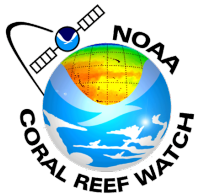
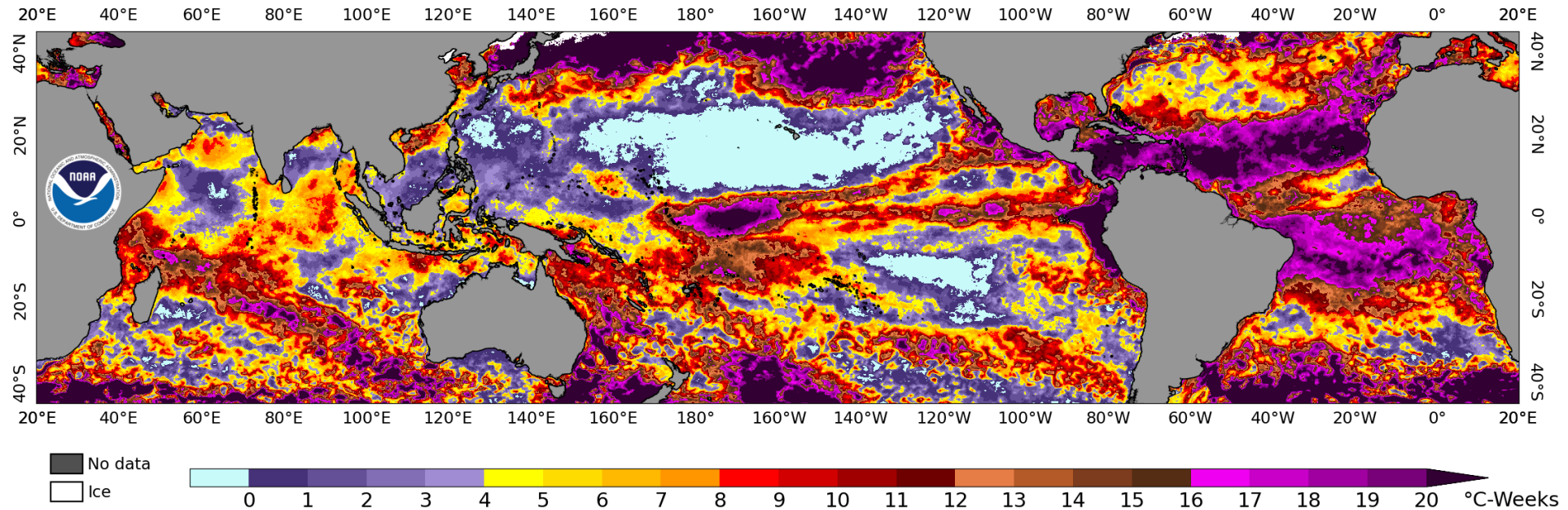


# The 4<sup>th</sup> Global Coral Bleaching Event (GBE4): 2023 - ?

Derek Manzello, Ph.D.  
NOAA Coral Reef Watch

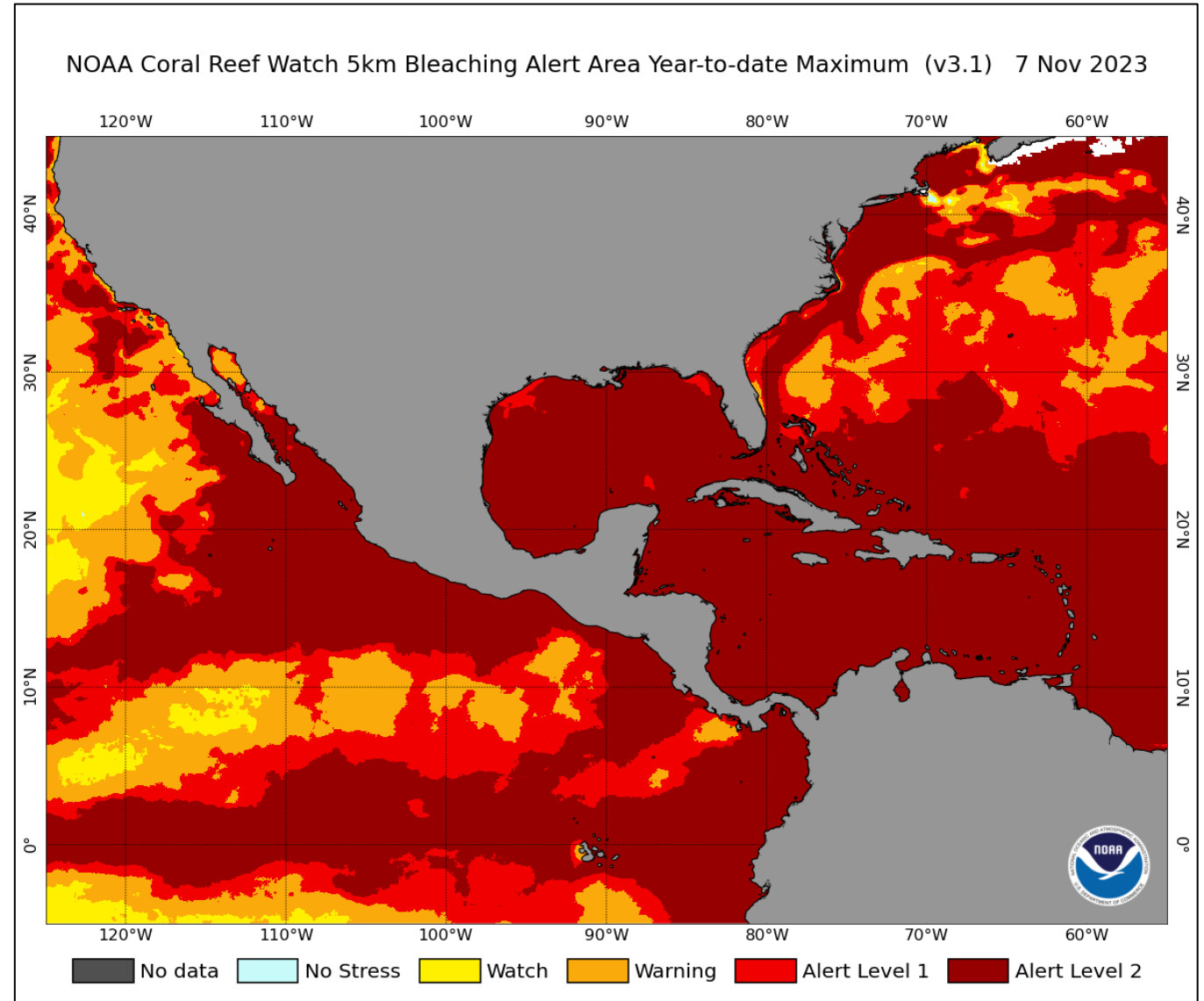
NOAA Coral Reef Watch 5km Degree Heating Week Maximum (v3.1) 1 January 2023 - 10 May 2024



