Enhancing Coastal and Ocean Observing and Innovation: OAR and IOOS

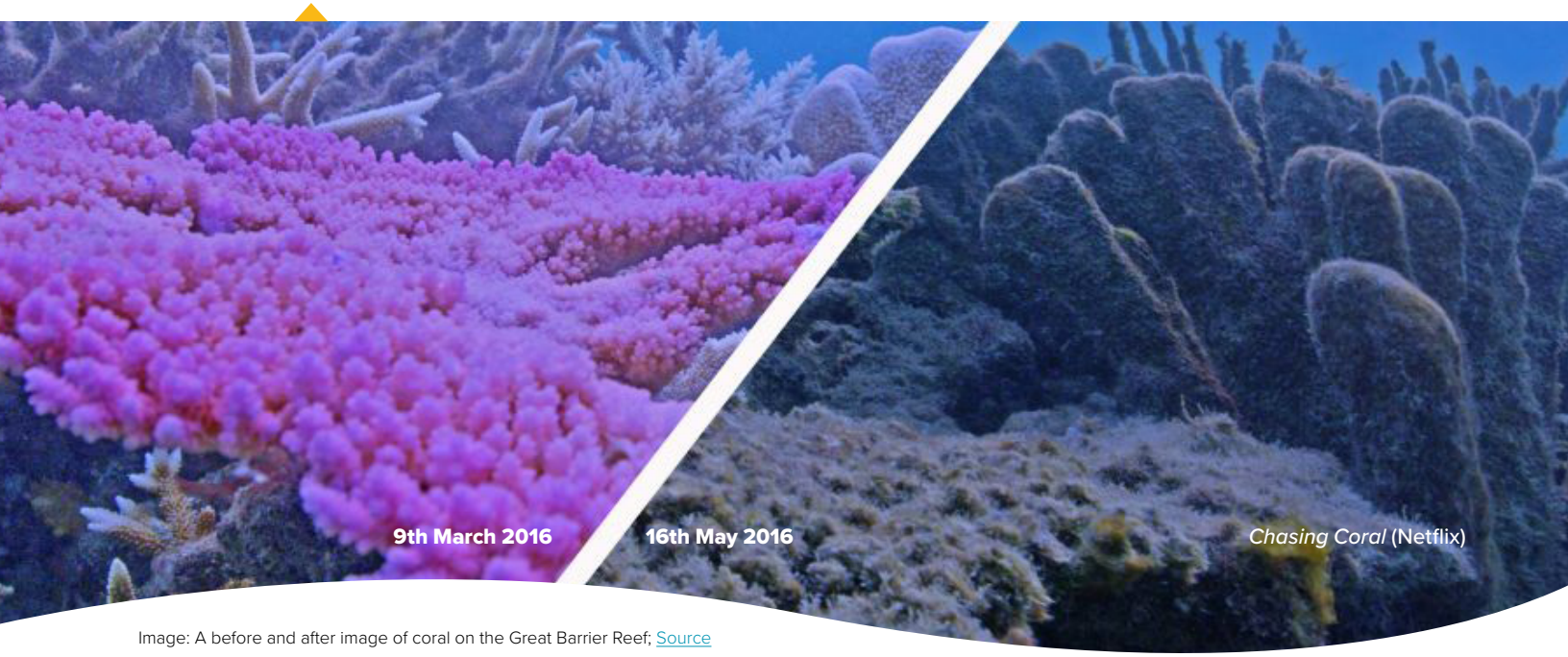


Image: A before and after image of coral on the Great Barrier Reef; Source

Marine Heatwaves

OVERVIEW

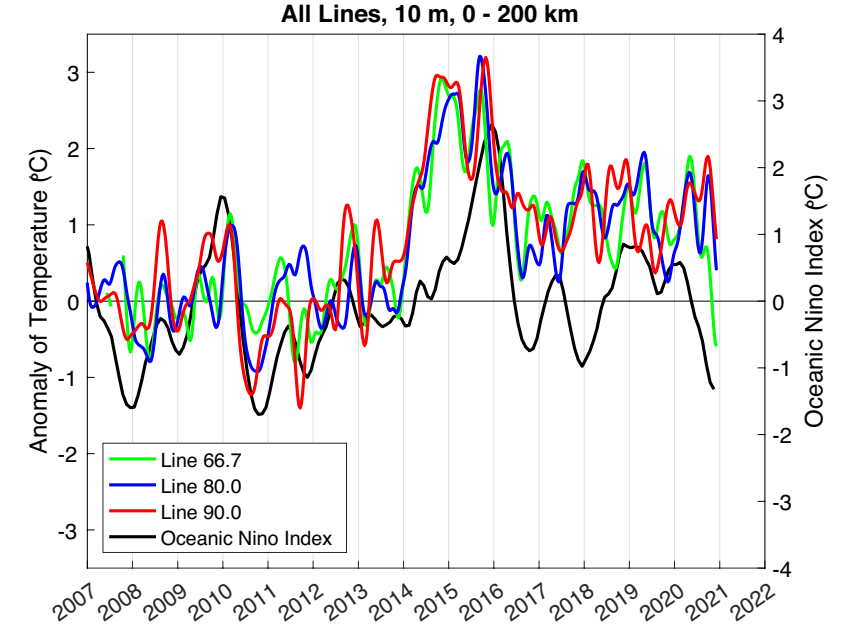
Marine heatwaves (MHW) are anomalously warm, prolonged, and discrete events that occur when temperatures are warmer than the 90th percentile and last at least five days[1]. As the ocean warmed in recent decades, data suggest MHW events are occurring more frequently and climate models suggest that the frequency, size, intensity, and duration of these events will continue to increase markedly as the climate continues to warm. The unusually warm water resulting from MHWs results in profound economic and ecological impacts to marine ecosystems, fishing and aquaculture industries, and coastal communities.

