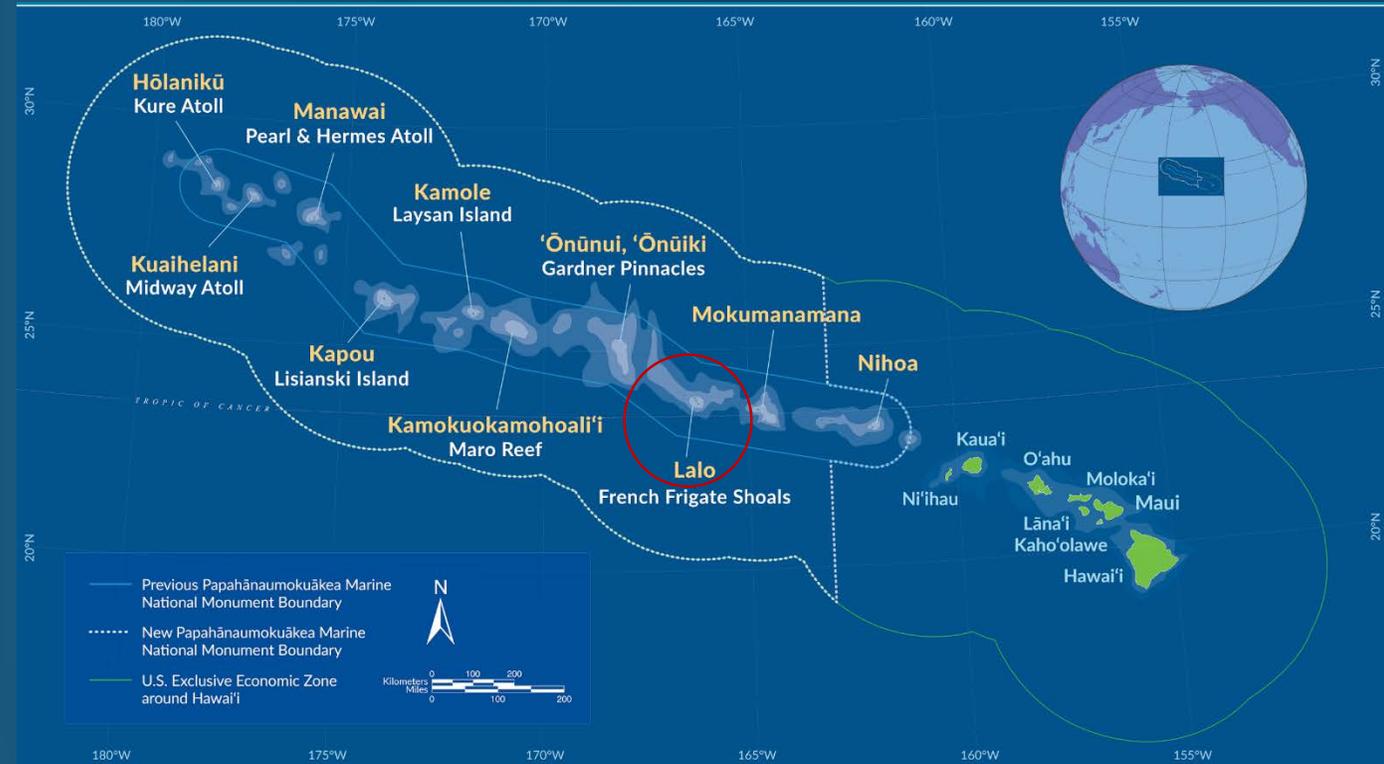


