

Ocean temperature, coral bleaching, and sea level outlooks

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Outline of Presentation

- 3-month SST outlook from WMO LRF MME
- SST forecast verification
- Predicting skipjack tuna fishing grounds
- Coral Bleaching 12-weeks outlook
- Sea Level Anomaly outlooks
- Key messages

















• Below-average SSTs are expected for May-July across the central equatorial Pacific (Nauru, Kiribati)

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- SSTs remain above average for most PI countries : Palau, FSM in the north Pacific and for East Timor, PNG, Solomon Islands, Vanuatu, New Caledonia, Vanuatu, Fiji, Tonga, Niue, Southern Cook islands and Austral islands (French Polynesia) in the South Pacific.
- Good agreement between the models and high confidence in giant horseshoe of warmer water dominating the western and mid-latitude Pacific. No consensus for Tuvalu, Tokelau, Samoa, Wallis-and-Futuna, Northern Cook Islands and the remainder of French Polynesia



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- Both warm and cool anomalies decline in intensity, except around the coasts of PNG and East Timor where waters are getting warmer.
- Near normal or slightly below average temperatures are expected for Nauru and Kiribati.
- Continuation of warm conditions out to August-October from PNG to the southernmost French Polynesian islands.
- No consensus elsewhere : Tuvalu, Tokelau, Samoa, Wallis-and-Futuna, etc.



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3-month SST forecast verification

How well do the predicted probabilities of an event correspond to their observed frequencies?





3-month SST forecast verification

How well did the forecast anomalies correspond to the observed anomalies?



Predicting skipjack tuna fishing grounds



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Catches in the western and central Pacific account for more than half of global tuna production. Much of this catch comes from the waters of 10 PICTs (Cook Islands, FSM,Kiribati, RMI, Nauru, Palau, PNG, Solomon Islands, Tokelau, Tuvalu) : high dependency on tuna stocks for food security and economic development (Clark et al., 2021)

Skipjack stock biomass is associated with the warm pool (Lehodey et al., 1997)

Distribution of skipjack tuna catch (tonnes) and mean sea surface temperature (SST, in °C) in the Pacific Ocean. (a) In the first half of 1989 (La Niña period). (b) In the first half of 1992 (El Niño period).

The effect of ENSO on the location of the warm pool (SST > 28-29 °C) and the distribution of skipjack catch is clearly evident. The stocks move between areas further to the east in El Niño years and further west in La Niña years







Predicting skipjack tuna fishing grounds 3-months outlook





The spatial distribution of skipjack tuna catches is predicted to contract westward (west of Phoenix Islands Protected Area). In the South Pacific, good fishing locations are likely to extend further south (15°S-10°S)

!!! Predictions of catch amounts vary from one EEZ to another and from one tuna species to another : see case study for FSM in Kim et al. (2020) .



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Coral Bleaching - Analysis & 12-weeks outlook

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- Corals are vulnerable to bleaching when the SST exceeds the temperatures normally experienced in the hottest month of the year.
- Mass coral bleaching has been shown to be caused by prolonged periods of heat stress.

Stress Level	Definition	Potential Bleaching Intensity
No Stress	HotSpot <= 0	No Bleaching
Bleaching Watch	0 < HotSpot < 1	_
Bleaching Warning	1 <= HotSpot and 0 < DHW < 4	Possible Bleaching
Bleaching Alert Level 1	1 <= HotSpot and 4 <= DHW < 8	Significant Bleaching Likely
Bleaching Alert Level 2	1 <= HotSpot and 8 <= DHW	Severe Bleaching and Significant Mortality I

- As of Jan 2022, Coral Bleaching HotSpots remained absent from much of the Northern Hemisphere . Torres Strait islands, portions of GBR, PNG, New Caledonia, Vanuatu Fiji, Southern Tonga and Austral islands experienced heat stress (>= Bleaching Alert Level 1). Multiple instances of coral bleaching reported on the GBR ; minor bleaching were reported in Fiji and New Caledonia.
- Recent trends : Heat stress has dissipated from much of the southern Pacific Ocean, except on Torres Strait, PNG and Austral islands where heat stress is on Alert level 2.



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MMM : long-term mean SST of the climatologically hottest month of year HotSpot = SST – MMM Degree Heating Week = sum of Coral Bleaching HotSpots greater than 1 °C, over a 12-week window

Outlook : As the southern Pacific Ocean cools and heat stress completely dissipates from the region by may 2022, NOAA Coral Reef Watch's Outlook expects heat stress on PNG will continue over the next 8-12 weeks.





Sea Level Anomaly outlooks

- Sea level is favoured to be notably higher than normal (>10 cm) for East Timor, PNG, Solomon Islands, Northern Vanuatu, northern Fiji and southern Tuvalu.
- Periods of higher-than-normal tides are critical when a tropical cyclone is in the vicinity, a distant storm generates a long swell that breaks on the coast or a tsunami threatens the coastline
- Pools of lower sea levels are predicted in RMI, New Caledonia, Tonga and Marquesas.





- Warmer than normal for most countries in the west. Cooler along the equator towards the east. No guidance for Tuvalu, Tokelau, Samoa, Wallis-and-Futuna, Northern Cook Islands and French Polynesia (excl. Austral islands).
- Fisheries convergence zone contracts westward
- Countries to be aware of higher tides, especially in East Timor, PNG, Solomon Islands and parts of Vanuatu, Fiji and Tuvalu where > 10 cm SLA are predicted.
- Coral Bleaching remains on alert levels for PNG. Alert levels intensify for Palau, FSM and Solomon islands.



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Key messages









