Assessing coastal change along rocky and remote shorelines

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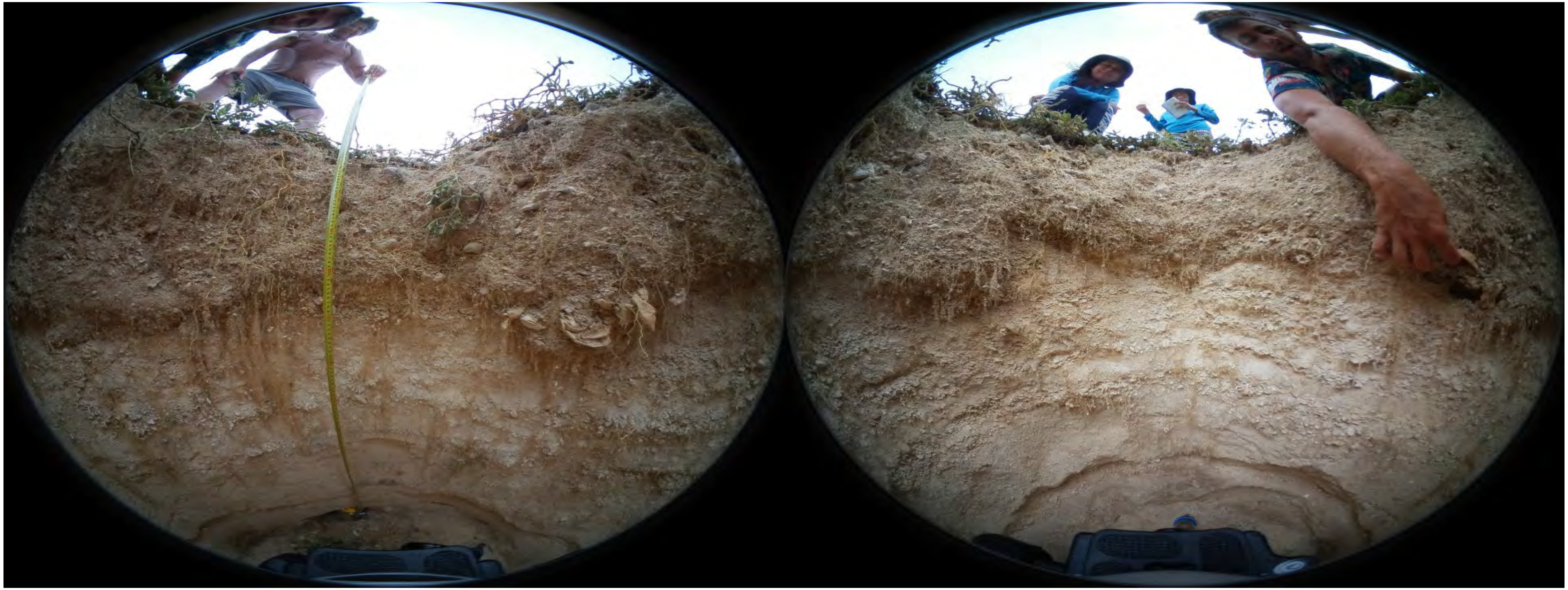
THE MEGA LAB

Remote low lying islands

NEED
- Future sea level estimates exceed average island elevation
- Hurricane Walaka devastated island and coral habitat

CHALLENGES
- Limited data
- Limited access
- Remotely sensed data is poorly georeferenced

SOLUTIONS
- Land and marine surveys
  - diver & UAS + GPS surveys
- Sediment sampling
- Aerial imagery & LiDAR surveys are planned



He pūkoʻa kani ʻāina

A coral reef that grows into an island.

The resiliency of our islands is dependent upon the health of our reefs.

Production

Framework- corals, cca, cementation

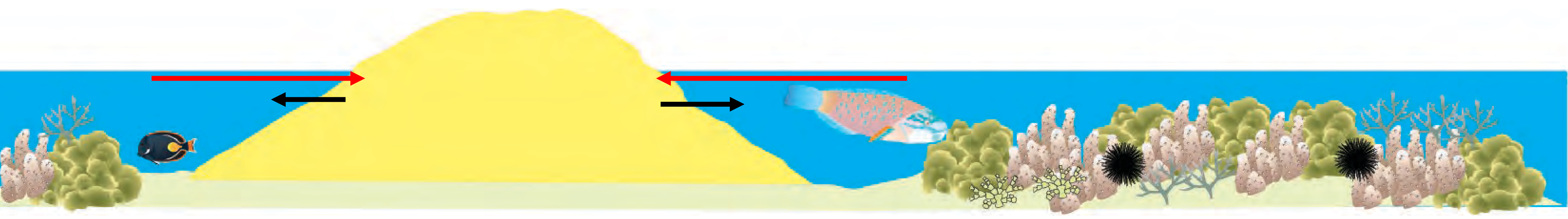
Direct producers- foraminifera, shells, etc