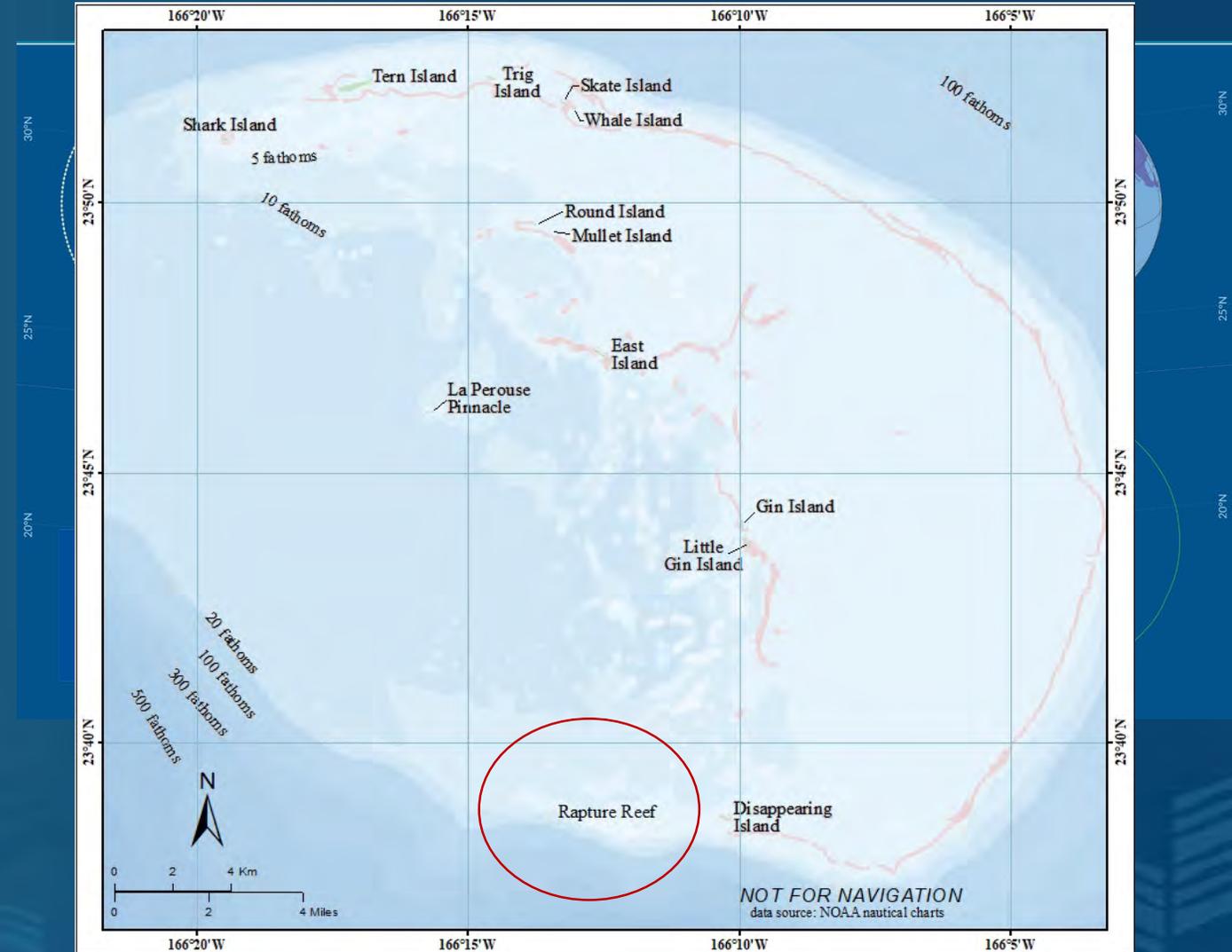
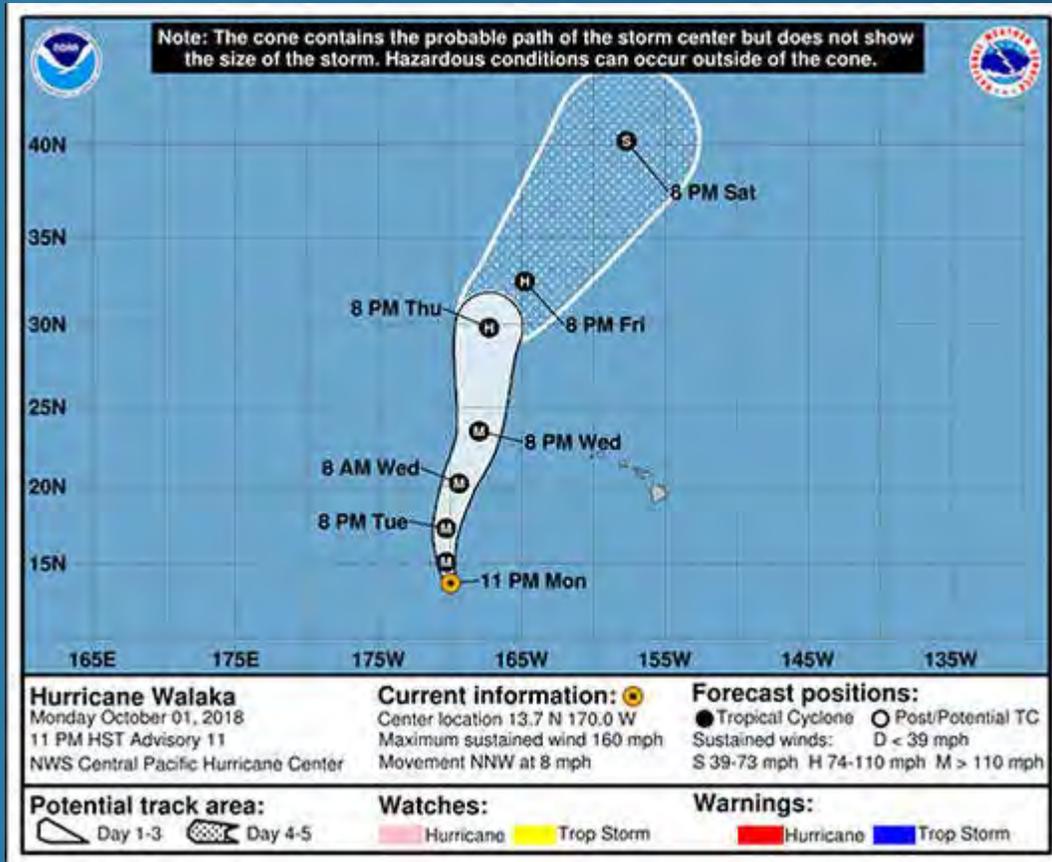
Recent Findings from the Field: Marine Impacts

