

Ongoing Reef Replenishment in Southern Belize with an Emphasis on Mapping and Quantifying Natural and Replenished Acroporid Cover

FRAGMENTS
of HOPE



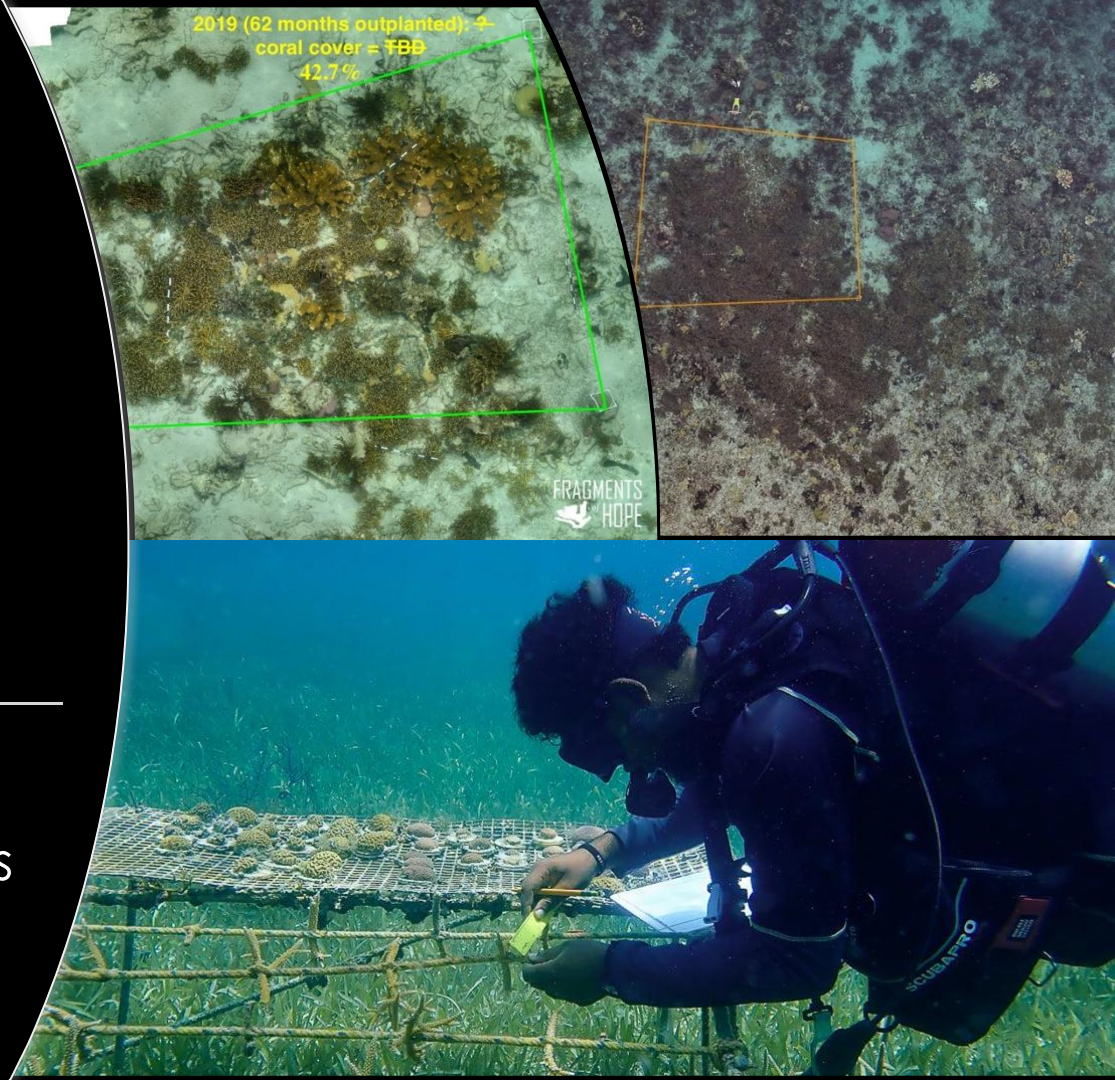
Belize Marine Fund
2nd Biennial Conference

Lisa Carne lisasinbelize@gmail.com
Jamani Balderamos jbalderamos@gmail.com
Steve Schill sschill@tnc.org
Emily Peters epete156@yahoo.com



How much reef have you replenished?

