Restoration 2021 Expansion & Advances

Jessica Levy
Restoration Program Manager

RESTORATION
EDUCATION
SCIENCE

CORAL RESTORATION FOUNDATION™

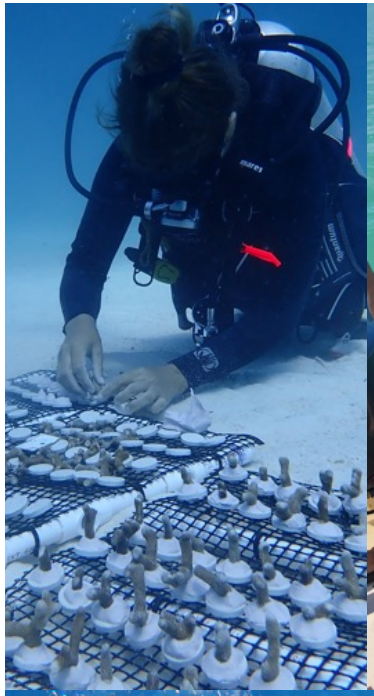
RESTORATION 2021

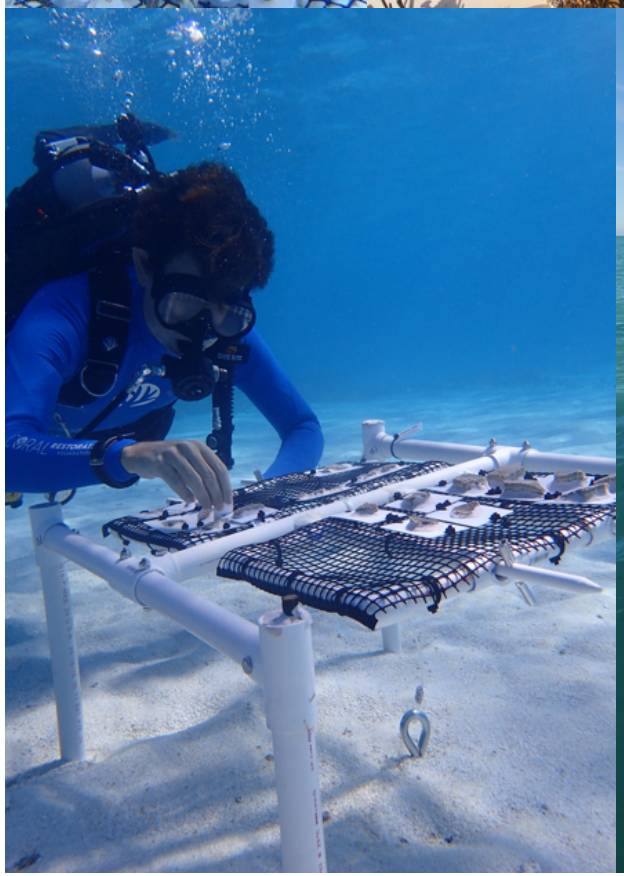
- In 2021, we aim to return 41,000 corals at nine sites
  - 21,615 staghorn
  - 14,939 elkhorn
  - 4,700 boulder
- Efforts in support of M:IR
  - Carysfort Complex
  - Horseshoe Reef
  - Cheeca Rocks
  - Sombrero Reef
  - Newfound Harbor
  - Looe Key
  - Eastern Dry Rocks
- To support restoration efforts 2021 will focus on capacity building and innovation within nurseries and restoration methods.

Expansion

Nursery-based

- Carysfort expanded from 100 to 160 structures.
- Key West expanded from 50 to 150 structures
- Addition of Pickles table nursery
- Addition of Looe Key nursery

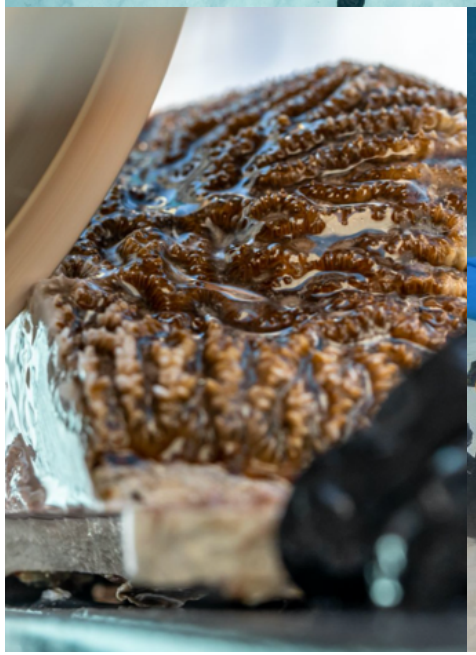




Nursery-based Advances

Novel Coral Propagation Methods

- Multi-species
- Corals collected from FKEC structures from Marathon to Card Sound
- Represent novel source of coral w/o damaging wild stands
- 458 colonies from 13 species
- Established in new Pickles table nursery as an intermediate step.



Nursery-based Advances

Coral Propagation Methods

- Pillar Coral
- Investigating both in-situ and ex-situ fragmentation methods and nursery performance
- Assist R&D phase 1 of M:IR
  - Goal to produce stock for outplant efforts in phase 2

Outplant-based Advances

Staghorn novel methods

- In 2019, we began developing techniques that will allow us to restore ecosystem functionality more quickly.
- This work involves getting larger corals out onto the reef – immediately restoring structural complexity.
- We are working with sustainable materials including bamboo and hemp rope.

Outplant-based Advances

Boulder coral novel methods

- Developed in collaboration with the Coral Restoration Consortium Engineering/Innovations group
- Engineered structures for outplanting boulder corals
  - Can "skirt" in nursery first
  - Expedited planting
  - Provides pristine substrate

WORK SUPPORTED BY:
NOAA #NA19NMF4630260
Monroe County TDC
Ocean Reef Club
Restore Act
National Fish & Wildlife Foundation *(NOAA & Armaco)*
And many others...

