OCEAN WARMING

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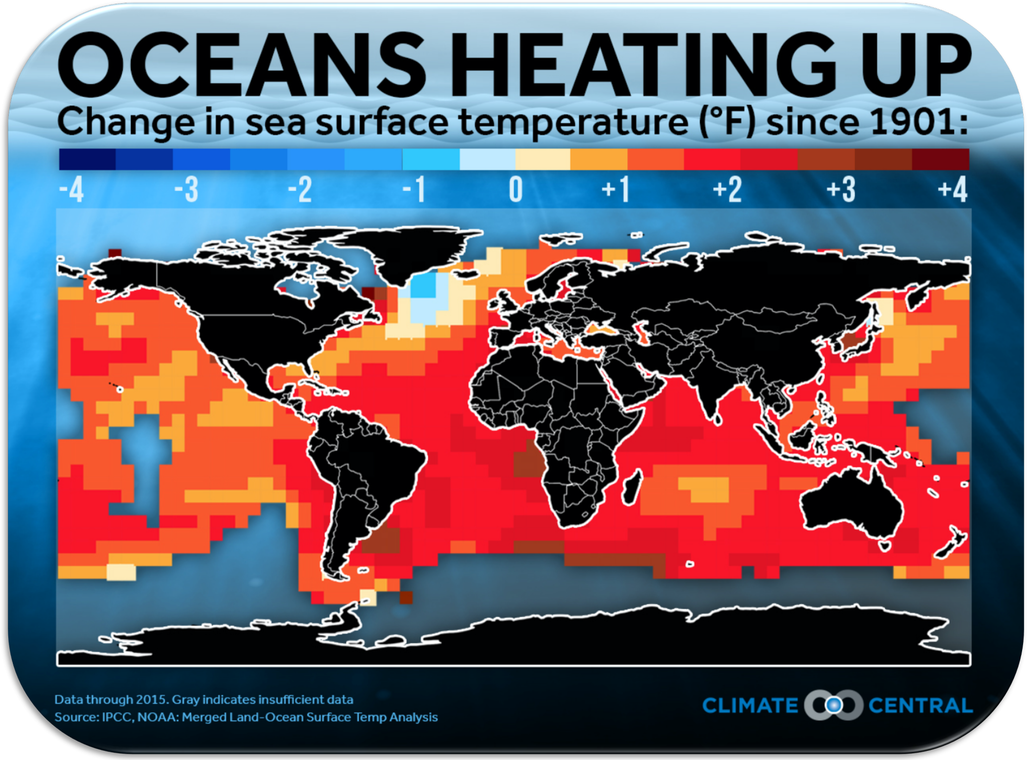

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Since the oceans represent 71% of the Earth's surface (including 6% of ice cover), they represent a huge reservoir of heat, which is available for exchange with the atmosphere. Such large heat capacity of the oceans delays the global warming effect in the lower atmosphere.

While the atmosphere moves more rapidly than the global ocean, the latter has much larger energy storage. Just the top 3.2 m of the ocean has the same heat capacity as the entire atmosphere - the total ocean heat content is estimated to be one thousand times that of the atmosphere.

MOVIE – Where's the Heat?

