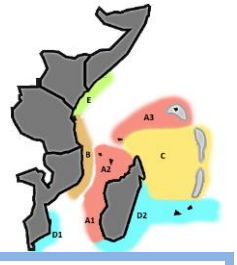
WESTERN INDIAN OCEAN – Regional coral bleaching alert



DATE OF THIS ALERT: 01 April 2020

http://www.cordioea.net/bleachingalert/

Contact: bleaching@cordioea.net

Bleaching Alert Level

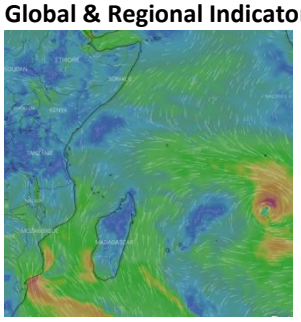
- ***'warning'*** *– indications of warmer conditions that may result in some bleaching*
- ***'level 1' – moderate bleaching possible***
- ***'level 2' – severe bleaching likely***

Forecasted bleaching is for the entire season (Jan-May), to facilitate preparation and early responses

1 April 2020 – Coral bleaching forecast – Western Indian Ocean

Area	Region	Alert	Bleaching observations
S Moz/S Africa	*Cool, south (D1)*	*none*	*Bleaching risk ended*
SWIO/E Madag	*Cool, south (D2)*	*none*	*Bleaching risk ended*
SW Madagascar	*Hot, south (A1)*	*severe*	*Bleaching risk ended*
South Equat Curr	*Moderate, central (C)*	*moderate*	
East Moz Cha/Comoros	*Hot, central (A2)*	*moderate*	*Early bleaching, Mayotte*
NW Moz Cha /Tanz	*Warm, central (B)*	*moderate*	*Low bleaching (Zanzibar)*
NW Seychelles	*Hot, north (A3)*	*moderate*	*None reported yet*
Kenya-Somalia	*Variable, north (E)*	*moderate*	*Moderate bleaching (Kenya)*

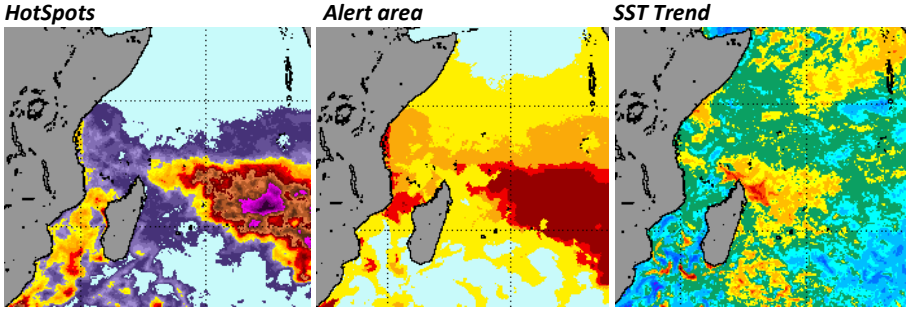
Global & Regional Indicators



Both ENSO and IOD are in neutral/slightly negative phases. The Indian Ocean monsoon season is about to switch with doldrum conditions off Kenya/S. Somalia and the Seychelles, where the ITCZ is passing overhead. Southerly winds are already strengthening in the south (map at left from windy.ty, showing winds forecast for 2 April in the afternoon), causing cooling throughout the Mozambique channel and southern region.

NOAA Products – 1 April 2020

HotSpots ***Alert area*** ***SST Trend***



Left: Hot spot development is highest along the East African coast – N Mozambique, Tanzania, Kenya, where the alert for coral bleaching is high for the coming week (center). However temperatures are declining throughout the region (right) as the hot season is about to end. The intense warming patch off NE Madagascar is a remnant from cool waters due to cyclone Herold, 2 weeks ago.

