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An approach in assessing nutrient limitations in polar, tropical and temperate microalgae: nutrient-induced fluorescence transients (NIFTs)

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Nutrient-induced fluorescence transients (NIFTs) approach has a potential in assessing nutrient limitations in laboratory cultures as it is rapid and cost-effective compared to conventional methods. 9 polar species (*Chaetoceros neglectus*, *Chaetoceros neglectus*, *Fragilariopsis curta*, *Fragilariopsis obliquecostata*, *Navicula directa*, *Navicula glaceii*, *Odontella weisflogii*, *Proboscia alata* and *Thalassiosira tumida*), 9 temperate species (*Alexandrium catanella*, *Amphidinium massartii*, *Alexandrium minutum*, *Euglena gracilis*, *Emiliania huxleyi*, *Gymnodinium catenatum*, *Karlodinium veneficum*, *Tabellaria flocculosa* and *Tetraselmis suecica*) and 13 tropical species of microalgal cultures (*Chaetoceros* sp., *Chloropsis* sp., *Isochrysis* sp., *Nannochloropsis* sp., *Tetraselmis* sp., *Alexandrium affine*, *Alexandrium minutum*, *Alexandrium tamiyavanichi*, *Bysmatrum* sp., *Coolia malayensis*, *Gambierdiscus* sp., *Nitzschia* sp. and *Prorocentrum* sp.) were grown under nutrient-limited conditions and NIFTs' responses were measured following re-supply of possible limiting nutrients (nitrate, phosphate or silica) by using Pulse Amplitude Modulation (PAM) fluorometers. We observed NIFT responses differ across microalgal taxa. For polar species, 5 out of 9 species were undetectable by NIFT. Only *N. directa* showed positive NIFT responses following re-supply of phosphate and silica. For temperate species, *G. catenatum* the only species undetectable by NIFT. *A. catanella* nad *A.minutum* showed positive NIFT responses following re-supply of phosphate and silica. For tropical species, *A. minutum* and *C. malayensis* showed positive NIFT response following re-supply of nitrate. Addition of phosphate induced positive fluorescence changes in *A. minutum* and *Gambierdiscus* sp. Positive NIFT responses indicated there were nutrient limitations in the cultures. These results suggest that NIFT is species-specific because not all species respond well to NIFT. This method offers potential for assessing the importance of nitrate, phosphate or silica as nutrient sources to microalgal populations and as a diagnostic tool for nutrient limitations.

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