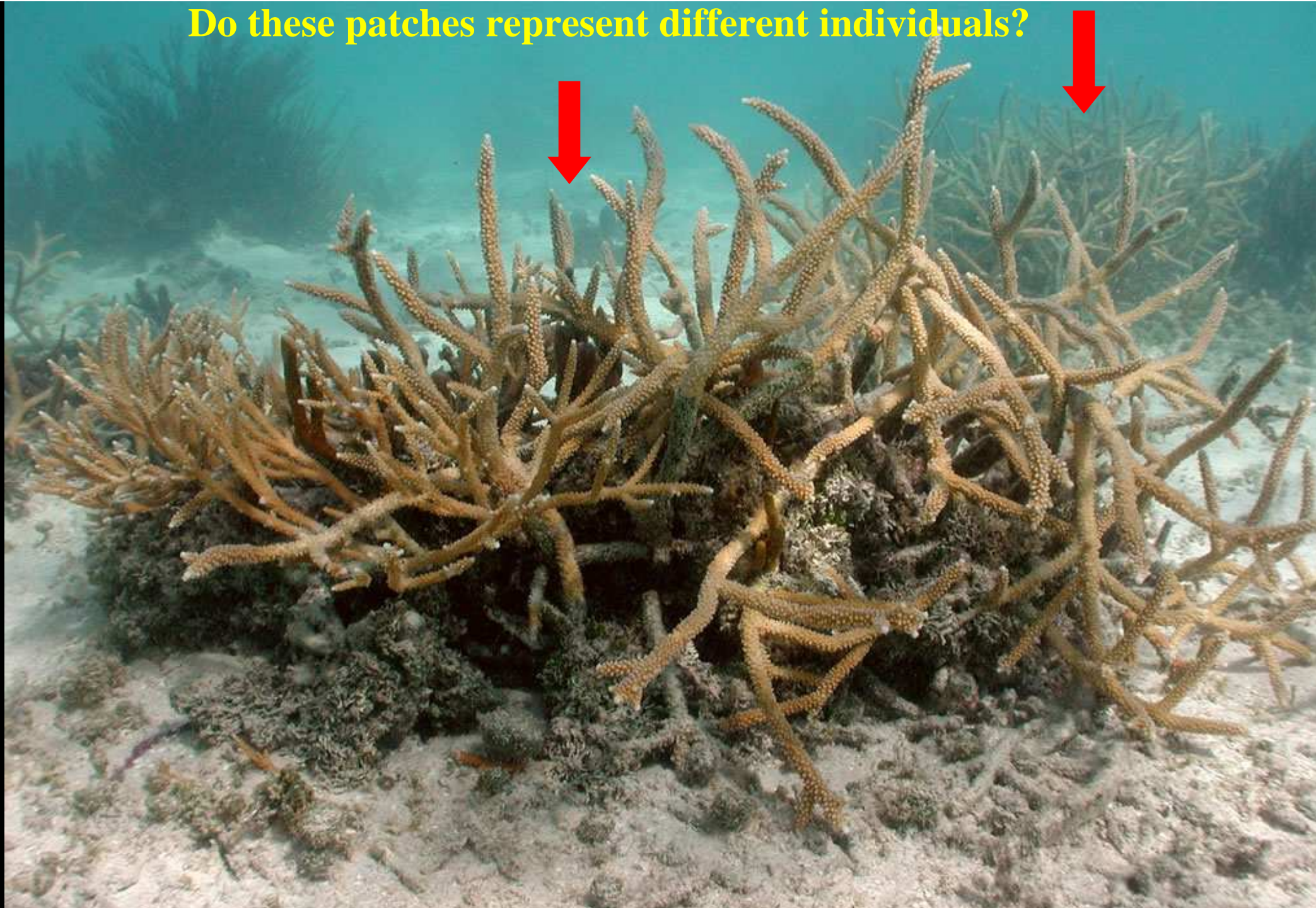
Proposed Sampling Locations of *Acropora*