WORK PERMITED UNDER:
FKNMS-2019-012-V1
FKNMS-2019-193
FWC and ACOE

THANK YOU

FOR SPREADING OCEAN AWARENESS

This page intentionally left blank

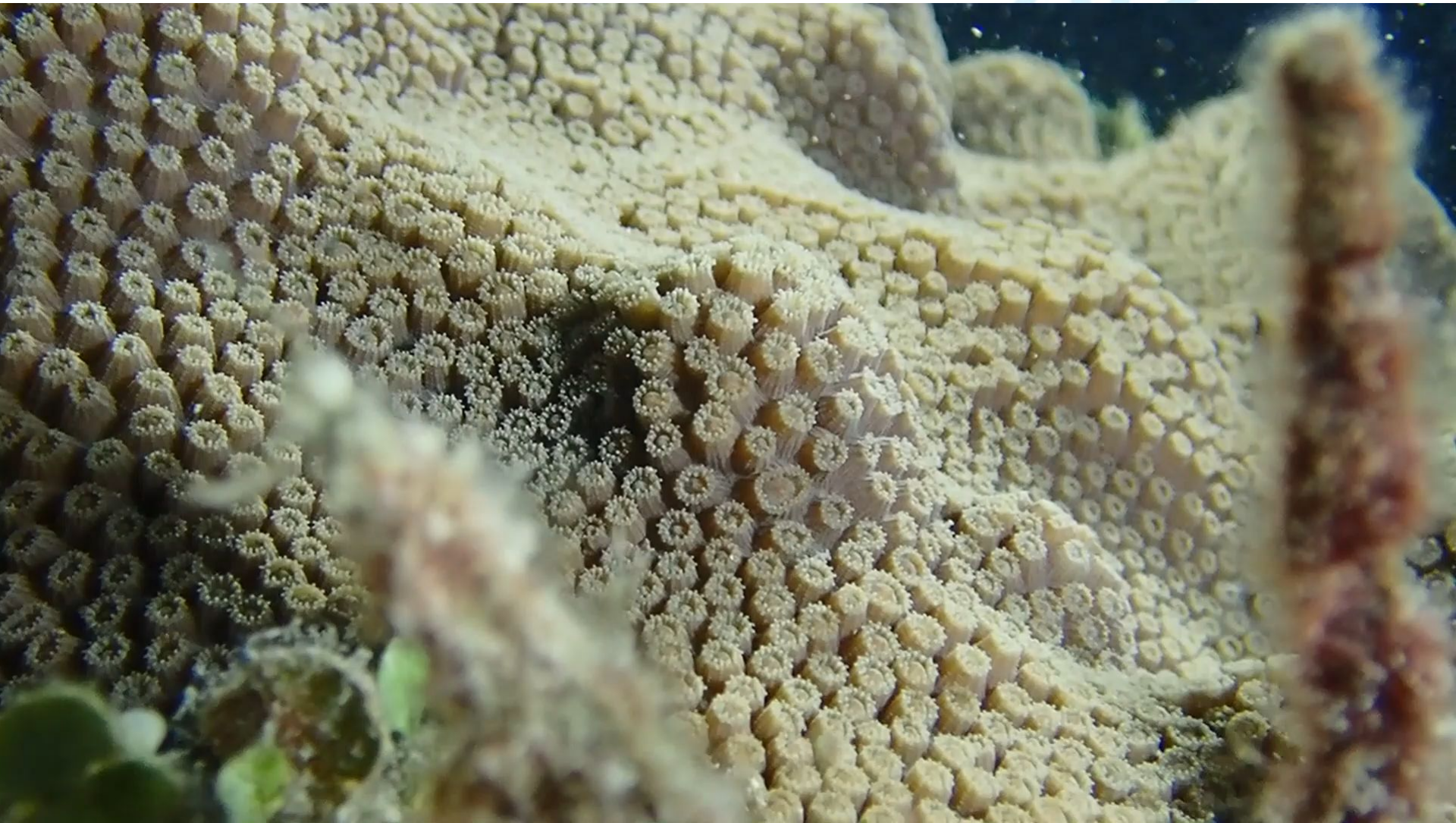
Coral Reproduction + Restoration

SAC Meeting 2/16/21

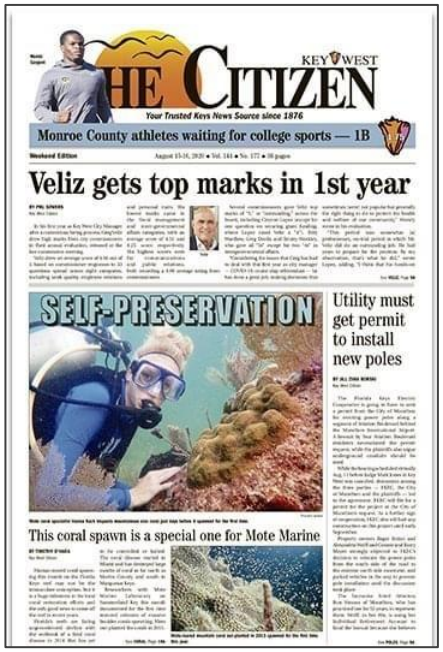
Dr. Hanna Koch
Postdoctoral Research Fellow
Coral Reef Restoration Program
Mote Marine Laboratory
Summerland Key, FL