# Bleaching Alert Levels: *A New Reality*

**Bleaching Alert Level 1 ( $4 < \text{DHW} < 8$ )**  
Significant Bleaching Likely

**Bleaching Alert Level 2 ( $\text{DHW} > 8$ )**  
Severe Bleaching and Significant Mortality Likely



# New Bleaching Alert Levels

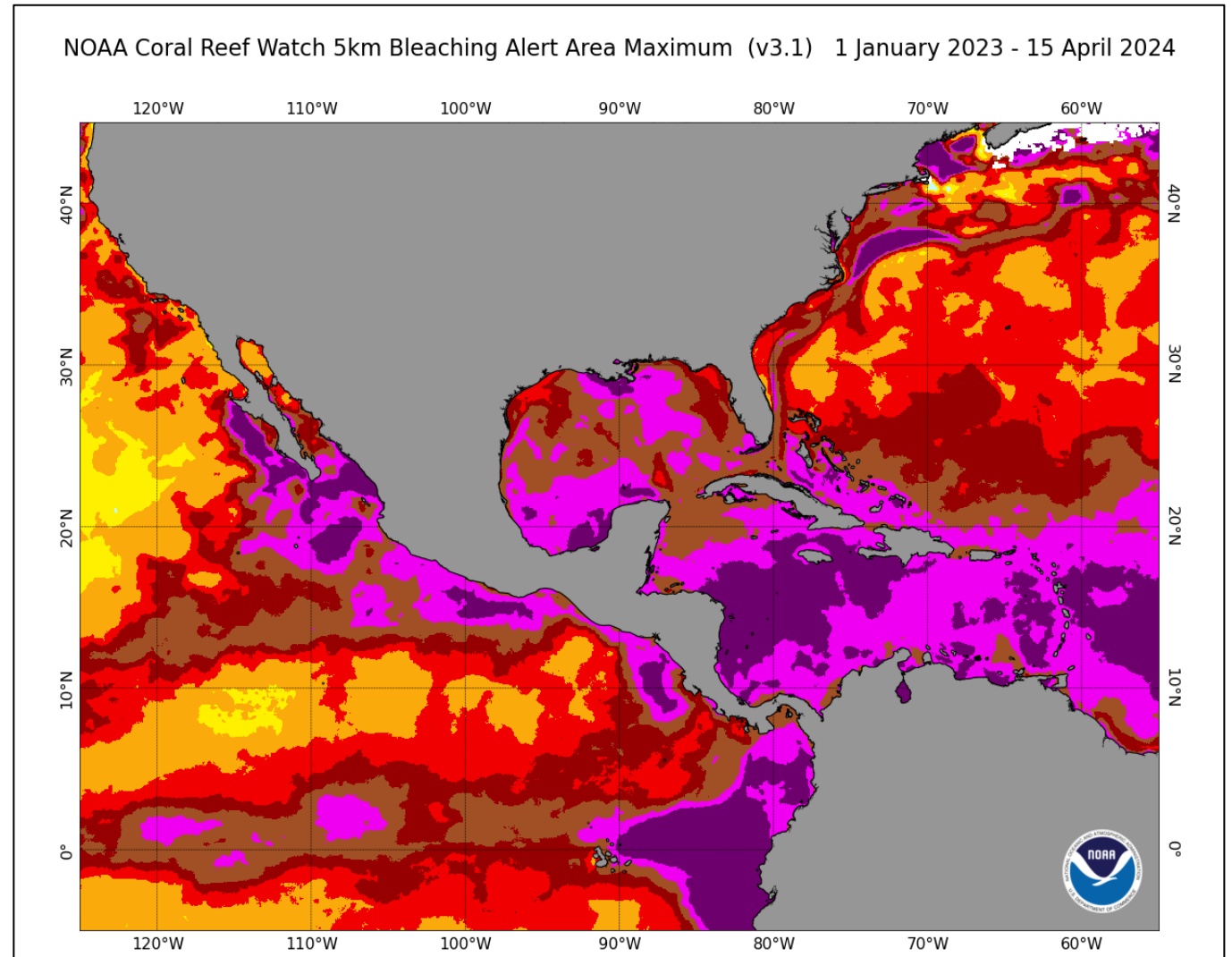
**Bleaching Alert Level 1 ( $4 < \text{DHW} < 8$ )**  
Reef-Wide Bleaching