Erosion

Biological-fish, urchins

Physical- storms

Chemical- dissolution



Bio-geological linkages of reef island systems

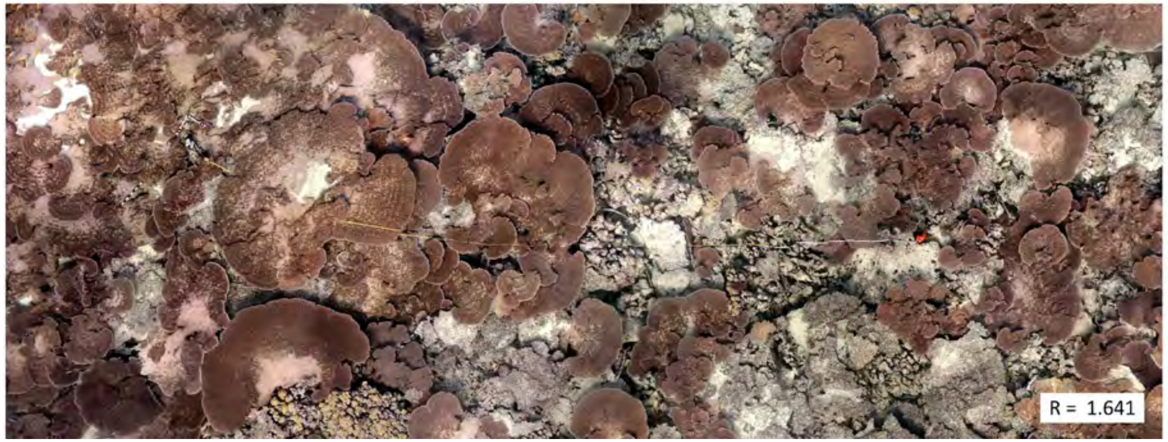
Coral reefs are

- biological sediment factories
- foundational to island development & resilience

Hurricane Walaka

October 2018- Cat. 3, sustained winds of 125+ mph and wave heights of 11-15 m decimated coral reef and island environments