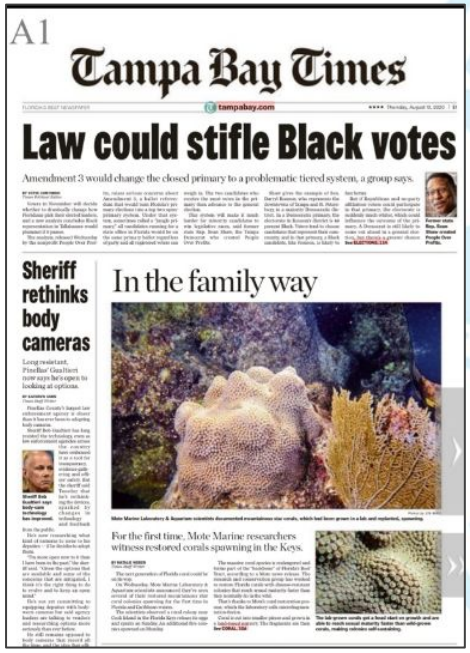
Restored mountainous star corals spawn

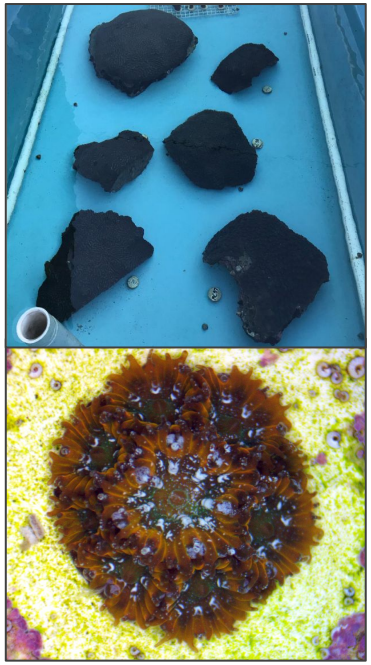
Orbicella faveolata

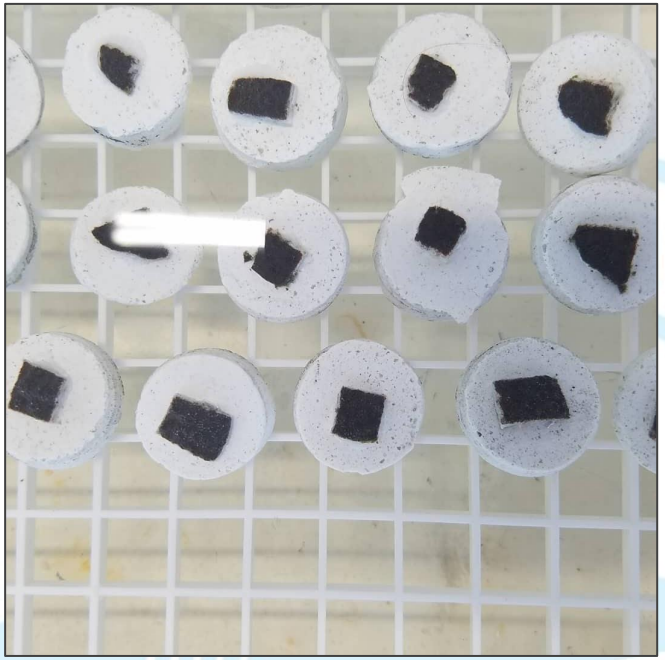


First corals of any slow-growing massive or mounding species documented to sexually reproduce after being restored to the reef

