

Supplementary S1 | List of anthozoan taxa observed bleached off-transect during surveys in June 2019 in Pulau Lang Tengah in Northeast Peninsular Malaysia.

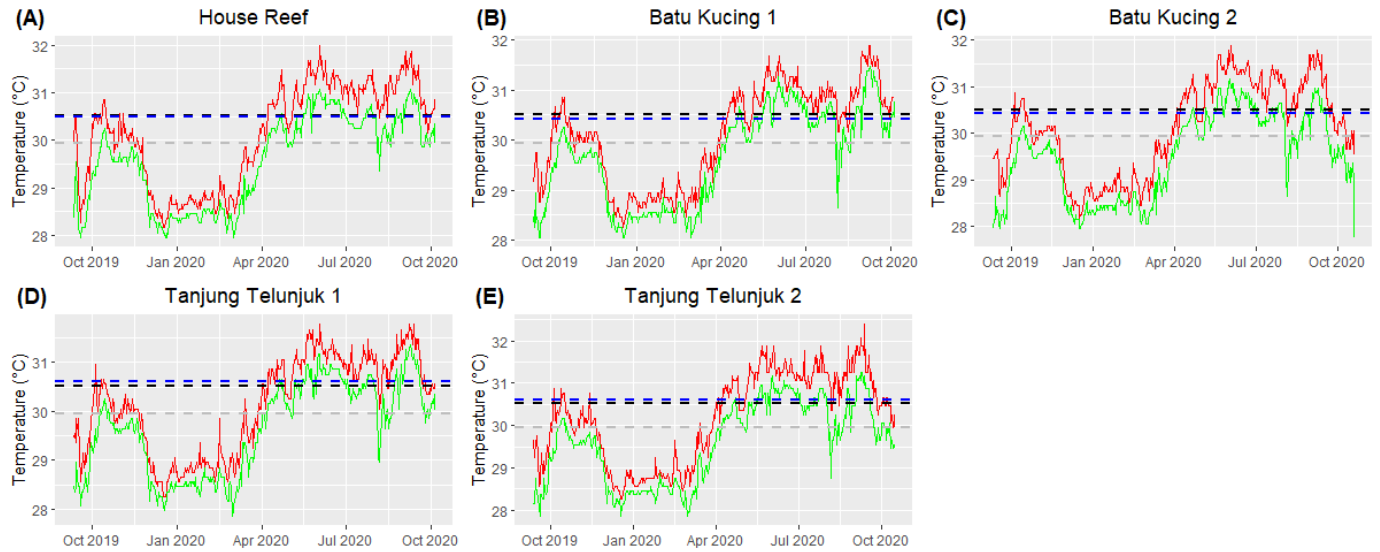
Non-scleractinian	Common name	Species name
Anemone	Magnificent Anemone	<i>Heteractis magnifica</i> ; <i>Heteractis crispa</i>
Anemone	Bubble Tip Anemone	<i>Entacmaea quadricolor</i>
Anemone	Carpet Anemone	<i>Stichodactyla gigantea</i>
Fire Coral	-	<i>Millepora cataphyllia</i>
Soft Coral	-	<i>Sarcophyton spp.</i>
Soft Coral	-	<i>Sinularia spp.</i>
Zoanthid	-	<i>Palythoa tuberculosa</i>
Scleractinian	Colony growth form	Species name
<i>Alveopora</i>	Submassive	<i>A. allingi</i>
<i>Alveopora</i>	Submassive	<i>A. catalai</i>
<i>Alveopora</i>	Submassive	<i>A. gigas</i>
<i>Astrea</i>	Submassive	<i>A. curta</i>
<i>Astrea</i>	Submassive	<i>A. annuligrea</i>
<i>Cycloseris</i>	Solitary	<i>Cycloseris spp.</i>
<i>Ctenactis</i>	Solitary	<i>C. albitentaculata</i>
<i>Ctenactis</i>	Solitary	<i>C. crassa</i>
<i>Ctenactis</i>	Solitary	<i>C. echinata</i>
<i>Gardineroseris</i>	Submassive	<i>G. Planulata</i>
<i>Leptoseris</i>	Encrusting (plate)	<i>L. scabra</i>
<i>Lithophyllon</i>	Encrusting (plate)	<i>L. undulatum</i>
<i>Montipora</i>	Encrusing with upgrowth	<i>M. hispida</i>
<i>Phymastrea</i>	Submassive	<i>P. valenciennesi</i>
<i>Porites</i>	Branching	<i>P. cylindrica</i>
<i>Psammocora</i>	Columnar	<i>P. digitata</i>

Supplementary S2 | Mean annual sea surface temperature (SST°C) and mean bleaching season (April-September) sea surface temperatures of the 10 warmest years since 1985 are shown for Pulau Lang Tengah, Northeast Peninsular Malaysia. SST was recorded by the National Oceanic and Atmospheric Association (NOAA), Coral Reef Watch (CRW) product, version 3.1, 2014.

