Review of Benthic Substrates for Micronesia's Coral-Reef Monitoring Programs Using Coral Reef Point Count Software

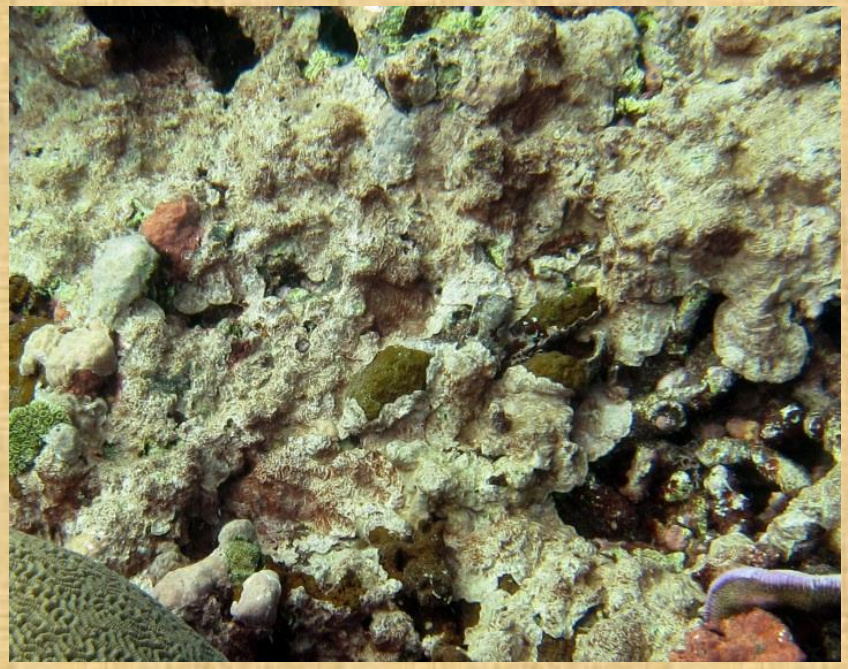
Focus of presentation

- To help identify and become comfortable with the most common benthic substrates from photo-quadrat data used by monitoring programs
- Not focused on identifying coral genera, see other materials for coral taxonomy
- Focused upon common substrates other than corals that are good indicators of reef ‘condition’
- Can be expanded upon later, send recommendations for what to include

Examples of common benthic substrates other than corals

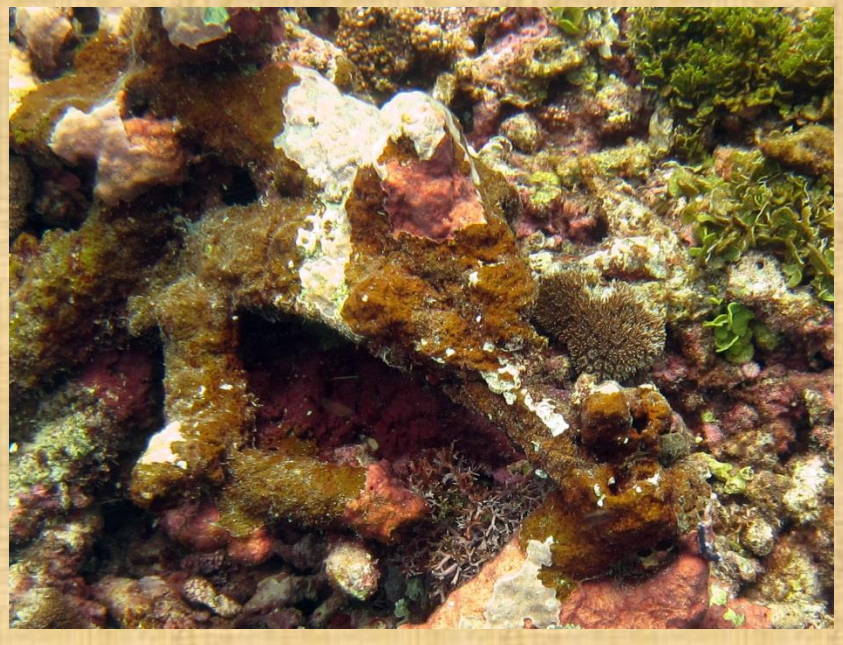
CCA

- Crustose coralline algae
  - Reef cementers, help glue reef structure together, heavily calcified
  - Many coral larvae shown to preferentially settle on CCA versus other substrates
  - *Hydrolithon*, *Porolithon*, and *Titanoderma* are some key genera
  - Typically lighter shades of pink and purple
  - CCA are most often associated with healthy reefs (+)



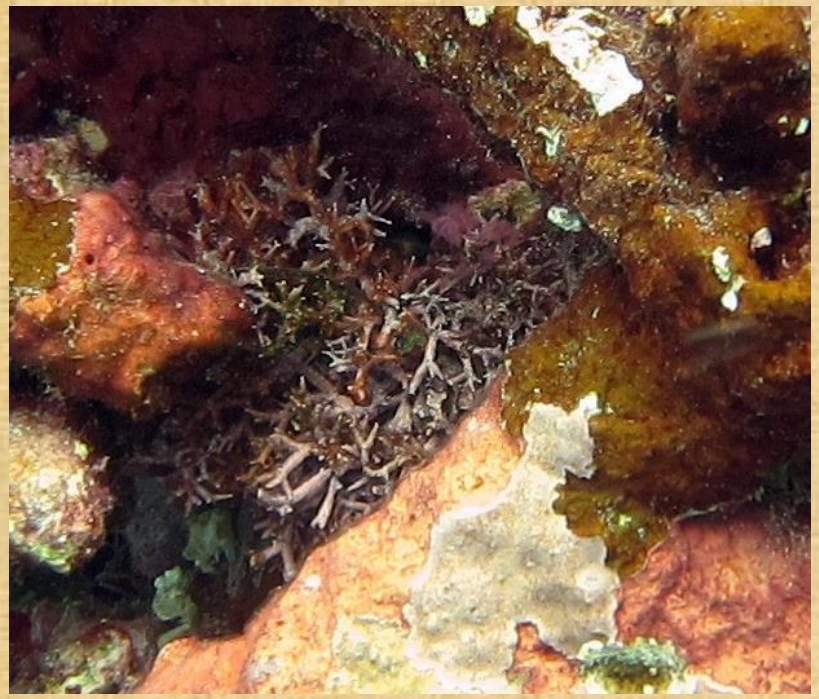
FCA

- Fleshy coralline algae
  - Less influential reef cementers, often only partially calcified
  - FCA have been shown to shed their outer epidermal layer when coral larvae try and settle
  - FCA known for more rapid lateral growth, wih the ability to shade even adult coral colonies
  - *Peyssonnelia* and *Pneophyllum* are some key genera
  - Typically darker shades of pink, purple, brown, or mottled
  - FCA are known to be more abundant on unhealthy reefs (-) in comparison to CCA



BCA

- Branching coralline algae
  - Heavily calcified branching algae, typically found around inner reef habitats and lagoons
  - *Neogoniolithon* and *Porolithon* some key genera for BCA species
  - Can be mistaken for coral growth, most notably *Pocillopora damicornis*, but pink/white color is distinguishing
  - BCA are not fully considered to be (+) or (-) indicators to healthy reefs, for now we consider neutral