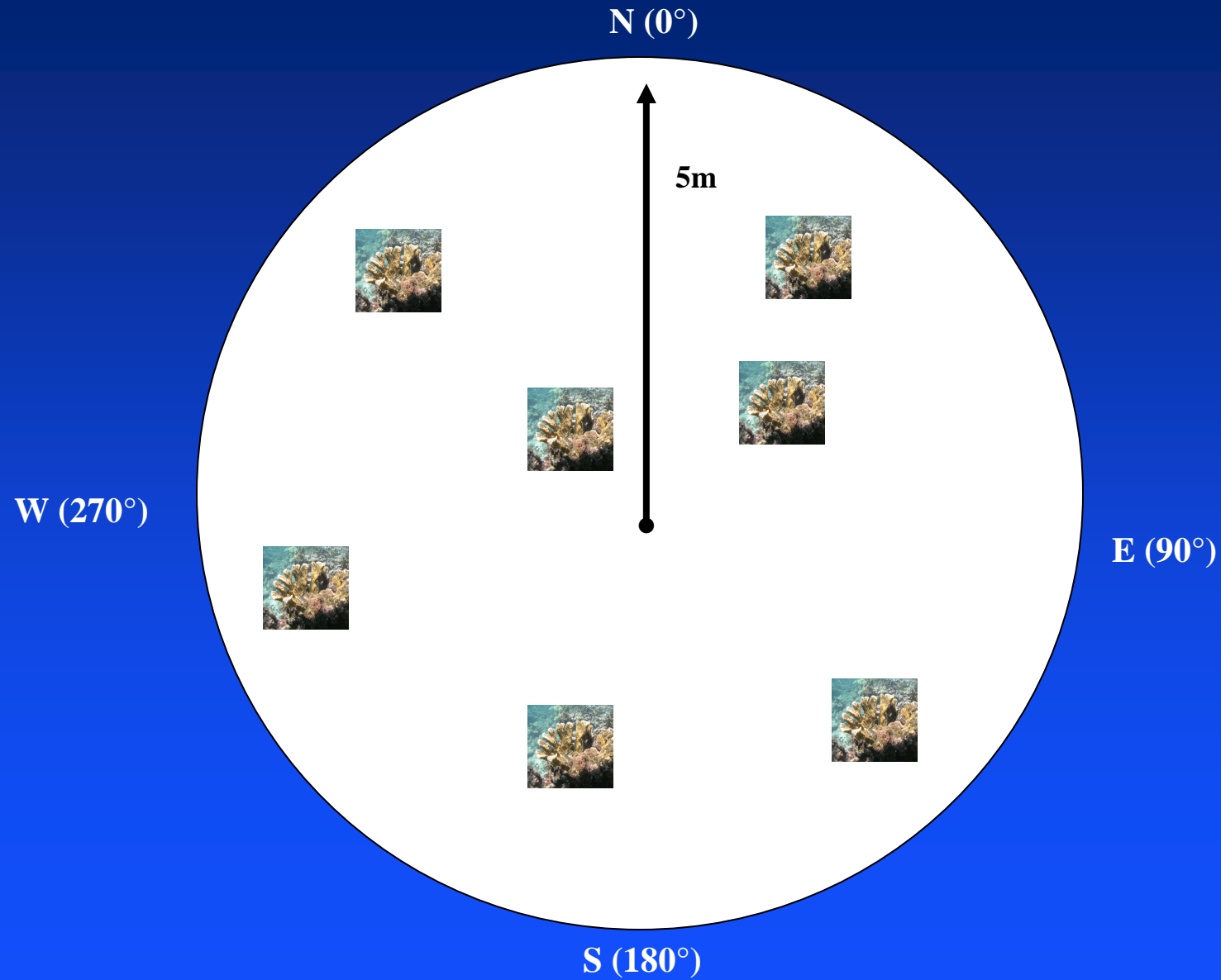
Is this patch 1 individual?



Do these patches represent different individuals?



