Corrigendum: seasonal dynamics in dissolved organic matter, hydrogen peroxide, an...

Health & Medicine

A corrigendum on

Seasonal Dynamics in Dissolved Organic Matter, Hydrogen Peroxide, and Cyanobacterial Blooms in Lake Erie

by Cory, R. M., Davis, T. W., Dick, G. J., Johengen, T., Denef, V. J., Berry, M. A., et al. (2016). Front. Mar. Sci. 3: 54. doi: 10. 3389/fmars. 2016. 00054

In the original article, there was a spreadsheet error in the calculation of hydrogen peroxide (H_2O_2) concentrations in Lake Erie. Hydrogen peroxide concentrations were measured using the Amplex Red method, which requires subtraction of the background reagent signal from all samples and standards. Subtraction of background reagent signal was not done when reporting hydrogen peroxide concentrations in the original manuscript; this error has now been corrected. Corrected hydrogen peroxide concentrations are lower than reported in the paper by a factor of 1. 8 (i. e., original H_2O_2 / 1. 8 = corrected H_2O_2). Corrected H_2O_2 concentrations are significantly, linearly correlated with the originally reported H_2O_2 concentration ($p < 0.001$, $R^2 = 0.8$, slope = 1. 8 ± 0. 04). Thus, the temporal and spatial patterns in H_2O_2 concentrations reported in Lake Erie in Figures 7D, 10D, 11 remain the same, but the hydrogen peroxide concentrations reported in Figures 3, 4D, 8C, 10D, 11, 13 are lower by a factor of 1. 8. Corrected H_2O_2 concentrations were within measurement error of the original reported concentration for 12% of the Lake Erie samples, while 88% of the corrected H_2O_2 concentrations were significantly lower than the original, reported concentration.

Corrected text is reported here. In the abstract and results section, the text below replaces the original text from the published manuscript with the only difference being the corrected H_2O_2 concentrations. In the discussion and conclusions sections, minor revisions were made to sentences in the published manuscript (shown below) to provide a more conservative interpretation of the relative importance of biological activity to H_2O_2 concentrations. That is, given the lower H_2O_2 concentrations after correction, photochemical processes of CDOM may account for a larger fraction of H_2O_2 than originally assessed. However, the main conclusion of the paper remains the same: that biological activity likely contributed substantially to H_2O_2 concentrations in Lake Erie.

Abstract:

“ Concentrations of H_2O_2 in Lake Erie ranged from 2 ± 24 nM to 1140 ± 240 nM (average of 162 ± 11 nM; $n = 221$).

Materials and Methods, Section 2. 6 H_2O_2 Concentrations, Paragraph Number 1:

Results, Section 3. 4 H_2O_2 Concentrations in Lake Erie, Paragraph Number 1:

Hydrogen peroxide concentrations in the surface waters of Lake Erie varied by over an order of magnitude during the study period, from 2 ± 24 to 1, 140 ± 240 nM (average ± SE from triplicate measurements of each water sample), with an overall average of 162 ± 11 nM (average ± SE, $n = 221$; Figure 10D).

Results, Section 3. 4 H_2O_2 Concentrations in Lake Erie, Paragraph Number 3:

The largest difference in H_2O_2 concentration between surface water and depth was observed when H_2O_2 at 21 m was nearly double the surface concentration at the same site under mixed conditions (312 ± 53 nM vs. 148 ± 42 nM H_2O_2 in bottom vs. surface, respectively at site 949 in the central basin; Figure 8C).

Discussion, Section 4, Paragraph Number 1:

The average and range of hydrogen peroxide (H_2O_2) concentrations in Lake Erie (162 ± 11 nM, up to a maximum of 1, 140 ± 240 nM; Table 1 and Figure 10D) were higher than the range previously observed at one station in the western basin of Lake Erie in August 1987 (100–200 nM; Cooper et al., 1989), but within the wide range of H_2O_2 concentrations observed in lakes (~10 nM to > 2 μM; (Cooper and Zika, 1983; Cooper et al., 1989; Häkkinen et al., 2004; Febria et al., 2006; Khan et al., 2013; Scully et al., 1996).

Discussion, Section 4, Paragraph Number 2:

Using the average calculated photochemical production rate of 67 ± 3 nM h^{-1} H_2O_2 by CDOM, it would take almost 3 h of mid-day light to produce the observed average concentration of H_2O_2 (162 ± 11 nM) assuming no other sources and no sinks. All water samples were collected between 09: 00 to 15: 30 h, with the majority of samples collected between 10: 00 h and 12: 30 h, suggesting that there could have been sufficient time and UV light for

photochemical production to generate the observed concentrations if H_2O_2 sinks were minimal.

Discussion, Section 4, Paragraph Number 3:

Photochemical production of H_2O_2 by CDOM could account for the observed H_2O_2 if CDOM in the lake consistently had ~ 3-fold higher apparent quantum yields (Φ_λ; *Equation 3*) than we used.

Discussion, Section 4, Paragraph Number 7:

For example, given that the depths of bottom water sampled (4–61 m) were also greater than the depth of UV light penetration (depth of 1% light was 1. 5 ± 0. 1 m for 412 nm), there was not enough UV light to produce the 30–300 nM H_2O_2 observed at depth (Figure 8C).

However, in this study, similar magnitudes of H_2O_2 concentrations were observed between surface and bottom waters even at depths > 20 m during stratified conditions (Figure 8C).

Conclusions and Implications, Section 5, Paragraph Number 1:

This study demonstrated that CDOM and H_2O_2 concentrations were not related and that even the upper estimates of photochemical production of H_2O_2 by CDOM were likely too low to account for all H_2O_2 (especially at depths below the photic zone). These results, combined with measured and estimated rates of biological production of H_2O_2 that can equal or exceed photochemical production (this study; Marsico et al., 2015), strongly suggest

that biological activity contributes substantially to H_2O_2 concentrations in Lake Erie.

Conflict of Interest Statement

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.