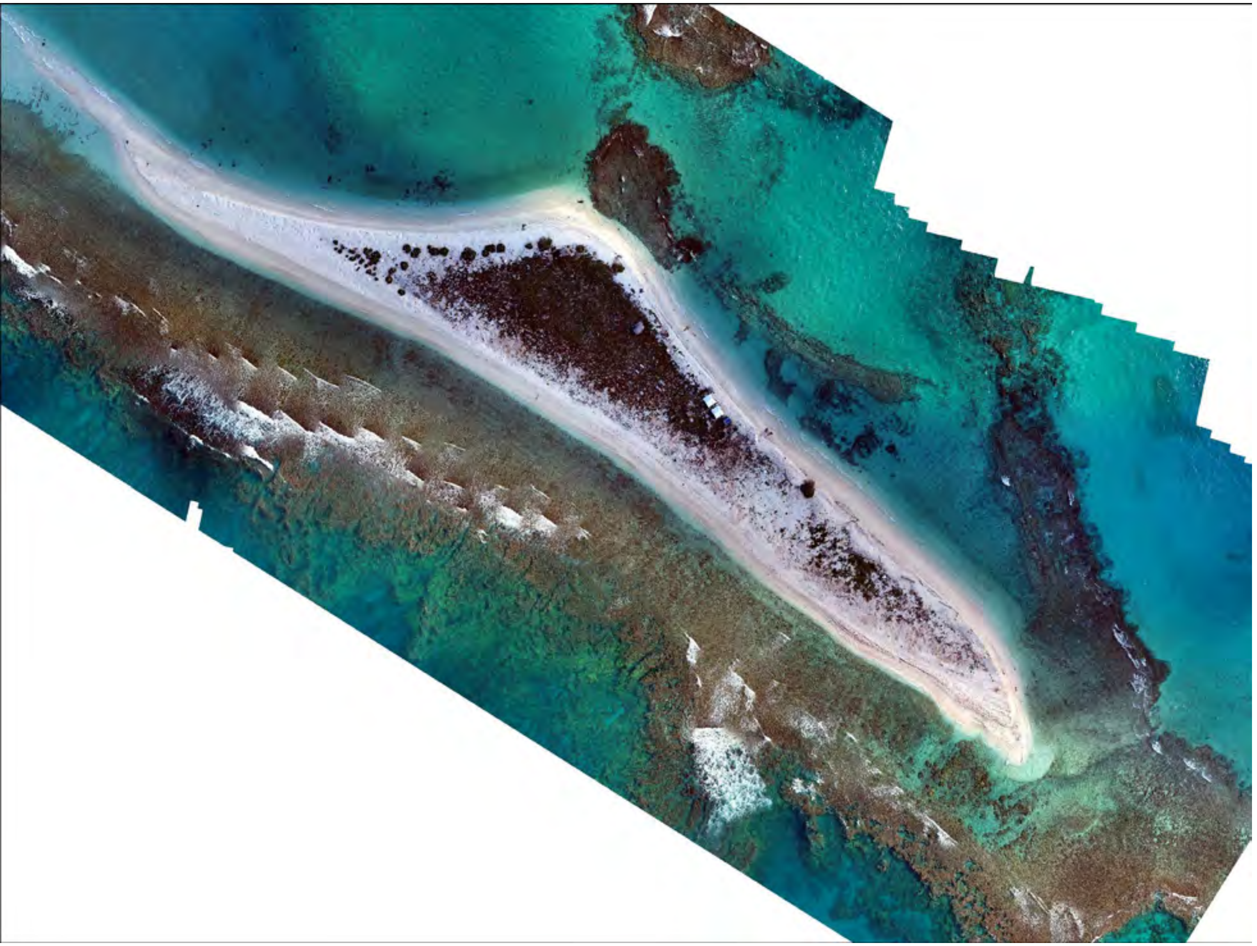
After



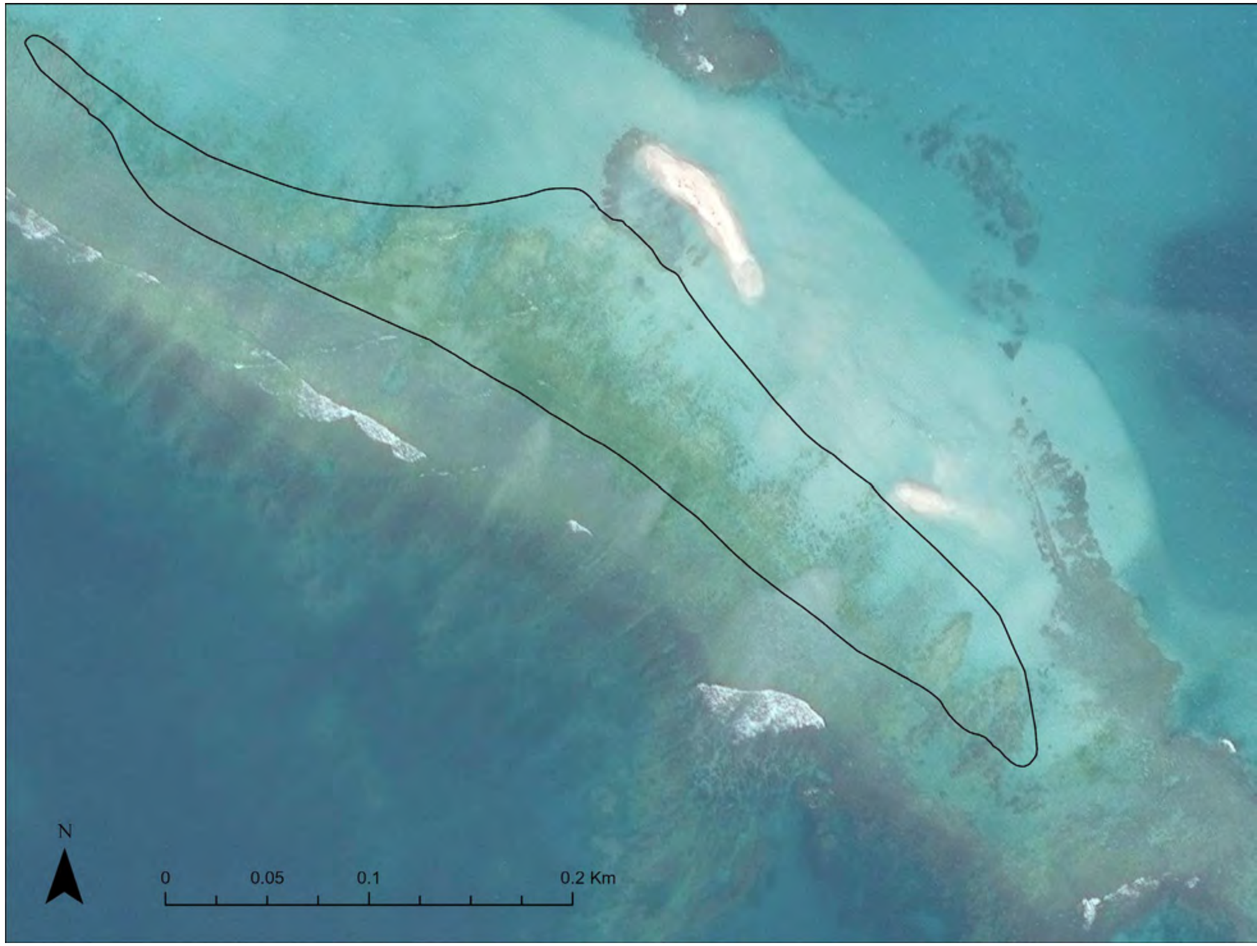
Before

Reef images provided by Dr. John Burns & Kailey Pascoe at the University of Hawai‘i Hilo MEGA Lab

