

SEA CHANGE...

**The Keys to Restoring our Coral Reefs:
Innovative Science-Local Partnerships-Global Impact**



Dr. Michael P. Crosby
President & CEO

Allison Delashmit
Director, Keys Regional Operations

www.mote.org

Leading the Way in Global Marine Science and Education



INTERNATIONAL MARINE SCIENCE DIPLOMACY



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Director, International Consortium
for Marine Conservation



Ethn Muller, Ph.D.
Staff Scientist



Ken Leber, Ph.D.
Associate Vice President
for Research, Directorate of
Fisheries and Aquaculture



Dana Wetzel, Ph.D.
Manages Environmental
Laboratory of Forensics



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Associate Vice President
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Conservation



Emily Hall, Ph.D.
Manages Ocean
Acidification Program



Carlos Yanes-Roca, Ph.D.
Postdoctoral Scientist



Kevan Mann, Ph.D.
Manages Marine and
Freshwater Aquaculture
Research Program



Dave Vaughan, Ph.D.
Manages Coral Reef
Restoration Program



Nick Whitney, Ph.D.
Manages Behavioral,
Ecology and Physiology
Program



Nicole Rhody, Ph.D.
Postdoctoral Scientist



Randy Wells, Ph.D.
Manages Sarasota Dolphin
Research Program



Vince Lovko, Ph.D.
Manages Phytoplankton
Ecology Program



Gretchen Lovewell, M.S.
Manages Stranding
Investigations Program



Ernie Estevez, Ph.D.
Senior Scientist Emeritus



Gerie Clark, Ph.D.
Director Emerita



Michael P. Crosby, Ph.D.
President & CEO





International Center for Coral Reef Research & Restoration (IC2R3) – Summerland Key





1 • Mote Marine Laboratory & Aquarium

2 • Mote Aquaculture Research Park

3 • Coral Nursery at Bud N' Mary's

4 • Florida Keys History Discovery Center

5 • Elizabeth Moore International Center for Coral Reef Research & Restoration

6 • Florida Keys National Marine Sanctuary's Eco-Discovery Center

Sarasota

Key West

Islamorada
Summerland Key

Mote Locations Map

A Beyond 2020 Vision for the future of Mote

- Increase # of PhD's
- Expand Partnerships
- Stimulate S&T based economic development
- Meet 21st Century Grand Challenges



CORAL ARE SLIPPING INTO FUNCTIONAL EXTINCTION

Carysfort Reef, Florida Keys



1980



Today



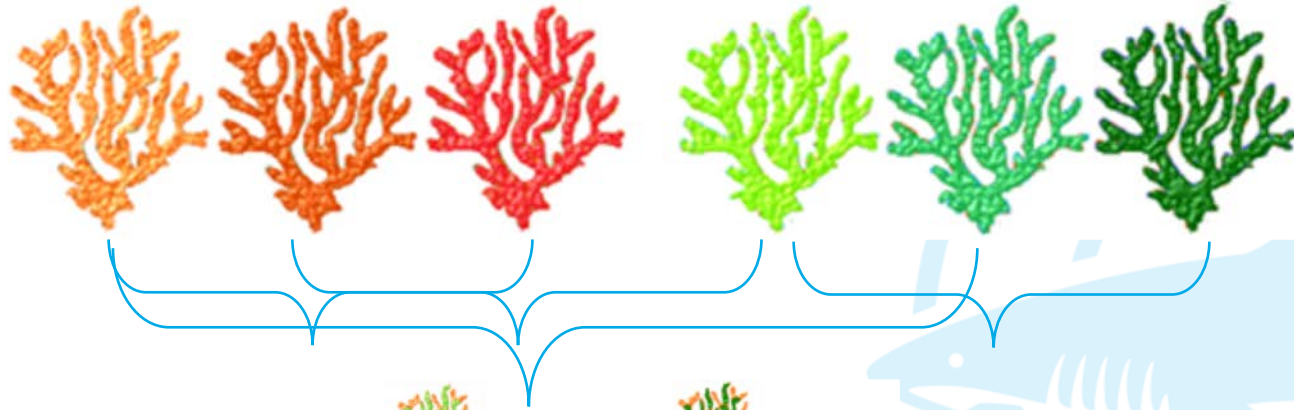
“We’re seeing 50- and 100-year-old corals that are dying. You can’t replace a 50-year-old coral in a decade.”