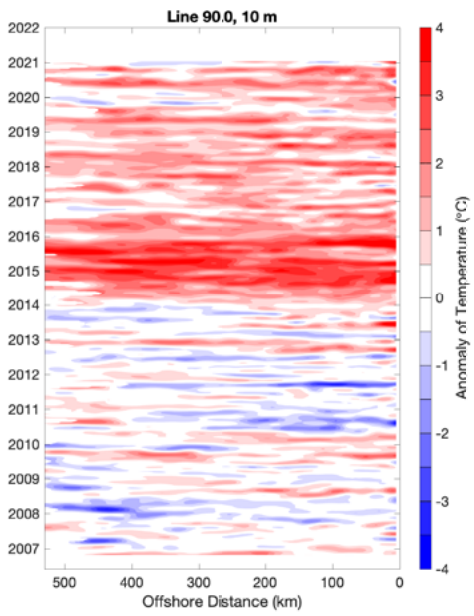
OPPORTUNITY

Better understanding and predicting MHWs requires improved answers to the following:

- How do the air-sea interactions and oceanic processes with MHWs vary regionally and seasonally?
- Are there different mechanisms responsible for the creation versus maintenance of MHWs?
- Are sub-surface MHWs fundamentally different?
- What effect do marine cold snaps have on MHWs?
- What mix of ocean observations are required to monitor and predict MHWs?

The 2014-2016 Marine Heat Wave (“the blob”) brought attention to the importance of observing ocean temperature relative to climatology. The Oceanic and Atmospheric Research (OAR), Integrated Ocean Observing System (IOOS), and Sea Grant held two Pacific Anomalies Workshops in 2015 and 2016 that brought scientists together to discuss the observational and mechanism needs related to predicting and responding to MHWs. Taken together, these series of workshops have been highly effective in enhancing the collective understanding of MHWs by highlighting knowledge and observational gaps, and identifying specific recommendations for improving the scientific understanding and prediction of future MHW events.





NEXT

OAR-IOOS Marine Heat Wave Recommendations:

Near-term Recommendations (0-1 years)

- Compile a list of the National Oceanic and Atmospheric Administration's (NOAA) MHW-related products and services.
- Develop an observing asset list.
- Identify data gaps that can be filled by IOOS-OAR collaboration.

Mid-term Recommendations (2-5 years)

- Enhance observing networks and improve predictability by increasing the understanding physics, chemistry, and biology with respect to MHWs.
- Leverage OAR and IOOS observations and capabilities to improve understanding of marine ecosystem effects.
- Develop a nested info/data system that starts with real-time observations, synthesized and integrated, feeding into regional indices/dashboards, that can then feed into the national climate assessments.
- Develop an MHW early warning system or identification of MHW early warning indicators with predictions of near term impacts.

Long-term Recommendations (5+ years)

- Develop modular, adaptive systems that capture biogeochemical and ecological (e.g., eDNA, acoustics) parameters and can be integrated into extant autonomous underwater vehicle (AUV, A robot that travels underwater without requiring input from an operator) payloads.
- Develop regional-to-pan regional reanalysis products that make full use of IOOS and OAR observing capabilities to make real improvements in predictability.
- Re-evaluate and evolve how to measure and report ocean observations.

Image: California Underwater Glider Network—MHW Tracking (Surface-to-Surface MHWs in the California Ecosystem); Dan Rudnick, SIO

An example of how IOOS and OAR gliders are being used to highlight the intensity of MHWs, their progression over space, and study whether correlations exist with El Niño events. These data are pivotal for understanding MHW mechanisms and for information about which conditions the ecosystem encounters over time and space. The plots show data for 10 meter depth, but note that gliders are collecting full-water column profile data, yielding views at any depth 0-200 meters.

1 Hobday et al., 2016

For additional information, please contact:
Mackenzie Solomon
National Oceanic and Atmospheric Administration
Office of Legislative & Intergovernmental Affairs
(202) 482-2497 • mackenzie.solomon@noaa.gov