Methods to quantify:
Growth rates
Diver based photo mosaics
Drone ortho mosaics

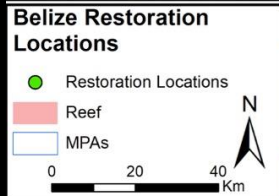


Drones



- With large-scale success at restoration sites, a method to quantify the full extent of coral growth was needed
- Drones provide a high-resolution, bird's eye view of restoration sites capturing the full extent of shallow coral cover

- Our strategy to date:
 - Mapping extant acroporids (during hottest months)
 - SHALLOW SITES!
 - Host & symbiont genetics
 - Outplanting multiple genets in proximity
 - & documenting spawning (**success!**)



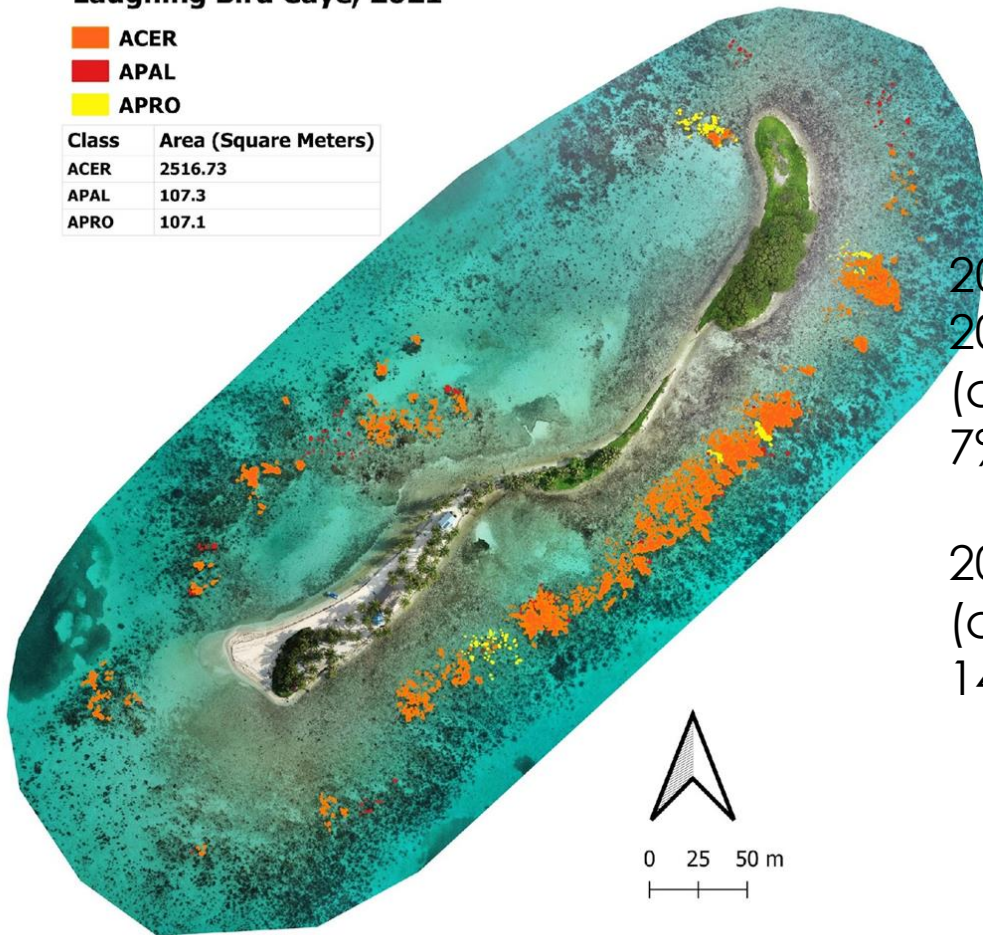
Basemap: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
 Esri, Garmin, GEBCO, NOAA NODC, and other

Laughing Bird Caye, 2021

- ACER
- APAL
- APRO

Class	Area (Square Meters)
ACER	2516.73
APAL	107.3
APRO	107.1

Total



2019: 2240m²
2020: 2347m²
(change=157 or 7%)

