



## Spatial distribution of intact polar lipids in North Sea surface waters: Relationship with environmental conditions and microbial community composition

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**ABSTRACT:** We characterized and quantified the intact polar lipid (IPL) composition of the surface waters of the North Sea and investigated its relationships with environmental conditions, microbial abundances, and community composition. The total IPL pool comprised at least 600 different IPL species in seven main classes: the glycerophospholipids phosphatidylcholine (PC), phosphatidylglycerol (PG), and phosphatidylethanolamine (PE); the sulfur-bearing glycerolipid sulfoquinovosyldiacylglycerol (SQDG); and the nitrogen-bearing betaine lipids diacylglyceryl-trimethylhomoserine (DGT5), diacylglyceryl-hydroxymethyltrimethylalanine (DGTA), and diacylglyceryl-carboxyhydroxymethylcholine (DGCC). Although no significant relationships were found between the IPL composition and environmental parameters, such as nutrient concentrations, distance-based ordination yielded distinct clusters of IPL species, which could in turn be tentatively correlated with the predominant microbial groups. SQDGs and PGs, as well as PC species containing saturated fatty acid moieties, were related to picoeukaryote abundances and PC species with polyunsaturated fatty acid (PUFA) moieties to nanoeukaryote abundances. The PEs were likely of mixed cyanobacterial – bacterial origin, whereas DGTA and DGCC species were mainly associated with cyanobacteria. DGT5s were likely derived from either pico- or nanoeukaryotes, although the DGT5 species with PUFAs also showed some relationship with cyanobacterial abundances. Concentrations of the algal-derived IPLs showed strong positive correlations with chlorophyll *a* concentrations, indicating they may be used as biomarkers for living photosynthetic microbes. However, direct relationships between the IPLs and microbial groups were relatively weak, implying that the predominant IPLs in marine surface waters are not derived from single microbial groups and that direct inferences of microbial community compositions from IPL compositions should be considered with care.

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