**Bleaching Alert Level 2 ( $8 < \text{DHW} < 12$ )**  
Reef-Wide Bleaching with Mortality of Heat-Sensitive Corals

**Bleaching Alert Level 3 ( $12 < \text{DHW} < 16$ )**  
Multi-Species Mortality

**Bleaching Alert Level 4 ( $16 < \text{DHW} < 20$ )**  
Severe, Multi-Species Mortality (> 50% of corals)

**Bleaching Alert Level 5 ( $\text{DHW} > 20$ )**  
Near Complete Mortality (> 80% of corals)



# New Bleaching Alert Levels

**Bleaching Alert Level 1 ( $4 < \text{DHW} < 8$ )**  
Reef-Wide Bleaching

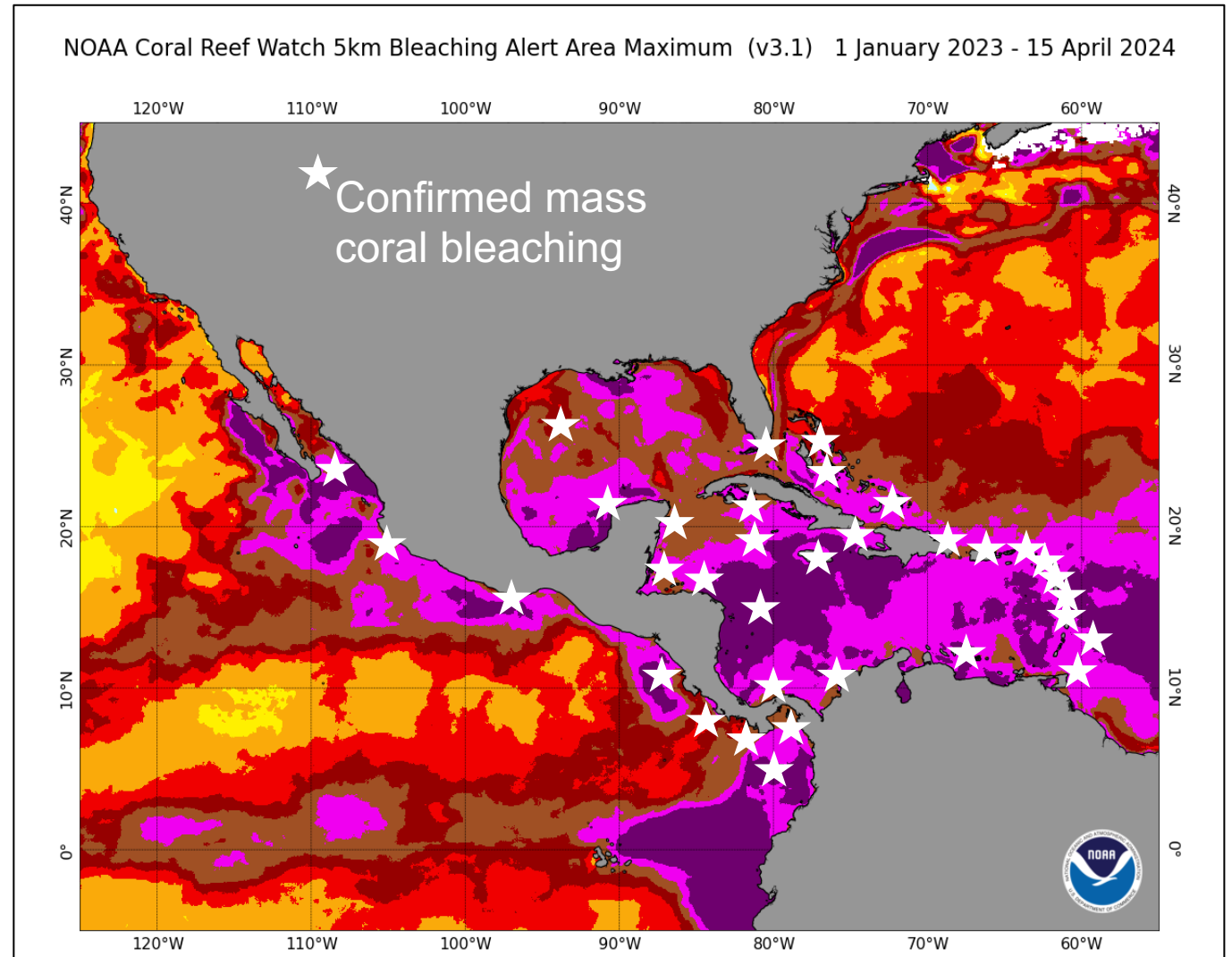
**Bleaching Alert Level 2 ( $8 < \text{DHW} < 12$ )** \*  
Reef-Wide Bleaching with Mortality of Heat-Sensitive Corals

**Bleaching Alert Level 3 ( $12 < \text{DHW} < 16$ )**  
Multi-Species Mortality

**Bleaching Alert Level 4 ( $16 < \text{DHW} < 20$ )**  
Severe, Multi-Species Mortality (> 50% of corals)

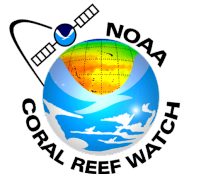
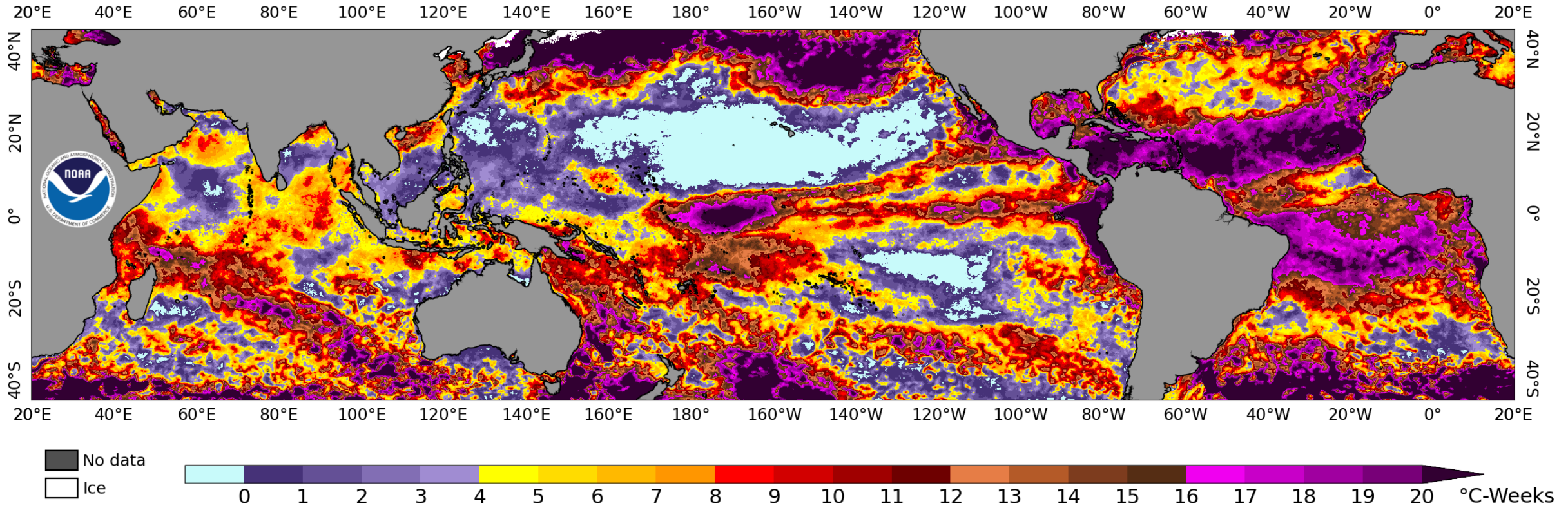
**Bleaching Alert Level 5 ( $\text{DHW} > 20$ )**  
Near Complete Mortality (> 80% of corals)

\* **Severe coral mortality can occur at AL2:**  
-for heat sensitive species (*Acropora*)  
-when a reef experiences 1st event (e.g., NGBR, 2016)



# Max Degree Heating Weeks: 2023 - 2024

NOAA Coral Reef Watch 5km Degree Heating Week Maximum (v3.1) 1 January 2023 - 10 May 2024

