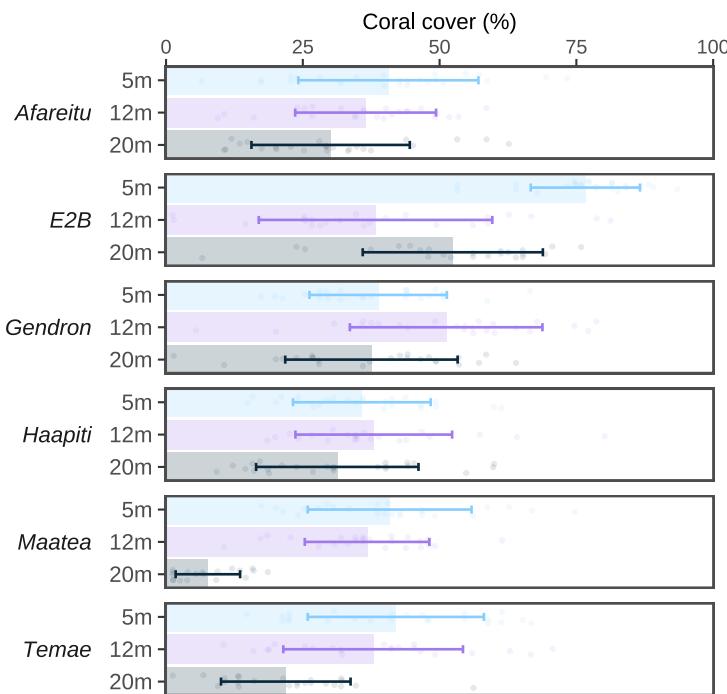


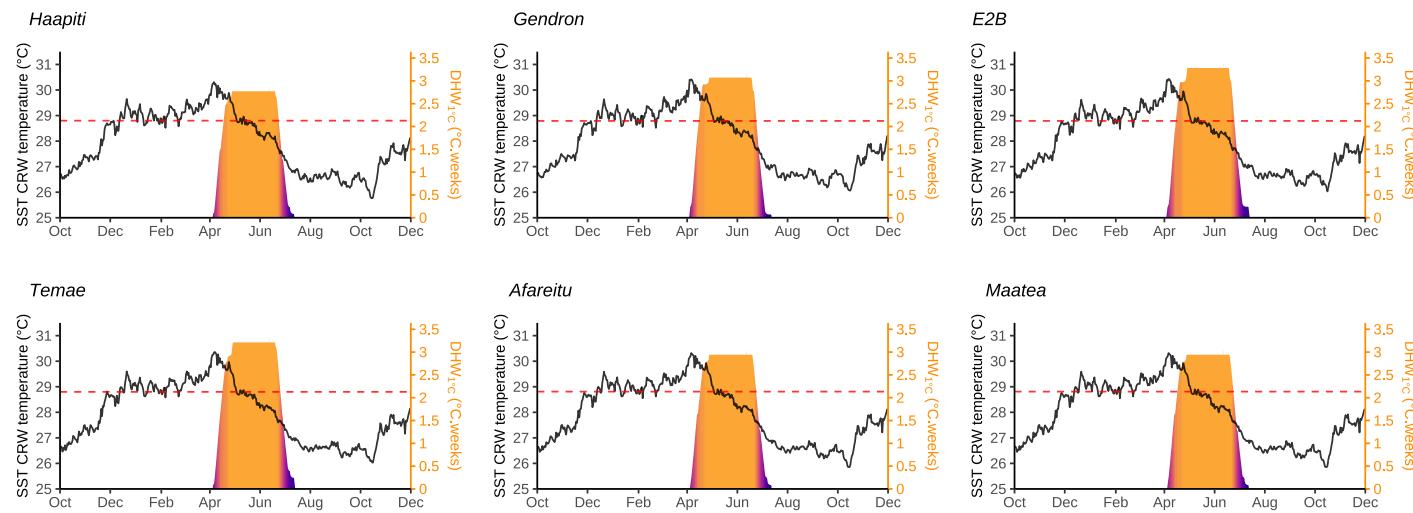
Supplementary information for  
**When depth fails to prevent bleaching but limits coral death: insights from the 2019 heatwave in Mo'orea**

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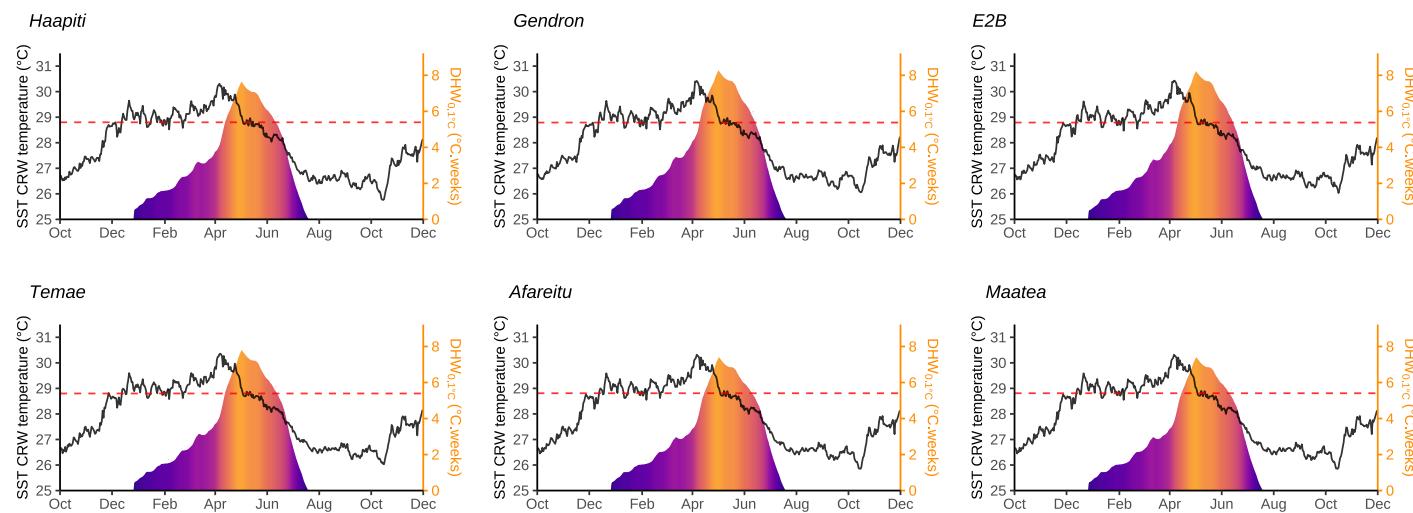


