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Erratum: A decadal decline in relative abundance and a shift in microphytoplankton composition at a long-term coastal station off southeast Australia

Our paper, published in *Limnology and Oceanography* (Vol. 59, p. 519–531, 2014), contains a calculation error in the determination of water-column phytoplankton cell densities from microscope-obtained cell counts. This error alters some statistical analyses and interpretations related to the second hypothesis (H2: Total phytoplankton abundance has increased at PH_{100m} over the 11-yr study period). The error does not affect the results and interpretations related to the first hypothesis.

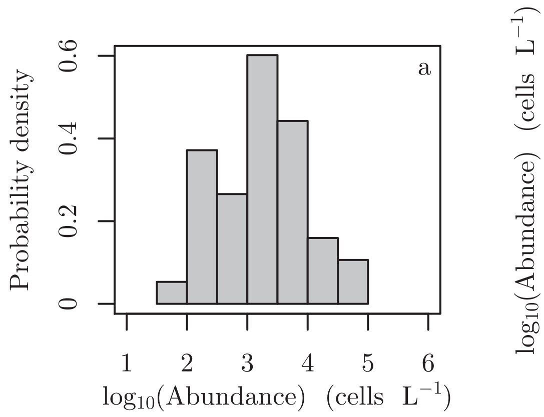
Methods

The sample collection jar volume was 120 mL, not 150 mL. The equation used to calculate cell densities is based on the Lund method (Hotzel and Croome 1999) as follows: cells mL^{-1} = (cell count/number of slide traverses) × sample dilution factor × Lund conversion factor/concentration factor. The Lund conversion factor was calibrated as 589.69 mL^{-1} for the microscope used. The concentration factor (39,286.27) was calculated as the quotient of the volume of water filtered by the 245-mm-diameter net over a distance of 100 m (4,714,352 mL; 50 m down and then 50 m up, assuming a cylindrical volume) and the volume of the sample bottle (120 mL). Phytoplankton data and associated metadata are publicly available at http://catalogue.aodn.org.au/geonetwork/srv/en/metadata.show?uuid=bc6bb3ec-bfa0-4a2a-ab01-8c3e337a9013. Environmental data are at http://imos.aodn.org.au/imos/.

Data analysis and results

The nonzero abundance values per taxon varied by 3 orders of magnitude (not 13 as previously reported). Corrected mean abundance and associated correspondence analysis (CA) scores for each taxon are given in the corrected Web Appendix Table A2 (www.aslo.org/lo/toc/vol_59/issue_6/2240a.html) and the 20 most abundant taxa have been reordered (corrected Fig. 2). *Thalassiosira* cf. *partheneia* and *Trichodesmium erythraeum* remain the dominant taxa. Three new taxa (*Thalassiosira* spp., *Detonula pumila*, and *Meuniera membranacea*) are now among the top 20 species. The top 20 taxa represent 95% of the organisms sampled during the study period. The corrected total abundance data varied from 62 (23 August 2004) to 74,150 (28 February 2001) cells L^{-1}, whereas the abundance data are a unimodal probability distribution (corrected Fig. 4a). Highest monthly mean abundance occurred in March, September, November, and December (corrected Fig. 4b). The relationship between the relative abundance of diatoms (logistic transformed) and year remained significant for the updated data set ($r = 0.26$, $p = 0.007$). The correlation between the relative abundance of diatoms and CA2 remained nonsignificant ($p = 0.65$). Applying linear regression analyses to the full data set, the logarithm of the corrected microphytoplankton abundance shows no significant decline toward the present for total abundance ($p = 0.16$; corrected Fig. 8a), nor for diatom

Corrected Figure 2. Twenty most abundant taxa and their abundance per sample across the 11-yr sampling period (1998–2009). Taxa are listed in order of decreasing average abundance. Larger circles correspond to taxa with higher abundances in a sample (cells L^{-1}).



Corrected Figure 4. (a) Bars represent the empirical frequency distribution of log. (b) Average monthly abundance estimates showing peak cell densities occurred in March, September, November, and December. Whiskers represent 95% confidence intervals for the averages, which were generated using 10,000 bootstrap samples.