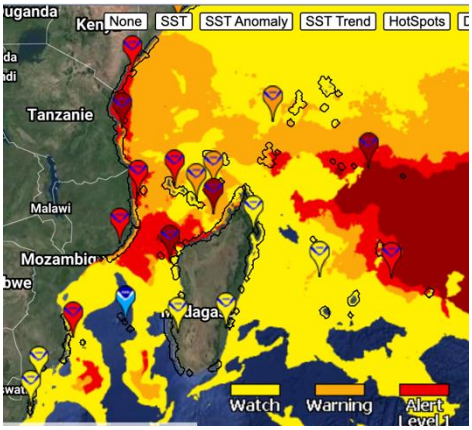
REPORT ALL BLEACHING (AND NON-BLEACHING) OBSERVATIONS HERE

https://goo.gl/forms/jP3Ke9cclt3VM9403

Recent bleaching observations – 1 April 2020

- Nyali, Kenya, 28 Mar 2020; **Moderate bleaching (10-50%)** (David Obura, CORDIO)
- Mombasa, Kenya 28-29 Mar 2020, **High bleaching (50-90%)** (Dawn Goebbels,Citizen Scientist)
- Moroni, Comoros 26 Mar 2020; **Medium bleaching (10-50%)** (Said Ahamad, AIDENGO Comoros)
- Zanzibar, Tanzania 25 Mar 2020, **High bleaching (50-90%)** (Nayra Pluma, Rising Sun Diving Center)
- Mombasa, Kenya 22 Mar 2020; **Low bleaching (1-10%)** (Gudka Mishal, CORDIO)
- Kilifi, Kenya 17-20 Mar 2020; **Medium bleaching (10-50%)** (S. Julian, Ali Swaleh, CORDIO)
- Tudor creek, Kenya 19 Mar 2020. **Low bleaching (1-10%)** (Peter Musembi, CORDIO)
- Shimoni, Kenya, 13-15 Mar 2020. **Low bleaching (1-10%)** (Ewout Knoester, REEFolution)
- Mombasa, Kenya 12-14 Mar 2020, **Low bleaching (10-50%)** (S.Julian, Ali Swaleh, CORDIO)
- Watamu, Kenya, 7-11 Mar 2020. **Low bleaching (1-10%)** (Dadley Tsiganyiu, KWS; Gabriel Grimsditch,UNEP)
- Jambiani, Zanzibar, 20-28 Feb 2020. **Low bleaching (1-10%)** (Christian Vaterlaus, Marine Cultures)
- Kizimkazi, Zanzibar, 19 Feb 2020. **Low bleaching (1-10%)** (Lara Jackson, African Impact)
- Kilifi, Kenya, 17-18 Feb 2020. **Low bleaching (1-10%)** (Julian Sitemba, Ali Swaleh Aboud, CORDIO)
- Diani, Kenya, 14 Feb 2020. **No bleaching (<1%)** (Jenni Choma, Marine Education Ctr)
- Mayotte -13.03S,45.21E, 1st Feb 2020. **Bleaching** (Gaby Barathieu)

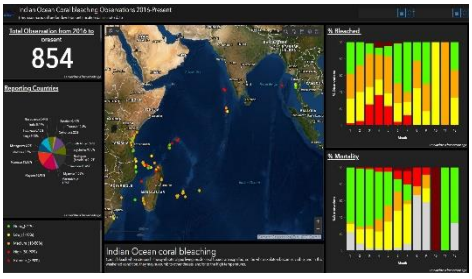
Virtual stations



All virtual stations are showing moderate to high levels of bleaching alert, maximal in the northern Mozambique channel and East Africa coast. The hot pool of water in the central Indian Ocean has not reached the granitic Seychelles islands yet (unusually), and may dissipate before bleaching risk is higher there.

Bleaching observations to date

Overall, bleaching observations have been at lower levels (low to moderate) than anticipated (moderate to severe)



We have received a total of 48 observation records to date.

CORDIO GMES AND AFRICA CORAL SPECIALIST GROUP

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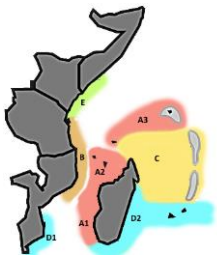

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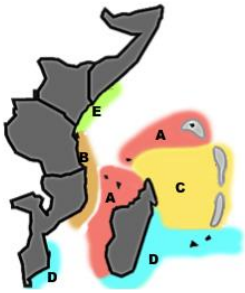
Explanations

WIO climatology regions



Since 2014, bleaching reporting regions are used as defined by SST analysis from the last decade (2003-2009 as 'background' years, and 2010 as a year of high bleaching), rather than a longer historical record that includes pre-1998 SSTs. Five SST zones were identified:

A – the hottest region; the East Mozambique Channel and Comoros (reported as A1, SW Madagascar; A2, NE Madagascar Channel; and A3, NW Seychelles islands).