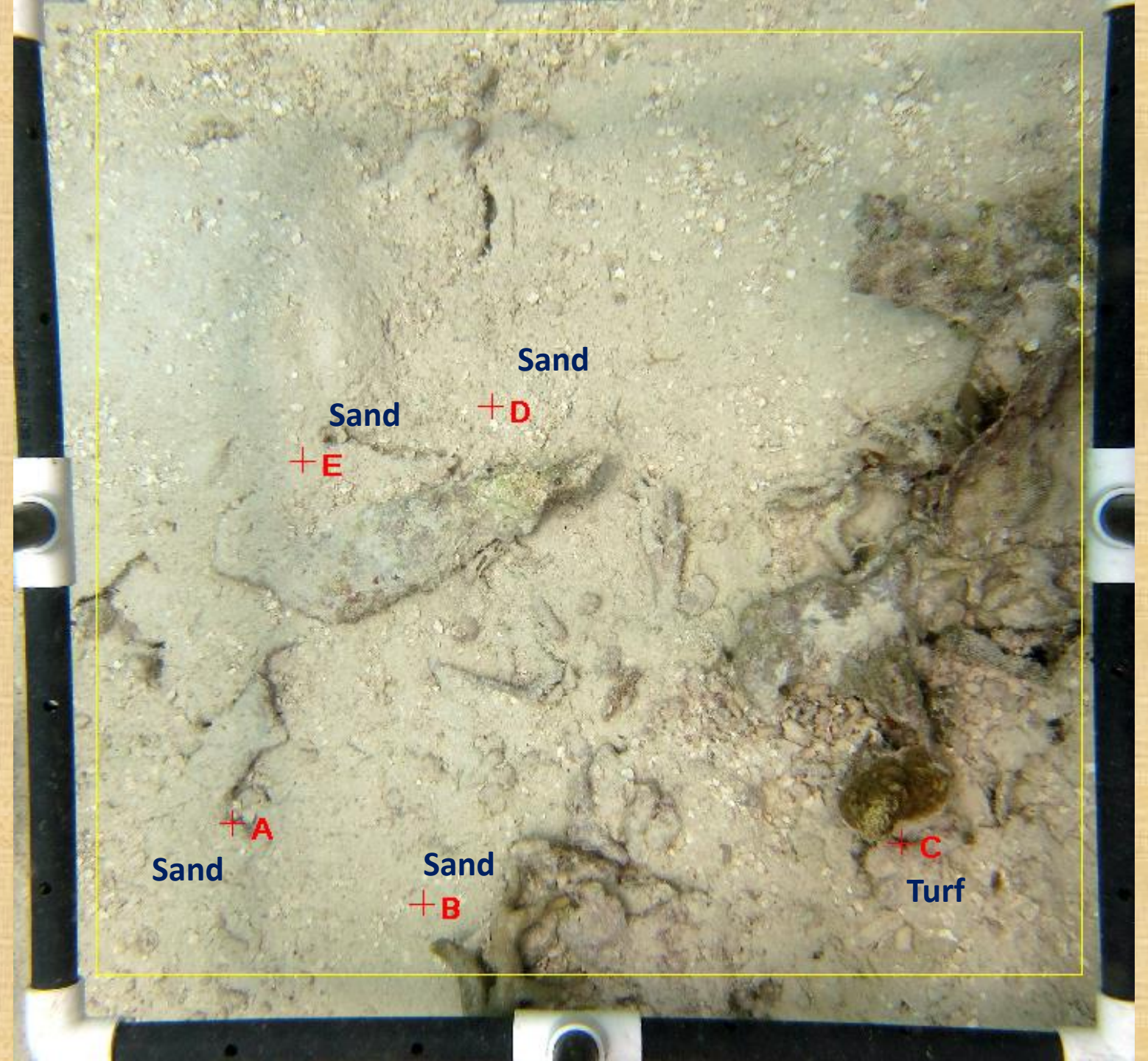


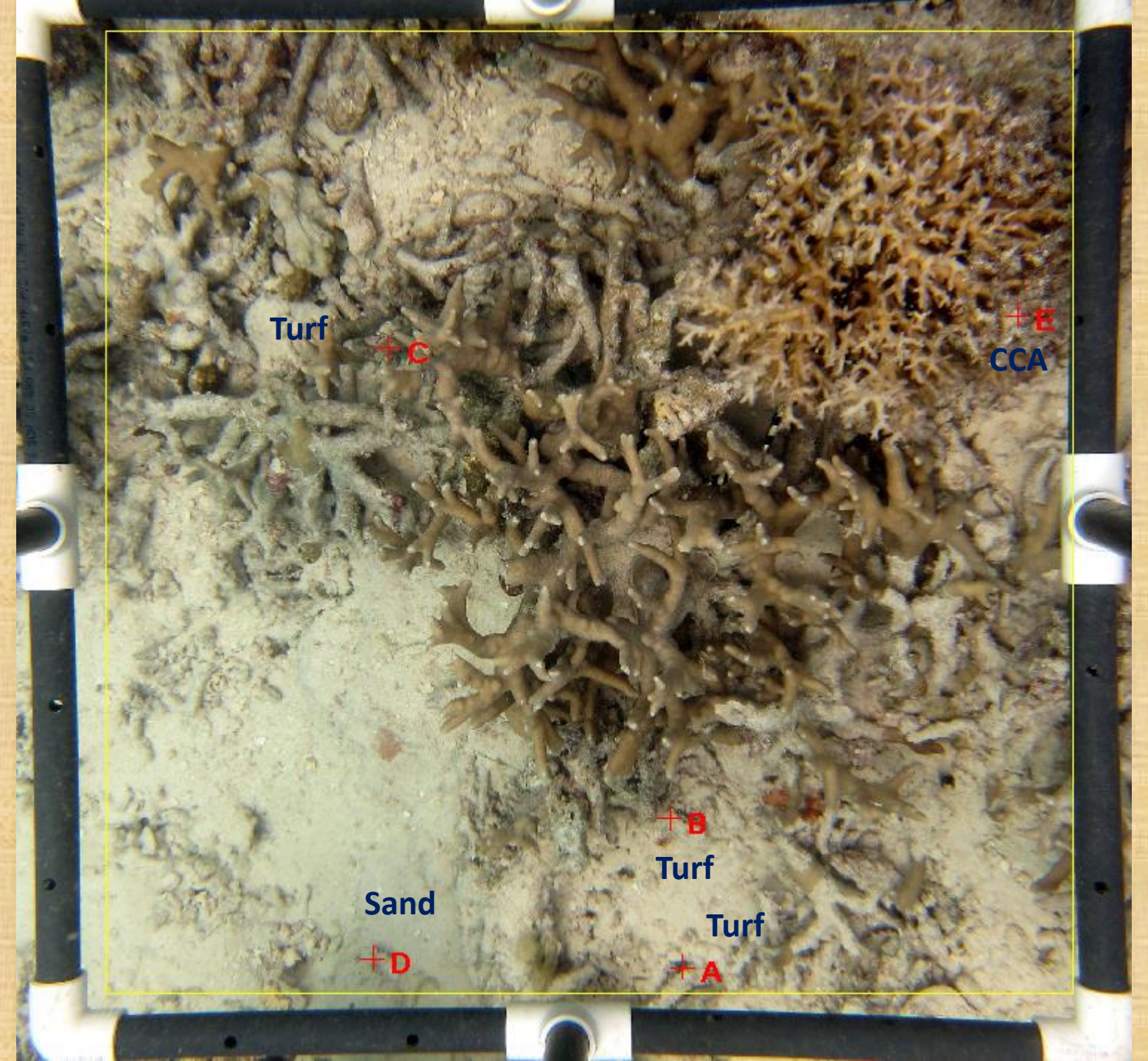
Turf

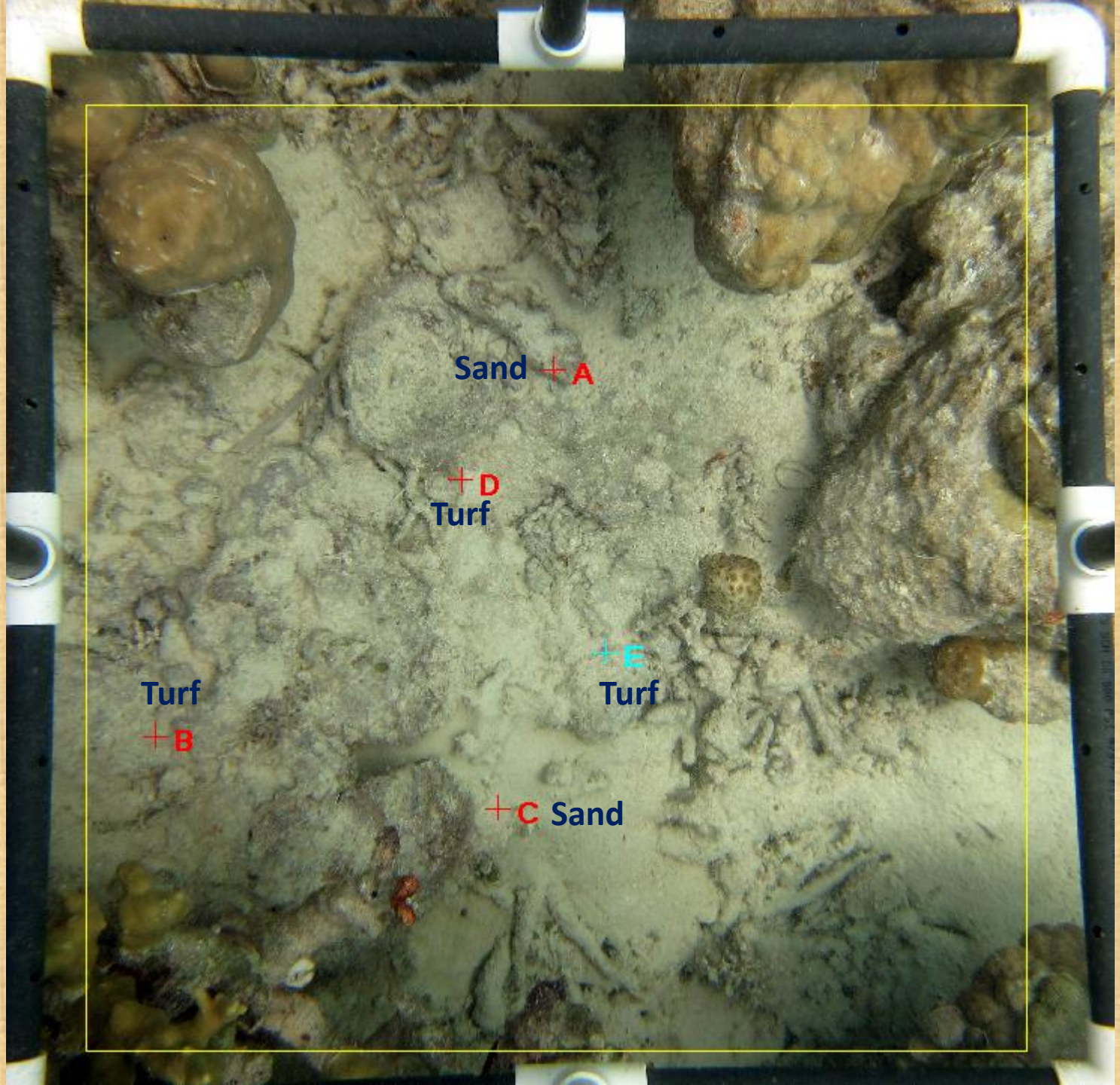
- Turf algae
  - Comprised mainly of microalgae often belonging to the family Gelidiaceae
  - However, all erect algal substrates less than 2 cm in height are typically classified as turfs
  - Typically looks like fuzzy substrate of varying color (dark browh, green, and red are most common)
  - Macroalgae greater than 2 cm in height are typically classified by genus in coral point count software

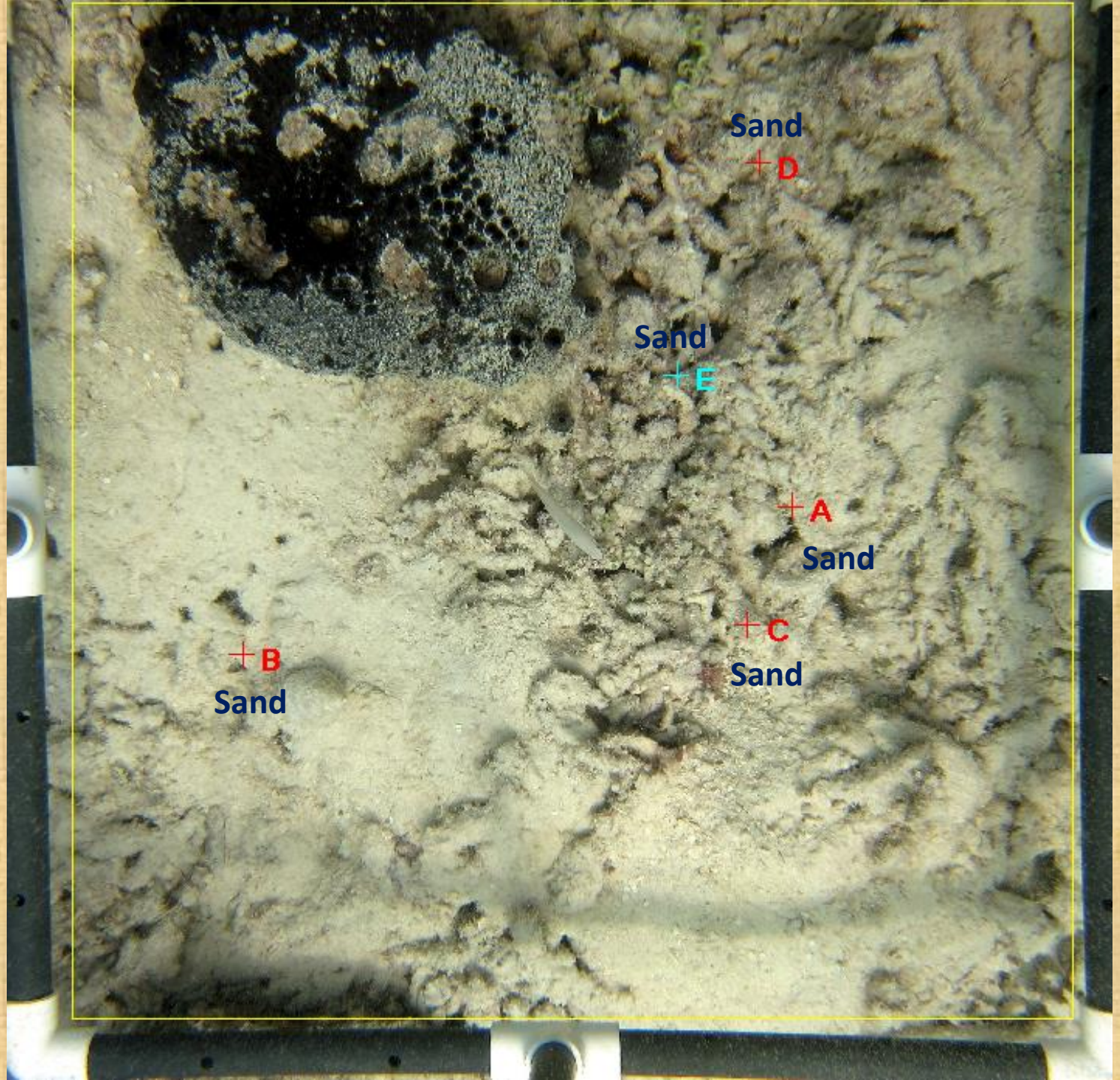
Some examples of photographs analyzed from Pohnpei

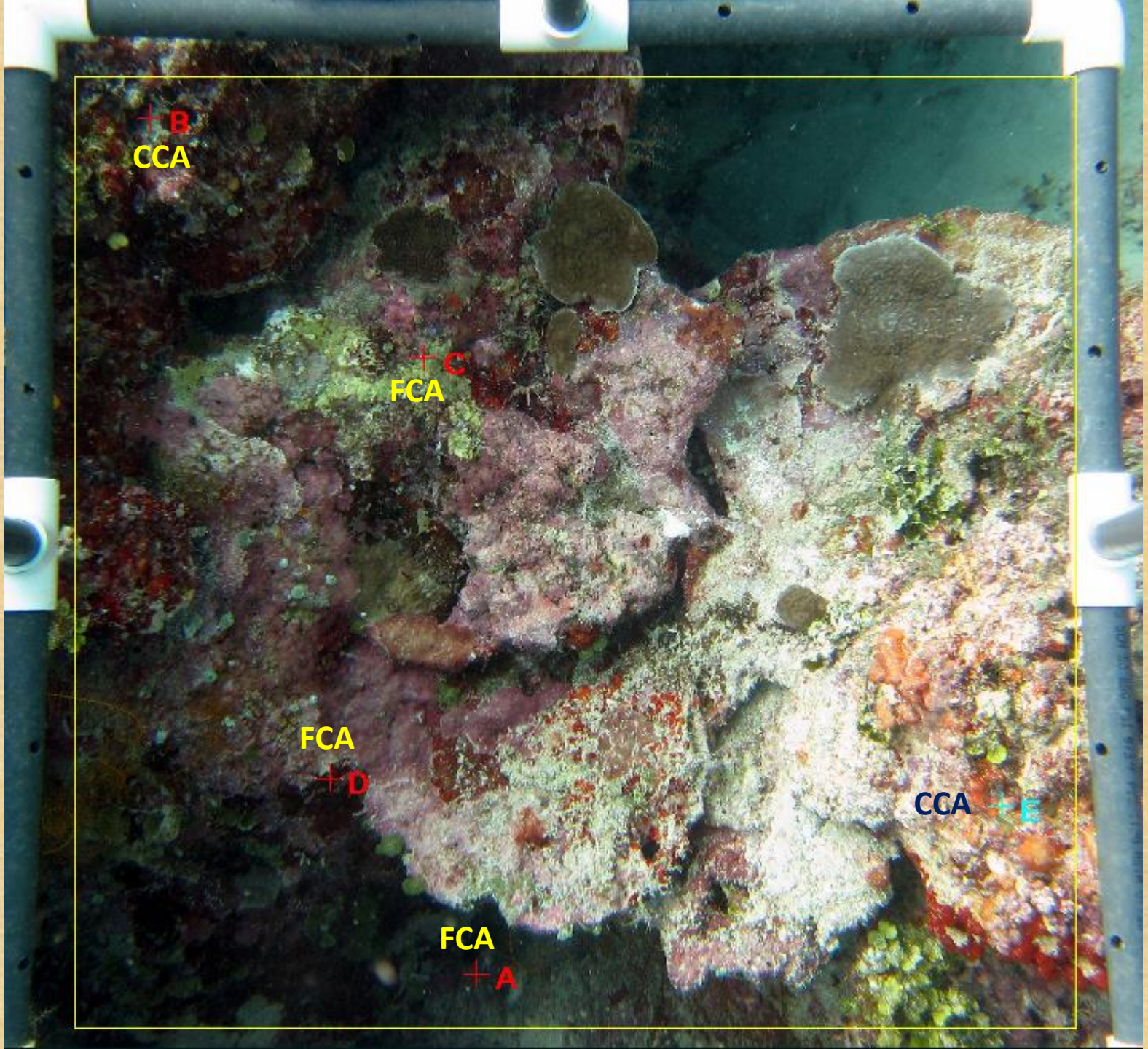
- Note
  - No two people will score every data point the same every time
  - However, on average similar scoring of benthic substrates should exist