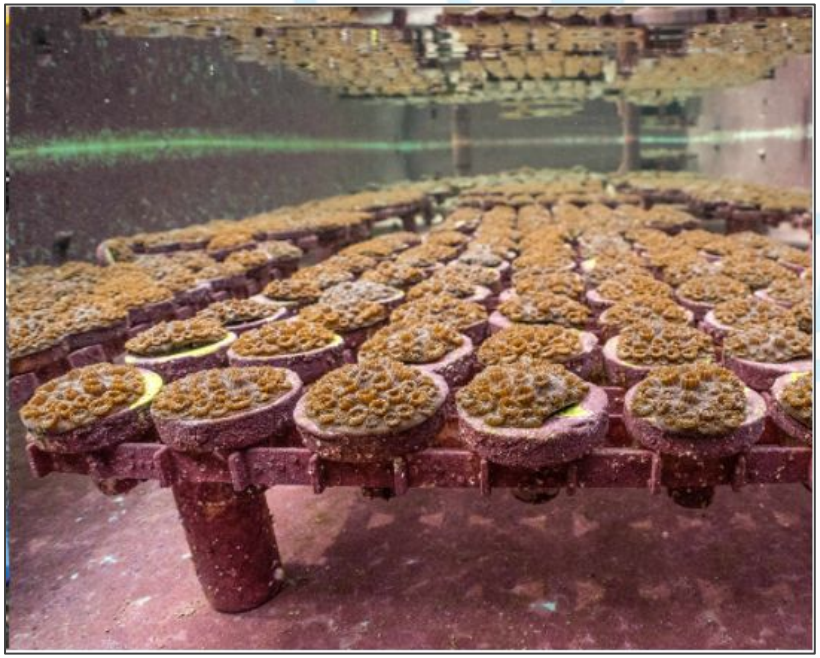




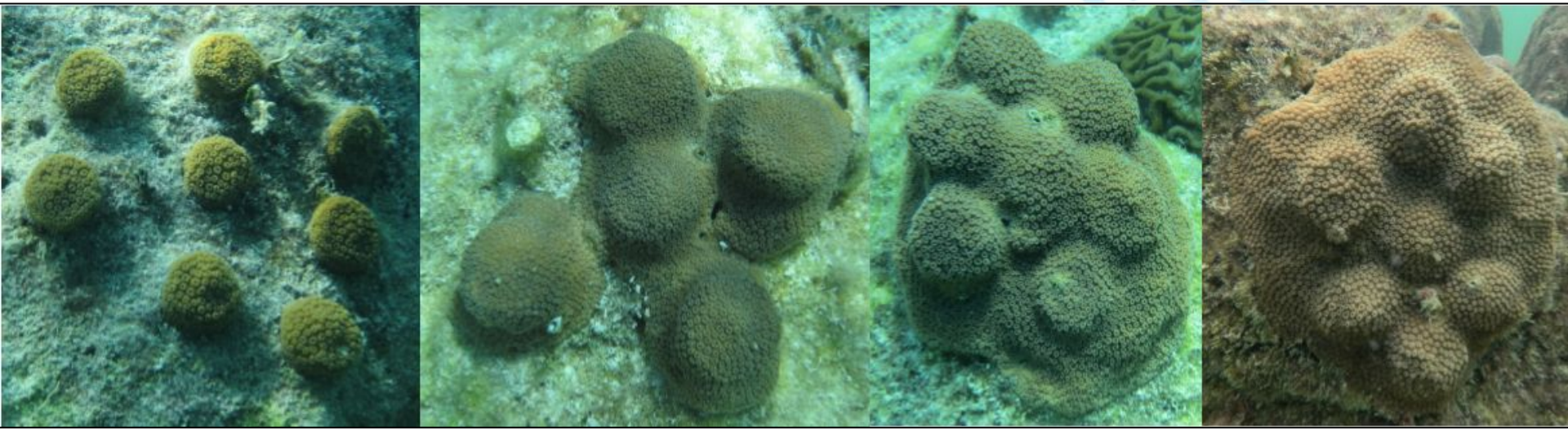




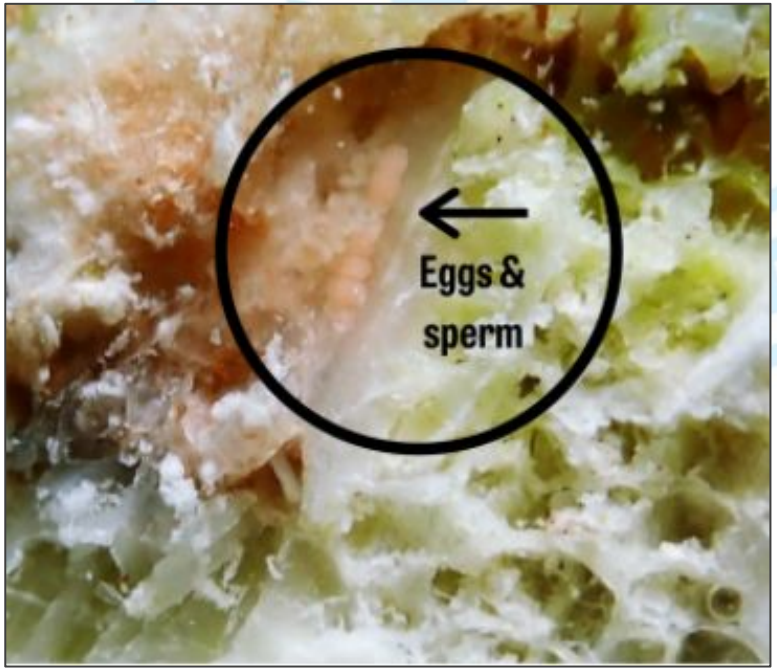
Microfragmentation + land-based nursery grow-out



Outplanting + reskinning



Monitoring



Cook Island Case Study (August 2020)

- Natural reproductive rhythms
  - Spawned during predicted peak window (NAFM) & timeframe (MAS)
  - Can cross-fertilize with outplants + wild colonies
  - Maximizes diversity
- High synchrony
  - Spawned within 10-min window
  - Supports more successful fertilization
- Resilient
  - Survived:
    - Bleaching events
    - Category-4 hurricane
    - SCTLD (most)
      - 2 treated with antibiotics
  - Spawned after being cored

Acropora assisted sexual reproduction

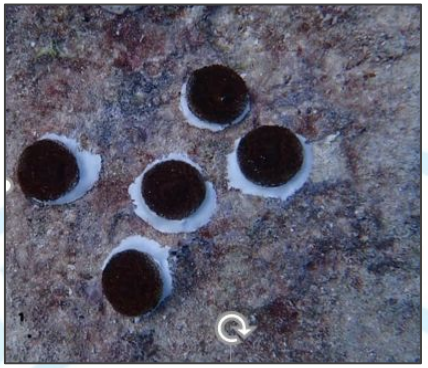
Staghorn (*A. cervicornis*)

Stress-tested parental genotypes

3 yrs = >1500 new sexually produced genotypes into Mote's restoration gene pool

Outplanted:

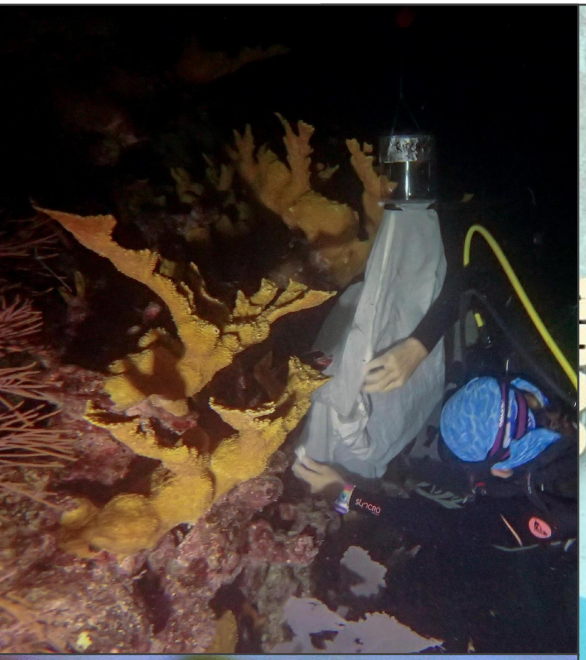
- 300 genotypes, > 1750 corals,
- 100% genotype survival, 96% frag survival

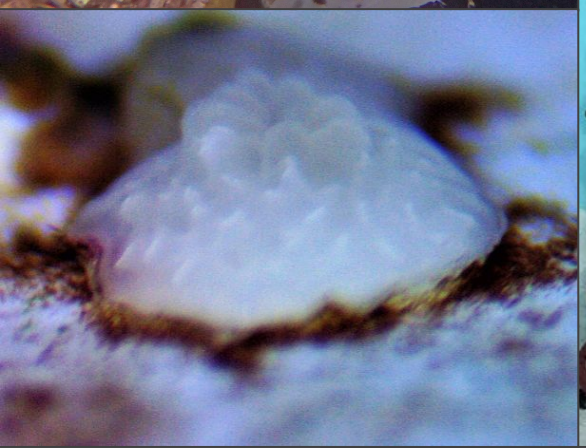


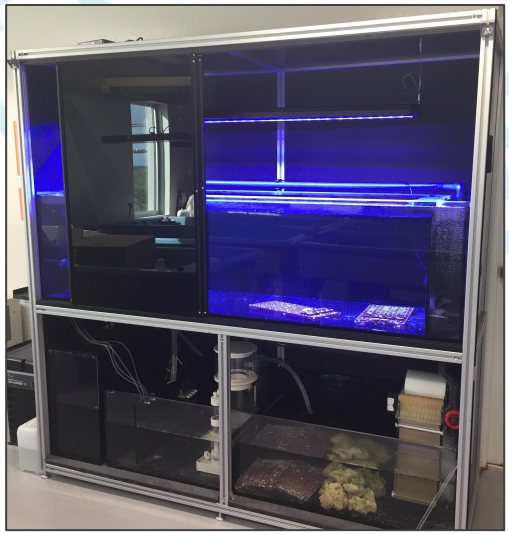
Acropora assisted sexual reproduction

Elkhorn (*A. palmata*)