2021: 2730m²
(change=333 or 14%)



sub-site 13

Moho Caye Aug, 2021

ACER
APAL



UTM Zone 16N
WGS 84

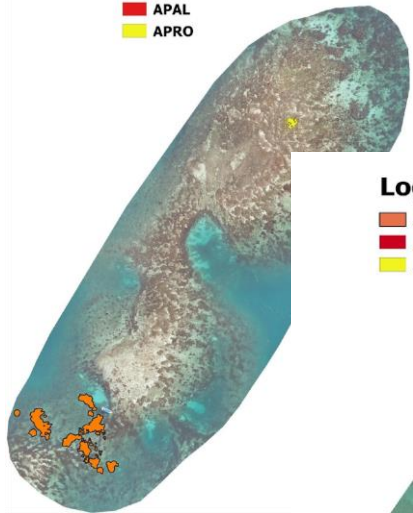
Moho Caye

- Unprotected restoration site
- 22,630 frags (2015-2021)
- Mostly Apal micro frags 2020-2021
- Recreation and tourism use

Species	Year/m ²			Diff.
	2019	2020	2021	
ACER	218	217	439	221

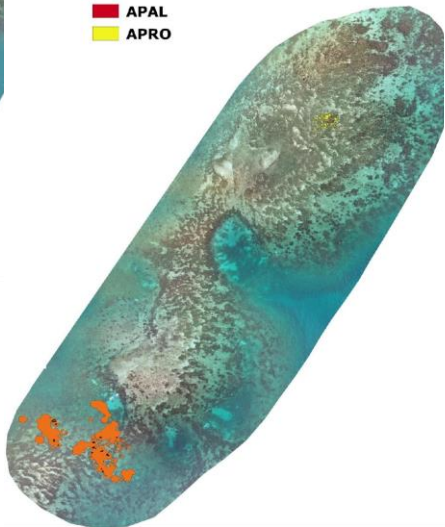
Loggerhead Caye 2019

- ACER
- APAL
- APRO



Loggerhead Caye 2020

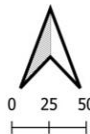
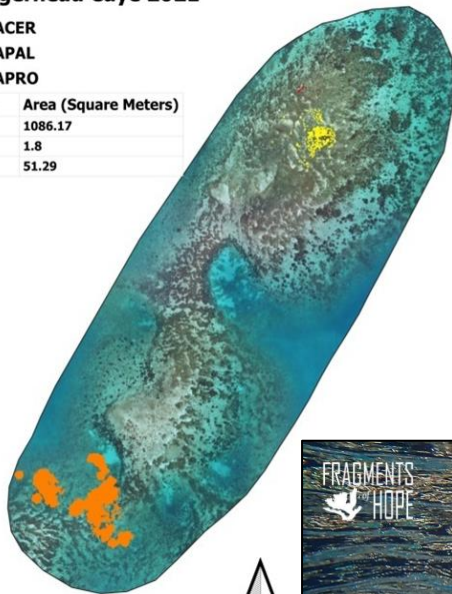
- ACER
- APAL
- APRO