East island displaced ~ 100 m, reduced to 5% size

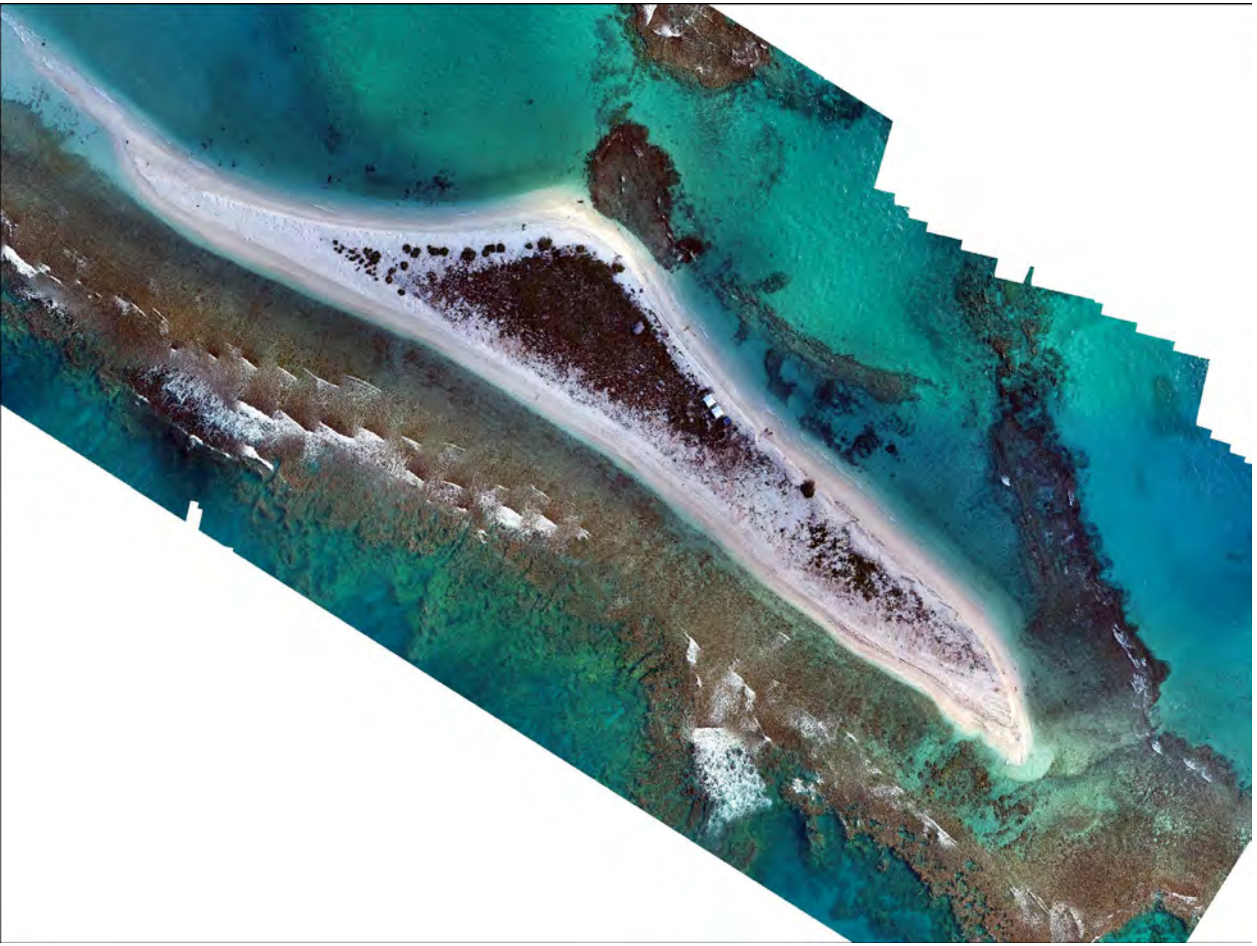


East prior to Hurricane (July 2018)