~300 new sexually produced genotypes



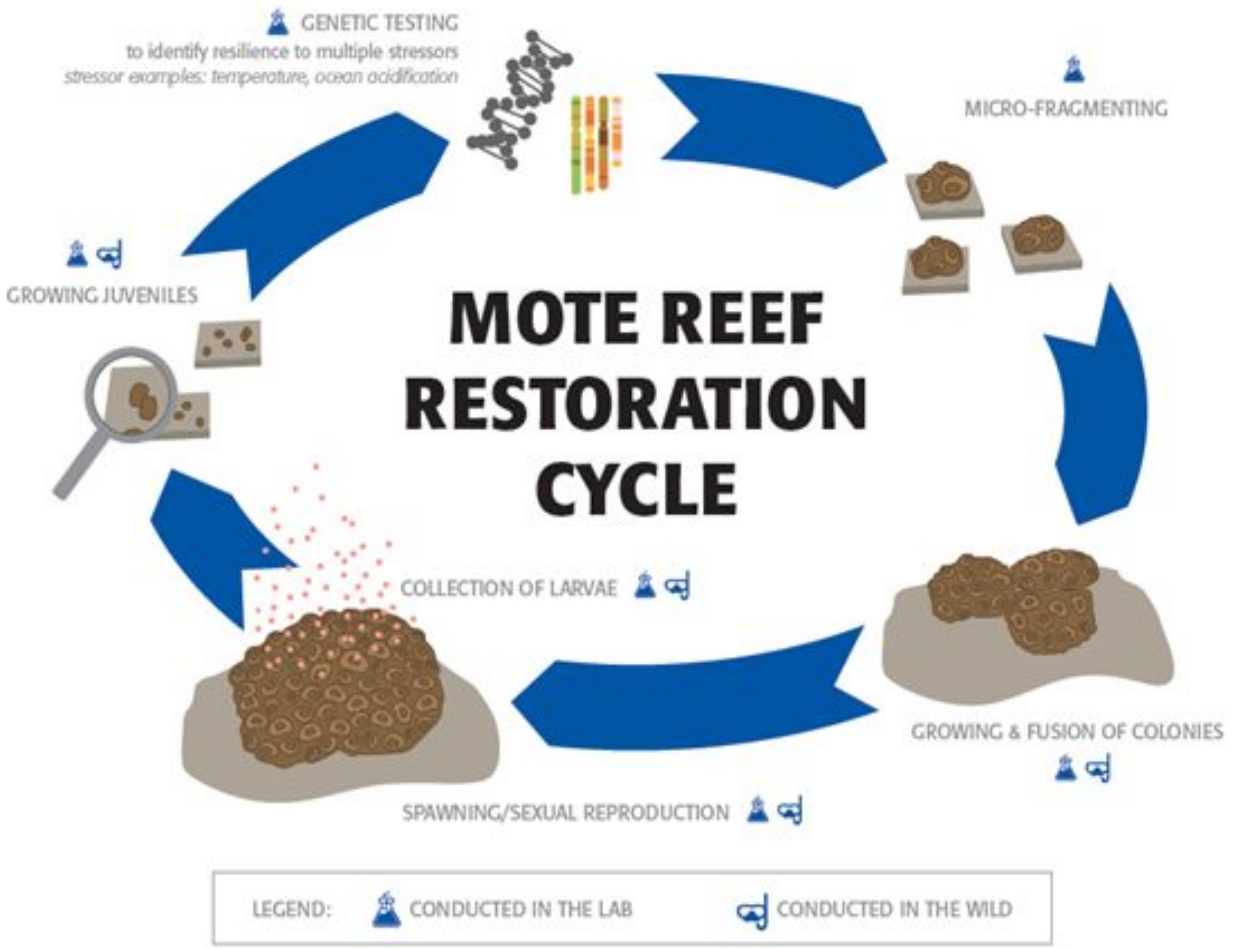




Implications

- Promotes faster population & ecosystem recovery
  - Quicker recolonization of dead coral heads
  - Rapidly increases living coral cover
  - **Faster onset of sexual maturity/reproduction**
  - Diversity generated more quickly & more likely retained
- Sources for assisted sexual reproduction work
- Should work for any other species/region of the world

Integration + upscaling



Mote's coral genotype holdings currently consist of **>1,600 genotypes** from **17 species**, with **~3k** additional genotypes from **3 species** that are expected to be added over **next years**

MISSION: ICONIC REEFS

CORAL RESTORATION FOUNDATION · THE FLORIDA AQUARIUM · Reef Renewal · National Marine Sanctuary Foundation · UF IFAS UNIVERSITY of FLORIDA · The Nature Conservancy

Thank you


MOTE MARINE
LABORATORY
NATIONAL MARINE
SANCTUARIES
FLORIDA KEYS

This page intentionally left blank

Reef Renewal USA

- Florida Keys based 501 (c) 3
- 20 Species of Coral
- Community based volunteer program