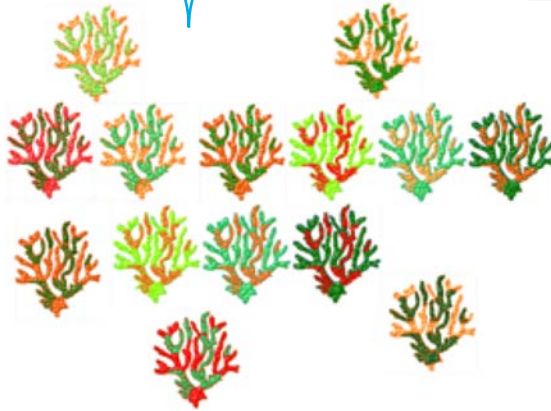
MICROFRAGMENTING & RESKINNING



We Breed Parents with Different Beneficial Traits

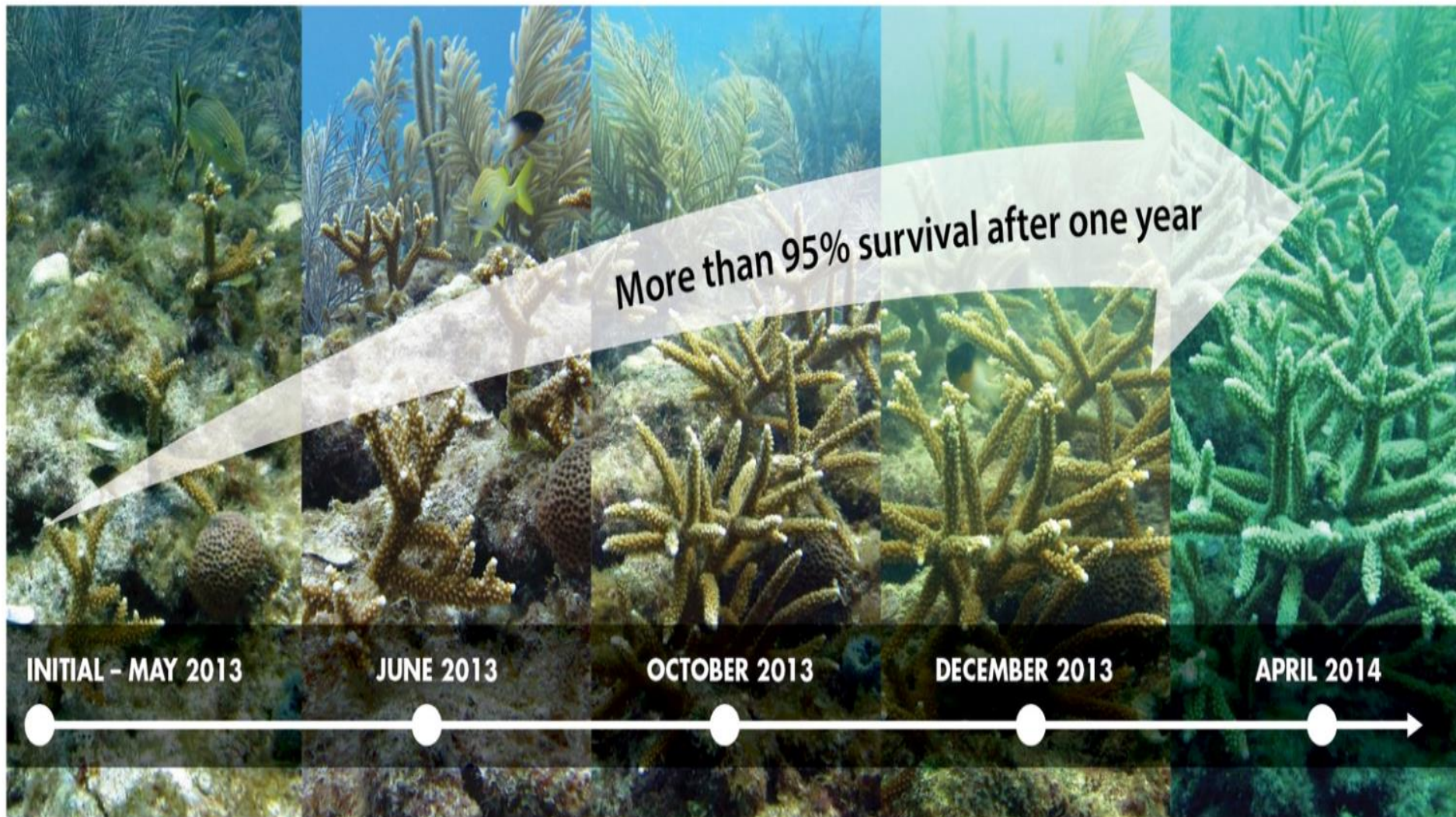


**Genetically diverse,
stress-tolerant offspring
with different trait
combinations inherited
from parents**



Dr. Erinn Muller





More than 95% survival after one year

INITIAL - MAY 2013

JUNE 2013

OCTOBER 2013

DECEMBER 2013