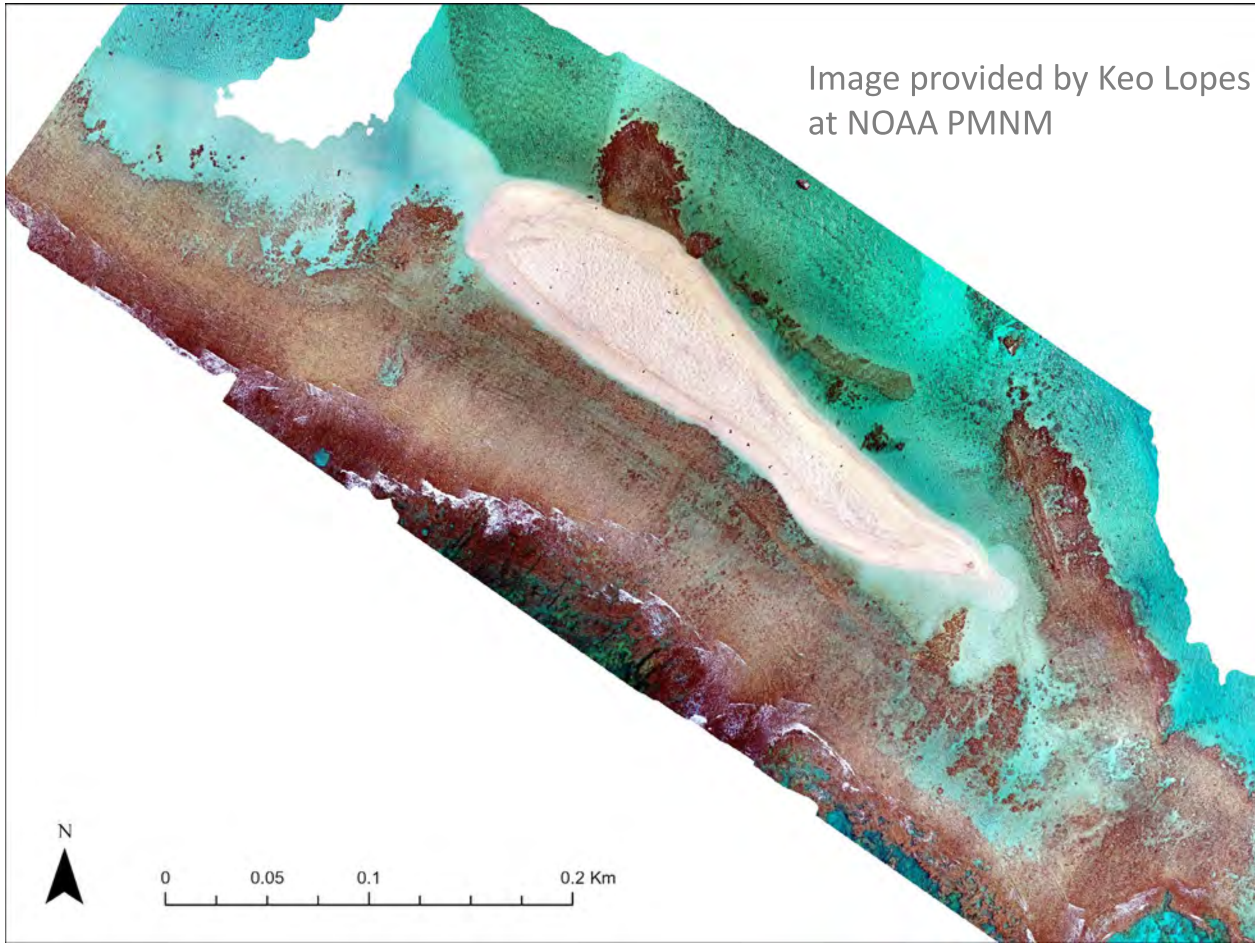


East after Cat 3 Hurricane (Oct 2018)