Loggerhead Caye 2021

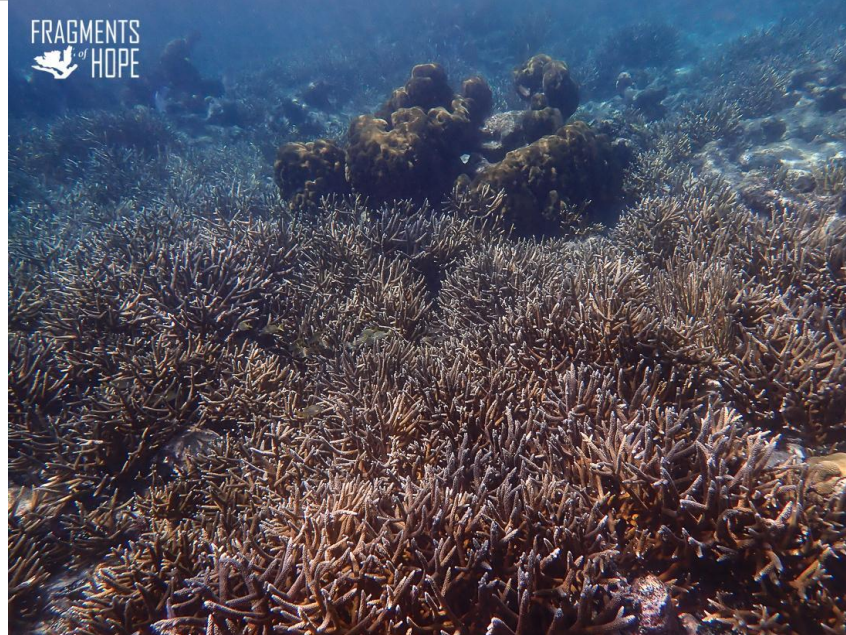
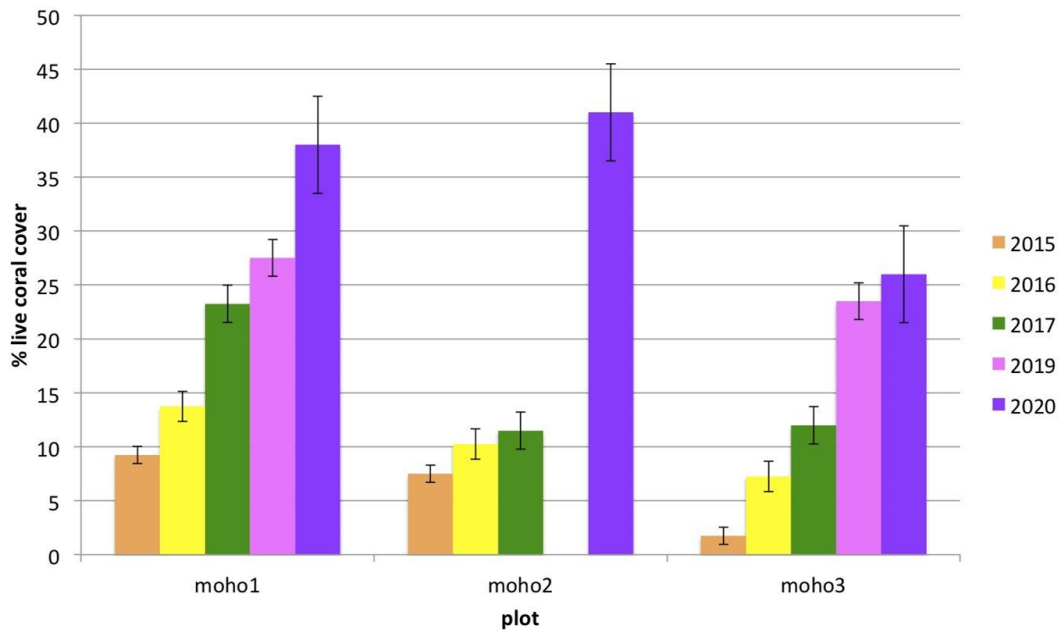
- ACER
- APAL
- APRO

Class	Area (Square Meters)
ACER	1086.17
APAL	1.8
APRO	51.29



Live coral cover on three Moho Caye Mosaics: 2015-2020*

Note Hurricane Earl was August 2016



Sub-site	Area m ²	Outplant date	% acropora of total live coral
moho1	120	12-2015	31 of 38% (2020)
moho2	101	12-2015	32 of 41% (2020)
moho3	105	12-2015	23 of 26% (2020)

Belize_FOH_12Nov20_Benthic_Classes_v2

Class_name

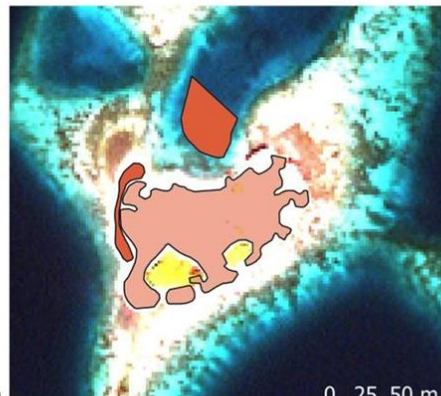
- Land Barren/Sand
- Grass/Low veget:
- Hardbottom
- Mangrove
- Mangrove Wet/S
- Muddy Bottom
- Reef
- Reef Rubble
- Reef Shallow
- Reef Shallow Alg
- Sand
- Seagrass Dense
- Seagrass Sparse

Class	Hectares
Land Barren/Sand	22.6
Grass/Low vegetation	3.0

Altered Land Vs. Total Land Mass

- Borrow Area
- Filled Area

Percent Change | 8%



0 1 2 km

0 25 50 m

ESS,
alize
elop



Lessons Learned & Next Steps

- Drones only work in shallow sites
- Restricted conditions (early AM light, no breeze, no rain)
- Costs & casualties (drone > \$1500, multiple batteries needed, software expenses, replacements)
- Subjectivity in classification
- **Equate shallow restoration with shoreline protection**
- Continue to quantify yearly changes

Key Donors & partners

Contact: lisasinbelize@gmail.com