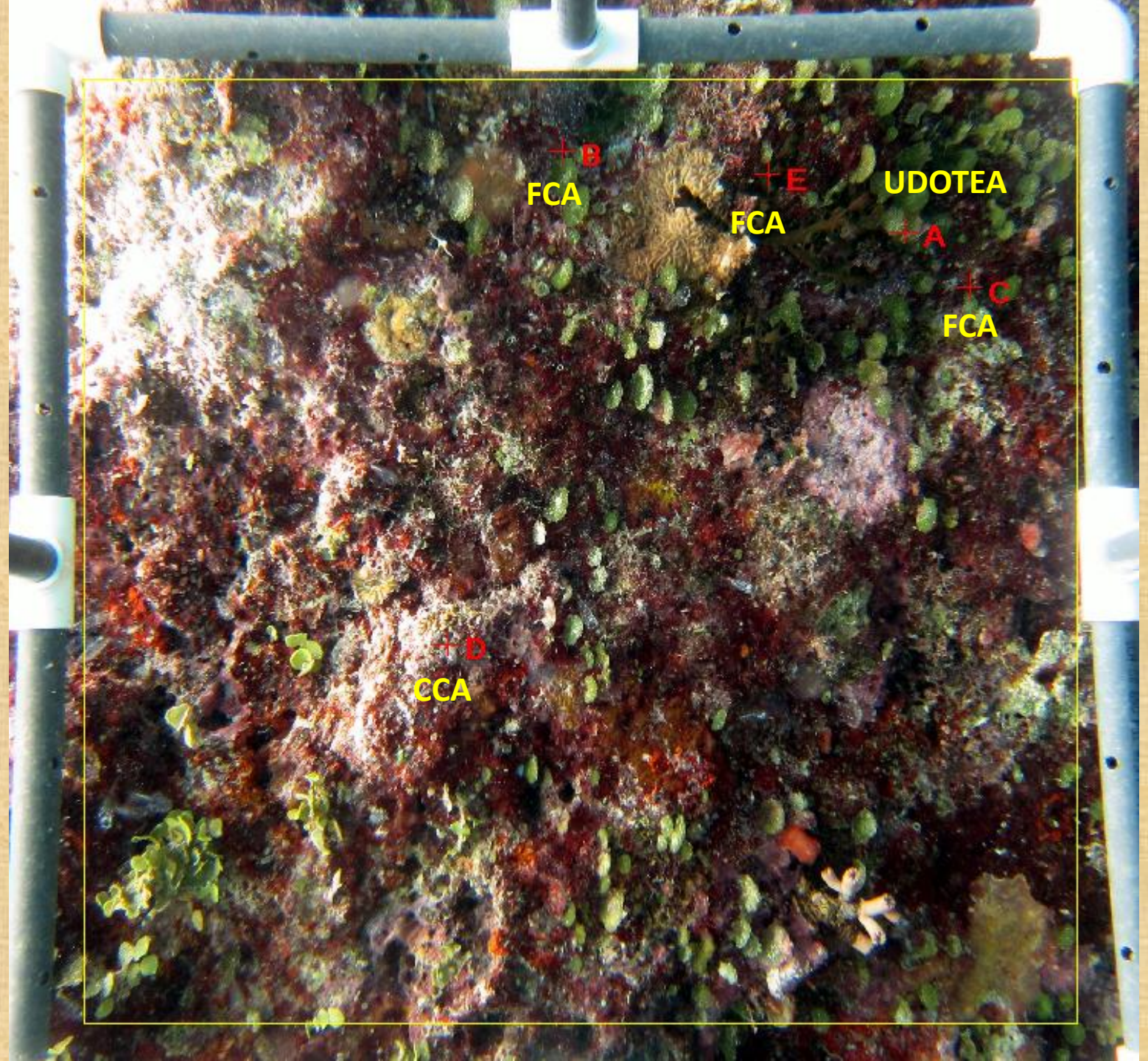

Sand
Sand
D
E
A
Sand
Sand
B
C
Turf


Turf
C
E
CCA
B
Turf
Turf
Sand
D
A

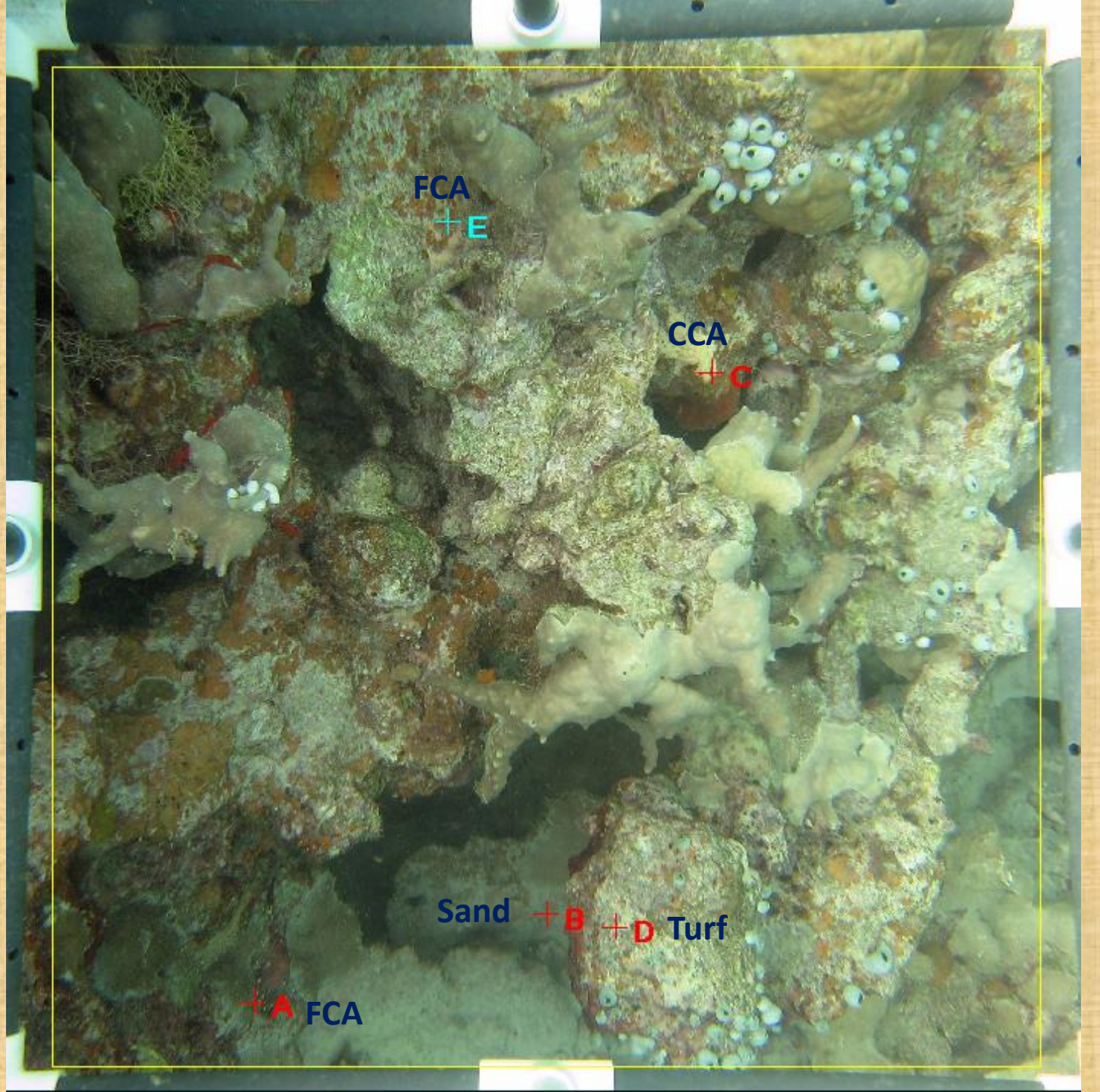

Sand
A
D
Turf
E
Turf
Turf
B
C
Sand

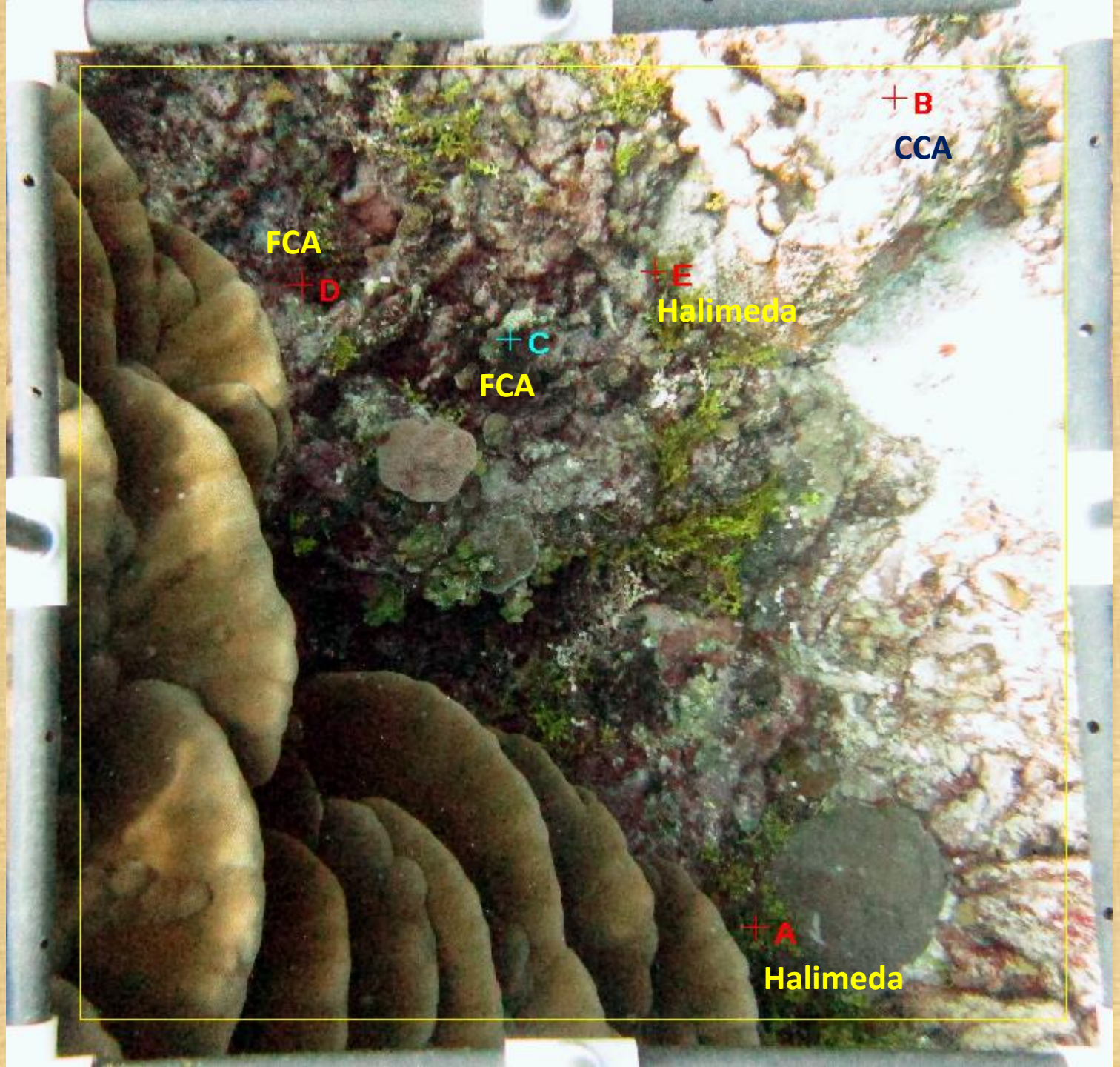

Sand
D
Sand
E
A
Sand
C
Sand
B
Sand


B
CCA
C
FCA
FCA
D
CCA
E
FCA
A

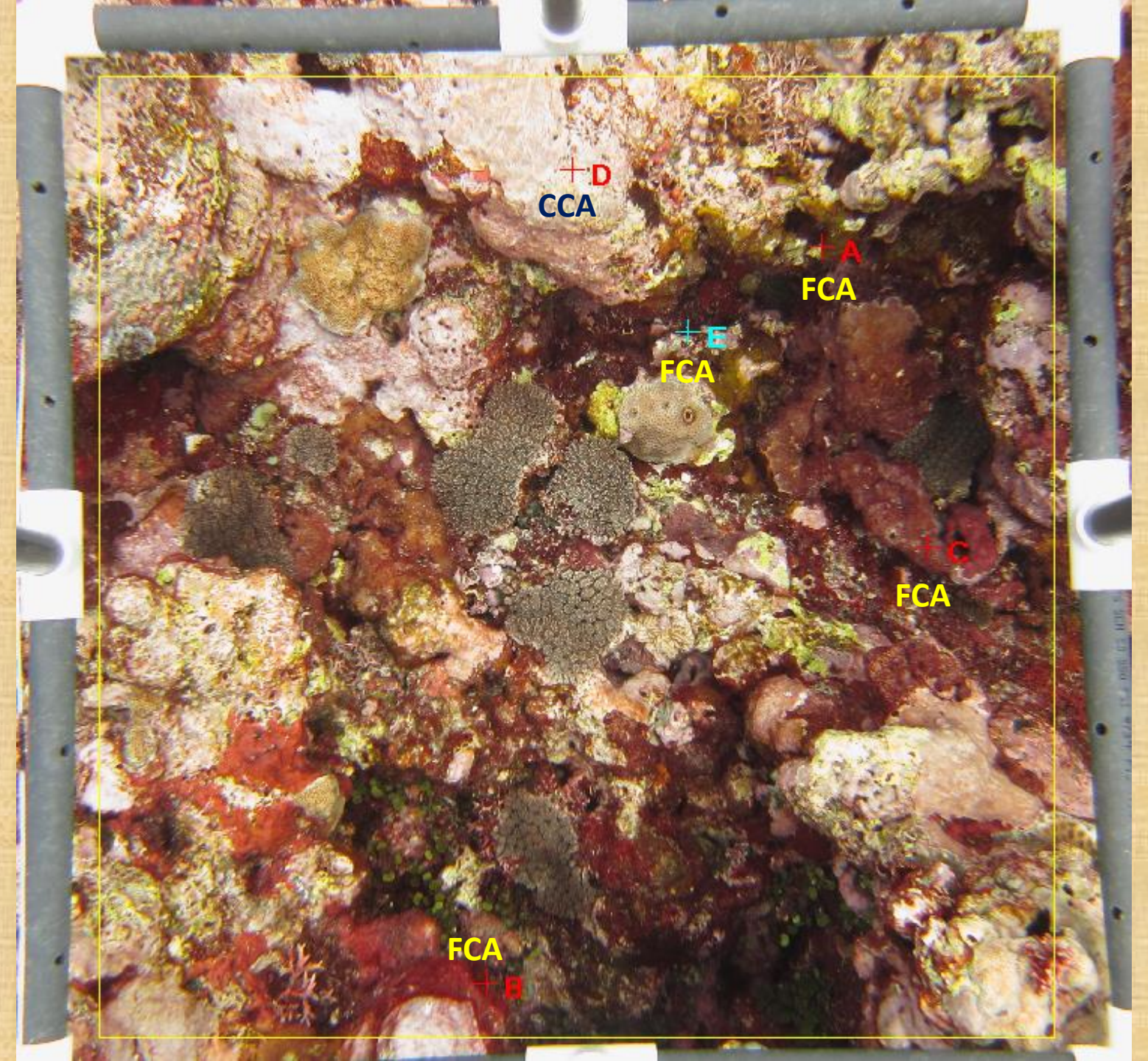

B
FCA
E
FCA
UDOTEA
A
C
FCA
D
CCA