**Fig. S1** Coral cover around Mo'orea at 5, 12 and 20 meters deep before the bleaching event of 2019. Sites were in good health with a strong coral cover. Bar and errorbars are mean  $\pm$  standard deviation and points are raw data

**a. DHW cutoff 1°C**



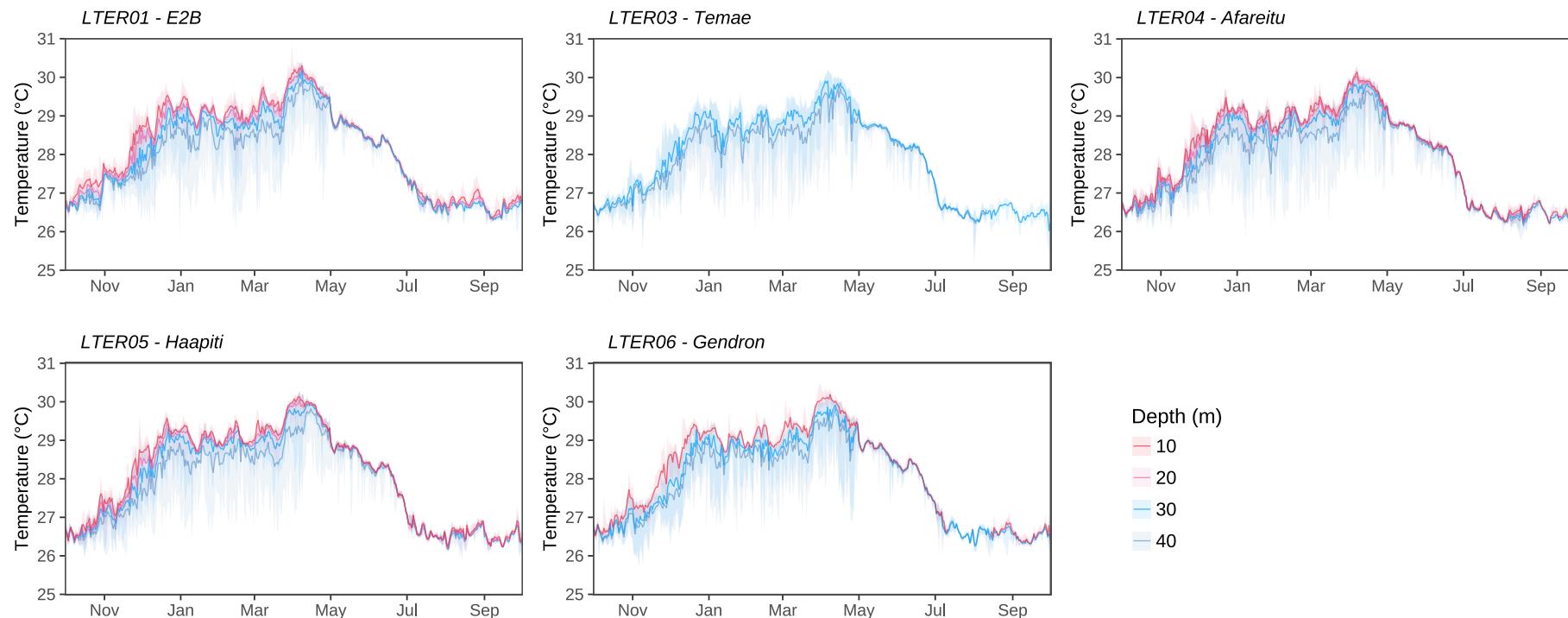
**b. DHW cutoff 0°C**



**Fig. S2** Daily sea surface temperature (SST) and (A) degree heating weeks (DHW) (common 1°C threshold) and (B) DHW at 0.1°C threshold (low magnitude stress). Extracted from Coral Reef Watch NOAA 5-km resolution. Horizontal red dashed line represents the MMM extracted from NOAA climatologies at each site

**Table S1** Site- and depth-specific *in-situ* maximum monthly means (MMM). MMM are averages of the warmest month over the period 2005-2003. *In-situ* temperature data were extracted from Moorea Coral Reef LTER et al. (2025).