Reef Renewal
USA

Reef Renewal USA
Regional Coral Nurseries

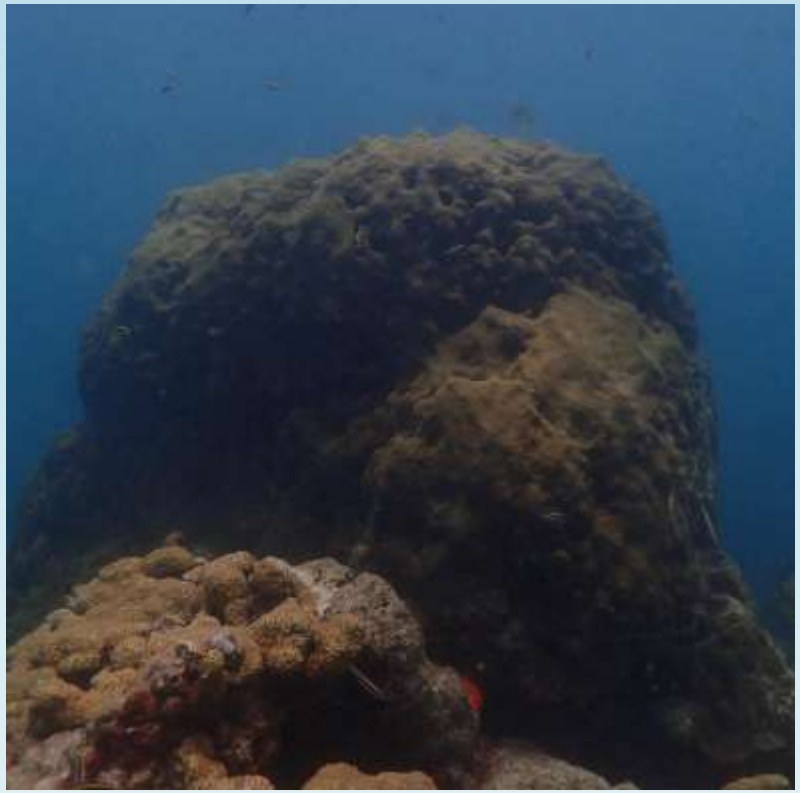
Acropora Corals

Elkhorn Coral
Acropora palmata

Staghorn Coral
Acropora cervicornis

Reef Renewal USA

Star corals in the Genus *Orbicella*



Mountainous Star Coral
Orbicella faveolata

Lobed Star Coral
Orbicella annularis

Boulder Star Coral
Orbicella franksi

Reef Renewal USA

Other Star Corals

Giant Star Coral
Montastrea cavernosa

Smooth Star Coral
Solenastrea bournoni

Blushing Star Coral
Stephanocoenia intersepta

Reef Renewal USA

Other Star Corals

Massive Starlet Coral
Siderastrea siderea

Elliptical Star Coral
Dichocoenia stokesi

Reef Renewal USA

Brain Corals

Knobby Brain Coral
Pseudodiploria clivosa

Grooved Brain Coral
Diploria labyrinthiformis

Reef Renewal USA

Brain Corals

Boulder Brain Coral
Colpophyllia natans

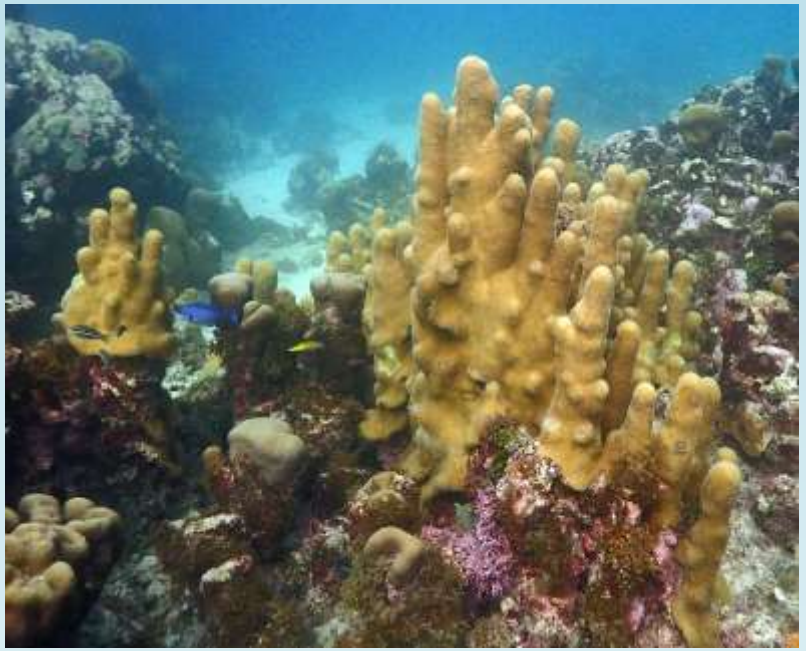
Symmetrical Brain Coral
Pseudodiploria strigosa