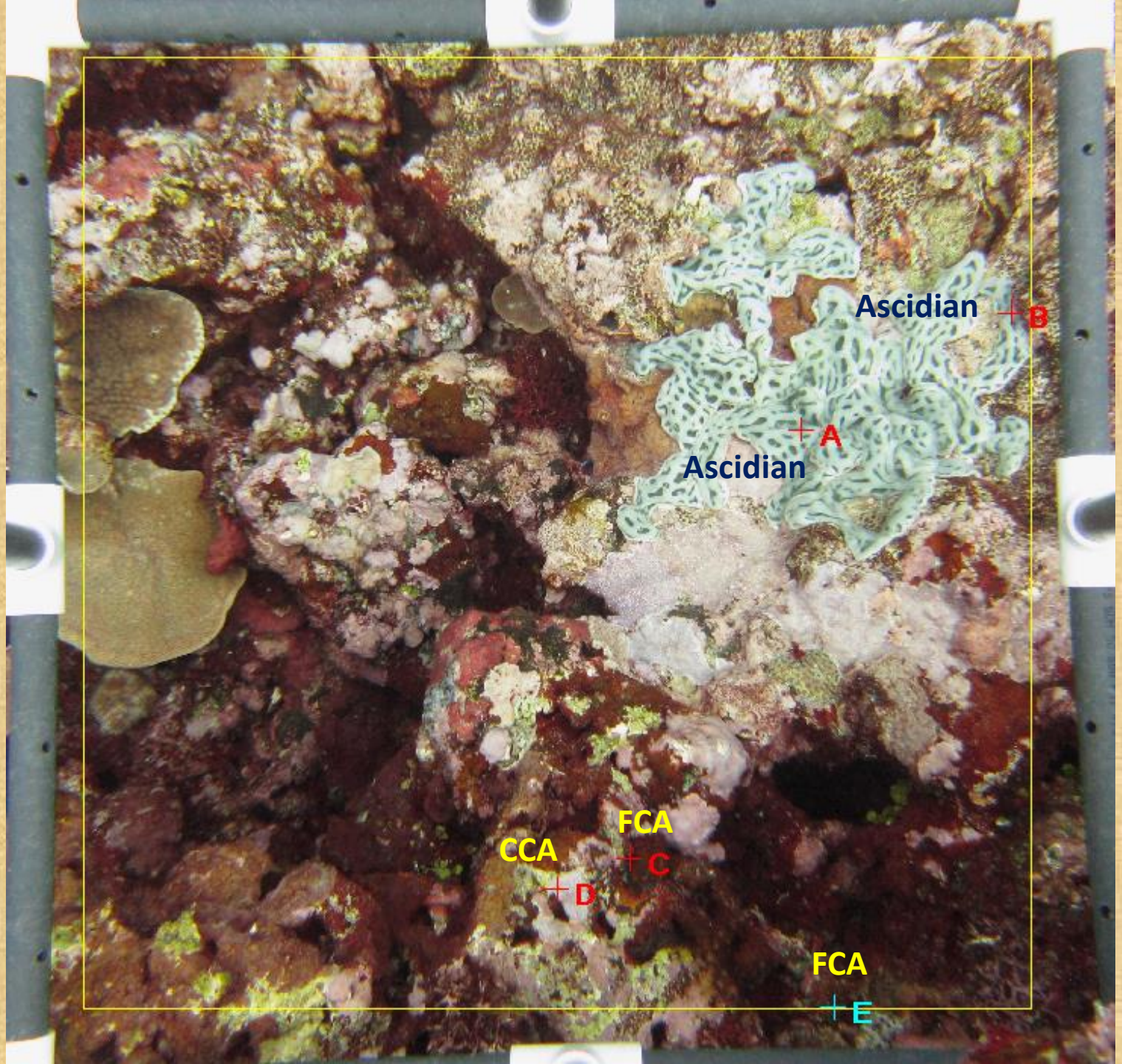
A
CCA
D
Sand
B
CCA
E
Sand
C
FCA

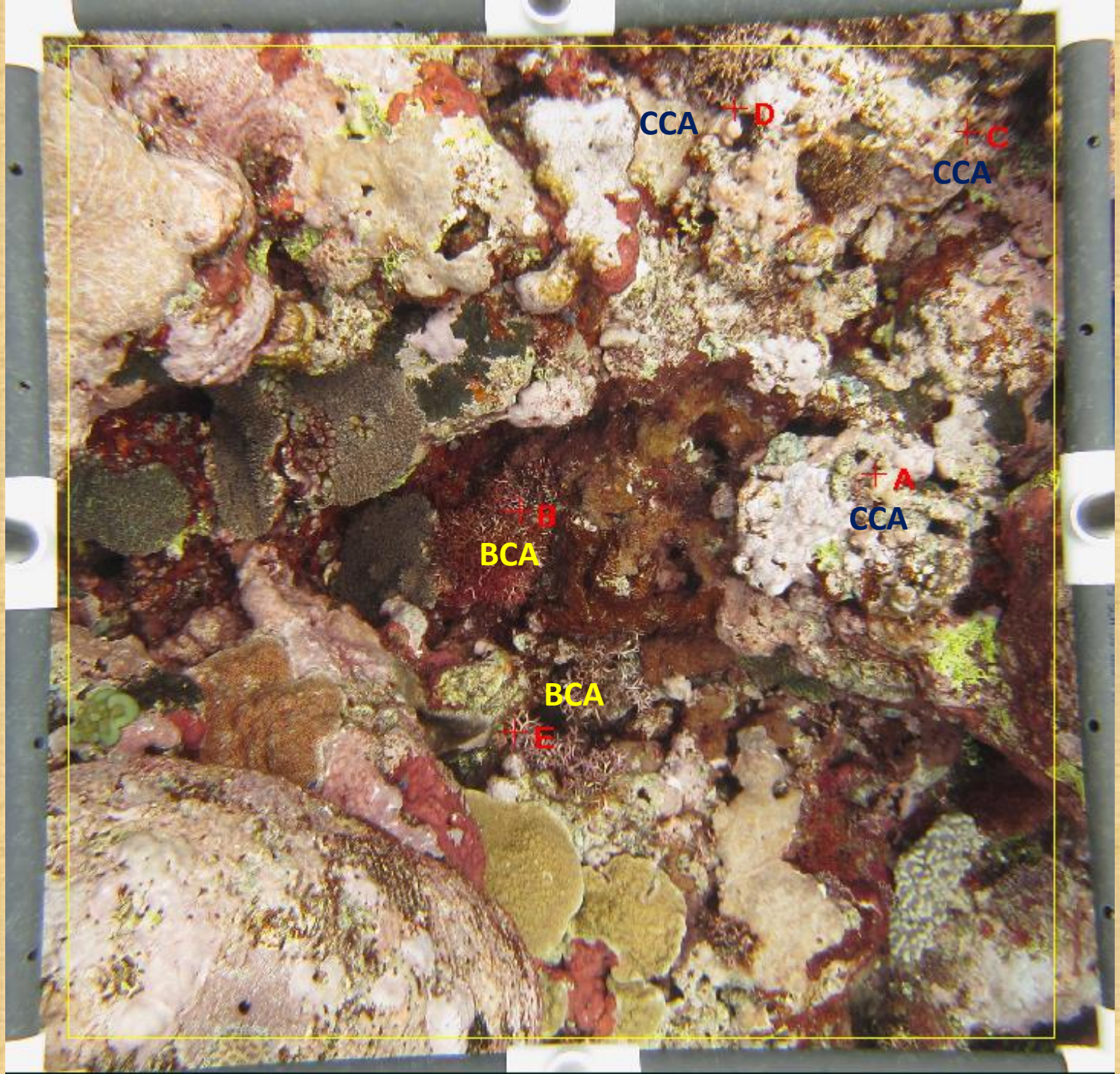

FCA
E
CCA
C
Sand
B
D
Turf
A
FCA

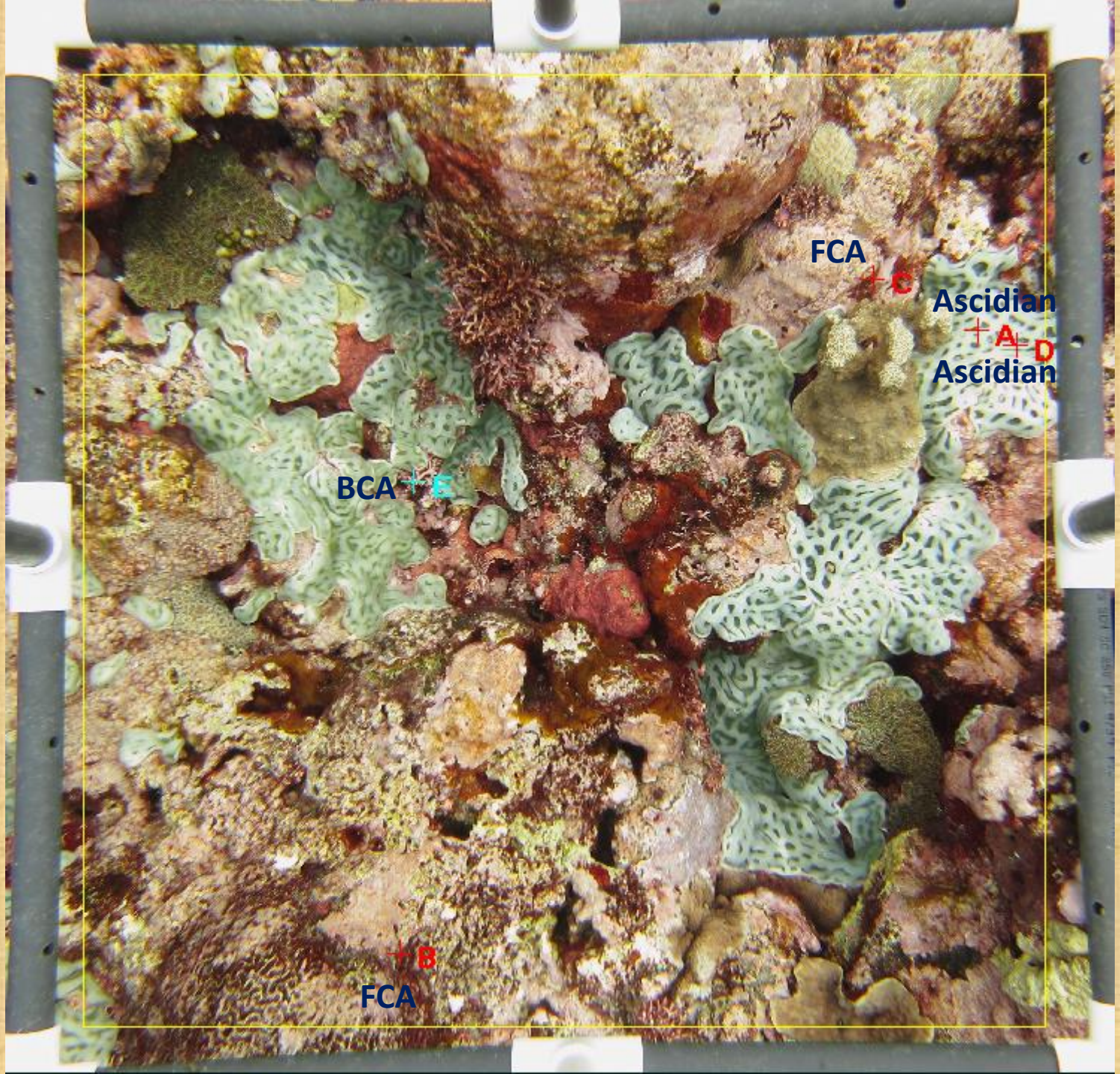

B
CCA
FCA
D
E
Halimeda
C
FCA
A
Halimeda

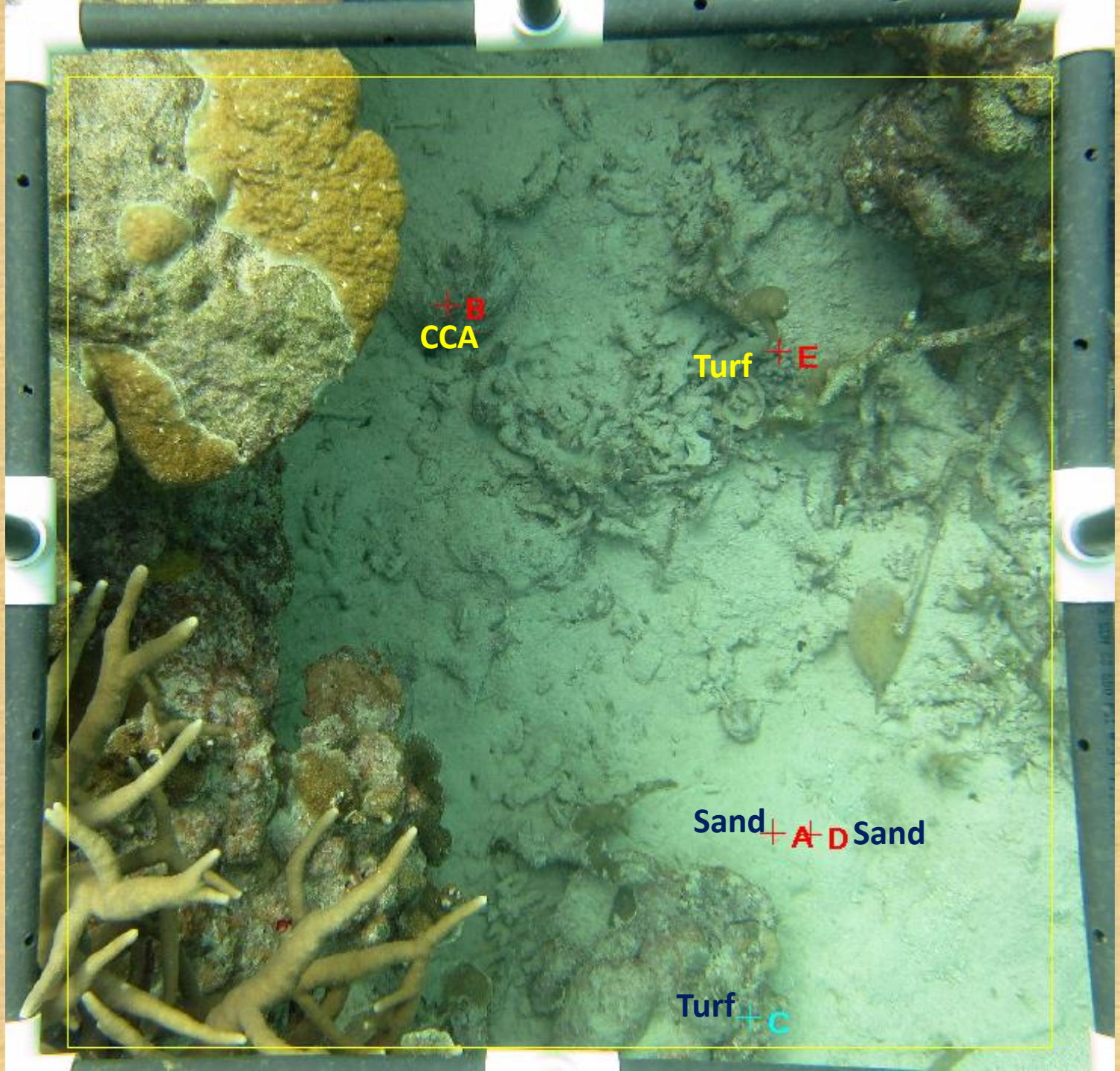
D
CCA
B
Ascidian
A
FCA
C
CCA
E
FCA

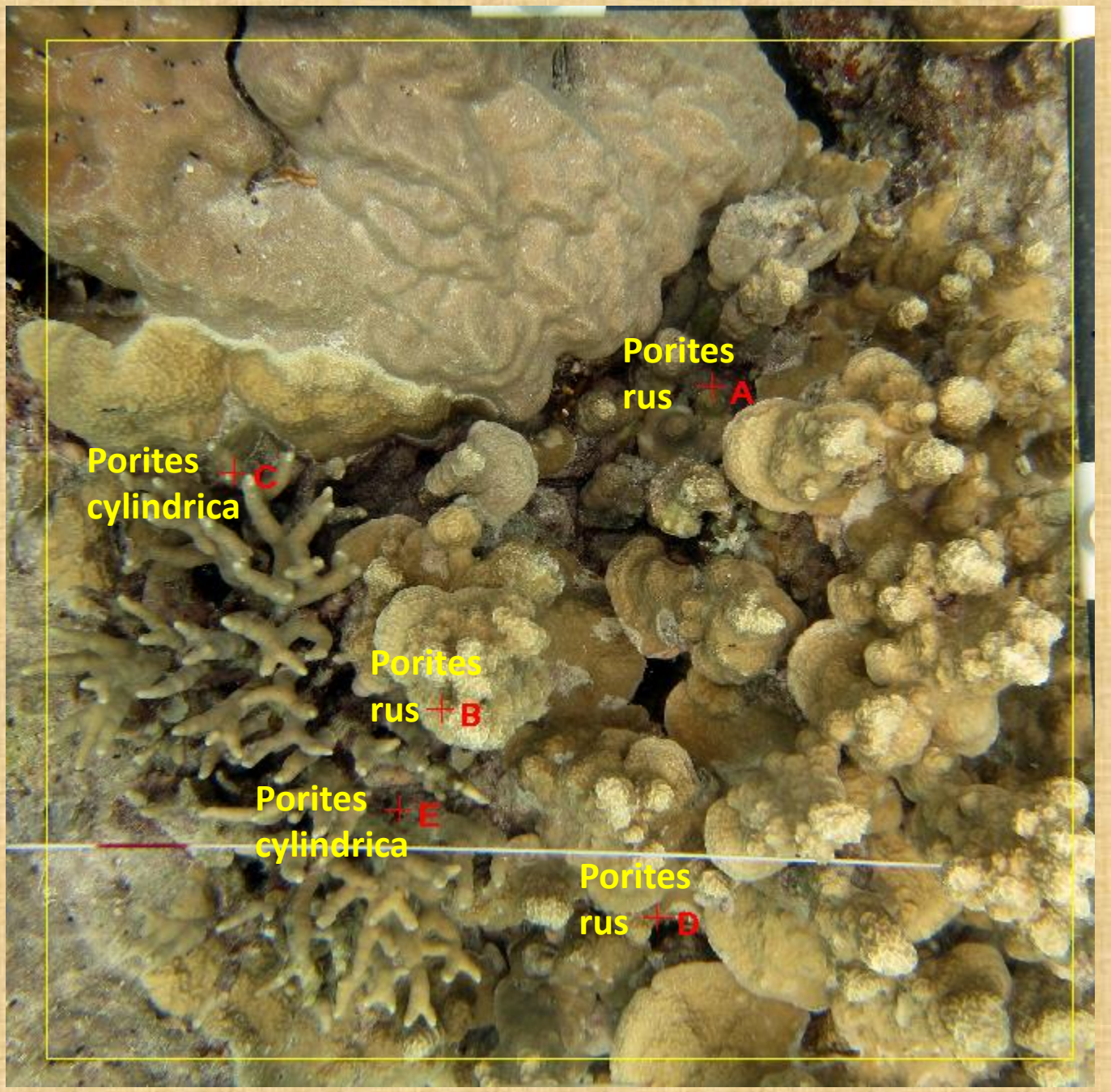

D
CCA
A
FCA
E
FCA
C
FCA
