

# Effects of thermal stress on key processes driving coral-population dynamics

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## Supplement 1

Table S1 The initial abundances for each size class used in the differential equations coral model

Starting vectors for model simulations						
Site	Depth (m)	Size class	Year			
			1996	1997	1998	1999
<b>Kushibaru</b>	1	1	13	9	12	3
		2	17	18	12	17
		3	11	14	15	9
		4	6	7	6	11
		5	5	4	5	4
		6	2	3	2	1
		7	3	2	1	1
	3	1	13	6	5	4
		2	8	8	10	10
		3	5	3	3	2
		4	5	2	2	4
		5	1	2	1	0
	6	6	0	0	0	0
		7	0	0	0	0
		1	5	4	4	3
		2	7	6	4	5
		3	5	4	5	3
		4	1	0	1	2
		5	0	0	0	1
	6	0	0	0	0	
	7	0	0	0	0	

Nishihama		1	23	19	17	11
		2	14	17	16	16
		3	6	10	10	10
1		4	2	1	1	1
		5	3	3	2	2
		6	2	0	1	0
		7	0	0	0	0
		1	21	16	13	4
		2	21	19	12	22
		3	5	13	13	7
3		4	8	5	6	7
		5	0	1	0	0
		6	0	0	0	0
		7	0	0	0	0
		1	14	13	6	1
		2	3	5	6	8
		3	2	3	2	1
6		4	2	0	1	1
		5	0	0	0	0
		6	0	0	0	0
		7	0	0	0	0

All the Lefkovitch matrices should be read first by row and then by column. Therefore, the upper triangle represents growth transitions and the lower triangle represents partial mortality transitions.

Table S2 Lefkovitch matrices calculated for Kushibaru depths 1, 3, and 6 m for the 1996-97 transition. The resulting mortality rate is also shown below each matrix

Kushibaru Depth 0 to 1 m, 1996–97							
Size Class	1	2	3	4	5	6	7
1	0.38	0.23	0	0	0	0	0
2	0.06	0.76	0.12	0	0	0	0
3	0	0.09	0.91	0	0	0	0
4	0	0	0	1.00	0	0	0
5	0	0	0.20	0	0.60	0.20	0
6	0	0	0	0	0	0.50	0.50
7	0	0	0	0	0.33	0.33	0.33
Mortality	0.38	0.06	0	0	0	0	0

Kushibaru Depth 3 to 4 m, 1996–97

Size Class	1	2	3	4	5	6	7
1	0.31	0.31	0	0	0	0	0
2	0	0.13	0.25	0	0	0	0
3	0	0.20	0	0.20	0.20	0	0
4	0.20	0	0.20	0.20	0	0	0
5	0	0	0	0	1.00	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0

Mortality	0.38	0.63	0.40	0.40	0	0	0
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Kushibaru Depth 6 to 7 m, 1996–97

Size Class	1	2	3	4	5	6	7
1	0.40	0.40	0	0	0	0	0
2	0.14	0.57	0	0	0	0	0
3	0	0	0.60	0	0	0	0
4	0	0	1.00	0	0	0	0
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0

Mortality	0.20	0.29	0.40	0	0	0	0
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Table S3 Lefkovitch matrices calculated for Nishihama depths 1, 3, and 6 m for the 1996-97 transition. The resulting mortality rate is also shown below each matrix

Nishihama Depth 0 to 1 m, 1996-97

Size Class	1	2	3	4	5	6	7
1	0.48	0.30	0	0	0	0	0
2	0	0.57	0.29	0	0	0	0
3	0	0.17	0.50	0.17	0	0	0
4	0	0	0.50	0	0	0	0
5	0	0	0.33	0	0.67	0	0
6	0	0	0	0	0.50	0	0
7	0	0	0	0	0	0	0
Mortality	0.22	0.14	0.17	0.50	0	0.50	0

Nishihama Depth 3 to 4 m, 1996-97

Size Class	1	2	3	4	5	6	7
1	0.48	0.38	0	0	0	0	0
2	0	0.38	0.33	0	0	0	0
3	0	0	0.80	0.20	0	0	0
4	0	0	0.25	0.50	0.13	0	0
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
Mortality	0.14	0.29	0	0.13	0	0	0