Depth	E2B	Temae	Afareitu	Haapiti	Gendron
10m	28.94	28.79	28.83	28.87	28.90
20m	28.87	28.75	28.75	28.89	28.81
30m	28.83	28.73	28.76	28.85	28.83
40m	28.68	28.56	28.56	28.62	28.75



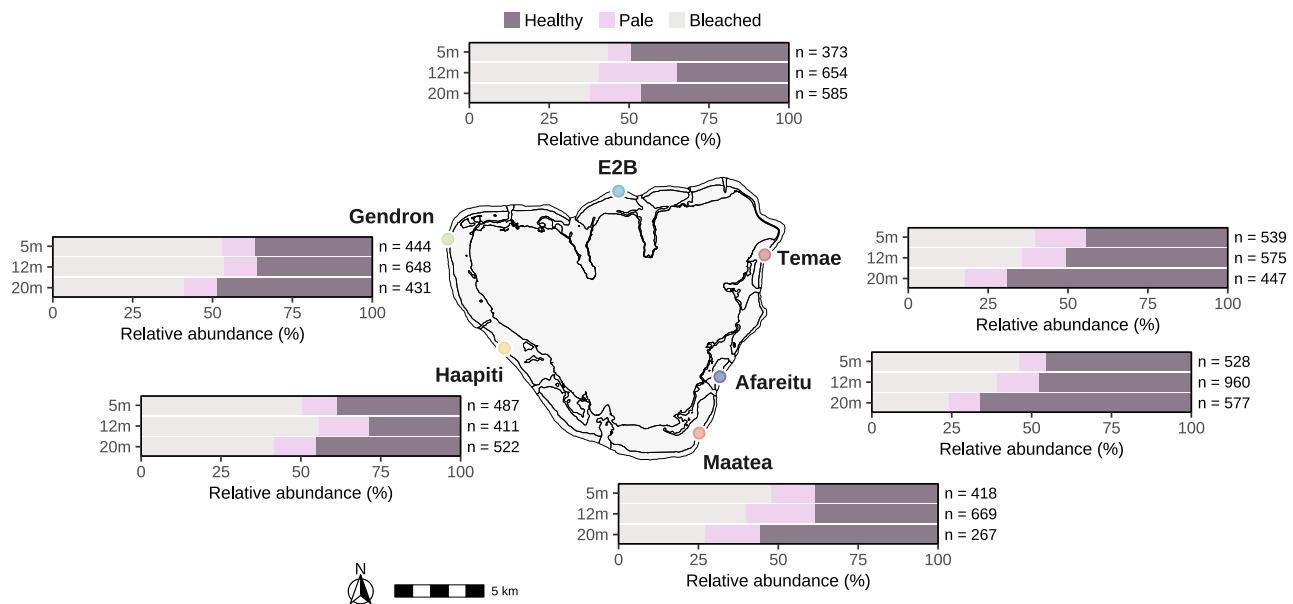
**Fig. S3** Daily mean (line) and range (ribbon) temperatures around along the outer slope at 10, 20, 30 and 40 meters from October 1, 2018 to October 1, 2019. Temperature data were extracted from Moorea Coral Reef LTER et al. (2025). Dashed horizontal line represent MMM (extracted from NOAA climatologies) at each site

**Table S2** Pairwise post-hoc Dunn tests on accumulated heat stress (AHS) and mean daily temperature fluctuations (MDTF) along the depth gradient

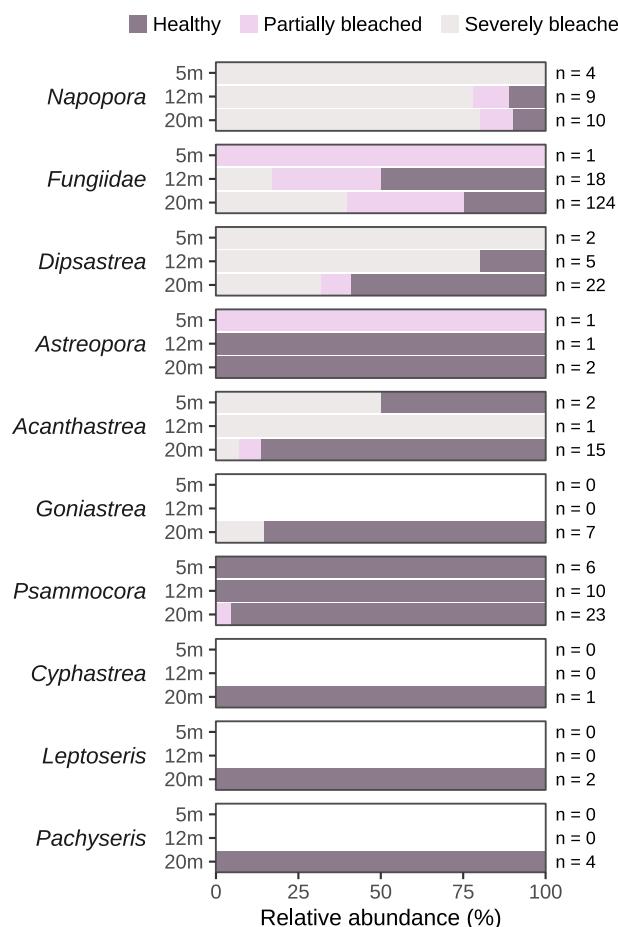
	Contrasts	Z	p-value
<i>Accumulated heat stress</i>	10 - 20	0.302	0.3811
	10 - 30	2.450	0.0214 *
	20 - 30	1.934	0.0398 *
	10 - 40	2.863	0.0126 *
	20 - 40	2.314	0.0207 *
	30 - 40	0.438	0.3967
<i>Mean daily temperature fluctuations</i>	10 - 20	-0.454	0.3250
	10 - 30	-1.993	0.0463 *
	20 - 30	-1.356	0.1051
	10 - 40	-3.469	0.0016 ***
	20 - 40	-2.712	0.0100 *
	30 - 40	-1.566	0.0881

**Table S3** Summary of all final models fitted. Models were chosen based on likelihood-ratio tests: random structure always included sites, fixed effects always included depth (factorial), taxa and its interaction with taxa was also considered. Explained variability is expressed through marginal  $R^2$  ( $R^2_m$ ; variability explained by the fixed effects) and conditional  $R^2$  ( $R^2_c$ ; variability explained by both fixed and random effects) when random effects were retained.