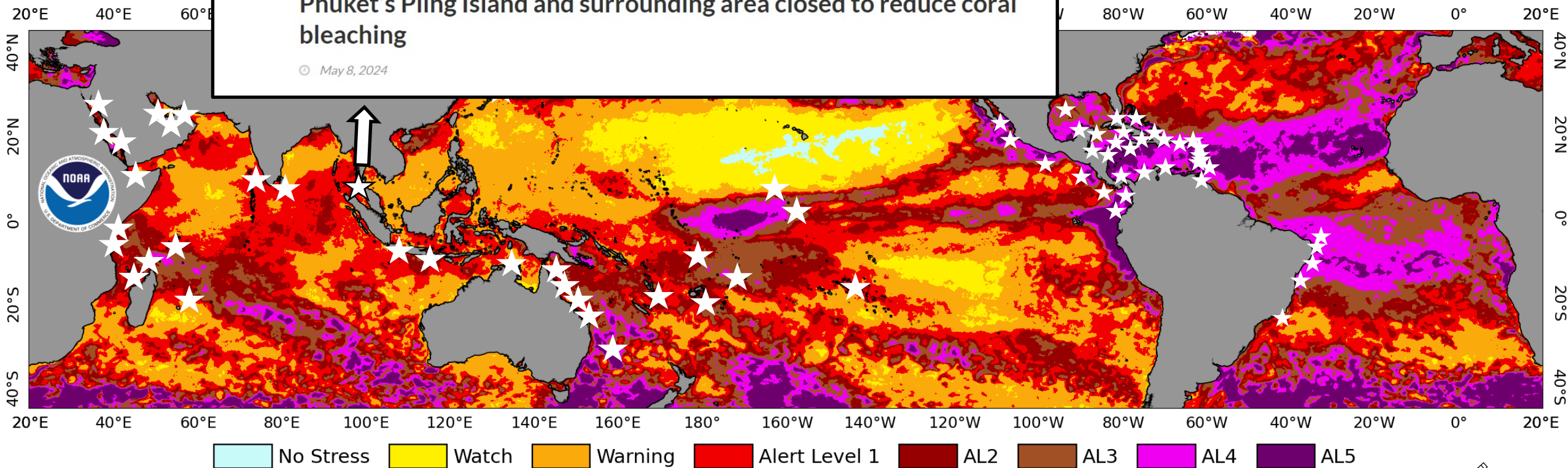


## Phuket's Pling Island and surrounding area closed to reduce coral bleaching

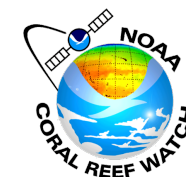
© May 8, 2024

: 2023 - 2024

January 2023 - 10 May 2024

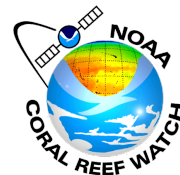
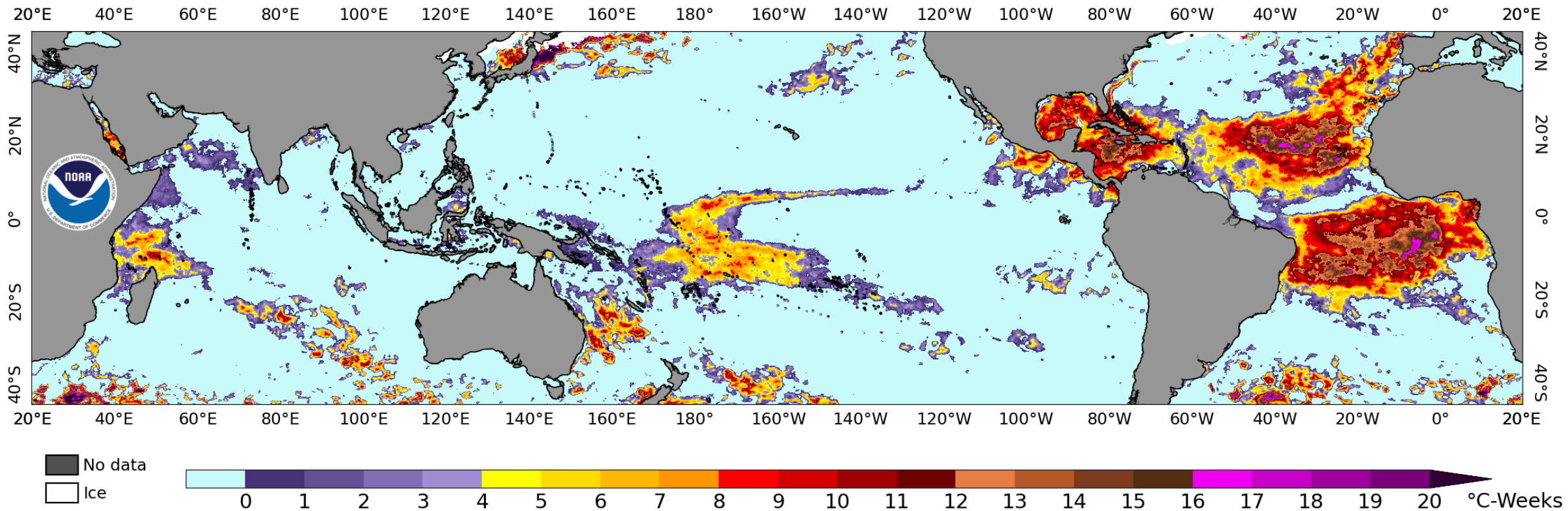


**Mass bleaching confirmed in at least 57 countries/territories**



# Record-Setting Heat Stress

$$\Delta\text{DHW} = (\text{Max DHW}_{2023-2024}) - (\text{Max DHW}_{1985-2022})$$



# Ranking the 4 Global Coral Bleaching Events

## Global Bleaching Event Index\*

Event	Years	Peak % Reef Area Impacted
GBE1	1998	20%
GBE2	2010	35%
GBE3	2014-2017	56.1%
<b>GBE4</b>	<b>2023-?</b>	<b>60.2% and increasing</b>

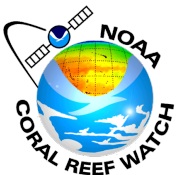
\*GBE Index developed by Skirving et al. (2019, *Coral Reefs*)  
*Measure of % reef pixels experiencing bleaching-level heat stress within past 365 days*