Year	Annual mean SST (°C)	Year	Bleaching season mean SST (°C)
2010	29.65	2010	30.38
2016	29.51	2020	30.24
1998	29.48	1998	30.13
2020	29.47	2019	30.12
2019	29.45	2014	30.1
2017	29.39	2016	30.09
2018	29.25	2017	30.02
2013	29.19	2013	29.97
2014	29.19	2006	29.93
2012	29.18	2009	29.89

Supplementary S3 | Summary of recorded thermal stress (DHW °C –weeks) in 2019 and 2020 at numerous locations across the eastern coast of Peninsular Malaysia. Heat stress was recorded by the National Oceanic and Atmospheric Association (NOAA), Coral Reef Watch (CRW) product, version 3.1, 2014.

Location	Coordinates	DHW 2019	DHW 2020	Peak DHW 2019	Peak DHW 2020
Pulau Perhentian	5°56'02.5"N, 102°43'51.5"E	2.00	0.15	01.06.2019	31.05.2020
Pulau Lang Tengah	5°46'30.0"N, 102°52'30.0"E	1.05	0.00	01.06.2019	-
Pulau Yu Kecil	5°37'28.3"N, 103°09'38.4"E	2.53	0.00	01.06.2019	-
Pulau Tenggol	4°48'14.1"N, 103°40'46.5"E	2.65	0.47	12.05.2019	22.05.2020
Pulau Tioman	2°47'58.6"N, 104°10'09.5"E	1.74	0.49	09.05.2019	22.05.2020
Pulau Sibul	2°13'14.7"N, 104°03'16.7"E	4.61	1.90	15.05.2019	21.05.2020



Supplementary S4 Mean *in-situ* temperature measurements around Pulau Lang Tengah, Northeast Peninsular Malaysia, are shown for each recording station at 8 meters water depth. Mean maximum temperature is shown in red, and mean minimum temperature is shown in green. The grey dotted line represents the maximum monthly mean (MMM=29.94°C) based on historical satellite measurements by the National Oceanic and Atmospheric Association (NOAA), Coral Reef Watch (CRW), version 3.1 (2014), and the black line represents the established *in-situ* MMM (30.51°C) of Pulau Lang Tengah after interpolating satellite data with *in-situ* measurements. The blue dotted line presents the established site-specific *in-situ* MMM after interpolating satellite data with site-specific *in-situ* measurements (MMM HR=30.50°C, MMM BK=30.42°C, MMM TT=30.60°C).