APRIL 2014



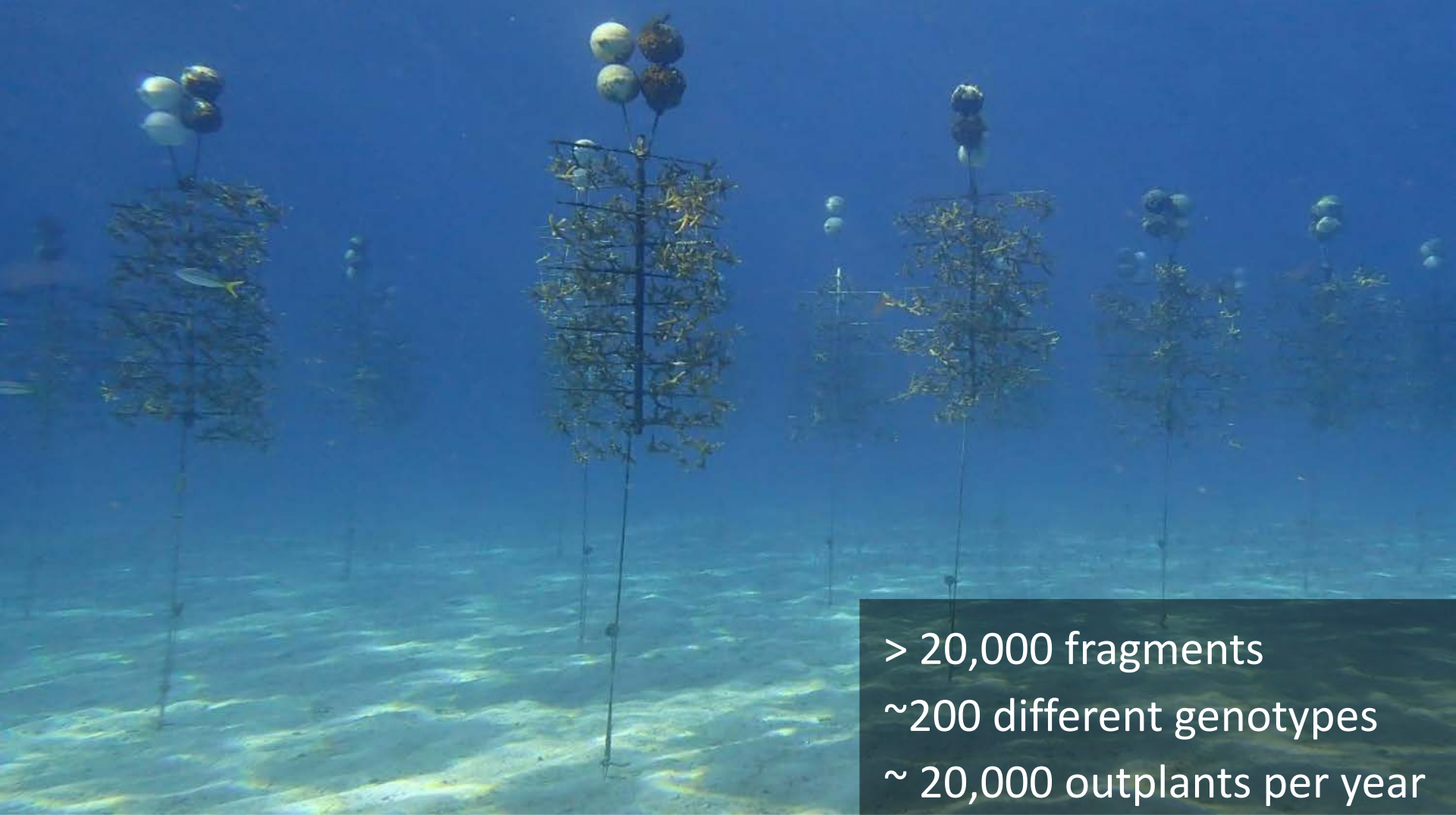
MOTE.ORG

MOTE LAND-BASED CORAL NURSERIES

- > 30,000 fragments
- > 1000+ genotypes
- ~15,000 outplants per year



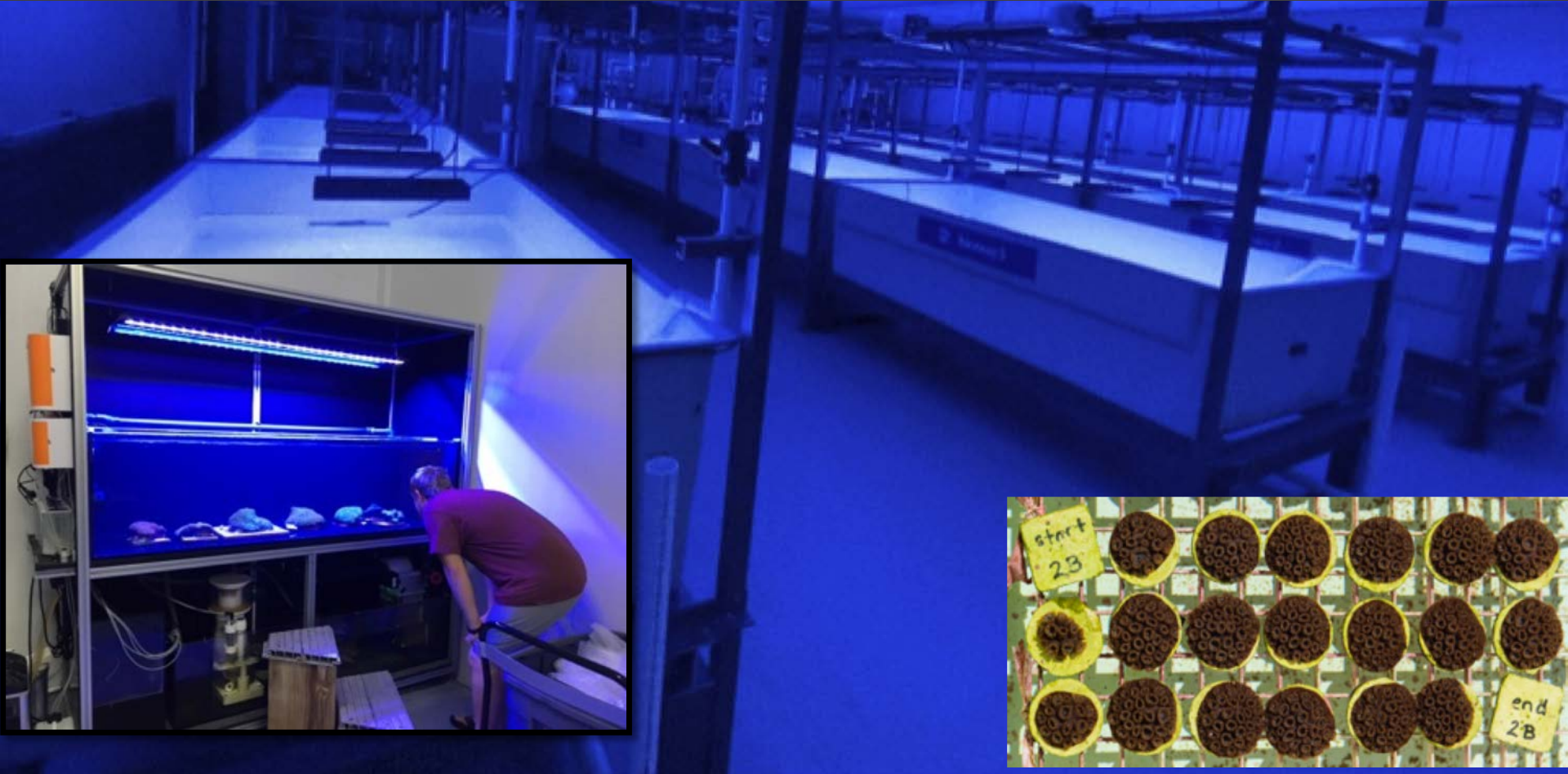
MOTE IN-WATER CORAL NURSERIES



> 20,000 fragments
~200 different genotypes
~ 20,000 outplants per year



Mote's International Coral Gene Bank & Sexual Propagation Lab