## Resultant Impacts

- 8% of world's corals died in 1998
- 14% further loss from 2009-2018

Source: Status of Coral Reefs of the World: 2020

**>99% of Atlantic reef areas have experienced bleaching-level heat stress within past year**

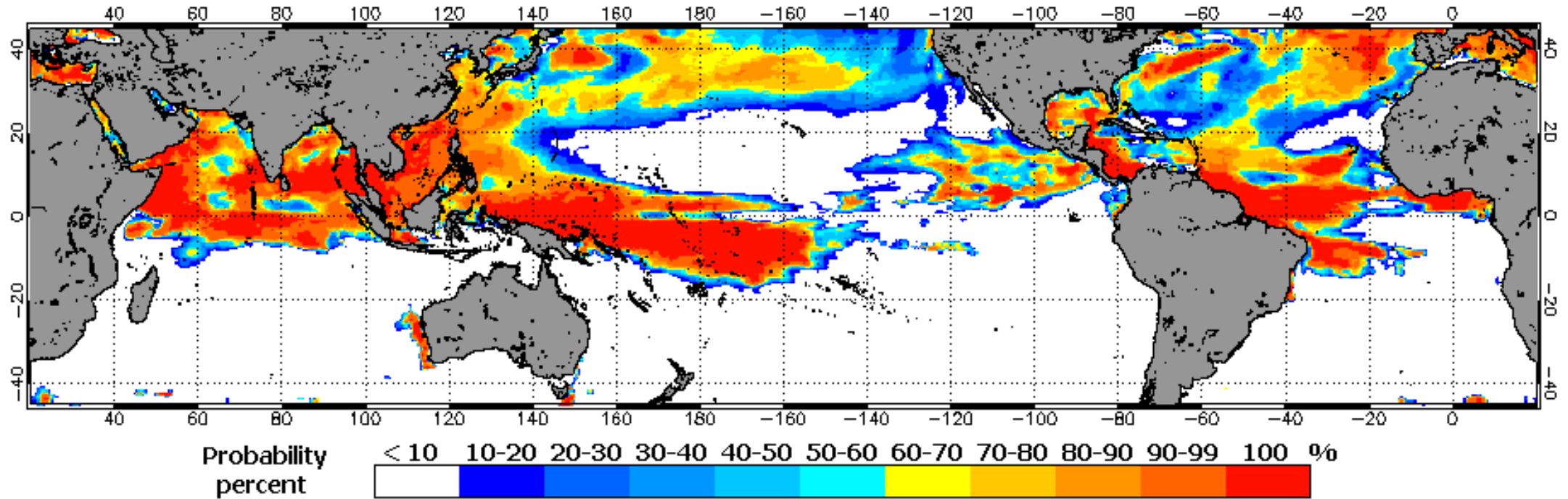




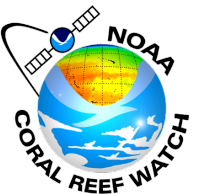
# Four-Month Coral Bleaching Outlook (Updated weekly)