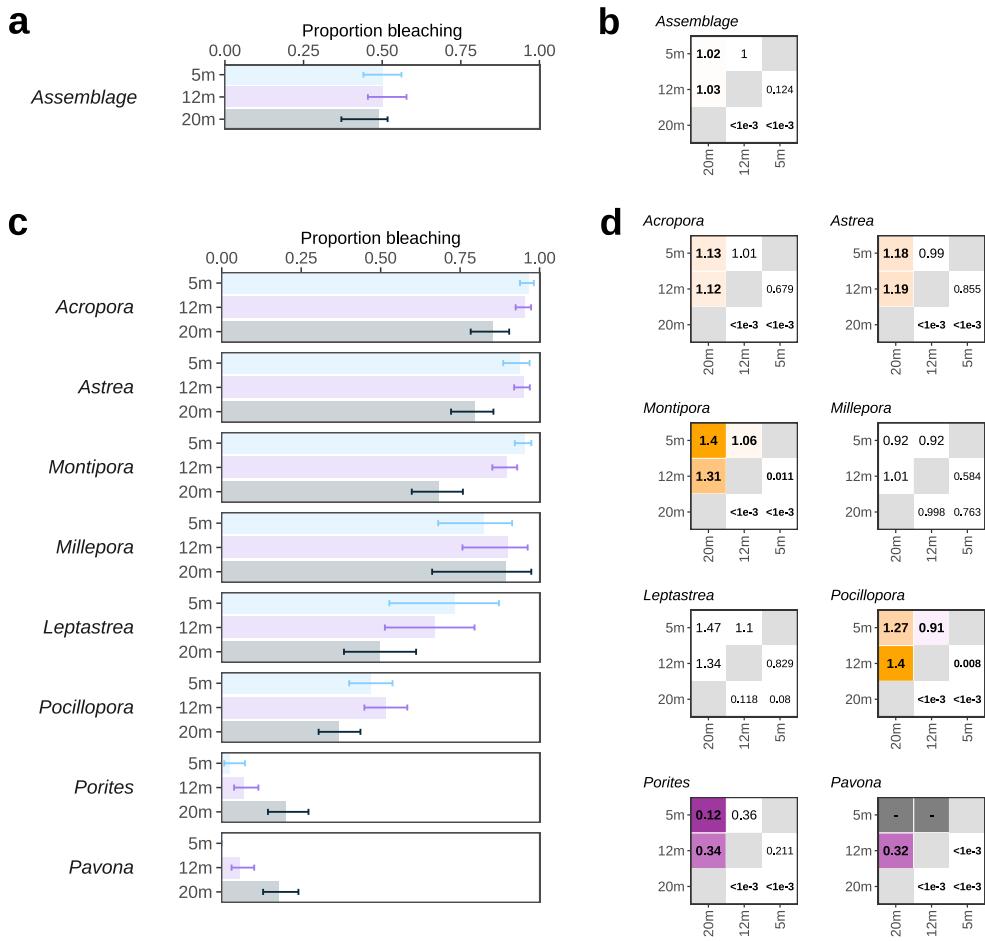
	Model chosen	Family distribution	Explained variability
<b>Bleaching prevalence</b> global (assemblage)	Bleached [1 if pale or bleached ; 0 if healthy] ~ Depth + (1 Site) + (1 Genus)	Binomial	$R^2_m = 1\%$ ; $R^2_c = 53\%$
	Bleached [1 if pale or bleached ; 0 if healthy] ~ Depth*Genus + (1 Site) for genus: <i>Acropora</i> , <i>Pocillopora</i> , <i>Astrea</i> , <i>Montipora</i> , <i>Leptastrea</i> , <i>Millepora</i> , <i>Pavona</i> , <i>Porites</i>		
<b>Bleaching severity</b> taxa level	Severity [1 if severely bleached ; 0 if partially] ~ Depth*Genus + (1 Site) for genus: <i>Acropora</i> , <i>Pocillopora</i> , <i>Astrea</i> , <i>Montipora</i> , <i>Leptastrea</i> , <i>Millepora</i> , <i>Pavona</i> , <i>Porites</i> , Filtered to bleached colony only	Binomial	$R^2_m = 61\%$ ; $R^2_c = 62\%$
<b>Live coral cover</b> global	(Live coral, Total points - live coral) ~ Time*Depth +(1 Site)	Binomial	$R^2_m = 4\%$ ; $R^2_c = 7\%$
	(Live coral, Total points - live coral) ~ Time*Depth*Genus +(1 Site)		
<b>Relative coral cover loss</b> global	Relative cover loss ~ Depth + (1 Site)	Beta	$R^2_m = 41\%$ ; $R^2_c = 43\%$
	Relative cover loss ~ Depth*Genus + (1 Site) for genus: <i>Pocillopora</i> and <i>Acropora</i> only		
<b>Shift in composition</b> distance in nMDS space	Distance ~ Depth	Gamma Log link	$R^2 = 21\%$



**Fig. S4** Patterns of coral bleaching around Mo'orea island. Proportion of colonies that were healthy (brown), pale (pink) and bleached (grey) in mid-April 2019 at the 6 different surveyed sites from shallow to intermediate depths. Numbers of colonies surveyed are indicated for each site and depth (n)



**Fig. S5** Bleaching susceptibility of rare coral taxa (< 10 observations per depth) across depths, classified from most (top) to least (bottom) sensitive. Stacked barplot represent relative abundance of corals in the different health status from healthy to severely bleached. Number of observations at each depth is annotated for each taxon.