https://www.youtube.com/watch?v=lQK2iKn3YkA

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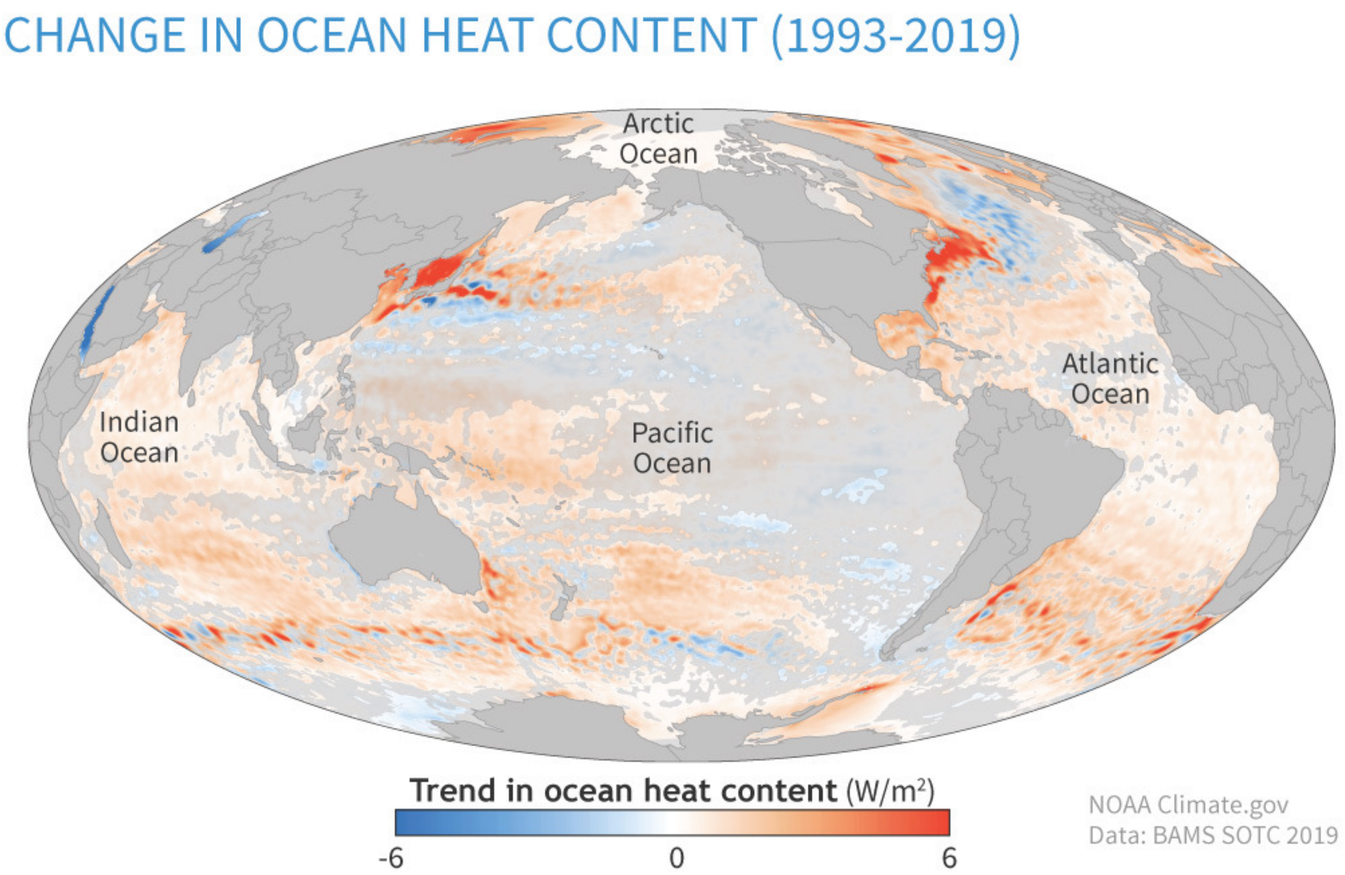
Since the beginning of the 20th century average global sea surface temperature (SST) has increased around 0.13°C per decade in the upper 75 m of the ocean, and 0.015°C per decade at 700 m depth.



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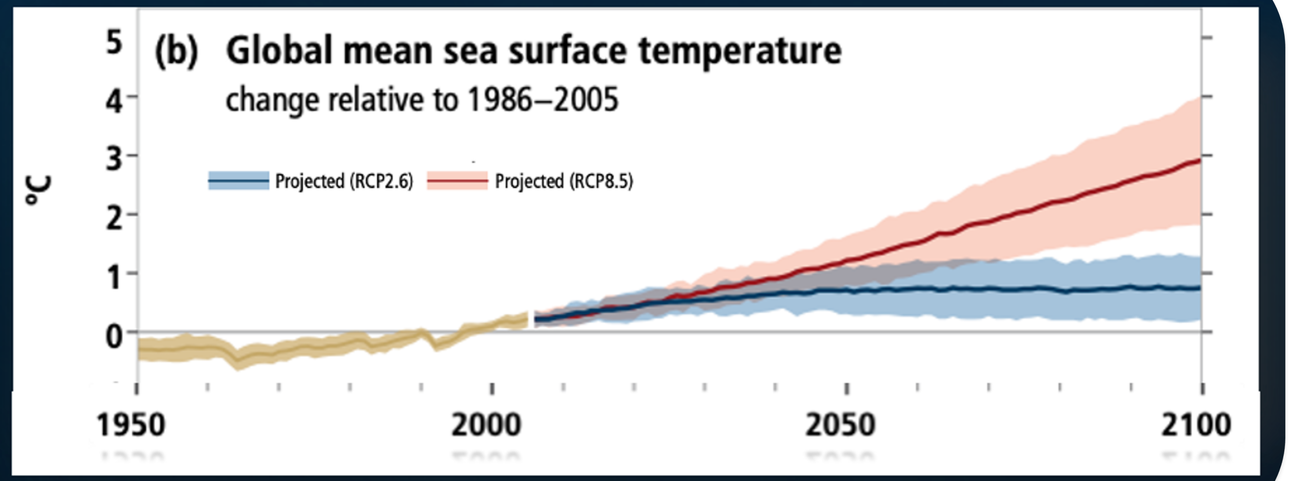
Projections of Sea surface temperature (SST)