2024 May 7 NOAA Coral Reef Watch Bleaching Heat Stress Probabilities (Alert 1 & 2) for May–Aug 2024

Experimental, v5.0, CFSv2–based, 28 to 112 Ensemble Members



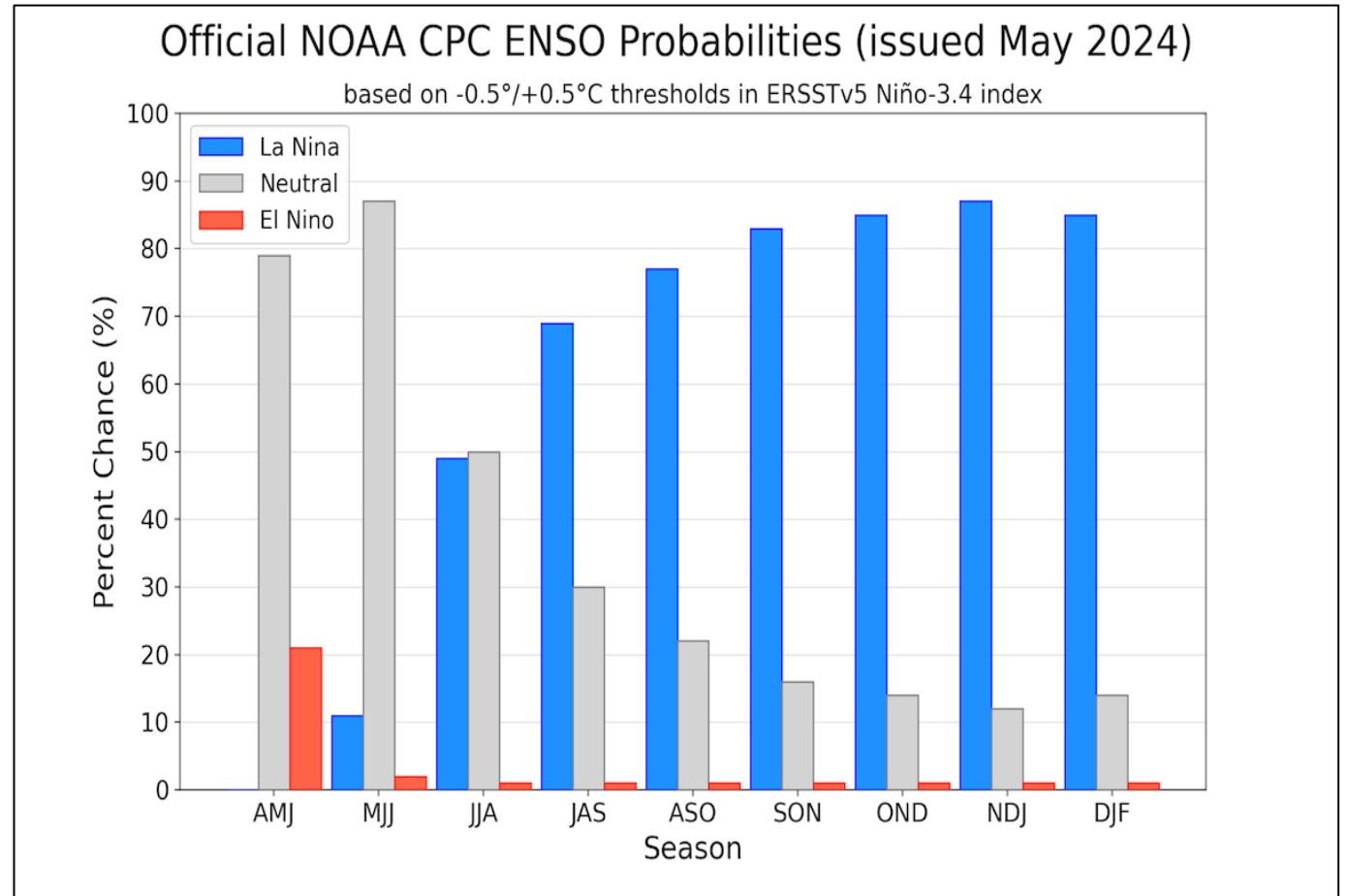
NOAA Coral Reef Watch



# Good Riddance, El Niño!

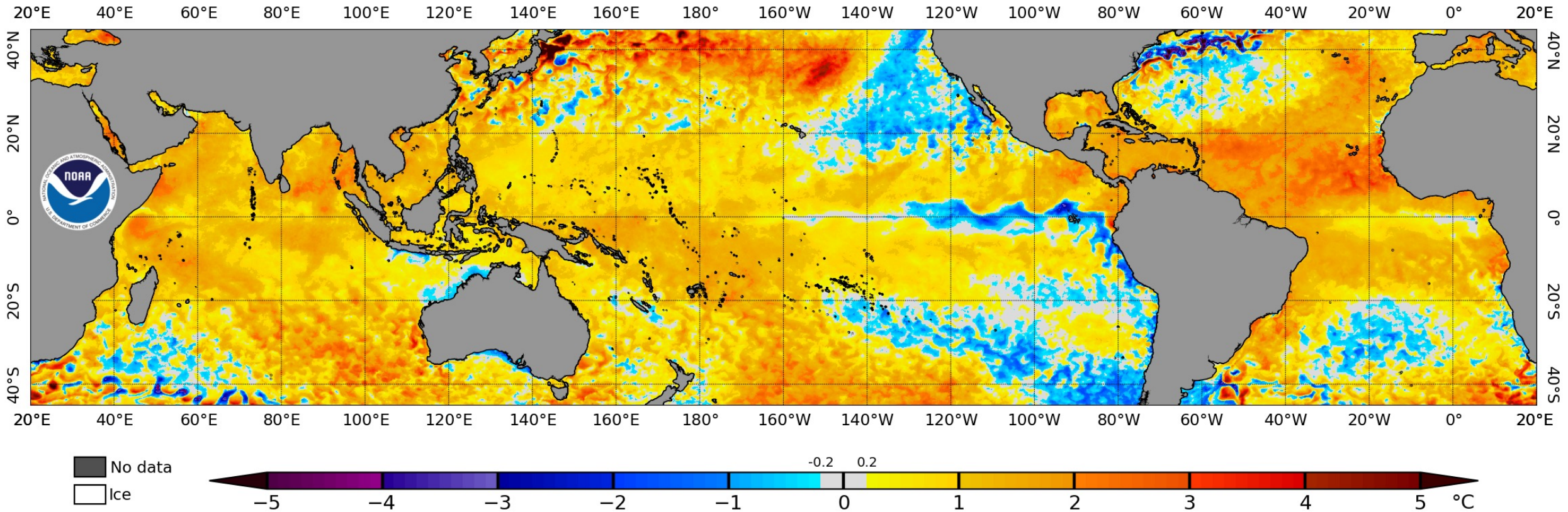
-Transition to ENSO-neutral likely this month

-La Niña develops in June-August (49% chance) or July-September 2024 (69% chance)



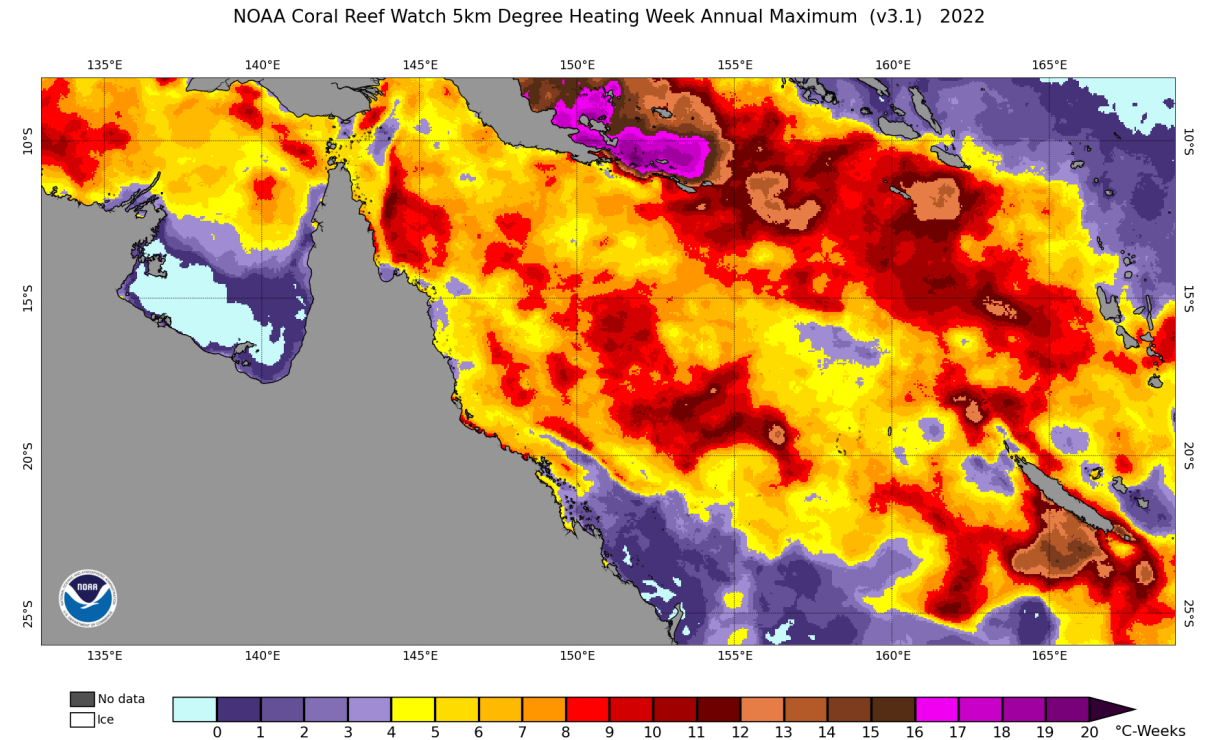
# ...But, the ocean is still running a serious fever...

NOAA Coral Reef Watch Daily 5km SST Anomalies (v3.1) 12 May 2024

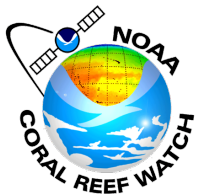


# ...and mass bleaching is now occurring during all phases of ENSO...

- First mass bleaching event on the Great Barrier Reef during La Niña in 2022 (Spady et al. 2022, *F1000*)
- Ocean temps have warmed to where large-scale bleaching now occurs out of phase with El Niño