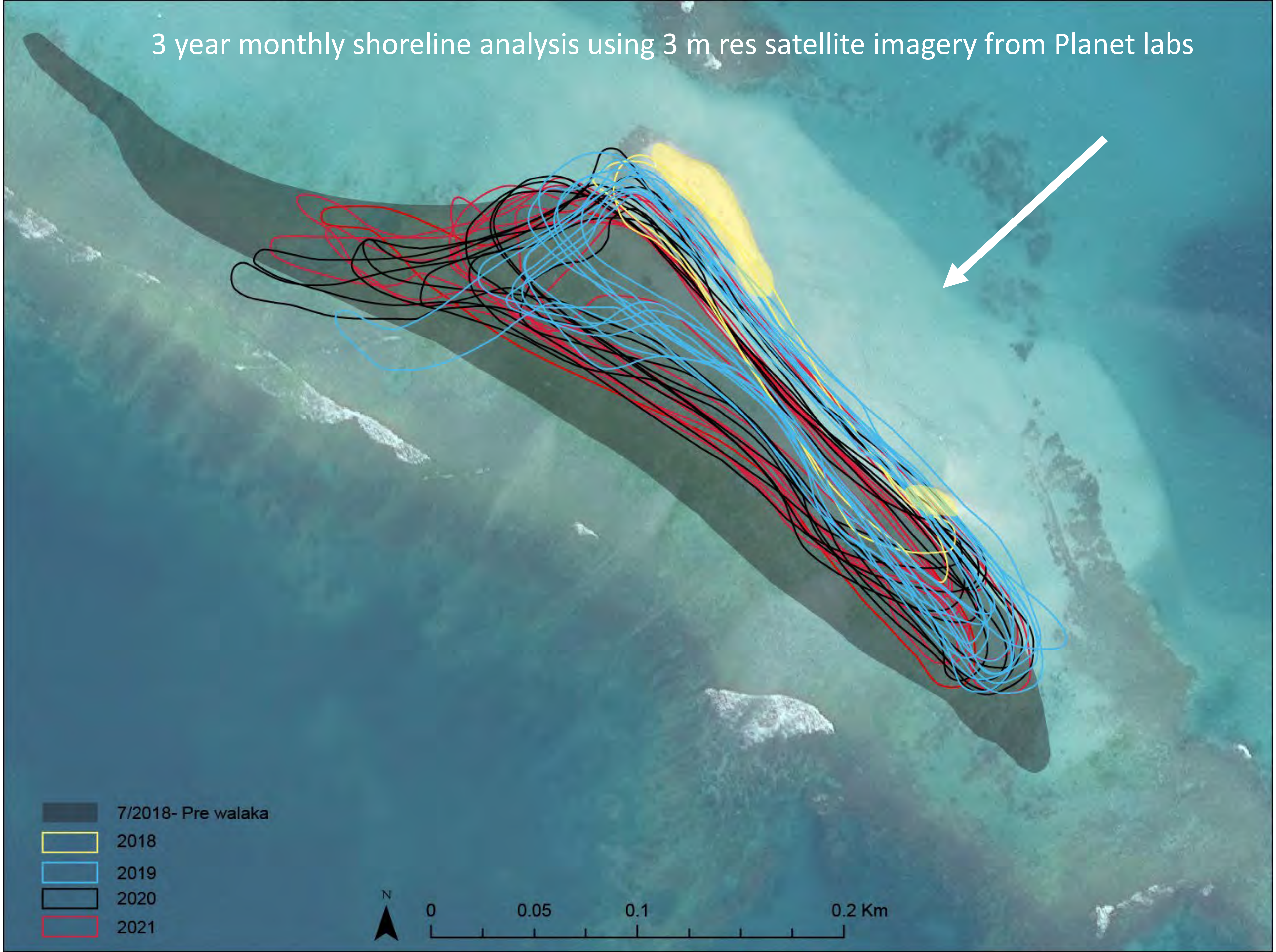
East island recovered 56% pre-Hurricane size, approx. 12 m/yr.



East prior to Hurricane (July 2018)

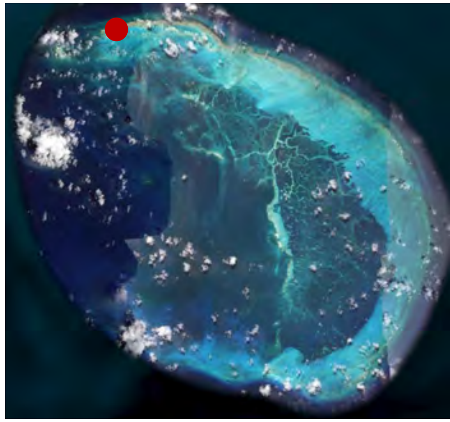


East 3 years after Hurricane (July 2021)


3 year monthly shoreline analysis using 3 m res satellite imagery from Planet labs
7/2018- Pre walaka
2018
2019
2020
2021
N
0
0.05
0.1
0.2 Km

