

REPLY COMMENT

'Time-integrated thermal bleaching thresholds of reefs and their variation on the Great Barrier Reef'

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The purpose of the formula in Berkelmans (2002) is to describe how the estimated bleaching threshold was derived by weighting the difference between the warmest bleaching year and the coolest non-bleaching year. As indicated above, the formula as it appeared in the published paper is incorrect. The published formula applies to the ranking of bleaching severity from 1 to 5, with 5 being the worst bleaching score. To be consistent with the bleaching scores published in an earlier paper (Berkelmans & Oliver 1999), I reversed the ranking of the bleaching scores, but failed to correct the formula in the final manuscript. The correct formula and the one used in the calculation of the bleaching curves is:

$$b_c = T_n + s/5(T_b - T_n), \text{ for } T_b > T_i$$

Table 1 shows a worked example for Kelso Reef. The formula is applied by firstly summing the number of days at or above each interval of average daily temperature to obtain the equivalent of a cumulative frequency distribution of average daily temperatures. The data for 1999 show that there were 19 days at or above

29.2°C, but only 9 days at or above 29.3°C. I suggest that the reason for the apparent discrepancy in Table 1 in the Comment (Dunne 2002 this volume) is because the author is trying to read the graph by entering at the y-axis (cumulative number of days) and thus interpolating both between the number of days (20, 15 and 10 d) and the temperature. As a result of the double interpolation, small errors are propagated through the calculation of the predicted bleaching curve points leading to seemingly erroneous results. I have checked and can verify that the bleaching curves presented in the paper have been correctly calculated, and that the error is restricted to the way the formula is expressed in 'Materials and methods' in Berkelmans (2002, p. 75). Thus, none of the results and conclusions are affected.

On the issue of how the formula applies when the bleaching severity score is 5 (no or low bleaching), the problem of whether or not to calculate a bleaching curve does not arise. The formula only applies to bleaching severity scores between 1 ('Extreme bleaching') and 4 ('Moderate bleaching'), as stated in Berkelmans (2002, p. 75). In the aerial bleaching surveys

Table 1. Comparison of the bleaching curve obtained with the corrected algorithm to the curve in Fig. 4 of Berkelmans (2002)

y-axis: exposure time (d)	x-axis: temperature (°C)			Predicted bleaching curve point using corrected formula	Actual point from Fig. 4	Result
	Warmest non-bleaching year (1999)	Coolest bleaching year (1998)	Difference between 1998 & 1999			
29.2	19	23	4	22.2	22.2	Correct
29.3	9	22	13	19.4	19.4	Correct
29.4	5	21	16	17.8	17.8	Correct
29.5	2	17	15	14	14	Correct
29.6	1	16	15	13	13	Correct
29.7	1	14	13	11.4	11.4	Correct
29.8	0	9	9	7.2	7.2	Correct
29.9	0	5	5	4	4	Correct
30.0	0	2	2	1.6	1.6	Correct
30.1	0	0	0	0	0	Correct

of Berkelmans & Oliver (1999), the score of 5 was reserved for reefs that showed no apparent bleaching, notwithstanding a few pale colonies which might normally be expected to be pale in summer. Clearly it makes no sense to calculate bleaching curves for reefs in this category.

I apologise for the error in the published formula and regret any confusion this may have caused. I am also grateful for the opportunity to be able to correct it here.

Editorial responsibility: Otto Kinne (Editor), Oldendorf/Luhe, Germany

LITERATURE CITED

- Berkelmans R (2002) Time-integrated thermal bleaching thresholds of reefs and their variation on the Great Barrier Reef. *Mar Ecol Prog Ser* 229:73–82
- Berkelmans R, Oliver JK (1999) Large scale bleaching of corals on the Great Barrier Reef. *Coral Reefs* 18:55–60
- Dunne RP (2002) Comment on Berkelmans (2002) 'Time-integrated thermal bleaching thresholds of reefs and their variation on the Great Barrier Reef'. *Mar Ecol Prog Ser* 237:307–308

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Erratum

Active heterotrophic nanoflagellates in the hypoxic water-column of the eutrophic Masan Bay, Korea

Jong S. Park, Byung C. Cho

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- On page 36, right column, 2nd paragraph, lines 25–28: 'We checked ... and found no significant change of DO... .' should read 'We checked ... and found some changes of DO... .'

The conclusions of the paper remain unchanged.