**Fig. S6** Bleaching susceptibility over depths of the (a)(b) coral assemblages and (c)(d) the most abundant coral taxa (with > 10 observations for each depth). (a)(c) Barplot and errorbars are predicted probabilities ( $\pm$  95% confidence intervals) from the best fitted model, (b)(d) significant pairwise differences are in bold – upper left triangles are ratios of emmeans, and lower right triangles are the associated contrast p-values. Ratios should be read as Y axis/X axis. Significant differences are in bold and colored according to their importance (ratios > 1 in shades of orange and < 1 in shades of purple); e.g. for Acropora estimate<sub>5m/20m</sub> = 1.13, p-value = < 0.001. To account for Jensen's inequality, bias-adjustment were applied based on sigma = 1.9426 for the assemblage as the variation associated with taxa was important (variance = 3.62; sd = 1.9); and sigma = 0.3230 for taxa-specific responses.

	Acropora	Pocillopora	Astrea	Pavona	Montipora	Millepora	Leptastrea	Acropora
Acropora	13.01	2.08	1.03	-	1.07	1.07	1.47	
Leptastrea	8.85	1.42	1.43	-	0.73	0.73		<1e-3
Millepora	12.15	1.95	1.04	-	1		0.006	0.404
Montipora	12.2	1.95	1.04	-		1	<1e-3	0.002
Pavona	0.02	0	-		<1e-3	<1e-3	<1e-3	<1e-3
Astrea	12.65	2.03		<1e-3	0.507	0.962	<1e-3	0.575
Pocillopora	6.24		<1e-3	<1e-3	<1e-3	<1e-3	0.002	<1e-3
Porites		<1e-3	<1e-3	<1e-3	<1e-3	<1e-3	<1e-3	<1e-3

**Fig. S7** Bleaching susceptibilities of the most abundant taxa (> 10 observations per depth). Pairwise differences in the proportion of bleached corals between taxa (averaged depth). Upper left triangles are ratios of emmeans, and lower right triangles are the associated contrast p-values. Ratios should be read as Y axis/X axis. Significant differences are in bold and colored according to their importance (ratio > 1 in shades of orange and <1 in shades of purple). A bias adjustment of 0.3230 was applied.

**Table S4** Pairwise post-hoc Tukey t-tests of differences in estimated marginal means (emmeans) of probabilities to be severely bleached when colonies are bleaching-susceptible

Genus	Contrast	Odds ratio	SE	z.ratio	p-value
<i>Acropora</i>	5m / 12m	8e6	1e10	0.01	0.9999
	5m / 20m	1e7	2e10	0.01	0.9999
	12m / 20m	1.78	1.37	0.67	0.7817
<i>Astrea</i>	5m / 12m	1.21	0.25	0.63	0.8033
	5m / 20m	0.76	0.18	-1.41	0.3344
	12m / 20m	0.66	0.13	-2.46	0.0367 **
<i>Leptastrea</i>	5m / 12m	1.05	0.82	-0.01	0.9999
	5m / 20m	0.54	0.38	-0.95	0.6059
	12m / 20m	0.54	0.30	-1.22	0.4405
<i>Millepora</i>	5m / 12m	1.06	0.52	0.01	1.0000
	5m / 20m	0.33	0.21	-1.81	0.1678
	12m / 20m	0.33	0.21	-1.82	0.1643
<i>Montipora</i>	5m / 12m	1.72	0.36	2.28	0.0587
	5m / 20m	1.66	0.43	1.71	0.2031
	12m / 20m	1.02	0.25	-0.15	0.9879
<i>Pocillopora</i>	5m / 12m	1.59	0.18	3.63	0.0008 ***
	5m / 20m	1.64	0.23	3.15	0.0046 ***
	12m / 20m	1.09	0.14	0.25	0.9673
<i>Porites</i>	5m / 12m	0.73	0.98	-0.27	0.9594
	5m / 20m	0.97	1.22	-0.07	0.9972
	12m / 20m	1.40	0.84	0.46	0.8886
<i>Pavona</i>	12m / 20m	0.05	0.05	-2.84	0.0045 ***

**Table S5** Pairwise post-hoc Tukey t-tests of differences in estimated marginal means (emmeans) of live coral cover before and after bleaching across depths and taxa