Nishihama Depth 6 to 7 m, 1996-97

Size Class	1	2	3	4	5	6	7
1	0.57	0.29	0	0	0	0	0
2	0.33	0.33	0.33	0	0	0	0
3	0	0	1.00	0	0	0	0
4	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
Mortality	0.14	0	0	1.00	0	0	0

Table S4 Lefkovitch matrices calculated for Kushibaru depths 1, 3, and 6 m for the 1997-98 transition. The resulting mortality rate is also shown below each matrix

Kushibaru Depth 0 to 1 m, 1997–98

Size Class	1	2	3	4	5	6	7
1	0.78	0.11	0	0	0	0	0
2	0.17	0.44	0.11	0	0	0	0
3	0	0.14	0.71	0.07	0	0	0
4	0	0	0.14	0.71	0.14	0	0
5	0	0	0	0	0.75	0.25	0
6	0.33	0	0	0	0.33	0	0
7	0	0	0	0	0	0.50	0.50
Mortality	0.11	0.28	0.07	0	0	0.33	0

Kushibaru Depth 3 to 4 m, 1997–98

Size Class	1	2	3	4	5	6	7
1	0.67	0.33	0	0	0	0	0
2	0	0.88	0	0	0	0	0
3	0	0	1.00	0	0	0	0
4	0	0	0	0.50	0.50	0	0
5	0	0.50	0	0.50	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
Mortality	0	0.13	0	0	0	0	0

Kushibaru Depth 6 to 7 m, 1997–98

Size Class	1	2	3	4	5	6	7
1	0.75	0	0	0	0	0	0
2	0	0.67	0.33	0	0	0	0
3	0	0	0.75	0.25	0	0	0
4	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
Mortality	0.25	0	0	0	0	0	0

Table S5 Lefkovitch matrices calculated for Nishihama depths 1, 3, and 6 m for the 1997-98 transition. The resulting mortality rate is also shown below each matrix

Nishihama Depth 0 to 1 m, 1997-98

Size Class	1	2	3	4	5	6	7
1	0.53	0.26	0	0	0	0	0
2	0.06	0.59	0.24	0	0	0	0
3	0	0.10	0.60	0	0	0	0
4	0	0	0	1.00	0	0	0
5	0	0	0	0	0.67	0.33	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
Mortality	0.21	0.12	0.30	0	0	0	0

Nishihama Depth 3 to 4 m, 1997-98

Size Class	1	2	3	4	5	6	7
1	0.50	0.25	0	0	0	0	0
2	0	0.32	0.26	0.05	0	0	0
3	0	0.08	0.54	0.08	0	0	0
4	0	0	0.20	0.80	0	0	0
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
Mortality	0.25	0.37	0.31	0	1.00	0	0

Nishihama Depth 6 to 7 m, 1997-98

Size Class	1	2	3	4	5	6	7
1	0.46	0.31	0	0	0	0	0
2	0	0.40	0	0	0	0	0
3	0	0	0.67	0.33	0	0	0
4	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
Mortality	0.23	0.60	0	0	0	0	0

Table S6 Lefkovitch matrices calculated for Kushibaru depths 1, 3, and 6 m for the 1998-99 transition. The resulting mortality rate is also shown below each matrix

Kushibaru Depth 0 to 1 m, 1998–99

Size Class	1	2	3	4	5	6	7
1	0.25	0.58	0	0	0	0	0
2	0	0.42	0.33	0	0	0	0
3	0	0.27	0.33	0.27	0	0	0
4	0	0	0	0.83	0.17	0	0
5	0	0.20	0	0	0.40	0.20	0
6	0	0	0	0.50	0.50	0	0
7	0	0	0	0	0	0	1.00
Mortality	0.17	0.25	0.13	0	0.20	0	0

Kushibaru Depth 3 to 4 m, 1998–99

Size Class	1	2	3	4	5	6	7
1	0.40	0.60	0	0	0	0	0
2	0	0.60	0.10	0	0	0	0
3	0	0.33	0.33	0.33	0	0	0
4	0	0	0	1.00	0	0	0
5	0	0	0	1.00	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
Mortality	0	0.30	0	0	0	0	0