20 Boulder Star Coral
fragments planted in 2014

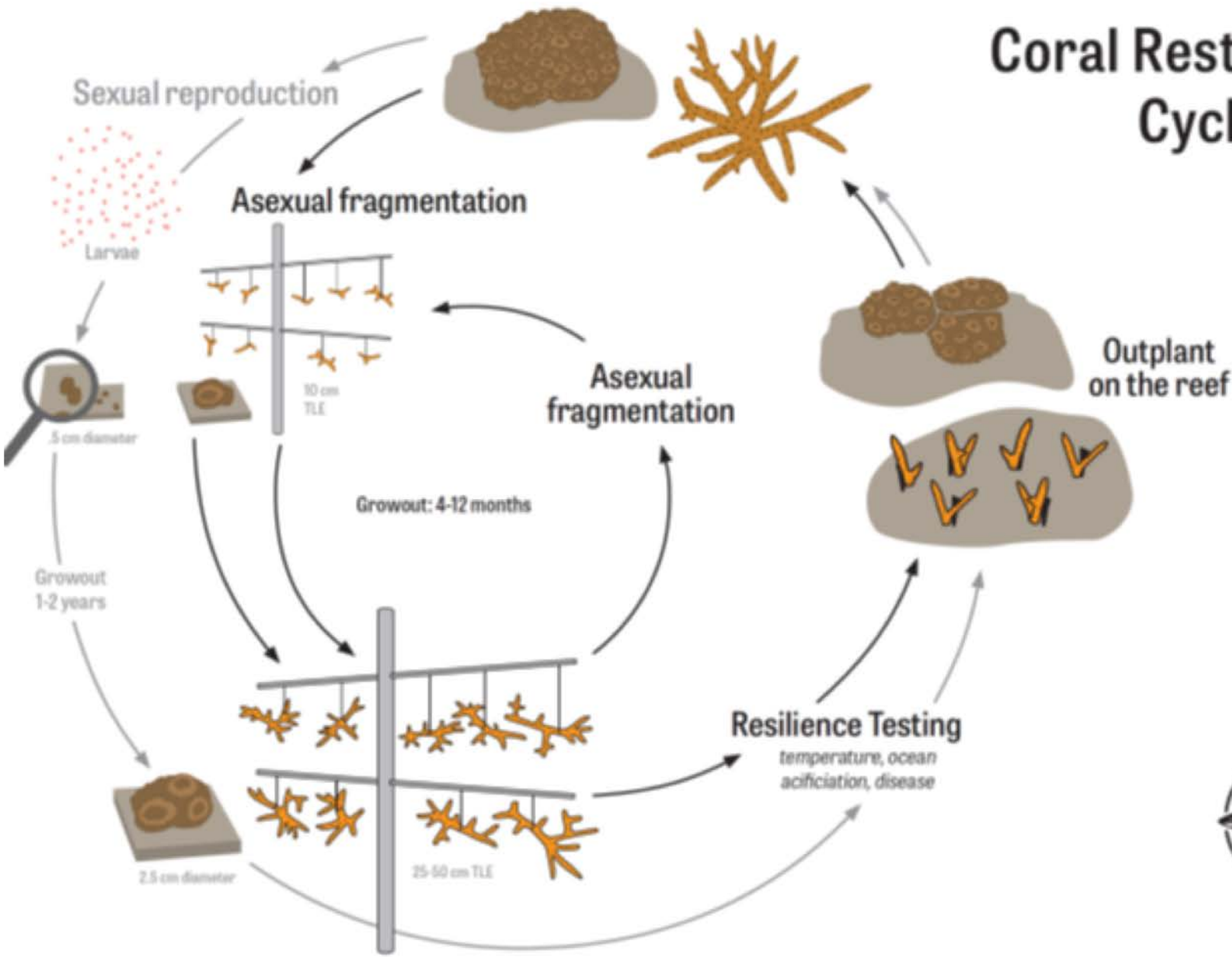


Fusing into a single 50 to 75
year-old size colony in 2016



MOTE'S RESILIENT REEF RESTORATION CYCLE

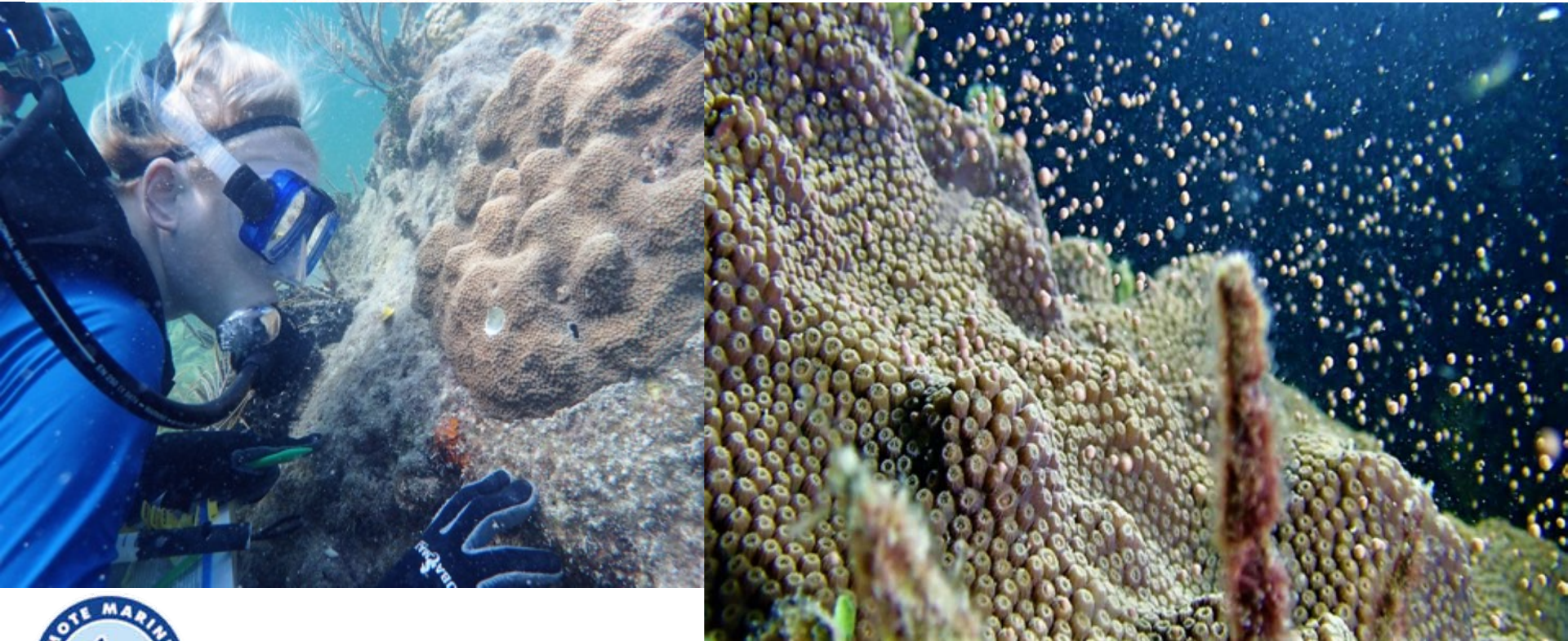
Coral Restoration Cycle



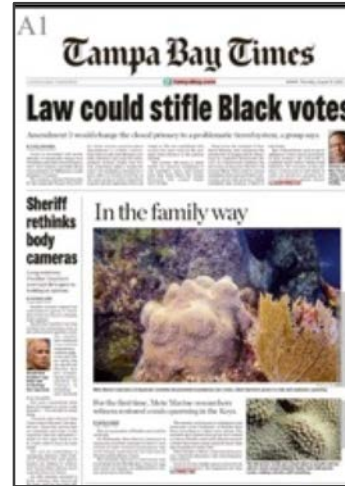
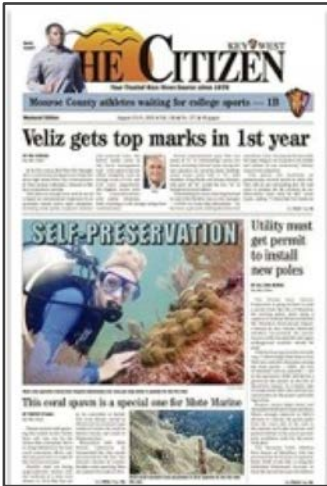
Restored Corals Spawn Hope for Reefs Worldwide

Novel technologies establish a new paradigm for global coral reef restoration, with in situ spawning of mature, environmentally resilient corals in five years instead of decades.

Hanna R. Koch, Erinn Muller, and Michael P. Crosby



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



TheScientist


EXPLORING LIFE, INSPIRING INNOVATION

NEWS & OPINION MAGAZINE SUBJECTS MULTIMEDIA

Restored Corals Spawn Hope for Reefs Worldwide

Hanna R. Koch, Erin Muller, Michael P. Crosby | Feb 1, 2021

Novel technologies establish a new paradigm for global coral reef restoration, with in situ spawning of mature, environmentally resilient corals in five years instead of decades.



World

Coral grown in lab is thriving on reef

United States

Florida's endangered coral reef could be brought back from the brink of extinction, marine biologists said yesterday, announcing a breakthrough in their efforts to produce living species that reproduce in the water.

Two varieties of coral grown in a laboratory and transplanted onto a reef near the Florida Keys have shown signs that they are about to reproduce in the spawning season that begins each August, usually after a full moon.