SST expected an increase up to 3°C until 2100

(IPCC 2019)



IPCC – "The Intergovernmental Panel on Climate Change"

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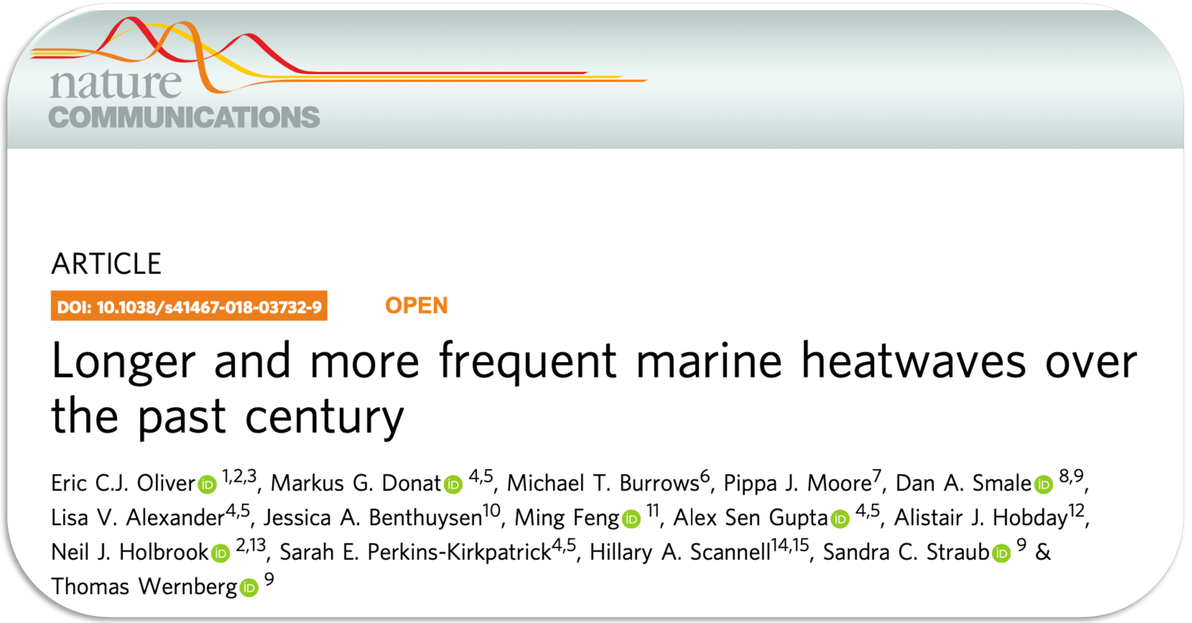
Concomitantly, the number of extreme temperature events – also known as **marine heatwaves (MHWs)** - have increased 84% at a global scale, namely in two different (17-year) periods:

i) 1982-1998
and
ii) 2000-2016.