Reef Renewal USA

Other Corals

Knobby Finger Coral
Porites furcata

Mustard Hill Coral
Porites astreoides



Pillar Coral
Dendrogyra cylindrus

Reef Renewal USA

Other Corals

Rough Cactus Coral
Mycetophyllia ferox

Ivory Tree Coral
Oculina diffusa

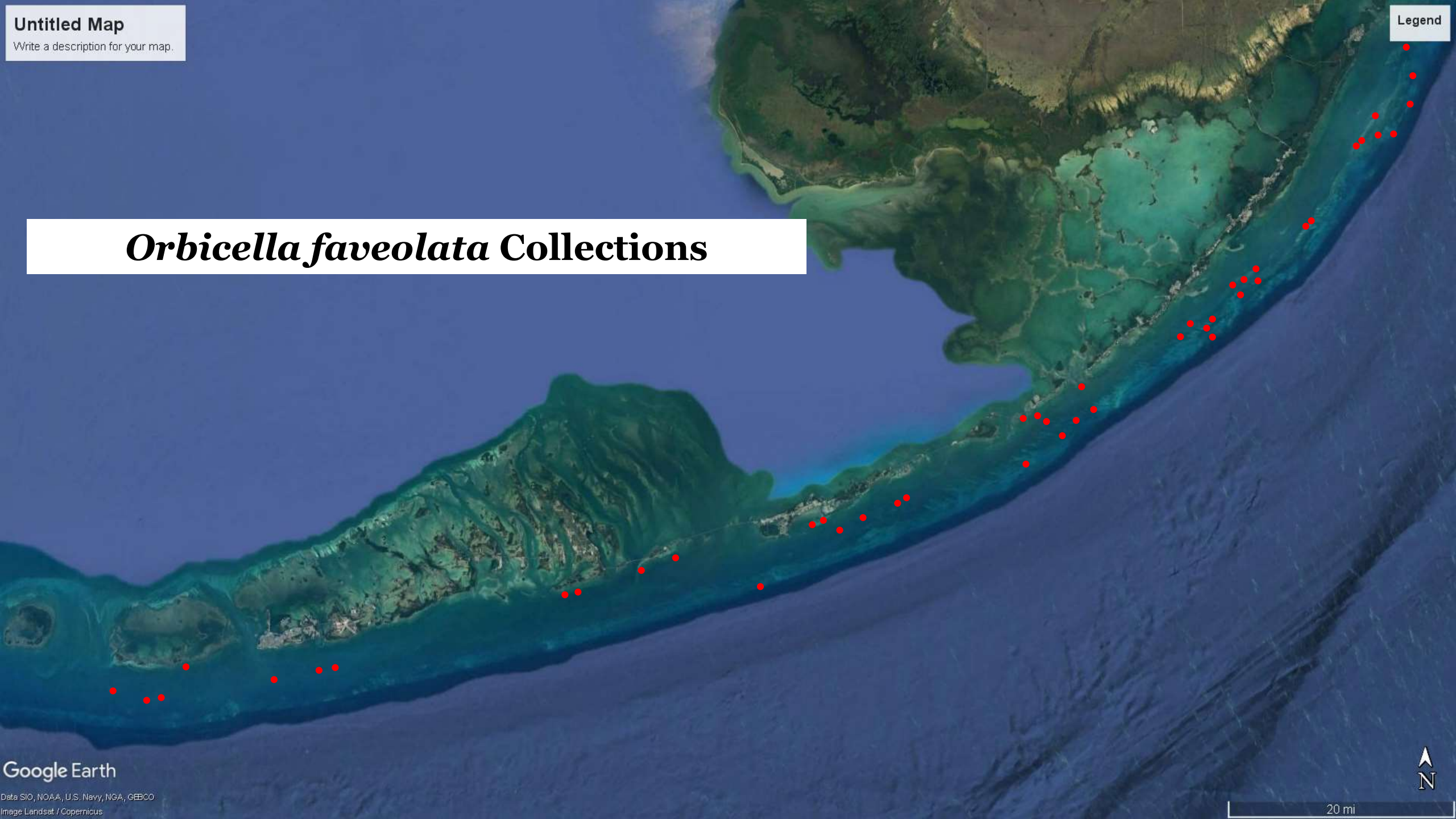
Blade Fire Coral
Millepora complanata

Reef Renewal USA

Looking for the Survivors

- Collecting corals from throughout the Keys
- Collecting corals from multiple habitat types
  - Inshore
  - Offshore
  - Mid channel
- Looking for corals that survived:
  - 2010 Cold Fronts
  - 2014/2015 Bleaching
  - Ongoing Stony Coral Tissue Loss Disease

Reef Renewal USA


Untitled Map
Write a description for your map.
Legend
Orbicella faveolata Collections
Google Earth
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus
N
20 mi

Collecting Corals

Tagging and measuring at the Reef

Tagged coral at the nursery

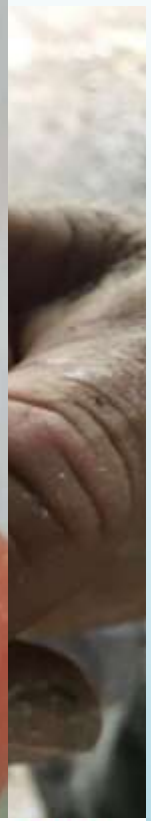
Reef Renewal
USA

Processing Corals on Land

- Initial Collections
- Drilling, Trimming, Mounting

Processing Corals on Land

- Initial Collections
- Drilling, Trimming, Mounting

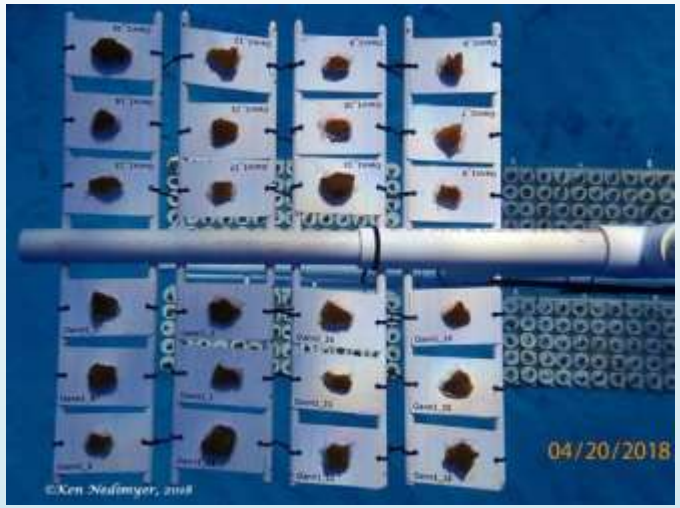


Mounting Broodstock Corals

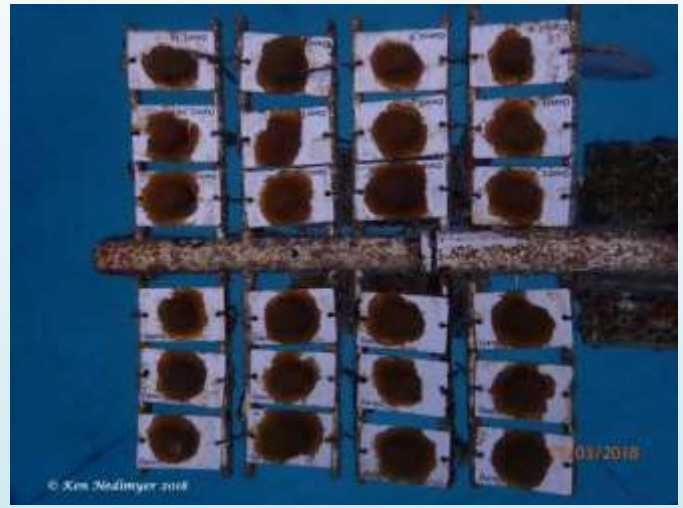
- Initial Collections
- Drilling, Trimming, Mounting
- The Broodstock System