FCA
B

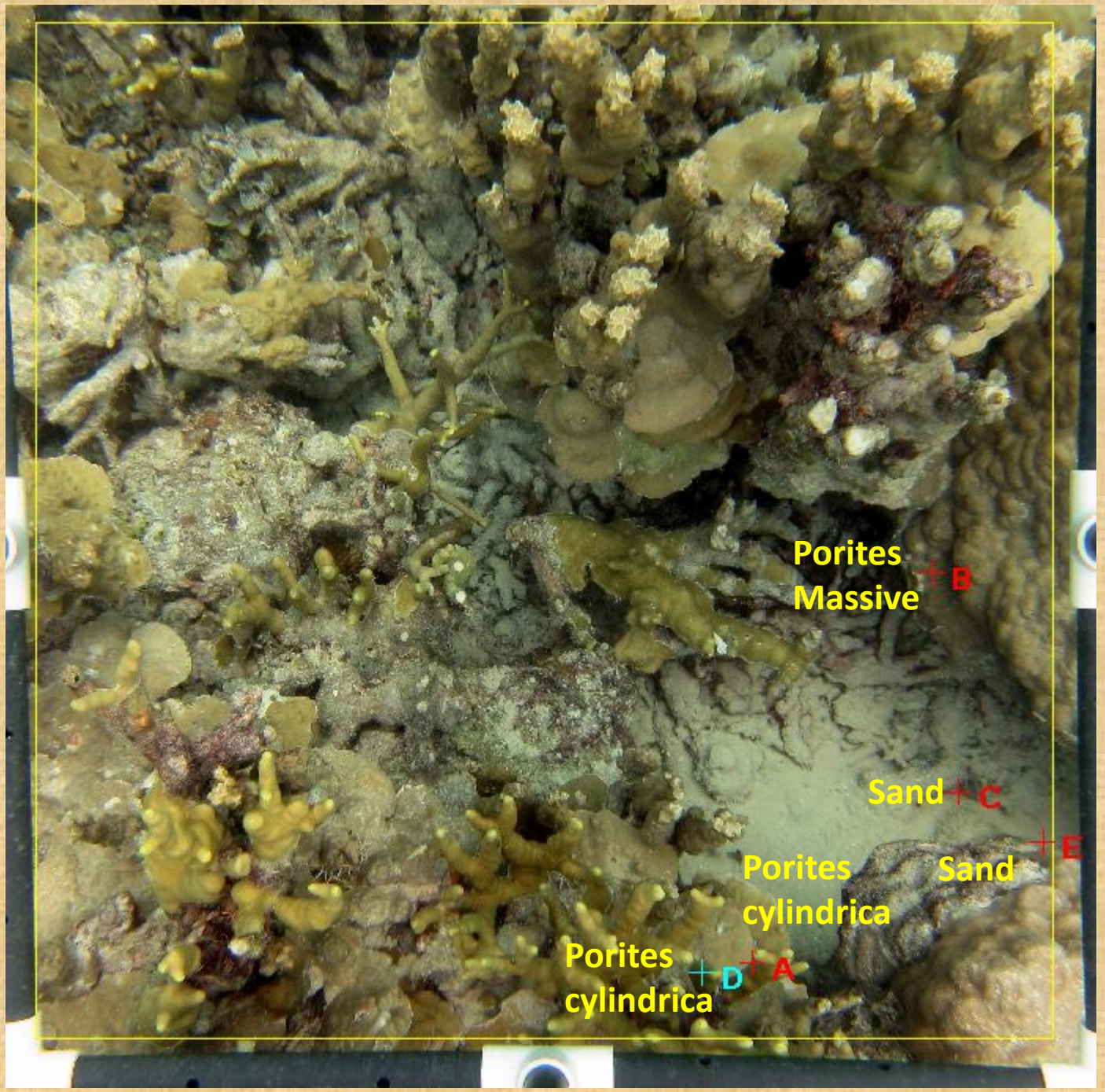

Ascidian
B
A
Ascidian
FCA
CCA
C
D
FCA
E

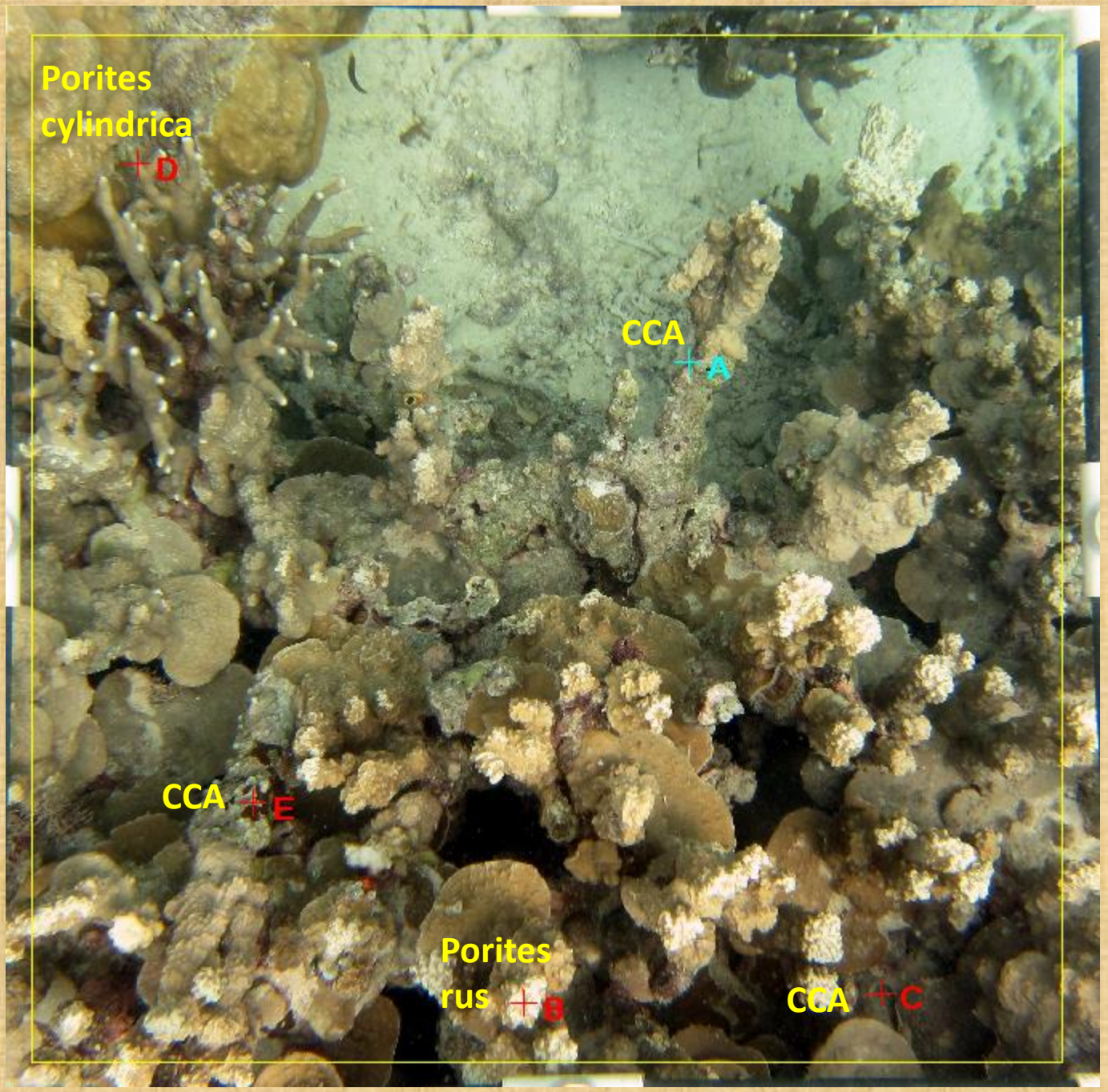

CCA
D
C
CCA
A
CCA
B
BCA
BCA
E

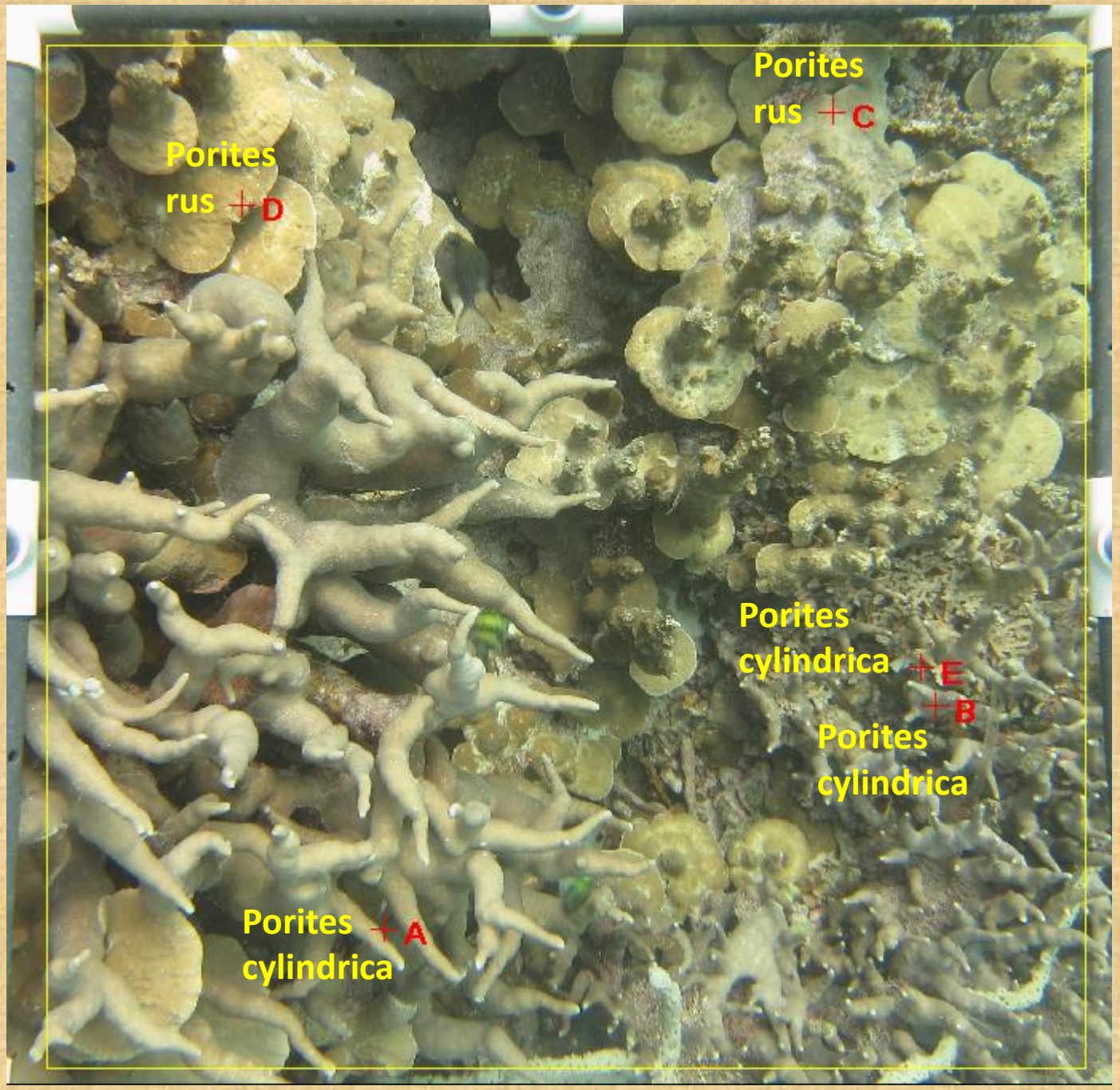

FCA
C
Ascidian
A
D
Ascidian
BCA
E
B
FCA

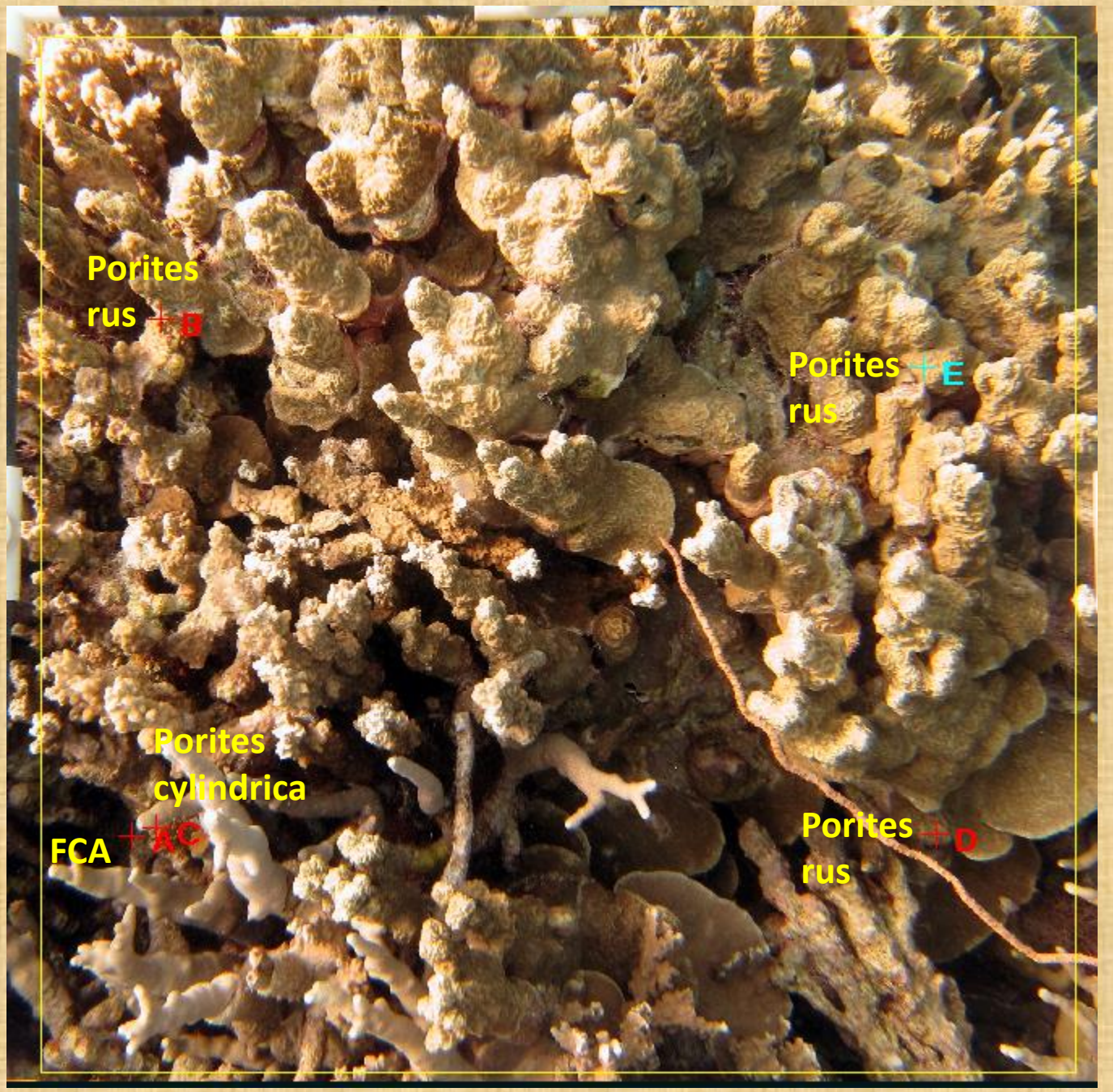

B
CCA
Turf
E
Sand
A
D
Sand
Turf
C

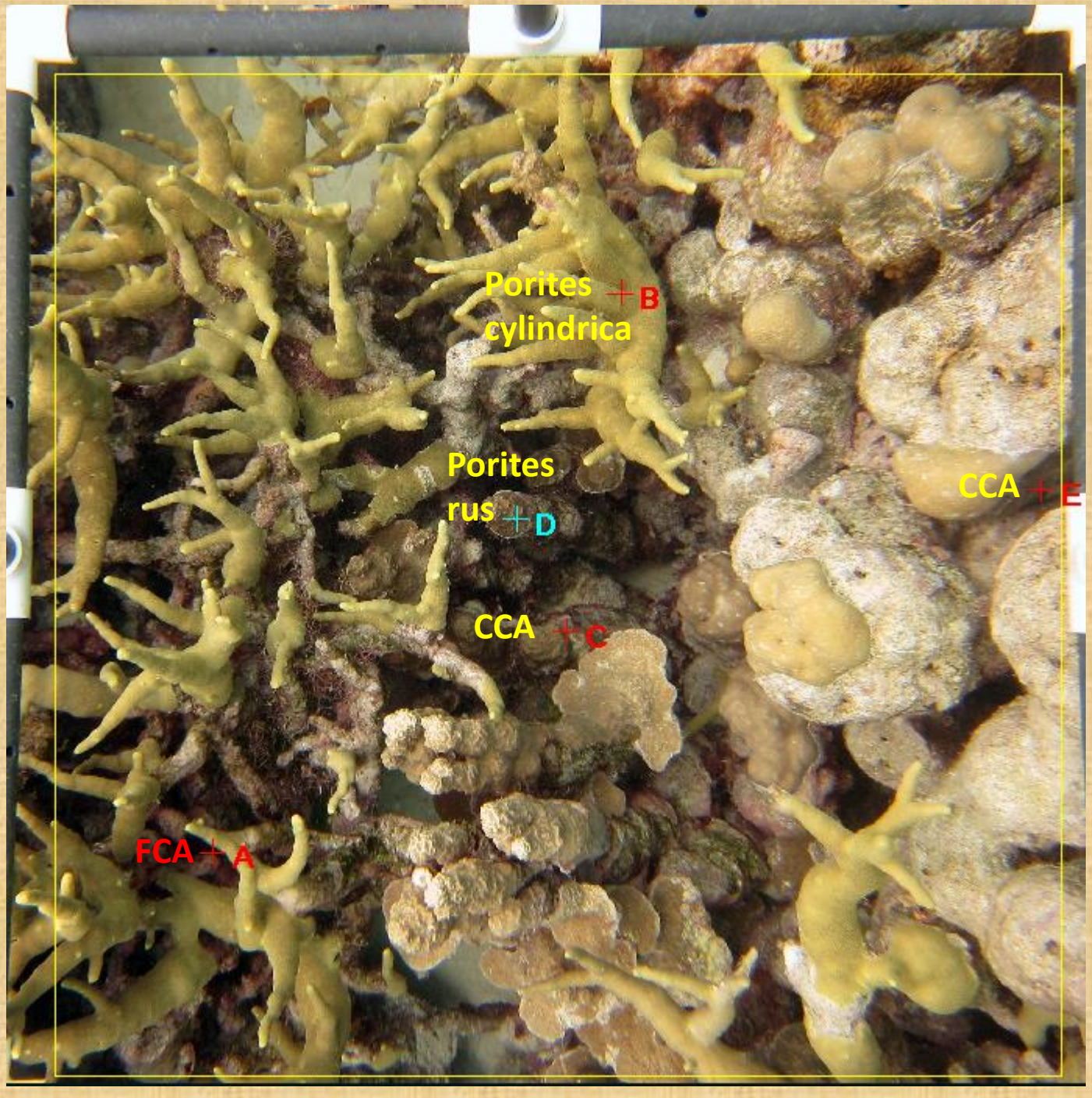

Porites rus A