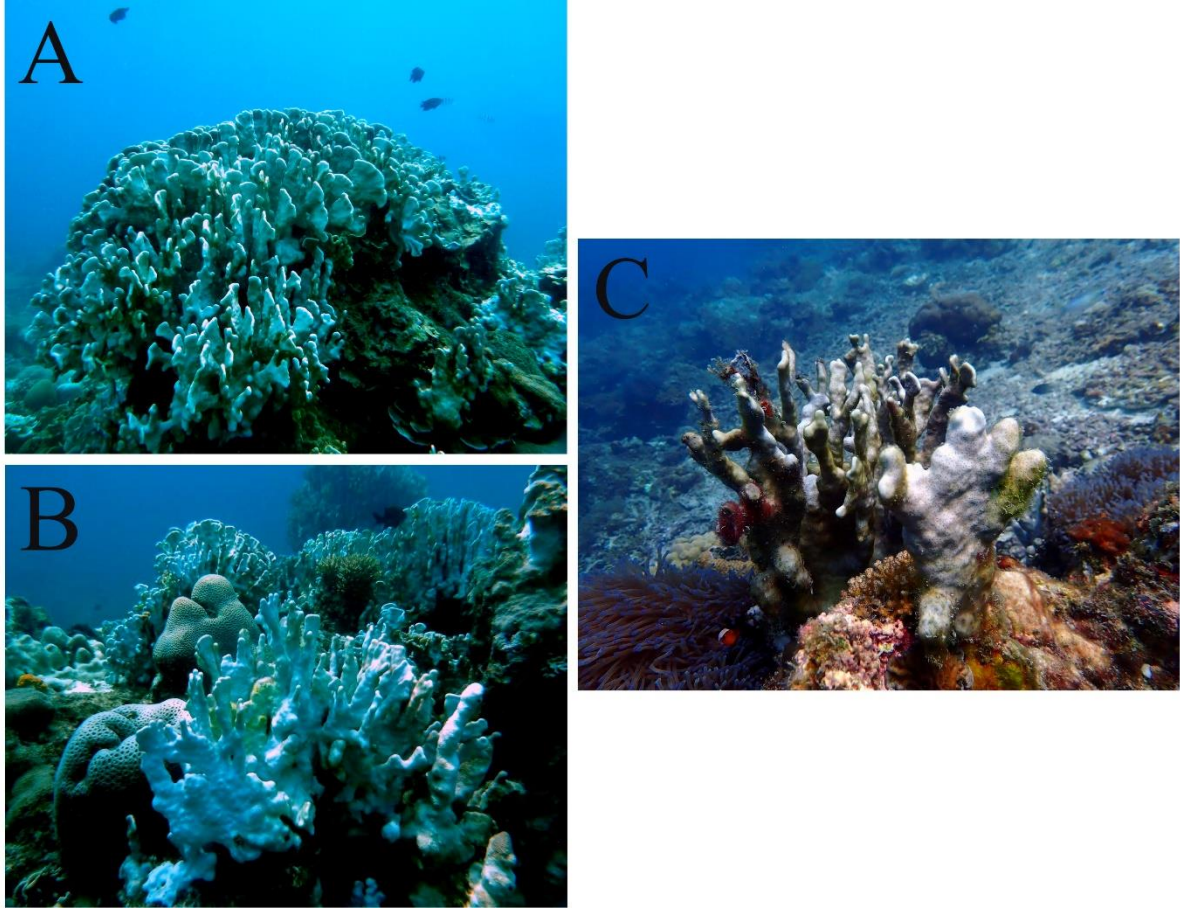
Supplementary S5 | General table showing the taxon-specific bleaching (BI) and bleaching induced mortality index (BIMI). The percentage of partial and whole-colony mortality of scleractinian taxa is shown during successive bleaching events in June 2019 and June 2020 in Pulau Lang Tengah, Northeast Peninsular Malaysia.

<i>Genus</i>	<i>Morphology</i>	June 2019		October 2019			June 2020	
		n (colonies)	BI	n (colonies)	Dead (%)	BIMI	n (colonies)	BI
<i>Acropora</i>	Arborescent	26	3.0	17	5.9	0.25	15	0.0
	Corymbose	32	1.6	25	0.0	0.00	33	2.6
	Digitate	9	0.8	12	0.0	0.00	11	0.0
	Hispidose	143	37.4	100	0.0	0.00	102	0.0
	Tabular	10	1.4	4	25.0	0.50	11	0.0
<i>Astreopora</i>	Massive	1	0.4	1	0.0	0.00	2	0.4
	Encrusting	1	1.0	1	0.0	0.00	0	0.0
<i>Blasstomussa</i>	Encrusting	0	0.0	1	0.0	0.00	3	0.0
<i>Cyphastrea</i>	Encrusting	19	11.4	25	0.0	0.00	22	1.8
<i>Diploastrea</i>	Encrusting	2	0.2	2	0.0	0.00	2	0.2
<i>Echinopora</i>	Branching	19	16.4	11	0.0	0.00	7	1.0
	Encrusting	15	2.6	14	7.1	0.50	17	0.0
<i>Favia</i>	Encrusting	11	0.0	17	0.0	0.00	31	0.8
	Submassive	47	11.2	74	2.7	0.50	76	2.8
	Massive	3	1.6	5	40.0	0.75	7	1.2
<i>Favites</i>	Encrusting	48	16.4	35	2.9	0.25	35	2.6
<i>Fungia</i>	Solitary	115	45.2	120	0.8	0.50	137	12.0
<i>Galaxea</i>	Encrusting	96	1.6	110	0.0	0.00	101	4.8
<i>Goniastrea</i>	Submassive	52	34.2	61	0.0	0.00	44	6.6
<i>Goniopora</i>	Submassive	0	0.0	4	0.0	0.00	3	0.0
<i>Herpolitha</i>	Solitary	2	1.2	4	0.0	0.00	1	0.0
<i>Heliopora</i>	Columnar	122	100.4	99	14.1	11.25	92	37.6
<i>Hydnophora</i>	Branching	1	0.4	1	0.0	0.00	1	0.0
	Encrusting	6	2.4	7	0.0	0.00	6	0.6
<i>Leptastrea</i>	Encrusting	69	4.6	72	0.0	0.00	80	6.8
<i>Leptoria</i>	Submassive	2	0.0	1	0.0	0.00	1	0.0
<i>Merulina</i>	Encrusting	7	2.2	6	0.0	0.00	5	0.0
<i>Montipora</i>	Encrusting	15	4.4	8	0.0	0.00	7	0.6
	Vase	36	5.2	32	6.3	1.25	37	1.0
<i>Oulophyllia</i>	Massive	5	0.6	2	0.0	0.00	3	0.0
<i>Pachyseris</i>	Encrusting	3	2.0	2	0.0	0.00	1	0.0
<i>Pavona</i>	Encrusting	9	0.0	11	0.0	0.00	7	0.0
	Foliose	135	84.4	114	4.4	2.25	123	33.2
<i>Physogyra</i>	Submassive	1	0.0	7	0.0	0.00	5	0.0
<i>Platygyra</i>	Encrusting	12	1.2	17	5.9	0.25	23	3.6
	Submassive	56	17.4	78	2.6	1.25	80	15.6