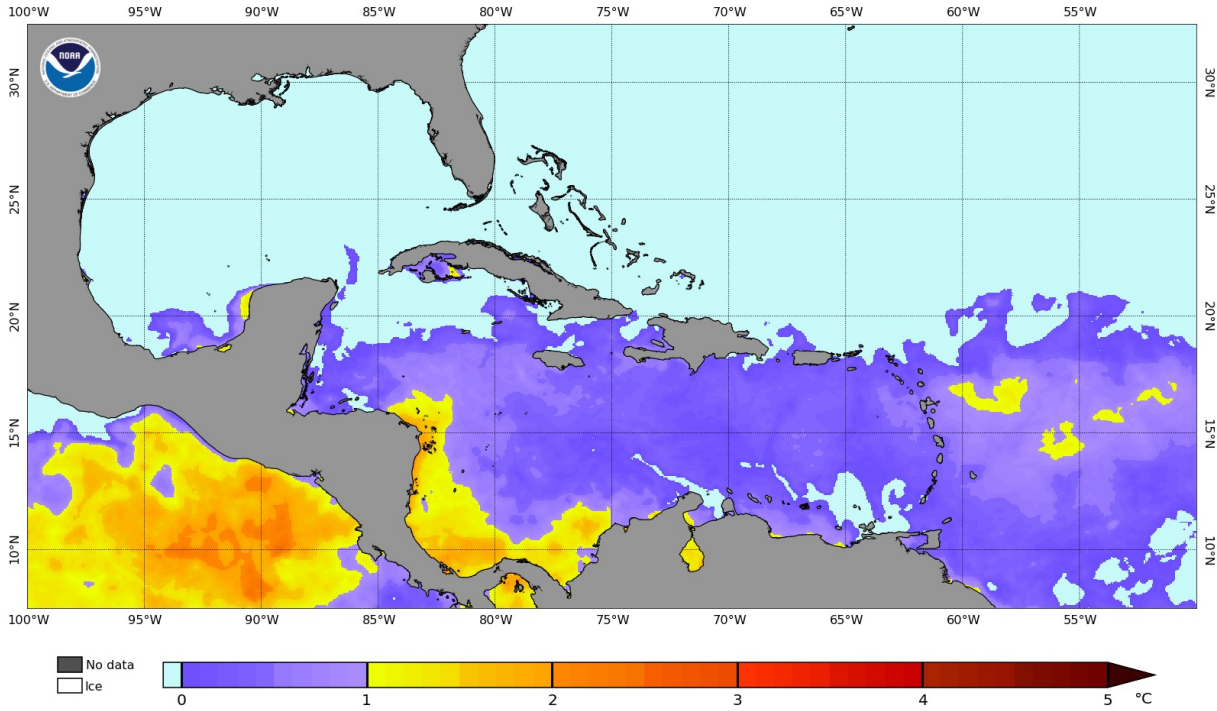
Max 2022 DHW for GBR



# This is very concerning...

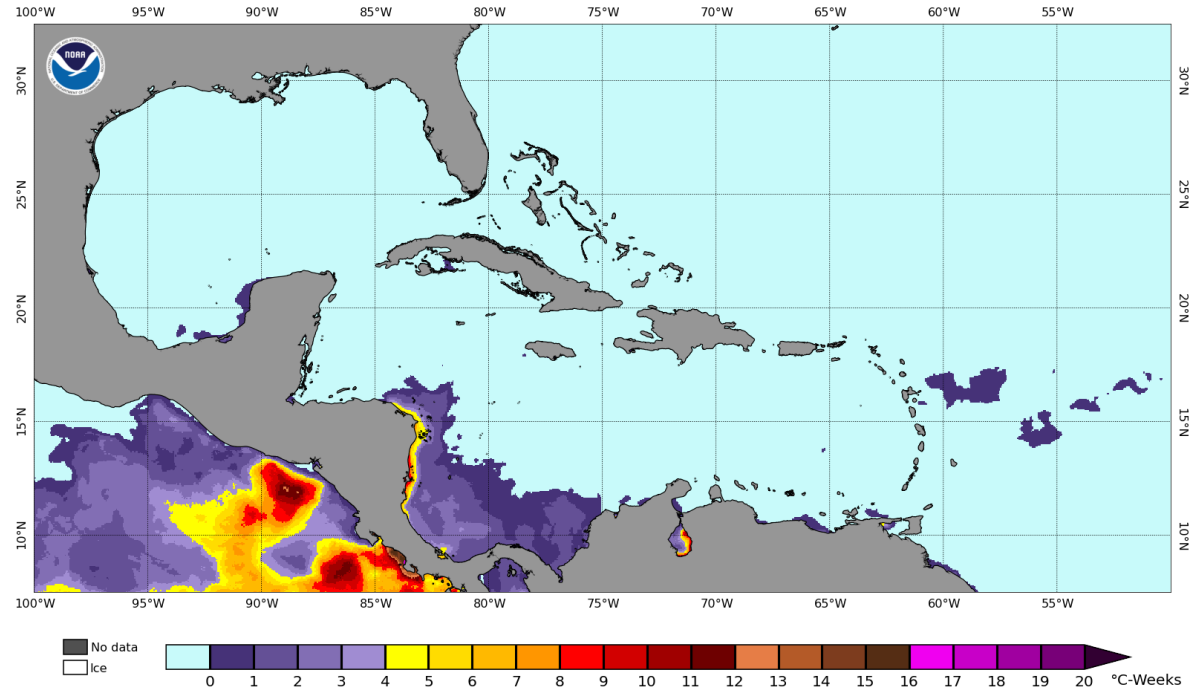
## Hotspots

NOAA Coral Reef Watch Daily 5km HotSpots (v3.1) 12 May 2024



## Degree Heating Weeks

NOAA Coral Reef Watch Daily 5km Degree Heating Weeks (v3.1) 12 May 2024

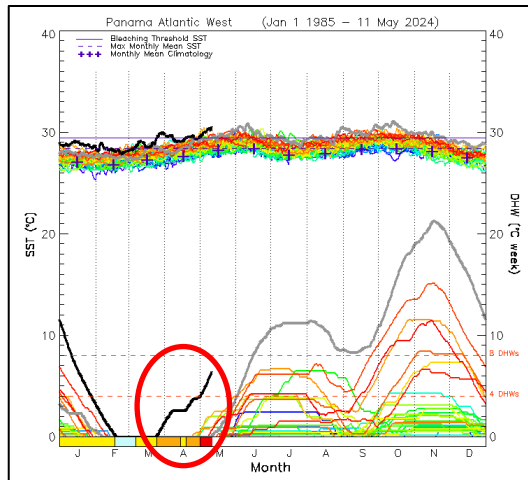


**DHWs ALREADY accumulating in S. Caribbean!!!**

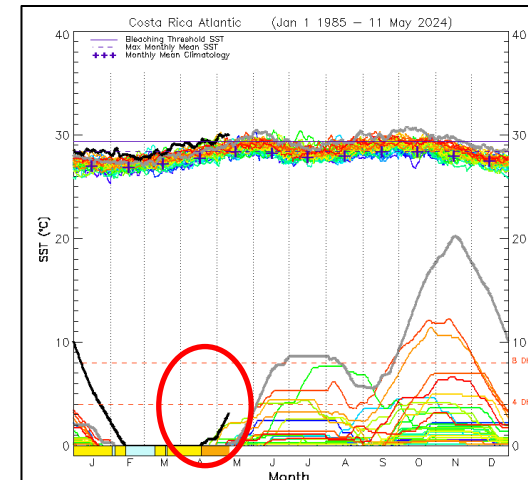
# Heat Stress *ALREADY* accumulating in S. Caribbean!!!

Caribbean Panamá

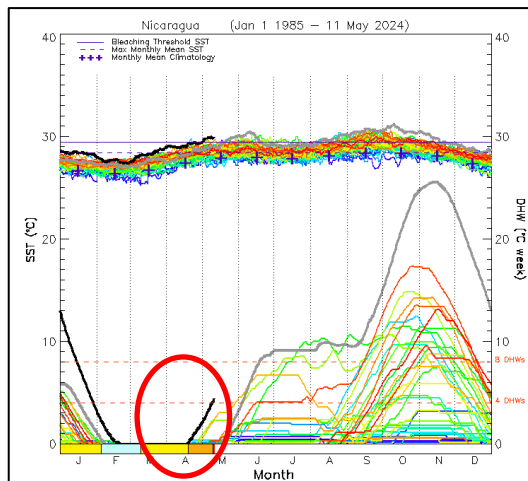
**One of 1<sup>st</sup> Atlantic locations to bleach in 2023**