Porites cylindrica C
Porites rus B
Porites cylindrica E
Porites rus D


Porites
Massive
B
Sand
C
E
Porites
cylindrica
Sand
Porites
cylindrica
D
A

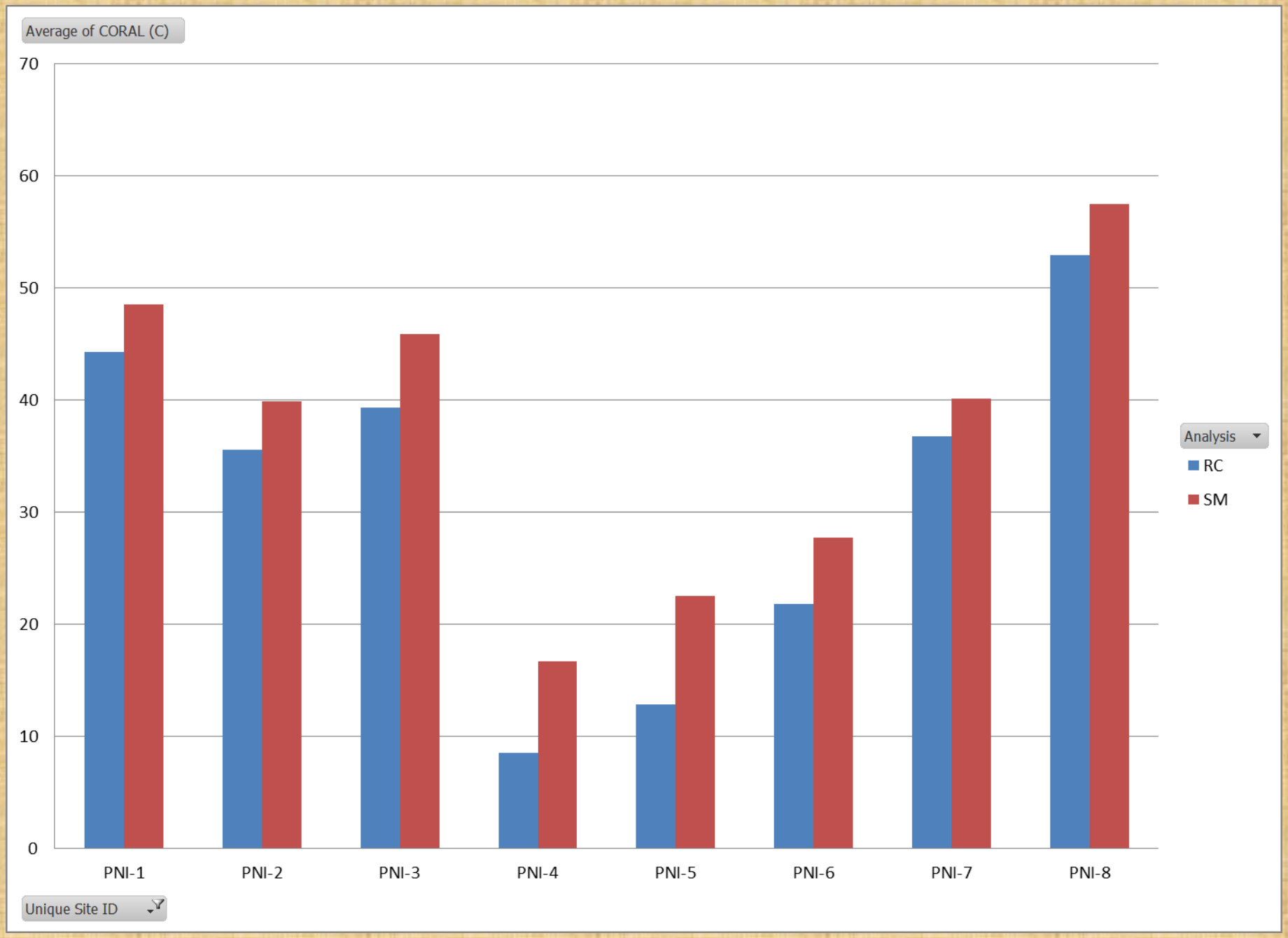

Porites cylindrica
D
CCA
A
CCA
E
Porites rus
B
CCA
C

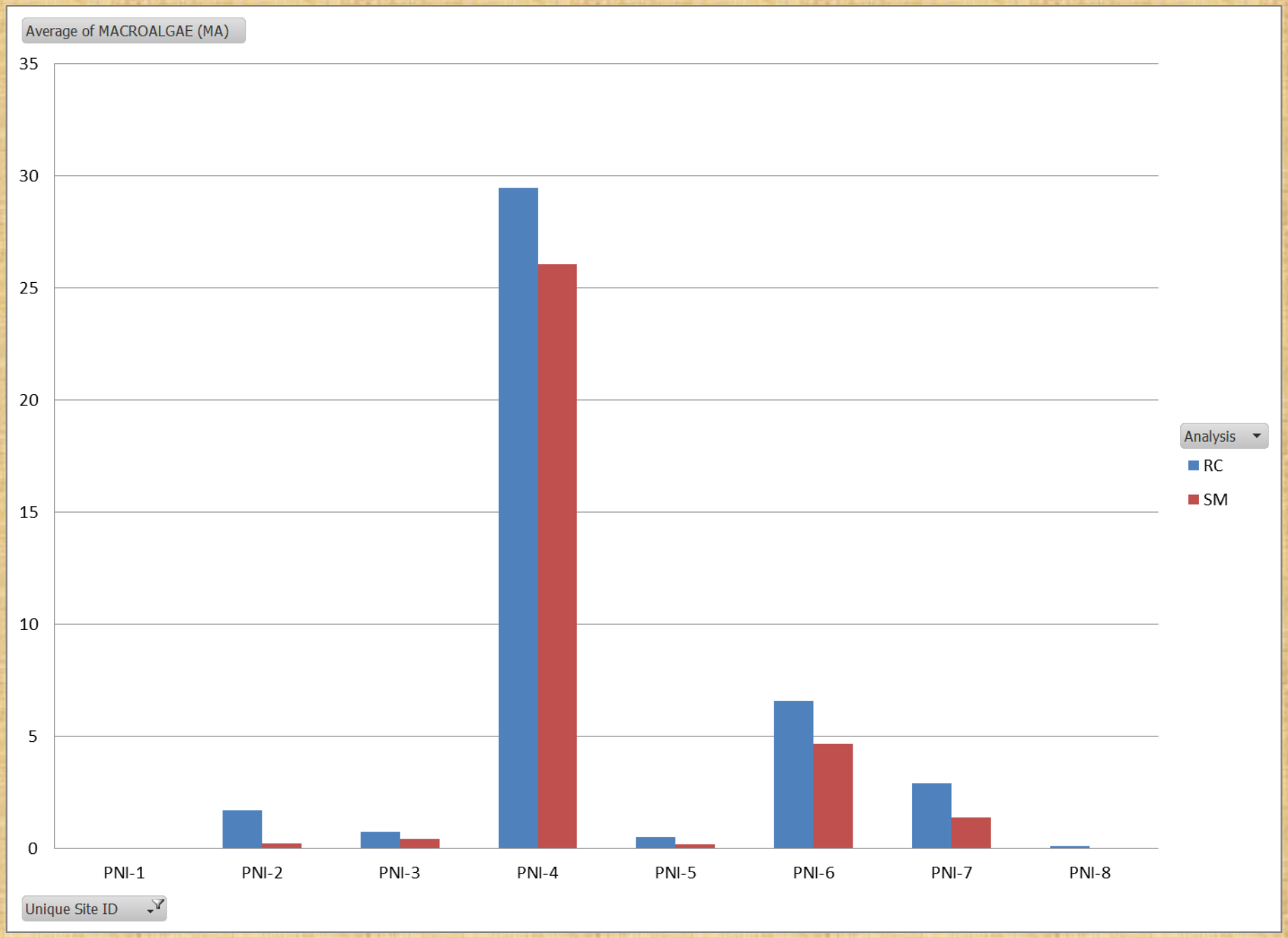

Porites rus
C
Porites rus
D
Porites cylindrica
E
B
Porites cylindrica
Porites cylindrica
A