October 10, 2019

Hurricane Walaka October 2018



Hurricane Walaka October 2018



Hurricane Damage to Rapture Reef, FFS

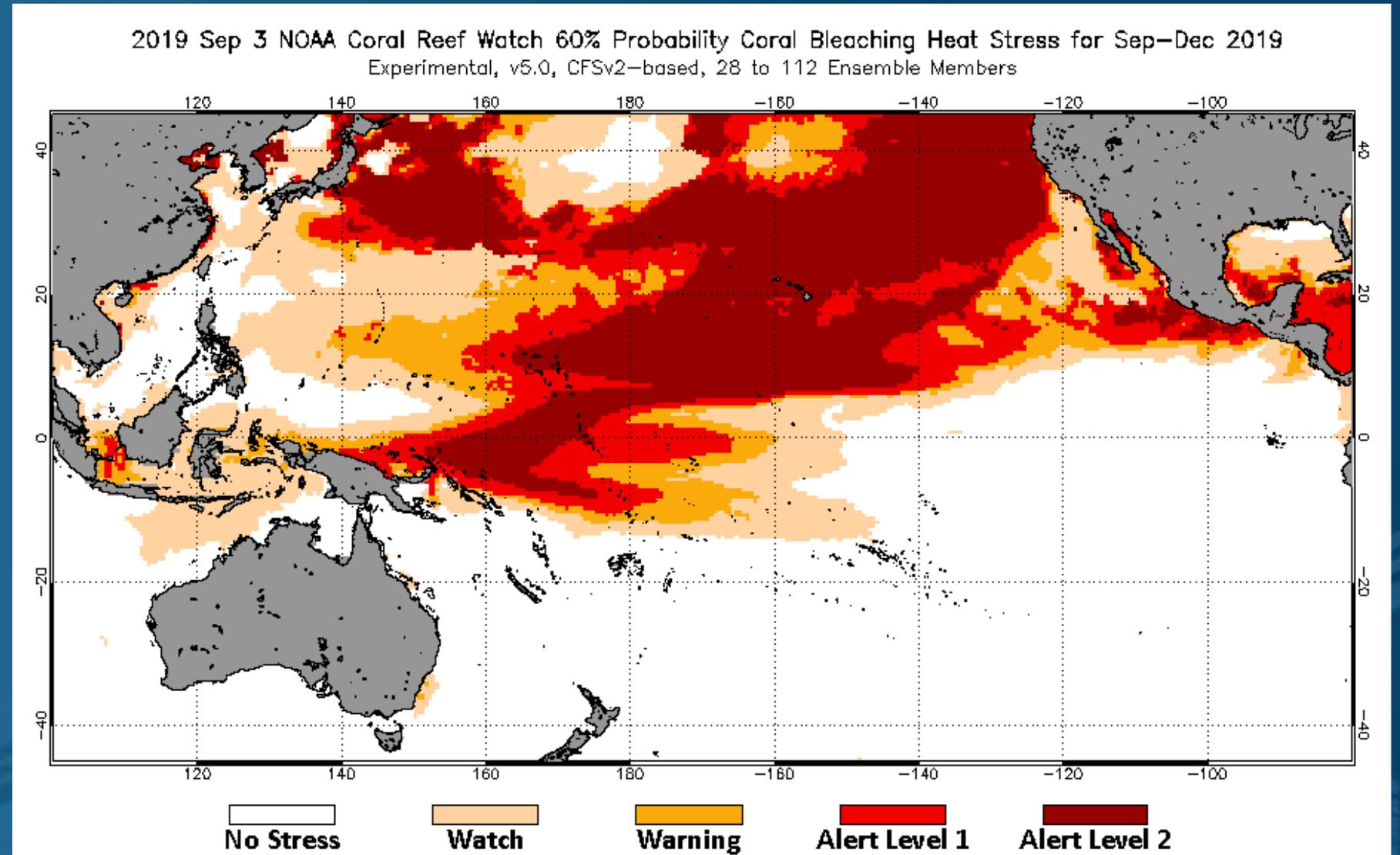


Left: Fish school at French Frigate Shoals prior to Hurricane Walaka (Credit: James Watt/NOAA). Right: Divers observed devastating damage to coral reef sites at French Frigate Shoals (Credit: Kailey Pascoe/NOAA)