The two varieties, noncolonial star and branching staghorn, were engineered using a technique that accelerated their growth, the Mote Marine Laboratory said. The noncolonial star coral was "outplanted" in 2019 on a reef near Cook Island, on the Lower Key at the southwestern tip of Florida.

Before this year's spawn, in which entire colonies release eggs and sperm in a blizzard, a scientist from the laboratory held nightly dives to assess the state of her specimens. The laboratory said it appeared that they were going to join it.

Hanna Koch, its reproduction specialist, said that she had seen eggs and sperm in the corals, needs to be released. The laboratory said that these were the first known corals of any massive or mounding species that have been documented to be sexually mature after being restored in Florida or Caribbean waters.

The laboratory added that the staghorn corals grown in the laboratory, which were planted between 2019 and 2021, were also preparing to spawn, a first observed only once before.

"It was a great surprise to see that Mote's outplants are sexually mature," Dr. Koch said. "I have been monitoring these for several seasons now but we have a lot of stressors on our reefs, including temperature stress, and bleaching, hurricanes and disease, so I wasn't sure if our corals would have the additional energy required to put towards sexual development."

They appeared resilient, she said. "We are eagerly awaiting to observe them spawn this month or next."

Restoration at the Florida Aquarion are due to experience a similar breakthrough involving pillar corals, another threatened species.

The aquarion said that its researchers had spawned the coral for the second year in a row "through lab-induced techniques." The Mote Marine Laboratory said it had used a technique which corals are broken into five fragments that are grown separately and then encouraged to join together.

Using this technique, corals that can take decades to reach sexual maturity were found to become capable of spawning after five years.

"The breakthrough was billed as a milestone in the effort to restore reefs damaged by pollution, disease and the warming of the ocean."

"Dr. Koch's finding is proof that this method works and that we can produce reproductive viable corals of slow-growing coral species in only a handful of years," a spokeswoman for the laboratory said. "This provides hope for bringing back Florida's coral reef from the brink of functional extinction."



Hanna Koch said that she had seen signs of hope for the coral reefs



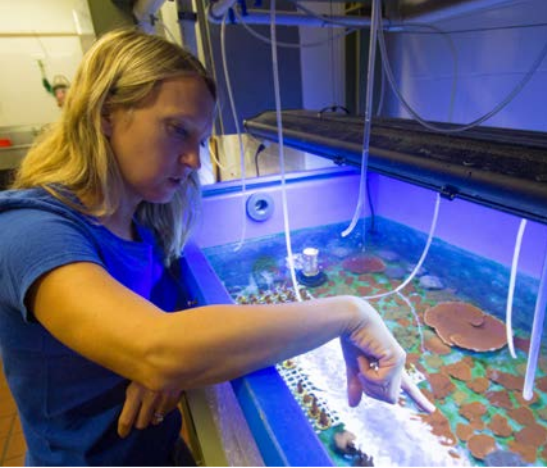
THE CORAL LAZARUS EFFECT

It is indeed possible to
“bring back to life” a dead 50-year-old coral
in a matter of years via recent advancements.



The Mote Model for Coral Restoration: Research Innovation + Volunteer Citizen Scientists





OUR STRATEGIC VISION:

FLORIDA KEYS CORAL DISEASE RESPONSE & RESTORATION INITIATIVE

- Utilize genetic strains that demonstrate enhanced resiliency to increased water temperatures, decreased pH and coral disease,
- Include designs for multiyear monitoring to assess survival and ecosystem health,
- Restore at least 20 acres of coral reefs in the Florida Keys with over 1 million corals to achieve an approximate 30% coral cover in an area equivalent to one-third of the restorable area for the seven Iconic Reefs, and
- Add 2,500 ft² to Mote's International Coral Gene Bank that will allow for up to 15,000 additional living coral representing approximately 4,000 unique genotypes to be available in perpetuity for ongoing and future research and restoration.



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