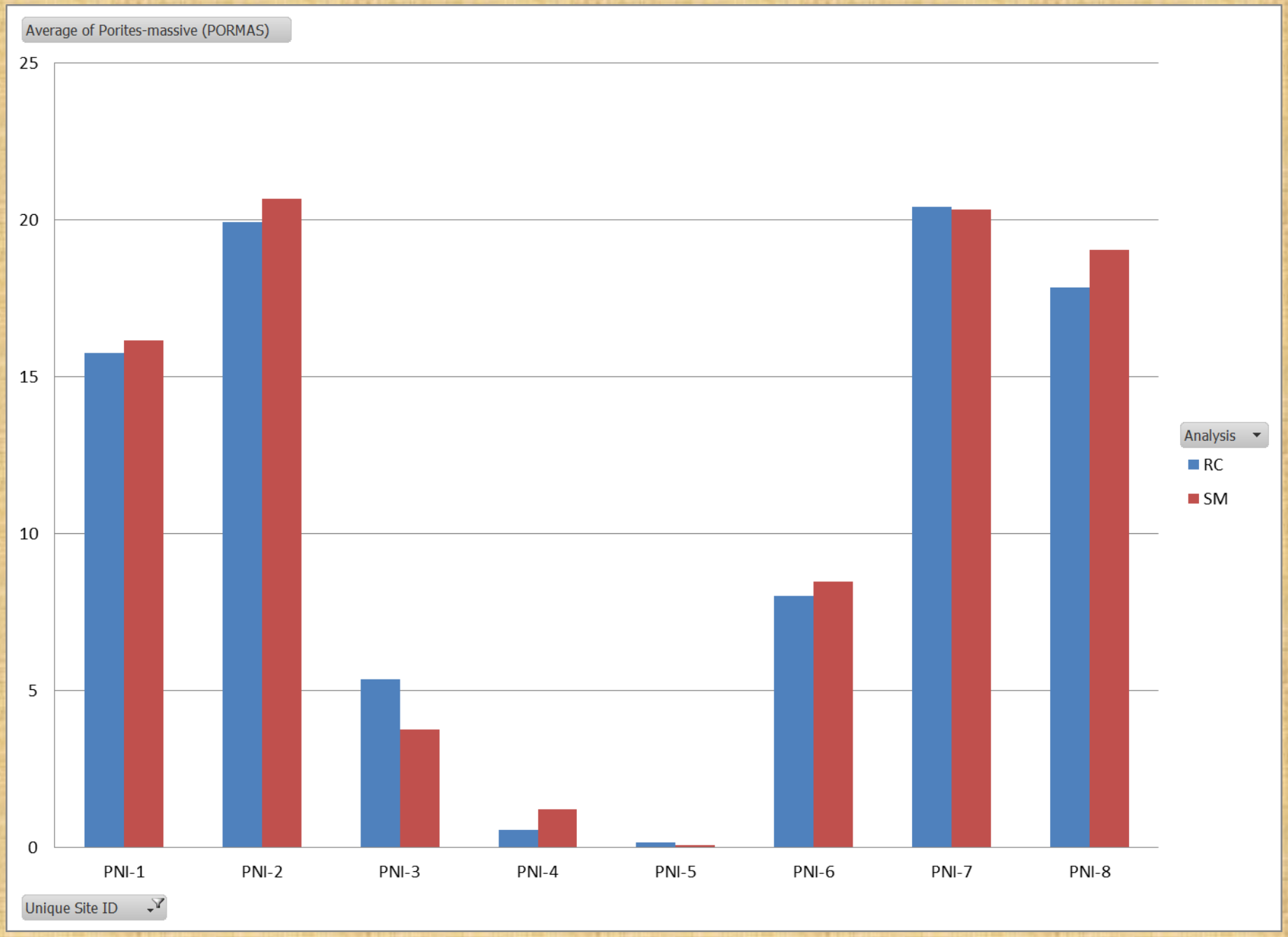

Porites rus B
Porites rus E
Porites cylindrica
FCA AG
Porites rus D

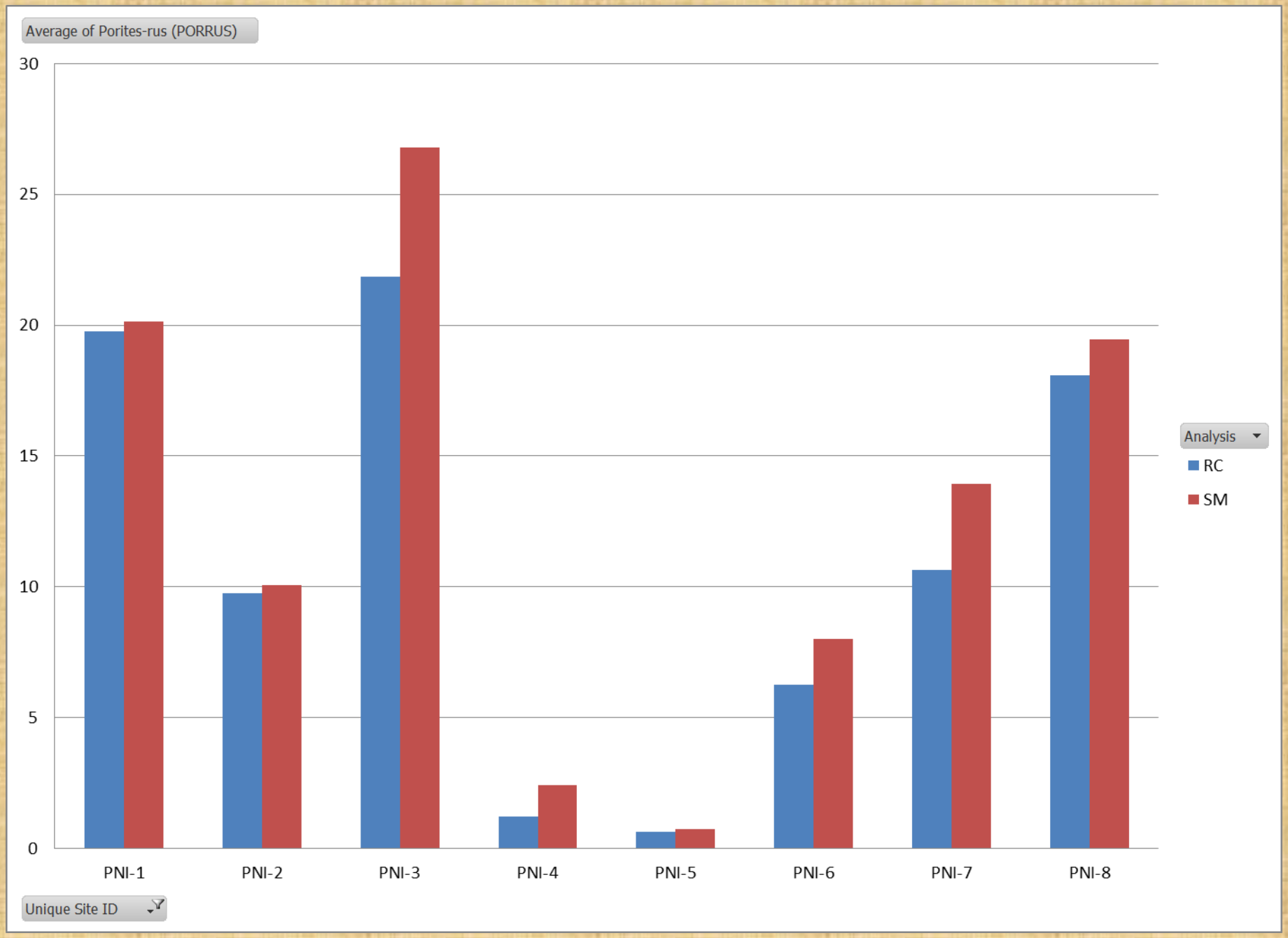

Porites cylindrica
B
Porites rus
D
CCA
C
CCA
E
FCA
A

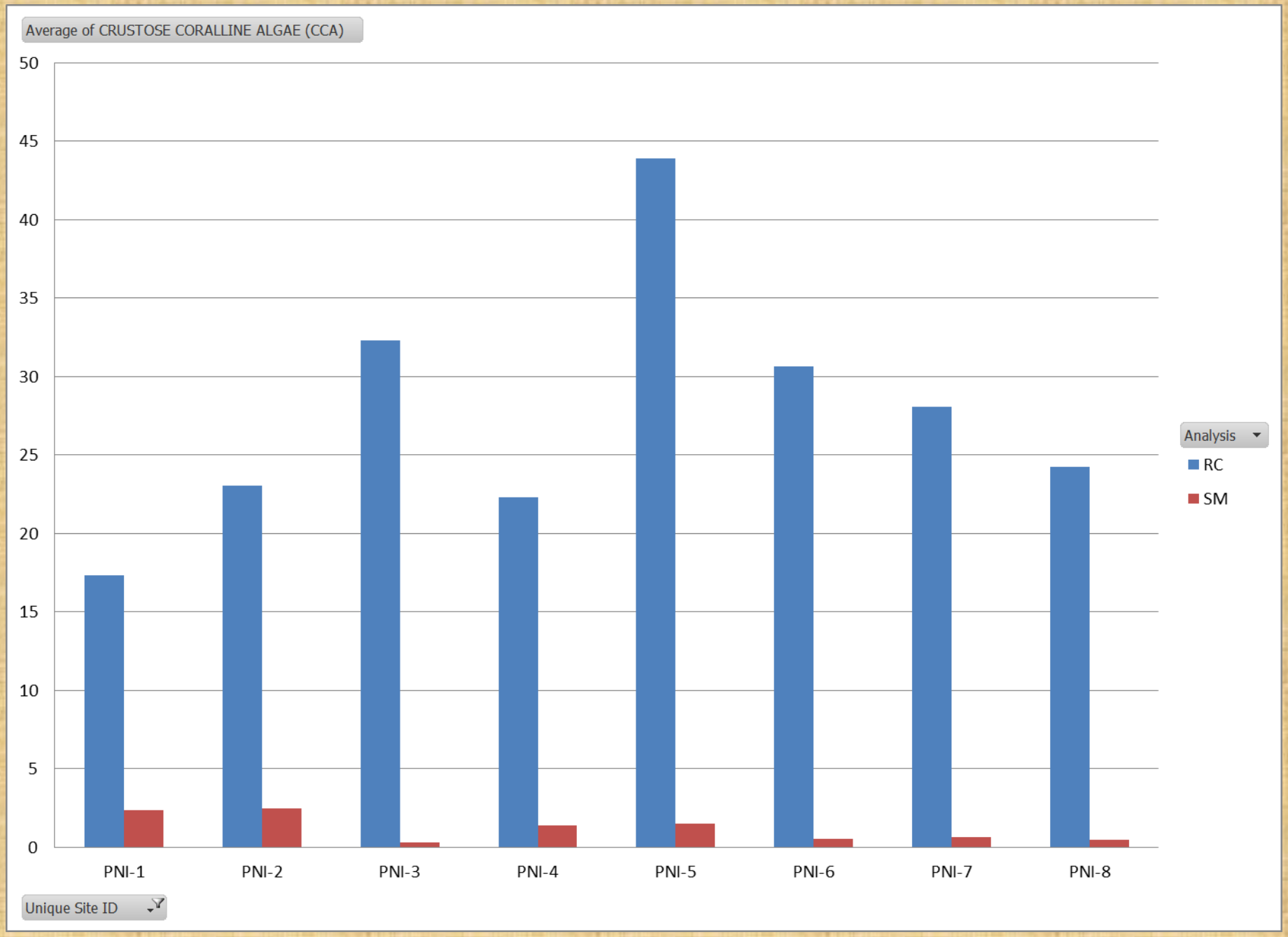
Comparative pivot tables for Pohnpei

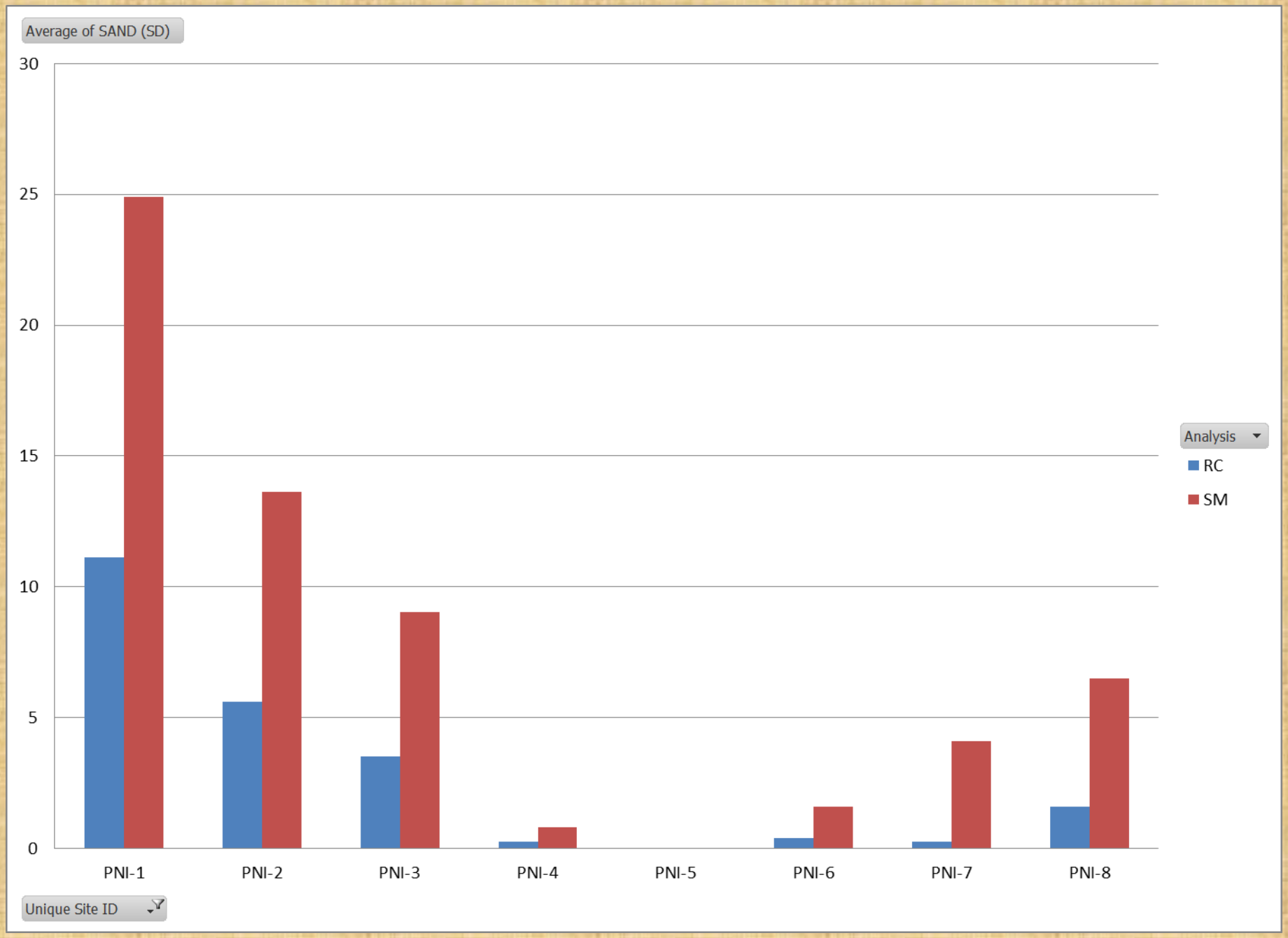

Average of CORAL (C)
70
60
50
40
30
20
10
0
PNI-1
PNI-2
PNI-3
PNI-4
PNI-5
PNI-6
PNI-7
PNI-8
Analysis
RC
SM
Unique Site ID

