Fore-C: Forecasting coral disease outbreaks across the tropical Pacific

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Corals reefs provide ecosystem services

- Tourism
- Food
- Livelihoods
- Coastline protection
Unprecedented & ongoing outbreak
Unprecedented & ongoing outbreak
Drivers of coral disease spread
Overarching objective for Fore-C

Forecasting regions

- MARIANA ARCHIPELAGO
- CORAL TRIANGLE
- NORTHWESTERN HAWAIIAN ISLANDS
- MAIN HAWAIIAN ISLANDS
- PACIFIC REMOTE ISLAND AREAS
- AUSTRALIA
- AMERICAN SAMOA
Overarching objective for Fore-C

Tissue Loss

Black band

Growth anomalies

Photo: Bette Willis
Temperature as a disease driver

Pathogen survival, growth, virulence

Coral susceptibility
Temperature as a disease driver
Temperature as a disease driver

Hot Snap

Winter Condition

50 km

5 km

Outbreak Risk

Low  Moderate  High

Accumulated Winter Anomaly

Cool  Mild  Warm

Legend:

Land  Land mask  Sea
Water quality as a disease driver

Chlorophyll-a
Turbidity

Pathogen growth, transport

Coral susceptibility, feeding
Water quality as a disease driver

Maui Nui Daily VIIRS 750m
Chlorophyll-a (2019-05-03)
Water quality as a disease driver

Spatial buffer (pixels)

Time scale (days)

Days
- 0-20
- 20-40
- 40-60
- 60-80
- 80-100
Water quality as a disease driver

Spatial buffer (pixels)

Time scale (days)

30 pix = 22.5km

5 pix = 3.75km
Water quality as a disease driver
Other disease drivers

• Colony size
• Coral density
• Coral community composition
• Depth
• Irradiance
• Wave exposure
• Stream exposure
• Coastal development
• Agriculture and golf runoff
• Human population size
Results from Hawaii
Large corals = higher disease risk
Growth anomalies

Associated with human activities in watersheds adjacent to shallow, semi-protected coral reefs
Associated with reef structure, water motion, and temperature exposure
Preliminary results from Guam
Disease risk influenced by colony size, beaching history, chlorophyll-α
Learn more at Austin’s poster
Outbreak response network

Forecasting regions

Partners
- TNC
- NOAA ESD
- CRAG/DMWR
- NPS
- GBRMPA
- U of Guam
Guam outbreak

Photos: Laurie Raymundo
Guam outbreak

Conceptual diagram

Healthy
Diseased
Stressed
Initial prototype

Beta rollout: July 2020
Thank you