

Marine Heat Waves

It is well-known that heatwaves occur in the atmosphere, which are familiar with the extended periods of excessively hot weather. However, heatwaves can also occur in the ocean and these are known as marine heatwaves (i.e., MHWs). These marine heatwaves, when ocean temperatures are extremely warm for an extended period of time can have devastating and long-term impacts on ecosystems, causing abrupt ecological changes and socioeconomic consequences.

In recent years, a number of prominent MHWs have been reported with devastating changes to marine ecosystems around the globe ⁽¹⁾. These include MHW events in the northwest Atlantic in 2012, northeast Pacific Ocean from 2013–2016, Tasman Sea in 2015/16, and waters around tropical Australia in 2015/16. On a global scale, these extreme temperature events have increased in frequency, a trend projected to continue throughout the twenty-first century.

Different definitions of MHW have used different thresholds, but basically it is the ocean's equivalent to what a heat wave in the weather is, which is very unusual temperatures that make a difference in the marine ecosystem. In Climate Insights, we follow the same idea we define the heatwaves over land (see section of 3.6.5). That is, we define a marine heatwave (MHW) as daily SST must exceed the calendar-day 90th percentile (SST90) for at least five consecutive days. The SST90 is a daily percentile climatology with a length of 366 days.

According its definition, marine heatwaves can occur in summer or winter, where they are known as “winter warm-spells” - they are defined based on differences with expected temperatures for the location and time of year. These winter events can have important impacts, such as in the southeast of Australia where the spiny sea urchin can only colonise further south when winter temperatures are above 12 °C. A winter warm spell there can help promote colonisation .

Despite a growing appreciation of their importance, scientific understanding of marine heatwaves (MHWs) is in its infancy compared to that of atmospheric heatwaves. On the other hand, impacts and implications of marine heatwave already become quite significant. For example, marine heatwaves affect ecosystem structure, by supporting certain species and suppressing others. Marine heatwaves can change the habitat ranges of certain species. Biodiversity can be drastically affected by marine heatwaves. Moreover, marine heatwaves can cause economic losses through impacts on fisheries and aquaculture.

¹Holbrook NJ, Scannell HA, Sen Gupta A, Benthuyssen JA, Feng M, Oliver ECJ, et al. A global assessment of marine

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By raising general awareness of the phenomena of marine heatwaves, and by improving our scientific understanding of their physical properties and ecological impacts, it is expected that future conditions can be better understood predicted so as to protect vulnerable marine habitats and resources.

A demonstration is presented in the following images (Fig. 1 and 2) for marine heatwave frequency (MHWF, unit: times/year) and marine heatwave days (MHWD, unit: days/year).

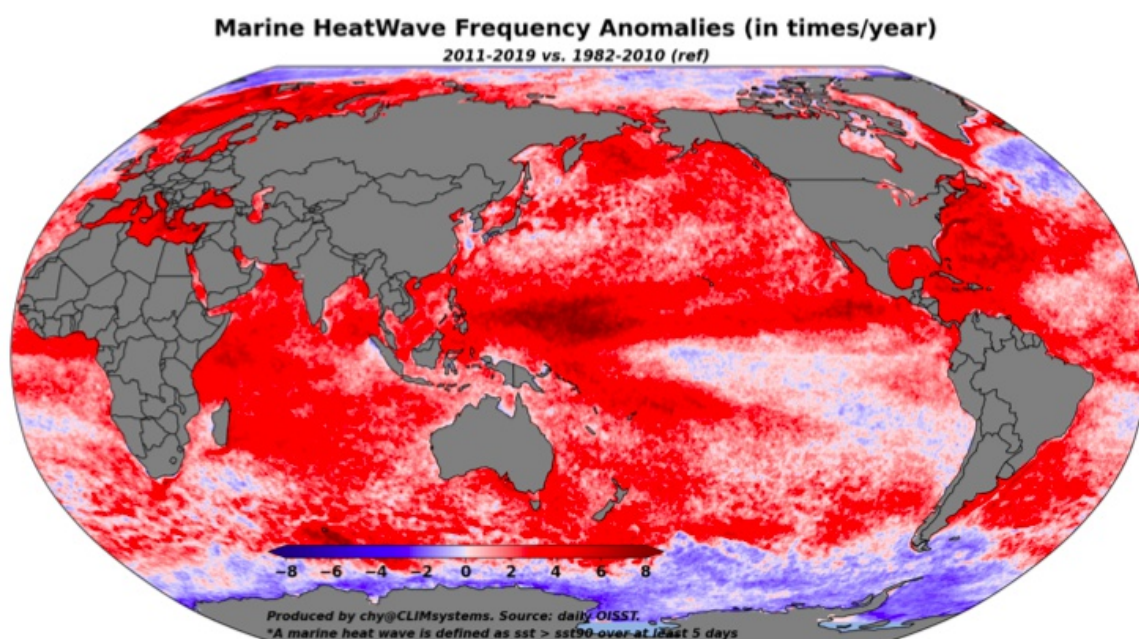


Fig. 1. Marine heatwave frequency changes (times/year) in latest 9 years compared with the baseline period of 1981-2010

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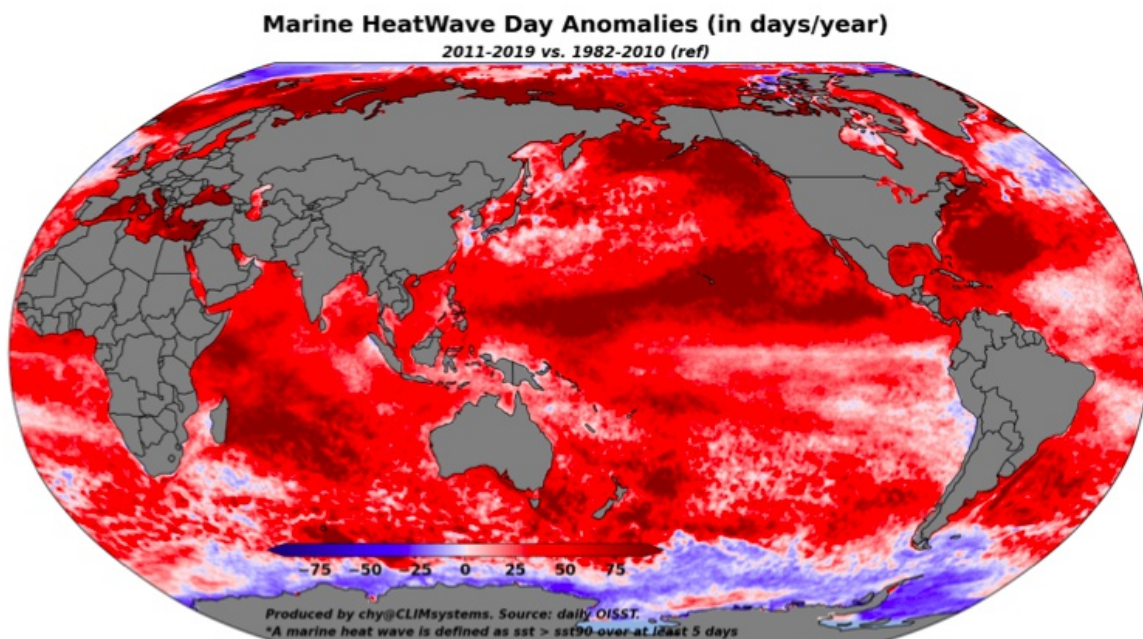


Fig. 2. Marine heatwave day changes (days/year) in latest 9 years compared with the baseline period of 1981-2010