Many argue that the expected warming trends will escalate the frequency and severity of MHW events



nature COMMUNICATIONS

ARTICLE

DOI: 10.1038/s41467-018-03732-9 OPEN

Longer and more frequent marine heatwaves over the past century

Eric C.J. Oliver[1,2,3], Markus G. Donat[4,5], Michael T. Burrows[6], Pippa J. Moore[7], Dan A. Smale[8,9], Lisa V. Alexander[4,5], Jessica A. Benthuysen[10], Ming Feng[11], Alex Sen Gupta[4,5], Alistair J. Hobday[12], Neil J. Holbrook[2,13], Sarah E. Perkins-Kirkpatrick[4,5], Hillary A. Scannell[14,15], Sandra C. Straub[9] & Thomas Wernberg[9]

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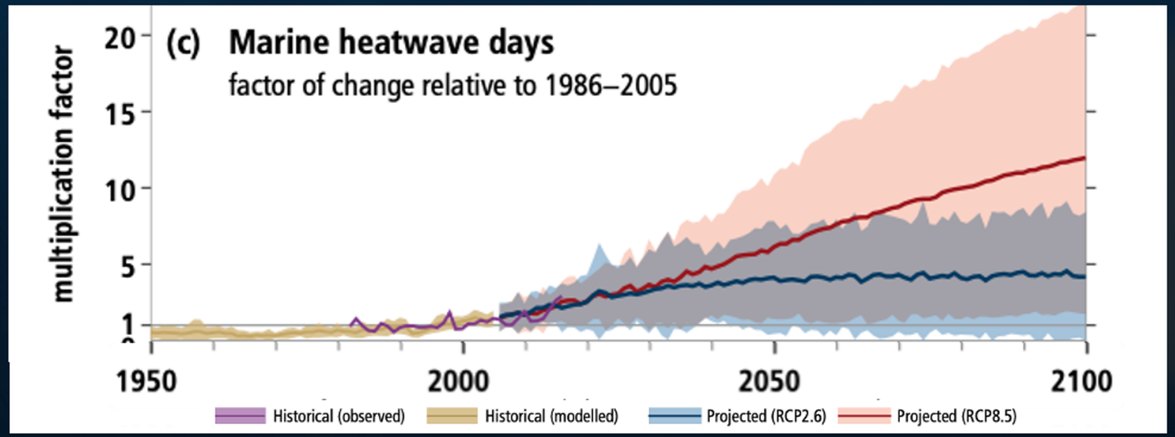
The frequency of these events is expected to **continue to escalate (> 10x)**



IPCC 2019

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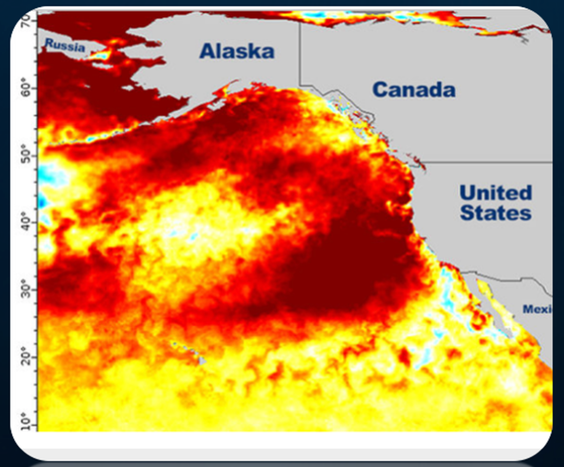
"The Blob"



The longest MHW that was ever recorded lasted.

It began in 2013 and lasted until 2016, in the northeastern Pacific, from Alaska to Baja California.

(Cavole et al. 2016; Di Lorenzo & Mantua 2016)

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MOVIE – A Changing Ocean: Warm Pacific Temperatures Could Signal a Return of **'The Blob'**