Direction of wave overwash

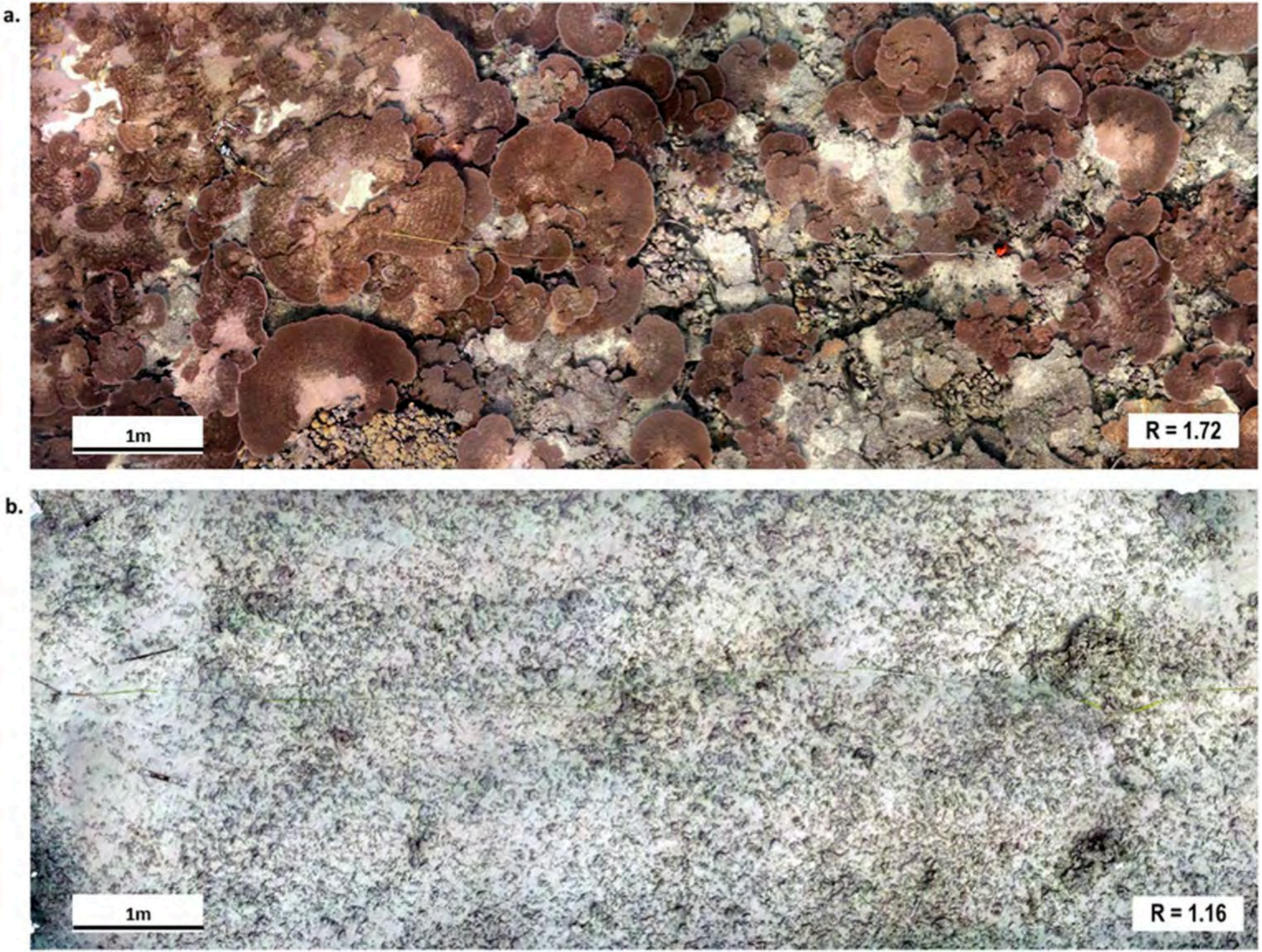
Tern Island



Direction of wave overwash

Removed vegetation & elevated portions of the island

Tern Island

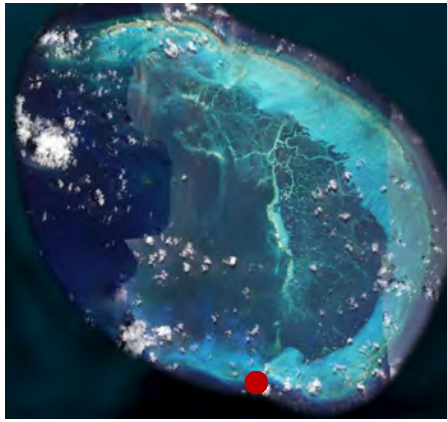


RAPTURE REEF

Pre Walaka: September 2017
70% *Acropora* coral

Walaka: October 2018

Post Walaka: July 2019
99% rubble and sand



Initial recovery of coral reef documented 3 years post Hurricane Walaka

Table 1. Percentage of benthic cover in 2017 (before Walaka), 2019 (nine months after Walaka) and 2021 (three years after Walaka), with "-" denoting no detection.

	2017 [1]	2019 [1]	2021
Tabulate *Acropora*	69.7	-	-
Encrusting *Porites*	0.8	-	0.04
Encrusting *Montipora*	0.1	-	-
Branching *Pocillopora*	-	-	0.31
Crustose coralline algae	1.7	-	-
Macro and filamentous algae	-	-	0.35
Sponges	-	-	0.66
Hard substrata	27.0	0.3	-
Rubble	-	67.9	80.66
Sand	0.7	31.8	17.70

[1] Source: Pascoe et al., 2021 [6].