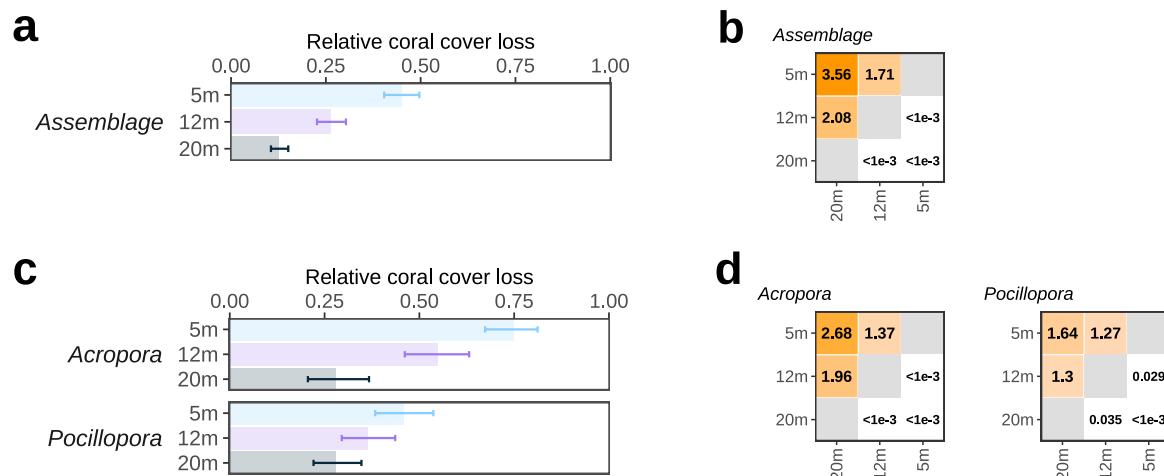
Genus	Before/After contrast	Odds ratio	SE	z.ratio	p-value
<i>Assemblage</i>	5m	3.041	0.091	35.684	< 0.0001 ***
	12m	1.852	0.054	19.312	< 0.0001 ***
	20m	1.338	0.041	7.860	< 0.0001 ***
<i>Acropora</i>	5m	4.525	0.568	11.747	< 0.0001 ***
	12m	2.178	0.197	8.204	< 0.0001 ***
	20m	1.547	0.179	3.456	0.0005 ***
<i>Astrea</i>	5m	1.036	0.302	0.000	0.9999
	12m	1.036	0.203	0.000	0.9999
	20m	1.061	0.233	0.110	0.9127
<i>Montipora</i>	5m	1.042	0.081	0.078	0.9376
	12m	1.041	0.104	0.050	0.9600
	20m	1.077	0.135	0.313	0.7541

<i>Millepora</i>	5m	1.036	0.122	0.000	0.9999	
	12m	1.036	0.317	0.000	0.9998	
	20m	1.036	0.236	0.000	1.0000	
<i>Leptastrea</i>	12m	1.036	0.493	0.000	1.0000	
	20m	1.036	0.308	0.000	0.9999	
<i>Pocillopora</i>	5m	3.051	0.099	33.119	< 0.0001	***
	12m	1.775	0.058	16.510	< 0.0001	***
	20m	1.317	0.047	6.704	< 0.0001	***
<i>Porites</i>	5m	1.036	0.141	0.000	0.9998	
	12m	1.036	0.087	0.000	1.0000	
	20m	1.042	0.081	0.077	0.9385	
<i>Pavona</i>	5m	1.036	0.348	0.000	0.9999	
	12m	1.036	0.153	0.000	1.0000	
	20m	1.046	0.149	0.071	0.9434	

**Table S6** Pairwise post-hoc Tukey t-tests of differences in estimated marginal means (emmeans) of live coral cover between depth, before and after bleaching, across taxa. Contrasts are only presented before bleaching for taxa which did not significantly lose coral cover loss (Table S5).

Genus	Time	Contrast	Odds ratio	SE	z.ratio	p-value	
Assemblage	Before	5m / 12m	1.356	0.037	9.228	< 0.0001	***
		5m / 20m	2.032	0.058	23.017	< 0.0001	***
		12m / 20m	1.576	0.046	13.955	< 0.0001	***
	After	5m / 12m	0.825	0.026	-7.710	< 0.0001	***
		5m / 20m	0.894	0.028	-5.076	< 0.0001	***
		12m / 20m	1.139	0.035	2.584	0.0264	*
Acropora	Before	5m / 12m	1.255	0.097	2.483	0.0348	*
		5m / 20m	1.716	0.160	5.404	< 0.0001	***
		12m / 20m	1.416	0.129	3.437	0.0017	**
	After	5m / 12m	0.604	0.081	-4.020	0.0002	***
		5m / 20m	0.586	0.084	-3.971	0.0002	***
		12m / 20m	1.006	0.116	-0.255	0.9647	
Astrea	Before	5m / 12m	0.888	0.220	-0.622	0.8079	
		5m / 20m	0.887	0.228	-0.603	0.8184	
		12m / 20m	1.035	0.215	-0.003	1.0000	
Montipora	Before	5m / 12m	1.409	0.127	3.428	0.0018	***
		5m / 20m	1.775	0.184	5.187	< 0.0001	***
		12m / 20m	1.304	0.147	2.044	0.1019	
Millepora	Before	5m / 12m	5.217	1.209	6.979	< 0.0001	***
		5m / 20m	2.708	0.493	5.276	< 0.0001	***
		12m / 20m	0.538	0.145	-2.429	0.0401	*
Leptastrea	Before	12m / 20m	1.384	0.549	0.729	0.4662	