<i>Pocillopora</i>	Corymbose	29	11.6	31	6.5	1.5	38	5.6
<i>Porites</i>	Encrusting	47	24.6	68	1.5	1.00	76	7.6
<i>Porites 2</i>	Encrusting	447	152.8	384	1.3	3.00	354	42.4
<i>Porites</i>	Massive	155	82.0	164	6.7	5.25	189	38.8
<i>Psammocora</i>	Encrusting	18	0.6	16	0.0	0.00	22	0.0
	Foliose	24	0.2	29	0.0	0.00	26	0.0
<i>Sandolitha</i>	Solitary	1	0.2	3	0.0	0.00	3	0.0
<i>Stylocoenellia</i>	Cryptic	5	0.0	0	0.0	0.00	6	0.0
<i>Symphyllia</i>	Submassive	26	1.6	31	3.2	1.00	34	1.4
Total		1882	686.4	1826	2.9	31.25	1885	231.6

Supplementary S6 | Comparison of bleaching incidence and mortality of hard corals in Pulau Tioman in 2010 [as recorded by Guest et al. (2012)] and Pulau Lang Tengah in 2019. Mortality incidence for Lang Tengah Island was recorded in October 2019. For surveys in Pulau Lang Tengah, moderate bleaching includes categories pale live and fluorescent (B2), and colonies with $\leq 66\%$ of surface area bleached (B3 and B4). Severe bleaching includes all colonies with $>66\%$ of the colony surface area bleached (categories B5-B6).

Genus	Pulau Tioman 2010 (Guest et al. 2012)					Pulau Lang Tengah 2019				
	n	Normal (%)	Moderate (%)	Severe (%)	Dead (%)	n	Normal (%)	Moderate (%)	Severe (%)	Dead (%)
<i>Acropora</i>	632	70	3	1	26	220	30	67	3	1
<i>Pocillopora</i>	87	39	21	2	38	29	38	28	34	7
<i>Hydnophora</i>	32	3	3	41	53	7	29	43	29	0
<i>Echinopora</i>	8	100	0	0	0	34	35	12	53	4
<i>Favites</i>	53	91	9	0	0	48	37	29	34	3
<i>Symphyllia</i>	7	86	14	0	0	26	69	31	0	0
<i>Platygyra</i>	43	86	9	2	2	68	25	62	13	0
<i>Galaxea</i>	56	91	7	2	0	96	92	8	0	0
<i>Favia</i>	19	100	0	0	0	61	66	18	16	0
<i>Fungia</i>	128	54	38	5	4	115	17	58	25	1
<i>Pavona</i>	6	17	0	67	17	144	38	5	57	4
<i>Goniastrea</i>	71	90	6	0	4	52	29	6	65	0
<i>Cyphastrea</i>	15	87	13	0	0	19	32	16	53	0
<i>Montipora</i>	418	78	4	0	17	51	65	24	12	5
<i>Porites 1 +2</i>	86	74	23	2	0	649	46	18	36	3



Supplementary Figure S7 | High bleaching incidence and severity of *Heliopora* sp. colonies was recorded in June 2019 and June 2020 around Pulau Lang Tengah in Northeast Peninsular Malaysia: (A) shows a large *Heliopora* sp. colony on a shallow (5-6 m) fringing reef; (B) highlights high bleaching incidence of *Heliopora* sp. at windward sites and subsequent partial mortality of individual colonies (C).