Broodstock Growout

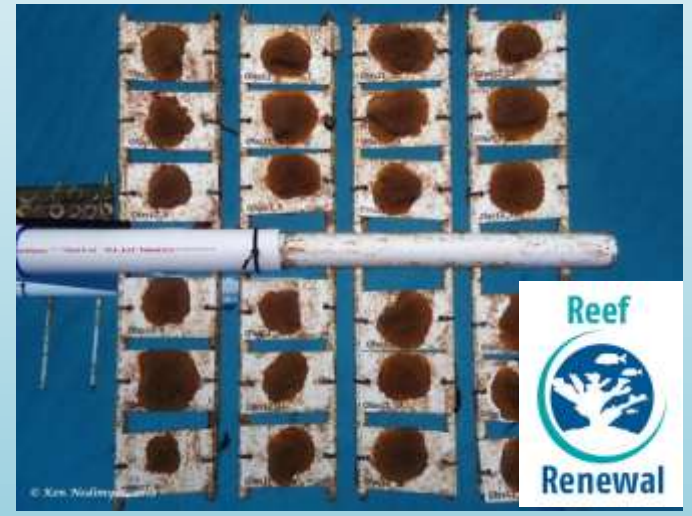
- Initial Collections
- Drilling, Trimming, Mounting
- The Broodstock System



6 months



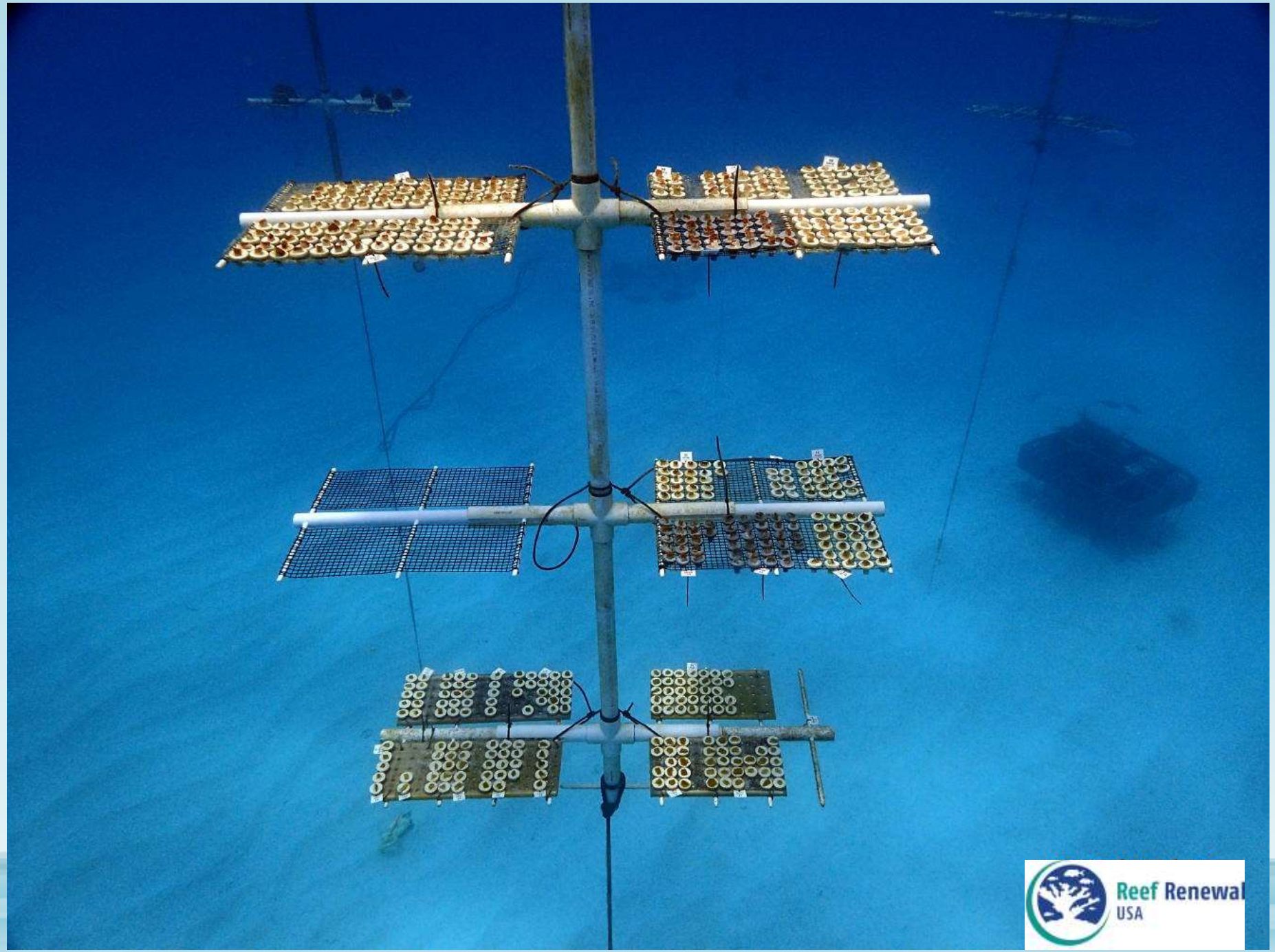
4 months



Mounting MicroFrags

- Initial Collections
- Drilling, Trimming, Mounting
- The Broodstock System
- The Grow Out System

Modular Grow out Tree



Knobby Brain Coral

Pseudodiploria clivosa

Replacing Trees with Ropes

Rope Nurseries at the Reef

Rope Nurseries at the Reef

Expedited Outplanting