Kushibaru Depth 6 to 7 m, 1998–99

Size Class	1	2	3	4	5	6	7
1	0.50	0.50	0	0	0	0	0
2	0	0.75	0.25	0	0	0	0
3	0.20	0	0.40	0.40	0	0	0
4	0	0	0	0	1.00	0	0
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
Mortality	0	0	0	0	0	0	0

Table S7 Lefkovitch matrices calculated for Nishihama depths 1, 3, and 6 m for the 1998-99 transition. The resulting mortality rate is also shown below each matrix

Nishihama Depth 0 to 1 m, 1998-99							
Size Class	1	2	3	4	5	6	7
1	0.47	0.24	0	0	0	0	0
2	0.06	0.56	0.19	0	0	0	0
3	0.10	0.20	0.60	0.10	0	0	0
4	0	0	0	0	1.00	0	0
5	0	0	0.50	0	0.50	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
Mortality	0.29	0.19	0	0	0	1.00	0

Nishihama Depth 3 to 4 m, 1998-99							
Size Class	1	2	3	4	5	6	7
1	0.23	0.46	0	0	0	0	0
2	0	0.75	0.08	0.08	0	0	0
3	0	0.23	0.46	0.15	0	0	0
4	0	0.33	0	0.67	0	0	0
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
Mortality	0.31	0.08	0.15	0	0	0	0

Nishihama Depth 6 to 7 m, 1998-99							
Size Class	1	2	3	4	5	6	7
1	0	0.67	0	0	0	0	0
2	0	0.50	0	0	0	0	0
3	0	0	0.50	0.50	0	0	0
4	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
Mortality	0.33	0.50	0	1.00	0	0	0



Table S8 Lefkovitch matrices calculated for Kushibaru depths 1, 3, and 6 m for the 1999-2000 transition. The resulting mortality rate is also shown below each matrix

Kushibaru Depth 0 to 1 m, 1999–2000

Size Class	1	2	3	4	5	6	7
1	0.33	0	0	0	0	0	0
2	0	0.35	0.35	0.06	0	0	0
3	0.11	0.44	0.22	0.11	0	0	0
4	0	0	0.27	0.18	0.36	0	0
5	0	0	0	0.25	0.50	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	1.00
Mortality	0.67	0.24	0.11	0.18	0.25	1.00	0

Kushibaru Depth 3 to 4 m, 1999–2000

Size Class	1	2	3	4	5	6	7
1	0.50	0.50	0	0	0	0	0
2	0	0.20	0.10	0	0	0	0
3	0	0	1.00	0	0	0	0
4	0	0	0.25	0.25	0	0	0
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
Mortality	0	0.70	0	0.50	0	0	0

Kushibaru Depth 6 to 7 m, 1999–2000

Size Class	1	2	3	4	5	6	7
1	0.67	0	0	0	0	0	0
2	0	0.40	0	0	0	0	0
3	0	0	1.00	0	0	0	0
4	0	0	0	0.50	0	0	0
5	0	0	0	0	1.00	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
Mortality	0.33	0.60	0	0.50	0	0	0

Table S9 Lefkovitch matrices calculated for Nishihama depths 1, 3, and 6 m for the 1999-2000 transition. The resulting mortality rate is also shown below each matrix

Nishihama Depth 0 to 1 m, 1999–2000

Size Class	1	2	3	4	5	6	7
1	0	0.82	0	0	0	0	0
2	0.06	0.38	0.44	0	0	0	0
3	0.10	0.10	0.20	0.20	0	0	0
4	0	0	1.00	0	0	0	0
5	0	0	0	0	0.50	0.50	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
Mortality:	0.18	0.13	0.40	0	0	0	0

Nishihama Depth 3 to 4 m, 1999–2000

Size Class	1	2	3	4	5	6	7
1	0	0.25	0.25	0	0	0	0
2	0.05	0.27	0.27	0.05	0.05	0	0
3	0	0	0.14	0.57	0	0	0
4	0	0	0.14	0.57	0.14	0	0
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
Mortality:	0.50	0.32	0.29	0.14	0	0	0

Nishihama Depth 6 to 7 m, 1999–2000

Size Class	1	2	3	4	5	6	7
1	0	1.00	0	0	0	0	0
2	0	0.50	0.25	0.13	0	0	0
3	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
Mortality:	0	0.13	1.00	1.00	0	0	0