

The changing ocean: lesson 1 of 3

A warming ocean

Where the extra heat goes,
and how scientists measure
heat stress on reefs



Bleached coral



The ocean takes the heat

more than 90%

of the extra heat trapped by greenhouse gases has gone into the ocean

Without the ocean, the air would have warmed far more. But that heat is changing life in the sea.



Experiment: why the sea warms slowly

1. Fill one cup with sand and one with the same amount of water.
2. Put a thermometer in each and record the starting temperatures.
3. Put both under a lamp or in the sun. Record every 2 minutes for 10 minutes.
4. Move them into the shade and record for another 10 minutes.

Predict

Which will heat up faster? Which will stay warm longer? What does that tell you about the ocean?



Marine heatwaves

A marine heatwave is a period when the sea is much warmer than usual for days, weeks or even months.

Corals live close to the top of the temperature range they can survive. A long heatwave makes them push out their algae and bleach.



Bleached coral



Degree heating weeks

Scientists at NOAA Coral Reef Watch use satellites to measure sea temperature over every reef.

When the sea is at least 1°C above the usual summer maximum, each week counts towards the heat stress. Degree heating weeks (DHW) add up those extra degrees over the last 12 weeks.

One week at 2°C above the maximum adds 2 DHW. Two weeks at 1.5°C adds 3 DHW.



NOAA's bleaching alert levels

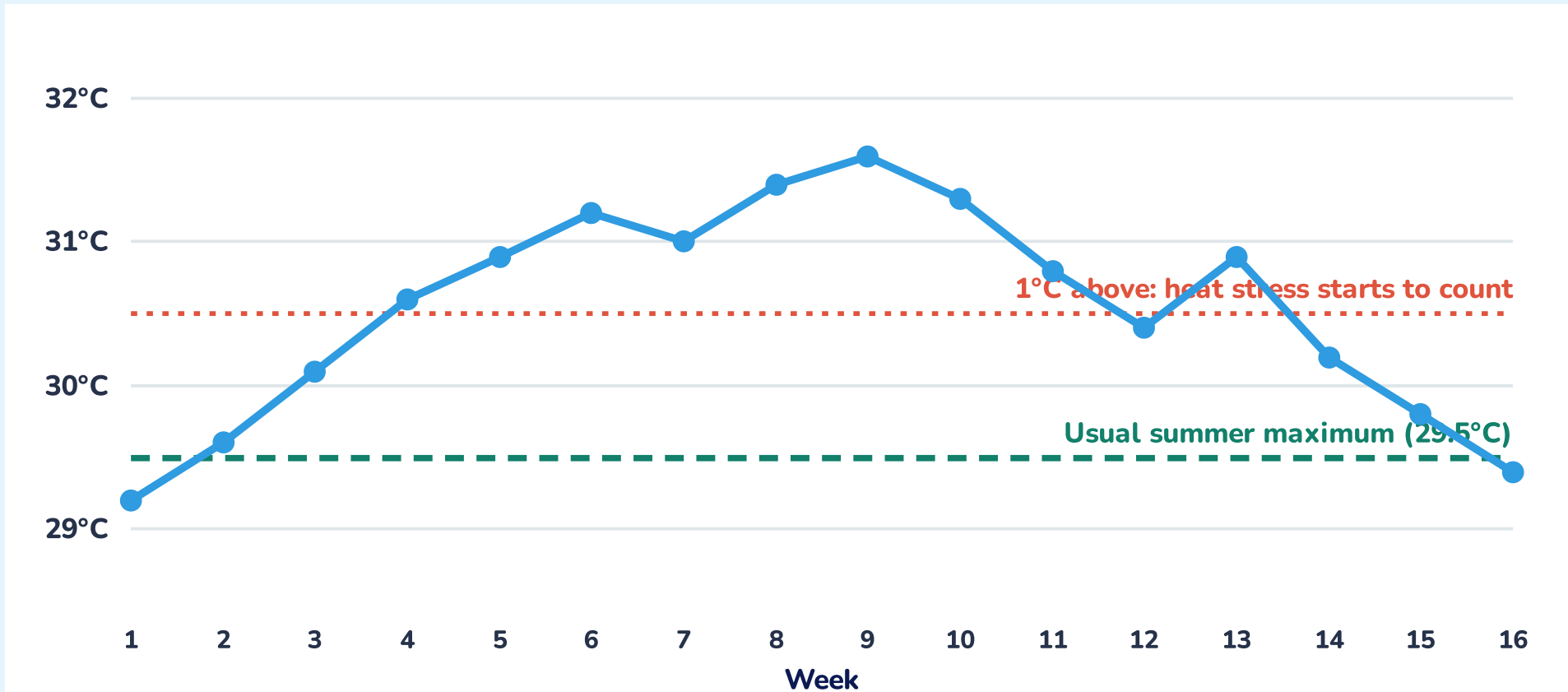


Levels 3, 4 and 5 were added in December 2023, because reefs were facing heat stress the old scale could not describe. Level 5 means a risk of near-complete coral death.



Your turn: a hot year on a reef

Practice data for a reef in the central Philippines. Use the table on your worksheet to work out the DHW.



Check your answer

14.2 DHW

by week 13

Alert level 3

risk of death for many coral species

Did you remember to leave out weeks less than 1°C above the maximum?



Talk about it

Why does the ocean warm more slowly than land, but stay warm longer?

Why do scientists count heat over 12 weeks, not one hot day?

What would you want to know about a reef after a level 3 alert?

Next time: an acidifying ocean



Photos and sources

Photos: bleached coral from MCP's media library. Chart and practice data made for this lesson. All illustrations drawn for this lesson by Marine Conservation Philippines.

Sources:

- IPCC (2021). Sixth Assessment Report, Working Group I.
- NOAA Coral Reef Watch. Bleaching alert area and degree heating weeks.
- NOAA Coral Reef Watch (2024). New alert levels, ICRI briefing.

Full links are in the teacher reading. Free to use and share for education. Made by Marine Conservation Philippines. More free lessons: marineconservationphilippines.org/resources/teachers-resources/