https://www.youtube.com/watch?v=t5ugEwvct3c

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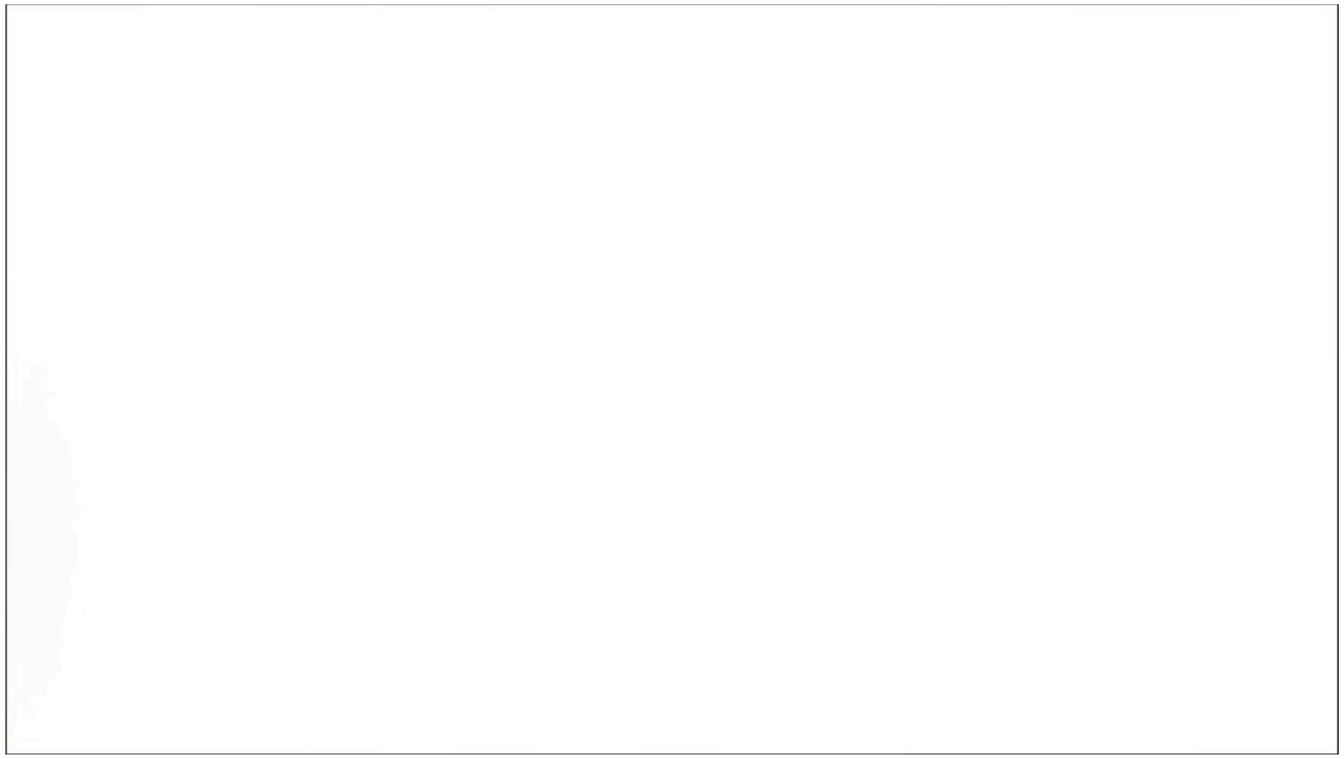
MOVIE – Coral bleaching animation



https://www.youtube.com/watch?v=_ZfGIKiSwwQ

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ARTICLE

doi:10.1038/nature21707

Global warming and recurrent mass bleaching of corals

Terry P. Hughes[1], James T. Kerry[1], Mariana Álvarez-Noriega[1,2], Jorge G. Álvarez-Romero[1], Kristen D. Anderson[1], Andrew H. Baird[1], Russell C. Babcock[3], Maria Beger[4], David R. Bellwood[1,2], Ray Berkelmans[5], Tom C. Bridge[1,6], Ian R. Butler[7], Maria Byrne[8], Neal E. Cantin[9], Steeve Comeau[10], Sean R. Connolly[1,2], Graeme S. Cumming[1], Steven J. Dalton[11], Guillermo Diaz-Pulido[12], C. Mark Eakin[13], Will F. Figueira[14], James P. Gilmour[15], Hugo B. Harrison[1], Scott F. Heron[13,16,17], Andrew S. Hoey[1], Jean-Paul A. Hobbs[18], Mia O. Hoogenboom[1,2], Emma V. Kennedy[12], Chao-yang Kuo[1], Janice M. Lough[1,9], Ryan J. Lowe[10], Gang Liu[13,16], Malcolm T. McCulloch[10], Hamish A. Malcolm[11], Michael J. McWilliam[1], John M. Pandolfi[7], Rachel J. Pears[19], Morgan S. Pratchett[1], Verena Schoepf[10], Tristan Simpson[20], William J. Skirving[13,16], Brigitte Sommer[7], Gergely Torda[1,9], David R. Wachenfeld[19], Bette L. Willis[1,2] & Shaun K. Wilson[21]