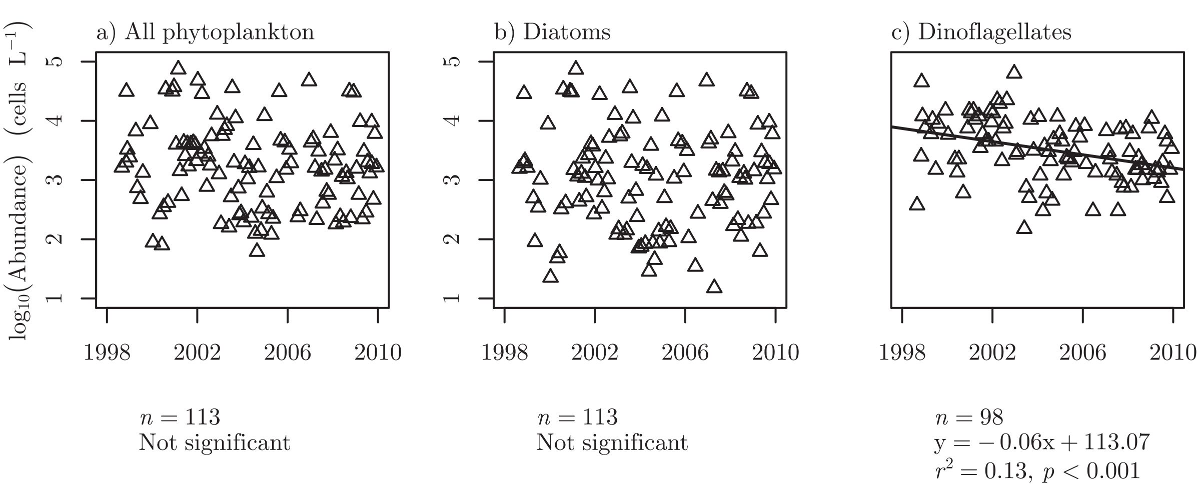
abundance (p = 0.78; corrected Fig. 8b), but a significant decline for dinoflagellate abundance ($r^2 = 0.13$, $p = 0.0002$; corrected Fig. 8c). This corresponded to a 95% confidence interval for the rate of decline of 5.95% to 17.7% yr^{-1} (corrected Fig. 8c).

Discussion

The corrected abundance data vary by three orders of magnitude, which is comparable with other upwelling and coastal regions throughout the world (Zingone et al. 2010). Furthermore, peak cell densities occurred most commonly in March, September, November, and December (corrected Fig. 4b), consistent with previous, shorter-term studies carried out at this location (Ajani et al. 2001).

On the basis of the corrected data, our study continues to refute H2, revealing no significant increase in microphytoplankton at PH_{100m} over the past decade. It does, however, suggest a decline in dinoflagellates (statistically significant) toward the present (corrected Figure 8a–c). Two factors may contribute to these findings. First, given that diatoms are the most abundant microphytoplankton taxa at PH_{100m}, and that they depend on silicate for growth, the lack of increase in abundance and a shift toward a smaller species, *Thalassiosira* cf. *partheneia*, may still be attributable to the long-term decline in silicate over the past few decades (Thompson et al. 2009).

References to a "decline in biomass" or a "decline in diatom abundance" should be amended to a "decline in dinoflagellate abundance." A similar decline in dinoflagellate abundance was observed over a 50-yr time period by Hinder et al. (2012) in the North Sea, who linked this decline to increasing sea-surface temperature and wind. We consider our study short in comparison with the study of Hinder et al. (2012), and suggest that longer-term data collected at this location may elucidate such causal



Corrected Figure 8. Trends in total community abundance for (a) all phytoplankton, (b) diatoms, and (c) dinoflagellates. Line represents a least-squares regression model that was separately fitted to data where the correlation analysis indicated a significant ($p < 0.05$) trend.

pathways. For this reason, we continue to advocate that there is a critical need for continued sampling at the Port Hacking coastal monitoring station to establish long-term trends.

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