Collection Method



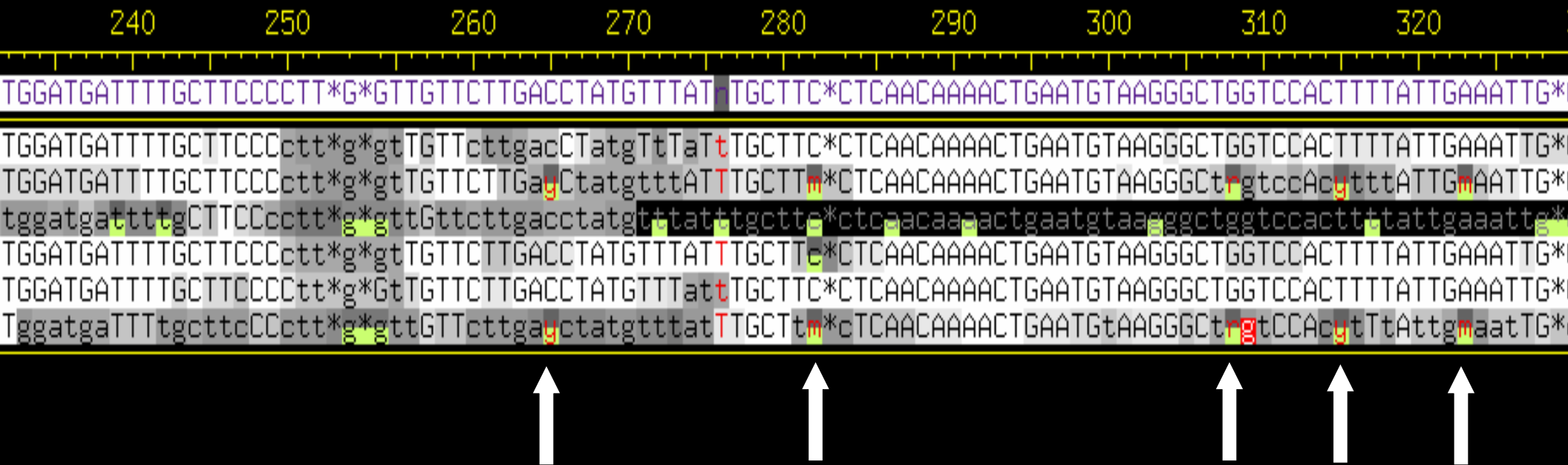
Materials and Methods

Genes:

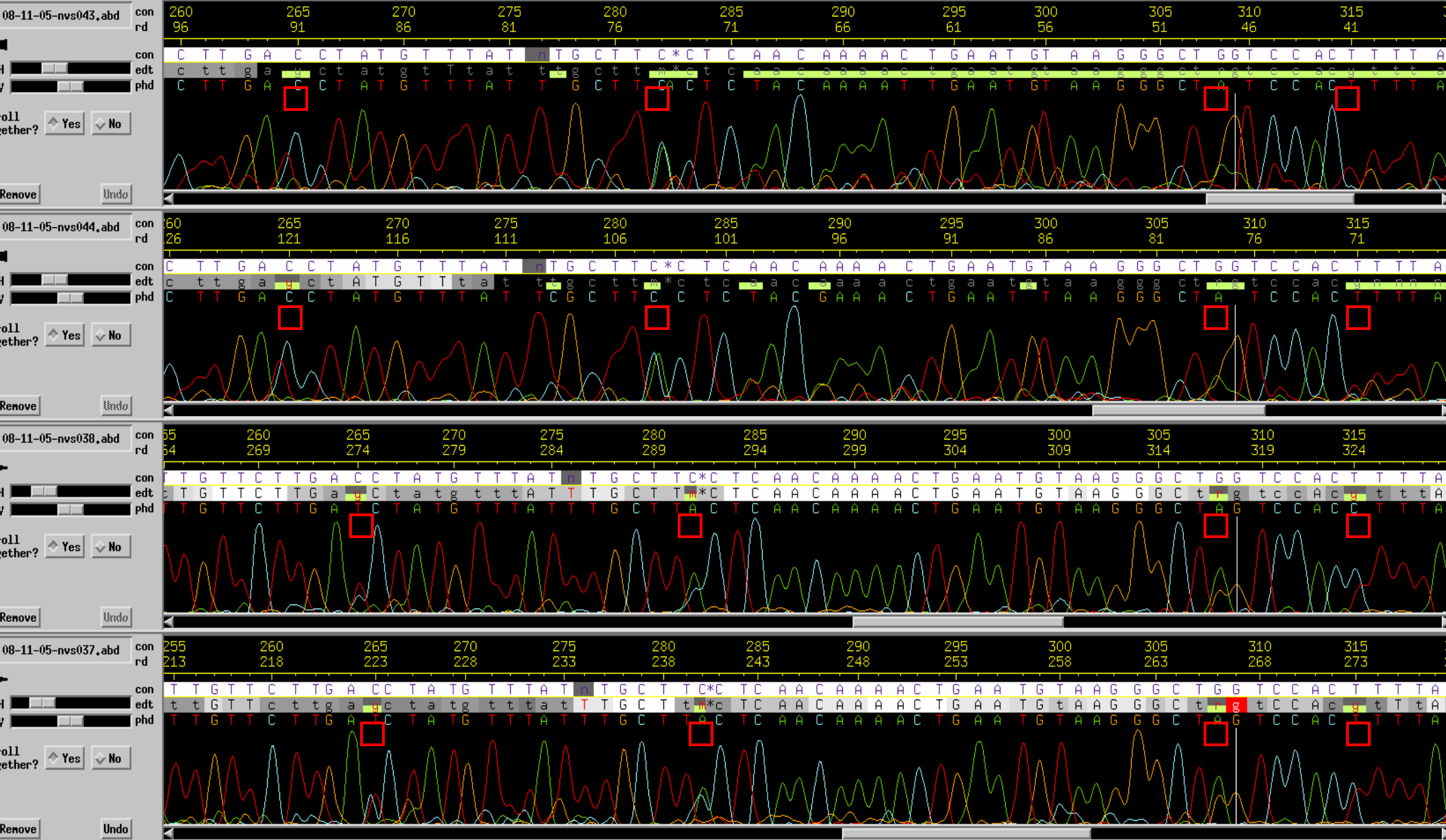
MtDNA: putative control region.