<u>Pre Walaka: September 2017</u>
Acropora coral dominant
minimal sand

<u>9 mon. Post Walaka: July 2019</u>
no coral
rubble & sand dominant

<u>3 yrs Post Walaka: August 2021</u>
coral recruits
binders (sponges)
sand export
reef fish return

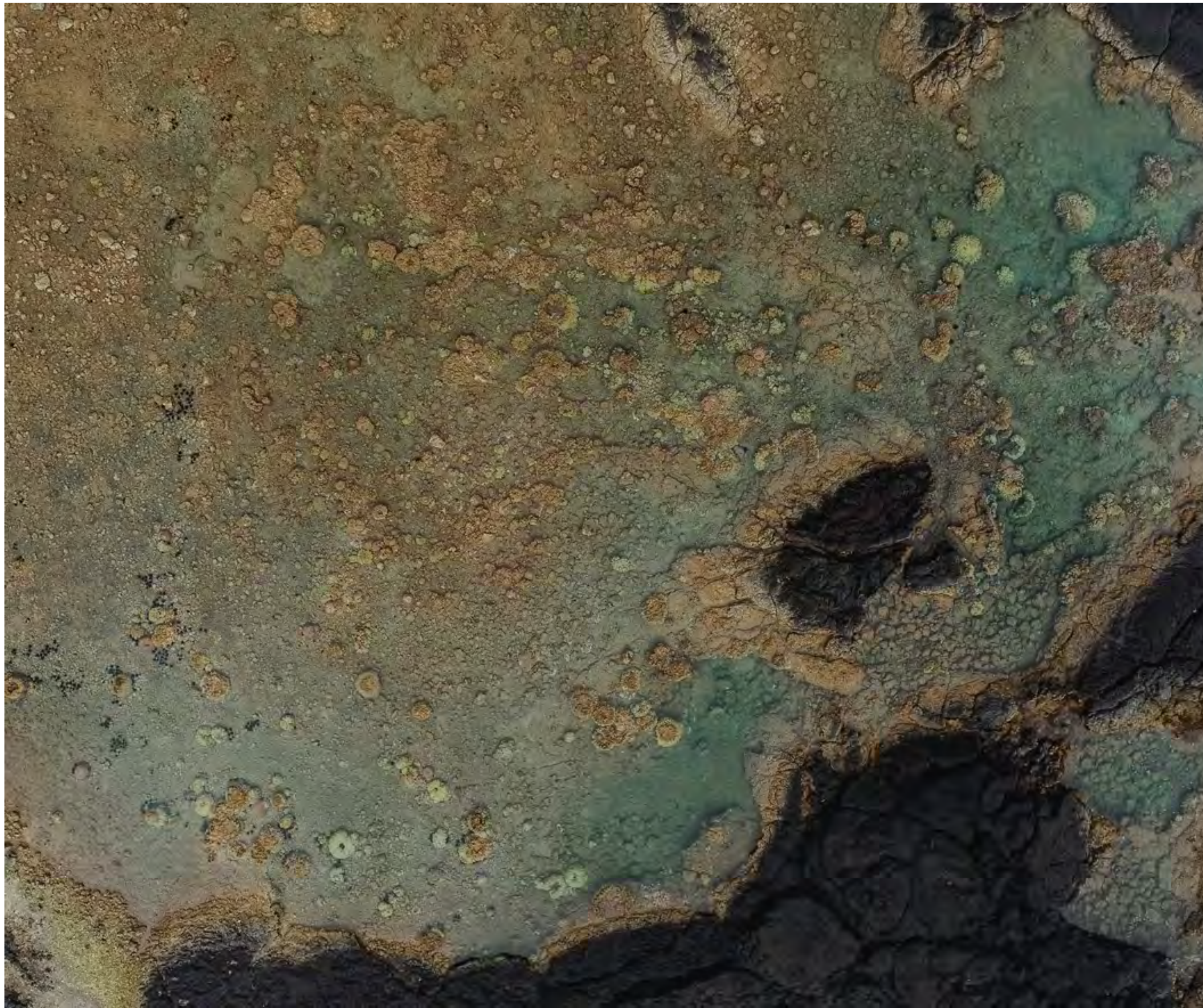
Fukunaga et al, 2022 ; Pascoe et al., 2021

Rocky and intertidal coastlines

NEED
- Most sea level and shoreline estimates do not include rocky shorelines
- Rocky & intertidal shorelines are important fisheries, & access points to the ocean

CHALLENGES
- Limited data
  - Low resolution data sets do not properly capture habitat
- Gaps in knowledge as to how intertidal habitat will evolve with elevated water levels

SOLUTIONS
- Land and marine surveys using a multi-scaled approach



Multi-scaled approach to assess sea level rise impacts to Hawaiian aquatic resources.

- 3 graduate students
- PhD pipeline w/UHH & ASU
- 2 NASA DEVELOP cohorts
- Coastal UAV mapping course

Funded by NASA