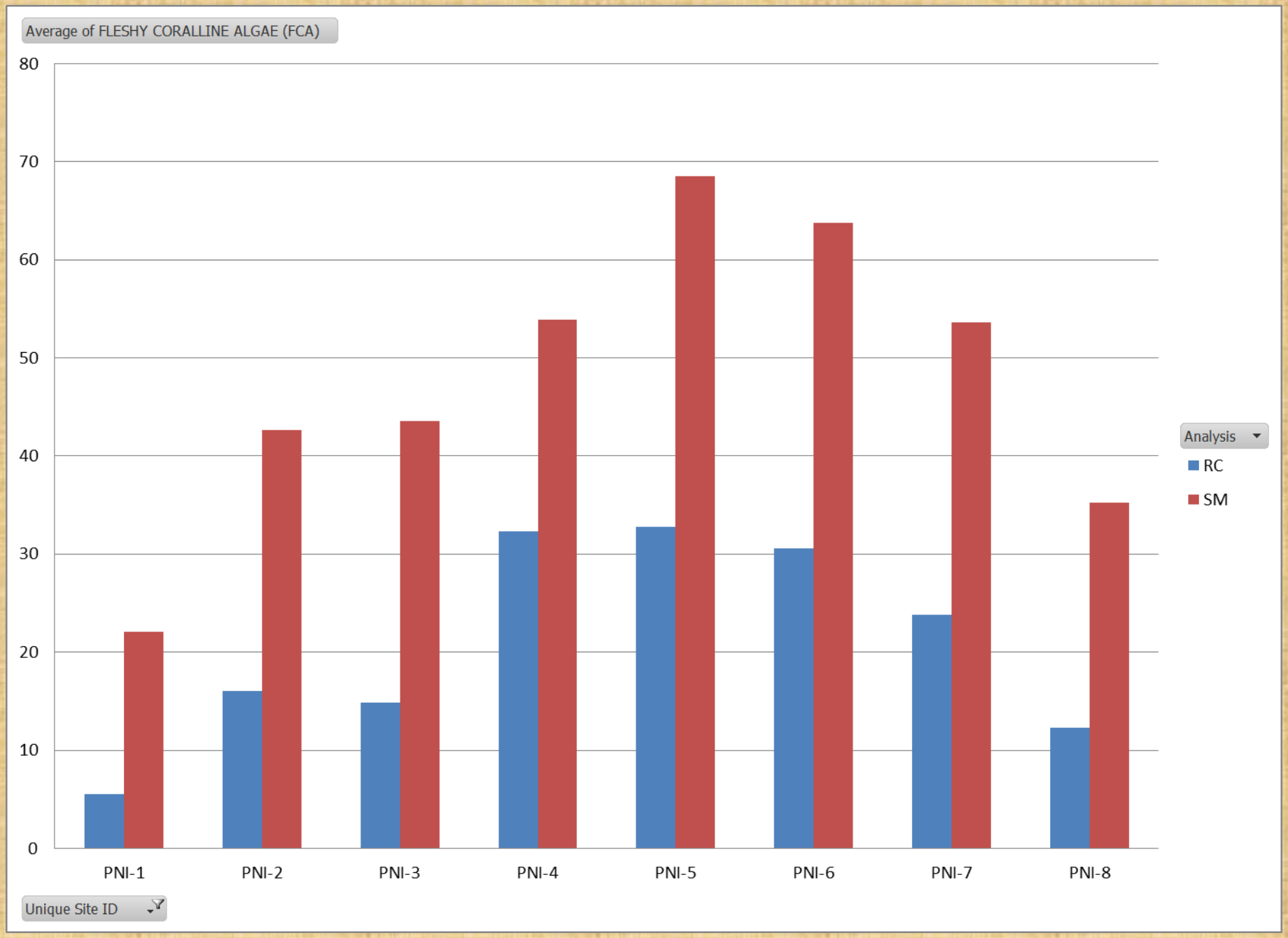

Average of MACROALGAE (MA)
35
30
25
20
15
10
5
0
PNI-1
PNI-2
PNI-3
PNI-4
PNI-5
PNI-6
PNI-7
PNI-8
Unique Site ID
Analysis
RC
SM

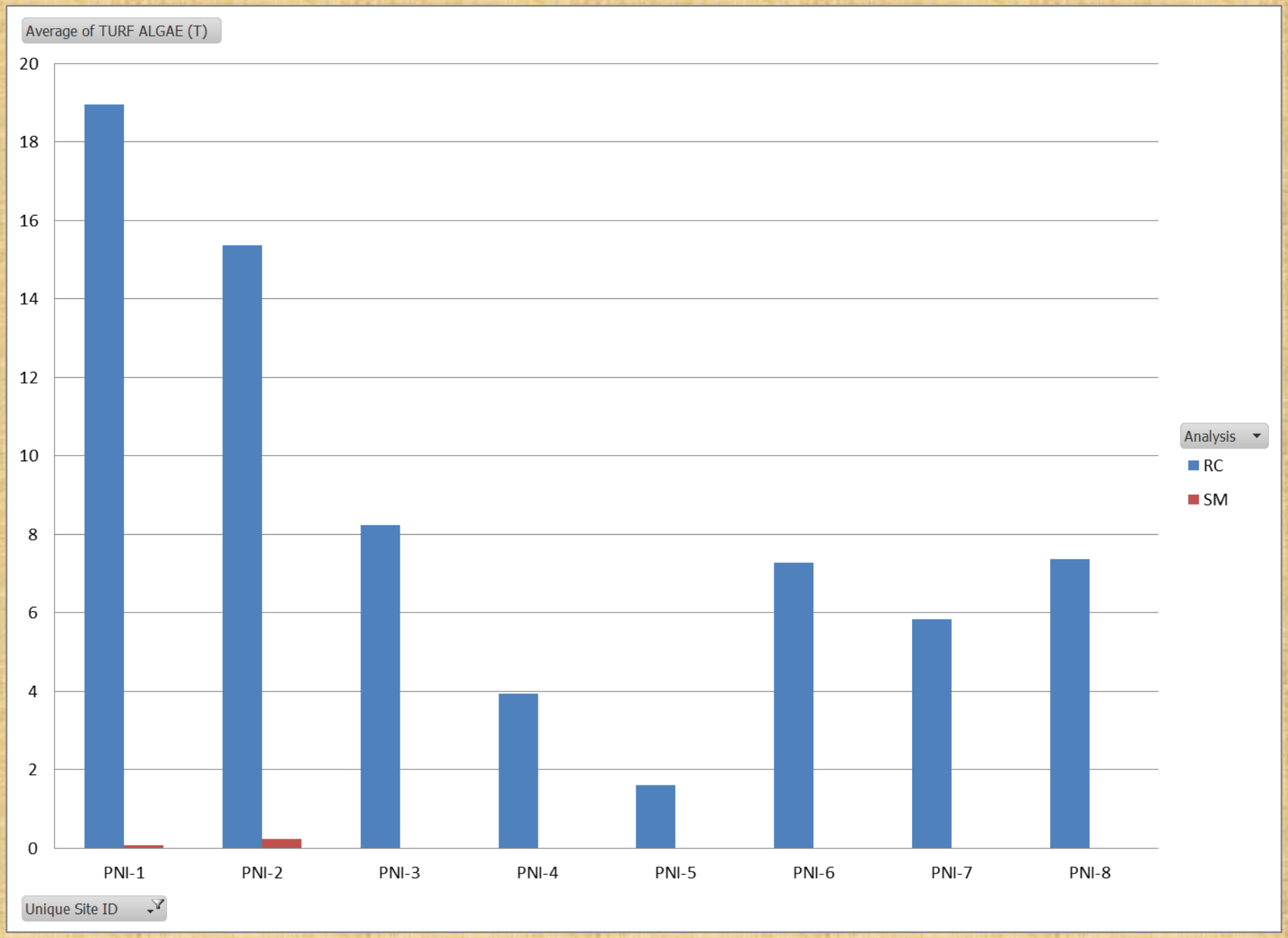

Average of Porites-massive (PORMAS)
25
20
15
10
5
0
PNI-1
PNI-2
PNI-3
PNI-4
PNI-5
PNI-6
PNI-7
PNI-8
Analysis
RC
SM
Unique Site ID

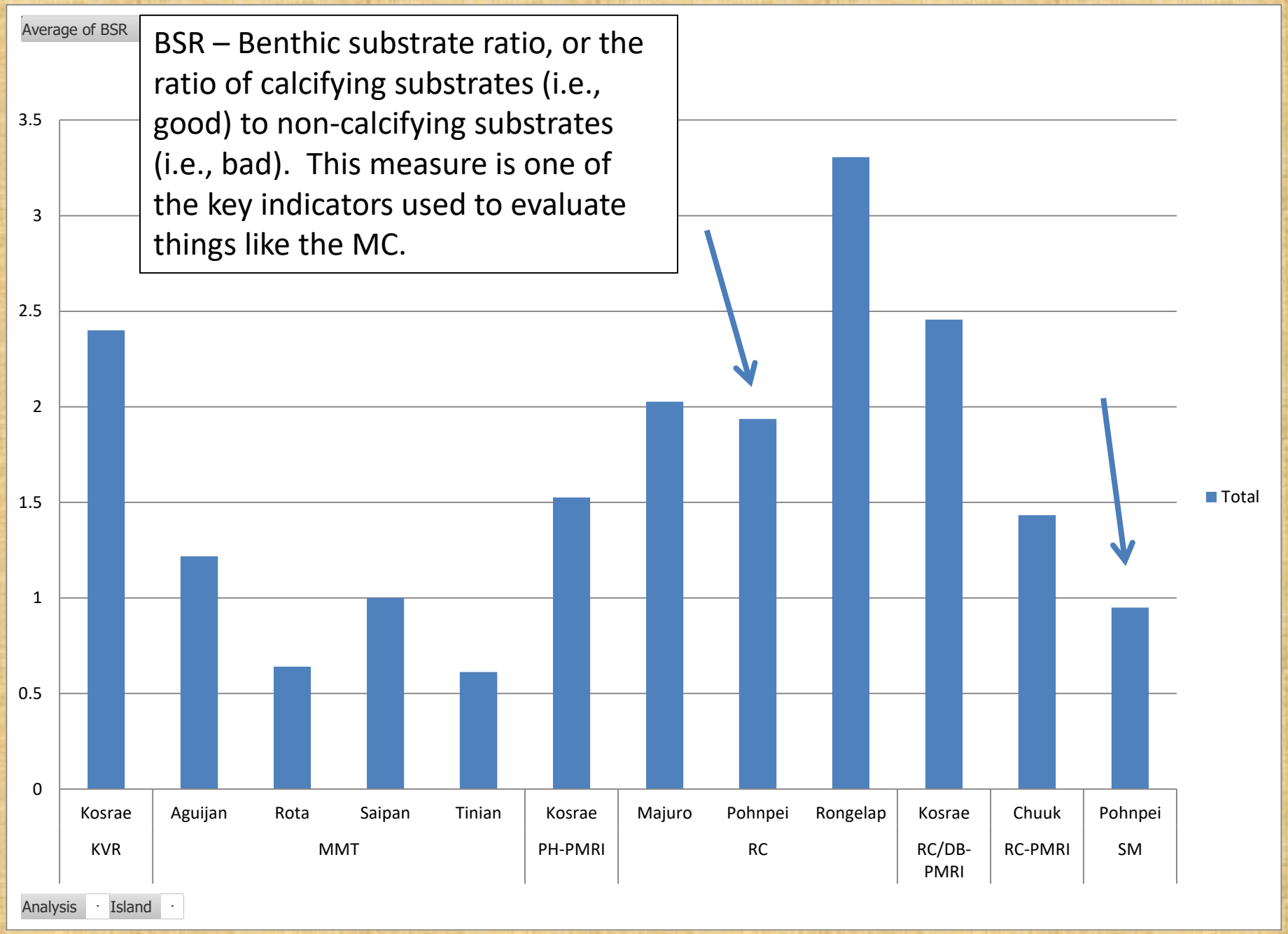

Average of Porites-rus (PORRUS)
30
25
20
15
10
5
0
PNI-1
PNI-2
PNI-3
PNI-4
PNI-5
PNI-6
PNI-7
PNI-8
Unique Site ID
Analysis
RC
SM


Average of CRUSTOSE CORALLINE ALGAE (CCA)
50
45
40
35
30
25
20
15
10
5
0
PNI-1
PNI-2
PNI-3
PNI-4
PNI-5
PNI-6
PNI-7
PNI-8
Unique Site ID
Analysis
RC
SM


Average of SAND (SD)
30
25
20
15
10
5
0
PNI-1
PNI-2
PNI-3
PNI-4
PNI-5
PNI-6
PNI-7
PNI-8
Unique Site ID
Analysis
RC
SM


Average of FLESHY CORALLINE ALGAE (FCA)
80
70
60
50
40
30
20
10
0
PNI-1
PNI-2
PNI-3
PNI-4
PNI-5
PNI-6
PNI-7
PNI-8
Analysis
RC
SM
Unique Site ID


Average of TURF ALGAE (T)
20
18
16
14
12
10
8
6
4
2
0
PNI-1
PNI-2
PNI-3
PNI-4
PNI-5
PNI-6
PNI-7
PNI-8
Analysis
RC
SM
Unique Site ID


Average of BSR
BSR – Benthic substrate ratio, or the ratio of calcifying substrates (i.e., good) to non-calcifying substrates (i.e., bad). This measure is one of the key indicators used to evaluate things like the MC.
3.5
3
2.5
2
1.5
1
0.5
0
Total
Kosrae
Aguijan
Rota
Saipan
Tinian
Kosrae
Majuro
Pohnpei
Rongelap
Kosrae
Chuuk
Pohnpei
KVR
MMT
PH-PMRI
RC
RC/DB-PMRI
RC-PMRI
SM
Analysis
Island