Hughes et al. Nature

Ted Talk – Terry Hughes

Yes, we can save the world's coral reefs

TEDx JCUCairns

x = independently organized TED event

https://www.youtube.com/watch?v=x5LshSZn5RA

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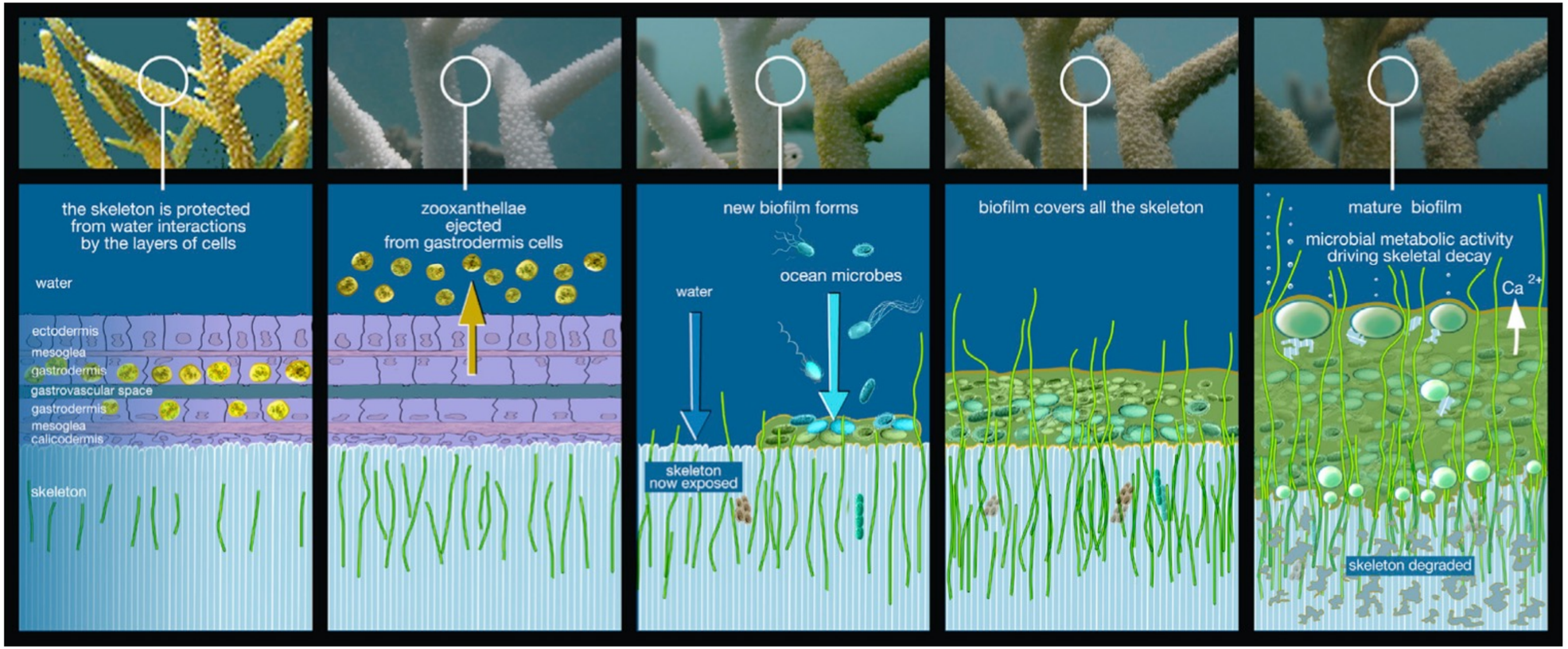

Schematic Representation of the Succession of Coral Dissolution following Marine Heatwaves

Legatt al. 2019 (Current Biology)

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Marine Heat Waves and the impacts in blue ecosystems

nature climate change

ARTICLES

https://doi.org/10.1038/s41558-018-0096-y

A marine heatwave drives massive losses from the world's largest seagrass carbon stocks

A. Arias-Ortiz[1*], O. Serrano[2,3], P. Masqué[1,2,3], P. S. Lavery[2,4], U. Mueller[2], G. A. Kendrick[3,5], M. Rozaimi[2,6], A. Esteban[2], J. W. Fourqurean[5,7], N. Marbà[8], M. A. Mateo[2,4], K. Murray[9], M. J. Rule[3,9] and C. M. Duarte[8,10]

nature climate change

LETTERS

PUBLISHED ONLINE: 22 JULY 2012 | DOI: 10.1038/NCLIMATE1627

An extreme climatic event alters marine ecosystem structure in a global biodiversity hotspot