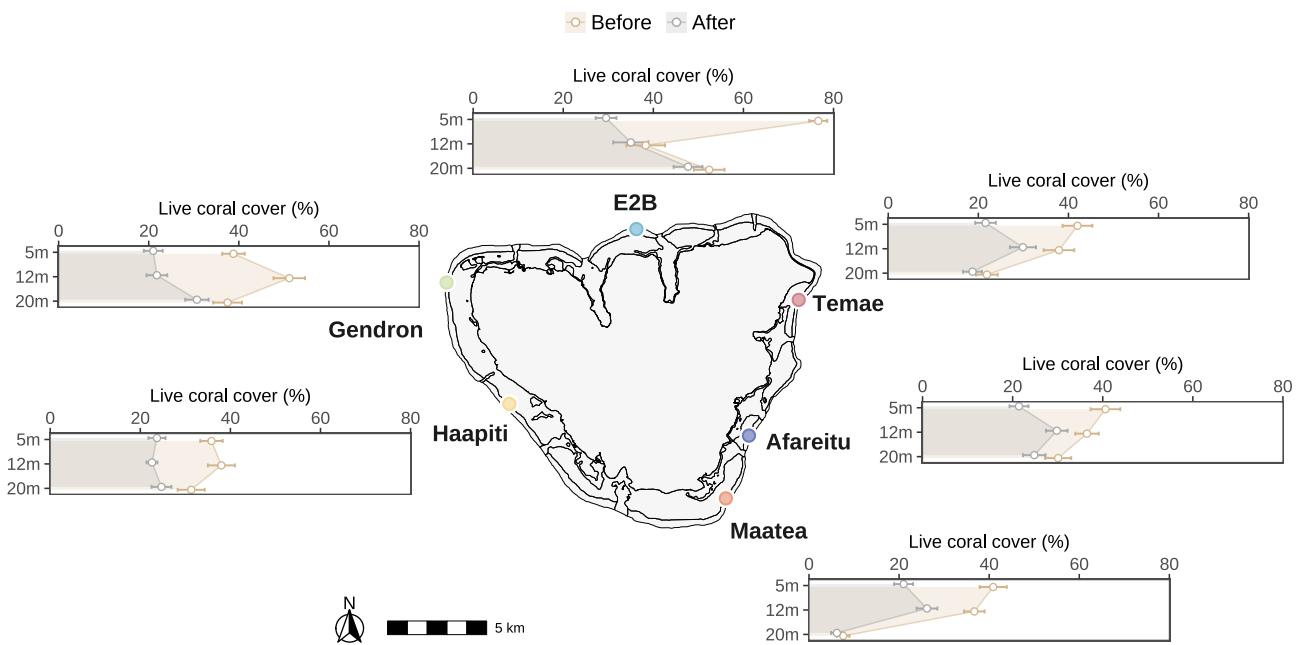
<i>Pocillopora</i>	Before	5m / 12m	1.462	0.043	11.795	< 0.0001	***
		5m / 20m	2.134	0.067	22.894	< 0.0001	***
		12m / 20m	1.511	0.049	11.612	< 0.0001	***
<i>Porites</i>	After	5m / 12m	0.851	0.030	-5.514	< 0.0001	***
		5m / 20m	0.921	0.034	-3.185	0.0041	***
		12m / 20m	1.121	0.040	2.207	0.0700	
<i>Pavona</i>	Before	5m / 12m	0.653	0.169	-1.778	0.1770	
		5m / 20m	0.593	0.153	-2.163	0.0776	
		12m / 20m	0.941	0.136	-0.668	0.7822	



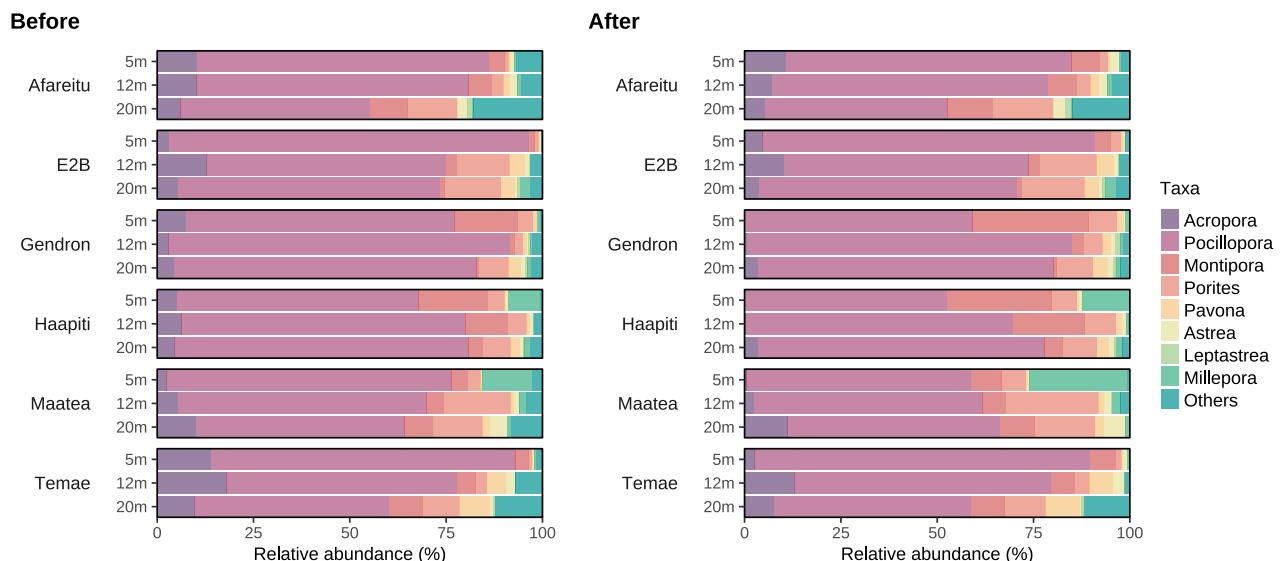
**Fig. S8** Relative coral cover loss of (a)(b) the coral assemblages and (c)(d) the two dominant taxa *Acropora* and *Pocillopora* with depth. (a)(c) Predictions ± 95% confidence intervals and (c)(d) the pairwise differences in the relative proportion of coral cover lost between depths. Upper left triangles are ratios of emmeans, and lower right triangles are the associated contrast p-values. Ratios should be read as Y axis/X axis. Significant differences are in bold and colored according to their importance (ratios > 1 in shades of orange and < 1 in shades of purple). A bias-adjustment of 0.1449 and 0.2659 were applied to coral assemblages and the taxon-specific models.