2019 Coral Bleaching Forecast

- Previously

- 2014
- 2010
- 2009
- 2007
- 2004
- 2002
- 1982



2019 Coral Bleaching Observations

- FFS



- P&H



- Lisianski

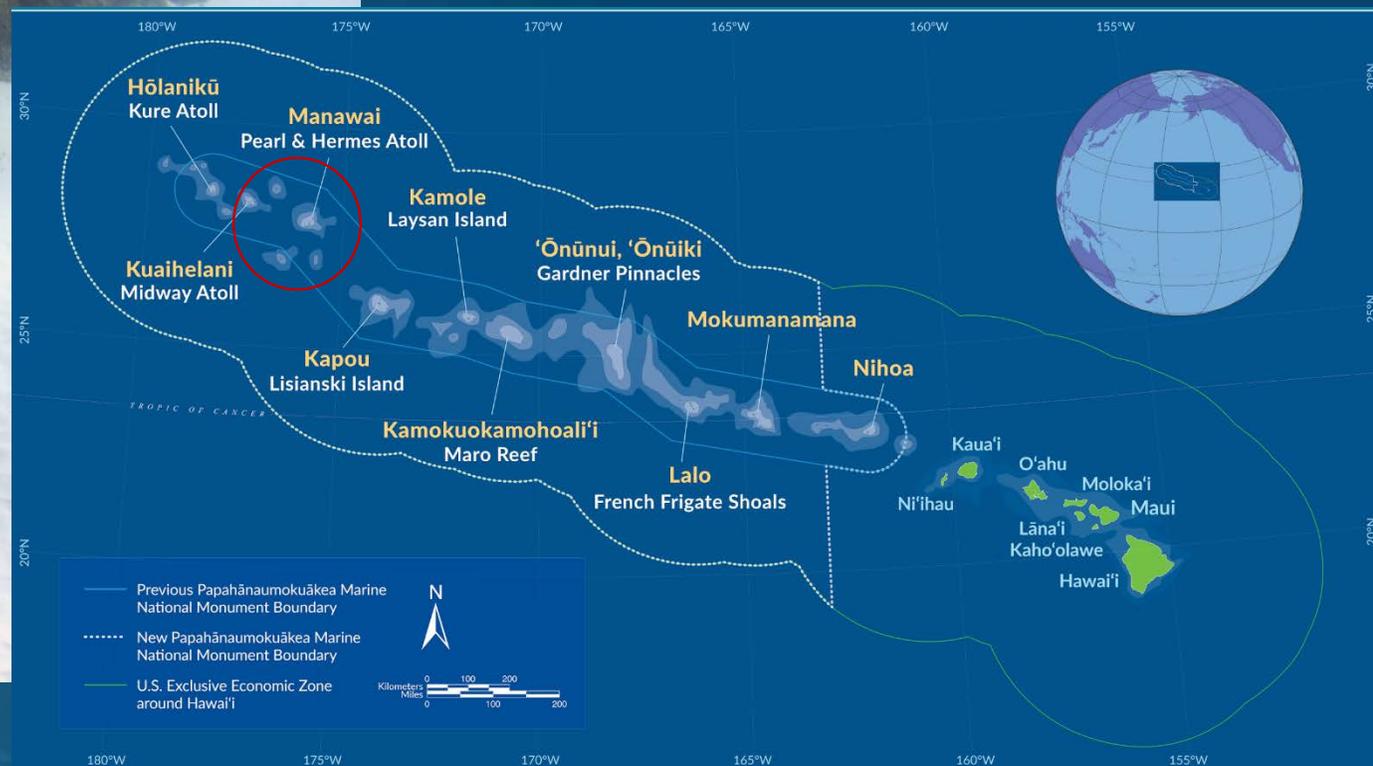


- Kure



- + Midway

Invasive Algae at Pearl & Hermes Reef



Research Team

- **Slides:** H. Spalding
- **Field work:** H. Spalding, T. Williams, K. Pascoe, and B. Craig
- **Surveys:** K. Pascoe, H. Spalding, T. Williams, B. Craig, and A. Fukunaga
- **3-D Photogrammetry:** K. Pascoe and B. Craig
- **Algal Fragment Experiments:** H. Spalding, T. Williams, and B. Hauk
- **Invasive Algal Advisement:** H. Spalding, A. Sherwood and C. Smith
- **Molecular and Morphological ID:** A. Sherwood and lab, H. Spalding
- **Mesophotic surveys:** R. Kosaki, B. Hauk, S. Matadobra, K. Lopes, J. Leonard
- **Boat support:** Crew of the R/V Rainier and NOAA boat crew