Nuclear DNA: ITS-1, and introns from *Pax-C* and calmodulin

Mutations and Detection of Heterozygotes



Mutations and Detection of Heterozygotes



Results of *A. cervicornis* from nuclear Pax-C

1. No genetic variation within colonies
2. No single point mutations detected between colonies
3. 1 colony in Laurel and 1 colony in Culebra were heterozygous at 2 nucleotide positions



Results of *A. cervicornis* from Calmodulin

1. No genetic variation within colonies
2. No single point mutations detected between colonies
3. 1 colony in Laurel and 2 other PR were heterozygous at 4 nucleotide positions
4. 4 out of 10 patches of *A. cervicornis* were heterozygous at the calmodulin locus in Puerto Rico
 - ◆ Heterozygosity (H) = 0.4

Acropora palmata - Calmodulin Intron

1. No genetic variation within colonies
2. No single point mutations detected between colonies
3. 4 out of 11 patches are heterozygous
 - Heterozygosity (H) = 0.36

Preliminary Conclusions

- *A. cervicornis* calmodulin - Heterozygosity (H) = 0.4
- *A. palmata* Heterozygosity (H) = 0.36
- The presence of heterozygosity in *Acropora* indicates occurrence of sexual reproduction (so it's not just asexual reproduction through fragmentation)
- Sampling is limited, more sampling localities are needed to characterize genetic variability (e.g. Desecheo, Mona)
- In the process of developing alternative molecular markers

La Parguera Locations -*Acropora cervicornis*

- San Cristobal (2 locations)
 - ◆ First location - 28 samples from 11 colonies*
 - ◆ Second location - 23 samples from 10 colonies*
- Laurel (1 location)
 - ◆ 10 samples from 5 colonies*
- Media Luna (1 location)
 - ◆ 20 samples from 10 colonies*

*more than two samples were collected from some colonies

Undisturbed Locations- *Acropora cervicornis*

- **Mona**
 - ◆ **7 locations**
 - ◆ **33 colonies sampled**

- **Lee Stocking Island, Bahamas**
 - ◆ **3 locations**
 - ◆ **17 colonies sampled**

La Parguera Locations -*Acropora palmata*

- **Laurel (2 locations)**
 - ◆ **First location - 14 samples from 7 colonies**
 - ◆ **Second location - 10 samples from 5 colonies**
- **Enrique (1 location)**
 - ◆ **12 samples from 6 colonies**
- **Media Luna (1 location)**
 - ◆ **22 samples from 11 colonies**