**Table S7** Pairwise post-hoc Tukey t-tests of differences in estimated marginal means of coral cover loss for *Acropora* and *Pocillopora* at the different depths

Contrast	Depth	Odds ratio	SE	z.ratio	p-value	
<i>Acropora</i> / <i>Pocillopora</i>	5m	3.44	0.64	6.41	1.43e-10	***
<i>Acropora</i> / <i>Pocillopora</i>	12m	2.29	0.39	4.61	3.96e-06	***
<i>Acropora</i> / <i>Pocillopora</i>	20m	1.13	0.22	0.42	0.677126	



**Fig. S9** Patterns of coral mortality around Mo'orea island following mass bleaching event. Relative coral cover loss observed in October 2019, is based on live coral cover before (living + recently dead corals) vs after the bleaching event, at the 6 different surveyed sites from shallow to intermediate depths (5 to 20m). Points are raw means and errorbars are standard errors.



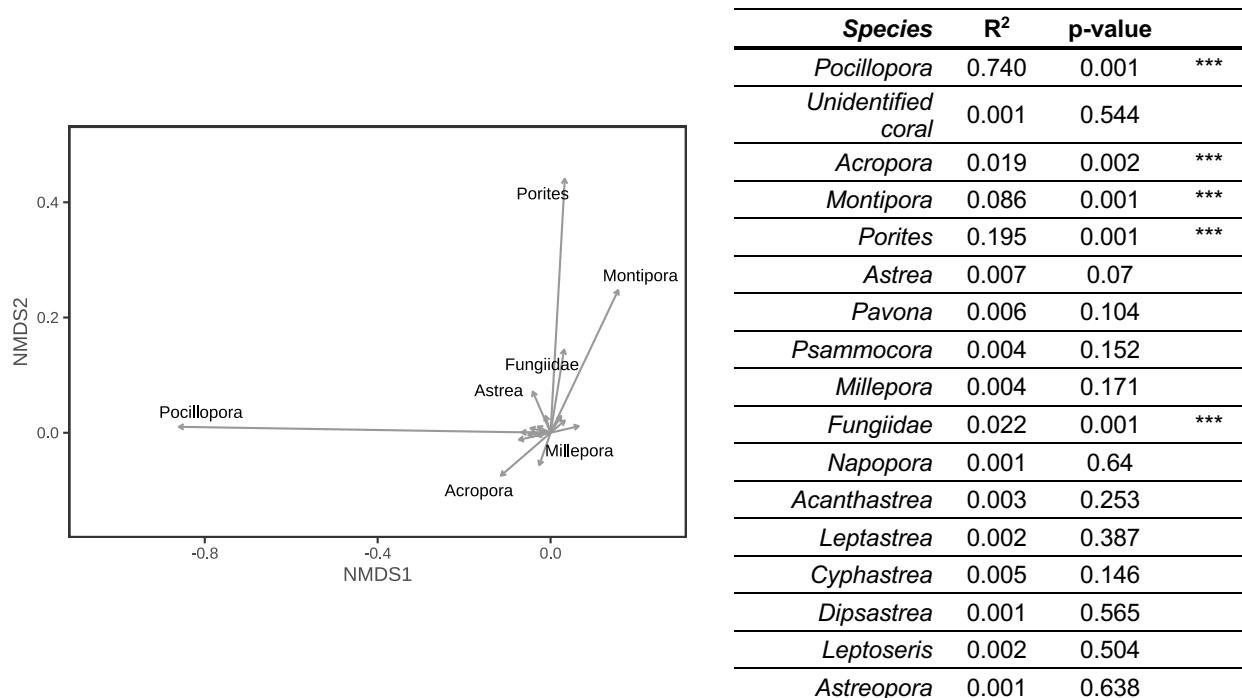
**Fig. S10** Coral assemblages at each surveyed site over depth before (accounting for living and recently dead corals) and after (accounting for living corals only in October 2019) the bleaching event

**Table S8** Pairwise PERMANOVA for coral assemblages before, after and their comparison. A Benjamini-Hochberg adjustment was applied for multiple comparisons.

	Depth1	Depth2	SumsOfSqs	F.Model	R <sup>2</sup>	p.value
Before	5m	12m	0.84	6.97	0.023	0.001 ***
	5m	20m	3.26	20.12	0.066	0.001 ***
	12m	20m	1.45	8.78	0.030	0.001 ***
After	5m	12m	1.11	7.91	0.026	0.001 ***
	5m	20m	2.18	12.24	0.041	0.001 ***
	12m	20m	0.81	4.48	0.016	0.001 ***
After - Before	5m	5m	5.70	44.52	0.131	0.001 ***
	12m	12m	1.83	13.87	0.046	0.001 ***
	20m	20m	0.19	0.88	0.003	0.496

**Table S9** Pairwise post-hoc Tukey t-tests of differences in estimated marginal means of compositional shift (distance in nMDS space)

Contrast	Ratio	SE	z.ratio	p-value
5m / 12m	1.95	0.51	2.57	0.0275 *
5m / 20m	3.46	0.86	4.98	<0.0001 ***
12m / 20m	1.77	0.45	2.26	0.0619



**Fig. S11** Genera structuring coral assemblages in the nMDS (envfit results). Significant taxa are important drivers of the composition of communities (999 permutations).