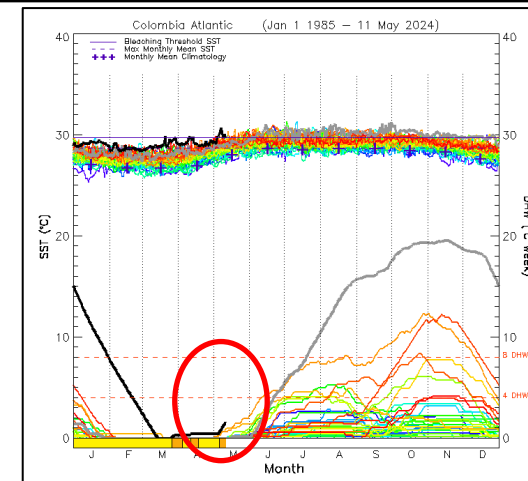
Caribbean Costa Rica



Nicaragua

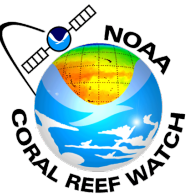


Caribbean Columbia



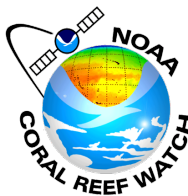
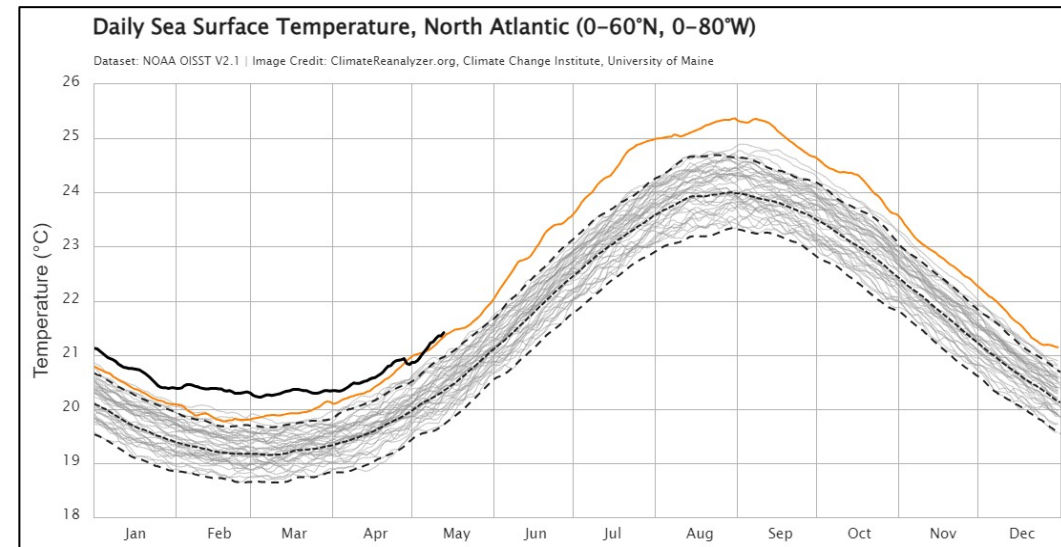
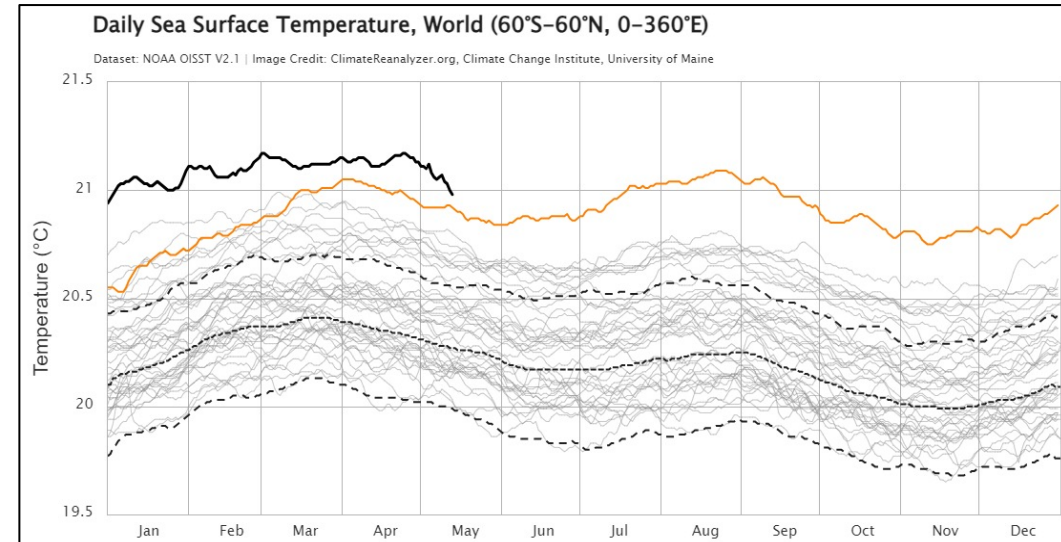
# Summary and Conclusions

- Since February 2023, severe coral bleaching reported from 57 countries/territories spanning all ocean basins
- As of May 12, 60.2% of the world's coral reef area has experienced bleaching-level heat stress in past year
  - ***This is a new record and is still increasing!***
- Impacts from this event will take 1-2 years to fully understand
  - We do know there were severe impacts to *Acropora* in wider Caribbean
  - First publication on this event from Mexican Pacific – 50-93% mortality in Huatulco, Oaxaca (Lopez-Perez et al. 2024, Oceans)
- Monitoring data needed during bleaching and 1-2 years after heat stress subsides!
  - Allows identification of resilient reefs, species, and genotypes
  - Provides blueprint for how to save corals during the next, inevitable coral bleaching event



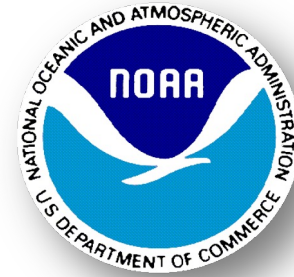
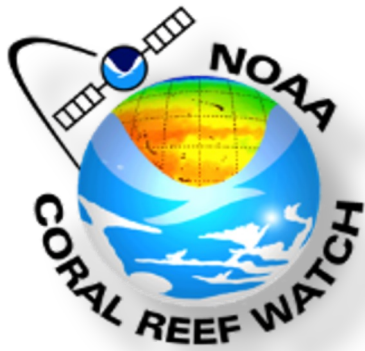
# Summary and Conclusions II

- These are “strange days” for global ocean temps
- Dissipating El Niño is good news...
  - ...but ocean still running a serious fever
- Important to understand the timing of subsequent disease and corallivore outbreaks
  - Many corals can survive bleaching, but later die from disease or predation
  - Preventing a local extinction could be as simple as picking snails off recovering corals!!





# Thank you from the NOAA Coral Reef Watch Team!!



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Coral Reef Watch



@CoralReefWatch