Typical *Montipora* reef at 5 ft, Pearl and Hermes



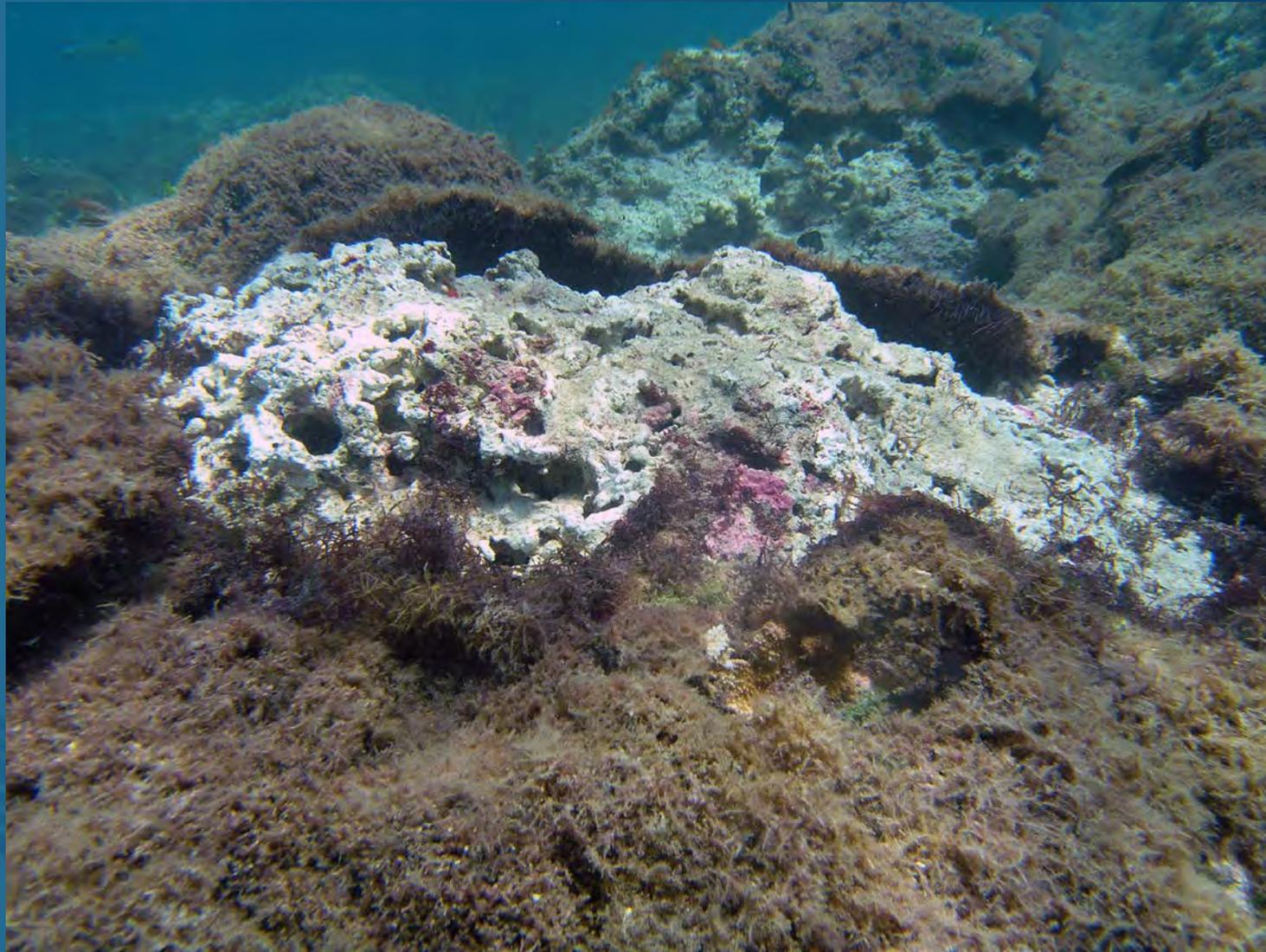
~100% cover of invasive alga at same site and depth,
Pearl and Hermes