Undisturbed locations -*Acropora palmata*

- Tres Palmas Reserve, Rincon (3 locations)
 - ◆ First location - 24 samples from 12 colonies
 - ◆ Second location - 20 samples from 10 colonies
 - ◆ Third location – 14 samples from 6 colonies
- Guiligan Island, Guanica (2 locations)
 - ◆ First location - 10 samples from 5 colonies
 - ◆ Second location – 8 samples from 4 colonies
- Mona (3 locations)
 - ◆ 13 colonies sampled
- Lee Stocking Island, Bahamas (3 locations)
 - ◆ 18 colonies sampled

Tres Palmas Reserve

Tres Palmas #1	A. palmata	N 18°20.951	W 067°15.875
colony	height (m)	width (m)	% live cover
1	0.55	1.3	70
2	0.3	0.26	50
3	0.9	1.8	75
4	0.65	2.55	80
5	0.8	1	90
6	0.5	0.7	95
7	0.4	1.1	90
8	0.5	1.2	80
9	0.55	1.2	95
10	0.9	2.9	70
11	0.45	1	70

•Tres Palmas #1 is located near the Southeast boundary of the Reserve

Tres Palmas #2	A. palmata	N 18°21.018	W 067°15.938
colony	height (m)	width (m)	% live cover
1	0.4	0.77	30
2	0.39	0.64	80
3	0.3	0.82	90
4	0.52	0.75	25
5	1	2.67	80
6	0.8	2.13	70
7	1	1.8	90
8	0.9	1.85	50
9	0.35	1.68	90
10	0.35	1.9	70

•Tres Palmas #2 is located in the middle of the Reserve's boundaries

Tres Palmas #3	A. palmata	N 18°21.139	W 067°16.038
colony	height (m)	width (m)	% live cover
1	0.25	0.85	95
2	0.56	1.33	40
3	0.26	1.4	85
4	0.2	0.6	40
5	0.33	1.13	80
6	0.65	4.1	70

•Tres Palmas #3 is located at the Northwest boundary of the Reserve

- Total of 27 colonies were sampled in the Tres Palmas Reserve
- Total of 58 samples were taken

Guiligan Island, Guanica

Guiligan Island #1	A. palmata	N 17°56.429	W 066°52.1 15
colony	height (m)	width (m)	% live cover
1	0.26	0.55	60
2	0.47	1.26	50
3	0.6	0.89	50
4	0.6	1.1	70
5	0.65	0.8	70

•Both of these locations were located in the back reef near the reef crest at Guiligan Island

Guiligan Island #2	A. palmata	N 17°56.449	W 066°52. 098
colony	height (m)	width (m)	% live cover
1	0.5	1.45	70
2	0.4	1.28	40
3	0.26	0.47	70
4	0.22	0.55	90

Summary

- *Acropora cervicornis*

- ◆ 131 samples from 86 colonies

- *Acropora palmata*

- ◆ 107 samples from 97 colonies

Vast majority of DNA data on the way

- ◆ 186 Control Region sequences and 204 PaxC sequences

Proposed Schedule

■ Fall 2006

- Finish collection of *Acropora* from all locations
- Culebra, Desecheo, North Coast of PR
- Collection of data
- Data Analysis

■ Spring 2006

- Data Analysis
- Manuscript Preparation

Acknowledgements

- NOAA and CCRI
- UPRM Marine Sciences Department

PaxC Intron (507 bp)

Polymorphism in *Acropora cervicornis*

Sample location	# of DNA sequences	# colonies:
Culebra	4	2
Cayo Enrique	4	2
Cayo Laurel	3	2

Calmodulin Intron (357 bp)

A. cervicornis

Sample location	# of sequences	# colonies:
Cayo Enrique	3	2
Cayo Laurel	3	2
Other PR*	6	6

*Genebank from (Vollmer and Palumbi) 2002

PaxC Intron (507bp)

A. palmata

Sample location	# of sequences	# colonies:
Cayo Enrique	2	1
Cayo Laurel	7	5
Culebra	8	4

Calmodulin Intron (357bp)

A. palmata

Sample location	# of sequences	# colonies:
Cayo Enrique	1	1
Cayo Laurel	4	3
Other PR*	7	7

*GeneBank (Vollmer and Palumbi 2002)