Thomas Wernberg[1,2,3,4*†], Dan A. Smale[1,2†], Fernando Tuya[4,5], Mads S. Thomsen[1,4], Timothy J. Langlois[1], Thibaut de Bettignies[1,2,4], Scott Bennett[1,2] and Cecile S. Rousseaux[6]

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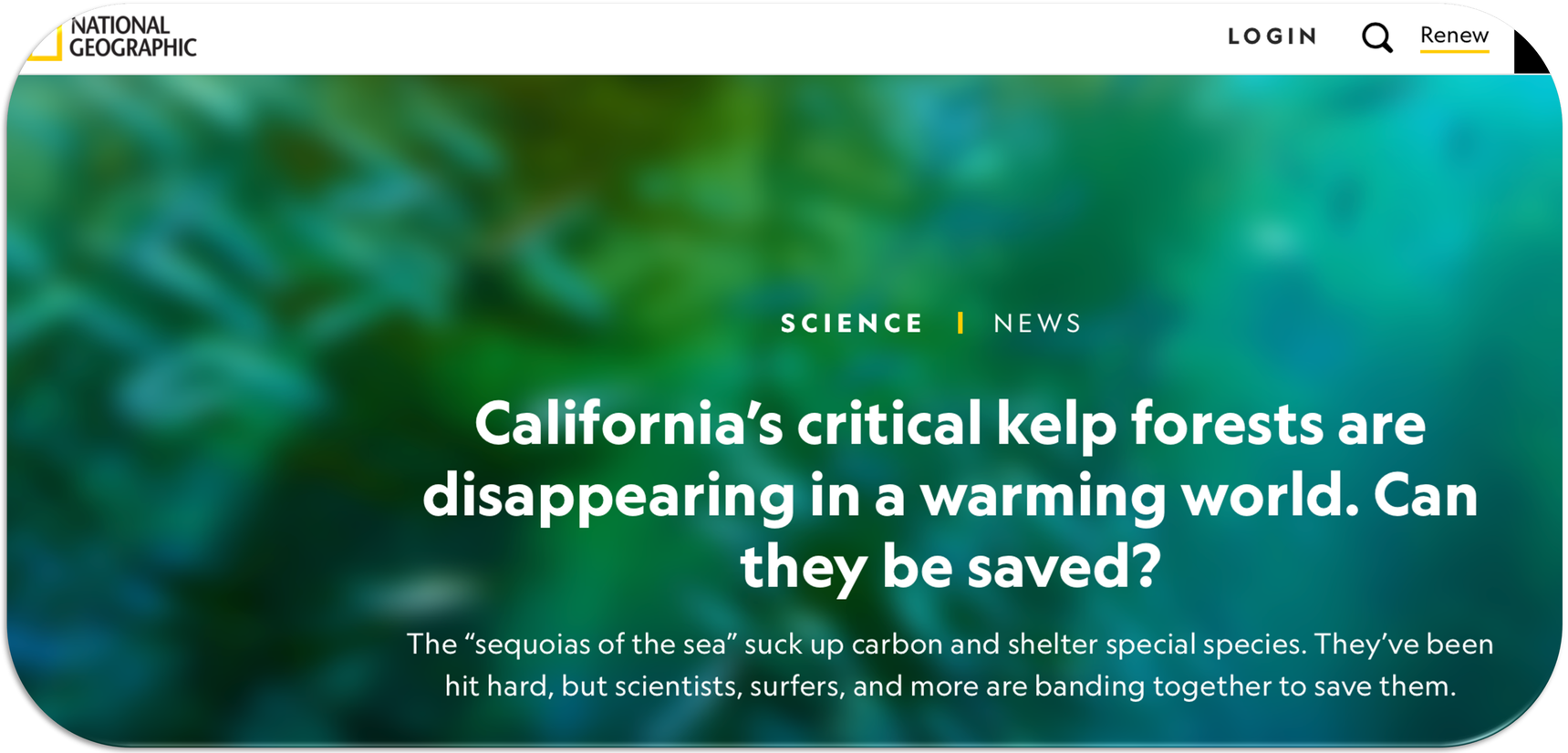

https://www.nationalgeographic.com/science/article/california-critical-kelp-forests-disappearing-warming-world-can-they-be-saved

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