B – the second hottest region; East African mainland coast from 7-18°S (Zanzibar/Dar es Salaam to Primeiras/Segundas islands), and including the Northwest Mozambique Channel

C – a moderate/intermediate region; the South Equatorial Current region, comprising the Mascarene Banks, southern Seychelles islands and NE Madagascar

D – the southern cooler regions; SW Indian Ocean islands, E and S Madagascar and S Mozambique and South Africa. Split into 2 sub-regions.

E – the cooler northern but highly variable region; the Kenya-Somali coast, including Pemba island and N Tanzania coast (Tanga).

Because of latitudinal variation (e.g. in A) and geographic splitting (e.g. A and D), we report in 8 sub-regions.

Alert levels

Statistical analysis of alerts from 2007-13 indicated that low confidence is attached to an alert of 'low' bleaching risk (i.e. not zero risk, but not severe). By contrast, predictions of 'mid' and 'high' risk of bleaching were more reliable. Accordingly, the alert is being presented as:

- ***'warning'** – indications of warmer conditions that may result in some bleaching*
- ***'level 1' – moderate bleaching possible***
- ***'level 2' – severe bleaching likely***

These findings match the categories used by NOAA, with 'watch', 'bleaching level 1' and bleaching level 2' categories, respectively.

Sea Surface Temperatures (SST)

The surface of the sea heats up by direct insolation, causing stress to corals and other shallow water organisms. Satellites directly measure the skin-temperature of the sea, providing these maps and coral bleaching products for early warning.

Predicted Bleaching

The Bleaching Thermal Stress Outlook is based on sea surface temperature (SST) forecasts generated by the Linear Inverse Model from the NOAA Earth System Research Laboratory. In a normal year, the Outlook forecasts no potential for bleaching. The baseline years for calculations (i.e. the climatology) are 1985-93, excluding 1991 and 1992 due to high atmosphere volcanic dust from Mt. Pinatubo.

Wind-driven mixing

Wind is an important physical factor influencing conditions conducive to coral bleaching. Wind-driven mixing reduces temperature stress and wind generated waves can scatter harmful levels of incoming solar radiation.

- *Cyclones - cause strong mixing, reducing SST.*
- *Doldrums - periods of sustained low wind promote stratification, and heating of the upper layers of water. They therefore promote environmental conditions adverse to corals experiencing thermal and/or light stress.*

El Niño/Southern Oscillation (ENSO)

The El Niño/Southern Oscillation (ENSO) is the most important coupled ocean-atmosphere phenomenon to cause global climate variability on interannual time scales.

***Multivariate ENSO Index (MEI**) - Negative values of the MEI represent the cold ENSO phase (La Niña), while positive MEI values represent the warm ENSO phase (El Niño).*

***The Southern Oscillation Index (SOI)** is calculated from the monthly or seasonal fluctuations in the air pressure difference between Tahiti and Darwin (Note, negative SOI is equivalent to positive MEI).*

***The Nino 3.4 index** is similar to the SOI, but focused on the central Pacific Niño region, straddling the equator and from 170-120°W. It has been found to be most strongly associated with climatic consequences in the African region, so is used here.*

Indian Ocean Dipole

The Indian Ocean Dipole is analogous to the ENSO, but for the Indian Ocean. It is calculated using the Dipole Mode Index (DMI), which calculates the gradient between the western equatorial Indian Ocean (50E-70E and 10S-10N) and the south eastern equatorial Indian Ocean (90E-110E and 10S-0N).

Global indicators

Local temperatures are affected by global and regional trends. With global warming, temperatures are expected to rise over longer periods (decades), but significant variation can occur between years, and under the influence of regional and multi-year factors such as ocean-atmosphere interactions across the Pacific and Indian Ocean.

Data sources

https://www.metoffice.gov.uk/research/climate/seasonal-to-decadal/long-range/decadal-fc/index
http://coralreefwatch.noaa.gov/
https://en.wikipedia.org/wiki/2019%E2%80%9320_South-West_Indian_Ocean_cyclone_season
http://www.mtotec.com/
http://www.bom.gov.au/climate/enso/#tabs=Indian-Ocean
http://www.ioc-goos-
https://stateoftheocean.osmc.noaa.gov/sur/ind/dmi.php
http://www2.cnrs.fr/en/3148.htm

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