Invasive algal mat, 5 ft, becoming unattached from top of reef



Reef with mat removed from the top



Same reef, with *Chondria* filling in the pukas

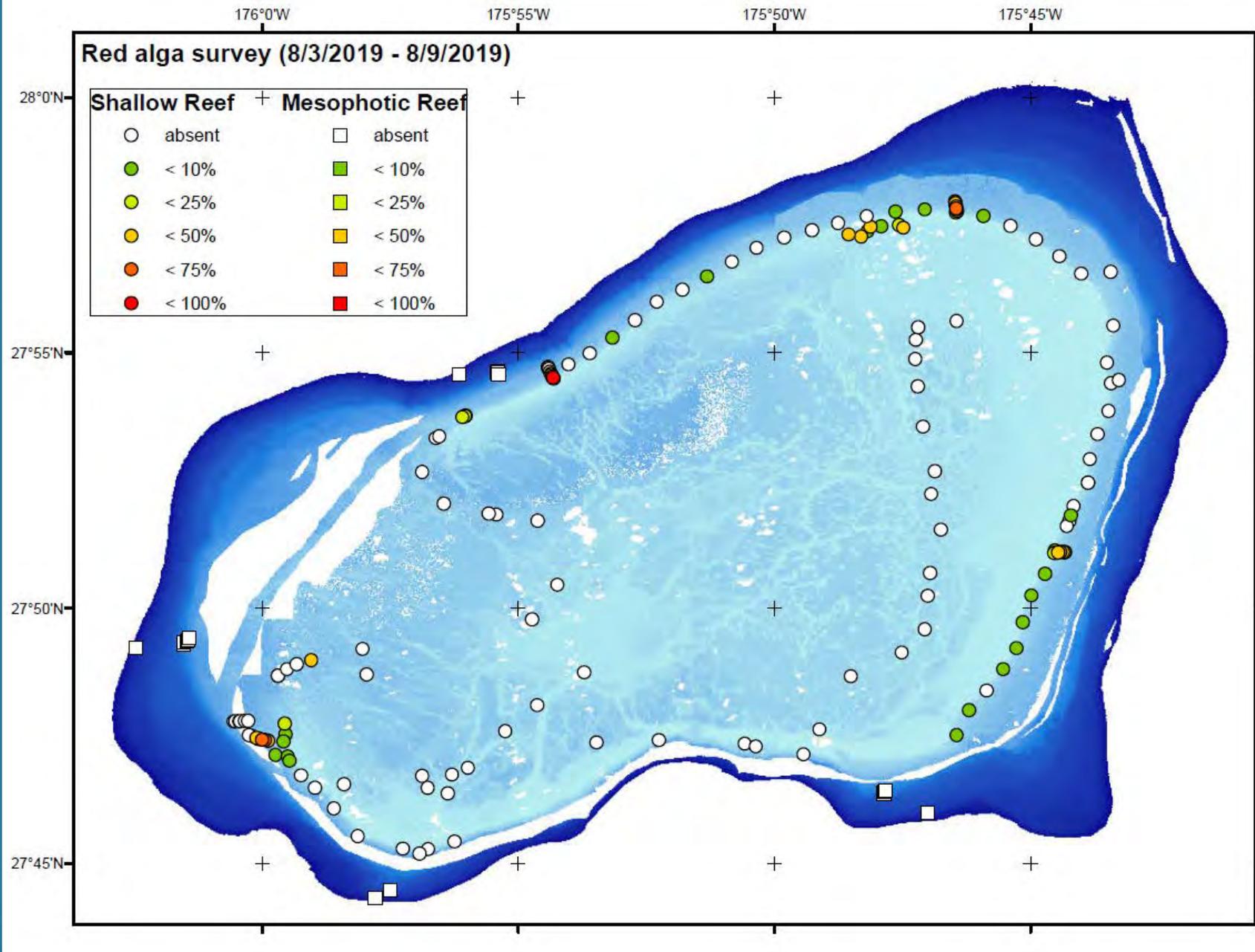


Invasive alga overgrowing *Porites lichen* reef, 40 ft depth



Example of invasive alga overgrowing native algae (*Microdictyon* and *Halimeda* spp.)

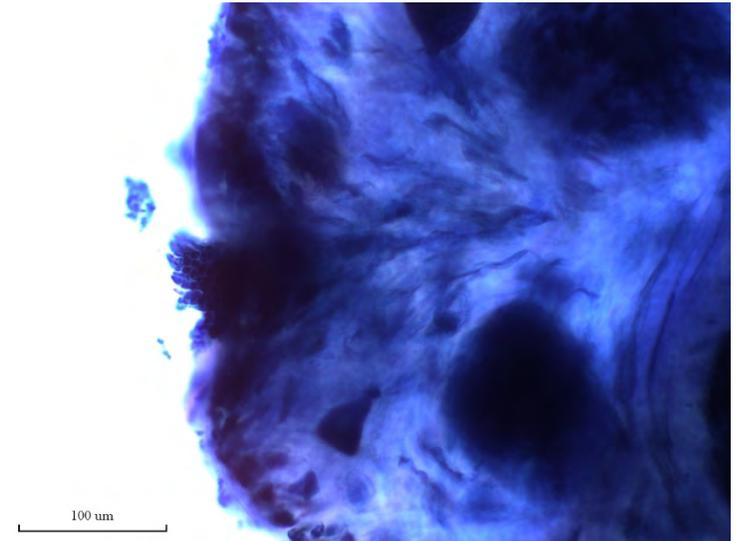
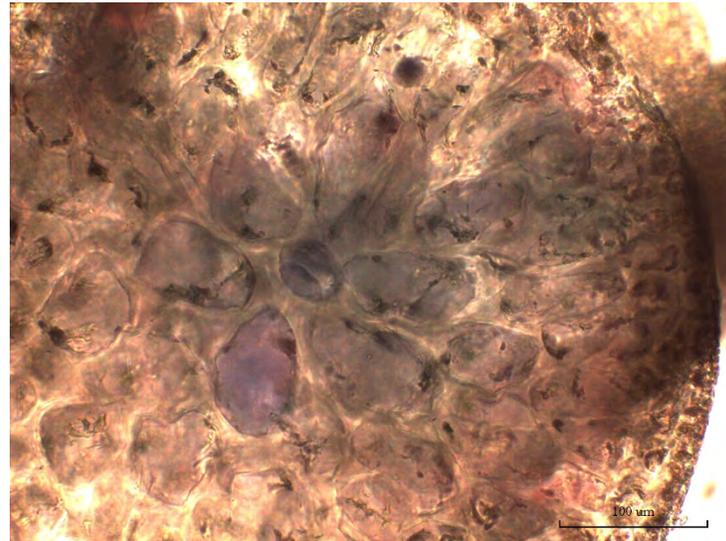




- Invasive algal surveys; mostly at 20-30 ft depths.
- Alga may be more widespread at deeper depths (to at least 70 ft.)



It has been identified as a *Chondria*, but the species is unclear. It does not currently match a known species in the Hawaiian Archipelago



Same family as *Acanthophora* and *Laurencia*

Tetraspores were observed in some individuals

Observation Timeline

2014 PMNM

- NW Backreef
- No observable mats
- Photos

2015 PMNM

- NW Backreef
- Isolated mats
- No observable mats at other backreef or forereef sites
- Photos

2016 NMFS

- Mats observed
- Sample
- “Before” photo of ARMS site

2017 PMNM

- Mats observed
- Photogrammetry

2019 PMNM Mats observed

- N, SE, SW Forereefs
- 20-30 ft
- Photos
- Samples

What we DO know:

- Red alga in genus *Chondria*.
- Is not known from Hawaii
- Can overgrow and smother both native algae and corals
- Is widespread from 5 to at least 70 ft depths around Pearl and Hermes
- Spur and groove reefs
- Controlled by 6% commercial bleach for 10 minutes
- First detection in 2014
- Hard to identify in the field
- Unattached mats floating
- Unattached fragments and mats were observed in the water.



What we DON'T know:

- Growth rate
- Lower depth range > 70 ft?
- Present in other locations
- Population structure
- Species
- Origins or mode of introduction
- Herbivory



Samples/Field work in hand:

- Samples for molecular verification from every site surveyed
- Population-level samples (n = 5 sites around P&H, with 25 samples taken every 1-2 m per site) for connectivity and ploidy research
- Samples preserved for stable isotope and tissue nutrient analyses
- Distribution map around Pearl and Hermes
- Extensive photo and video documentation at Pearl and Hermes
- 3-D photogrammetry of sites with and without invasive algae at similar depths

Next Steps:

- MMB ad hoc Technical Working Group
 - Information gaps & research needs
- UH Botany & College of Charleston
 - Genetics
- Evaluate policy needs

